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

NMOCD
JAN 11 2019
DISTRICT III

Form C-147
Revised April 3, 2017

Recycling Facility and/or Recycling Containment

Type of Facility: ☑ Recycling Facility ☑ Recycling Containment*

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

pCS1902229621

*** 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: Enduring Resources IV, LLC (For multiple operators attach page with information) OGRID #: 372286
Address: 200 Energy Court, Farmington, NM 87401
Facility or well name (include API# if associated with a well): KWU 2309-19K
OCD Permit Number: 3RF-43 (For new facilities the permit number will be assigned by the district office)
U/L or Qtr/Qtr NESW Section 19 Township 23N Range 9W County: San Juan
Surface Owner: ☑ Federal ☐ State ☐ Private ☐ Tribal Trust or Indian Allotment

2.
☒ **Recycling Facility:**
Location of recycling facility (if applicable): Latitude 36.210825 Longitude -107.831105 NAD83
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
* Conditions of Approval Attached.
☒ 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
☐ **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 36.210825 Longitude -107.831105 NAD83
☑ For multiple or additional recycling containments, attach design and location information of each containment
☐ Lined ☑ Liner type: Thickness 45 mil ☑ LLDPE ☐ HDPE ☐ PVC ☐ Other _____
☑ String-Reinforced
Liner Seams: ☑ Welded ☑ Factory ☐ Other _____ Volume: 213,698 bbl Dimensions: L 500' x W 240' x D 25'
☐ Recycling Containment Closure Completion Date: _____

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Smith, Cory, EMNRD

From: Smith, Cory, EMNRD
Sent: Tuesday, January 22, 2019 9:25 AM
To: Andrea Felix
Cc: Fields, Vanessa, EMNRD
Subject: Enduring KWU 2309-19K Assigned 3RF-43

Andrea,

The following Recycling Facility have been approved please see below for their assigned 3RF #'s.

Facility Name	Admin #	Conditions of Approval
KWU 2308-19K	3RF-43	Notify OCD 72 hours prior to the leak detection being covered. Provide OCD 48 hour notice prior to starting operations (Filling the containment with any liquid) and the Operator must Inspect the Leak Detection to confirm that no liquids are present.

OCD recommends that Enduring plans to install the liner/leak detections systems in favorable weather to avoid trapping any liquids within the system.

Enduring may search OCD online under Administrative/Environmental Orders "3RF – Recycling Facility – Aztec – (3RF)" to find the scanned document(Once it is scanned).

If you have any questions give me a call. Please remember Enduring will need the Admin # to report on form C-148 monthly please make sure that Enduring sends them in as soon as possible and even if there is no activity.

Cory Smith
Environmental Specialist
Oil Conservation Division
Energy, Minerals, & Natural Resources
1000 Rio Brazos, Aztec, NM 87410
(505)334-6178 ext 115

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_____

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): Andrea Felix Title: Regulatory Manager

Signature: Date: 1-11-2019

e-mail address: afelix@enduringresources.com Telephone: (505) 386-8205

11.

OCD Representative Signature: **Approval Date:** 1/22/19

Title: Environmental Spec. **OCD Permit Number:** 3RF-43

☐ OCD Conditions

☒ Additional OCD Conditions on Attachment Emailed 1/22/19

C-147 Registration Package

Prepared for

Enduring Resources IV, LLC
200 Energy Court
Farmington, NM 87401
(505) 386-8205

Developed by

EIS
Energy Inspection Services
479 Wolverine Drive
Bayfield, Colorado 81122
Phone: (970) 881-4080

TABLE OF CONTENTS

1. Introduction

Applicant	Enduring Resources IV, LLC
Project Name	KWU 2309-19K
Project Type	Recycling Containment Registration
Legal Location	NESW, Section 19, T-23-N, R-9-W, San Juan County, NM
Lease Number(s)	NMNM 135255A

In accordance with NMAC 19.15.34, Enduring Resources IV, LLC (Enduring) requests the registration of the proposed Recycling Containment through the approval of this C-147 registration package. The facility and containments will be used to treat and recycle produced water for re-use in Enduring Resources, LLC completion activities.

This package contains the C-147 form and associated documents for registration of the KWU 2309-19K Recycling Containment.

A copy of the C-147 has been submitted to the land owner, the Bureau of Land Management.

2. Variance Explanation

All requested variance provide equal or better protection of fresh water, public health, and the environment.

C-147 #5 Fencing

19.15.34.12.D(1) NMAC states "Recycling containments shall be fenced with a four foot fence that has at least four strands of barbed wire evenly spaced in the interval between one foot and four feet above ground level."

Enduring will install an eight (8) foot chain link fence with one strand of barbed wire around the facility as requested by the surface owners to allow for greater protection to the facility than the requirements of 19.15.34.12.D(1)

3. Siting Criteria

3.1. Distance to Groundwater

A test well was drilled on the KWU 787H on 9/18/2018 per the attached MO-TE Drilling Log which indicates a groundwater depth greater than 100'. The KWU 787H has an elevation of 6596'. The KWU 2309-19K has an elevation of 6625' providing an increase of 29'. The groundwater depth is estimated to be greater than 129'. Therefore the groundwater depth is greater than 50 feet below the bottom of the recycling containment.

3.2. Distance to Surface Water

There are not any continuously flowing watercourses within 300' nor any other significant watercourse and lakebed or playa lake within 200' of the recycling containment as shown on the Aerial or Topo maps provided.

3.3. Distance to Structures

There are no permanent residence, school, hospital, institution or church at the time of initial registration within 1000' of the recycling containment as shown on the Aerial and Topo maps provided.

3.4. Distance to Non-Public Water Supply

There are no springs or fresh water wells used for domestic or stock water purposes within 500' in existence at the time of initial registration as shown on the Aerial and Topo maps provided.

3.5. Distance to Municipal Boundaries and Defined Fresh Water Fields

The recycling facility is not within any incorporated municipal boundaries within a defined municipal fresh water well field covered by a municipal ordinance adopted pursuant to Section 3-27-3 NMSA 1978, as amended.

3.6. Distance to Subsurface Mines

The recycling containment is not located in an "unstable" area. The location is not over a mine and is not on the side of a hill. The location of the excavated surface material will not be located within 100 feet of a continuously flowing or significant watercourse. According to the NM EMNRD Mining and Mineral Divisions database there are no subsurface mines in Section 30, Township 23N, Range 9W of San Juan County.

3.7 Distance to 100-Year Floodplain

The KWU 2309-19K proposed recycling containment is not located within a 100-year floodplain as demonstrated on the FEMA Map.

4. Design and Construction Plan

In accordance with Rule 19.15.34 the following information describes the design and construction of the recycling containment on Enduring's locations.

The Enduring Design and Construction Plan assists Enduring personnel in ensuring compliance with the minimum design and construction requirements for recycling containments as defined by the NMOCD outlined in 19.15.34.12 NMAC. The plan applies to any Enduring Employee(s) and subcontractor(s) whose job requires them to assist with the design and construction of the recycling facility. The plan is designed to ensure compliance with the minimum design and construction requirements for recycling facilities as defined by the NMOCD outlined in 19.15.34.12 NMAC.

Enduring shall design and construct a recycling containment in accordance with the following specifications.

4.1. Foundation Construction

Approximately 6" of topsoil will be stripped and stockpiled for final cover at the time of closure. The topsoil will be stored on the perimeter of the permitted facility.

The recycling containment will have a properly constructed foundation and interior slopes consisting of a firm, unyielding base, smooth and free of rocks, debris, sharp edges or irregularities to prevent the liner's rupture or tear. The containment will ensure confinement of produced water, to prevent releases and to prevent overtopping due to wave action or rainfall. A geotextile under the liner will be used, if needed, to reduce the localized stress-strain or protuberances that otherwise may compromise the liner's integrity. The final sub grade shall be scarified to a minimum depth of 12 inches, moisture conditioned to near Optimum Moisture and compacted to 95% of maximum dry density as determined by a Standard Proctor (ASTM 698).

Positive draining should be provided during construction and maintained throughout the life of the proposed project to prevent surface runoff from entering the pond. Protective slopes should be provided with a minimum grade of approximately 5 percent for at least 10 feet from the structures. Backfill against footings, exterior walls, and in utility trenches should be well compacted and free of all construction debris to reduce the possibility of moisture infiltration.

The pond inside Levey grade will be constructed no steeper than 3H:1V grade and the pond outside Levey grade will be constructed no steeper than 5H:1V grade.

4.2. Liner Construction

Enduring's recycling containment shall incorporate, a primary (upper) liner and a secondary (lower) liner with a leak detection system. The primary (upper) liner will be a 45-mil LLDPE string reinforced liner resistant to UV light, petroleum hydrocarbons, salt and acidic/alkaline solutions and shall cover the bottom and sides of the pit including the minimum three (3) feet of freeboard per NMOCD 19.15.17.11.G.9. The secondary liner will be a 45-mil LLDPE string reinforced liner for initial leak detection and shall cover the bottom and sides of the pit including the minimum three (3) feet of freeboard per NMOCD 19.15.17.11.G.9.

A secondary leak detection system will be installed at the designated corner of each pit. The pit bottom will be sloped to the detection system that will be comprised of 2" and 4" PVC solid and perforated pipe with 1-1/2" Type F coarse drain rock bedding.

Enduring shall ensure the subcontractor installing the recycling containment minimized liner seams and orient them up and down, not across, a slope of the levee. Enduring shall ensure that factory welded seams shall be used where possible. Enduring shall ensure the subcontractor installing the recycling containment ensures field seams in the geosynthetic material are thermally seamed and that prior to any field seaming, the installer overlaps the liners four to six inches. The subcontractor installing the liner shall minimize the number of field seams and corners and irregularly shaped areas. Enduring will only hire qualified personnel to perform field welding and testing.

Enduring shall install manufacturer recommended DrainTube gas ventilation geocomposite grid produced by Afitex Texel. This layer is intended to vent in situ gases that have potential to create "whale" in the produced water pit that would decrease storage capacity. The product consists of a drainage layer and a filter layer comprised of short synthetic staple fibers of 100% polypropylene needle-punched together with perforated corrugated polypropylene pipes regularly spaced, up to 4 pipes per meter, inside. The pipes have two perforations per corrugation at 180 degrees and alternating at 90 degrees. https://www.draintube.net/docs/en/download/technical_data_sheet/draintube_300p_st_series_fos.pdf The conductive grid is needle punched together between the geotextile layers and is comprised of two conductive inox cables forming a 50 mm x 50 mm network. Geoconduct is compatible with geoelectrical leak location surveys.

The liner system shall be anchored as designed in a 2 FT x 2.5 FT anchor trench and topped with 6 inches of road base.

At the point of discharge into or suction from the recycling containment, Enduring will insure that the liner is protected from excessive hydrostatic force and potential mechanical damage. External discharge and/or suction lines will not penetrate the liner.

4.3. Leak Detection System

Enduring shall place a leak detection system between the upper and lower geomembrane liners that shall consist of a 200-mil genet to facilitate drainage. The leak detection system shall consist of a properly designed drainage and collection and removal system placed above the lower geomembrane liner in depressions and sloped to facilitate the earliest possible leak detection. A 4 foot deep depression will be constructed to allow for collection of any leaking liquid. A 4 and 2 inch PVC pipe will be installed in between the primary and secondary liners from the top of the pit to the depression to allow for detection and removal of liquid that may collect between the primary and secondary liners.

4.4. Signage

Enduring will sign the containment with an upright sign no less than 12" by 24" with lettering not less than 2" in height in a conspicuous place near the containment. Enduring will provide the operator's name, location of the containment by quarter-quarter or unit letter, Section, Township, Range and emergency telephone numbers.

4.5. Entrance Protection

Enduring will surround the containment with an eight foot chain link fence. All gates leading in and out of the containment will be closed and locked when personnel are not on-site. The fencing will be kept in good repair, and shall be inspected as part of the weekly inspection performed at the containment facility.

4.6. Wildlife Protection

Enduring will install a bird deterrent system pursuant to the attached *Migratory Bird Mitigation Plan*. The containment will be inspected weekly for dead migratory birds and will be reported accordingly.

5. Maintenance and Operating Plan

In accordance with Rule 19.15.34 the following information describes the operation and maintenance of recycling containments on Enduring's locations.

5.1. Inspection Timing

Enduring shall inspect the recycling containment and associated leak detection systems weekly while it contains fluids. A current log of inspections will be maintained and the log will be made available for review upon division request. If fluids are found in the sump, the fluids will be sampled and then pumped out. In addition to human monitoring the pond fluid level will be determined via two (2) hydrostatic pressure gauges and a float gauge. At a fluid height of 22', an automated valve will close and prevent any more fluid from entering the containment.

5.2. Maintenance

1. Enduring shall maintain and operate the recycling containment as follows:
   A. Removing any visible lay of oil from the surface of the containment.
   B. Maintaining at least 3' of freeboard at each containment
   C. The injection or withdrawal of fluids from the containment shall be accomplished through a header, diverter or other hardware that prevents damage to the liner by erosion, fluid jets, or impact from installation and removal of hoses and pipes
   D. If the containment's primary liner is compromised above the fluid's surface, Enduring will repair the damage or initiate replacement of the primary liner within 48 hours of discovery or seek an extension from the division district office.
   E. If the primary liner is compromised below the fluid's surface, Enduring will remove all fluid above the damage or leak within 48 hours of discovery, notify the divisions distraction office and repair the damage or replace the primary liner.
   F. The containment will be operated to prevent the collection of surface water run-on with containment walls of 9.5' height.
   G. Enduring will install, or maintain on site, an oil absorbent boom or other device to contain an unanticipated release.
   H. Enduring will not store or discharge any hazardous waste at the facility or within the containment.

5.3. Cessation of Operations

Enduring will report the cessation of operations or if less than 20% of the total fluid capacity is used every six months following the first withdrawal of produced water for use to the appropriate division district office. If additional time is needed for closure, Enduring will request an extension from the appropriate division district office prior to the expiration of the initial six month time period.

6. Closure Plan

In accordance with Rule 19.15.34 the following information describes the closure requirements of recycling containments on Enduring's locations.

All closure activities will include proper documentation and be available for review upon request and will be submitted to the OCD within 60 days of closure. Closure report will be filed on C-147 and incorporate the following:

- Details on capping and covering, where applicable
- Inspection Reports
- Sampling Results

Once Enduring has ceased operations, all fluids will be removed within 60 days and the containment shall be closed within six months.

6.1 Fluid Removal

The containment will be closed by first removing all fluids, contents and synthetic liners and disposed of in a division-approved facility or recycle, reuse or reclaim the liquids in a manner that the appropriate division district office approves.

6.2 Soil Sampling

Enduring will test the soils beneath the containment for contamination with a five-point composite sample which includes stained or wet soils, if any, and that sample shall be analyzed for the constituents listed in Table I below:

Components	Test Method	51' - 100' GW Depth Limit (mg/kg)	>100' GW Depth Limit (mg/kg)
Chloride	EPA 300.0	10,000	20,000
TPH (GRO+DRO+MRO)	EPA SW-846 Method 8015M	2,500	2,500
GRO + DRO	EPA SW-846 Method 8015M	1,000	1,000
BTEX	EPA SW-846 Method 8021B or 8260B	50	50
Benzene	EPA SW-846 Method 8021B or 8260B	10	10

a. If any containment concentration is higher than the parameters listed in Table I, Enduring will receive approval before proceeding with closures as the division may required additional delineation upon review of the results.
b. If all contaminant concentrations are less than or equal to the parameters listed in Table I then Enduring will proceed to backfill with non-waste containing, uncontaminated, earthen material.

6.3 Reclamation

The topsoil and subsoil will be replaced to their original relative positions and contoured so as to achieve erosion control, long-term stability and preservation of surface water flow patterns.

Enduring will reclaim and reseed the recycling containment area pursuant to the requirements listed in 19.15.34.14. Once Enduring has closed the recycling containment, we will reclaim the containment's location to a safe and stable condition that blends with the surrounding undisturbed area and matches the existing grade. Topsoils and subsoils shall be replaced to their original relative positions and contoured so as to prevent ponding and erosion. The disturbed area shall then be reseeded in the first favorable growing season following closure of a recycling containment. Enduring will restore the impacted surface area to the condition that existed prior to the construction of the recycling containment.

Reclamation of all disturbed areas no longer in use shall be considered completed when all ground surface disturbing activities at the site have been completed, and a uniform vegetative cover has been established that reflects a life-form ratio of plug or minus fifty percent (50%) of pre-disturbance levels and a total percent plant cover of at least seventy percent (70%) of pre-disturbance levels, excluding noxious weeds.

The re-vegetation and reclamation obligations imposed by federal, state trust land or tribal agencies on lands managed by those agencies shall supersede these provisions and govern the obligations of any operator subject to those provisions, provided that the other requirements provide equal or better protection of fresh water, human health and the environment. Enduring will notify the OCD district office when reclamation and revegetation have been completed.

7. iWATERS REPORT

New Mexico Office of the State Engineer

Water Column/Average Depth to Water

(A CLW##### in the POD suffix indicates the POD has been replaced & no longer serves a water right file.)

(R=POD has been replaced, O=orphaned, C=the file is closed)

(quarters are 1=NW 2=NE 3=SW 4=SE)
(quarters are smallest to largest)

(NAD83 UTM in meters)

(In feet)

POD Number	Code	POD Sub-basin	County	Q 64	Q 16	Q 4	Sec	Tws	Rng	X	Y	Depth Well	Depth Water	Water Column
SJ 00001		SJ	SJ		4	1	12	23N	09W	253534	4014427*	695	630	65
SJ 00144		SJ	SJ	1	1	3	31	23N	09W	244786	4007922*	100		
SJ 01710		SJ	SJ		1	3	25	23N	09W	252985	4009203*	550	173	377

Average Depth to Water: **401 feet**

Minimum Depth: **173 feet**

Maximum Depth: **630 feet**

Record Count: 3

PLSS Search:

Township: 23N **Range:** 09W

***UTM location was derived from PLSS - see Help**

1/10/19 12:08 PM

WATER COLUMN/ AVERAGE DEPTH TO WATER

MO-TE DRILLING, INC.

DAY TUES

DRILLER Jeremy		LEFT TOWN	ARRIVED FIELD
HELPER Kasey		LEFT FIELD	ARRIVED TOWN
HELPER		TOTAL FOOTAGE TODAY	

RIG NO. 212 DATE 9-18-18 CLIENT Enduring

BEGIN WORK ON HOLE NO. KWU2309-30D AT _____ FEET

BEGIN WORK ON HOLE NO. _____ AT _____ FEET

TIME FROM	TIME TO	ACTIVITY
		Latitude 36.203349
		Longitude -107.387349
8:30	9:30	Drive out to location
9:30	9:40	Rig up
9:40	10:00	Drill 6 1/4" Ø-50', no water
10:00	10:25	Drill 50'-100'
10:25	10:45	Rig down
10:45	11:45	Standby for water test
11:45		tested for water, no standing water. Dump soil only @ 86'
11:50		move off location
		Enduring & OCD to return to
		location tomorrow to recheck

BIT RECORD

SIZE & MAKE	SERIAL NO.	FOOTAGE

CIRCULATION MATERIAL

QUAN.	UNIT	MATERIAL

NO. OF LOADS OF WATER _____ SOURCE _____

ENDURING RESOURCES
200 Energy Court • Farmington, NM 87401
Telephone (505) 636-9741 Fax (505) 334-1979

KWU 2309-30D

Ground Water Depth Confirmation

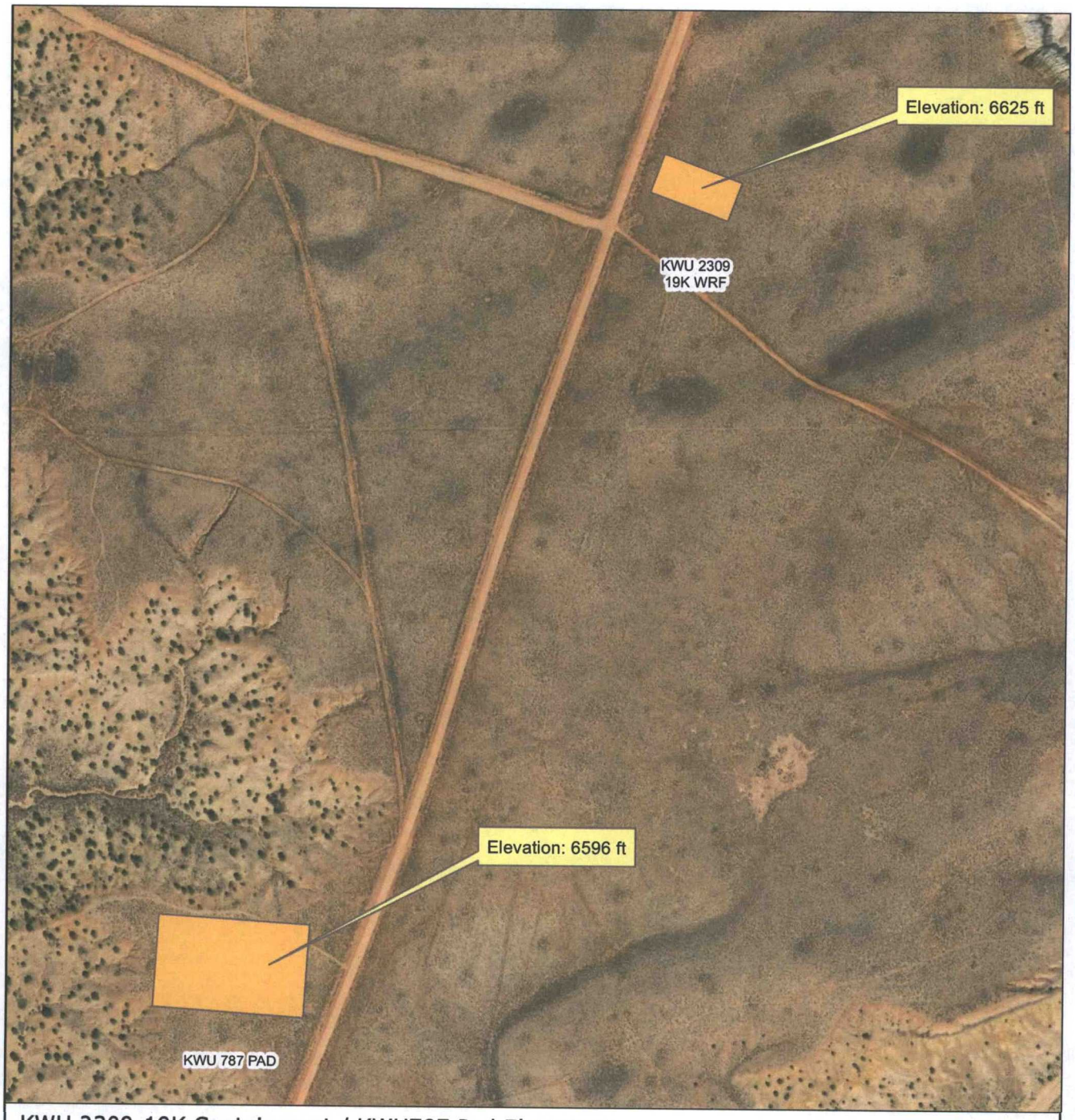
Day 2

Attendees:

Vanessa Fields	NMOCD
James McDaniel	Enduring Resources
Chad Snell	Enduring Resources

Day 1 Recap:
Damp soil only @86 feet when Mo-Te Drilling Rig 212 left location. Enduring & NMOCD will return to location on 9-19-2018 to recheck and confirm ground water depth.

Arrived at location at 9am boring was tagged at 86 feet deep before encountering damp soil, Vanessa advised NMOCD will go forward with drillers log of water encountered at 86 feet deep.



KWU 2309-19K Containment / KWU787 Pad Elevations

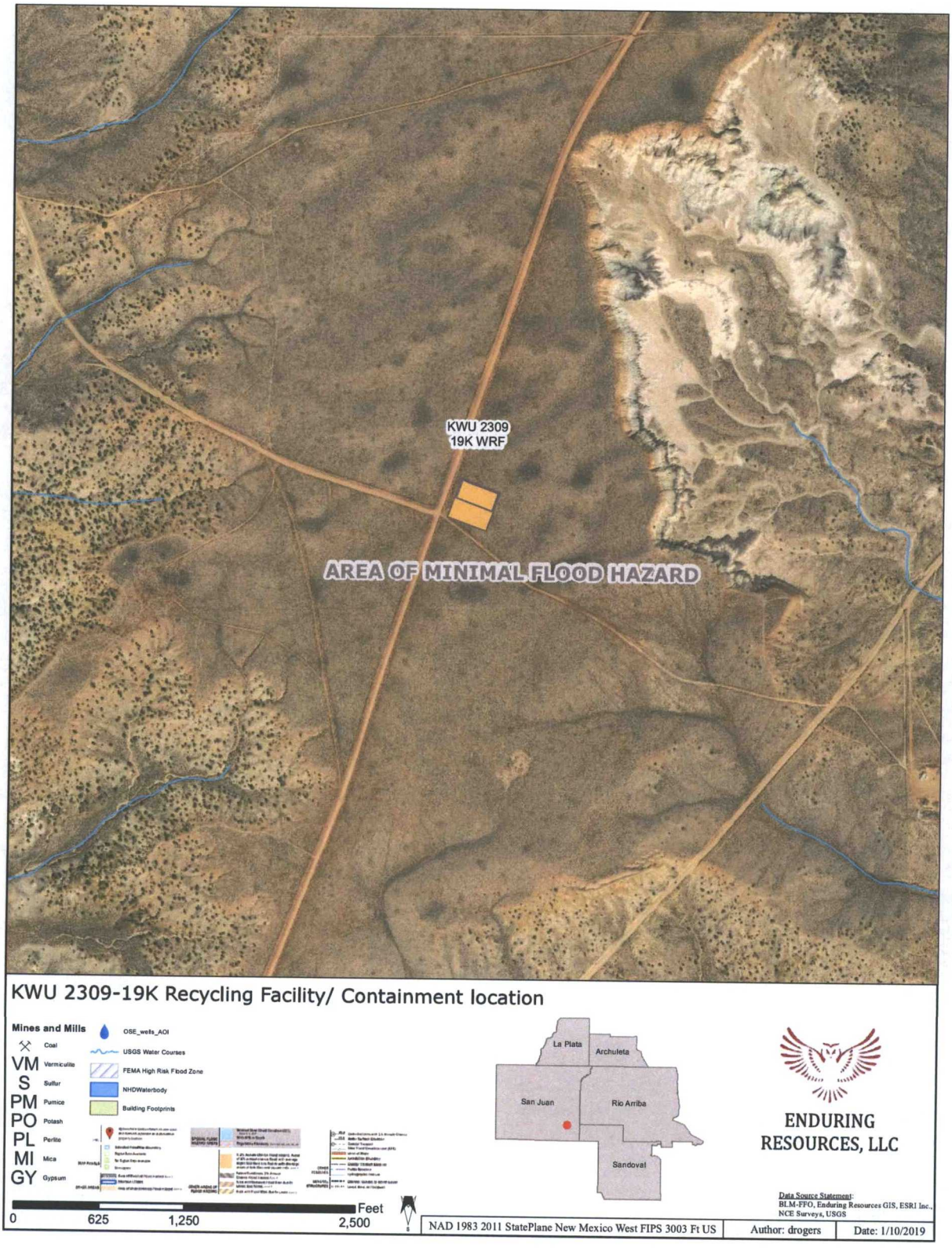
ENDURING RESOURCES, LLC

0 330 660 1,320 Feet

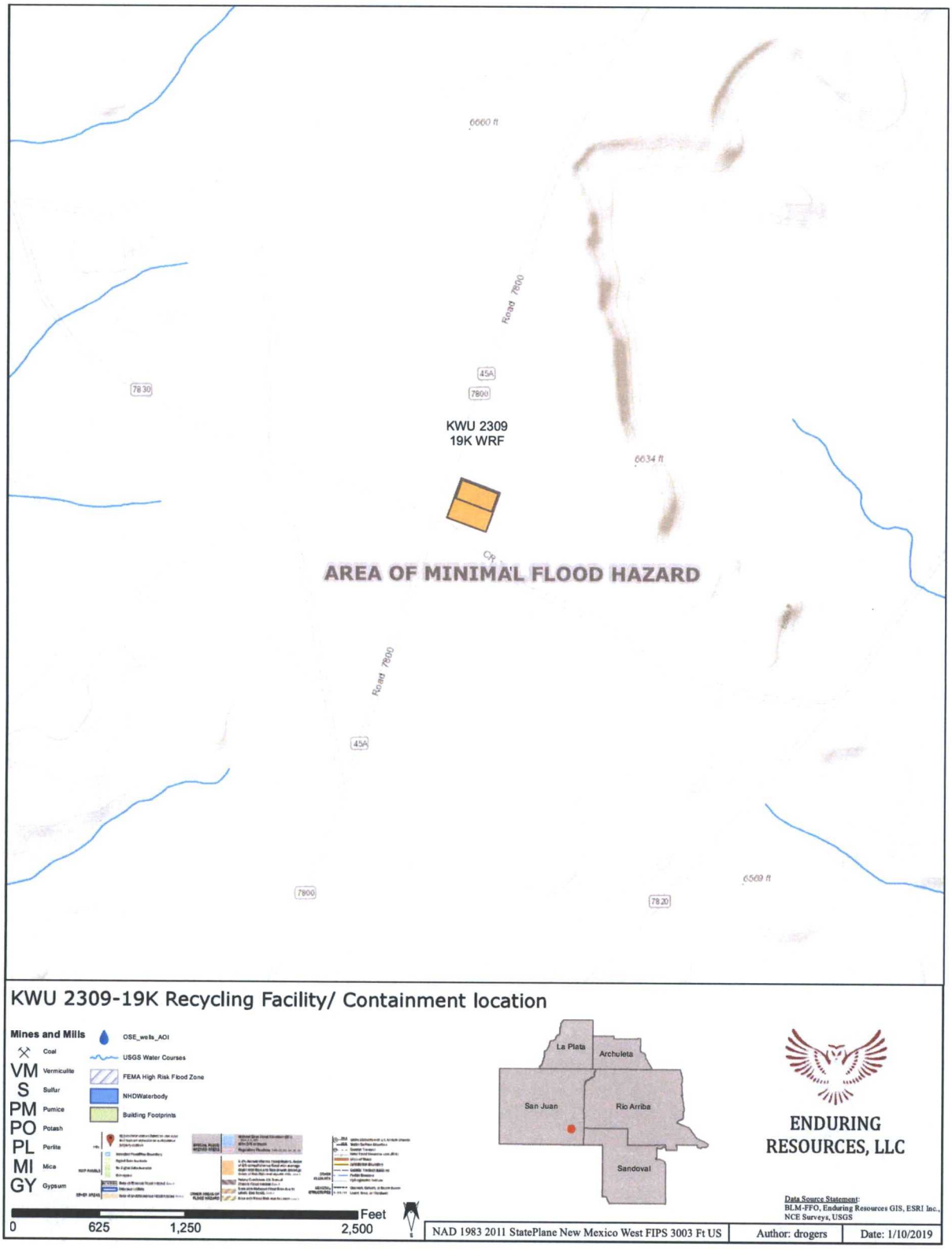
Data Source Statement:
BLM-FFO, Enduring Resources GIS, ESRI Inc., NCE Surveys, USGS

NAD 1983 2011 StatePlane New Mexico West FIPS 3003 Ft US	Author: drogers	Date: 1/10/2019

8. Aerial Map



9. TOPO MAP



12. HYDROLOGY REPORT

Hydrogeological Report for KWU 2309-19K

Regional Geological context:

The Nacimiento Formation is of Paleocene age (Baltz, 1967, p. 35). It crops out in a broad band inside the southern and western margins of the central basin and in a narrow band along the west face of the Nacimiento Uplift. The Nacimiento is a nonresistant unit and typically erodes to low, rounded hills or forms badland topography.
The Nacimiento Formation occurs in approximately only the southern two-thirds of the San Juan Basin where it conformably overlies and intertongues with the Ojo Alamo Sandstone (Fassett, 1974, p. 229). The Nacimiento Formation grades laterally into the main part of the Animas Formation (Fassett and Hinds, 1971, p. 34); thus, in this area, the two formations occupy the same stratigraphic interval.
Strata of the Nacimiento Formation were deposited in lakebeds in the central basin area with lesser deposition in stream channels (Brimhall, 1973, p. 201). In general, the Nacimiento consists of drab, interbedded black and gray shale with discontinuous, white, medium- to very coarse grained arkosic sandstone (Stone e al., 1983, p.30). Stone et al. indicated that the formation may contain more sandstone than commonly reported because some investigators assume the slope-forming strata in the unit area shales, whereas in many places the strata actually are poorly consolidated sandstones. Total thickness of the Nacimiento Formation ranges from about 500 to 1,300 feet. The unit generally thickens from the basin margins toward the basin center (Steven et al., 1974). The sandstone deposits within the Nacimiento Formation are much thinner than the total thickness of the formation because their environment of deposition was localized stream channels (Brimhall, 1973, p. 201). The thickness of the combined San Jose, Animas, and Nacimiento Formations ranges from 500 to more than 3.500 feet.

Hydraulic Properties:

Reported well yields for 53 wells completed in either the Animas or Nacimiento Formations range from 2 to 90 gallons per minute and the median yield is *7.5* gallons per minute. The primary use of water from Nacimiento and Animas Formations is domestic and livestock supplies. There are no known aquifer tests for the Animas or Nacimiento Formations, but specific capacities reported for six wells range from 0.24 to 2.30 gallons per minute per foot of drawdown (Levings et al., 1990).
The Animas and Nacimiento Formations are in many ways hydrologically similar to the San Jose Formation because sands in both units produce approximately the same quantities of water. However, the greater percentage of fine materials in the Animas and Nacimiento Formations may restrict downward vertical leakage to the Ojo Alamo Sandstone or Kirtland Shale. The poorly cemented fine material is highly erodible, forms a badland terrain, and supports only spotty vegetation. These conditions are more conductive to runoff than retention of precipitation.

References:

Baltz, E.H., 1967, Stratigraphy and regional tectonic implications of part of Upper Cretaceous rocks, east-central San Juan Basin, New Mexico: USGS Professional Paper 552, 101 p.

Brimhall, R.M., 1973, Ground-water hydrology of Tertiary rocks of the San Juan Basin, New Mexico, in Fassett, J.E., ed., Cretaceous and Tertiary rocks of the Southern Colorado Plateau: Four Corners Geological Society Memoir, p. 197-207.

Fassett, J.E., 1974, Cretaceous and Tertiary rocks of the eastern San Juan Basin, New Mexico and Colorado, in Guidebook of Ghost Ranch, central-northern New Mexico: New Mexico Geological Society, 25th Field Conference, p. 225-230.

Fassett, J.E., and Hinds, J.S., 1971, Geology and fuel resources of the Fruitland Formation and Kirtland Shale of the San Juan Basin, New Mexico and Colorado: USGS Professional Paper 676, 76 p.

Levings, G.W., Craigg, S.d., Dam, W.L., Kernodle, J.M., and Thorn, C.R., 1990, Hydrogeology of the San Jose, Nacimiento, and Animas Formations in the San Juan structural basin, New Mexico, Colorado, Arizona, and Utah: USGS Hydrologic Investigations Atlas HA-720-A, 2 sheets.

