June 2021

Volume 1
C-147 Registration Package for Sombrero Above-Ground Storage Tank
Section 7, T21S, R33E, Lea County

Existing pad with current drilling.

Prepared for:
Chisholm Energy Operating LLC
801 Cherry St Suite 1200 Unit 20
Fort Worth, TX 76102

Prepared by:
R.T. Hicks Consultants, Ltd.
901 Rio Grande NW F-142
Albuquerque, New Mexico

R. T. HICKS CONSULTANTS, LTD.

901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Since 1996

June 9, 2021

Mr. Mike Bratcher
NMOCD - District 2, Supervisor811 S. First St.
Artesia, NM 88210Via E-Mail

Ms. Victoria Venegas
NMOCD - District 2 811 S. First St.
Artesia, NM 88210Via E-Mail

RE: Chisholm Energy Operating, LLC, Sombrero AST Containment
Section 7, T21-S, R33-E, Lea County, C-147 Volume 1 and Volume 2

Dear Mr. Bratcher and Ms. Venegas:

On behalf of Chisholm Energy Operating, LLC, R.T. Hicks Consultants is pleased submit a permit for the above-referenced project that consists of one (1) AST Containment. Both documents will be transmitted to OCD via the OCD Online portal. Please note that Chisholm plans to begin filling the AST with produced water on or about July 22, 2021. We appreciate your timely review.

Volume 1 contains:

- C-147 form signed by the operator,
- Survey showing the location of the AST Containment pad and driving directions,
- AST Operations and Closure Plans (verbatim from the approved Pintail AST Containment),
- Siting Criteria Demonstration.

Hicks Consultants affirms that:

- The location meets all siting criteria in the Rule and the location meets thespecified setback criteria,
- We conducted a foot survey to check that all setback criteria are met,
- The Operation and Maintenance Plan and Closure Plan are consistent with the Rule and previously approved by OCD.

Volume 2 contains information specific to the design and construction of the proposed ASTand variance requests to cause the AST to conform to Rule 34. Specifically, you will find:

- Engineering drawings for the proposed 60,000 bbl. AST Containment (RockwaterTank) are fully consistent with plans previously approved by OCD,
- The Design/Construction Plan verbatim from the recently approved Pintail ASTContainment
- The manual for AST set up from Select Energy Services
- Variances for AST Storage Containments – all of which have been approved by OCD previously (e.g. Pintail Containment).

In compliance with 19.15.34.10 of the Rule, the original submission was copied to BLM Carlsbad who is the representative of the owner of the surface upon which the containment will be constructed (i.e., the United States).

If you have any questions or concerns regarding this registration or the attached C-147, please contact me. As always, we appreciate your work ethic and attention to detail.

Sincerely,
R.T. Hicks Consultants

Randall T. Hicks PGPrincipal

Copy: Chisholm Energy Operating, LLC
State Land Office

C-147

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

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

Form C-147
Revised 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) _____

*** 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: : Chisholm Energy Operating LLC OGRID #: 372137

Address: 801 Cherry St Suite 1200 Unit 20 Fort Worth TX, 76102

Facility or well name (include API# if associated with a well): Sombrero Recycling Facility and Containment

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

U/L or Qtr/Qtr ____N_____ Section 7 Township 21S Range 33E County: Lea

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

2.

☒ **Recycling Facility:**

Location of (if applicable): Latitude 32.4880652° Longitude -103.6139487° NAD83 (Approximate)

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

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

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

☒ Fluid Storage

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

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

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

☐ **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 **See Attachment** *(adjacent):* (if applicable) Latitude 32.4880652° Longitude -103.6139487° NAD83 (Approximate)

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

☒ Lined ☐ Liner type: Thickness **See Attachment**: HDPE ☒ LLDPE ☐ HDPE ☐ PVC ☐ Other

Primary liner 2 x 30 mil LLDPE ; Secondary liner 40 mil LLDPE . SEE DESIGN DRAWINGS ☐ String-Reinforced

Liner Seams: ☒ Welded ☐ Factory ☐ Other _ Volume: SEE DESIGN DRAWINGS bbl Dimensions: (Inside dimensions) SEE DESIGN

☐ Recycling Containment Closure Completion Date:_____

4.

Bonding:

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

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

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

5. **Fencing:**

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

☐ Alternate. Please specify___ _____

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. See Volume 2

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 FIGURES 1, 1a, 2	☐ 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 FIGURE 3	☐ Yes ☒ No ☐ NA
Within the area overlying a subsurface mine. - Written confirmation or verification or map from the NM EMNRD-Mining and Minerals Division FIGURE 4	☐ Yes ☒ No
Within an unstable area. - Engineering measures incorporated into the design; NM Bureau of Geology & Mineral Resources; USGS; NM Geological Society; topographic map FIGURE 5	☐ Yes ☒ No
Within a 100-year floodplain. FEMA map FIGURE 6	☐ 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 FIGURE 7	☐ 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 FIGURE 8	☐ 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. FIGURES 1 and 7 - NM Office of the State Engineer - iWATERS database search; visual inspection (certification) of the proposed site	☐ Yes ☒ No
Within 500 feet of a wetland. FIGURE 9 - 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): Jennifer Elrod Title: Regulatory