Stone, W.J., Lyford, F.P., Frenzel, P.F., Mizell, N.H., and Padgett, E.T., 1983, Hydrogeology and water resources of San Juan Basin, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Hydrologic Report 6.

NMOCD

JAN 15 2019

DISTRICT III

13. SURFACE OWNER NOTIFICATION

RECEIVED

JUL 02 2018

Farmington Field Office
Bureau of Land Management

Form 3160-5
(June 2015)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

FORM APPROVED
OMB No. 1004-0137
Expires: January 31, 2018

SUNDRY NOTICES AND REPORTS ON WELLS

Do not use this form for proposals to drill or to re-enter an abandoned well. Use Form 3160-3 (APD) for such proposals.

SUBMIT IN TRIPLICATE *- Other instructions on page 2*

5. Lease Serial No.

6. If Indian, Allottee or Tribe Name

7. If Unit of CA/Agreement, Name and/or No.
NMNM135255A

1. Type of Well
☒Oil Well ☐Gas Well ☐Other

8. Well Name and No.
KIMBETO WASH UNIT

2. Name of Operator
Enduring Resources, LLC

9. API Well No.

3a. Address
332 Cr 3100 Aztec, NM 87410

3b. Phone No. *(include area code)*
505-636-9741

10. Field and Pool or Exploratory Area
KIMBETO WASH UNIT

4. Location of Well *(Footage, Sec., T.,R.,M., or Survey Description)*

11. Country or Parish, State
San Juan, NM

12. CHECK THE APPROPRIATE BOX(ES) TO INDICATE NATURE OF NOTICE, REPORT OR OTHER DATA

TYPE OF SUBMISSION	TYPE OF ACTION			
☒Notice of Intent	☐Acidize	☐Deepen	☐Production (Start/Resume)	☐Water ShutOff
	☐Alter Casing	☐Hydraulic Fracturing	☐Reclamation	☐Well Integrity
☐Subsequent Report	☐Casing Repair	☐New Construction	☐Recomplete	☐Other
☐Final Abandonment Notice	Change Plans	☐Plug and Abandon	☐Temporarily Abandon	KIMBETO WASH UNIT REMOTE 1 FACILITY
	☐Convert to Injection	☐Plug Back	☐Water Disposal	

13.Describe Proposed or Completed Operation: Clearly state all pertinent details, including estimated starting date of any proposed work and approximate duration thereof. If the proposal is to deepen directionally or recomplete horizontally, give subsurface locations and measured and true vertical depths of all pertinent markers and zones. Attach the Bond under which the work will be perfonned or provide the Bond No. on file with BLM/BIA. Required subsequent reports must be filed within 30 days following completion of the involved operations. If the operation results in a multiple completion or recompletion in a new interval, a Form 3160-4 must be filed once testing has been completed. Final Abandonment Notices must be filed only after all requirements, including reclamation, have been completed and the operator has detennined that the site is ready for final inspection.)

KIMBETO WASH UNIT-

Enduring Resources IV, LLC is changing the well completion operation from a nitrogen to a slick water completion operation. This change in completion operations will allow for the use and reuse of nonpotable water and will significantly reduce the amount of flaring needed to clean a well up to pipeline quality.
Enduring would like to utilize the approved Kimbeto Wash Unit Remote 1 area as a Water Recycling Facility in order to achieve the goal of a slick water completion operation. The facility will consist of a water supply well sourcing nonpotable water from the Entrada formation for oil and gas completion and recycling purposes which will be permitted with the Office of the State Engineer. This facility will supply water for Enduring Resources IV, LLC operations only and within the approved West Lybrook, Rodeo and Kimbeto units. Surface water lines will be utilized within the already approved pipeline ROW corridors to transfer the water to each location for completion activities. No new surface approvals are necessary for this request, Enduring will follow all existing stipulations and COA's.
A c102 of the approved Kimbeto Wash Unit Remote 1 area is attached.

BLM'S APPROVAL OR ACCEPTANCE OF THIS ACTION DOES NOT RELIEVE THE OPERATOR FROM OBTAINING ANY OTHER AUTHORIZATION REQUIRED FOR OPERATIONS ON FEDERAL AND INDIAN LANDS

14. I hereby certify that the foregoing is true and correct. Name *(Printed/Typed)*
Andrea Felix

Title Regulatory Manager

Signature

Date 7/2/18

THE SPACE FOR FEDERAL OR STATE OFICE USE

Approved by

Title PE

Date 7/2/18

Conditions of approval, if any, are attached. Approval of this notice does not warrant or certify that the applicant holds legal or equitable title to those rights in the subject lease which would entitle the applicant to conduct operations thereon.

Office FFO

Title 18 U.S.C Section 1001 and Title 43 U.S.C Section 1212, make it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

OPERATOR

Enduring Resources, LLC's
Recycling Containment
Migratory Bird Mitigation Plan

Enduring Resources, LLC (Enduring) is proposing this Migratory Bird Mitigation Plan (Mitigation Plan) in compliance with the New Mexico Oil Conservation Division (NMOCD) Rule 19.15.34.12.E Enduring shall ensure that the recycling containment is protective of wildlife by implementing the following proposed Mitigation Plan. Enduring employees will inspect the containment weekly for and, within 30 days of discovery, report the discovery of dead migratory birds or other wildlife to the appropriate wildlife agency and to the division district office in order to facilitate assessment and implementation of measures to prevent incidents from reoccurring. This Mitigation Plan will utilize a combination of visual and audio deterrents to discourage wildlife, particularly birds and bats, from the recycling containment in order to mitigate potential impacts. This Mitigation Plan would be implemented while the Recycling Containment is active and in use, as to not desensitize birds to the deterrents.

The following mitigations will be implemented to reduce any wildlife impacts that may occur from the Recycling Containment:

- The following visual bird deterrents will be installed (Appendix A):
  - Bird-X Prowler Owl decoys will be installed at all four corners of the Containment.
  - Scare-Eye Balloons will be installed along the perimeter of the Containment.
- A Bird-X BroadBand PRO System will be installed at the Containment facility. It utilizes sonic (naturally-recorded bird destress calls & predator cries) to deter birds; as well as, ultrasonic high-frequency sound waves to deter bats. Bird propane cannons were avoided, so as not to disturb other wildlife species.
- The containment will be inspected on a monthly basis when water is present in the containment. All inspectors will insure the containment is receiving only filtered produced water with no hydrocarbons, as well as being trained to inspect the premises for, and respond to any wildlife incident, should it occur.
- Inspection will include:
  - An inspection of the filtration system and all visual and audio deterrents to insure they are in working order and functioning properly.
  - A thorough search of the entire containment facility, and just beyond, for the presence of any wildlife (entrapped, injured, dead, etc.).
- In the event a wildlife incident should occur, James McDaniel with Enduring will be contacted immediately and he will notify the appropriate wildlife agency and division district office. Enduring, appropriate wildlife agency, and division district office will then work collaboratively to address the incident appropriately to insure the incident does not reoccur.

BIRD-X
Pest control for today's environment.

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- Electronic Bird Control >
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  - Other Electronic Bird Deterrents
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- Bird Netting
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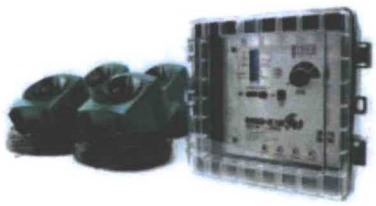
- Laser Bird Control
- Shock Track Systems
- Bird Balls
- Bird Wire
- Visual Scares and Predator Decoys
- Bird Gels, Taste Aversions, & OvoControl® P
- For Songbird Lovers
- Remote Control Drone
- Retail Products
- Accessories

BroadBand PRO

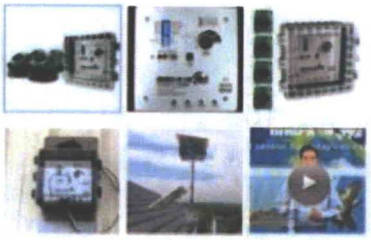


- Combines SONIC and ULTRASONIC Bird Control Technology
- Creates Uninviting Environment For Birds
- Covers Up To SIX ACRES

IN STOCK - AVAILABLE IMMEDIATELY!

Deter Birds With Multi-Faceted Sonic and Ultrasonic Attack! The BroadBand PRO's 4-speaker system simultaneously emits sounds that are both audible and inaudible to humans that confuse, disorient, and intimidate pest birds, keeping them away

Starting at ~~$850.00~~ NOW $725.00 (15% SAVINGS!)



Voltage Options: BroadBand PRO 110v ($725
Quantity: 1
Price: **$725.00**
Product Total: $725.00

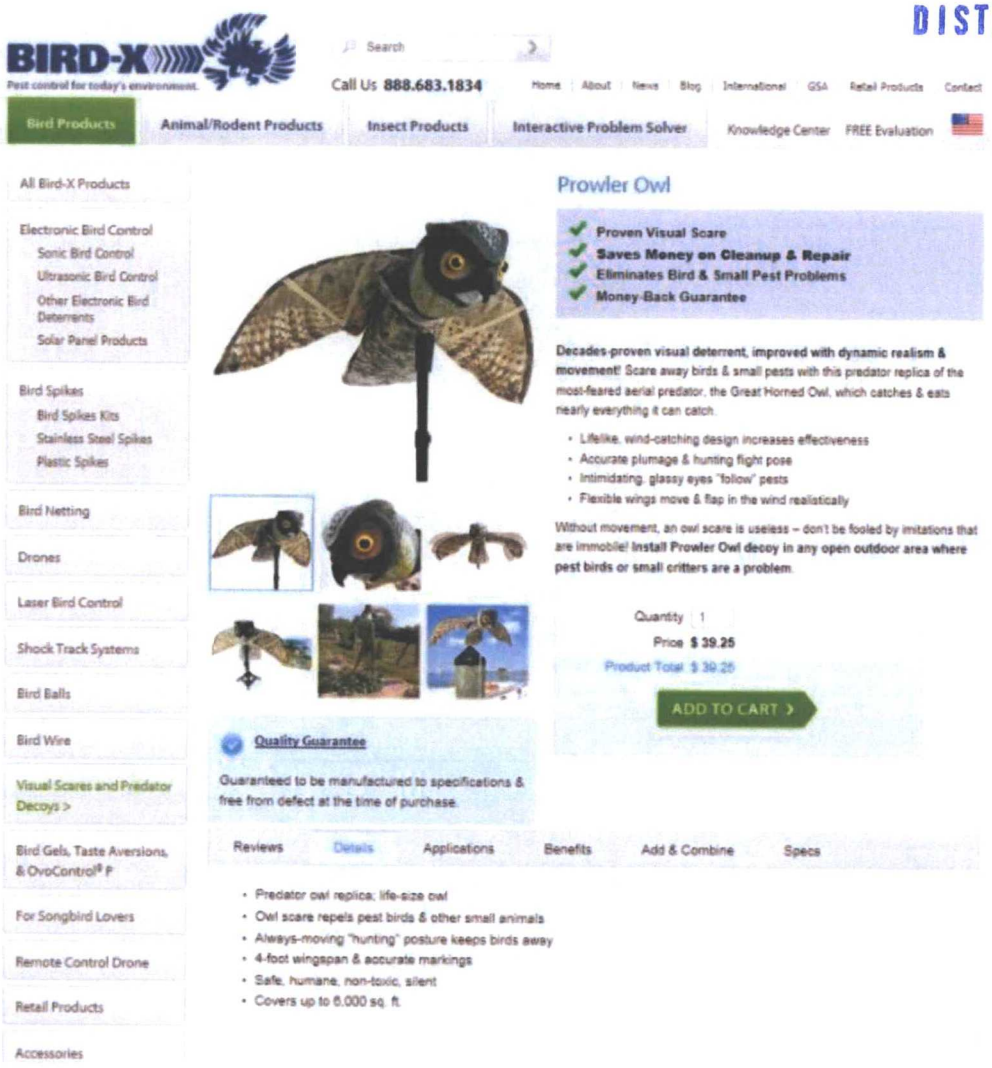
ADD TO CART >

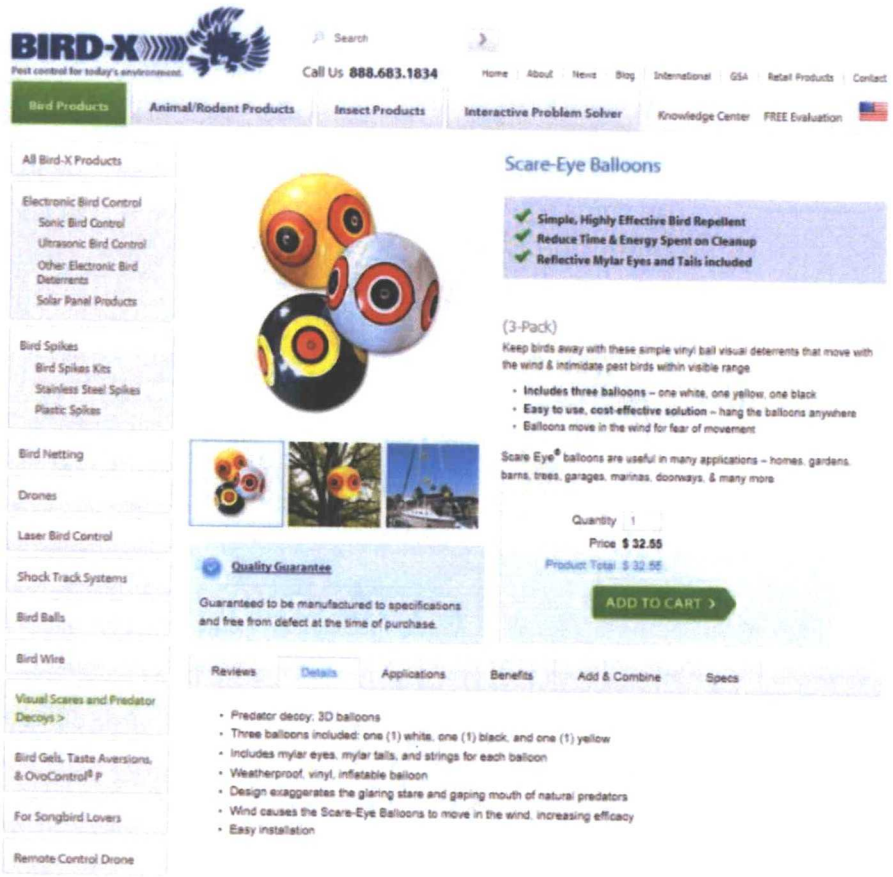
Reviews | Details | Applications | Benefits | Add & Combine | Specs | Case Studies

Guarantee + Warranty

Backed by our 30 Day Electronics Performance Satisfaction Guarantee AND our 6-Month Manufacturer's Warranty Against Material Defects

- **Option to add 3 Visual Scares to package for added efficacy**
- Emits a combination of audible noises & high-frequency sound waves that are silent-to-most-humans
  - **SONIC**: Uses naturally-recorded bird distress calls & predator cries; covers up to 6 acres
  - **ULTRASONIC**: Uses high-frequency sound waves; covers up to 3,600 sq. ft.
- 4 speakers included – 4 independent speakers with 100 ft. of wire each
- Fully programmable – control volume, sound delays, & daylight / night operation
- Weather resistant – NEMA type box is designed to withstand outdoor use
- Option to add an assortment of three (3) high-quality visual scare products





ATTACHMENT B - CONTAINMENT CONSTRUCTION PLANS

787H RECYCLING CONTAINMENT PIT PROJECT

CONSTRUCTION PLANS

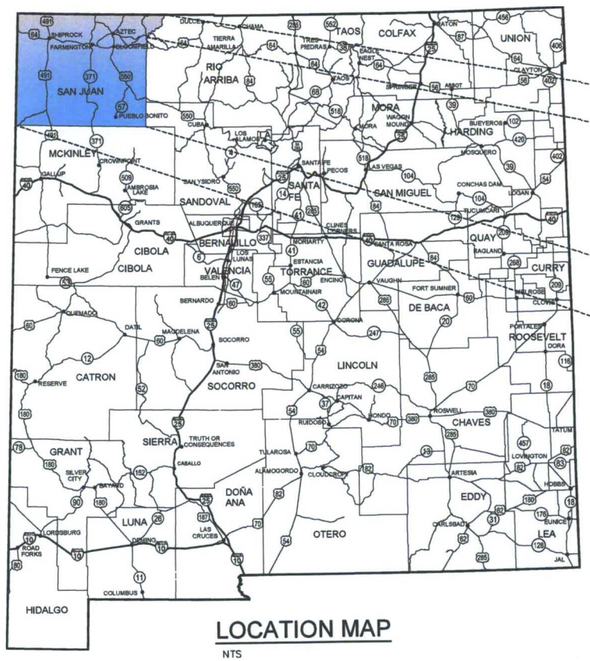
SITE CONTROL

CENTER OF PRODUCED WATER PIT Lat 36°12'37"N Long 107°49'54"W

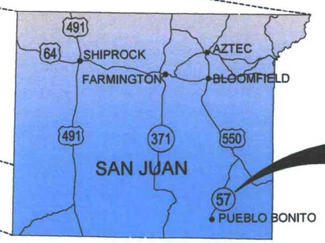
SECTION 30, TOWNSHIP 23 NORTH, RANGE 9 WEST, NEW MEXICO PRINCIPAL MERIDIAN,
SAN JUAN COUNTY, NEW MEXICO

SAN JUAN COUNTY, NEW MEXICO
December 2018

PROJECT DESCRIPTION:
KIMBETO WASH RECYCLING PIT



LOCATION MAP
NTS



PROJECT LOCATION
NTS

VICINITY MAP
NTS

Sheet List Table

Sheet Number	Sheet Title
G100	COVER
G101	GENERAL NOTES AND LEGEND
C101	SITE PLAN
C102	SITE GRADING AND DRAINAGE PLAN
C103	SITE PROFILES
C104	SITE CROSS-SECTIONS
C105	HORIZONTAL CONTROL PLAN
C106	LINER BALLAST TUBES AND PIT GEOCOMPOSITE VENTILATION GRID LAYOUT
C107	GEOCOMPOSITE DETAILS
C108	LINER AND BALLAST TUBE DETAILS
C109	LEAK DETECTION SYSTEM AND PIT ACCESS ROAD DETAILS
C110	CHAIN LINK SECURITY FENCE DETAILS
C111	SITE EROSION AND SEDIMENTATION CONTROL PLAN
C112	SITE EROSION AND SEDIMENTATION CONTROL DETAILS

THESE DETAILED PLANS AND SPECIFICATIONS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION ON BEHALF OF SOUDER, MILLER & ASSOCIATES.

Heather D. McDaniel 12-21-2018

HEATHER D. MCDANIEL, P.E. NM #22047 DATE
PROJECT MANAGER

SOUDER, MILLER & ASSOCIATES
8000 W. 14th Avenue
Lakewood, CO 80214

SEALED DATE ON THE PLANS. IF CHANGES TO ANY SITE CONDITIONS AND/OR REGULATIONS OCCUR BEFORE THE PROJECT CONSTRUCTION DATE, THE OWNER SHALL NOTIFY ENGINEER OF SUCH CHANGES AND OBTAIN THE ENGINEER'S OPINION AS TO THE COMPLETENESS OF THE PLANS AND SPECIFICATIONS. ANY SUCH CHANGE IN FIELD CONDITIONS AND/OR REGULATIONS MAY REQUIRE ADDITIONAL DESIGN SERVICES AND COMMENSURATE FEE INCREASE TO ACCOMMODATE SUCH CHANGES.

2. CLARIFICATIONS AND/OR REQUESTS REGARDING PROJECT INTENT AND MODIFICATIONS SHALL BE SUBMITTED TO THE ENGINEER PRIOR OR DURING CONSTRUCTION IN A FORMAL WRITTEN REQUEST FOR INFORMATION (RFI). THE ENGINEER SHALL NOT BE HELD LIABLE IF RECOMMENDATION(S) ARE ALTERED BY OTHERS.

3. SITE CONDITIONS, EACH SUBCONTRACTOR DOING WORK ON THE PROJECT SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR THE SAFETY OF ALL PERSONS AND PROPERTY WITHIN THEIR WORK AREAS, DAY AND NIGHT, DURING BOTH WORKING AND NONWORKING HOURS; AND, SHALL PROVIDE ALL BARRICADES, SHORING, FLAG MEN, SIGNS, LIGHTING AND OTHER DEVICES REQUIRED THEREOF.

4. THE CONTRACTOR WILL BE RESPONSIBLE FOR THE REPAIR AND/OR REPLACEMENT OF ANY DAMAGE DETERMINED TO BE CAUSED BY THE CONSTRUCTION OF THIS PROJECT TO ROADS, FENCES, DRAINAGES, DRAINAGE STRUCTURES, UTILITIES, INCLUDING CONDUIT, WIRING, EQUIPMENT, AND FIBER-OPTICS. THE CONTRACTOR SHALL REPAIR AND/OR REPLACE ALL DESTROYED OR DAMAGED SURFACE IMPROVEMENTS WITH IMPROVEMENTS EQUAL TO THOSE REMOVED.

5. STOCKPILING OF TOP SOIL: CONTRACTOR SHALL SEGREGATE AND STOCKPILE ALL TOPSOIL OUTSIDE OF THE CONSTRUCTION AREA WITH APPROPRIATE SEDIMENT CONTROL. TOP SOIL SHALL BE REDISTRIBUTED ON THE OUTSIDE OF CONSTRUCTED BERMS, AND EITHER SEEDED, AND MULCHED OR PROTECTED WITH EROSION CONTROL MEASURES. REFER TO CONSTRUCTION PLANS FOR DETAILS.

6. ALL EXISTING TRAFFIC SIGNS, MILEPOST MARKERS AND DELINEATORS WITHIN CONSTRUCTION LIMITS SHALL BE REMOVED OR OFFSET BY THE CONTRACTOR AS DIRECTED BY THE OWNER'S DESIGNEE. INFORMATION SIGNS ARE TO BE OFFSET, AND ALL OTHERS ARE TO BE REMOVED. THIS WORK WILL BE INCLUDED IN THE UNIT BID PRICE FOR REMOVAL OF STRUCTURES AND OBSTRUCTIONS.

7. THE CONTRACTOR SHALL MAINTAIN REASONABLE ACCESS TO ALL ADJACENT PROPERTIES BY PROVIDING EASY RIDING CONNECTIONS TO TURNOUTS AND DRIVEWAYS AS DETERMINED ACCEPTABLE BY THE OWNER'S REPRESENTATIVE OR DESIGNEE. THIS WORK WILL BE CONSIDERED INCIDENTAL TO COMPLETION OF THE PROJECT AND NO MEASUREMENT OF PAYMENT WILL BE MADE THEREFORE.

8. THE CONTRACTOR IS HEREBY ADVISED THAT UTILITY RELOCATION BY UTILITY COMPANIES WILL BE DONE CONCURRENTLY WITH CONSTRUCTION. THE CONTRACTOR SHALL PROVIDE FOR UTILITY WORK IN CONJUNCTION WITH CONSTRUCTION OPERATIONS AND SHALL COORDINATE THE SCHEDULING OF WORK WITH THE RESPECTIVE UTILITY COMPANIES IN ORDER TO AVOID DELAYS DUE TO UTILITY WORK. THE CONTRACTOR SHALL PROVIDE FOR THESE CONTINGENCIES WHEN BIDDING THE PROJECT. NO CLAIM FOR DELAYS DUE TO UTILITY WORK WILL BE ALLOWED.

9. THERE IS NO CONSTRUCTION CLEAR ZONE FOR THIS PROJECT. THE CONTRACTOR SHALL NOT STORE EQUIPMENT OR MATERIAL OUTSIDE OF THE PROJECT BOUNDARIES ON THIS PROJECT. THIS WORK SHALL BE CONSIDERED INCIDENTAL TO THE COMPLETION OF THE PROJECT AND NO SEPARATE MEASUREMENT OR PAYMENT WILL BE MADE THEREFORE.

10. EMERGENCY ACCESS SHALL REMAIN OPEN AT ALL TIMES.

11. THE CONTRACTOR WILL REMOVE AND PROTECT ROAD NAME SIGNS DURING CONSTRUCTION AND REPLACE AS SOON AS POSSIBLE AFTER CONSTRUCTION.

12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPORTING AND CLEAN UP OF SPILLS ASSOCIATED WITH PROJECT CONSTRUCTION AND SHALL REPORT AND RESPOND TO SPILLS OF HAZARDOUS MATERIAL SUCH AS GASOLINE, DIESEL, MOTOR OILS, SOLVENTS, CHEMICALS, TOXIC AND CORROSIVE SUBSTANCES, AND OTHER MATERIALS WHICH MAY BE A THREAT TO PUBLIC HEALTH OR THE ENVIRONMENT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPORTING PAST SPILLS ENCOUNTERED DURING CONSTRUCTION AND OF CURRENT SPILLS NOT ASSOCIATED WITH CONSTRUCTION. REPORTS SHALL BE MADE IMMEDIATELY TO THE ENVIRONMENTAL EMERGENCY SPILL REPORTING LINE AT 1-866-428-6535 AND TO THE OWNER'S REPRESENTATIVE OR DESIGNEE. ANY UNREPORTED SPILLS IDENTIFIED AFTER CONSTRUCTION AND ASSOCIATED WITH PROJECT CONSTRUCTION SHALL BE CLEANED UP BY THE CONTRACTOR IN ACCORDANCE WITH THE CONTRACT. THE CONTRACTOR SHALL BEAR THE FULL COST OF CLEANUP OF SUCH UNREPORTED SPILLS.

13. FINAL PAYMENT OF CONCRETE AND REINFORCING BARS SHALL BE BASED ON PLAN QUANTITIES. IF THE DESIGN IS REVISED DURING CONSTRUCTION OR IF A QUANTITY CHANGE IS REQUIRED DUE TO DESCREPANCIES ON THE PLANS, THE PAYMENT SHALL BE BASED ON COMPUTED FIELD QUANTITIES MEASURED TO NEAT LINES.

14. EXISTING FENCE, SIGNS AND OTHER ITEMS OF PRIVATE PROPERTY FOUND TO BE WITHIN THE RIGHT-OF-WAY ARE TO BE REMOVED AND REPLACED AT THE EDGE OF RIGHT-OF-WAY, BY THE CONTRACTOR. THIS WORK WILL BE CONSIDERED INCIDENTAL TO THE COMPLETION OF THE PROJECT AND NO MEASUREMENT OF PAYMENT WILL BE MADE THEREFORE.

15. THROUGHOUT THE LIFE OF THE PROJECT THE CONTRACTOR SHALL KEEP LOCAL LANDOWNERS INFORMED IN TIMELY FASHION, OF ANY LANE CLOSURES WHICH WILL RESTRICT THE NORMAL FLOW OF TRAFFIC. THERE WILL BE NO DIRECT PAYMENT FOR THIS WORK.

16. THE CONTRACTOR SHALL MAINTAIN UP TO DATE SETS OF AS-BUILT PLANS FOR THE PROJECT. THESE PLANS SHALL BE KEPT CURRENT, WITHIN FIFTEEN (15) DAYS, AT ALL TIMES AND SHALL BE SUBJECT TO REVIEW BY THE OWNER'S REPRESENTATIVE OR DESIGNEE THROUGHOUT THE PROJECT AND WILL BE REVIEWED BY THE OWNER'S REPRESENTATIVE OR DESIGNEE FOR ACCURACY AND COMPLETENESS AT LEAST ONCE EVERY 15 DAYS. THE FINAL AS-BUILT PLANS SHALL BE SUBMITTED TO THE OWNER'S REPRESENTATIVE OR DESIGNEE PRIOR TO FINAL PAYMENT.

17. ALL WORK IN THE VICINITY OF LIVE STREAMS, WATER IMPOUNDMENTS, WETLANDS OR IRRIGATION SUPPLIES SHALL BE AFFECTED IN SUCH A MANNER AS TO MINIMIZE VEGETATION REMOVAL, SOIL DISTURBANCE AND EROSION. CROSSINGS OF LIVE STREAMS WITH HEAVY EQUIPMENT SHALL BE MINIMIZED, AS DETERMINED BY THE OWNER'S REPRESENTATIVE OR DESIGNEE. EQUIPMENT REFUELING, MAINTENANCE AND CEMENT DUMPING IN THE VICINITY OF WATER COURSES IS STRICTLY PROHIBITED AND SHALL BE PERFORMED IN PROPER CONTAINMENT AREAS.

18. TOPOGRAPHY SHOWN ON THESE PLANS IS ACCORDING TO FIELD LOCATION BY NCE SURVEYS, INC. JAMES C. EDWARDS P.L.S. #15269, DATED AUGUST 12, 2018.

19. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL REMOVALS REQUIRED TO COMPLETE THE PROJECT. ADDITIONAL REMOVALS NOT SHOWN ON THE PLANS WILL BE DESIGNATED BY THE OWNER'S REPRESENTATIVE OR DESIGNEE. THIS WORK WILL BE CONSIDERED AS INCLUDED IN THE CONTRACT PRICE FOR REMOVAL OF STRUCTURES AND OBSTRUCTIONS AND THE CONTRACTOR WILL NOT RECEIVE ADDITIONAL COMPENSATION FOR UNLISTED REMOVALS.

20. UNSUITABLE CONSTRUCTION MATERIALS AND DEBRIS FROM CLEARING AND GRUBBING ARE TO BE PLACED IN AN ENVIRONMENTALLY SUITABLE DISPOSAL SITE.

21. UTILITY LOCATIONS SHOWN WITHIN THE PROJECT BOUNDARY ARE BASED UPON THE BEST AVAILABLE EVIDENCE, BUT THE POSITIONS ARE NOT WARRANTED TO BE ACCURATE. CONTACT UTILITY PROVIDERS BEFORE STARTING ANY EXCAVATION WORK. SHOULD CONFLICTING INFORMATION OR INTERFERENCE PROBLEMS APPEAR IN THE CONSTRUCTION DRAWINGS THE CONTRACTOR SHALL BRING THAT INFORMATION TO THE ATTENTION OF THE ENGINEER IMMEDIATELY PRIOR TO INSTALLATION. FAILURE TO DO SO SHALL NOT BE A BASIS OF EXTRA PAYMENT TO THE CONTRACTOR.

22. THE CONTRACTOR SHALL NOTIFY ALL UTILITY COMPANIES BEFORE COMMENCING WORK AND SHALL BE RESPONSIBLE FOR COMPLYING WITH NEW MEXICO ONE-CALL PROCEDURES. ANY DAMAGE TO EXISTING UTILITIES MUST BE IMMEDIATELY REPORTED TO THE APPROPRIATE UTILITY COMPANY.

23. NEW MEXICO 811 LOCATES SHALL BE FIELD VERIFIED BY THE CONTRACTOR THROUGH POTHOLING AND COORDINATION WITH UTILITY OWNER.

24. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING THE RESPECTIVE UTILITY COMPANIES PRIOR TO GRADING OR TRENCHING.

25. THE CONTRACTOR SHALL REVIEW AND FOLLOW THE RECOMMENDATIONS PROVIDED IN THE "GEOTECHNICAL ENGINEERING REPORT - ADDENDUM #1 KIMBETO REMOTE FACILITY FRACKING WATER POND KWU 3209-19K" SAN JUAN COUNTY, NEW MEXICO, PREPARED BY GEOMAT INC., DATED DECEMBER 7, 2018 FOR MOISTURE CONTENT, MAXIMUM COMPACTED LIFT DEPTHS, AND MINIMUM COMPACTION REQUIREMENTS FOR THE PROJECT.

29. PLACE AND COMPACT FILL IN HORIZONTAL LIFTS, USING EQUIPMENT AND PROCEDURES THAT WILL PRODUCE RECOMMENDED MOISTURE CONTENTS AND DENSITIES THROUGHOUT THE LIFT.

UN-COMPACTED FILL LIFTS SHOULD NOT EXCEED 10 INCHES LOOSE THICKNESS.

MATERIALS SHOULD BE COMPACTED TO THE FOLLOWING:

MINIMUM PERCENT

MATERIAL	(ASTM D698)
LINER SUBGRADE	PER LINER MANUFACTURER'S RECOMMENDATIONS
SUBGRADE SOILS BENEATH FILL AREAS	95
ON SITE OR IMPORTED SOIL FILLS:	
BENEATH FOOTINGS AND SLABS ON GRADE	95
AGGREGATE BASE BENEATH SLABS AND PAVEMENTS	95
MISCELLANEOUS BACKFILL	90

ON-SITE AND IMPORTED SOILS SHOULD BE COMPACTED AT MOISTURE CONTENTS NEAR OPTIMUM.
EMBANKMENT FILLS SHOULD BE COMPACTED TO A MINIMUM 95 PERCENT OF THE MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D698 AT NEAR OPTIMUM MOISTURE CONTENT IN LIFTS NOT EXCEEDING 10-INCHES IN LOOSE THICKNESS.

30. BACKFILL MATERIALS TO BE PLACED UNDER CONCRETE SLABS SHALL BE A GRANULAR SOIL. EXPANSIVE TYPE SOILS ARE PROHIBITED AS BACKFILL MATERIALS.

31. THE EARTHWORK HAUL ON THIS PROJECT WILL BE CONSIDERED AS INCLUDED IN THE CONTRACT PRICE FOR UNCLASSIFIED EXCAVATION AND BORROW AS APPLICABLE, AND NO SEPARATE MEASUREMENT OR PAYMENT WILL BE MADE THEREFORE.

32. THE PROJECT WILL HAVE ALTERATION, VERIFICATION, AND SUBGRADE DENSITY TESTS COMPLETED BY A GEOTECHNICAL ENGINEERING COMPANY TO VERIFY COMPACTION. PROOF ROLLING WILL BE COMPLETED ALONG THE PROJECT SUBGRADE AND ANY SOFT SPOTS WILL BE REMOVED AND RECONSTRUCTED BEFORE THE CONTRACTOR BEGINS WORK.

33. NOTWITHSTANDING THE APPROVAL OF THESE GRADING PLANS, THE CONTRACTOR IS RESPONSIBLE FOR THE PREVENTION OF DAMAGE TO ADJACENT PROPERTY. NO PERSON SHALL EXCAVATE ON LAND SO CLOSE TO THE PROPERTY LINE AS TO ENDANGER ANY SUCH PROPERTY FROM SETTLING, CRACKING, EROSION, SILTING, SCOUR OR OTHER DAMAGE, WHICH MIGHT RESULT FROM THE GRADING DESCRIBED ON THE PLAN.

34. SPECIAL CONDITION: IF ANY ARCHAEOLOGICAL RESOURCES ARE DISCOVERED ON THE SITE OF THIS GRADING OPERATION, SUCH OPERATION WILL CEASE IMMEDIATELY, AND THE PERMITTEE WILL NOTIFY THE OWNER'S REPRESENTATIVE.

35. ALL PROJECT LIMITS AND CONSTRUCTION AREAS SHALL BE CLEARLY DELINEATED IN THE FIELD PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION AND/OR GRADING.

36. DURING ROUGH GRADING OPERATIONS AND PRIOR TO THE CONSTRUCTION OF ANY PERMANENT DRAINAGE STRUCTURES, TEMPORARY DRAINAGE CONTROL SHALL BE PROVIDED TO PREVENT PONDING WATER AND DAMAGE TO CONTIGUOUS PROPERTIES.

37. NO OBSTRUCTION OF FLOOD PLAINS OR NATURAL WATER COURSES WILL BE PERMITTED.

38. ALL EXISTING DRAINAGE COURSES ON THE PROJECT SITE MUST CONTINUE TO FUNCTION DURING STORM CONDITIONS. PROTECTIVE MEASURERS AND TEMPORARY DRAINAGE PROVISIONS MUST BE USED TO PROTECT CONTIGUOUS PROPERTIES DURING GRADING OPERATIONS.

39. THE FINISHED GRADE SHALL BE SLOPED AWAY FROM ALL EXTERIOR BUILDING WALLS AND FACILITIES TO PROMOTE POSITIVE DRAINAGE AWAY FROM FOUNDATIONS.

40. SAN JUAN COUNTY SHALL BE NOTIFIED 72 HOURS PRIOR TO COMMENCING ANY WORK IN THE PUBLIC RIGHT OF WAY.

41. ROADWAY SECTION REPLACEMENT SHALL MEET CURRENT SAN JUAN COUNTY AND UNITED STATES BUREAU OF LAND MANAGEMENT GOLD BOOK STANDARDS FOR DEPTH OR MATCH EXISTING DEPTH, WHICHEVER IS THICKER.

42. RECORD DRAWINGS OR WORK COMPLETED SHALL BE SUBMITTED TO ENGINEER PRIOR TO FINAL ACCEPTANCE OF THE INSTALLATIONS.

43. IN THE EVENT A SERVICE OUTAGE IS REQUIRED, CONTRACTOR WILL NOTIFY ALL AFFECTED PARTIES DATE OF OUTAGE AND DURATION THEY WILL BE WITHOUT SERVICE.

44. OWNER WILL ENSURE THAT ALL INSTALLED EROSION AND SEDIMENTATION CONTROL MEASURES COMPLY WITH THEIR EXISTING ASSET STORMWATER POLLUTION PREVENTION PLAN(SWPPP).

45. EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE IMPLEMENTED AND SHALL BE KEPT IN PLACE UNTIL EROSION AND SEDIMENTATION POTENTIAL IS MITIGATED. REMOVAL OF SILT AND SEDIMENT IS REQUIRED ONCE SILT AND SEDIMENT HAS REACHED HALF THE HEIGHT OF THE SILT FENCE. EROSION AND SEDIMENTATION CONTROL DEVICES SHALL BE CHECKED AND MAINTAINED PER THE OWNERS PERMIT.

46. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN THE FIELD.

47. THE CONTRACTOR SHALL COORDINATE STRUCTURAL DRAWINGS WITH OTHER DRAWINGS FOR INDIVIDUAL ITEMS. DISCREPANCIES UNCOVERED, IF ANY, SHALL BE REPORTED BEFORE PROCEEDING WITH THE WORK SO THAT PROPER ADJUSTMENT CAN BE MADE.

48. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING SAFE AND ADEQUATE SHORING FOR ALL PARTS OF THE PROJECT DURING CONSTRUCTION. ALL STRUCTURES SHOWN ON THE DRAWINGS HAVE BEEN DESIGNED FOR STABILITY UNDER FINAL CONFIGURATION.

49. THE OWNER WILL PROVIDE CONSTRUCTION OBSERVERS AND MATERIAL TESTERS TO OBSERVE AND TEST ALL CONTROLLED EARTHWORK. THE CONSTRUCTION OBSERVERS AND MATERIAL TESTERS SHALL PROVIDE CONTINUOUS ON-SITE OBSERVATION AND TESTING DURING CONSTRUCTION OF CONTROLLED EARTHWORK. THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION OBSERVERS AND MATERIAL TESTERS AT LEAST TWO WORKING DAYS IN ADVANCE OF ANY FIELD OPERATIONS OF THE CONTROLLED EARTHWORK.

50. CONTRACTOR SHALL COMPLY WITH ANY AND ALL CONDITIONS OF APPROVALS ISSUED BY THE REGULATORY AGENCIES AS DETERMINED BY OWNER.

51. ENGINEER HAS NO CONTROL OVER COST OF LABOR, MATERIALS, EQUIPMENT OR SERVICES FURNISHED BY OTHERS, COMPETITIVE BIDDING OR MARKET CONDITIONS.

FARMINGTON, NEW MEXICO, 87401
(505) 386-8887

CIVIL ENGINEER

HEATHER D. MCDANIEL, P.E.
SOUDER, MILLER & ASSOCIATES (SMA)
8000 WEST FOURTEENTH AVENUE
LAKEWOOD, COLORADO 80214
(303) 239-9011

SURFACE MANAGER

BUREAU OF LAND MANAGEMENT
6251 COLLEGE BLVD, SUITE A
FARMINGTON, NEW MEXICO 87402
(505) 564-7600

ABBREVIATIONS

BLM	BUREAU OF LAND MANAGEMENT	ME	MATCH EXISTING
CMP	CORRUGATED METAL	MIL or MM	MILLIMETER
CU. FT.	CUBIC FEET	MIN.	MINIMUM
CU. YD.	CUBIC YARDS	N.T.S.	NOT TO SCALE
DIA.	DIAMETER (Ø)	O.C.	ON CENTER
ELEV.	ELEVATION	OD	OUTSIDE DIAMETER
EOG	EDGE OF GRAVEL ROAD	R.C.	REINFORCED CONCRETE
EX	EXISTING	RT	RIGHT
FT	FEET	SQ. FT.	SQUARE FEET
FG	FINISH GRADE	STA.	STATION
GALV	GALVANIZE	TOE	TOE OF BANK
HORIZ	HORIZONTAL	TOP	TOP OF BANK
LF	LINEAR FEET	TYP	TYPICAL
LLDPE	LINEAR LOW-DENSITY POLYETHYLENE	w/	WITH
LT	LEFT		
MAX.	MAXIMUM		
MCC	MECHANICAL CONTROL CENTER		

LEGEND

- 6620 — EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- 6620 — PROPOSED INDEX CONTOURS
- PROPOSED INTERMEDIATE CONTOURS
- PROPOSED DRAINAGE PIPE
- PROPOSED CHAIN LINK FENCE
- PROPOSED MAN WAY PEDESTRIAN GATE

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SAN JUAN COUNTY, NM

ENDURING RESOURCES

ENDURING RESOURCES KWU 2309-19K WATER RECYCLE FACILITY GENERAL NOTES AND LEGEND

ND NOT TO BE USED FO
CONSTRUCTION UNLESS IT I

HDM	DJR	HDM

December 2018

SITE MAP 1 C101

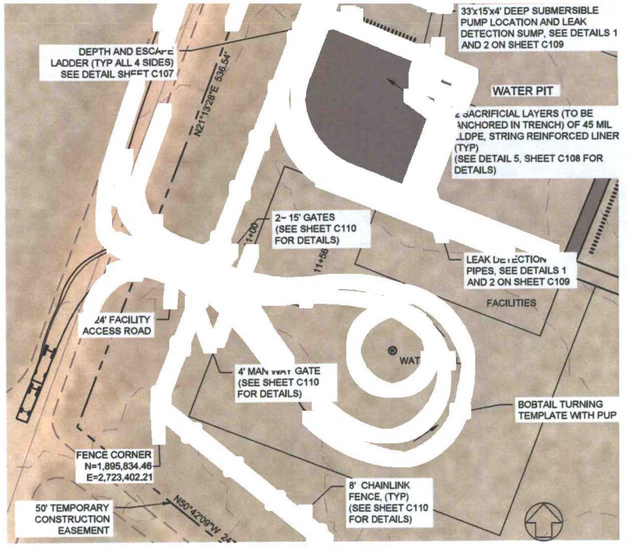
0 50' 100'

SCALE: 1" = 50'

PROPOSED POND INFORMATION:
TOP OF BERM ELEVATION (3' FREEBOARD): 6630.25FT
WATER SURFACE ELEVATION: 6627.25 FT

GENERAL NOTES:

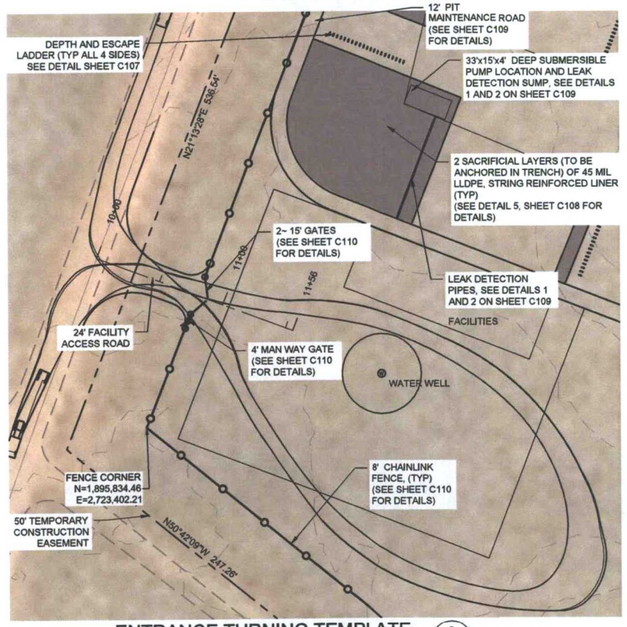
1. STOCKPILING OF TOP SOIL: CONTRACTOR SHALL SEGREGATE AND STOCKPILE ALL TOPSOIL OUTSIDE OF THE CONSTRUCTION AREA WITH APPROPRIATE SEDIMENT CONTROL. TOP SOIL SHALL BE REDISTRIBUTED ON THE OUTSIDE OF CONSTRUCTED BERMS, AND EITHER SEEDED, AND MULCHED OR PROTECTED WITH EROSION CONTROL MEASURES. REFER TO CONSTRUCTION PLANS FOR



BOBTAIL AND PUP TURNING TEMPLATE 2 C101

0 50' 100'

SCALE: 1" = 50'



ENTRANCE TURNING TEMPLATE 3

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ENDURING RESOURCES

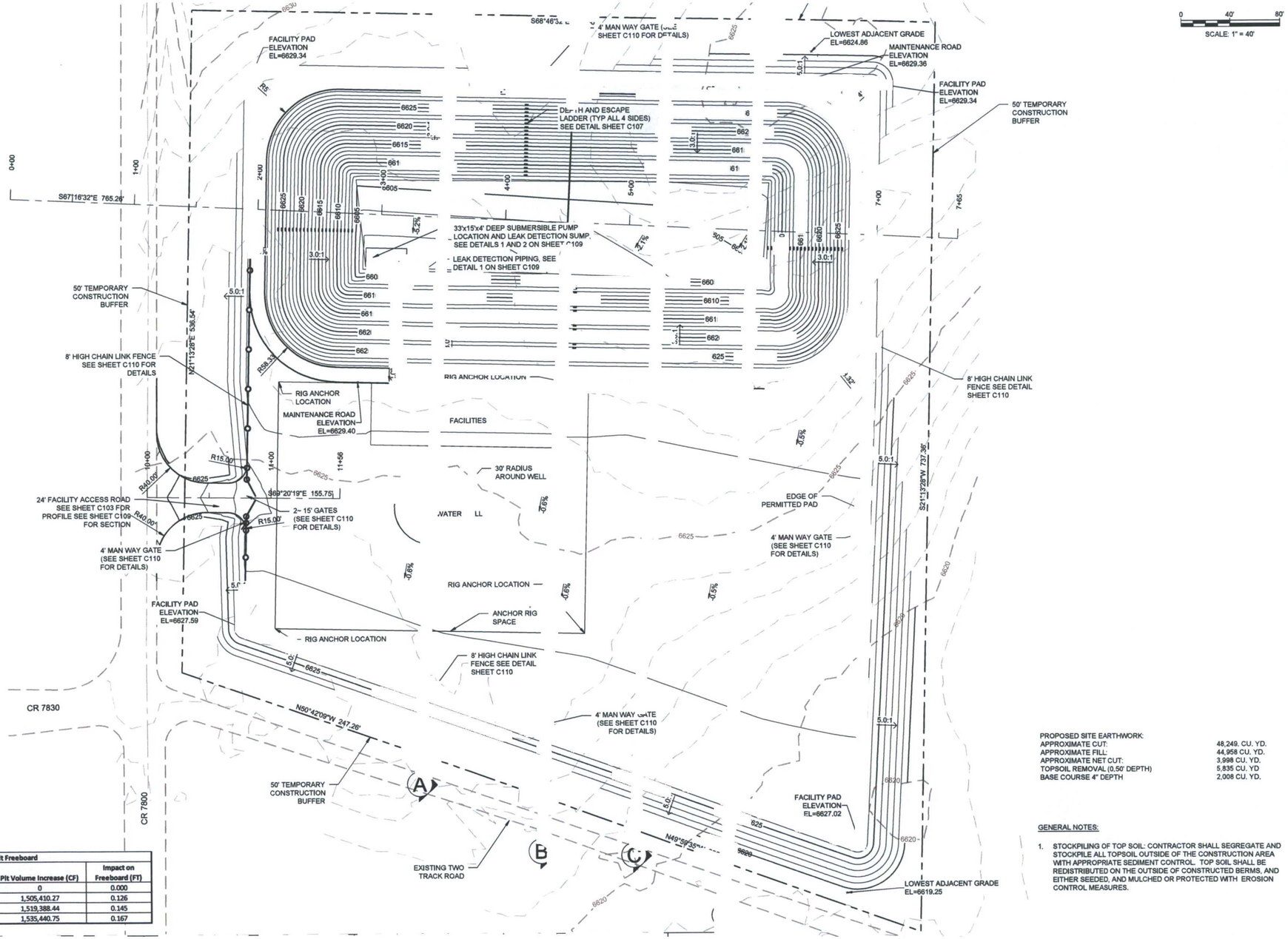
SAN JUAN COUNTY, NM

ENDURING RESOURCES KWU 2309-19K WATER RECYCLE FACILITY

SITE PLAN

HDM DJR HDM

Date: December 2017



Rainfall Impact on Pit Freeboard			
Storm Event	Stormwater Volume (CF)	Pit Volume Increase (CF)	Impact on Freeboard (FT)
Maximum Storage	1,493,326.15	0	0.000
25-Yr, 24-Hr	12,084.12	1,505,410.27	0.126
50-Yr, 24-Hr	13,978.17	1,519,388.44	0.145
100-Yr, 24-Hr	16,052.31	1,535,440.75	0.167

PROPOSED SITE EARTHWORK:

APPROXIMATE CUT:	48,249. CU. YD.
APPROXIMATE FILL:	44,958 CU. YD.
APPROXIMATE NET CUT:	3,998 CU. YD.
TOPSOIL REMOVAL (0.50' DEPTH)	5,835 CU. YD
BASE COURSE 4" DEPTH	2,008 CU. YD.

GENERAL NOTES:

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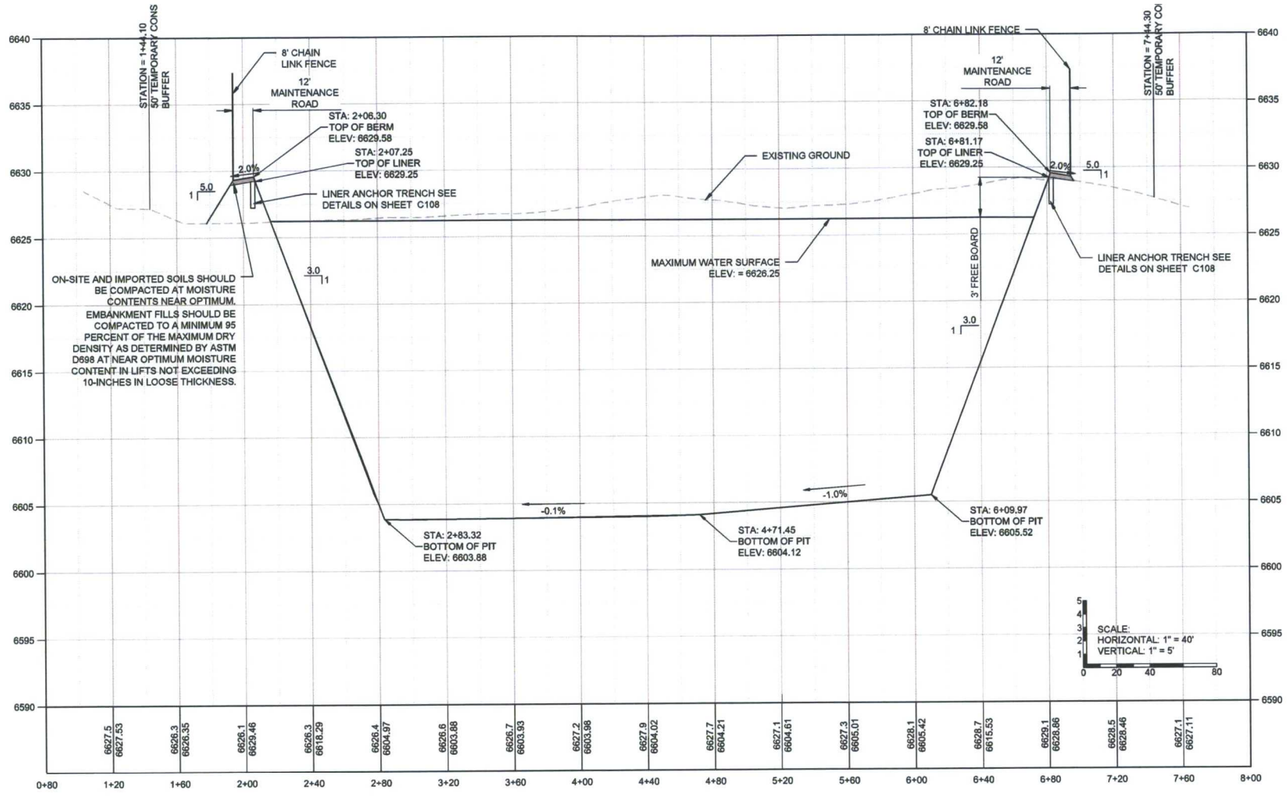
SAN JUAN COUNTY, NM

ENDURING RESOURCES

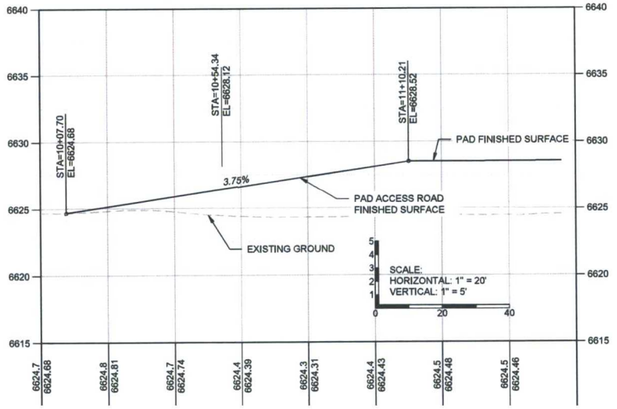
ENDURING RESOURCES KWU 2309-19K WATER RECYCLE FACILITY SITE GRADING AND DRAINAGE PLAN

HDM DJR HDM

Date: December 2018



PIT PROFILE



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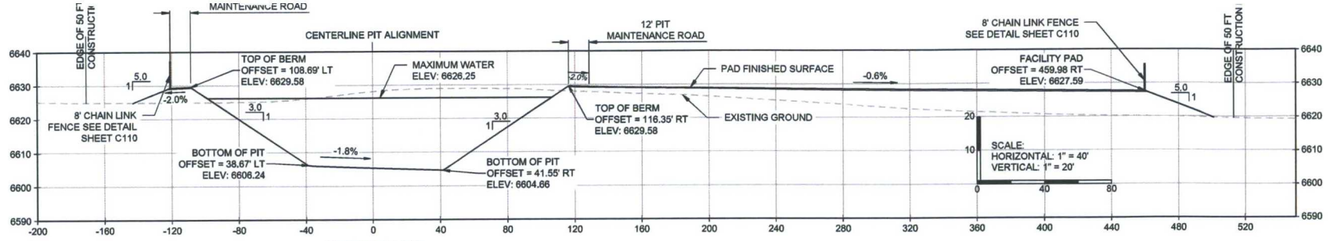
SAN JUAN COUNTY, NM

ENDURING RESOURCES

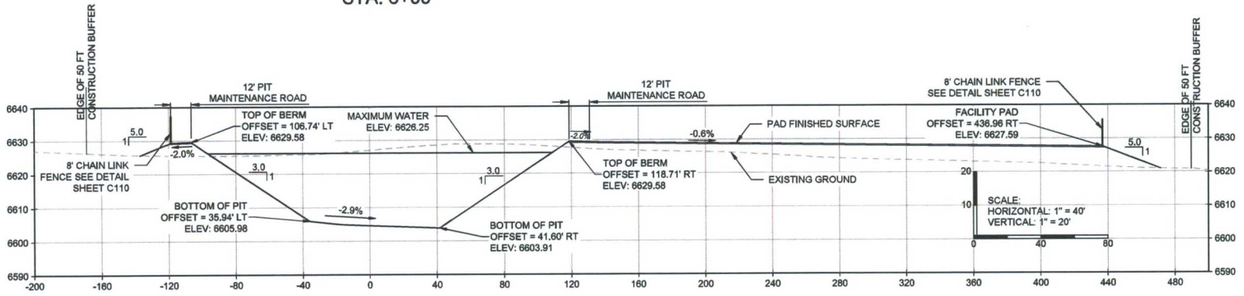
ENDURING RESOURCES KWU 2309-19K
WATER RECYCLE FACILITY
SITE PROFILES

HDM	DJR	HDM

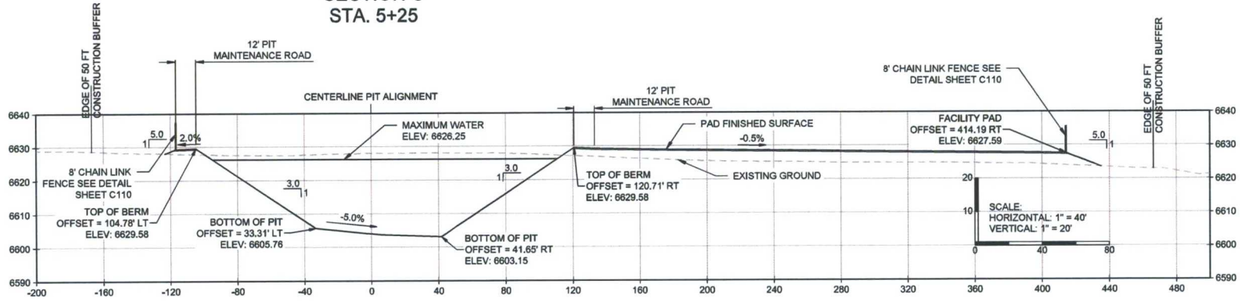
December 2018



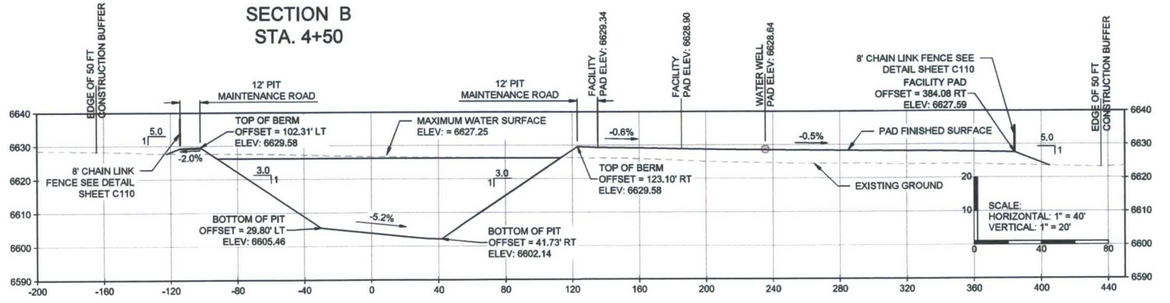
SECTION D
STA. 6+00



SECTION C
STA. 5+25



SECTION B
STA. 4+50



SECTION A

NOTE:
1. ON-SITE AND IMPORTED SOILS SHOULD BE COMPACTED AT MOISTURE CONTENTS NEAR OPTIMUM. EMBANKMENT FILLS SHOULD BE COMPACTED TO A MINIMUM 95 PERCENT OF THE MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D698 AT NEAR OPTIMUM MOISTURE CONTENT IN LIFTS NOT EXCEEDING 10-INCHES IN LOOSE THICKNESS.

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SAN JUAN COUNTY, NM

ENDURING RESOURCES

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SITE CROSS-SECTIONS

AND NOT TO BE USED FOR CONSTRUCTION UNLESS IT IS

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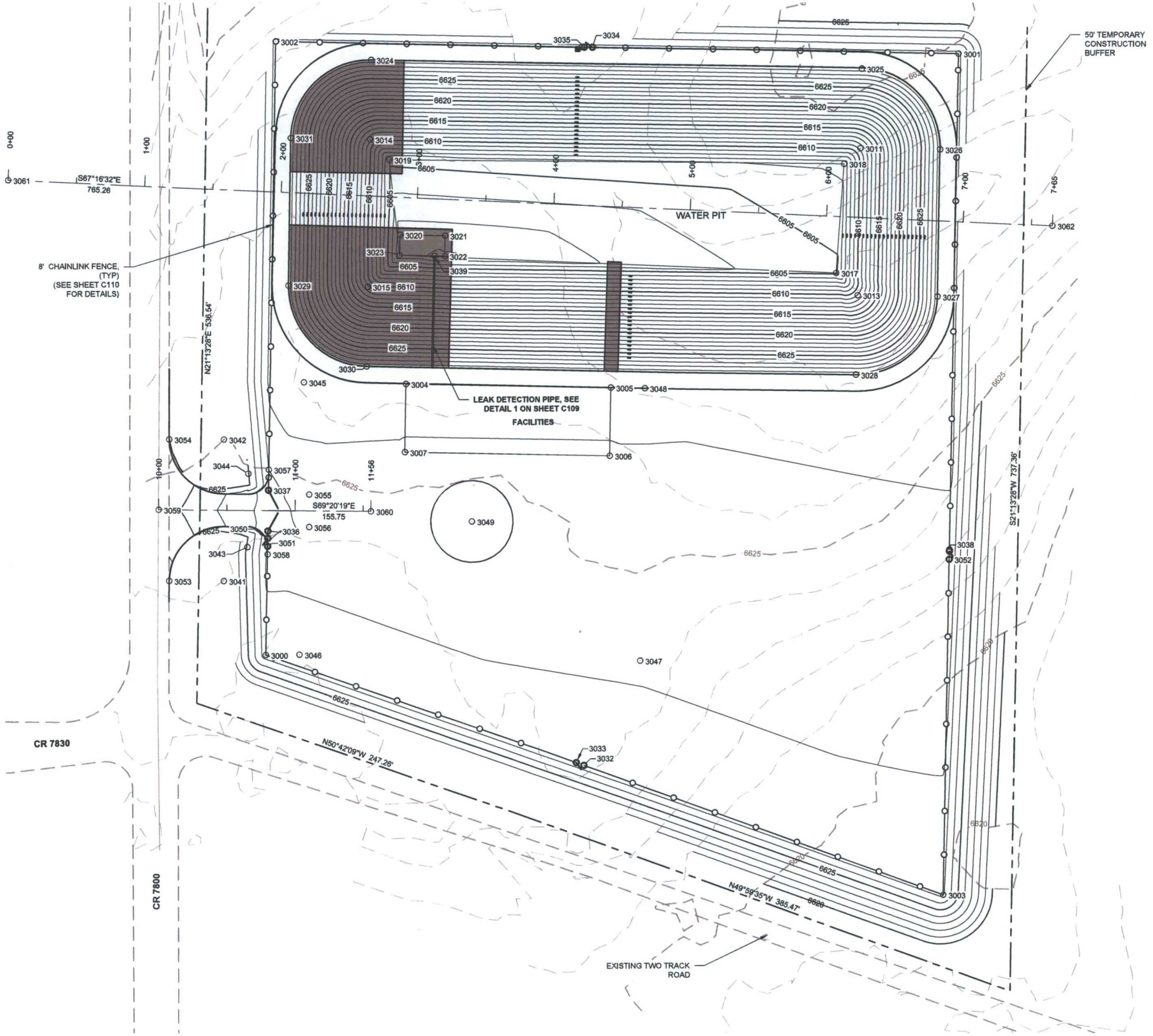
December 2017



0 40' 80'

SCALE: 1" = 40'

Point Table

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
3000	1895834.46	2723402.21	6627.56	FENCE CORNER
3001	1896073.17	2724031.30	6629.34	FENCE CORNER
3002	1896254.18	2723565.21	6629.34	FENCE CORNER
3003	1895497.52	2723807.73	6627.02	FENCE CORNER
3004	1895985.42	2723567.83	6629.34	FACILITY
3005	1895931.11	2723707.66	6629.34	FACILITY
3006	1895884.51	2723689.55	6628.90	FACILITY
3007	1895938.81	2723549.73	6628.90	FACILITY
3011	1896032.97	2723940.09	6611.33	RADIUS PT @ 58.34'
3013	1895932.11	2723901.01	6611.13	RADIUS PT @ 58.34
3014	1896162.99	2723605.43	6611.34	RADIUS PT @ 58.34
3015	1896061.98	2723566.20	6611.29	RADIUS PT @ 58.34
3017	1895952.97	2723891.74	6604.75	PIT BOTTOM
3018	1896026.31	2723924.98	6606.25	PIT BOTTOM
3019	1896144.18	2723613.34	6605.25	PIT BOTTOM
3020	1896089.62	2723601.70	6602.50	SUMP
3021	1896077.60	2723632.43	6602.50	SUMP
3022	1896063.63	2723626.97	6601.86	SUMP
3023	1896075.65	2723596.24	6602.25	SUMP
3024	1896217.38	2723626.49	6629.58	TOP OF BERM/EOG
3025	1896087.34	2723961.22	6629.58	TOP OF BERM/EOG
3026	1896011.90	2723994.48	6629.58	TOP OF BERM/EOG
3027	1895910.89	2723955.34	6629.58	TOP OF BERM/EOG
3028	1895877.90	2723879.48	6629.58	TOP OF BERM/EOG
3029	1896083.09	2723511.83	6629.58	TOP OF BERM/EOG
3030	1896007.50	2723545.35	6629.58	TOP OF BERM/EOG
3031	1896184.11	2723551.06	6629.57	TOP OF BERM/EOG
3032	1895677.69	2723593.06	6627.59	GATE
3033	1895681.50	2723588.52	6627.59	GATE
3034	1896170.17	2723781.54	6629.34	GATE
3035	1896172.32	2723776.01	6629.34	GATE
3036	1895919.36	2723435.18	6627.77	GATE
3037	1895947.32	2723446.04	6627.88	GATE
3038	1895732.60	2723899.03	6628.65	GATE
3039	1896066.36	2723619.99	6601.75	SUMP
3041	1895896.04	2723392.15	6623.98	RADIUS PT 40'
3042	1895993.55	2723428.33	6625.00	RADIUS PT 40'
3043	1895913.46	2723416.80	6623.92	RADIUS PT 15'
3044	1895963.80	2723436.35	6624.86	RADIUS PT 15'
3045	1896012.59	2723497.85	6629.39	RIG ANCHOR
3046	1895826.16	2723425.45	6627.66	RIG ANCHOR
3047	1895735.66	2723658.49	6628.10	RIG ANCHOR
3048	1895922.09	2723730.89	6629.41	RIG ANCHOR
3049	1895874.12	2723578.17	6628.64	WATER WELL
3050	1895914.42	2723433.26	6627.91	GATE
3051	1895908.89	2723431.11	6628.07	GATE
3052	1895727.07	2723896.88	6628.62	GATE
3053	1895909.95	2723354.65	6624.13	PC
3054	1896007.46	2723390.82	6625.25	PC
3055	1895933.97	2723472.95	6628.62	ACCESS ROAD
3056	1895911.51	2723464.48	6628.41	ACCESS ROAD
3057	1895961.30	2723451.49	6628.00	ACCESS ROAD
3058	1895903.40	2723429.03	6628.23	ACCESS ROAD
3059	1895961.63	2723365.59	0.00	ACCESS ROAD CL STA 10+00
3060	1895906.67	2723511.33	0.00	ACCESS ROAD CL STA 11+55.75
3061	1896226.45	2723346.27	0.00	PIT ALIGNMENT STA 0+00

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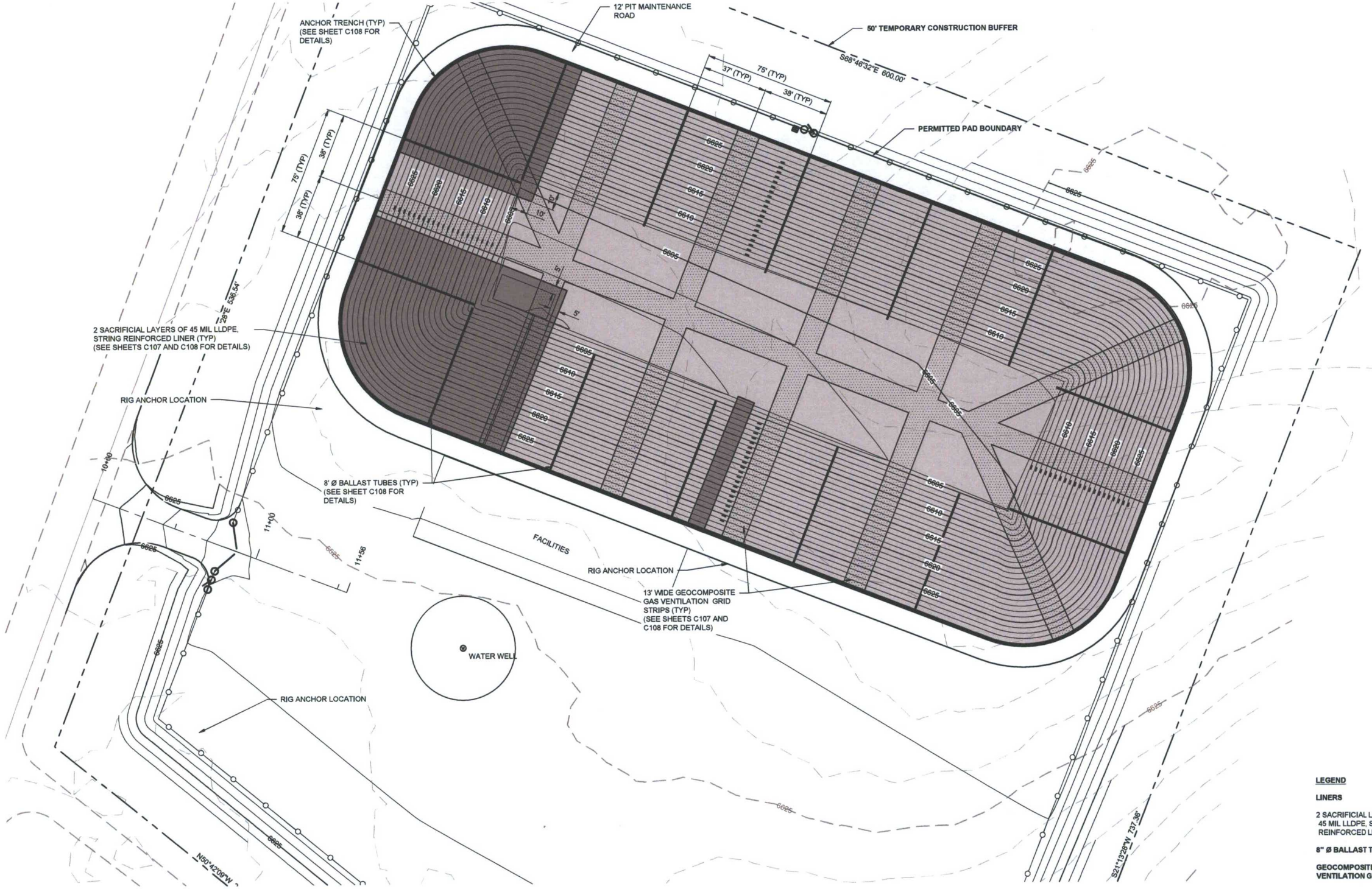
SAN JUAN COUNTY, NM

ENDURING RESOURCES

ENDURING RESOURCES KWU 2309-19K WATER RECYCLE FACILITY HORIZONTAL CONTROL PLAN

DWN: DJR CHK: HDM

DATE: December 2018



LEGEND

- LINERS
- 2 SACRIFICIAL LAYERS OF 45 MIL LLDPE, STRING REINFORCED LINER
- 8" Ø BALLAST TUBE
- GEOCOMPOSITE GAS VENTILATION GRID STRIPS

NOTES:

1. LINERS SHALL COVER PIT BOTTOM, SIDE SLOPES AND END IN THE ANCHOR TRENCH. SEE DETAIL SHEETS C107 AND C108 AND MANUFACTURES SPECIFICATIONS.
2. 8" Ø BALLAST TUBES SHALL BE PLACED EVERY 75'± AND SET 37.5' FROM THE PIT GEOCOMPOSITE GAS VENTILATION GRID WHERE POSSIBLE.