Signature: Jennifer Elrod Date: 6/9/21

e-mail address jelrod@chisholmenergy.com Telephone: 817 953 3728

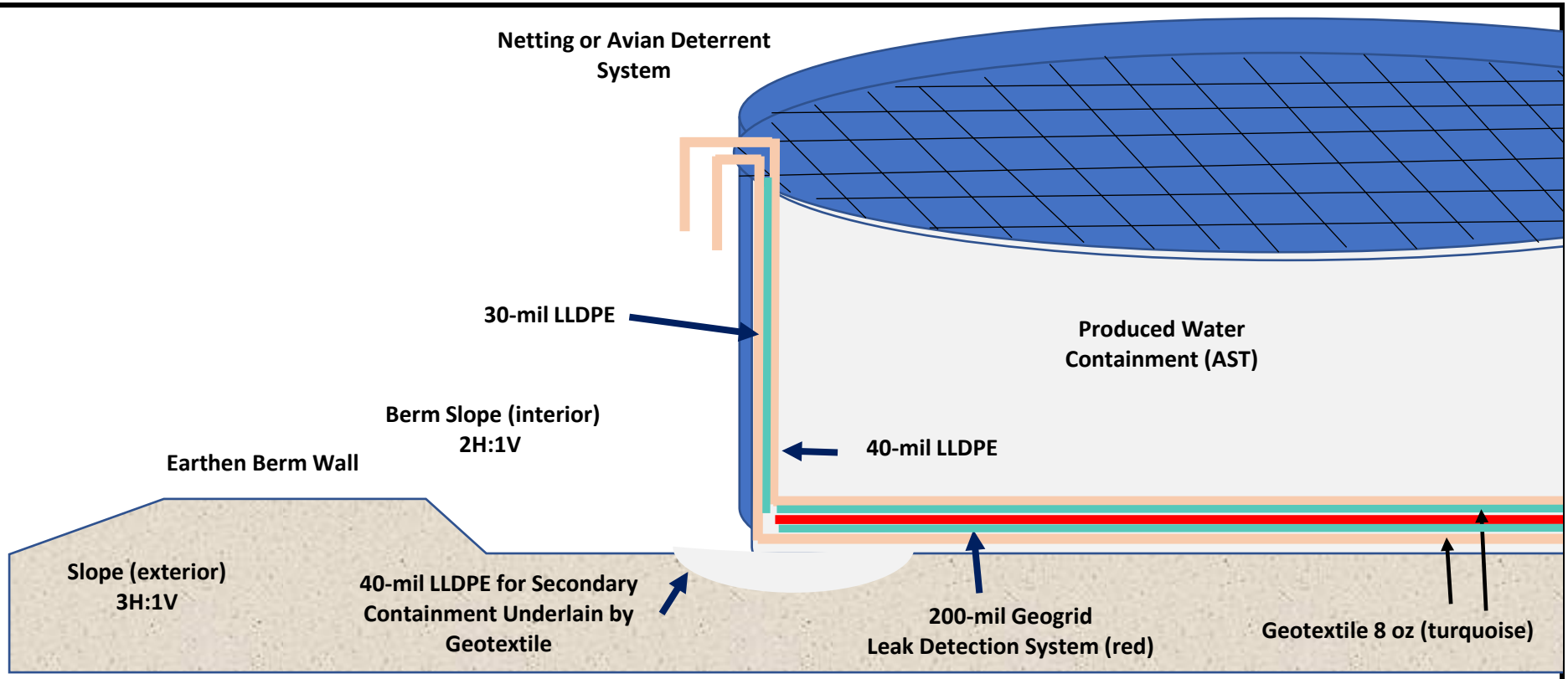
11.

OCD Representative Signature: _____ **Approval Date:** _____

Title: _____ **OCD Permit Number:** _____

☐ OCD Conditions _____

☐ Additional OCD Conditions on Attachment



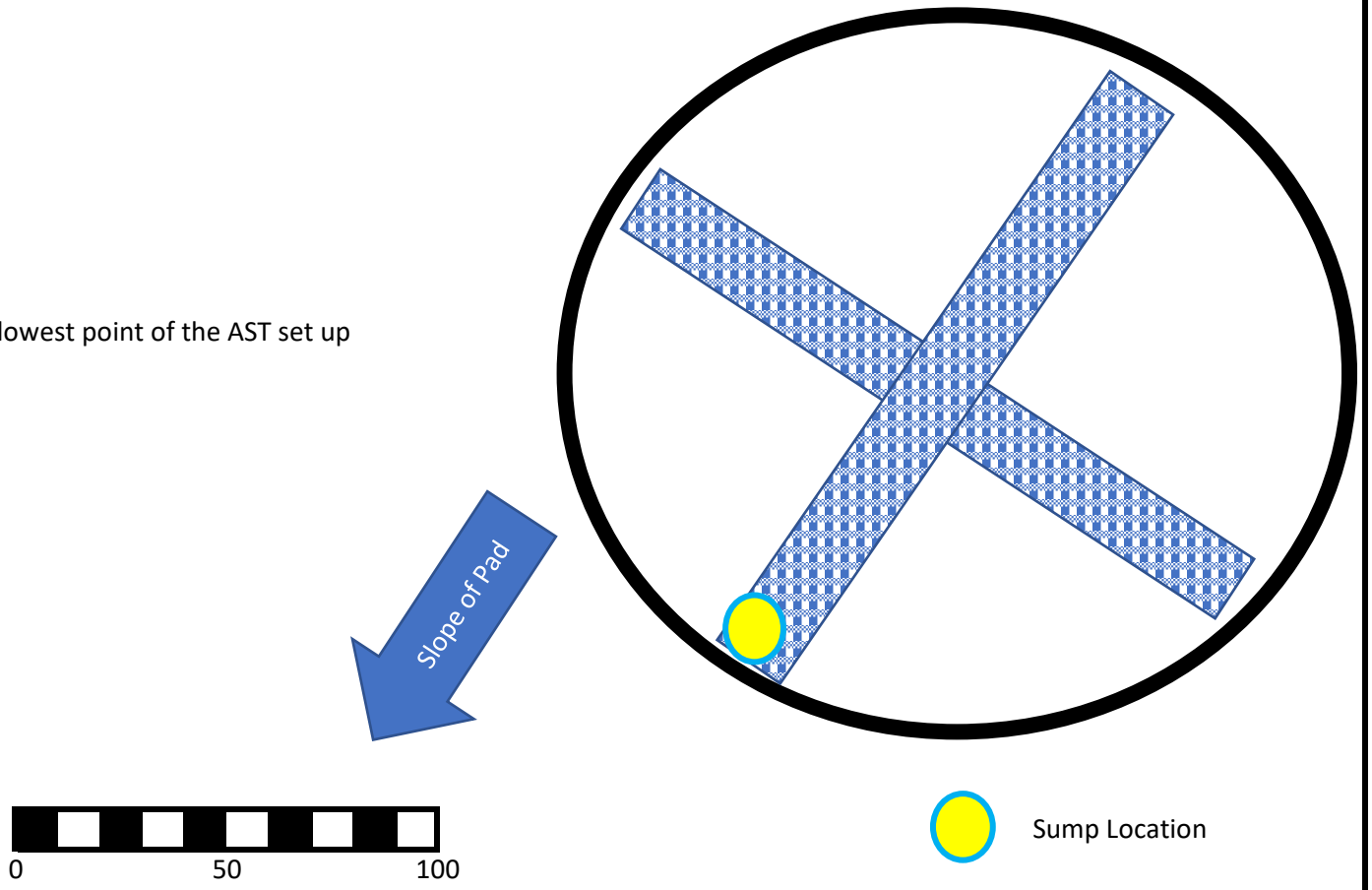
Description of Leak Detection System

- 2 30-mil LLDPE comprise primary liner and 30-mil LLDPE comprise the secondary liner
- 200-mil geogrid drainage layer lies between the primary and secondary liner per Plate 2
- Geotextile between the geogrid and each liner
- > 3-inch deep sump excavated on four sides of AST as a collection points for any seepage
- A ¾-inch aqua braid line runs from the collection sump beneath the geogrid drainage system to the outside of the AST
- Every week, a portable self-priming peristaltic pump connects to the leak detection system.
- The self-priming pump discharges into a ¾" aqua braid line, through a turbine meter, and back into the AST, on top of the primary liner
- If fluid is detected, it is tested for conductance to determine the origin of the water (i.e. produced water or condensation)