QUANTITIES:

2~45 MIL LLDPE LINERS:	13,405 SQ.YDS. X 2 = 26,810 SQ.YDS.
2~45 MIL SACRIFICIAL LINERS:	2,387 SQ. YDS. X 2 = 4,774 SQ. YDS.

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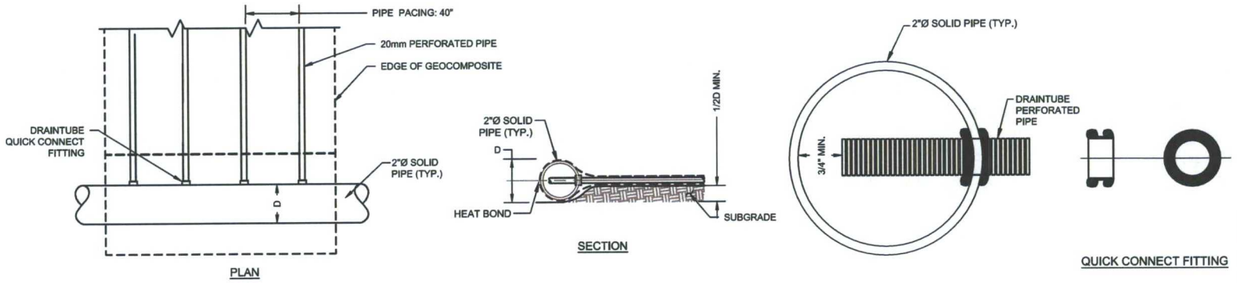
SAN JUAN COUNTY, NM

ENDURING RESOURCES

ENDURING RESOURCES KWU 2309-19K WATER RECYCLE FACILITY LINER BALLAST TUBES AND PIT GEOCOMPOSITE VENTILATION GRID LAYOUT

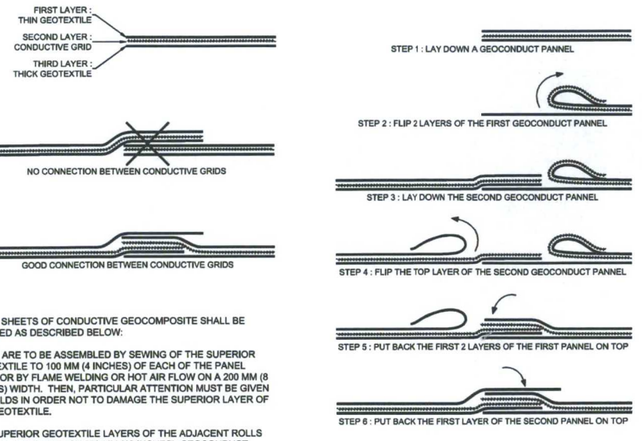
HDM DJR HDM

Date: December 2017



BERM VENT SIMPLE CONNECTION TO PIPE

N.T.S. — 1 / C107

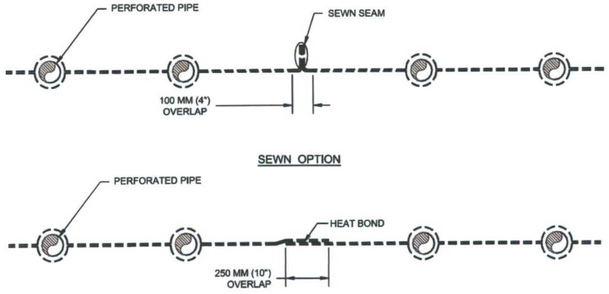


ADJACENT SHEETS OF CONDUCTIVE GEOCOMPOSITE SHALL BE OVERLAPPED AS DESCRIBED BELOW:

1. ROLLS ARE TO BE ASSEMBLED BY SEWING OF THE SUPERIOR GEOTEXTILE TO 100 MM (4 INCHES) OF EACH OF THE PANEL SIDES OR BY FLAME WELDING OR HOT AIR FLOW ON A 200 MM (8 INCHES) WIDTH. THEN, PARTICULAR ATTENTION MUST BE GIVEN TO WELDS IN ORDER NOT TO DAMAGE THE SUPERIOR LAYER OF THE GEOTEXTILE.
2. THE SUPERIOR GEOTEXTILE LAYERS OF THE ADJACENT ROLLS SHALL BE ROLLED BACK 250 MM (10 INCHES). GEOCONDUCT CONDUCTIVE GEOCOMPOSITE SHALL BE OVERLAPPED SUCH AS THE CONDUCTIVE GRIDS MUST BE IN DIRECT CONTACT ON A MINIMUM OF 200 MM (8 INCHES).

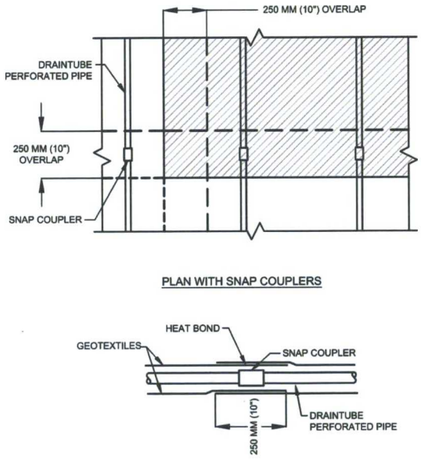
CONDUCTIVE GEOCOMPOSITE DETAILS

N.T.S. — 2 / C107



GAS VENTING GEOCOMPOSITE PANEL JOINING OPTIONS FOR SIDE

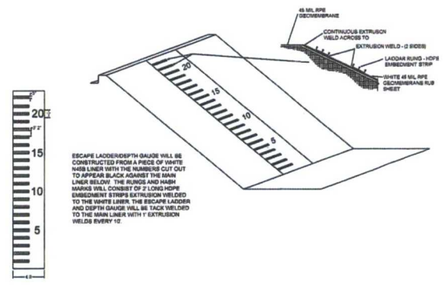
N.T.S. — 3 / C107



GAS VENTING GEOCOMPOSITE PANEL JOINING OPTIONS FOR END

N.T.S. — 4 / C107

NOTE:



NOTE:
DETAILS SHOWN ON THIS PAGE ARE FOR COORDINATION PURPOSES ONLY AND PER MANUFACTURE.

DEPTH GAUGE AND ESCAPE LADDER

N.T.S. — 5 / C107

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ENDURING RESOURCES

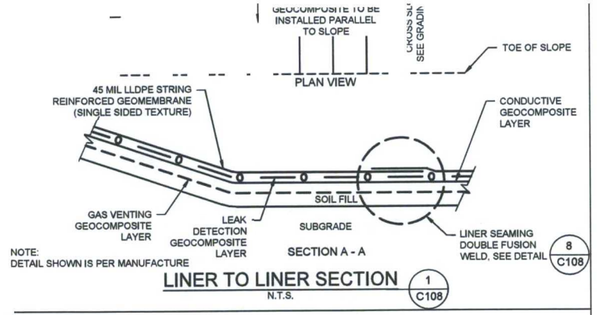
SAN JUAN COUNTY, NM

ENDURING RESOURCES KWU 2309-19K WATER RECYCLE FACILITY GEOCOMPOSITE DETAILS

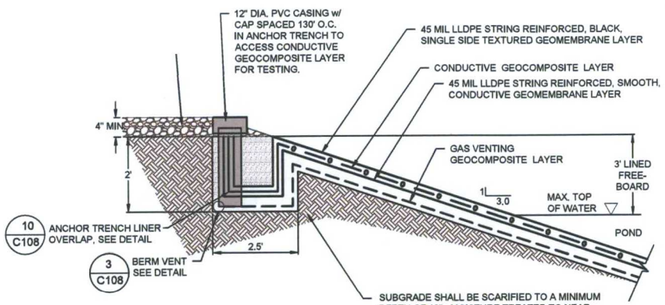
ND NOT TO BE USED FOR CONSTRUCTION UNLESS IT I

HDM DJR HDM

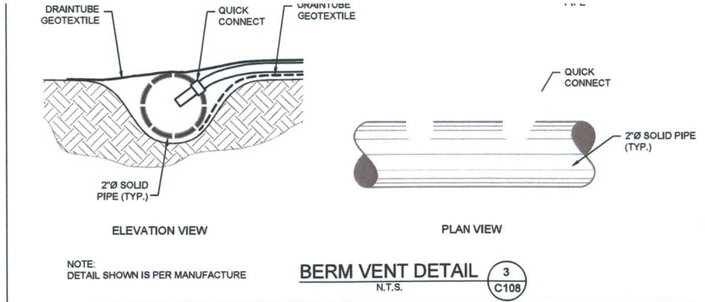
Date: December 2018



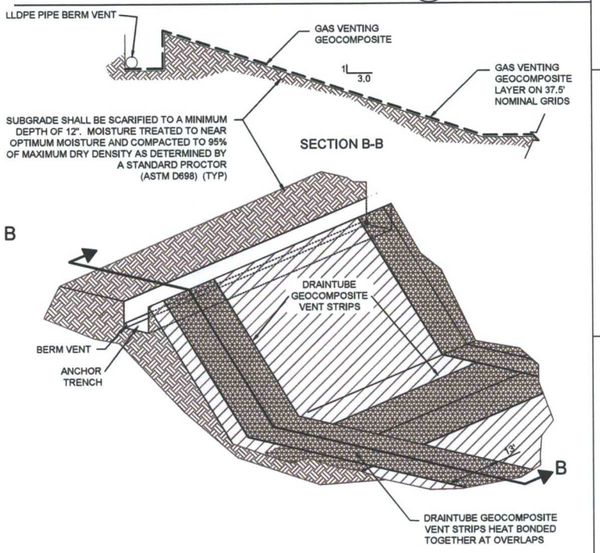
LINER TO LINER SECTION
N.T.S.
1 C108



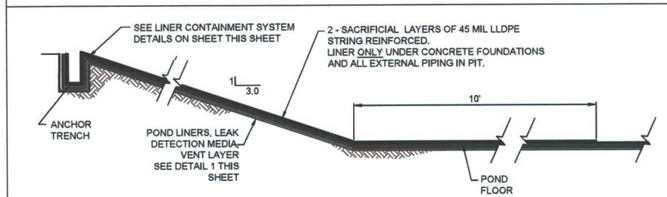
TYPICAL ANCHOR TRENCH DETAIL
N.T.S.
2 C108



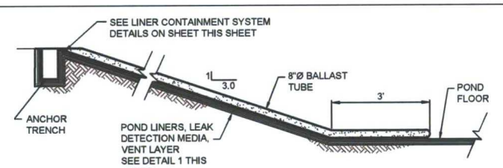
BERM VENT DETAIL
N.T.S.
3 C108



GEOCOMPOSITE GAS VENTILATION LAYER DETAIL
N.T.S.
4 C108

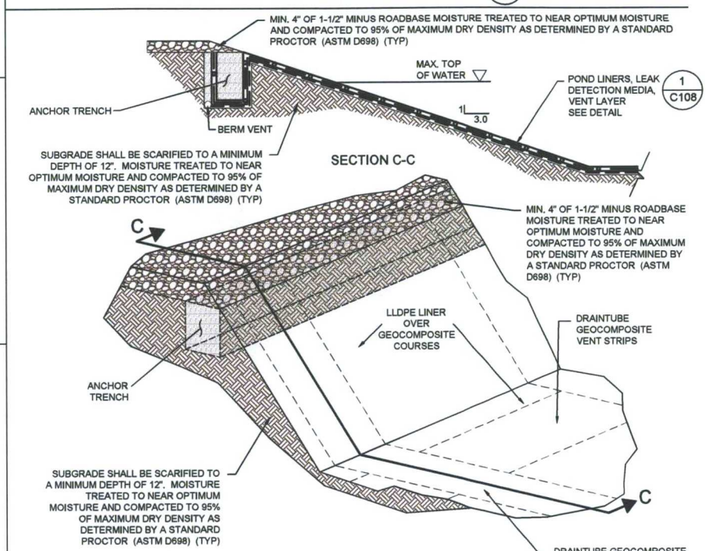


PROTECTION LINER DETAIL
N.T.S.
5 C108

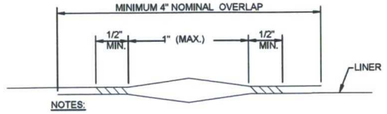


NOTES:
1. BALLAST TUBES TO BE 45-MIL LLDPE OR APPROVED EQUAL.
2. FILL 8"Ø BALLAST TUBES WITH SAND. ANCHOR IN LINER TRENCH AND EXTEND SEVERAL FEET ONTO POND FLOOR AS NOTED.

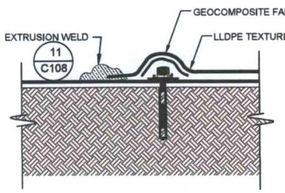
BALLAST TUBE DETAILS
N.T.S.
6 C108



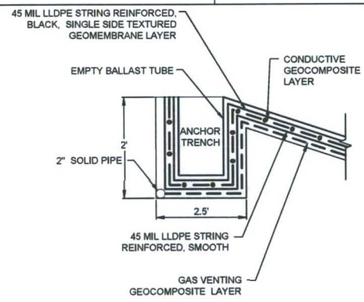
FINISHED GEOCOMPOSITE GAS VENTILATION LAYER WITH GEOMEMBRANE LINER SYSTEM AND BERM VENT DETAIL
N.T.S.
7 C108

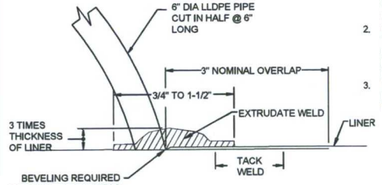


NOTES:
1. LINER SHEETS SHALL BE TACK WELDED TOGETHER AT OVERLAP TO FORM TEMPORARY BOND PRIOR TO WELDING.
2. DOUBLE FUSION WELDING SHALL BE THE PRIMARY SEAMING TECHNIQUE USED.
3. GRINDING NOT TO EXCEED 1/4" PAST "SQUEEZE-OUT" ON EITHER SIDE. PROPER CARE SHOULD BE TAKEN TO INSURE THAT VERY LITTLE MATERIAL IS TAKEN WHEN GRINDING.
4. AIR PRESSURE OR VACUUM TESTING SHALL BE THE NON-DESTRUCTIVE SEAM TEST METHODS FOR DOUBLE FUSION WELDS.
5. SUBGRADE PREPARATION, SELECT FILL (IF REQUIRED) SHALL BE PER LINER MANUFACTURES REQUIREMENTS.



EXTRUSION WELD AT ANCHOR DETAIL





NOTES:
1. LINER SHEETS TACK WELDED TOGETHER AT OVERLAP TO FORM TEMPORARY BOND PRIOR TO WELDING.
2. GRINDING NOT TO EXCEED 1/4" PAST "SQUEEZE-OUT" ON EITHER SIDE. PROPER CARE SHOULD BE TAKEN IN NOT REMOVING TOO MUCH MATERIAL WHEN GRINDING.
3. VACUUM TESTING IS THE NON-DESTRUCTIVE SEAM TEST METHOD FOR EXTRUSION WELDS.

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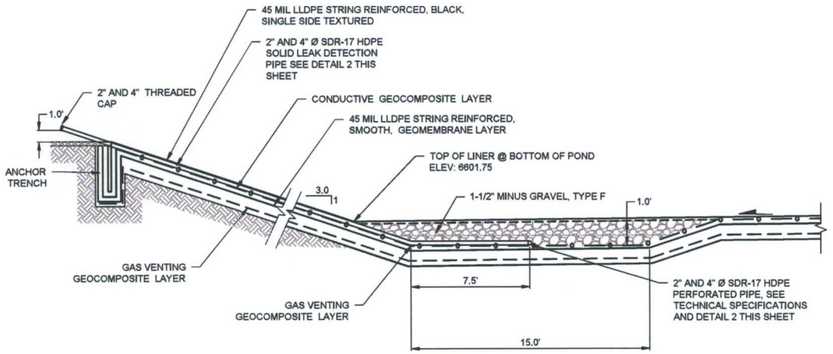
ENDURING RESOURCES

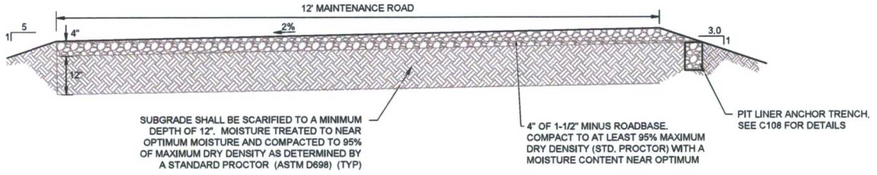
ENDURING RESOURCES KWU 2309-19K WATER RECYCLE FACILITY LINER AND BALLAST TUBE DETAILS

HDM DJR HDM

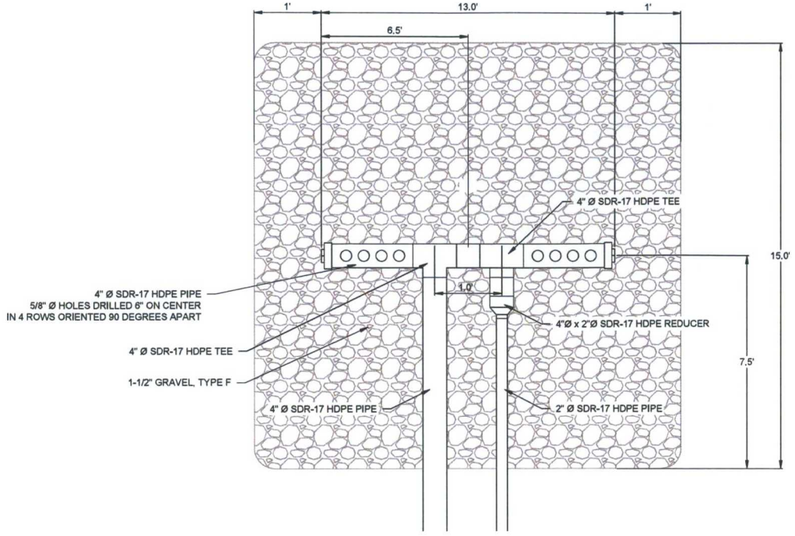
December 2017



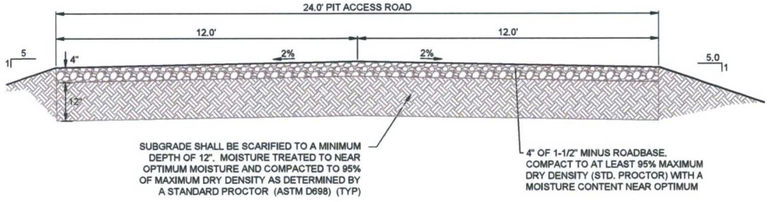
PRODUCED WATER PIT LEAK DETECTION
N.T.S.
1 C109



PRODUCED WATER PIT MAINTENANCE ROAD SECTION
N.T.S.
3 C109



LEAK DETECTION SYSTEM PIPE DETAIL
N.T.S.
2 C109



FACILITY ACCESS ROAD SECTION
N.T.S.
4 C109

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ENDURING RESOURCES

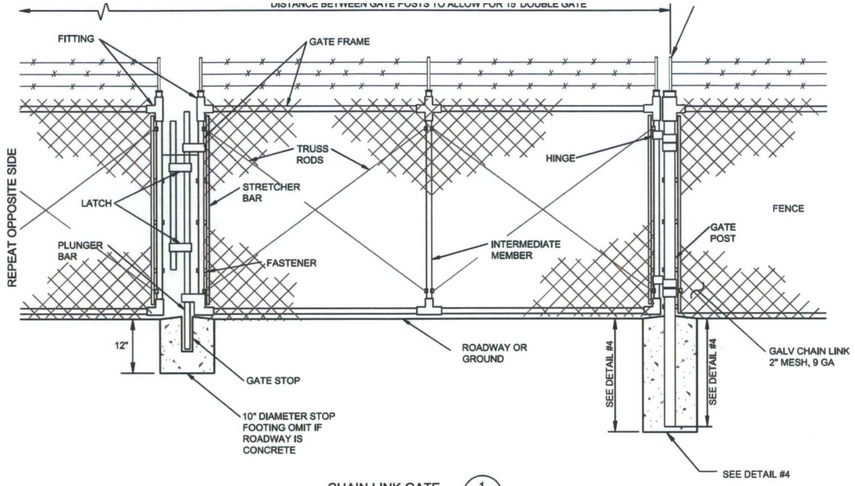
ENDURING RESOURCES KWU 2309-19K WATER RECYCLE FACILITY
LEAK DETECTION SYSTEM AND PIT ACCESS ROAD DETAILS

NEW MEXICO 22047 12-21-2017 PROFESSIONAL ENGINEER

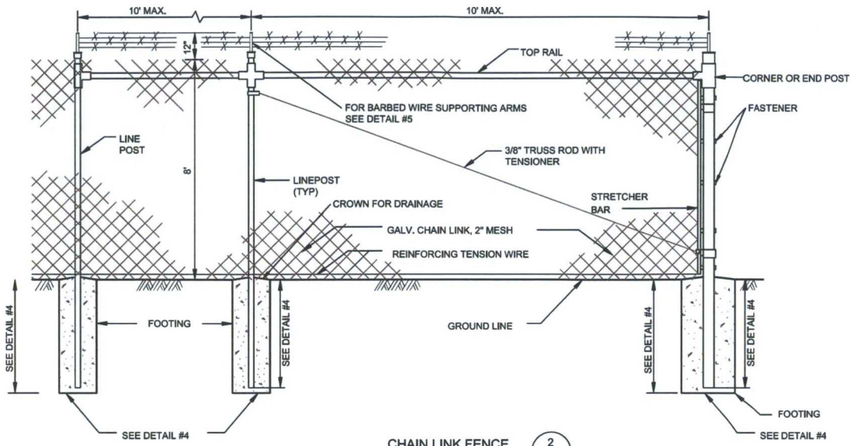
ND NOT TO BE USED FOR CONSTRUCTION UNLESS IT IS

HNM DJR HNM

Date: December 2017

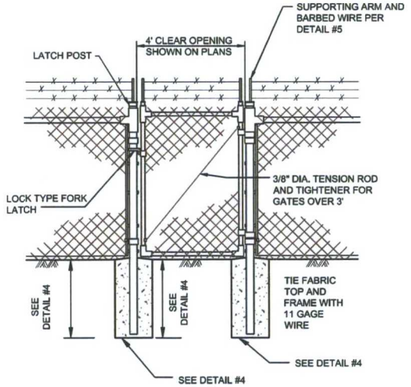


CHAIN LINK GATE 1 C110
N.T.S.

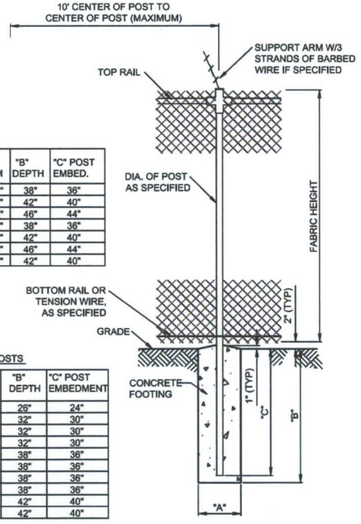


CHAIN LINK FENCE 2 C110
N.T.S.

NOTE:
AT BROW CROSSING, EMBED ON 6" CENTERS, 4 - 1/2"X24" GALVANIZED RODS WITH 2" HOOKED END INTO BROW DITCH CONCRETE. EXPOSED END OF ROD SHALL BE WOVEN INTO FENCE FABRIC.



4' MAN WAY GATE 3 C110
N.T.S.



GATE POST

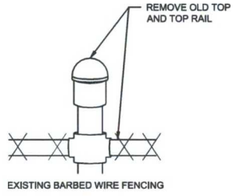
GATE LEAF WIDTH	GATE POST (OD)	FABRIC HEIGHT	"A" DIAM	"B" DEPTH	"C" POST EMBED.
3' TO 6'	2.785"	3' TO 5'	12"	38"	36"
		6' TO 9'	14"	42"	40"
		10' TO 12'	16"	46"	44"
7' TO 12'	4.000"	3' TO 5'	14"	38"	36"
		6' TO 9'	16"	42"	40"
		10' TO 12'	18"	46"	44"
13'	6.625"	8'-0"	16"	42"	40"

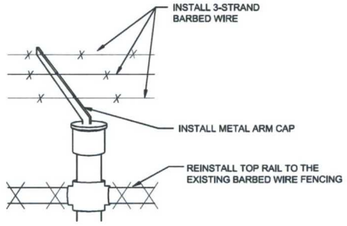
LINE AND TERMINAL POSTS

FABRIC HEIGHT	TYPE POST	"A" DIAM	"B" DEPTH	"C" POST EMBEDMENT
3'-0" TO 4'-0"	LINE	6"	26"	24"
	TERMINAL	10"	32"	30"
5'-0"	LINE	8"	32"	30"
	TERMINAL	10"	32"	30"
6'-0" TO 9'-0"	LINE	12"	38"	36"
	TERMINAL	12"	38"	36"
10'-0" TO 12'-0"	LINE	18"	38"	36"
	TERMINAL	18"	38"	36"
13'-0" TO 18'-0"	LINE	24"	42"	40"
	TERMINAL	24"	42"	40"

NOTE: TERMINAL POSTS INCLUDE END, CORNER, AND PULL POSTS SEE SPECIFICATIONS

CHAIN LINK FENCE FOUNDATION 4 C110
N.T.S.





NOTE:
ADD SUPPORTING ARM AND BARBED WIRE TO NEW AND EXISTING CHAINLINK FENCE POSTS AND GATES

SUPPORTING ARM AND BARBED WIRE 5 C110
N.T.S.

WARNING SIGN 6 C110
N.T.S.

WARNING SIGN 7 C110
N.T.S.

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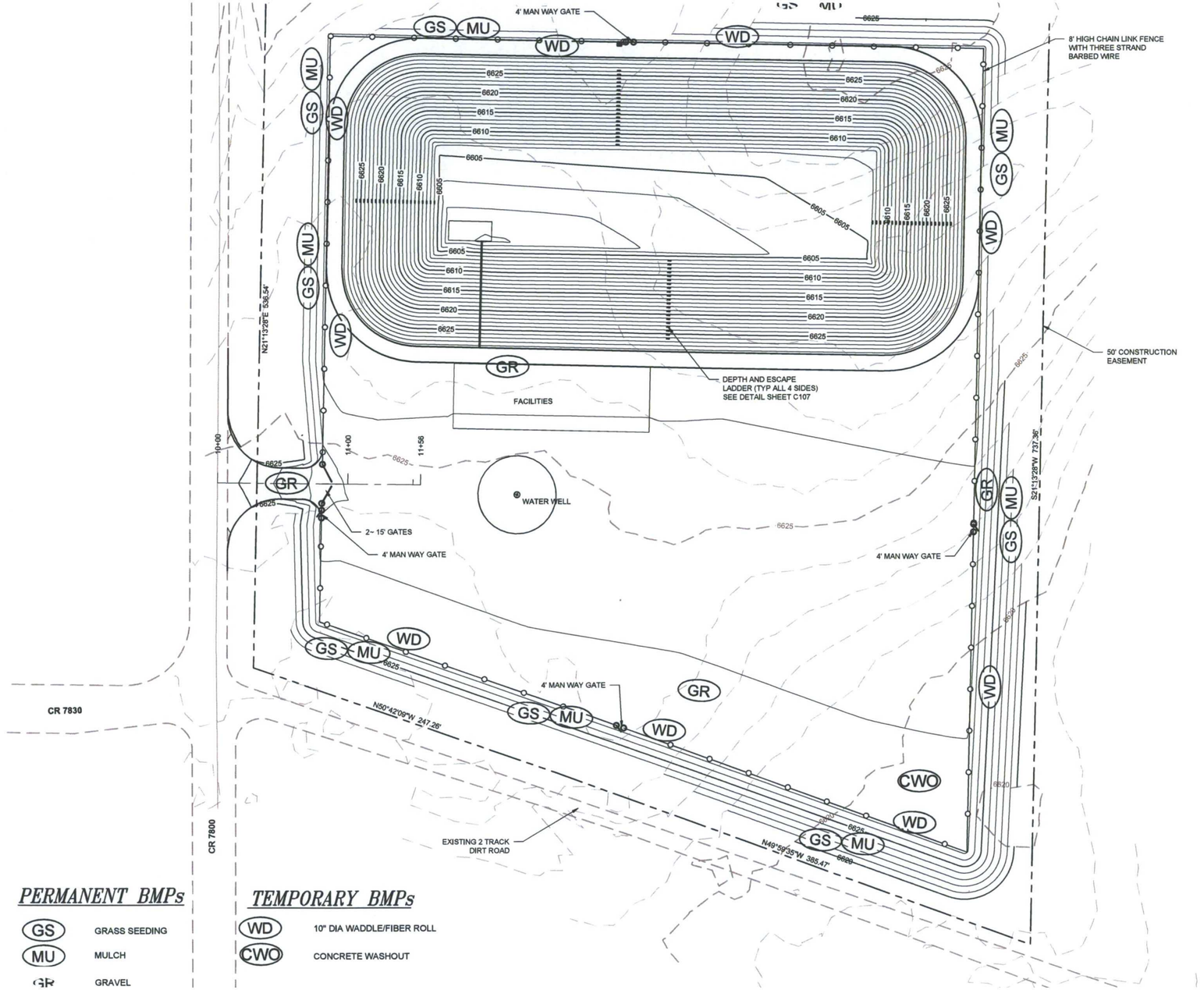
ENDURING RESOURCES

ENDURING RESOURCES KWU 2309-19K
WATER RECYCLE FACILITY
CHAIN LINK SECURITY FENCE DETAILS

HDM DJR HDM

Date: December 2018



0 40' 80'

SCALE: 1" = 40'

PERMANENT BMPs

GS	GRASS SEEDING
MU	MULCH
GR	GRAVEL

TEMPORARY BMPs

WD	10" DIA WADDLE/FIBER ROLL
CWO	CONCRETE WASHOUT

NOTES:

1. ALL FACILITY INFORMATION CAN BE FOUND ON SHEETS C101 AND C102.
2. ALL SLOPES SHALL HAVE WADDLES PLACED PARALLEL TO CONTOURS.
3. CONTRACTOR SHALL ADD GRASS SEED AND MULCH TO ALL UNPAVED/UNGRAVELED SURFACES THROUGHOUT THE SITE.
4. ALL SOIL STOCKPILES ARE TO HAVE WADDLE/FIBER ROLL PLACE AROUND TOP OF SLOPE.
5. STOCKPILING OF TOP SOIL: CONTRACTOR SHALL SEGREGATE AND STOCKPILE ALL TOPSOIL OUTSIDE OF THE CONSTRUCTION AREA WITH APPROPRIATE SEDIMENT CONTROL. TOP SOIL SHALL BE REDISTRIBUTED ON THE OUTSIDE OF CONSTRUCTED BERMS, AND EITHER SEEDED, AND MULCHED OR PROTECTED WITH EROSION CONTROL MEASURES.

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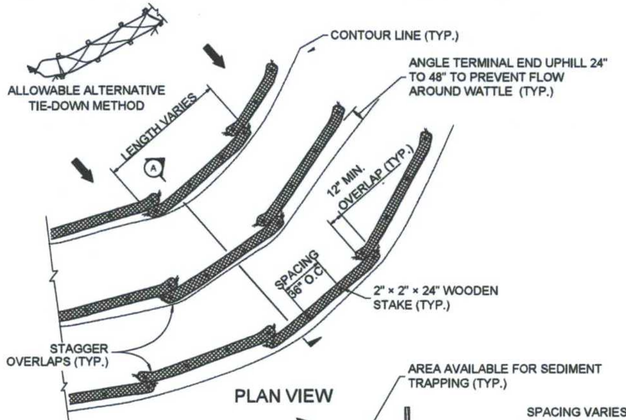
ENDURING RESOURCES

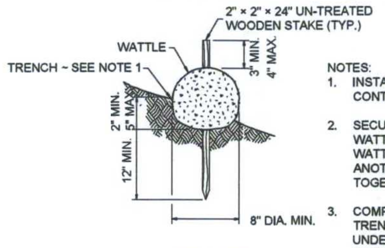
ENDURING RESOURCES KWU 2309-19K WATER RECYCLE FACILITY SITE EROSION AND SEDIMENTATION CONTROL PLAN

RJM DJR RJM

Date: December 2017



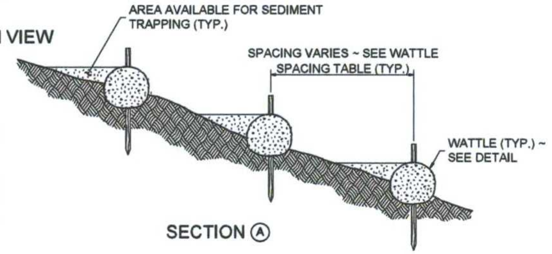
PLAN VIEW



WATTLE DETAIL

NOTES:

1. INSTALL WATTLES ALONG CONTOURS.
2. SECURELY KNOT EACH END OF WATTLE. OVERLAP ADJACENT WATTLE ENDS 12" BEHIND ONE ANOTHER AND SECURELY TIE TOGETHER.
3. COMPACT EXCAVATED SOIL AND TRENCHES TO PREVENT UNDERCUTTING. ADDITIONAL STAKING MAY BE NECESSARY TO PREVENT UNDERCUTTING.
4. INSTALL WATTLE PERPENDICULAR TO FLOW ALONG CONTOURS.
5. WATTLES SHALL BE INSPECTED REGULARLY, AND IMMEDIATELY AFTER A RAINFALL PRODUCES RUNOFF, TO ENSURE THEY REMAIN THOROUGHLY ENTRENCHED AND IN CONTACT WITH THE SOIL.

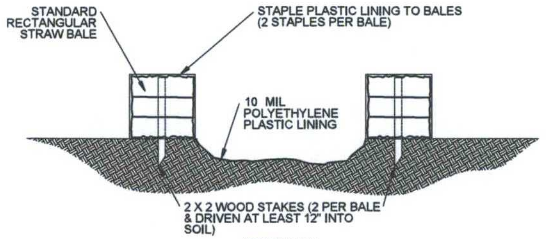


SECTION A

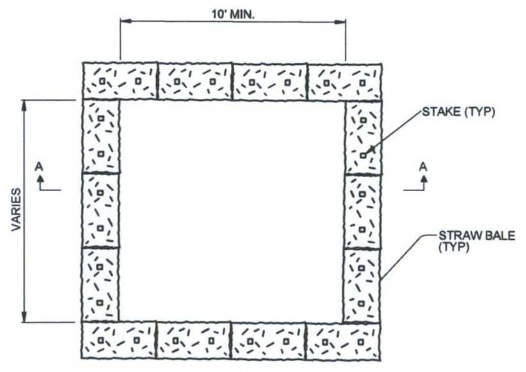
8" DIAMETER WATTLE SPACING TABLE	
SLOPE	MAXIMUM SPACING
1:1	10'
2:1	20'
3:1	30'
4:1	40'

WADDLE INSTALLATION ON SLOPES (WD)

N.T.S.



SECTION A-A



PLAN

CONCRETE TRUCK WASH OUT FACILITY

1. SEE SHEET C111 FOR SITE SPECIFIC APPLICATION OF EROSION CONTROL.
2. EROSION & SEDIMENTATION CONTROL PLAN WILL COMPLY WITH OWNER'S EXISTING ASSET SWPPP.
3. EROSION CONTROL SHALL BE IMPLEMENTED TO PROTECT PROPERTIES AND PUBLIC FACILITIES FROM THE ADVERSE EFFECTS OF EROSION AND SEDIMENTATION AS A RESULT OF CONSTRUCTION ACTIVITIES.
4. THE CONTRACTOR SHALL SET, LOCATE, AND MAINTAIN EROSION CONTROL MEASURES PER THE EROSION CONTROL PLAN, AND THE OWNER'S EXISTING ASSET STORMWATER POLLUTION PROTECTION PLAN. (SWPPP)
5. EROSION CONTROL MEASURES SHALL BE IMPLEMENTED AND SHALL BE KEPT IN PLACE UNTIL EROSION AND SEDIMENTATION POTENTIAL IS MITIGATED. REMOVAL OF SILT AND SEDIMENT IS REQUIRED PER SWPPP.
6. EROSION CONTROL DEVICES SHALL BE CHECKED AFTER EVERY STORM. REPAIRS OR REPLACEMENT TO THE EROSION CONTROL MEASURES SHALL BE MADE AS REQUIRED BY THE OWNERS PERMIT TO MAINTAIN PROPER PROTECTION.
7. SWPPP SHALL BE MODIFIED TO CONTROL EROSION AND SEDIMENT. TRANSPORT BY USING ANY MEANS SHOWN ON THIS PLAN OR IMPLEMENTING OTHER CONTROL MEASURES.
8. PERMANENT BEST MANAGEMENT PRACTICES (BMP'S) (I.E. SEEDED, MULCH) MUST BE IMPLEMENTED WITHIN 14 DAYS OF LAST CONSTRUCTION ACTIVITY IN THE AREA, AS REQUIRED PER THE SWPPP.
9. THE CONTRACTOR/OWNER SHALL UPDATE OR MODIFY THIS PLAN AS NEEDED TO COMPLY WITH THE APPLICABLE POLLUTANT DISCHARGE ELIMINATION SYSTEM REQUIREMENTS.
10. CONTRACTOR SHALL BE REQUIRED TO HAUL EXCESS CONCRETE AND WASHOUT OFF-SITE TO AN APPROVED/PERMITTED DISPOSAL SITE.
11. CONTRACTOR SHALL SPREAD STOCKPILED TOPSOIL BEFORE PLACING GRASS SEED AT CUT AND FILL LOCATIONS USING OWNER APPROVED MIX.
12. CONTRACTOR SHALL PLACE MULCH IN CONJUNCTION WITH GRASS SEEDING.

TEMPORARY BMPs

WD	10" DIA WADDLE/FIBER ROLL
CWO	CONCRETE WASHOUT

PERMANENT BMPs

GS	GRASS SEEDING
MU	MULCH
GR	GRAVEL

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ENDURING RESOURCES

ENDURING RESOURCES KWU 2309-19K
WATER RECYCLE FACILITY
SITE EROSION AND SEDIMENTATION CONTROL DETAILS

AND NOT TO BE USED FOR CONSTRUCTION UNLESS IT IS

DJB HDM

December 2018

ATTACHMENT C - GEOMAT REPORT

GEOTECHNICAL ENGINEERING REPORT – ADDENDUM #1
KIMBETO REMOTE FACILITY FRACKING WATER POND
KWU 2309-19K
SAN JUAN COUNTY, NEW MEXICO

Submitted To:

Eric Stevens
Enduring Resources
332 CR 3100
Aztec, New Mexico 87410

Submitted By:

GEOMAT Inc.
915 Malta Avenue
Farmington, New Mexico 87401

December 7, 2018
GEOMAT Project 182-3037

GEOMAT INC.
915 Malta Avenue • Farmington, NM 87401 • Tel (505) 327-7928 • Fax (505) 326-5721

December 7, 2018

Eric Stevens
Enduring Resources
332 CR 3100
Aztec, New Mexico 87410

RE: Geotechnical Engineering Study
Kimbeto Remote Facility Fracking Water Pond (KWU 2309-19K)
San Juan County, New Mexico
GEOMAT Project No. 182-3037

GEOMAT Inc. (GEOMAT) has completed the supplemental geotechnical engineering exploration for the Kimbeto pond site KWU 2309-19K located in San Juan, New Mexico. This addendum report includes supplemental borings and analyses. This study was performed in general accordance with the scope of services in our Proposal No. 182-04-22 dated April 20, 2018 and the request for supplemental work made via email dated July 18, 2018.

The results of our engineering study, including the geotechnical recommendations, site plan, boring records, and laboratory test results are attached. Based on the geotechnical engineering analyses, subsurface exploration and laboratory test results, a pond design consistent with Enduring Resources' existing practices could be constructed as an incised with embankments and double synthetic-lined pond as proposed. Other design and construction details, based upon geotechnical conditions, are presented in the report.

We have appreciated being of service to you in the geotechnical engineering phase of this project. If you have any questions or concerns regarding this addendum or the associated report, please feel free to contact us.

Sincerely yours,
GEOMAT Inc.

Robert "Bob" Flegal, P.E.
Senior Engineer

Matthew J. Cramer, P.E.
President

Copies to: Addressee (1); Heather McDaniel, P.E., C.F.M., SMA both via E-mail

TABLE OF CONTENTS

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GEOTECHNICAL ENGINEERING REPORT - ADDENDUM
KIMBETO REMOTE FACILITY FRACKING WATER POND (KWU 2309-19K)
SAN JUAN COUNTY, NEW MEXCO
GEOMAT PROJECT NO. 182-3037

INTRODUCTION

This report provides recommendations related to the design and construction of the KWU 2309-19K pond to be located in San Juan, New Mexico. This information contained in this report is supplemental to information contained in the Geotechnical Engineering Report No. 182-3037 – Services to Date letter, dated August 23, 2018 which is referenced herein and attached.

PROJECT DESCRIPTION

GEOMAT understands that the KWU 2309-19K pond location has been relocated approximately 100 feet north of the original site location with the new pond center located at approximately 36.210825° north latitude -107.831105° west longitude. We understand the pond will have dimensions of approximately 230 feet by 400 feet. The pond will be partially excavated (incised) into the existing grade at the site and will include both constructed pond embankments. The project will also include a constructed pad for placement of a drilled water well and general operation of the facility. It is our understanding that the pond will be 20 to 25 feet and it will be lined with a double HDPE liner system. The excavation is located on relatively flat terrain. It is anticipated that the pond embankments will be on the order of 10 to 15 feet maximum. Our understanding and assumptions of the proposed pond construction is based upon Enduring Resources' existing practices utilized on recently constructed ponds in the project vicinity.

SUPPLEMENTAL SITE EXPLORATION

Our scope of services performed for this addendum included advancing supplemental borings for sampling, laboratory testing of the samples and engineering analyses.

Field Exploration:

As requested by Enduring Resources, three additional soil borings, designated as B-7 through B-9, were drilled at the revised Kimbeto site as depicted on the attached Site Plan. Boring B-7 was located at the approximate center of the proposed expansion with B-8 and B-9 located to assist in exploration of the northern expansion.

Boring B-7 – Groundwater Verification and Soil Sampling

Boring B-7 was drilled on November 16, 2018 to an approximate depth of 75 feet below existing ground surface to check for groundwater to that depth. The boring was advanced using a CME-55 truck-mounted drill rig with continuous-flight, 7.25-inch O.D. hollow-stem auger. A 2-inch temporary PVC piezometer was installed and monitored for a 24-hour period to check for groundwater. No water was observed to be present in the piezometer after the 24-hour period. After verifying the absence of groundwater in the boring, the temporary casing was removed and the boring back-filled with cuttings.

In addition, during the boring of B-7 two representative bulk soil samples were obtained at intervals of 5'-10' and 10'-25' below ground surface. Representative samples were packaged and transported to TRI Environmental to be utilized for direct shear testing remolded to approximately 95 percent of the maximum dry density and optimum moisture content as determined by ASTM D698.

Drill Rig at Kimbeto Site B-7
View Toward the Southeast

Borings B-8 and B-9 – Soil Sampling

Borings B-8 and B-9 were drilled on November 19, 2018 to approximate depths of 30 feet below existing grade. The borings were advanced using a CME-45 truck-mounted drill rig with continuous-flight, 7.25-inch O.D. hollow-stem auger. The borings were continuously monitored by an engineer from our office who examined and classified the subsurface materials

encountered, obtained representative samples, observed groundwater conditions, and maintained a continuous log of each boring.

Soil samples were obtained from the borings using a combination of standard 2-inch O.D. split spoon and 3-inch O.D. modified California ring barrel samplers. The samplers were driven using a 140-pound hammer falling 30 inches. The standard penetration resistance was determined by recording the number of hammer blows required to advance the sampler in six-inch increments. Representative bulk samples of subsurface materials were also obtained.

Groundwater observations were made in each boring at the time of site exploration. Soils were classified in accordance with the Unified Soil Classification System described in Appendix A. Boring logs were prepared for B-8 and B-9 and are presented in Appendix A.

Laboratory Testing:

Samples retrieved during the field exploration were transported to our laboratory for further evaluation. At that time, the samples were prepared and laboratory tests were performed to evaluate the engineering properties of the subsurface materials.

SITE CONDITIONS

The site of the expanded pond appends an area of approximately 250 feet by 600 feet to the norther edge of the former. The ground surface across the site of the proposed pond was generally flat with a gentle slope to the southwest. The area explored was northeast of current construction and was vegetated by a significant growth of native weeds, sage brush and shrubs. No evidence of prior structural development was noted at the site.

SUBSURFACE CONDITIONS

Soil Conditions:

As presented on the Boring Logs in Appendix A, we encountered predominantly sandy soil conditions underlain by rock in B-8, similar to our initial investigations at the site. Sandstones/Siltstones interlayered with shale lenses were encountered below the sandy soils in B-8. The sandy soils encountered were medium dense and were generally dry to damp. The sandstone/siltstone rock was generally slightly too moderately weathered.

Groundwater Conditions:

Groundwater was not encountered in B-7 nor either of the subsequent borings. Groundwater elevations can fluctuate over time depending upon precipitation, irrigation, runoff and infiltration

of surface water. We do not have any information regarding the historical fluctuation of the groundwater level in this vicinity.

Laboratory Test Results:

Laboratory analyses of the bulk samples tested indicate the soils had fines contents (silt- and/or clay-sized particles passing the U.S. No. 200 sieve) of 32 and 22 percent for supplemental boring B-7. This is consistent with test results from previous exploration on the site. The plasticity index for B-7 at the 5'-10' level was 7 while the lower 10'-25' was non-plastic. Results of the ASTM D698 proctor test indicated maximum dry densities of 115.7 pcf and 116.2 pcf with optimum moisture contents of 12.5% and 12.6% for 5'-10' and 10'-25', respectively.

Direct shear results of remolded samples from the two composites for B-7 indicate effective friction angles, θ', of 39.9° and 40.6° for 5'-10' and 10'-25', respectively, and effective cohesion values, c', of approximately 72 psf and 0 psf, respectively. Approximate weighted averages of these values, equaling 40° for friction angle and 40 psf for cohesion, along with a dry density of 112 pcf were utilized in slope stability analysis of the revised pond embankments constructed with engineered fill at 95% compaction as recommended.

Results of both the GEOMAT testing and the TRI direct shear are attached in Appendix B.

OPINIONS AND RECOMMENDATIONS

Geotechnical Considerations:

The site is considered suitable for the proposed fracking water pond based on the geotechnical conditions encountered and tested for this report and our understanding of the project. If there are any significant deviations from the assumed finished elevations and/or pond locations noted at the beginning of this report, the opinions and recommendations of this report should be reviewed and confirmed/modified as necessary to reflect the final planned design conditions.

Pond Design and Construction:

Based upon the conditions encountered and our engineering analysis, the expanded Kimbeto site could be used for construction of a pond design consistent with Enduring Resources' existing practices as assumed. A double HDPE liner system should be installed in accordance with the manufacturer's recommendations. Compaction of the subgrade within the incised portions of the pond below the liner should be in accordance with the liner manufacturer's recommendations as well. Subgrade and fill for the embankments should be constructed in accordance with the **Placement and Compaction** section of this report. Embankment fills should be compacted to a minimum 95 percent of the maximum dry density as determined by ASTM D698 at near optimum moisture content in lifts not exceeding 10-inches in loose thickness.

Slope Stability Analysis:

A slope stability analysis was performed to evaluate both the cut slope inclinations for the incised portion of the pond and the constructed pond embankment. Data was based upon Enduring Resources' existing practices as previously described. Analysis was performed for the pond designed with 3.0:1 internal slopes with 5.0:1 external slopes (horizontal:vertical). A minimum access roadway width of 12 feet on the top of the pond embankments was used in the analyses. Light vehicle loads were added to the model as two 1500-pound point loads to represent the axle loads. Galena Slope Stability software (version 6.1) was used in developing our recommendations.

Seismic Considerations:

Seismic design parameters for the proposed KWU recycling pond were obtained utilizing the U.S. Geological Survey's (USGS) Unified Hazard Tool located at the web address - https://earthquake.usgs.gov/hazards/interactive/. The site replaces previously available information from the USGS and is part of the probabilistic seismic hazard analysis (PSHA) platform developed and maintained by the National Seismic Hazard Mapping Project (NSHMP) within the USGS earthquake hazards program.

The Earthquake Hazard and Probability Map for the Conterminous U.S. for 2014 (version 4.0.x) was selected to display the peak ground acceleration for n event with a probability of 2% in 50 years. From the projects location the site classification was determined to be on the B/C boundary. The resulting peak force produced an earthquake coefficient of 0.081, which was enter into the Galena models for all sections to represent an overlying earthquake force.

Note that the seismic site classification was estimated based on site location, the results of our subsurface exploration, experience with similar projects in the area, and a review of a geologic map of the project area. Additional exploration to greater depths would be required to verify the subsurface conditions below the depth explored for this report.

Slope Stability Analysis Results:

Graphical printouts are attached to this addendum and results are included in Table 1 below.

Table 1 - Slope Stability Analysis.

			Factor of Safety	
		Slope	**Base**	**Seismic Applied**
Embankment	Internal Slope	3.0:1	1.88	1.47
Embankment	External Slope	5.0:1	3.47	2.51

Based on the results of our subsurface exploration, laboratory testing, and engineering analyses, the designed grades of the incised pond walls and the constructed embankments are acceptable at the proposed 3.0:1 internal and 5.0:1 external in the site soils if constructed as recommended herein.

If the project scope changes further or is altered, GEOMAT should be notified to review the plans and confirm or modify our recommendations as necessary.

Lateral Earth Pressures:

For soils above any free water surface, recommended equivalent fluid pressures for unrestrained foundation elements are presented in the following table:

- **Active:**
  Granular soil backfill (on-site sand) .....35 psf/ft
  Undisturbed subsoil .....30 psf/ft

- **Passive:**
  Shallow foundation walls .....250 psf/ft
  Shallow column footings.....350 psf/ft
  Sump walls .....400 psf/ft
- **Coefficient of base friction**: 0.40
  The coefficient of base friction should be reduced to 0.30 when used in conjunction with passive pressure.

Where the design includes restrained elements, the following equivalent fluid pressures are recommended:

- **At rest:**
  Granular soil backfill (on-site sand).....50 psf/ft
  Undisturbed subsoil.....60 psf/ft

Earthwork:

General Considerations:

The opinions contained in this report for the proposed construction are contingent upon compliance with recommendations presented in this section. Although underground facilities such as foundations, septic tanks, cesspools, basements and irrigation systems were not encountered during site reconnaissance, such features could exist and might be encountered during construction.

Site Clearing:

1. Strip and remove all existing fill, debris and other deleterious materials from the proposed construction areas.

2. If unexpected fills or underground facilities are encountered during site clearing, we should be contacted for further recommendations. All excavations should be observed by GEOMAT prior to backfill placement.

3. Stripped materials consisting of vegetation and organic materials should be removed from the site, or used to re-vegetate exposed slopes after completion of grading operations. If it is necessary to dispose of organic materials on-site, they should be placed in non-structural areas, and in fill sections not exceeding 5 feet in height.

4. Sloping areas steeper than 5:1 (horizontal:vertical) should be benched to reduce the potential for slippage between existing slopes and fills. Benches should be level and wide enough to accommodate compaction and earth moving equipment.

5. All exposed areas which will receive fill, once properly cleared and benched where necessary, should be scarified to a minimum depth of eight inches, conditioned to near optimum moisture content, and compacted to at least 95% of standard proctor (ASTM D698).

Excavation:

We present the following general comments regarding our opinion of the excavation conditions for the designers' information with the understanding that they are opinions based on our boring data. More accurate information regarding the excavation conditions should be evaluated by contractors or other interested parties from test excavations using the equipment that will be used during construction.

Based on our subsurface evaluation it appears that shallow excavations in soils at the site will be possible using standard excavation equipment, however, rock was encountered at relatively shallow depths across the site. Excavations that encounter formational rock are expected to be difficult and may necessitate the use of heavy-duty equipment and/or specialized techniques.

On-site soils may pump or become unstable or unworkable at high water contents. Dewatering may be necessary to achieve a stable excavation. Workability may be improved by scarifying and drying. Over-excavation of wet zones and replacement with granular materials may be necessary. Lightweight excavation equipment may be required to reduce subgrade pumping.

Fill Materials:

1. Native soils could be used in any areas cut for facilitation of the pond excavation.

2. Select granular materials should be used as backfill behind walls that retain earth.

3. On site or imported soils to be used in structural fills should conform to the following:

Gradation	**Percent finer by weight (ASTM C136)**
3"	100
No. 4 Sieve	50-100
No. 200 Sieve	50 Max
Maximum expansive potential (%)*	1.5

* Measured on a sample compacted to approximately 95 percent of the ASTM D698 maximum dry density at about 3 percent below optimum water content. The sample is confined under a 144-psf surcharge and submerged. The recommended maximum expansive potential of 1.5% applies only to fill used beneath structures and not pond embankments.

4. If used, aggregate base should conform to Type I Base Course as specified in Section 303 of the 2014 New Mexico Department of Transportation (NMDOT) *"Standard Specifications for Road and Bridge Construction."*

Placement and Compaction:

1. Place and compact fill in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift.

2. Un-compacted fill lifts should not exceed 10 inches loose thickness.

3. Materials should be compacted to the following:

Material	Minimum Percent (ASTM D698)
Liner Subgrade	Per Liner Manufacturer's Recommendations
Subgrade soils beneath fill areas	95
On site or imported soil fills:	
Beneath footings and slabs on grade	95
Aggregate base beneath slabs and pavements	95
Miscellaneous backfill	90

4. On-site and imported soils should be compacted at moisture contents near optimum.

Compliance:

To assess compliance, observation and testing should be performed by GEOMAT.

Drainage:

Surface Drainage:

Positive drainage should be provided during construction and maintained throughout the life of the proposed project to prevent surface runoff from entering the pond.

Protective slopes should be provided with a minimum grade of approximately 5 percent for at least 10 feet from any structures. Backfill against footings, exterior walls, and in utility trenches should be well compacted and free of all construction debris to reduce the possibility of moisture infiltration.

Subsurface Drainage:

Free-draining, granular soils containing less than five percent fines (by weight) passing a No. 200 sieve should be placed adjacent to walls which retain earth. A drainage system consisting of either weep holes or perforated drain lines (placed near the base of the wall) should be used to intercept and discharge water which would tend to saturate the backfill. Where used, drain lines should be embedded in a uniformly graded filter material and provided with adequate clean-outs

for periodic maintenance. An impervious soil should be used in the upper layer of backfill to reduce the potential for water infiltration.

GENERAL COMMENTS

Our recommendations with respect to the construction of the Kimbeto pond are based on the information obtained from the supplemental borings and the original data reported in our August report. It should be realized that subsurface conditions could vary across the extent of the pond area, and these variations may not become apparent until construction is underway. If, during construction, soil types other than those encountered during our exploration are encountered, we should be contacted to observe the actual conditions and confirm/modify our recommendations, as appropriate. It is recommended that GEOMAT be retained to provide a general review of final design plans and specifications in order to confirm that grading recommendations in this report have been interpreted and implemented. In the event that any changes of the proposed project are planned, the opinions and recommendations contained in this report should be reviewed and the report modified or supplemented as necessary.

GEOMAT should also be retained to provide services during excavation, grading, and construction phases of the work. Construction testing, including field and laboratory evaluation of fill, backfill, and compacted slopes should be performed to determine whether applicable project requirements have been met.

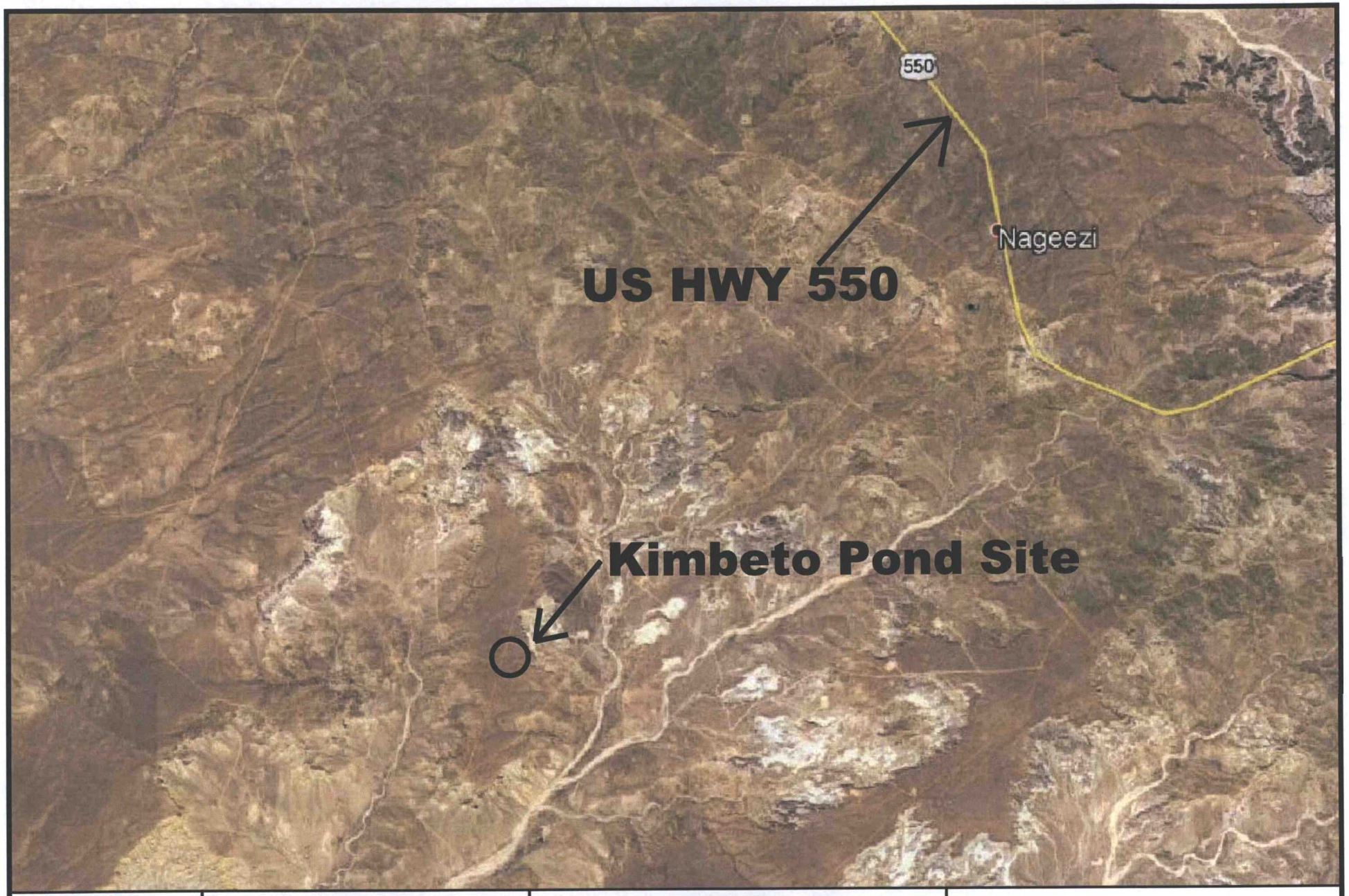
The analyses and recommendations in this report are based in part upon data obtained from the field exploration. The nature and extent of variations beyond the location of test borings may not become evident until construction. If variations then appear evident, it may be necessary to re-evaluate the recommendations of this report.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in this or similar localities at the same time. No warranty, express or implied, is intended or made. We prepared the report as an aid in design of the proposed project. This report is not a bidding document. Any contractor reviewing this report must draw his own conclusions regarding site conditions and specific construction equipment and techniques to be used on this project.

This report is for the exclusive purpose of providing geotechnical engineering and/or testing information and recommendations. The scope of services for this project does not include, either specifically or by implication, any environmental assessment of the site or identification of contaminated or hazardous materials or conditions. If the owner is concerned about the potential for such contamination, other studies should be undertaken. This report has also not addressed any geologic hazards that may exist on or near the site.

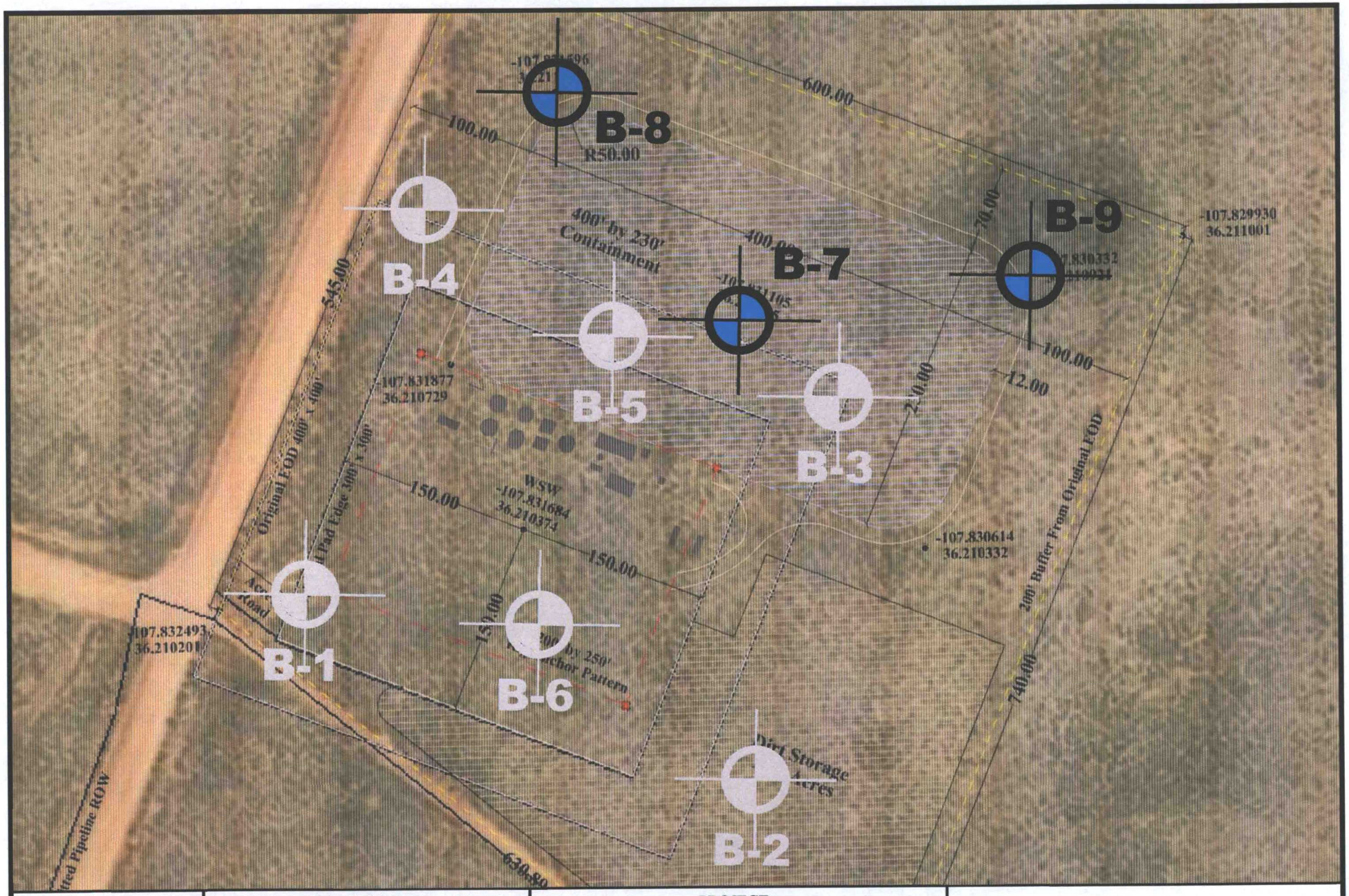
This report may be used only by the Client and only for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both on and off site), or other factors may change over time and additional work may be required with the passage of time. Any party, other than the Client, who wishes to use this report, shall notify GEOMAT in writing of such intended use. Based on the intended use of the report, GEOMAT may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements, by the Client or anyone else, will release GEOMAT from any liability resulting from the use of this report by an unauthorized party.

Appendix A



Approximate Not to Scale	VICINITY MAP Locations (approximate) GEOMAT Project No. 182-3037 Date of Exploration: November 16 & 19, 2018	PROJECT Kimbeto Remote Facility Pond Enduring Resources San Juan County, New Mexico

GEOMAT INC.



	SITE PLAN	PROJECT
Approximate Not to Scale	Approximate Boring Locations GEOMAT Project No. 182-3037 Date of Exploration: Nov. 16 & 19, 2018	Kimbeto Recycling Containment Facility KUW 2309-19K: Enduring Resources San Juan County, New Mexico

GEOMAT INC.

GEOMAT INC.
915 Malta Avenue
Farmington, NM 87401
Tel (505) 327-7928
Fax (505) 326-5721

Borehole B-8

Project Name: Kimbeto Remote Facility Pond
Project Number: 182-3037
Client: Enduring Resources
Site Location: San Juan County, New Mexico
Rig Type: CME-45
Drilling Method: 7.25" O.D. Hollow Stem Auger
Sampling Method: Hand, Ring, and Split spoon samples
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 11/19/2018
Latitude: Not Determined
Longitude: Not Determined
Elevation: Not Determined
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: MC
Remarks:

Laboratory Results: Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Symbol	Material Type	Soil Symbol	Depth (ft)	Soil Description
96.9			5.3	7-7-7	R 18		SC		5	Clayey SAND, tan/brown, fine grained, loose, slightly damp to damp white nodules caliche
				20-21-34	SS 18		SM		10	Silty SAND, tan, fine- to medium grained, dense to very dense, slightly damp to damp
99.8			7.5	45-50/3"	R 9				15	
							SC			Clayey SAND, tan/brown, fine grained, slightly damp
				25-35-34	SS 18		SP-SM		20	Poorly Graded SAND w/ silt, tan, fine grained, very dense, slightly damp
102.7			4.7	35-49-50/4"	R 16		RK		25	SILTSTONE, brown to tan, fine grained, dense, highly weathered, damp
				20-25-35	SS 18				30	
									35	Total Depth 31½ feet

A = Auger Cuttings R = Ring-Lined Barrel Sampler SS = Split Spoon GRAB = Manual Grab Sample D = Disturbed Bulk Sample

GEOMAT 182-3037.GPJ GEOMAT.GDT 11/29/18

GEOMAT INC.
915 Malta Avenue
Farmington, NM 87401
Tel (505) 327-7928
Fax (505) 326-5721

Borehole B-9

Project Name: Kimbeto Remote Facility Pond
Project Number: 182-3037
Client: Enduring Resources
Site Location: San Juan County, New Mexico
Rig Type: CME-45
Drilling Method: 7.25" O.D. Hollow Stem Auger
Sampling Method: Hand, Ring, and Split spoon samples
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 11/19/2018
Latitude: Not Determined
Longitude: Not Determined
Elevation: Not Determined
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: MC
Remarks:

Laboratory Results: Dry Density (pcf)	Laboratory Results: % Passing #200 Sieve	Laboratory Results: Plasticity Index	Laboratory Results: Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Symbol	Material Type	Soil Symbol	Depth (ft)	Soil Description
							SC		0	Clayey SAND, tan/brown, fine grained, dense, slightly damp
				18-17-17	SS 18				5	
							SM			Silty SAND, tan, fine rained, dense, slightly damp to damp
102.7			4.7	33-50/6"	R 12				10	
							SC			Clayey SAND, brown, fine grained, dense, damp
				15-24-26	SS 18				15	
							SP-SM			Silty SAND, tan, fine grained, dense, slightly damp to damp
109.8			2.2	17-29-50/6"	R 18				20	
										moderately cemented
				15-17-18	SS 18				25	
				7-17-19	SS 18				30	
							CL			Lean CLAY, brown, hard, slightly damp
										Total Depth 31½ feet
									35	

A = Auger Cuttings R = Ring-Lined Barrel Sampler SS = Split Spoon GRAB = Manual Grab Sample D = Disturbed Bulk Sample

GEOMAT 182-3037.GPJ GEOMAT.GDT 11/29/18

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions			Group Symbols	Typical Names
Coarse-Grained Soils More than 50% retained on No. 200 sieve	**Gravels** 50% or more of coarse fraction retained on No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands More than 50% of coarse fraction passes No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils 50% or more passes No. 200 sieve	**Silts and Clays** Liquid Limit 50 or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid Limit greater than 50		MH	Inorganic silts, micaceous or diatomaceous free sands or silts, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, mucic & other highly organic soils

CONSISTENCY OR RELATIVE DENSITY CRITERIA

Standard Penetration Test
Density of Granular Soils

Penetration Resistance, N (blows/ft.)	Relative Density
0-4	Very Loose
5-10	Loose
11-30	Medium Dense
31-50	Dense
>50	Very Dense

Standard Penetration Test
Density of Fine-Grained Soils

Penetration Resistance, N (blows/ft.)	Consistency	Unconfined Compressive Strength (Tons/ft2)
<2	Very Soft	<0.25
2-4	Soft	0.25-0.50
4-8	Firm	0.50-1.00
8-15	Stiff	1.00-2.00
15-30	Very Stiff	2.00-4.00
>30	Hard	>4.0

U.S. Standard Sieve Sizes

>12"	12"	3"	3/4"	#4	#10	#40	#200

Boulders	Cobbles	Gravel		Sand			Silt or Clay
		coarse	fine	coarse	medium	fine	

MOISTURE CONDITIONS

Dry	Absence of moist, dusty, dry to the touch
Slightly Damp	Below optimum moisture content for compaction
Moist	Near optimum moisture content, will moisten the hand
Very Moist	Above optimum moisture content
Wet	Visible free water, below water table

MATERIAL QUANTITY

trace	0-5%
few	5-10%
little	10-25%
some	25-45%
mostly	50-100%

OTHER SYMBOLS

R Ring Sample
S SPT Sample
B Bulk Sample
▼ Ground Water

BASIC LOG FORMAT:

Group name, Group symbol, (grain size), color, moisture, consistency or relative density. Additional comments: odor, presence of roots, mica, gypsum, coarse particles, etc.