R.T. Hicks Consultants Albuquerque, NM	**Design Sketch**	**Plate 1**
	Peak Oilfield Services	**May-21**

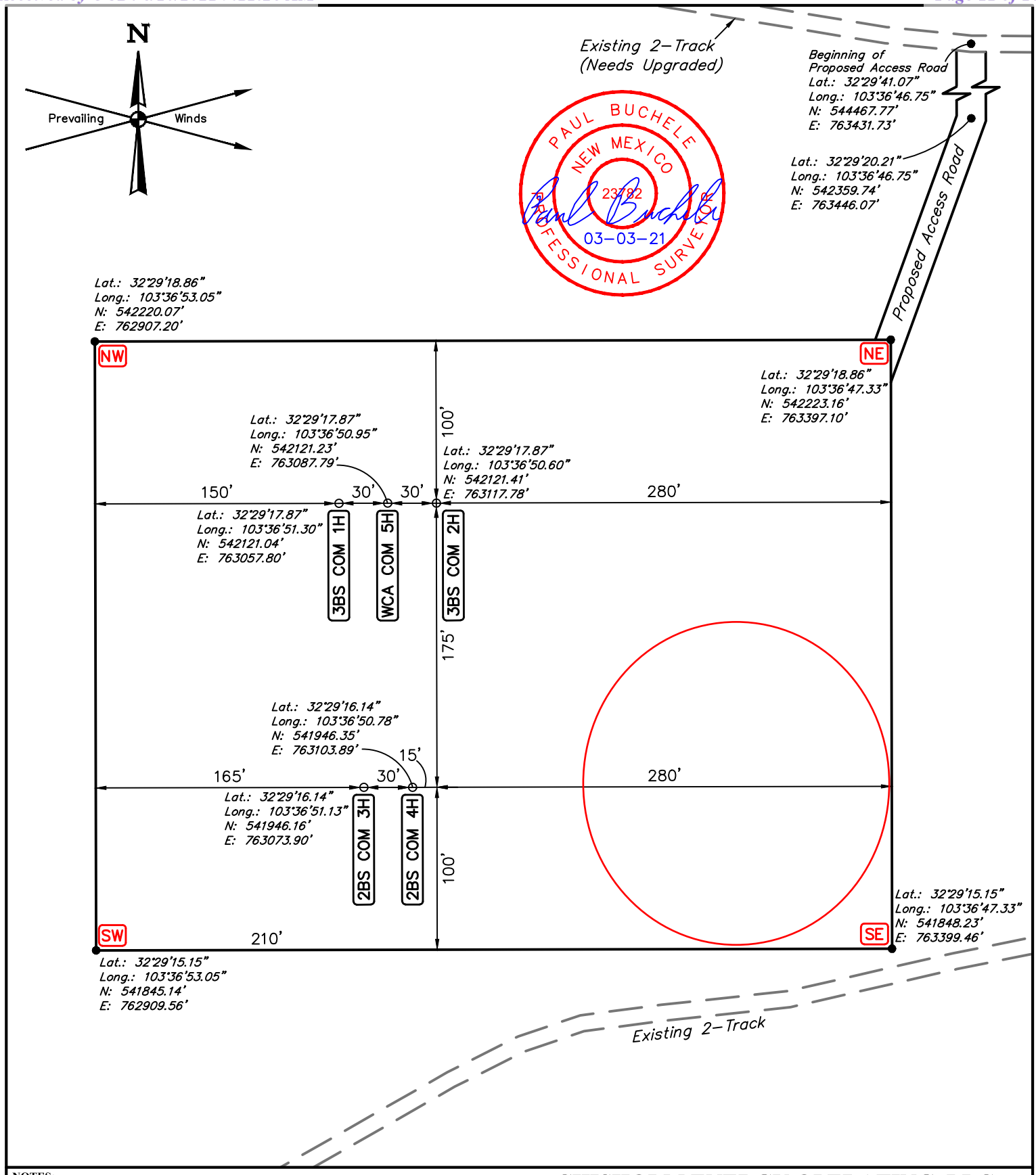
Use laser level to determine slope of pad and low point of AST

Sump at lowest point of the AST set up



R.T. Hicks Consultants Albuquerque, NM	Layout of Geogrid Drainage Mat	Plate 2
	Peak Oilfield Services- Sombrero AST	May 21

SURVEY FOR CONTAINMENT AND RECYCLING FACILITY



NOTES:

- Coordinates shown are New Mexico Coordinate system of 1983, East Zone, U.S. feet.
- Latitudes and Longitudes shown are NAD 83.

*AST location is approximate

UELS, LLC
Corporate Office * 85 South 200 East
Vernal, UT 84078 * (435) 789-1017

UINTAH ENGINEERING & LAND SURVEYING

CHISHOLM ENERGY OPERATING, LLC

SOMBRERO 18 FED 3BS COM 1H, 2H, 2BS COM 3H, 4H & WCA COM 5H
SE 1/4 SW 1/4, SECTION 7, T21S, R33E, N.M.P.M.
LEA COUNTY, NEW MEXICO

SURVEYED BY	B.W.B., R.H.C., M.M.D.	03-01-21	SCALE
DRAWN BY	R.J.	03-03-21	1" = 80'

SITE PLAN

AST Operations and Closure Plans

Operations and Maintenance Plan
Above Ground Tank Containment (AST)

General Specifications

This plan provides additional protocols to cause the proposed recycling containments (AST Containments) to conform to NMOCD Rules.

The operator will maintain and operate the recycling containments and facility in accordance with the following plan to contain liquids and maintain the integrity of the liner to prevent contamination of fresh water and protect public health and the environment.