EXAMPLE:

SILTY SAND w/trace silt (SM-SP), Brown, loose to med. Dense, fine to medium grained, damp

UNIFIED SOIL CLASSIFICATION SYSTEM

TEST DRILLING EQUIPMENT & PROCEDURES

Description of Subsurface Exploration Methods

Drilling Equipment – Truck-mounted drill rigs powered with gasoline or diesel engines are used in advancing test borings. Drilling through soil or softer rock is performed with hollow-stem auger or continuous flight auger. Carbide insert teeth are normally used on bits to penetrate soft rock or very strongly cemented soils which require blasting or very heavy equipment for excavation. Where refusal is experienced in auger drilling, the holes are sometimes advanced with tricone gear bits and NX rods using water or air as a drilling fluid.

Sampling Procedures - Dynamically driven tube samples are usually obtained at selected intervals in the borings by the ASTM D1586 test procedure. In most cases, 2" outside diameter, 1 3/8" inside diameter, samplers are used to obtain the standard penetration resistance. "Undisturbed" samples of firmer soils are often obtained with 3" outside diameter samplers lined with 2.42" inside diameter brass rings. The driving energy is generally recorded as the number of blows of a 140-pound, 30-inch free fall drop hammer required to advance the samplers in 6-inch increments. These values are expressed in blows per foot on the boring logs. However, in stratified soils, driving resistance is sometimes recorded in 2- or 3-inch increments so that soil changes and the presence of scattered gravel or cemented layers can be readily detected and the realistic penetration values obtained for consideration in design. "Undisturbed" sampling of softer soils is sometimes performed with thin-walled Shelby tubes (ASTM D1587). Tube samples are labeled and placed in watertight containers to maintain field moisture contents for testing. When necessary for testing, larger bulk samples are taken from auger cuttings. Where samples of rock are required, they are obtained by NX diamond core drilling (ASTM D2113).

Boring Records - Drilling operations are directed by our field engineer or geologist who examines soil recovery and prepares boring logs. Soils are visually classified in accordance with the Unified Soil Classification System (ASTM D2487), with appropriate group symbols being shown on the logs.

Appendix B

GEOMAT INC.

SUMMARY OF LABORATORY RESULTS

Project Name:	**Kimbeto Pond, KWU 2309-19K**	**Location:**	**San Juan County, New Mexico**
Project No.:	**182-3037**	**Date of Exploration:**	**November 16 & 19, 2018**

Lab Number	Borehole No.	Sample Depth (ft.)	Moisture (%)	Soil Wet Density (pcf)	Soil Dry Density (pcf)	CLASSIFICATION
7527	B-8	5	5.3%	102.0	96.9	Clayey **SAND** (SC)
7528	B-8	15	4.0%	103.8	99.8	Silty **SAND** (SM)
7529	B-8	25	7.5%	116.5	108.3	**SILTSTONE**
7530	B-9	10	4.7%	107.5	102.7	Silty **SAND** (SM)
7531	B-9	20	2.2%	112.2	109.8	Silty **SAND** (SM)

Lab Number	Borehole No.	Sample Depth (ft.)	ASTM D698 Proctor		MOISTURE CONT. (%)	ASTM D3080 Direct Shear		ASTM 4318 Atterberg Limits			% PASS #200 SIEVE	CLASSIFICATION
			Density (pcf)	Moisture (%)		c', psf	θ´, degrees	LL	PL	PI		
7525	B-7	5'-10'	115.7	12.8	4.5	72.0	39.9	22	15	7	32	Silty **SAND** (SM)
7526	B-7	10'-25'	118.1	12.5	2.6	0.0	40.6	NLL	NPL	NP	22	Silty **SAND** (SM)

Note: Laboratory results for GEOMAT's previous explorations are included with the August 23, 2018 Report which is attached to this addendum fro reference.

LABORATORY TESTING PROCEDURES

Consolidation Tests: One-dimensional consolidation tests are performed using "Floating-ring" type consolidometers. The test samples are approximately 2.5 inches in diameter and 1.0 inch high and are usually obtained from test borings using the dynamically-driven ring samplers. Test procedures are generally as outlined in ASTM D2435. Loads are applied in several increments to the upper surface of the test specimen and the resulting deformations are recorded at selected time intervals for each increment. Samples are normally loaded in the in-situ moisture conditions to loads which approximate the stresses which will be experienced by the soils after the project is completed. Samples are usually then submerged to determine the effect of increased moisture contents on the soils. Each load increment is applied until compression/expansion of the sample is essentially complete (normally movements of less than 0.0003 inches/hour). Porous stones are placed on the top and bottom surfaces of the samples to facilitate introduction of the moisture.

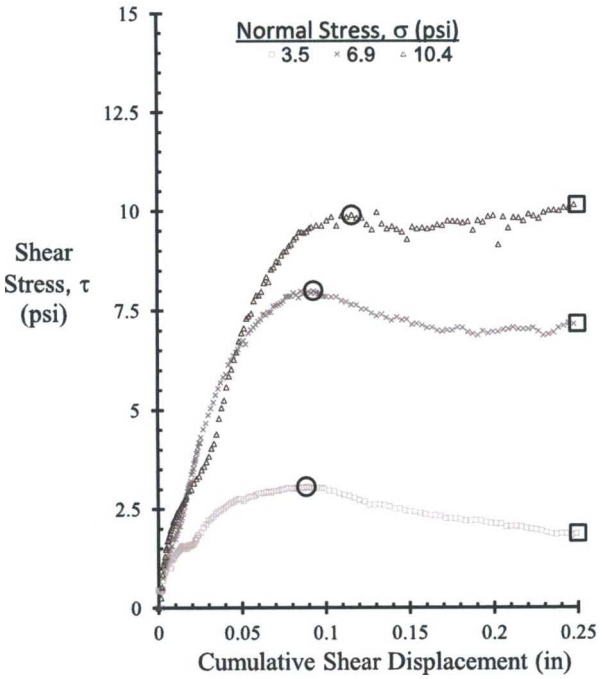
Expansion Tests: Tests are performed on either undisturbed or recompacted samples to evaluate the expansive potential of the soils. The test samples are approximately 2.5 inches in diameter and 1.0 inch high. Recompacted samples are typically remolded to densities and moisture contents that will simulate field compaction conditions. Surcharge loads normally simulate those which will be experienced by the soils in the field. Surcharge loads are maintained until the expansion is essentially complete.

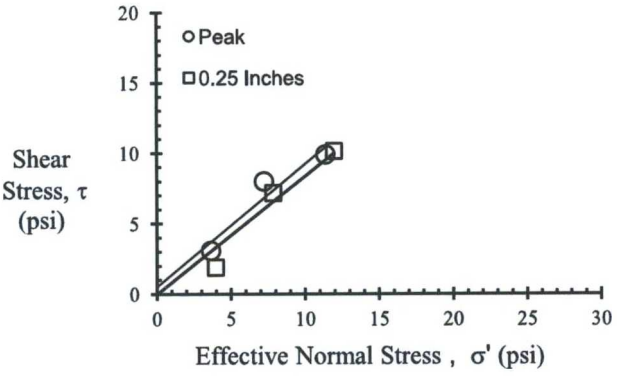
Atterberg Limits/Maximum Density/Optimum Moisture Tests: These tests are performed in accordance with the prescribed ASTM test procedures.

Direct Shear of Soil Under Consolidated-Drained Conditions

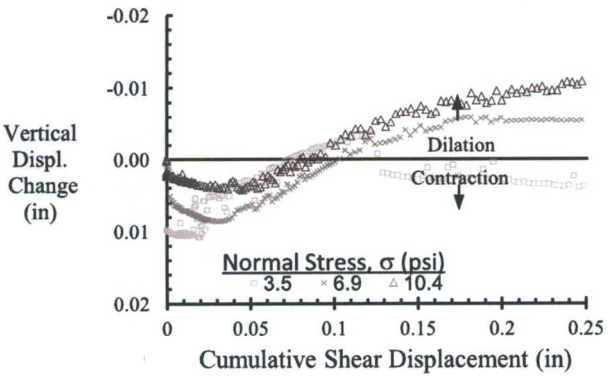
Client: GEOMAT Inc.
Project: WLU Pond
Sample: 7525 Fill Material

TRI Log#: 43200.1
Test Method: ASTM D3080





Note: Area Correction Has Been Applied



Sample Number		1	2	3
Initial Condition	Diameter, in	2.50	2.50	2.50
	Height, in (before consol)	1.00	1.00	1.00
	Water Content, %	13.0	13.0	13.0
	Saturation, %	72.4	72.2	72.0
	Dry Density, pcf	112.1	112.0	111.9
	Void Ratio	0.48	0.48	0.48
Post-Consol	Height, in (prior to shear)	1.00	1.00	0.99
	Dry Density, pcf	112.5	112.4	113.0
	Void Ratio	0.47	0.47	0.46
Displacement rate (in/min)		6.0E-04	6.0E-04	6.0E-04
Final Water Content, %		13.3	14.5	13.6
Peak	Normal Stress, σ' (psi)	3.66	7.26	11.41
	Shear Stress, τ (psi)	3.06	7.99	9.89
	Secant Friction Angle, Degrees	39.9	47.8	40.9
	Displacement (in)	0.09	0.09	0.12
	ϕ'_d, degrees	41.0		
	c'_d, psi	0.5		
0.25 Inches	Normal Stress, σ' (psi)	3.99	7.88	11.99
	Shear Stress, τ (psi)	1.88	7.16	10.15
	Secant Friction Angle, Degrees	25.2	42.2	40.2
	ϕ'_d, degrees	39.9		
	c'_d, psi	0 (Forced)		

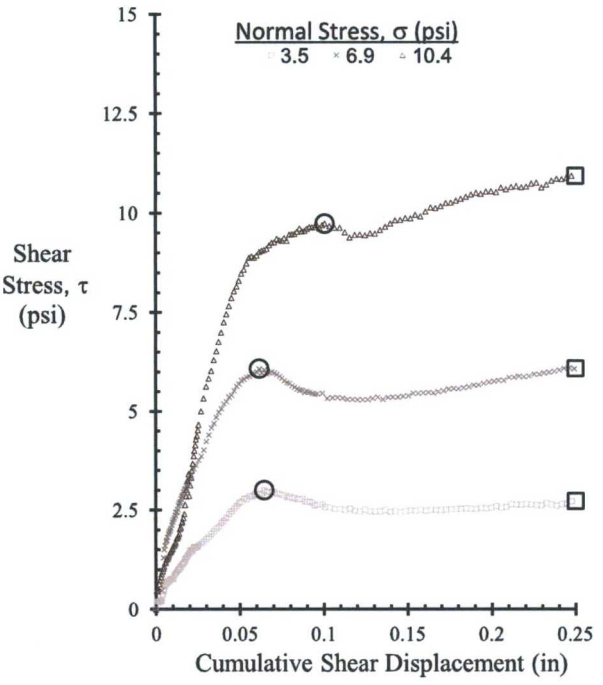
Note: The soil was air dried and passed through a No. 8 sieve to eliminate any over sized particles. The soil was moisture conditioned, allowed to equilibrate, and then adjusted according to the target gravimetric moisture content of 12.5% based on an oven dried moisture content. The specimen was then remolded into a known volume to achieve the target dry density of 112 pcf. A specific gravity of 2.65 was assumed for weight-volume calculations.

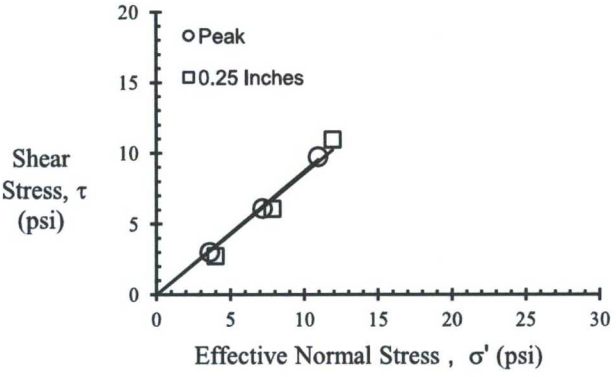
Jeffrey A. Kuhn, Ph.D., P.E., 12/6/18
Analysis & Quality Review/Date

Direct Shear of Soil Under Consolidated-Drained Conditions

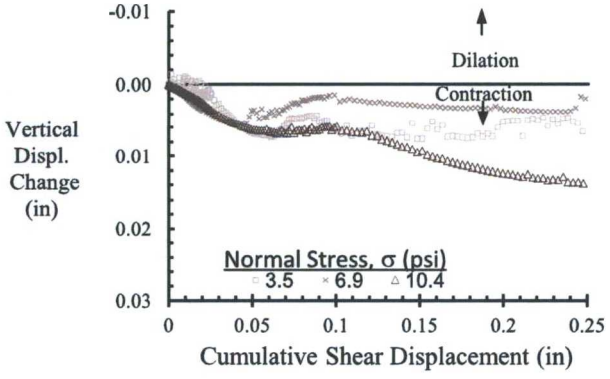
Client: GEOMAT Inc.
Project: WLU Pond
Sample: 7526 Fill Material

TRI Log#: 43200.2
Test Method: ASTM D3080





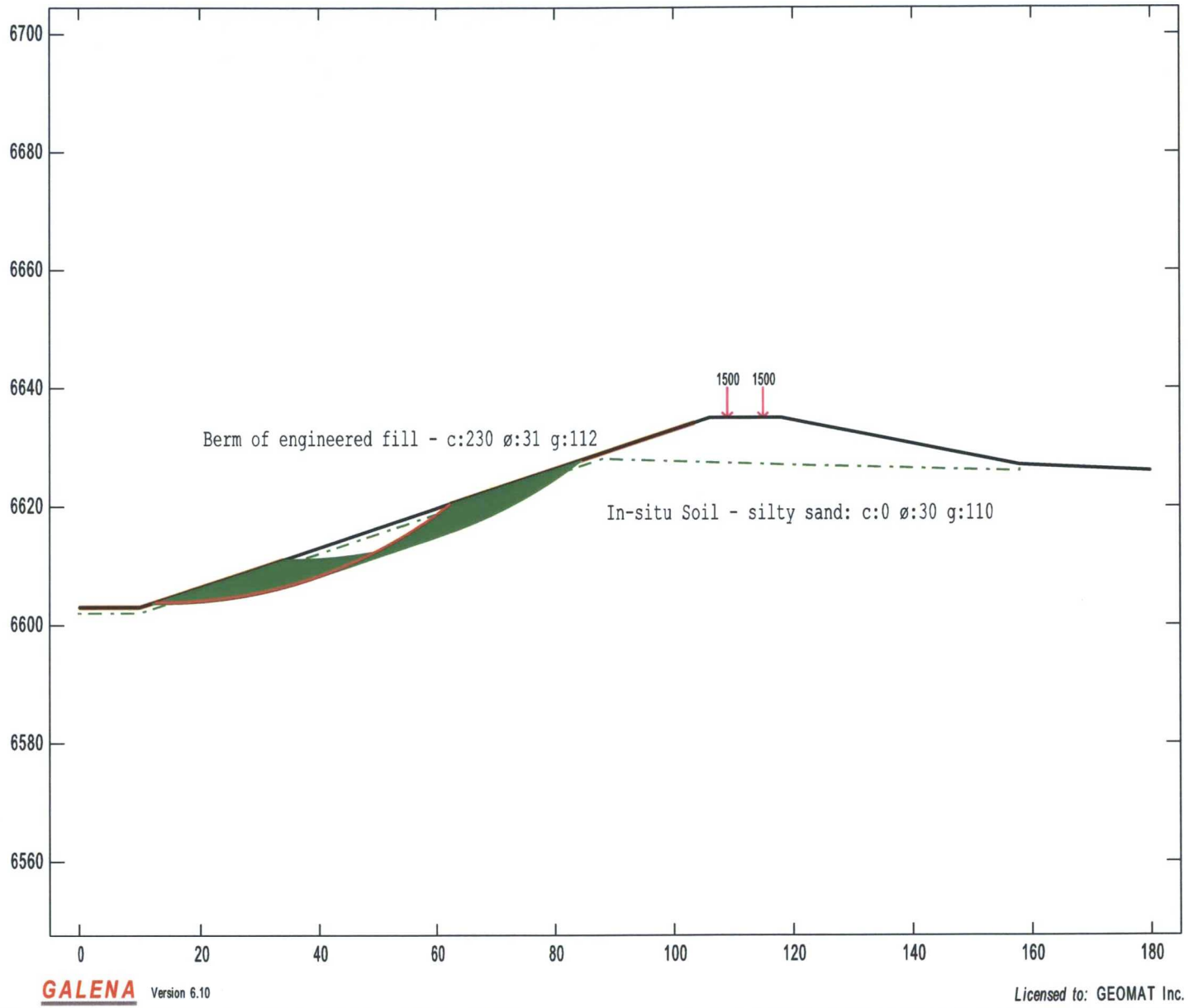
Note: Area Correction Has Been Applied



Sample Number		1	2	3
Initial Condition	Diameter, in	2.50	2.50	2.50
	Height, in (before consol)	1.00	1.00	1.00
	Water Content, %	12.6	12.6	12.6
	Saturation, %	65.1	64.9	66.1
	Dry Density, pcf	109.4	109.2	109.8
	Void Ratio	0.51	0.51	0.51
Post-Consol	Height, in (prior to shear)	1.00	1.00	1.00
	Dry Density, pcf	109.1	109.1	110.1
	Void Ratio	0.52	0.52	0.50
Displacement rate (in/min)		6.0E-04	6.0E-04	6.0E-04
Final Water Content, %		18.6	17.1	17.1
Peak	Normal Stress, σ' (psi)	3.62	7.19	10.95
	Shear Stress, τ (psi)	2.99	6.08	9.73
	Secant Friction Angle, Degrees	39.6	40.2	41.6
	Displacement (in)	0.06	0.06	0.10
	ϕ'_d, degrees	41.1		
	c'_d, psi	0 (Forced)		
0.25 Inches	Normal Stress, σ' (psi)	4.01	7.86	11.94
	Shear Stress, τ (psi)	2.72	6.07	10.93
	Secant Friction Angle, Degrees	34.2	37.7	42.5
	ϕ'_d, degrees	40.6		
	c'_d, psi	0 (Forced)		

Note: The soil was air dried and passed through a No. 8 sieve to eliminate any over sized particles. The soil was moisture conditioned, allowed to equilibrate, and then adjusted according to the target gravimetric moisture content of 12.5% based on an oven dried moisture content. The specimen was then remolded into a known volume to achieve the target dry density of 110 pcf. A specific gravity of 2.65 was assumed for weight-volume calculations.

Jeffrey A. Kuhn, Ph.D., P.E., 12/6/18
Analysis & Quality Review/Date



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Material Keys

Compacted Berm

Silty Sand (insitu)

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

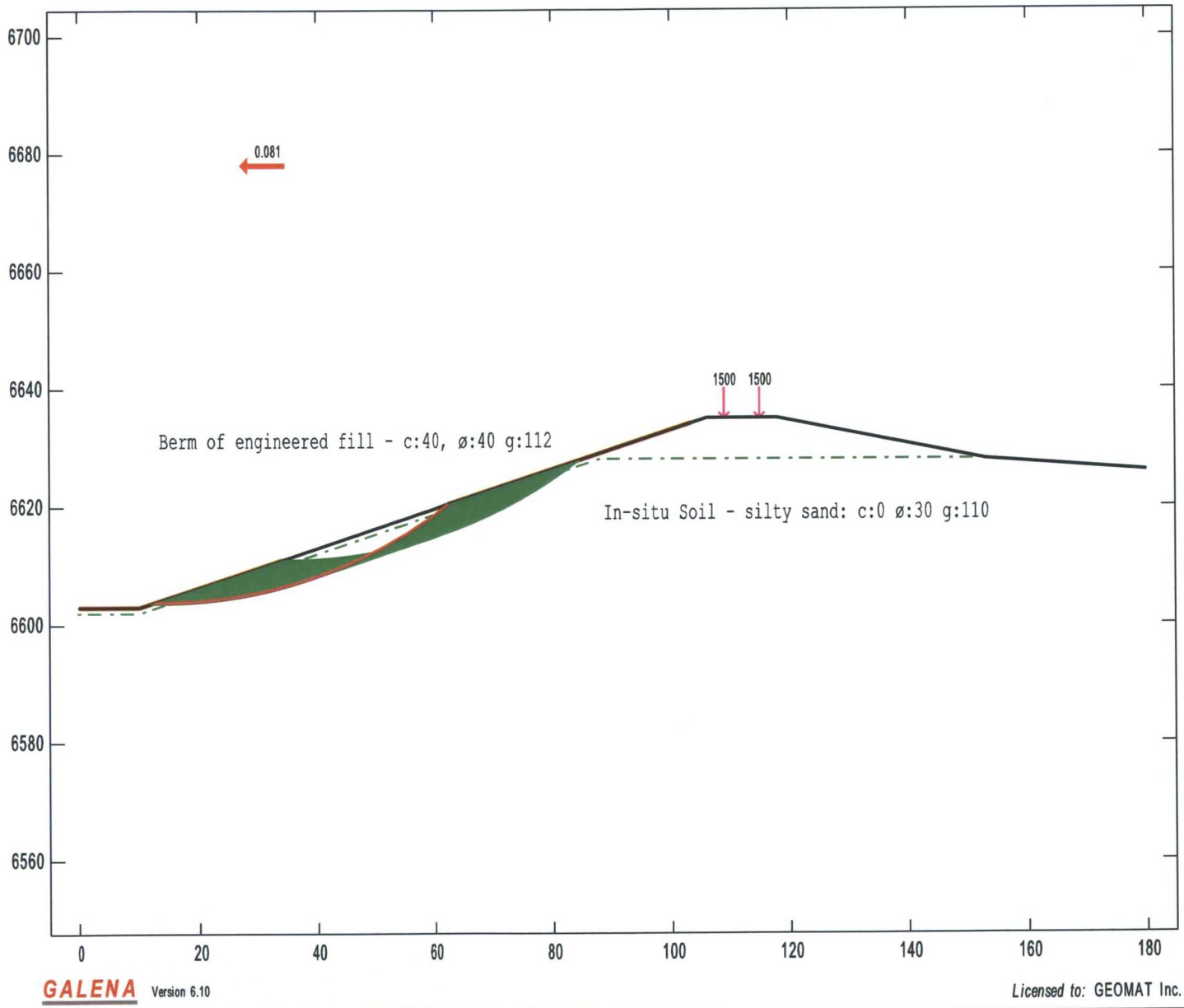
Critical Factor of Safety: 1.88

Project 182-3037 Kimbeto Wash Water Supply Well - III
Typical Pre-design

File: P:\Eng\Project 2018\182-3037 Kimbeto Wash Water Supply Well\Addenda\Engineering\Slope Stability\Kimbeto III Typical.gmf

Edited: 6 Dec 2018
Processed: 6 Dec 2018

GEOMAT Inc.



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Material Keys

Compacted Berm

Silty Sand (insitu)

Analysis 2

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.47

Project 182-3037 Kimbeto Wash Water Supply Well - III

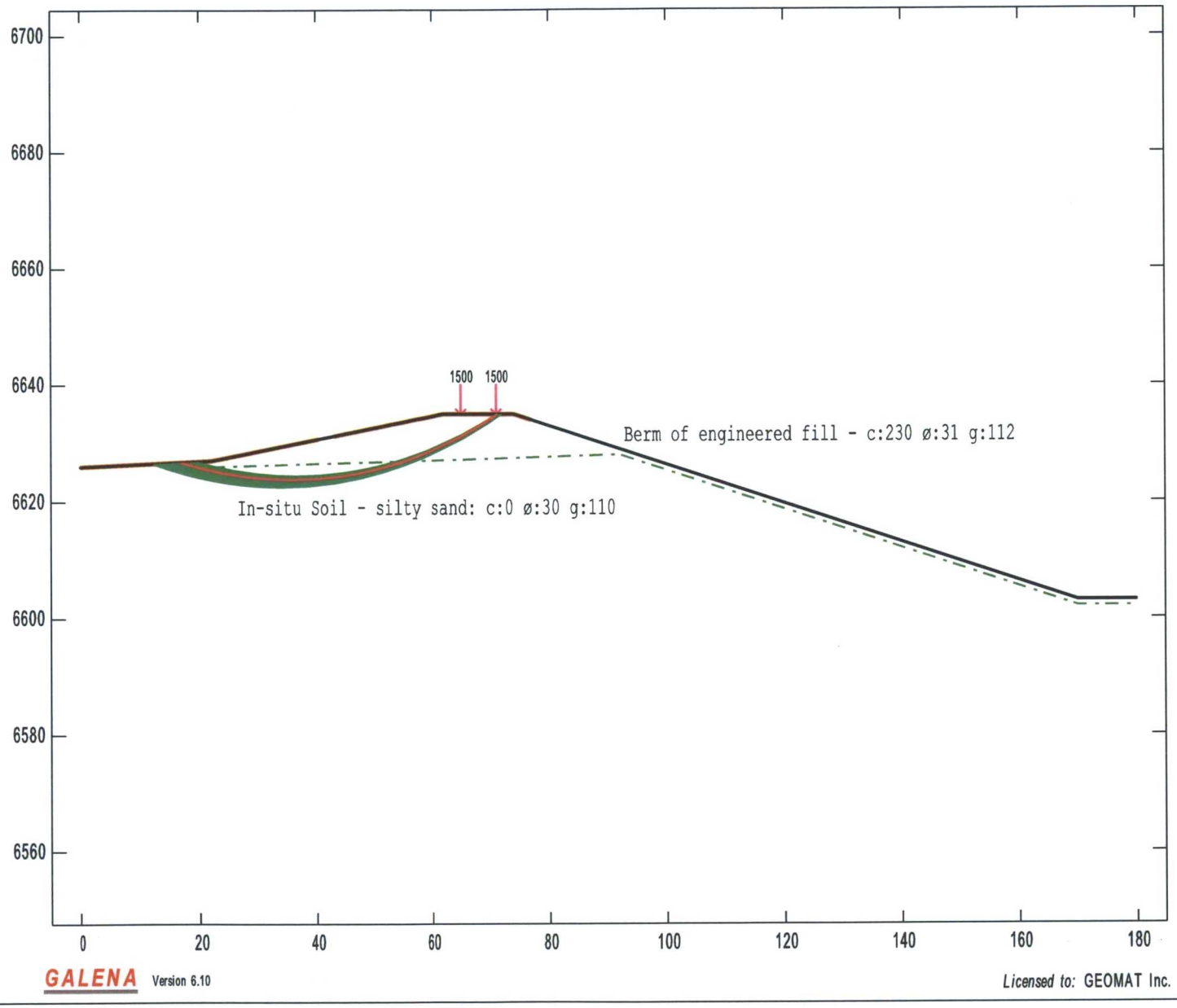
Typical Pre-design - Seismic force from USGS Unified Hazard Tool

File: P:\Eng\Project 2018\182-3037 Kimbeto Wash Water Supply Well\Addenda\Engineering\Slope Stability\Kimbeto III Typical.gmf

Edited: 6 Dec 2018

Processed: 6 Dec 2018

GEOMAT Inc.



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Material Keys

Compacted Berm

Silty Sand (insitu)

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

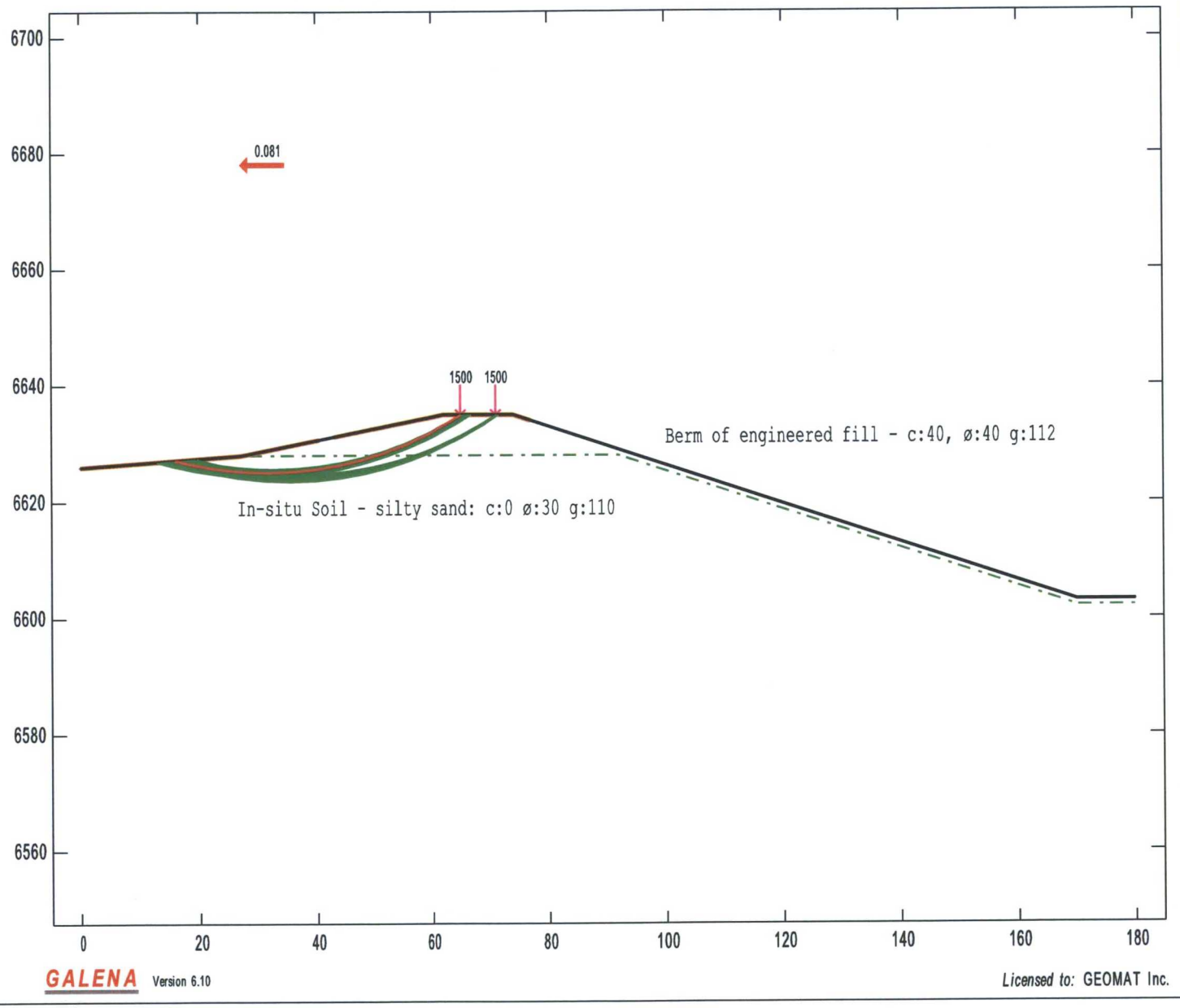
Critical Factor of Safety: 3.47

Project 182-3037 Kimbeto Wash Water Supply Well - III
Typical Pre-design

File: P:\Eng\Pro...\Kimbeto III Typical Seismic.gmf

Edited: 6 Dec 2018
Processed: 6 Dec 2018

GEOMAT Inc.



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Material Keys

Compacted Berm

Silty Sand (insitu)

Analysis 2

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 2.51

Project 182-3037 Kimbeto Wash Water Supply Well - III

Typical Pre-design - Seismic force from USGS Unified Hazard Tool

File: P:\Eng\Pro...\Kimbeto III Typical Seismic.gmf

Edited: 6 Dec 2018

Processed: 6 Dec 2018

GEOMAT INC

GEOMAT INC
915 Malta Avenue ◆ Farmington, NM 87401 ◆ Tel (505) 327-7928 ◆ Fax (505) 326-5721

August 23, 2018

Eric Stevens, P.E.
Enduring Resources
332 CR 3100
Aztec, New Mexico 87410

RE: Geotechnical Engineering Study – Services to Date
Kimbeto Remote Facility Fracking Water Pond
San Juan County, New Mexico
GEOMAT Project No. 182-3037

The purpose of this letter is to summarize our services to date for the referenced project. Our services were performed in general accordance with the scope of work described in our Proposal No. 182-04-22 dated April 20, 2018. We understand that the project scope has changed since we performed our services. This letter includes a summary of our field exploration and transmits the site plan, boring logs and laboratory results.

Field Subsurface Investigation

Subsurface conditions at the site were explored on June 25 and July 19, 2018, by drilling six exploratory borings, designated B-1 through B-6, at the approximate locations shown on the Site Plan in Appendix A. All of the borings were drilled to depths of approximately 35 feet below existing ground surface.