- The operator will use the treated produced water in the containments for drilling, completion (stimulation), producing or processing oil or gas or both. If other uses are planned, the operator will notify the OCD though the submission of a modified C-147.
- For all exploration and production operations that use produced water, the operator will conduct these activities in a manner consistent with hydrogen sulfide gas provisions in 19.15.11 NMAC or NORM provisions in 19.15.35 NMAC, as applicable.
- The operator will address all releases from the recycling and re-use of produced water in accordance with 19.15.29 NMAC.
- The operator will not discharge into or store any hazardous waste in the recycling containments, but they may hold fluids such was freshwater, brackish water, recycled and treated water, water generated by oil or gas processing facilities, or other waters that are gathered for well drilling or completion. The recycling facility will not be used for the disposal of produced water. The operator will maintain the containments free of miscellaneous solid waste or debris.
- The operator will verify that no oil is on the surface of the contained fluid. If oil is observed, the oil shall be removed using an absorbent boom or other device and properly disposed at an approved facility. An absorbent boom or other device will be maintained on site.
- The operator will install and use a header and diverter described in the design/construction plan in

19.15.34.10 B
Recycling containments may hold produced water for use in connection with drilling, completion, producing or processing oil or gas or both.

19.15.34.8 A
(5) All operations in which produced water is used shall be conducted in a manner consistent with hydrogen sulfide gas provisions in 19.15.11 NMAC or NORM provisions in 19.15.35 NMAC, as applicable.

19.15.34.8 A
(6) All releases from the recycling and re-use of produced water shall be handled in accordance with 19.15.29 NMAC.

19.15.34.10 B
Recycling containments may hold produced water for use in connection with drilling, completion, producing or processing oil or gas or both. Such fluids may include fresh water, brackish water, recycled and treated water, fluids added to water to facilitate well drilling or completion, water produced with oil and gas, flowback from operations, water generated by an oil or gas processing facility or other waters that are gathered for well drilling or completion but may not include any hazardous waste.

19.15.34.9 G
Recycling facilities may not be used for the disposal of produced water.

19.15.34.13 B
(1) The operator shall remove any visible layer of oil from the surface of the recycling containment
(7) The operator shall install, or maintain on site, an oil absorbent boom or other device to contain an unanticipated release.

19.15.34.13 B
(3) The injection or withdrawal of fluids from the containment shall be accomplished through a header, diverter or other hardware that prevents

order to prevent damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes during injection or withdrawal of liquids.

- *Pursuant to a variance*, the operator will maintain at least 2-feet of freeboard in each AST containment. Under extenuating circumstances, which will be noted on the inspection log as described below, the operator may temporarily exceed the freeboard mandate.
- If the liner develops a leak or if any penetration of the liner occurs above the liquid's surface, then the operator will repair the damage or initiate replacement of the liner within 48 hours of discovery (and immediately notify BLM) or will seek a variance from the division district office within this time period.
- If visible inspection suggests that the liner developed a leak or if any penetration of the liner occurs below the liquid's surface, then the operator will remove all liquid above the damage or leak line within 48 hours of discovery. The operator will also notify the district division office within this same 48 hours (and immediately notify BLM) of the discovery and repair the damage or replace the liner.
- In the event of a leak due to a hole in the liner, the following steps will be followed:
    1. If the source of the fluid is uncertain, comparative field tests may need to be performed on both the water in the containment and that which may have been released (e.g. pH, conductance, and chloride).
    2. If the fluid is found to be coming from the containment, determine the location from which the leak is originating.
    3. Mark the point where the water is coming out of the tank.
    4. Locate the puncture or hole in the liner.
    5. Empty the containment to the point of damage in liner.
    6. Clean area of liner that needs to be repaired.

damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes.

19.15.34.13 B
(2) The operator shall maintain at least three feet of freeboard at each containment.

19.5.34.13 B
(4) If the containment's primary liner is compromised above the fluid's surface, the operator shall repair the damage or initiate replacement of the primary liner within 48 hours of discovery or seek an extension of time from the division district office.
(5) If the primary liner is compromised below the fluid's surface, the operator shall remove all fluid above the damage or leak within 48 hours of discovery, notify the division district office and repair the damage or replace the primary liner.

7. Cut out piece of material (patch or tape) to overlay liner.
8. Either weld the patch to the injured area in the liner or apply tape over the rupture.
9. Make sure rupture is completely covered.
10. Monitor as needed.

Water should NEVER go below 12 inches at the lowest level of the tank to prevent impact from high winds.

If the tank is drained, it should be secured from wind impacts and the liner inspected and reposition (to provide sufficient slack during filling) prior to refilling, per direction of SOP.

The operator will report releases of fluid in a manner consistent with NMAC 19.15.29, as well as immediately notify BLM.

The operator will inspect and remove, as necessary, surface water run-on accumulated in the secondary containment

Monitoring, Inspections, and Reporting

Inspections are to routinely be performed, as well as when the ASTs are emptied and prior to refilling.
An "Inspection Form" meeting requirements according to NMAC 19.15.34, as well as BLM COA, is to be filled out during these routine inspections and is included at the end of this section.

Weekly inspections consist of

- reading and recording the fluid height of staff gauges, freeboard
- recording any evidence that the AST Containment surface shows visible oil,
- visually inspecting the containment's exposed liners
- checking the leak detection system for any evidence of a loss of integrity of the primary liner.
- inspect any diversion ditches and berms around the containment to check for erosion and collection of surface water run-on.

- inspect the leak detection system for evidence of damage or malfunction and monitor for leakage.
- Inspect the containment for dead migratory birds and other wildlife. Within 30 days of discovery (24 hours if federally protected), 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.

19.15.34.12 E
Netting. The operator shall ensure that a recycling containment is screened, netted or otherwise protective of wildlife, including migratory birds. The operator shall on a monthly basis inspect 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.

As stated above, if a liner's integrity is compromised, or if any penetration of the liner occurs, then the operator will take appropriate action within 48 hours as noted above, including immediate notification of BLM.

Monthly, the operator will:

- Report to the division the total volume of water received for recycling, with the amount of fresh water received listed separately, and the total volume of water leaving the facility for disposition by use on form C-148.
- Record sources and disposition of all recycled water.

Additional monitoring to identify hazards that may have developed, changes in site conditions, tank use and to enable early detection of structural issues such as uneven tank panel settlement, soil settlement, liner damage, insufficient liner slack, or leaks. If changes are noted, they should be communicated to the AST contractor (WWS Manager/Field Supervisor)

The operator will maintain a log of all inspections and make the log available for the appropriate Division district office's review upon request.

Cessation of Operations

If less than 20% of the total fluid capacity is utilized

every six months, beginning from the first withdraw, operation of the facility has ceased and the division district office will be notified. The division district may grant an extension not to exceed six months to determine the cessation of operations and the operator may request a *variance from this mandate to close for good cause and has been included in Volume 3*.

19.15.34.13 C
A recycling containment shall be deemed to have ceased operations if less than 20% of the total fluid capacity is used every six months following the first withdrawal of produced water for use. The operator must report cessation of operations to the appropriate division district office. The appropriate division district office may grant an extension to this determination of cessation of operations not to exceed six months.

The operator will remove all fluids from the recycling facility within 60 days of cessation of operations. An extension, not to exceed 2 months, may be granted by the district division for the removal of fluids from the facility.

19.15.34.14 A
Once the operator has ceased operations, the operator shall remove all fluids within 60 days and close the containment within six months from the date the operator ceases operations from the containment for use. The division district office may grant an extension for the removal of all fluids not to exceed two months.

The breakdown of the containments follows the reverse order of the setup steps presented in the set-up manual

Inspection Form

Date: _____

Chisholm Energy Sombrero AST Containment
Weekly inspection/Fluid level must be maintained > 1 foot

Tank ID: _____

Fluid Level: _____ Tank contents: _____

Inspection Task	Results		Remarks, Observations, and/or Remedial Actions
Visible Oil on Surface	☐ None Observed	☐ Yes, Describe Action	
An absorbent boom or similar device is located on site to remove visible oil from surface.			
At least 2 ft of freeboard	☐ Yes	☐ No, Measure Freeboard	
Evidence of surface water run-on	☐ None Observed	☐ Yes, Describe	
Check for excessive erosion of perimeter berms.			
Birds or wildlife in net or screen	☐ None Observed	☐ Yes, Describe	
Within 30 days of discovery (immediately if federally protected species, report dead birds or wildlife to the appropriate agency (USFWS, NMDGF) and to NMOCD district division office.			
Damage to netting or screen	☐ None Observed	☐ Yes, Describe	
Rupture of Liner	☐ None Observed	☐ Yes, Describe	
If rupture is above fluid level, repair within 48 hours. If below fluid level, remove fluid above within 48 hours, notify NMOCD district division office, and repair. Immediately notify BLM of any leak			
Clips or clamps properly securing liner	☐ Yes	☐ No, Describe	
If low level, enough liner slack on panel wall	☐ Yes	☐ No, Describe	
Uneven gaps between panels	☐ None Observed	☐ Yes, Describe	
Signs of tank settlement	☐ None Observed	☐ Yes, Describe	

Chisholm Energy

Erosion of soil surrounding tank (10 ft radius)	☐ None Observed	☐ Yes, Describe	
Running water on the ground	☐ None Observed	☐ Yes, Describe	
Unusual ponding of fluid inside berm	☐ None Observed	☐ Yes, Describe	
	Field test (pH, Cl-, conductance, etc.) ponded fluid and compare to fluid in tank. If tank is determined as the source, locate and repair rupture within 48 hours. Notify NMOCD district division office and repair. Immediately notify BLM.		
Rust or corrosion on panels, stairs, or hardware	☐ None Observed	☐ Yes, Describe	
Damage to any hardware	☐ None Observed	☐ Yes, Describe	

Additional Observations or Actions: _____

Inspected by: _____

Closure Plan

After operations cease, the operator will remove all fluids and commence reclamation efforts immediately. Final reclamation to be completed within 3 months from the date the operator ceases operations from the containment for use.

The surface owner will impose a closure design that conforms to their needs for the site. The operator understands that a variance will be submitted to OCD to allow for any alternative closure protocol (BLM requirements will supersede OCD rules if equal or better for protection of freshwater, human health and the environment).

The containments are expected to contain a small volume of solids, the majority of which will be windblown sand and dust with some mineral precipitates from the water.

The operator will notify the division district and BLM (phone or email) before initiating closure of the containments and/or facility.

Excavation and Removal Closure Plan – Protocols and Procedures

1. Residual fluids in the containments will be sent to disposal at a division-approved facility.
2. The operator will remove all solid contents and transfer those materials to the following division-approved facility:
   Disposal Facility Name: R360
   Permit Number NM 01-0006
3. If possible, geomembrane textiles and liners that exhibit good integrity may be recycled for use as an under liner of tank batteries or other use as approved by OCD.
4. Disassemble the recycling containment infrastructure according to manufacturer's recommendations
5. After the disassemble of the containments and removal of the contents and liners, soils beneath the tanks will be tested as follows
   a. Collect a five-point (minimum) composite from beneath the liner to include any obviously stained or wet soils, or any other evidence of impact from the containments for laboratory analyses for the constituents listed in Table I of 19.15.34.14 NMAC.
   b. If any concentration is higher than the parameters listed in Table I, additional delineation may be required, and closure activities will not proceed without Division

19.15.34.14 B
The operator shall close a recycling containment by first removing all fluids, contents and synthetic liners and transferring these materials to a division approved facility.

19.15.34.14 C
The operator shall 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.
(1) If any contaminant concentration is higher than the parameters listed in Table I, the division may require additional delineation upon review of the results and the operator must

approval.

c. If all constituents' concentrations are less than or equal to the parameters listed in Table I, then the operator will backfill the facility as necessary using non-waste containing, uncontaminated, earthen material and proceed to reclaim the surface to pre-existing conditions.

receive approval before proceeding with closure.
(2) If all contaminant concentrations are less than or equal to the parameters listed in Table I, then the operator can proceed to backfill with non-waste containing, uncontaminated, earthen material.

Reclamation and Re-vegetation

The operator will reclaim the surface to safe and stable pre-existing conditions that blends with the surrounding undisturbed area. "Pre-existing conditions" may include a caliche well pad that existed prior to the construction of the recycling containment and that supports active oil and gas operations.

19.15.34.14 E
Once the operator has closed the recycling containment, the operator shall reclaim the containment's location to a safe and stable condition that blends with the surrounding undisturbed area. Topsoils and subsoils shall 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. The disturbed area shall then be reseeded in the first favorable growing season following closure of a recycling containment. The operator shall substantially restore the impacted surface area to the condition that existed prior to the construction of the recycling containment.