Borings B-1 through B-4 were drilled on June 25, 2018 using a CME-55 truck-mounted drill rig with continuous-flight, 7.25-inch O.D. hollow-stem auger. The borings were continuously monitored by a field engineer from our office who examined and classified the subsurface materials encountered, obtained representative samples, observed groundwater conditions, and maintained a continuous log of each boring. Soil samples were obtained from borings B-1 through B-4 using a combination of standard 2-inch O.D. split spoon and 3-inch O.D. modified California ring barrel samplers. The samplers were driven using a 140-pound hammer falling 30 inches. The standard penetration resistance was determined by recording the number of hammer blows required to advance the sampler in six-inch increments. Representative bulk samples of subsurface materials were also obtained.

Groundwater evaluations were made in borings B-1 through B-4 at the time of site exploration. Soils were classified in accordance with the attached Unified Soil Classification System (USCS). Boring logs were prepared and are presented in Appendix A.

Eric Steven, P.E.
Enduring Resources
Summary of Services to Date for Kimbeto Remote Facility Fracking Water Pond
GEOMAT Project No. 182-3037
August 23, 2018

Borings B-5 and B-6 were drilled on July 19, 2018 to obtain additional soil samples for laboratory testing. The borings were advanced using a CME-55 truck-mounted drill rig with continuous-flight, 7.25-inch O.D. hollow-stem auger. Bulk samples of the auger cuttings were obtained. Penetration testing was not performed for B-5 and B-6, and boring logs were not recorded.

Laboratory Testing Services

Samples retrieved during the field exploration were transported to our laboratory for further evaluation. At that time, the field descriptions were confirmed or modified as necessary, and laboratory tests were performed to evaluate the engineering properties of the subsurface materials. The following tests were performed on selected samples, in general accordance with the American Society for Testing and Materials (ASTM) procedures:

- Moisture content ASTM D2216
- Dry density ASTM D7263
- Percent passing No. 200 ASTM D1140
- Atterberg Limits ASTM D4318
- Standard Proctor ASTM D698
- Direct Shear ASTM D3080
- Soil Classification (laboratory methods) ASTM D2487
- Soil Classification (visual-manual methods) ASTM D2488

The results of all laboratory tests are presented in the attached **Summary of Soil Tests** table and direct shear results printouts.

Thank you for the opportunity to be of service to you on this project. If you have any questions or need additional information, please contact us.

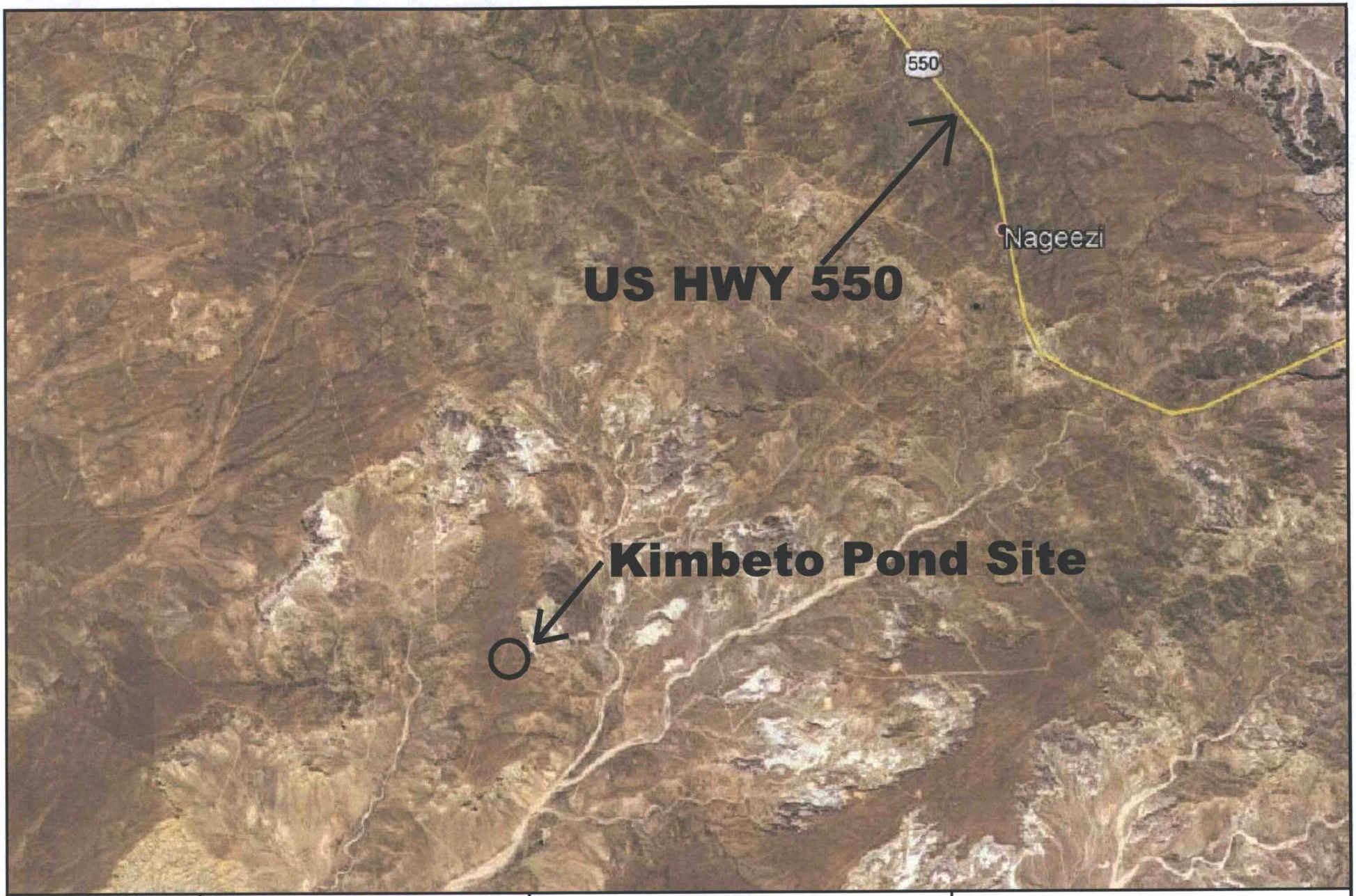
Respectfully submitted,
GEOMAT Inc.

Donald R. Baldwin
Donald R. Baldwin
Geologist

Robert "Bob" Flegal, P.E.
Senior Engineer

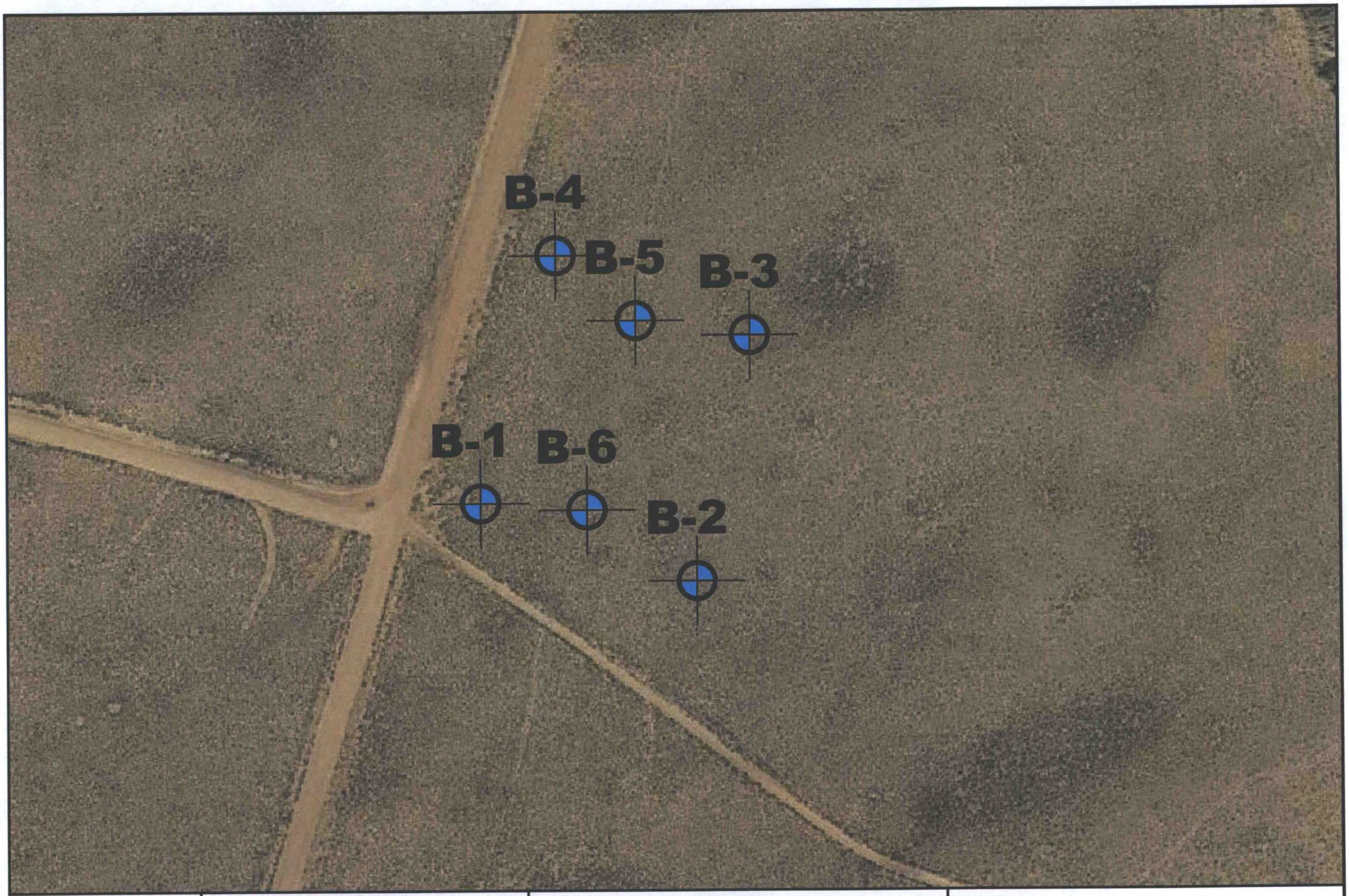
Attachments

Distribution: Addressee (1); Heather McDaniels, P.E., C.F.M. @ SMA both via email.



Approximate Not to Scale	VICINITY MAP Locations (approximate) GEOMAT Project No. 182-3037 Date of Exploration: June 25, 2018	PROJECT Kimbeto Remote Facility Pond Enduring Resources San Juan County, New Mexico

GEOMAT INC.



Approximate Not to Scale	SITE PLAN Boring Locations (approximate) GEOMAT Project No. 182-3037 Date of Exploration: June 25 & July 19, 2018	PROJECT Kimbeto Remote Facility Pond Enduring Resources San Juan County, New Mexico

GEOMAT INC.

GEOMAT INC.
915 Malta Avenue
Farmington, NM 87401
Tel (505) 327-7928
Fax (505) 326-5721

Borehole B-1

Project Name: Kimbeto Remote Facility Pond
Project Number: 182-3037
Client: Enduring Resources
Site Location: San Juan County, New Mexico
Rig Type: CME-55
Drilling Method: 7.25" O.D. Hollow Stem Auger
Sampling Method: Hand, Ring, and Split spoon samples
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 6/25/2018
Latitude: Not Determined
Longitude: Not Determined
Elevation: Not Determined
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: HK
Remarks: SW Corner

Laboratory Results										
Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Symbol	Material Type	Soil Symbol	Depth (ft)	Soil Description
					A		SC		1–5	Clayey SAND, tan/orange/brown, fine grained, medium dense, slightly damp
				12-10-12	SS 18				6	Contains silty sand lenses
							CL		7–12	Sandy Lean CLAY, brown, very stiff, moist
104.1	60	16	15.9	15-15-35	R 18					
				17-27-39	SS 18		SM		13–34	Silty SAND, gray to brown, fine- to medium grained, medium dense to very dense, slightly damp to damp
109.9	14	NP	4.2	29-42-50/5"	R 17					
				12-14-19	SS 18					
				16-19-22	SS 18					
				12-17-22	SS 18		RK		35–36	SHALE, dark gray/black, damp, weakly fissile/friable
									37–40	Total Depth 36½ feet

A = Auger Cuttings R = Ring-Lined Barrel Sampler SS = Split Spoon GRAB = Manual Grab Sample D = Disturbed Bulk Sample

GEOMAT 182-3037.GPJ GEOMAT.GDT 8/23/18

GEOMAT INC.
915 Malta Avenue
Farmington, NM 87401
Tel (505) 327-7928
Fax (505) 326-5721

Borehole B-2

Project Name: Kimbeto Remote Facility Pond
Project Number: 182-3037
Client: Enduring Resources
Site Location: San Juan County, New Mexico
Rig Type: CME-55
Drilling Method: 7.25" O.D. Hollow Stem Auger
Sampling Method: Hand, Ring, and Split spoon samples
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 6/25/2018
Latitude: Not Determined
Longitude: Not Determined
Elevation: Not Determined
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: HK
Remarks: SE Corner

Laboratory Results										
Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Symbol	Material Type	Soil Symbol	Depth (ft)	Soil Description
					A		SC		1	Clayey SAND, tan/orange/brown, fine grained, very loose, slightly damp
99.8			4.0	2-2-5	R 18				2	
									3	
									4	
									5	
									6	
									7	
									8	Silty SAND, gray to brown, fine- to medium grained, medium dense to very dense, slightly damp to damp
	14	NP		11-19-25	SS 18				9	
									10	
									11	
									12	
									13	
									14	
100.0			3.0	45-50/5"	R 11				15	
									16	
									17	
									18	
									19	
	40	1		31-37-50	SS 18		SM		20	
									21	
									22	
									23	
									24	
				50/6"	R 6				25	
									26	
									27	
									28	
									29	
									30	
				17-22-22	SS 18				31	
									32	
									33	
									34	
				36-50/5"	R 11		RK		35	SHALE, dark gray/black, damp, weakly fissile/friable
									36	
									37	Total Depth 36 feet
									38	
									39	
									40	

A = Auger Cuttings R = Ring-Lined Barrel Sampler SS = Split Spoon GRAB = Manual Grab Sample D = Disturbed Bulk Sample

GEOMAT 182-3037.GPJ GEOMAT.GDT 8/23/18

GEOMAT INC.
915 Malta Avenue
Farmington, NM 87401
Tel (505) 327-7928
Fax (505) 326-5721

Borehole B-3

Project Name: Kimbeto Remote Facility Pond
Project Number: 182-3037
Client: Enduring Resources
Site Location: San Juan County, New Mexico
Rig Type: CME-55
Drilling Method: 7.25" O.D. Hollow Stem Auger
Sampling Method: Hand, Ring, and Split spoon samples
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 6/25/2018
Latitude: Not Determined
Longitude: Not Determined
Elevation: Not Determined
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: HK
Remarks: NE Corner

Laboratory Results										
Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Symbol	Material Type	Soil Symbol	Depth (ft)	Soil Description
	34	8			A		SC		1-7	Clayey SAND, tan/orange/brown, fine grained, medium dense, slightly damp
				8-10-15	SS 18					
109.3			2.7	20-31-50	R 18				8-33	Silty SAND, gray to brown, fine- to medium grained, medium dense to very dense, slightly damp to damp
	18	4		12-24-39	SS 18					
110.5			4.7	20-50/5"	R 11		SM			
				14-17-20	SS 18					
				20-38-50/5"	R 17					
				14-18-26	SS 18		RK		34-36	SHALE, dark gray/black, damp, weakly fissile/friable
									37-40	Total Depth 36½ feet

A = Auger Cuttings R = Ring-Lined Barrel Sampler SS = Split Spoon GRAB = Manual Grab Sample D = Disturbed Bulk Sample

GEOMAT 182-3037.GPJ GEOMAT.GDT 8/23/18

GEOMAT INC.
915 Malta Avenue
Farmington, NM 87401
Tel (505) 327-7928
Fax (505) 326-5721

Borehole B-4

Project Name: Kimbeto Remote Facility Pond
Project Number: 182-3037
Client: Enduring Resources
Site Location: San Juan County, New Mexico
Rig Type: CME-55
Drilling Method: 7.25" O.D. Hollow Stem Auger
Sampling Method: Hand, Ring, and Split spoon samples
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 6/25/2018
Latitude: Not Determined
Longitude: Not Determined
Elevation: Not Determined
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: HK
Remarks: NW Corner

Laboratory Results										
Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Symbol	Material Type	Soil Symbol	Depth (ft)	Soil Description
					A		SM		1	Silty SAND, tan/orange/brown, fine- to medium grained, medium dense, slightly damp
104.7	16	NP	2.9	6-7-19	R 18				7	
				14-25-31	SS 18		SP-SM		8	Poorly-graded SAND with silt, gray to brown, fine- to medium grained, medium dense to very dense, slightly damp to damp
100.3	6	NP	4.0	24-50/6"	R 12				23	
				24-34-38	SS 18				24	Sandy Lean CLAY, light brown, hard, slightly damp
103.0	56	9	6.5	20-28-50/5"	R 17		CL		28	
				15-25-29	SS 18		SM		29	Silty SAND, gray/brown, fine- to medium grained, very dense, damp Contains gravel
				15-14-15	SS 18		RK		35	SHALE, dark gray/black, damp, weakly fissile/friable
									37	Total Depth 36½ feet
									40	

A = Auger Cuttings R = Ring-Lined Barrel Sampler SS = Split Spoon GRAB = Manual Grab Sample D = Disturbed Bulk Sample

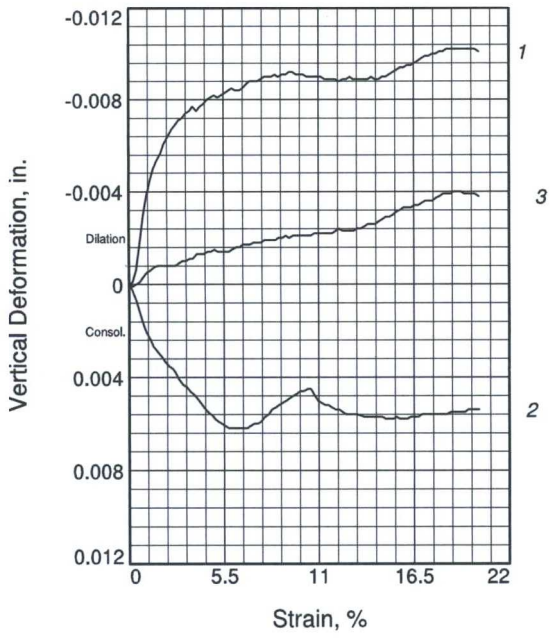
GEOMAT 182-3037.GPJ GEOMAT.GDT 8/23/18

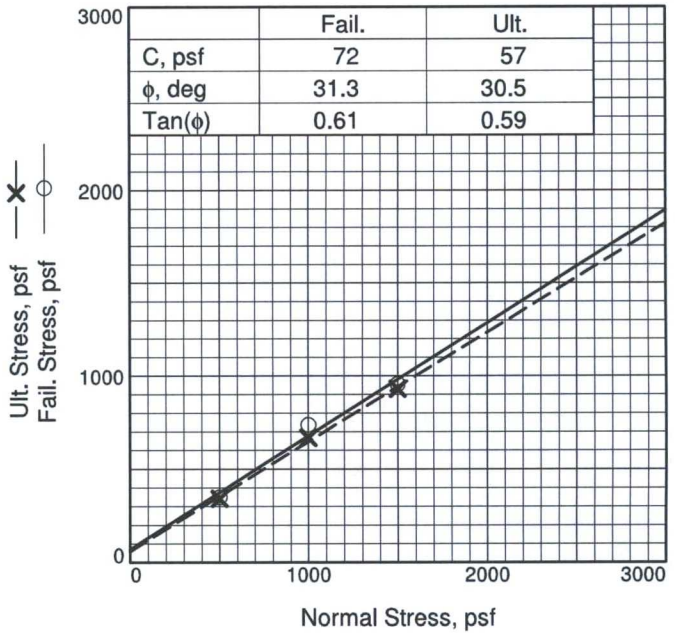
LAB NO.	BORING NO.	SAMPLE DEPTH (ft)	ASTM D698		MOISTURE CONT. (%)	DENSITY		ATTERBERG LIMITS			SWELL (%)	DIRECT SHEAR	% PASS #200 SIEVE	CLASSIFICATION
			Density	Moisture		WET (pcf)	DRY (pcf)	LL	PL	PI				
6743	B-1	10	-	-	15.9	120.6	104.1	29	13	16	-	-	60	Sandy Lean **CLAY** (CL)
6744	B-1	20	-	-	4.2	114.5	109.9	NLL	NPL	NP	-	-	13	Silty **SAND** (SM)
6745	B-2	5	-	-	4.0	103.8	99.8	-	-	-	-	-	-	Silty **SAND** (SM)
6746	B-2	10	-	-	-	-	-	NLL	NPL	NP	-	-	14	Silty **SAND** (SM)
6747	B-2	15	-	-	3.0	103.0	100.0	-	-	-	-	-	-	Silty **SAND** (SM)
6776	B-2	20	-	-	-	-	-	21	20	1	-	-	40	Silty **SAND** (SM)
6748	B-3	2.5	-	-	-	-	-	25	17	8	-	-	34	Clayey **SAND** (SC)
6749	B-3	10	-	-	2.7	112.2	109.3	-	-	-	-	-	-	Silty **SAND** (SM)
6777	B-3	15	-	-	-	-	-	23	19	4	-	-	18	Silty **SAND** (SM)
6750	B-3	20	-	-	4.7	115.7	110.5	-	-	-	-	-	-	Silty **SAND** (SM)
6751	B-4	5	-	-	2.9	107.8	104.7	NLL	NPL	NP	-	-	16	Silty **SAND** (SM)
6152	B-4	15	-	-	4.0	104.3	100.3	NLL	NPL	NP	-	-	6	Poorly-graded **SAND** with silt (SP-SM)
6780	B-4	25	-	-	-	-	-	28	19	9	-	-	56	Sandy Lean **CLAY** (CL)
6824	B-5	0 - 10	114.2	13.7%	-	-	-	29	14	15	-	Attached	53	Sandy Lean **CLAY** (CL)
6835	B-6	10 - 20	116.6	11.6%	-	-	-	NLL	NPL	NP	-	Attached	-	Silty **SAND** (SM)

GEOMAT INC.

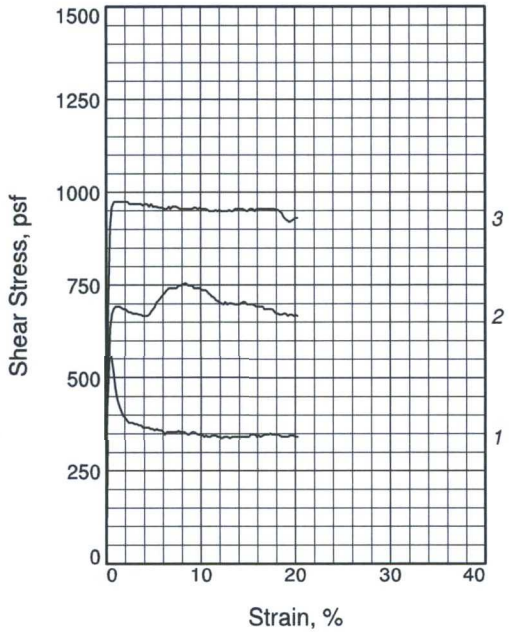
SUMMARY OF SOIL TESTS

Project	Kimbeto Remote Facility Fracking Water Pond
Job No.	182-3037
Location	San Juan County, New Mexico
Dates of Exploration	6/25/2018 7/19/2018





	Fail.	Ult.
C, psf	72	57
ϕ, deg	31.3	30.5
Tan(ϕ)	0.61	0.59



Specimen No.		1	2	3
Initial	Water Content, %	13.7	13.6	13.7
	Dry Density, pcf	108.9	108.2	108.7
	Saturation, %	67.6	65.9	67.4
	Void Ratio	0.5473	0.5577	0.5504
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	20.3	19.9	19.4
	Dry Density, pcf	108.9	109.6	110.7
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.5480	0.5385	0.5230
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	0.99	0.98
Normal Stress, psf		500	1000	1500
Fail. Stress, psf		347	736	955
Strain, %		10.1	10.1	10.1
Ult. Stress, psf		341	667	930
Strain, %		20.2	20.2	20.2
Strain rate, %/min.		0.04	0.04	0.04

Sample Type: Reconstituted
Description:

Assumed Specific Gravity= 2.7
Remarks: Failure chosen at 10% and 20% strain. Test was inundated.

Figure _____

Client: Geomat

Project: Kimbeto, S.Escavada & Rincon Ponds

Sample Number: 6824 **Depth:** 0-10'

Proj. No.: DV108-00304/04 **Date Sampled:** 7/28/18

Knight Piésold CONSULTING

Tested By: EAG **Checked By:** JDB

DIRECT SHEAR TEST

8/9/2018

Date: 7/28/18
Client: Geomat
Project: Kimbeto, S.Escavada & Rincon Ponds
Project No.: DV108-00304/04
Depth: 0-10' **Sample Number:** 6824
Description:
Remarks: Failure chosen at 10% and 20% strain. Test was inundated.
Type of Sample: Reconstituted
Assumed Specific Gravity=2.7 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	149.550		533.290
Moisture content: Dry soil+tare, gms.	131.530		506.600
Moisture content: Tare, gms.	0.000		375.070
Moisture, %	13.7	20.3	20.3
Moist specimen weight, gms.	149.6		
Diameter, in.	2.42	2.42	
Area, in.^{2}	4.60	4.60	
Height, in.	1.00	1.00	
Net decrease in height, in.		0.00	
Wet density, pcf	123.9	131.0	
Dry density, pcf	108.9	108.9	
Void ratio	0.5473	0.5480	
Saturation, %	67.6	100.0	

Test Readings for Specimen No. 1

Load ring constant = 31.408 lbs. per input unit
Normal stress = 500 psf
Strain rate, %/min. = 0.04
Fail. Stress = 347 psf **at reading no.** 49
Ult. Stress = 341 psf **at reading no.** 98

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0	0.0000
1	0.0050	0.4234	13.3	0.2	416	0.0001
2	0.0100	0.5571	17.5	0.4	548	0.0006
3	0.0150	0.5667	17.8	0.6	557	0.0017
4	0.0200	0.5221	16.4	0.8	513	0.0029
5	0.0250	0.4807	15.1	1.0	473	0.0038
6	0.0300	0.4489	14.1	1.2	441	0.0045
7	0.0350	0.4298	13.5	1.4	423	0.0050
8	0.0400	0.4171	13.1	1.7	410	0.0054
9	0.0450	0.4043	12.7	1.9	398	0.0057
10	0.0500	0.3980	12.5	2.1	391	0.0061
11	0.0550	0.3916	12.3	2.3	385	0.0064
12	0.0600	0.3852	12.1	2.5	379	0.0067
13	0.0650	0.3852	12.1	2.7	379	0.0069

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf	Vertical Def. Dial in.
14	0.0700	0.3852	12.1	2.9	379	0.0071
15	0.0750	0.3820	12.0	3.1	376	0.0072
16	0.0800	0.3820	12.0	3.3	376	0.0074
17	0.0850	0.3789	11.9	3.5	373	0.0075
18	0.0900	0.3789	11.9	3.7	373	0.0077
19	0.0950	0.3725	11.7	3.9	366	0.0075
20	0.1000	0.3725	11.7	4.1	366	0.0077
21	0.1050	0.3725	11.7	4.3	366	0.0078
22	0.1100	0.3725	11.7	4.5	366	0.0080
23	0.1150	0.3693	11.6	4.8	363	0.0081
24	0.1200	0.3693	11.6	5.0	363	0.0082
25	0.1250	0.3661	11.5	5.2	360	0.0081
26	0.1300	0.3693	11.6	5.4	363	0.0082
27	0.1350	0.3661	11.5	5.6	360	0.0083
28	0.1400	0.3661	11.5	5.8	360	0.0084
29	0.1450	0.3629	11.4	6.0	357	0.0085
30	0.1500	0.3534	11.1	6.2	347	0.0084
31	0.1550	0.3597	11.3	6.4	354	0.0084
32	0.1600	0.3597	11.3	6.6	354	0.0085
33	0.1650	0.3597	11.3	6.8	354	0.0087
34	0.1700	0.3597	11.3	7.0	354	0.0088
35	0.1750	0.3597	11.3	7.2	354	0.0088
36	0.1800	0.3597	11.3	7.4	354	0.0088
37	0.1850	0.3629	11.4	7.6	357	0.0089
38	0.1900	0.3597	11.3	7.9	354	0.0090
39	0.1950	0.3597	11.3	8.1	354	0.0090
40	0.2000	0.3597	11.3	8.3	354	0.0090
41	0.2050	0.3566	11.2	8.5	351	0.0091
42	0.2100	0.3534	11.1	8.7	347	0.0090
43	0.2150	0.3566	11.2	8.9	351	0.0091
44	0.2200	0.3597	11.3	9.1	354	0.0091
45	0.2250	0.3597	11.3	9.3	354	0.0092
46	0.2300	0.3566	11.2	9.5	351	0.0092
47	0.2350	0.3534	11.1	9.7	347	0.0091
48	0.2400	0.3534	11.1	9.9	347	0.0091
49	0.2450	0.3534	11.1	10.1	347	0.0091
50	0.2500	0.3470	10.9	10.3	341	0.0090
51	0.2550	0.3502	11.0	10.5	344	0.0090
52	0.2600	0.3470	10.9	10.7	341	0.0090
53	0.2650	0.3470	10.9	11.0	341	0.0090
54	0.2700	0.3502	11.0	11.2	344	0.0090
55	0.2750	0.3502	11.0	11.4	344	0.0089
56	0.2800	0.3502	11.0	11.6	344	0.0089
57	0.2850	0.3470	10.9	11.8	341	0.0089
58	0.2900	0.3470	10.9	12.0	341	0.0089
59	0.2950	0.3438	10.8	12.2	338	0.0088
60	0.3000	0.3470	10.9	12.4	341	0.0089

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf	Vertical Def. Dial in.
61	0.3050	0.3470	10.9	12.6	341	0.0089
62	0.3100	0.3470	10.9	12.8	341	0.0090
63	0.3150	0.3438	10.8	13.0	338	0.0089
64	0.3200	0.3470	10.9	13.2	341	0.0089
65	0.3250	0.3470	10.9	13.4	341	0.0089
66	0.3300	0.3470	10.9	13.6	341	0.0089
67	0.3350	0.3470	10.9	13.8	341	0.0089
68	0.3400	0.3470	10.9	14.0	341	0.0090
69	0.3450	0.3470	10.9	14.3	341	0.0089
70	0.3500	0.3470	10.9	14.5	341	0.0089
71	0.3550	0.3470	10.9	14.7	341	0.0090
72	0.3600	0.3470	10.9	14.9	341	0.0090
73	0.3650	0.3470	10.9	15.1	341	0.0091
74	0.3700	0.3534	11.1	15.3	347	0.0092
75	0.3750	0.3534	11.1	15.5	347	0.0093
76	0.3800	0.3534	11.1	15.7	347	0.0094
77	0.3850	0.3470	10.9	15.9	341	0.0094
78	0.3900	0.3502	11.0	16.1	344	0.0095
79	0.3950	0.3470	10.9	16.3	341	0.0095
80	0.4000	0.3502	11.0	16.5	344	0.0096
81	0.4050	0.3534	11.1	16.7	347	0.0097
82	0.4100	0.3534	11.1	16.9	347	0.0098
83	0.4150	0.3534	11.1	17.1	347	0.0099
84	0.4200	0.3566	11.2	17.4	351	0.0099
85	0.4250	0.3534	11.1	17.6	347	0.0100
86	0.4300	0.3534	11.1	17.8	347	0.0100
87	0.4350	0.3534	11.1	18.0	347	0.0101
88	0.4400	0.3534	11.1	18.2	347	0.0101
89	0.4450	0.3502	11.0	18.4	344	0.0102
90	0.4500	0.3470	10.9	18.6	341	0.0102
91	0.4550	0.3470	10.9	18.8	341	0.0102
92	0.4600	0.3470	10.9	19.0	341	0.0102
93	0.4650	0.3470	10.9	19.2	341	0.0102
94	0.4700	0.3502	11.0	19.4	344	0.0102
95	0.4750	0.3502	11.0	19.6	344	0.0102
96	0.4800	0.3502	11.0	19.8	344	0.0102
97	0.4850	0.3470	10.9	20.0	341	0.0102
98	0.4900	0.3470	10.9	20.2	341	0.0101

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	148.430		549.650
Moisture content: Dry soil+tare, gms.	130.650		523.600
Moisture content: Tare, gms.	0.000		392.950
Moisture, %	13.6	19.9	19.9
Moist specimen weight, gms.	148.4		
Diameter, in.	2.42	2.42	
Area, in.²	4.60	4.60	
Height, in.	1.00	0.99	
Net decrease in height, in.		0.01	
Wet density, pcf	122.9	131.4	
Dry density, pcf	108.2	109.6	
Void ratio	0.5577	0.5385	
Saturation, %	65.9	100.0	

Test Readings for Specimen No. 2

Load ring constant = 31.408 lbs. per input unit
Normal stress = 1000 psf
Strain rate, %/min. = 0.04
Fail. Stress = 736 psf **at reading no.** 49
Ult. Stress = 667 psf **at reading no.** 97

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0	0.0001
1	0.0050	0.4393	13.8	0.2	432	-0.0002
2	0.0100	0.6431	20.2	0.4	632	-0.0006
3	0.0150	0.6845	21.5	0.6	673	-0.0011
4	0.0200	0.7004	22.0	0.8	689	-0.0016
5	0.0250	0.7036	22.1	1.0	692	-0.0020
6	0.0300	0.7036	22.1	1.2	692	-0.0023
7	0.0350	0.7036	22.1	1.4	692	-0.0026
8	0.0400	0.7004	22.0	1.7	689	-0.0028
9	0.0450	0.6972	21.9	1.9	686	-0.0030
10	0.0500	0.6972	21.9	2.1	686	-0.0032
11	0.0550	0.6908	21.7	2.3	679	-0.0034
12	0.0600	0.6877	21.6	2.5	676	-0.0035
13	0.0650	0.6877	21.6	2.7	676	-0.0037
14	0.0700	0.6845	21.5	2.9	673	-0.0040
15	0.0750	0.6845	21.5	3.1	673	-0.0042
16	0.0800	0.6845	21.5	3.3	673	-0.0043
17	0.0850	0.6813	21.4	3.5	670	-0.0045
18	0.0900	0.6813	21.4	3.7	670	-0.0046
19	0.0950	0.6781	21.3	3.9	667	-0.0048
20	0.1000	0.6781	21.3	4.1	667	-0.0050
21	0.1050	0.6781	21.3	4.3	667	-0.0052
22	0.1100	0.6813	21.4	4.5	670	-0.0054
23	0.1150	0.6908	21.7	4.8	679	-0.0055
24	0.1200	0.6972	21.9	5.0	686	-0.0057
25	0.1250	0.7036	22.1	5.2	692	-0.0058
26	0.1300	0.7163	22.5	5.4	704	-0.0059