Areas not reclaimed as described herein due to their use in production or drilling operations will be stabilized and maintained to minimize dust and erosion.

For all areas disturbed by the closure process that will not be used for production operations or future drilling:

a. The operator will reclaim the containment's location to a safe and stable condition that blends with the surrounding undisturbed area.

b. Topsoils and subsoils shall 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.

c. The disturbed area shall then be reseeded with BLM defined seed mixture within the first 3 months following closure of a recycling containment in accordance with BLM requirements.

19.15.34.14 G
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.

Federal, state trust land, or tribal lands may impose alternate reclamation and re-vegetation obligations that provide equal or better protection of fresh water, human health, and the environment. Re-vegetation and reclamation plans imposed by the surface owner will be outlined in communications with the OCD.

The operator will notify the division when the site meets the surface owner's requirements or exhibits a uniform vegetative cover that reflects a life-form ratio of plus or minus fifty percent (50%) of pre-disturbance levels and a total percent plant cover of at least seventy

19.15.34.14 F
Reclamation of all disturbed areas no longer in use shall be considered complete when all ground surface disturbing activities at the site have been completed, and a uniform vegetative cover has been established

percent (70%) of pre-disturbance levels, excluding noxious weeds. (As surface owner, BLM will determine satisfactory completion of reclamation).

Closure Documentation

Within 60 days of closure completion, the operator will submit a closure report (Form C-147) to the District Division, with necessary attachments to document all closure activities are complete, including sampling results and details regarding backfilling and capping as necessary.

In the closure report, the operator will certify that all information in the report and attachments is correct and that the operator has complied with all applicable closure requirements and conditions specified in the closure plan.

that reflects a life-form ratio of plus 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.

19.15.34.14 D
Within 60 days of closure completion, the operator shall submit a closure report on form C-147, including required attachments, to document all closure activities including sampling results and the details on any backfilling, capping or covering, where applicable. The closure report shall certify that all information in the report and attachments is correct and that the operator has complied with all applicable closure requirements and conditions specified in division rules or directives.

SITING CRITERIA DEMONSTRATION

Discussion
Figures

Distance to Groundwater

Figures 1a and 1b, Figure 2, their associated legends, and the discussion presented below demonstrate that groundwater (fresh water, as defined by NMOCD Rules) at the location is greater than the required 50 feet below the proposed Sombrero AST that compose the Sombrero Site. Specifically, the estimated depth to water is greater than 100 feet.

Hydrogeology of Sombrero Site Containment

The proposed site for the Sombrero AST is located approximately 26.4 miles northwest of Eunice, New Mexico, and 36.4 miles northeast of Carlsbad, New Mexico. It lies 0.53 miles northwest of the top of Hat Mesa on the relatively flat, east-northeast "shoulder" of the Mesa, which is approximately 50 feet above the surrounding land. Vegetation in this area includes small yucca, dead mesquite, rabbit brush, and native grasses, all of which appear stunted due to drought. Caliche underlies the thin sand surface. According to the New Mexico State Geologic Map (Figures 1 and 2), the Sombrero Site is in an area where the surface unit is Quaternary-age eolian and piedmont (Qe/Qp) and Tertiary-age Ogalalla Formation (To), which are described as follows:

> To—Ogallala Formation (lower Pliocene to middle Miocene)—Alluvial and eolian deposits, and petrocalcic soils of the southern High Plains. Locally includes Qoa.
>
> Qe/Qp—Eolian and piedmont deposits (Holocene to middle Pleistocene)—Interlayed eolian sands and piedmont-slope deposits along the eastern flank of the Pecos River valley, primarily between Roswell and Carlsbad. Typically capped by thin eolian deposits.

As shown in the western portion of Figures 1 and 2, the upper Chinle Formation, T(r)cu, crops out at an elevation of 3601 feet above mean sea level and the Ogallala Formation is exposed at the Sombrero site.

Nearest the site, there are two wells, USGS-15861 and -15845, that reportedly draw water from Alluvium/Bolsom Formation. The USGS characterization may or may not be correct as:

- the 2015 measured depth to water in USGS-15830 is 131.01 feet and the reported depth of the well is 123 feet;
- MISC-73 reports a total well depth of 150 feet with a 1965 depth to water of 148.4 feet;
- the Ogallala, not Alluvium/Bolson is the surface unit at the location of these wells, and
- Groundwater Report #6 maps the top of the "redbed" (Chinle) in this area as 3750 feet above sea level, which calculates to a depth of Ogallala of (3885-3750=) 135 feet (see Figure 2b)

For the purpose of this submission, the absence of convincing data requires an assumption that the Ogalalla is saturated about 120 feet beneath the surface and the thickness of the zone of saturation is probably less than 20 feet.

Depth to Water Data and Nearby Wells

Figure 1 and the associated legend are topographic maps overlain by a transparent geologic map of the state of New Mexico that display the following:

- A blue hatched rectangle, which represents the footprint of the Sombrero Site.
- Water wells from the USGS database as green, cyan, purple, red, and blue triangles. These colors indicate the principal water-bearing unit for each well: Alluvium/Bolsom, Ogallala, Chinle, Santa Rosa, and Not Defined, respectively. The well number as defined in the database, recorded depth to water value, and date the water level was measured is displayed next to the corresponding well point.
- Miscellaneous water wells from public and non-public databases were identified by field inspection or other published documents are represented by yellow, cyan, green, dark green, and dark blue squares with black dots in the center. The colors correspond to the depth to water. The water level measurement and the date the measurement was recorded are displayed next to the corresponding well points. A larger scale map on the legend page of Figure 1 displays these closely-spaced wells.
- Water wells from the Office of the State Engineer's WATERS database as light blue, light green, dark green, dark blue, and red circles with colored triangles in the center. These symbols indicate the depth to water measured in the well. Well ID as documented in the WATERS database, depth to water value, and the date the value was recorded is displayed next to the corresponding well point.

A number of OSE wells in the area surrounding the Sombrero site have water level measurements as recent as 2018. These measurements (typically measured by drillers soon after well completion) and well logs associated with the wells (See Well Logs Appendix), help confirm the depth to water in the area is greater than the required 50

feet.

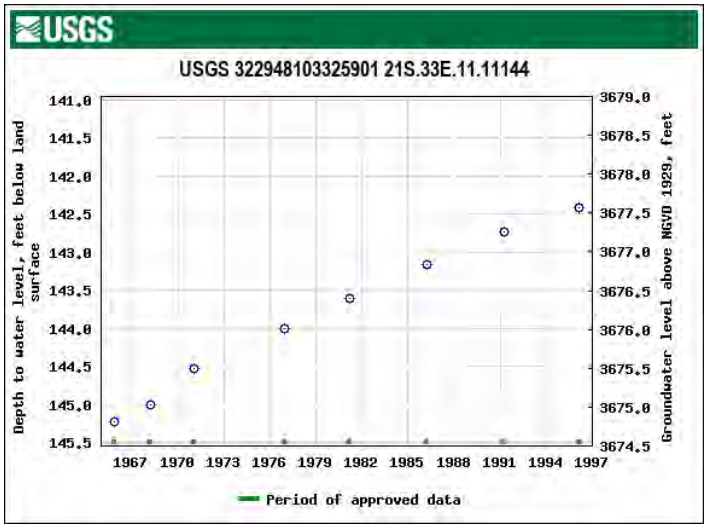
CP-01701 is 4.23 miles to the southwest of the Sombrero site and the depth to water at the time of drilling in 2018 was 560 feet. The driller, whom we believe provides accurate hydrogeologic data, identifies the water-bearing unit was a red siltstone with gypsum. the presence of gypsum and the depth of this unit suggests it is part of the Quartermaster Formation. The Santa Rosa Sandstone probably lies near the bottom of the tan/red sandstone (190-400 feet depth) and is not identified as a water-bearing unit.

CP-01151 is 3.96 miles to the northwest of the site and was drilled in 2013. The drillers did not encounter measurable water to 823 feet below surface. The deepest unit encountered by the driller was the "Red Bed". The depth of the Santa Rosa Sandstone or Quartermaster Formation is difficult to discern from the well log.

CP-00854 is located 4.05 miles to the southeast of the Sombrero site. We examined well logs for three nearby wells (CP-1349, CP-1357 and CP-1355) and believe CP-854 provides the best data. The depth to water recorded in 1966, at the time of drilling was reported to be 755 feet and the water bearing unit was a brown sand including some gravel. Because the well was drilled with air/air-foam, identification of the water-bearing units should be good.

Based upon the lithologic descriptions and water-producing capacity, we conclude that the 135-foot thick "brown sand and sandrock" from 755-890 is the Santa Rosa Sandstone.

Groundwater depth and elevation data are available for several wells in the area. USGS-15783 is located 3.66 miles northeast of the Sombrero site. The most recent water level measurement is from 1996 and is approximately 142.5 feet below the surface and the earliest measurement from 1966 is approximately 145.3 feet below the surface. Over the 30-year time period on the graph below (USGS 322948…901), there is a 2.8-foot change, which indicates the water level in this well is stable. This well monitors water levels in the Ogallala Aquifer.



USGS-15830 is located 0.21 miles due south of the Sombrero Site. The most recent water level measurement taken in 1986 is approximately 143 feet below the surface (See below, USGS 322900…302). The deepest water level measurement, taken in 1966 is approximately 149 feet below the surface. The shallowest water level measurement in this well is from 1981, approximately 142 feet depth is recorded for this. Over a 15-year time period, the change in water level is approximately 5 feet, which indicates a stable water level. As indicated earlier in this submission, we assume this well is completed in the Ogallala Aquifer.

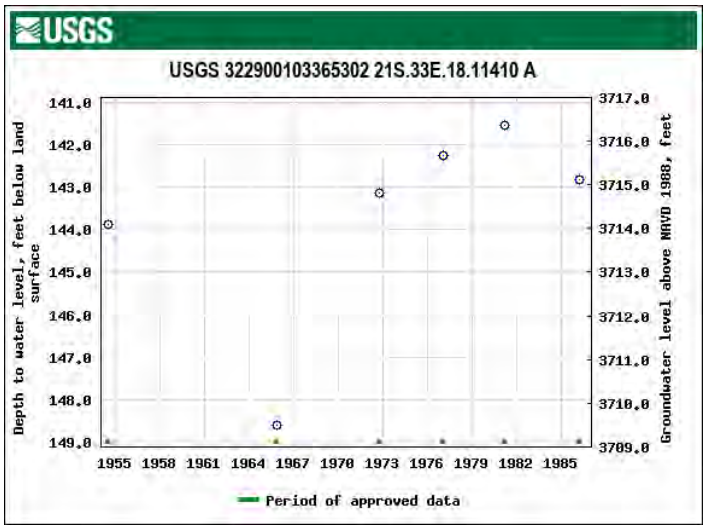


Figure 2 is a topographic map overlain by a transparent geologic map of the state of New Mexico and a potentiometric surface map and associated legend that displays the following:

- The Sombrero site as a blue hatched box.
- Water wells from the USGS database as green and purple triangles. These colors indicate the principal water-bearing unit for each well: Alluvium/Bolsom and Chinle respectively. The well number as defined in the database, recorded groundwater elevation value, and date the water elevation was measured is displayed next to the corresponding well point.
- Miscellaneous water wells from public and non-public databases were identified by field inspection or other published documents are represented by yellow, cyan, and green squares with black dots in the center. The colors correspond to the groundwater elevation. The water elevation measurement and the date the measurement was recorded are displayed next to the corresponding well points.

We used the USGS and MISC data to generate the potentiometric surface map. As indicated earlier, the geology and water level data demonstrate that wells in the area draw water from the Ogallala, Rustler and Santa Rosa formations. The water table elevations shown on Figure 2a are anchored by data showing that the elevation of the potentiometric surface beneath the Sombrero site is about 3908 feet ASL.

Figure 2b shows the potentiometric surface at the larger scale (90,000) than Figure 1 with the elevation of the red bed surface from Groundwater Report #6 as the base map. We believe this Figure best illustrates that water around the Sombrero AST overlies a lobe of Ogallala groundwater perched on the 3700–3750-foot contours of the top of the redbed. The groundwater above the 3750 contour is not hydraulically connected to the Ogallala to the east. Groundwater beneath the Sombrero AST drains to the east/southeast and thence southeast into the San Simon Swale as indicated by the redbed elevation and potentiometric surface.

- We conclude with a high degree of scientific certainty that the depth to the groundwater surface is (3650-3750=) 100 feet.

Distance to Municipal Boundaries and Freshwater Fields

Figure 3 demonstrates that the area of interest is not within incorporated municipal boundaries or within defined municipal freshwater well fields covered under a municipal ordinance adopted pursuant to NMSA 1978, Section 3-27-3, as amended.