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf	Vertical Def. Dial in.
27	0.1350	0.7227	22.7	5.6	711	-0.0060
28	0.1400	0.7290	22.9	5.8	717	-0.0061
29	0.1450	0.7354	23.1	6.0	723	-0.0061
30	0.1500	0.7418	23.3	6.2	729	-0.0061
31	0.1550	0.7482	23.5	6.4	736	-0.0061
32	0.1600	0.7545	23.7	6.6	742	-0.0061
33	0.1650	0.7545	23.7	6.8	742	-0.0061
34	0.1700	0.7545	23.7	7.0	742	-0.0060
35	0.1750	0.7545	23.7	7.2	742	-0.0059
36	0.1800	0.7545	23.7	7.4	742	-0.0059
37	0.1850	0.7609	23.9	7.6	748	-0.0058
38	0.1900	0.7609	23.9	7.9	748	-0.0056
39	0.1950	0.7641	24.0	8.1	751	-0.0055
40	0.2000	0.7673	24.1	8.3	754	-0.0053
41	0.2050	0.7673	24.1	8.5	754	-0.0052
42	0.2100	0.7609	23.9	8.7	748	-0.0051
43	0.2150	0.7609	23.9	8.9	748	-0.0050
44	0.2200	0.7609	23.9	9.1	748	-0.0049
45	0.2250	0.7545	23.7	9.3	742	-0.0048
46	0.2300	0.7545	23.7	9.5	742	-0.0047
47	0.2350	0.7545	23.7	9.7	742	-0.0046
48	0.2400	0.7545	23.7	9.9	742	-0.0045
49	0.2450	0.7482	23.5	10.1	736	-0.0045
50	0.2500	0.7482	23.5	10.3	736	-0.0044
51	0.2550	0.7482	23.5	10.5	736	-0.0044
52	0.2600	0.7418	23.3	10.7	729	-0.0047
53	0.2650	0.7386	23.2	11.0	726	-0.0049
54	0.2700	0.7322	23.0	11.2	720	-0.0050
55	0.2750	0.7290	22.9	11.4	717	-0.0051
56	0.2800	0.7227	22.7	11.6	711	-0.0051
57	0.2850	0.7195	22.6	11.8	707	-0.0052
58	0.2900	0.7163	22.5	12.0	704	-0.0053
59	0.2950	0.7131	22.4	12.2	701	-0.0053
60	0.3000	0.7099	22.3	12.4	698	-0.0054
61	0.3050	0.7163	22.5	12.6	704	-0.0055
62	0.3100	0.7099	22.3	12.8	698	-0.0055
63	0.3150	0.7131	22.4	13.0	701	-0.0055
64	0.3200	0.7131	22.4	13.2	701	-0.0055
65	0.3300	0.7099	22.3	13.6	698	-0.0056
66	0.3350	0.7099	22.3	13.8	698	-0.0056
67	0.3400	0.7099	22.3	14.0	698	-0.0056
68	0.3450	0.7131	22.4	14.3	701	-0.0056
69	0.3500	0.7163	22.5	14.5	704	-0.0056
70	0.3550	0.7163	22.5	14.7	704	-0.0056
71	0.3600	0.7099	22.3	14.9	698	-0.0057
72	0.3650	0.7099	22.3	15.1	698	-0.0057
73	0.3700	0.7099	22.3	15.3	698	-0.0057

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf	Vertical Def. Dial in.
74	0.3750	0.7099	22.3	15.5	698	-0.0056
75	0.3800	0.7068	22.2	15.7	695	-0.0057
76	0.3850	0.7036	22.1	15.9	692	-0.0057
77	0.3900	0.7036	22.1	16.1	692	-0.0057
78	0.3950	0.7036	22.1	16.3	692	-0.0056
79	0.4000	0.7036	22.1	16.5	692	-0.0056
80	0.4050	0.6972	21.9	16.7	686	-0.0056
81	0.4100	0.6972	21.9	16.9	686	-0.0055
82	0.4150	0.6972	21.9	17.1	686	-0.0055
83	0.4200	0.6972	21.9	17.4	686	-0.0055
84	0.4250	0.6972	21.9	17.6	686	-0.0055
85	0.4300	0.6908	21.7	17.8	679	-0.0055
86	0.4350	0.6845	21.5	18.0	673	-0.0055
87	0.4400	0.6845	21.5	18.2	673	-0.0055
88	0.4450	0.6813	21.4	18.4	670	-0.0055
89	0.4500	0.6813	21.4	18.6	670	-0.0054
90	0.4550	0.6845	21.5	18.8	673	-0.0054
91	0.4600	0.6845	21.5	19.0	673	-0.0054
92	0.4650	0.6781	21.3	19.2	667	-0.0054
93	0.4700	0.6813	21.4	19.4	670	-0.0054
94	0.4750	0.6813	21.4	19.6	670	-0.0053
95	0.4800	0.6781	21.3	19.8	667	-0.0053
96	0.4850	0.6813	21.4	20.0	670	-0.0053
97	0.4900	0.6781	21.3	20.2	667	-0.0053

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	149.300		559.600
Moisture content: Dry soil+tare, gms.	131.260		534.180
Moisture content: Tare, gms.	0.000		402.920
Moisture, %	13.7	19.4	19.4
Moist specimen weight, gms.	149.3		
Diameter, in.	2.42	2.42	
Area, in.²	4.60	4.60	
Height, in.	1.00	0.98	
Net decrease in height, in.		0.02	
Wet density, pcf	123.7	132.1	
Dry density, pcf	108.7	110.7	
Void ratio	0.5504	0.5230	
Saturation, %	67.4	100.0	

Test Readings for Specimen No. 3

Load ring constant = 31.408 lbs. per input unit
Normal stress = 1500 psf
Strain rate, %/min. = 0.04
Fail. Stress = 955 psf **at reading no.** 49
Ult. Stress = 930 psf **at reading no.** 98

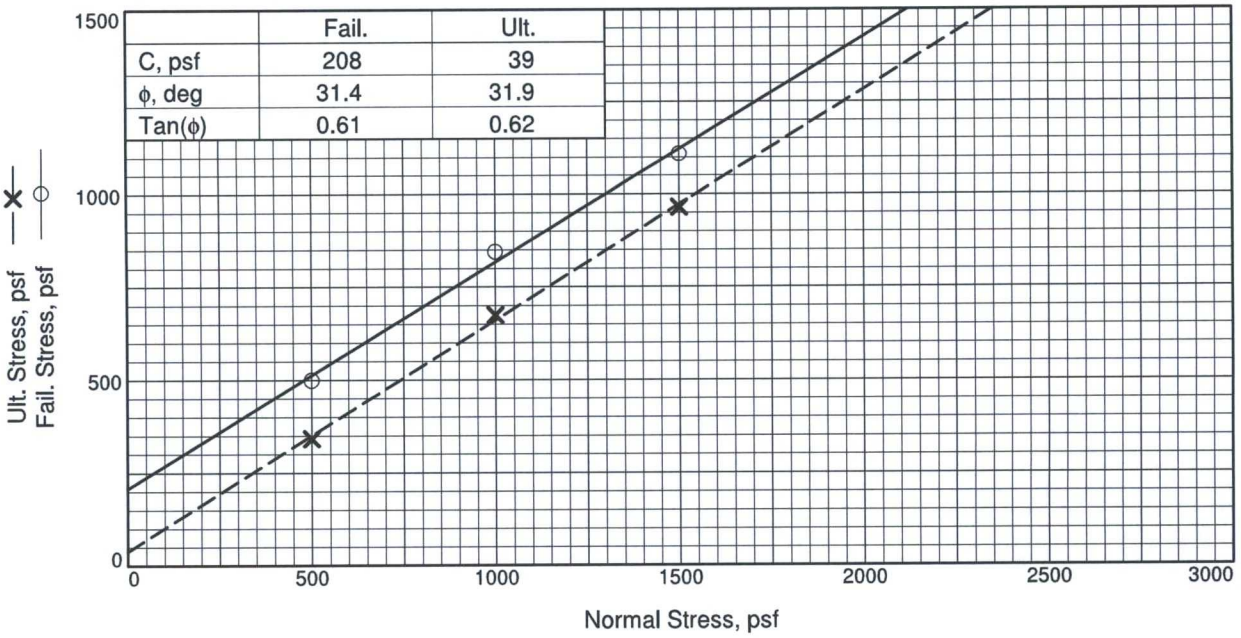
No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf	Vertical Def. Dial in.
0	0.0000	0.0000	0.0	0.0	0	0.0001
1	0.0050	0.6590	20.7	0.2	648	0.0000
2	0.0100	0.9201	28.9	0.4	905	0.0001
3	0.0150	0.9774	30.7	0.6	961	0.0002
4	0.0200	0.9901	31.1	0.8	974	0.0004
5	0.0250	0.9901	31.1	1.0	974	0.0006
6	0.0300	0.9901	31.1	1.2	974	0.0007
7	0.0350	0.9901	31.1	1.4	974	0.0008
8	0.0400	0.9901	31.1	1.7	974	0.0009
9	0.0450	0.9901	31.1	1.9	974	0.0009
10	0.0500	0.9901	31.1	2.1	974	0.0009
11	0.0550	0.9901	31.1	2.3	974	0.0009
12	0.0600	0.9837	30.9	2.5	967	0.0009
13	0.0650	0.9837	30.9	2.7	967	0.0009
14	0.0700	0.9837	30.9	2.9	967	0.0010
15	0.0750	0.9837	30.9	3.1	967	0.0011
16	0.0800	0.9837	30.9	3.3	967	0.0011
17	0.0850	0.9837	30.9	3.5	967	0.0012
18	0.0900	0.9837	30.9	3.7	967	0.0012
19	0.0950	0.9806	30.8	3.9	964	0.0014
20	0.1000	0.9837	30.9	4.1	967	0.0014
21	0.1050	0.9837	30.9	4.3	967	0.0014
22	0.1100	0.9774	30.7	4.5	961	0.0015
23	0.1150	0.9837	30.9	4.8	967	0.0015
24	0.1200	0.9774	30.7	5.0	961	0.0016
25	0.1250	0.9774	30.7	5.2	961	0.0015
26	0.1300	0.9774	30.7	5.4	961	0.0015

Test Readings for Specimen No. 3

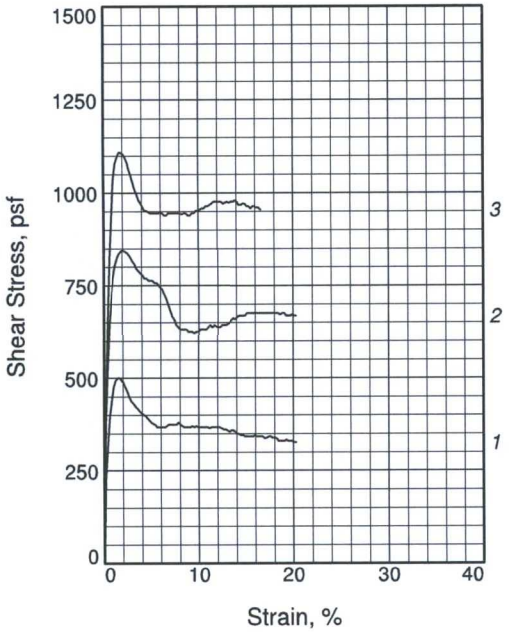
No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf	Vertical Def. Dial in.
27	0.1350	0.9742	30.6	5.6	958	0.0015
28	0.1400	0.9742	30.6	5.8	958	0.0015
29	0.1450	0.9742	30.6	6.0	958	0.0016
30	0.1500	0.9710	30.5	6.2	955	0.0017
31	0.1550	0.9710	30.5	6.4	955	0.0017
32	0.1600	0.9774	30.7	6.6	961	0.0018
33	0.1650	0.9710	30.5	6.8	955	0.0018
34	0.1700	0.9774	30.7	7.0	961	0.0018
35	0.1750	0.9774	30.7	7.2	961	0.0019
36	0.1800	0.9774	30.7	7.4	961	0.0019
37	0.1850	0.9742	30.6	7.6	958	0.0019
38	0.1900	0.9710	30.5	7.9	955	0.0020
39	0.1950	0.9710	30.5	8.1	955	0.0020
40	0.2000	0.9710	30.5	8.3	955	0.0020
41	0.2050	0.9710	30.5	8.5	955	0.0020
42	0.2100	0.9710	30.5	8.7	955	0.0021
43	0.2150	0.9710	30.5	8.9	955	0.0021
44	0.2200	0.9710	30.5	9.1	955	0.0022
45	0.2250	0.9742	30.6	9.3	958	0.0021
46	0.2300	0.9742	30.6	9.5	958	0.0022
47	0.2350	0.9710	30.5	9.7	955	0.0022
48	0.2400	0.9742	30.6	9.9	958	0.0022
49	0.2450	0.9710	30.5	10.1	955	0.0022
50	0.2500	0.9710	30.5	10.3	955	0.0022
51	0.2550	0.9710	30.5	10.5	955	0.0022
52	0.2600	0.9678	30.4	10.7	952	0.0023
53	0.2650	0.9646	30.3	11.0	949	0.0023
54	0.2700	0.9646	30.3	11.2	949	0.0023
55	0.2750	0.9646	30.3	11.4	949	0.0023
56	0.2800	0.9678	30.4	11.6	952	0.0023
57	0.2850	0.9646	30.3	11.8	949	0.0023
58	0.2900	0.9678	30.4	12.0	952	0.0024
59	0.2950	0.9646	30.3	12.2	949	0.0025
60	0.3000	0.9646	30.3	12.4	949	0.0024
61	0.3050	0.9646	30.3	12.6	949	0.0024
62	0.3100	0.9646	30.3	12.8	949	0.0024
63	0.3150	0.9678	30.4	13.0	952	0.0024
64	0.3200	0.9646	30.3	13.2	949	0.0025
65	0.3250	0.9646	30.3	13.4	949	0.0025
66	0.3300	0.9710	30.5	13.6	955	0.0026
67	0.3350	0.9710	30.5	13.8	955	0.0027
68	0.3400	0.9710	30.5	14.0	955	0.0027
69	0.3450	0.9710	30.5	14.3	955	0.0027
70	0.3500	0.9710	30.5	14.5	955	0.0028
71	0.3550	0.9678	30.4	14.7	952	0.0029
72	0.3600	0.9646	30.3	14.9	949	0.0030
73	0.3650	0.9678	30.4	15.1	952	0.0030

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf	Vertical Def. Dial in.
74	0.3700	0.9710	30.5	15.3	955	0.0031
75	0.3750	0.9710	30.5	15.5	955	0.0032
76	0.3800	0.9646	30.3	15.7	949	0.0033
77	0.3850	0.9710	30.5	15.9	955	0.0034
78	0.3900	0.9710	30.5	16.1	955	0.0034
79	0.3950	0.9710	30.5	16.3	955	0.0034
80	0.4000	0.9710	30.5	16.5	955	0.0035
81	0.4050	0.9710	30.5	16.7	955	0.0035
82	0.4100	0.9710	30.5	16.9	955	0.0036
83	0.4150	0.9710	30.5	17.1	955	0.0037
84	0.4200	0.9710	30.5	17.4	955	0.0037
85	0.4250	0.9710	30.5	17.6	955	0.0037
86	0.4300	0.9710	30.5	17.8	955	0.0038
87	0.4350	0.9678	30.4	18.0	952	0.0039
88	0.4400	0.9678	30.4	18.2	952	0.0040
89	0.4450	0.9646	30.3	18.4	949	0.0040
90	0.4500	0.9583	30.1	18.6	942	0.0040
91	0.4550	0.9487	29.8	18.8	933	0.0041
92	0.4600	0.9424	29.6	19.0	927	0.0041
93	0.4650	0.9392	29.5	19.2	923	0.0041
94	0.4700	0.9360	29.4	19.4	920	0.0040
95	0.4750	0.9392	29.5	19.6	923	0.0040
96	0.4800	0.9424	29.6	19.8	927	0.0040
97	0.4850	0.9455	29.7	20.0	930	0.0040
98	0.4900	0.9455	29.7	20.2	930	0.0039



	Fail.	Ult.
C, psf	208	39
ϕ, deg	31.4	31.9
Tan(ϕ)	0.61	0.62



Specimen No.		1	2	3
Initial	Water Content, %	11.3	11.4	11.6
	Dry Density, pcf	110.6	110.8	111.1
	Saturation, %	58.0	59.0	60.7
	Void Ratio	0.5245	0.5215	0.5170
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	19.2	18.6	18.0
	Dry Density, pcf	111.1	112.3	113.4
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.5177	0.5012	0.4861
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	0.99	0.98
Normal Stress, psf		500	1000	1500
Fail. Stress, psf		499	845	1109
Strain, %		1.4	2.1	1.7
Ult. Stress, psf		342	675	964
Strain, %		15.1	15.1	15.1
Strain rate, %/min.		0.04	0.04	0.04

Sample Type: Reconstituted
Description:

Assumed Specific Gravity= 2.7
Remarks: Failure chosen at peak shear stress and 15% strain. Test was inundated.

Figure _____

Client: Geomat

Project: Kimbeto, S.Escavada & Rincon Ponds

Sample Number: 6835 **Depth:** 10-20'

Proj. No.: DV108-00304/04 **Date Sampled:** 8/1/18

Knight Piésold CONSULTING

Tested By: EAG **Checked By:** JDB

DIRECT SHEAR TEST

8/9/2018

Date: 8/1/18
Client: Geomat
Project: Kimbeto, S.Escavada & Rincon Ponds
Project No.: DV108-00304/04
Depth: 10-20' **Sample Number:** 6835
Description:
Remarks: Failure chosen at peak shear stress and 15% strain. Test was inundated.
Type of Sample: Reconstituted
Assumed Specific Gravity=2.7 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	148.040		551.460
Moisture content: Dry soil+tare, gms.	133.050		525.960
Moisture content: Tare, gms.	0.000		392.910
Moisture, %	11.3	19.2	19.2
Moist specimen weight, gms.	148.0		
Diameter, in.	2.42	2.42	
Area, in.^{2}	4.58	4.58	
Height, in.	1.00	1.00	
Net decrease in height, in.		0.00	
Wet density, pcf	123.0	132.3	
Dry density, pcf	110.6	111.1	
Void ratio	0.5245	0.5177	
Saturation, %	58.0	100.0	

Test Readings for Specimen No. 1

Load ring constant = 31.408 lbs. per input unit
Normal stress = 500 psf
Strain rate, %/min. = 0.04
Fail. Stress = 499 psf **at reading no.** 7
Ult. Stress = 342 psf **at reading no.** 73

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
0	0.0000	0.0000	0.0	0.0	0
1	0.0050	0.2260	7.1	0.2	223
2	0.0100	0.3279	10.3	0.4	324
3	0.0150	0.4011	12.6	0.6	396
4	0.0200	0.4489	14.1	0.8	443
5	0.0250	0.4807	15.1	1.0	474
6	0.0300	0.4998	15.7	1.2	493
7	0.0350	0.5062	15.9	1.4	499
8	0.0400	0.5062	15.9	1.7	499
9	0.0450	0.4998	15.7	1.9	493
10	0.0500	0.4935	15.5	2.1	487
11	0.0550	0.4807	15.1	2.3	474
12	0.0600	0.4680	14.7	2.5	462
13	0.0650	0.4553	14.3	2.7	449

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
14	0.0700	0.4425	13.9	2.9	437
15	0.0750	0.4362	13.7	3.1	430
16	0.0800	0.4298	13.5	3.3	424
17	0.0850	0.4234	13.3	3.5	418
18	0.0900	0.4171	13.1	3.7	411
19	0.0950	0.4107	12.9	3.9	405
20	0.1000	0.4075	12.8	4.1	402
21	0.1050	0.4043	12.7	4.3	399
22	0.1100	0.3980	12.5	4.6	393
23	0.1150	0.3916	12.3	4.8	386
24	0.1200	0.3852	12.1	5.0	380
25	0.1250	0.3820	12.0	5.2	377
26	0.1300	0.3789	11.9	5.4	374
27	0.1350	0.3725	11.7	5.6	367
28	0.1400	0.3725	11.7	5.8	367
29	0.1450	0.3725	11.7	6.0	367
30	0.1500	0.3725	11.7	6.2	367
31	0.1550	0.3725	11.7	6.4	367
32	0.1600	0.3757	11.8	6.6	371
33	0.1650	0.3789	11.9	6.8	374
34	0.1700	0.3789	11.9	7.0	374
35	0.1750	0.3789	11.9	7.2	374
36	0.1800	0.3789	11.9	7.5	374
37	0.1850	0.3789	11.9	7.7	374
38	0.1900	0.3852	12.1	7.9	380
39	0.1950	0.3789	11.9	8.1	374
40	0.2000	0.3757	11.8	8.3	371
41	0.2050	0.3725	11.7	8.5	367
42	0.2100	0.3725	11.7	8.7	367
43	0.2150	0.3725	11.7	8.9	367
44	0.2200	0.3725	11.7	9.1	367
45	0.2250	0.3757	11.8	9.3	371
46	0.2300	0.3725	11.7	9.5	367
47	0.2350	0.3757	11.8	9.7	371
48	0.2400	0.3725	11.7	9.9	367
49	0.2450	0.3725	11.7	10.1	367
50	0.2500	0.3725	11.7	10.3	367
51	0.2550	0.3725	11.7	10.6	367
52	0.2600	0.3725	11.7	10.8	367
53	0.2650	0.3725	11.7	11.0	367
54	0.2700	0.3693	11.6	11.2	364
55	0.2750	0.3725	11.7	11.4	367
56	0.2800	0.3725	11.7	11.6	367
57	0.2850	0.3725	11.7	11.8	367
58	0.2900	0.3725	11.7	12.0	367
59	0.2950	0.3725	11.7	12.2	367
60	0.3000	0.3693	11.6	12.4	364

Test Readings for Specimen No. 1

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
61	0.3050	0.3661	11.5	12.6	361
62	0.3100	0.3661	11.5	12.8	361
63	0.3150	0.3629	11.4	13.0	358
64	0.3200	0.3597	11.3	13.2	355
65	0.3250	0.3629	11.4	13.5	358
66	0.3300	0.3629	11.4	13.7	358
67	0.3350	0.3597	11.3	13.9	355
68	0.3400	0.3534	11.1	14.1	349
69	0.3450	0.3534	11.1	14.3	349
70	0.3500	0.3502	11.0	14.5	345
71	0.3550	0.3502	11.0	14.7	345
72	0.3600	0.3470	10.9	14.9	342
73	0.3650	0.3470	10.9	15.1	342
74	0.3700	0.3470	10.9	15.3	342
75	0.3750	0.3470	10.9	15.5	342
76	0.3800	0.3470	10.9	15.7	342
77	0.3850	0.3502	11.0	15.9	345
78	0.3900	0.3470	10.9	16.1	342
79	0.3950	0.3470	10.9	16.3	342
80	0.4000	0.3470	10.9	16.6	342
81	0.4050	0.3470	10.9	16.8	342
82	0.4100	0.3406	10.7	17.0	336
83	0.4150	0.3438	10.8	17.2	339
84	0.4200	0.3470	10.9	17.4	342
85	0.4250	0.3470	10.9	17.6	342
86	0.4300	0.3438	10.8	17.8	339
87	0.4350	0.3438	10.8	18.0	339
88	0.4400	0.3406	10.7	18.2	336
89	0.4450	0.3343	10.5	18.4	330
90	0.4500	0.3343	10.5	18.6	330
91	0.4550	0.3343	10.5	18.8	330
92	0.4600	0.3343	10.5	19.0	330
93	0.4650	0.3375	10.6	19.2	333
94	0.4700	0.3343	10.5	19.5	330
95	0.4750	0.3343	10.5	19.7	330
96	0.4800	0.3343	10.5	19.9	330
97	0.4850	0.3311	10.4	20.1	327
98	0.4900	0.3311	10.4	20.3	327

Parameters for Specimen No. 2

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	148.500		550.780
Moisture content: Dry soil+tare, gms.	133.310		526.040
Moisture content: Tare, gms.	0.000		392.730
Moisture, %	11.4	18.6	18.6
Moist specimen weight, gms.	148.5		
Diameter, in.	2.42	2.42	
Area, in.²	4.58	4.58	
Height, in.	1.00	0.99	
Net decrease in height, in.		0.01	
Wet density, pcf	123.4	133.1	
Dry density, pcf	110.8	112.3	
Void ratio	0.5215	0.5012	
Saturation, %	59.0	100.0	

Test Readings for Specimen No. 2

Load ring constant = 31.408 lbs. per input unit

Normal stress = 1000 psf

Strain rate, %/min. = 0.04

Fail. Stress = 845 psf **at reading no.** 10

Ult. Stress = 675 psf **at reading no.** 73

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
0	0.0000	0.0000	0.0	0.0	0
1	0.0050	0.3789	11.9	0.2	374
2	0.0100	0.5412	17.0	0.4	534
3	0.0150	0.6526	20.5	0.6	644
4	0.0200	0.7290	22.9	0.8	719
5	0.0250	0.7800	24.5	1.0	769
6	0.0300	0.8118	25.5	1.2	801
7	0.0350	0.8341	26.2	1.4	823
8	0.0400	0.8468	26.6	1.7	835
9	0.0450	0.8532	26.8	1.9	842
10	0.0500	0.8564	26.9	2.1	845
11	0.0550	0.8532	26.8	2.3	842
12	0.0600	0.8500	26.7	2.5	839
13	0.0650	0.8437	26.5	2.7	832
14	0.0700	0.8341	26.2	2.9	823
15	0.0750	0.8246	25.9	3.1	813
16	0.0800	0.8182	25.7	3.3	807
17	0.0850	0.8055	25.3	3.5	795
18	0.0900	0.7991	25.1	3.7	788
19	0.0950	0.7927	24.9	3.9	782
20	0.1000	0.7864	24.7	4.1	776
21	0.1050	0.7800	24.5	4.3	769
22	0.1100	0.7800	24.5	4.6	769
23	0.1150	0.7736	24.3	4.8	763
24	0.1200	0.7736	24.3	5.0	763
25	0.1250	0.7736	24.3	5.2	763
26	0.1300	0.7673	24.1	5.4	757

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
27	0.1350	0.7673	24.1	5.6	757
28	0.1400	0.7609	23.9	5.8	751
29	0.1450	0.7545	23.7	6.0	744
30	0.1500	0.7482	23.5	6.2	738
31	0.1550	0.7354	23.1	6.4	726
32	0.1600	0.7227	22.7	6.6	713
33	0.1650	0.7099	22.3	6.8	700
34	0.1700	0.6908	21.7	7.0	682
35	0.1750	0.6749	21.2	7.2	666
36	0.1800	0.6654	20.9	7.5	656
37	0.1850	0.6526	20.5	7.7	644
38	0.1900	0.6463	20.3	7.9	638
39	0.1950	0.6399	20.1	8.1	631
40	0.2000	0.6399	20.1	8.3	631
41	0.2050	0.6399	20.1	8.5	631
42	0.2100	0.6399	20.1	8.7	631
43	0.2150	0.6335	19.9	8.9	625
44	0.2200	0.6335	19.9	9.1	625
45	0.2250	0.6335	19.9	9.3	625
46	0.2300	0.6304	19.8	9.5	622
47	0.2350	0.6335	19.9	9.7	625
48	0.2400	0.6335	19.9	9.9	625
49	0.2450	0.6399	20.1	10.1	631
50	0.2500	0.6399	20.1	10.3	631
51	0.2550	0.6399	20.1	10.6	631
52	0.2600	0.6399	20.1	10.8	631
53	0.2650	0.6463	20.3	11.0	638
54	0.2700	0.6526	20.5	11.2	644
55	0.2750	0.6463	20.3	11.4	638
56	0.2800	0.6526	20.5	11.6	644
57	0.2850	0.6495	20.4	11.8	641
58	0.2900	0.6463	20.3	12.0	638
59	0.2950	0.6463	20.3	12.2	638
60	0.3000	0.6526	20.5	12.4	644
61	0.3050	0.6526	20.5	12.6	644
62	0.3100	0.6526	20.5	12.8	644
63	0.3150	0.6558	20.6	13.0	647
64	0.3200	0.6590	20.7	13.2	650
65	0.3250	0.6654	20.9	13.5	656
66	0.3300	0.6717	21.1	13.7	663
67	0.3350	0.6686	21.0	13.9	660
68	0.3400	0.6749	21.2	14.1	666
69	0.3450	0.6781	21.3	14.3	669
70	0.3500	0.6781	21.3	14.5	669
71	0.3550	0.6781	21.3	14.7	669
72	0.3600	0.6781	21.3	14.9	669
73	0.3650	0.6845	21.5	15.1	675

Test Readings for Specimen No. 2

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
74	0.3700	0.6845	21.5	15.3	675
75	0.3750	0.6845	21.5	15.5	675
76	0.3800	0.6845	21.5	15.7	675
77	0.3850	0.6845	21.5	15.9	675
78	0.3900	0.6845	21.5	16.1	675
79	0.3950	0.6845	21.5	16.3	675
80	0.4000	0.6845	21.5	16.6	675
81	0.4050	0.6845	21.5	16.8	675
82	0.4100	0.6845	21.5	17.0	675
83	0.4150	0.6845	21.5	17.2	675
84	0.4200	0.6845	21.5	17.4	675
85	0.4250	0.6845	21.5	17.6	675
86	0.4300	0.6845	21.5	17.8	675
87	0.4350	0.6845	21.5	18.0	675
88	0.4400	0.6845	21.5	18.2	675
89	0.4450	0.6845	21.5	18.4	675
90	0.4500	0.6813	21.4	18.6	672
91	0.4550	0.6845	21.5	18.8	675
92	0.4600	0.6845	21.5	19.0	675
93	0.4650	0.6781	21.3	19.2	669
94	0.4700	0.6781	21.3	19.5	669
95	0.4750	0.6781	21.3	19.7	669
96	0.4800	0.6813	21.4	19.9	672
97	0.4850	0.6781	21.3	20.1	669
98	0.4900	0.6781	21.3	20.3	669

Parameters for Specimen No. 3

Specimen Parameter	Initial	Consolidated	Final
Moisture content: Moist soil+tare, gms.	149.250		560.690
Moisture content: Dry soil+tare, gms.	133.710		536.610
Moisture content: Tare, gms.	0.000		402.900
Moisture, %	11.6	18.0	18.0
Moist specimen weight, gms.	149.3		
Diameter, in.	2.42	2.42	
Area, in.²	4.58	4.58	
Height, in.	1.00	0.98	
Net decrease in height, in.		0.02	
Wet density, pcf	124.0	133.9	
Dry density, pcf	111.1	113.4	
Void ratio	0.5170	0.4861	
Saturation, %	60.7	100.0	

Test Readings for Specimen No. 3

Load ring constant = 31.408 lbs. per input unit
Normal stress = 1500 psf
Strain rate, %/min. = 0.04
Fail. Stress = 1109 psf **at reading no.** 8
Ult. Stress = 964 psf **at reading no.** 73

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
0	0.0000	0.0000	0.0	0.0	0
1	0.0050	0.4234	13.3	0.2	418
2	0.0100	0.6590	20.7	0.4	650
3	0.0150	0.8309	26.1	0.6	820
4	0.0200	0.9615	30.2	0.8	949
5	0.0250	1.0474	32.9	1.0	1033
6	0.0300	1.0920	34.3	1.2	1077
7	0.0350	1.1111	34.9	1.4	1096
8	0.0400	1.1238	35.3	1.7	1109
9	0.0450	1.1238	35.3	1.9	1109
10	0.0500	1.1206	35.2	2.1	1106
11	0.0550	1.1111	34.9	2.3	1096
12	0.0600	1.0983	34.5	2.5	1084
13	0.0650	1.0792	33.9	2.7	1065
14	0.0700	1.0601	33.3	2.9	1046
15	0.0750	1.0410	32.7	3.1	1027
16	0.0800	1.0219	32.1	3.3	1008
17	0.0850	1.0092	31.7	3.5	996
18	0.0900	0.9933	31.2	3.7	980
19	0.0950	0.9837	30.9	3.9	971
20	0.1000	0.9742	30.6	4.1	961
21	0.1050	0.9646	30.3	4.3	952
22	0.1100	0.9646	30.3	4.6	952
23	0.1150	0.9615	30.2	4.8	949
24	0.1200	0.9583	30.1	5.0	945
25	0.1250	0.9583	30.1	5.2	945
26	0.1300	0.9583	30.1	5.4	945

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
27	0.1350	0.9583	30.1	5.6	945
28	0.1400	0.9583	30.1	5.8	945
29	0.1450	0.9615	30.2	6.0	949
30	0.1500	0.9583	30.1	6.2	945
31	0.1550	0.9519	29.9	6.4	939
32	0.1600	0.9519	29.9	6.6	939
33	0.1650	0.9583	30.1	6.8	945
34	0.1700	0.9583	30.1	7.0	945
35	0.1750	0.9583	30.1	7.2	945
36	0.1800	0.9583	30.1	7.5	945
37	0.1850	0.9583	30.1	7.7	945
38	0.1900	0.9583	30.1	7.9	945
39	0.1950	0.9583	30.1	8.1	945
40	0.2000	0.9551	30.0	8.3	942
41	0.2050	0.9583	30.1	8.5	945
42	0.2100	0.9583	30.1	8.7	945
43	0.2150	0.9519	29.9	8.9	939
44	0.2200	0.9519	29.9	9.1	939
45	0.2250	0.9583	30.1	9.3	945
46	0.2300	0.9583	30.1	9.5	945
47	0.2350	0.9646	30.3	9.7	952
48	0.2400	0.9646	30.3	9.9	952
49	0.2450	0.9678	30.4	10.1	955
50	0.2500	0.9710	30.5	10.3	958
51	0.2550	0.9710	30.5	10.6	958
52	0.2600	0.9774	30.7	10.8	964
53	0.2650	0.9774	30.7	11.0	964
54	0.2700	0.9806	30.8	11.2	967
55	0.2750	0.9837	30.9	11.4	971
56	0.2800	0.9901	31.1	11.6	977
57	0.2850	0.9901	31.1	11.8	977
58	0.2900	0.9901	31.1	12.0	977
59	0.2950	0.9901	31.1	12.2	977
60	0.3000	0.9901	31.1	12.4	977
61	0.3050	0.9837	30.9	12.6	971
62	0.3100	0.9869	31.0	12.8	974
63	0.3150	0.9901	31.1	13.0	977
64	0.3200	0.9869	31.0	13.2	974
65	0.3250	0.9901	31.1	13.5	977
66	0.3300	0.9901	31.1	13.7	977
67	0.3350	0.9933	31.2	13.9	980
68	0.3400	0.9901	31.1	14.1	977
69	0.3450	0.9806	30.8	14.3	967
70	0.3500	0.9806	30.8	14.5	967
71	0.3550	0.9837	30.9	14.7	971
72	0.3600	0.9837	30.9	14.9	971
73	0.3650	0.9774	30.7	15.1	964

Test Readings for Specimen No. 3

No.	Horizontal Def. Dial in.	Load Dial	Load lbs.	Strain %	Shear Stress psf
74	0.3700	0.9774	30.7	15.3	964
75	0.3750	0.9710	30.5	15.5	958
76	0.3800	0.9774	30.7	15.7	964
77	0.3850	0.9774	30.7	15.9	964
78	0.3900	0.9742	30.6	16.1	961
79	0.3950	0.9742	30.6	16.3	961
80	0.4000	0.9678	30.4	16.6	955

Appendix C

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org