- The nearest freshwater well field is 26.4 miles to the northeast and is owned by the City of Hobbs.
- The nearest municipality is the City of Eunice, which is 22 miles southeast of the site.

Distance to Subsurface Mines

Figure 4 and our general reconnaissance of the area demonstrate the absence of subsurface mines in the area.

- The Sombrero site is not in an area where subsurface mines exist.
- The site is located within the Main potash district.
- The nearest surface mine mapped in the MILS database is a caliche pit 0.70 miles to the southwest.

Distance to High or Critical Karst Areas

Figure 5 illustrates the Sombrero Site absence of mapped areas of high or critical karst potential.

- The Sombrero site is not located within high or critical karst potential areas.
- Our field investigation saw no evidence of karst features such as sinkholes.

Distance to 100-Year Floodplain

Figure 6 demonstrates the absence of 100-year flood plains with respect to the proposed location for the Sombrero site.

- The nearest 100-year flood plain is 16.36 miles southwest of the site.

Distance to Surface Water

Figure 7 and the site visit demonstrate the that the Sombrero Site is outside of the setback distances for a continuously flowing watercourse, significant watercourse or the next lower order tributary, lakebed, sinkhole, playa lake (measured from the ordinary high-water mark) or spring.

- The nearest surface water feature is an intermittent stream that is located 374.25 feet due west.
- We observed no watercourses that meet the Rule 34 definition near the site.

Distance to Permanent Residences or Structures

Figure 8 demonstrates that the proposed site for the Sombrero Site is not within the setback distances of an occupied permanent residence, school, hospital, institution, church, or other structure at the time of the initial application.

- The only structures near the proposed site are the well pads and pipelines. There is currently ongoing drilling operations by Chisholm Energy within the boundary of the recycling containment area.

Distance to Non-Public Water Supply

Figures 1 and 7 demonstrate the Sombrero location is not within the setback distances of a spring or freshwater well used for domestic or stock watering purposes, in existence at the time of initial application.

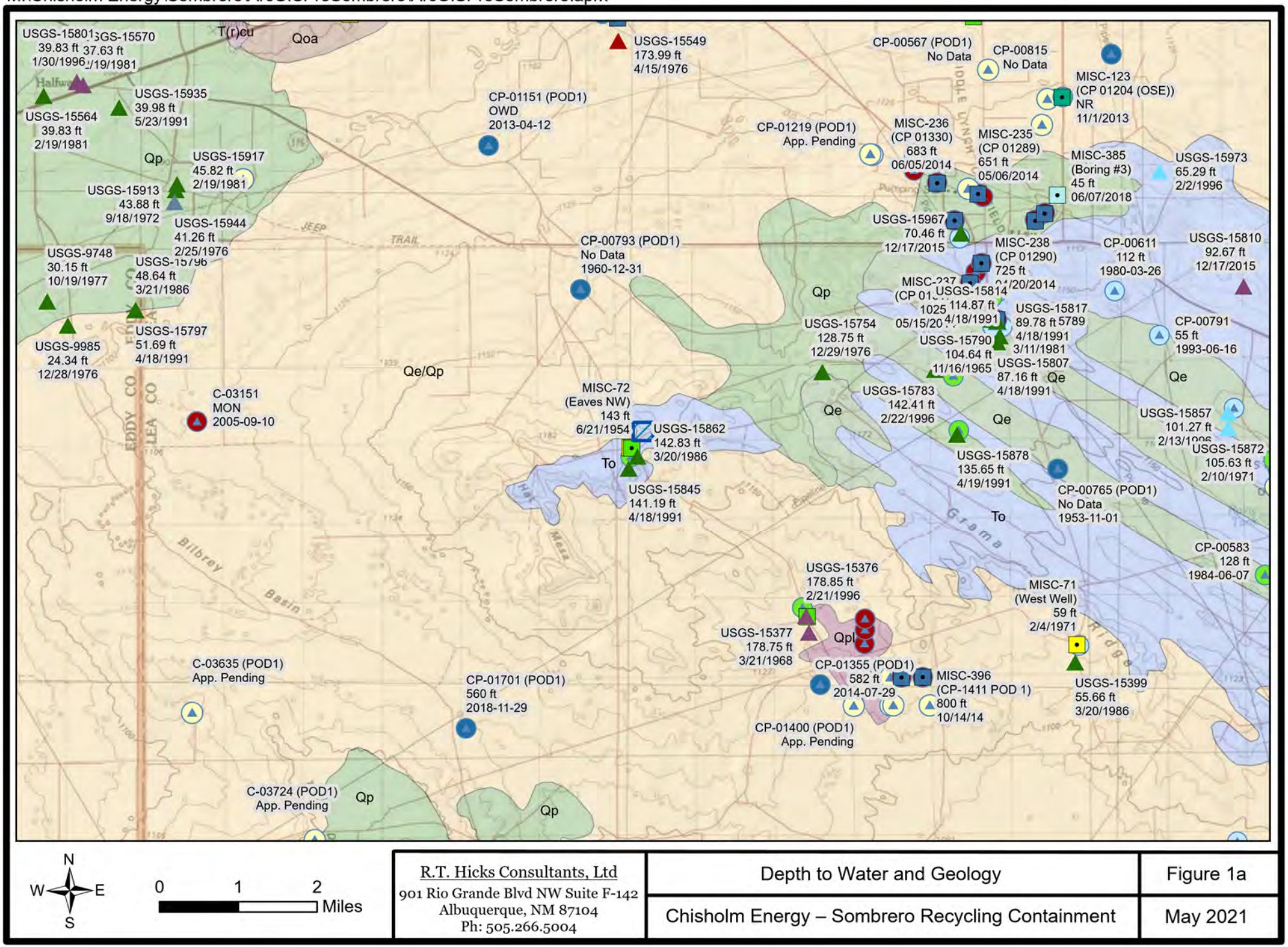
- Figure 1 shows the location of all area water wells. The nearest well, USGS-15830, is located more than 500 feet from the location of the AST. We believe this USGS well is the same as MISC-73, which is discussed above.
- No domestic water wells are located within 1,000 feet of the recycling area.
- No springs were identified in the area.
- The site is not within 500 feet of a spring or freshwater well used for domestic or stock watering purposes, in existence at the time of initial application.

Distance to Wetlands

Figure 9 demonstrates that the proposed site of the Sombrero site is not within the 300-foot setback distance of a wetland.

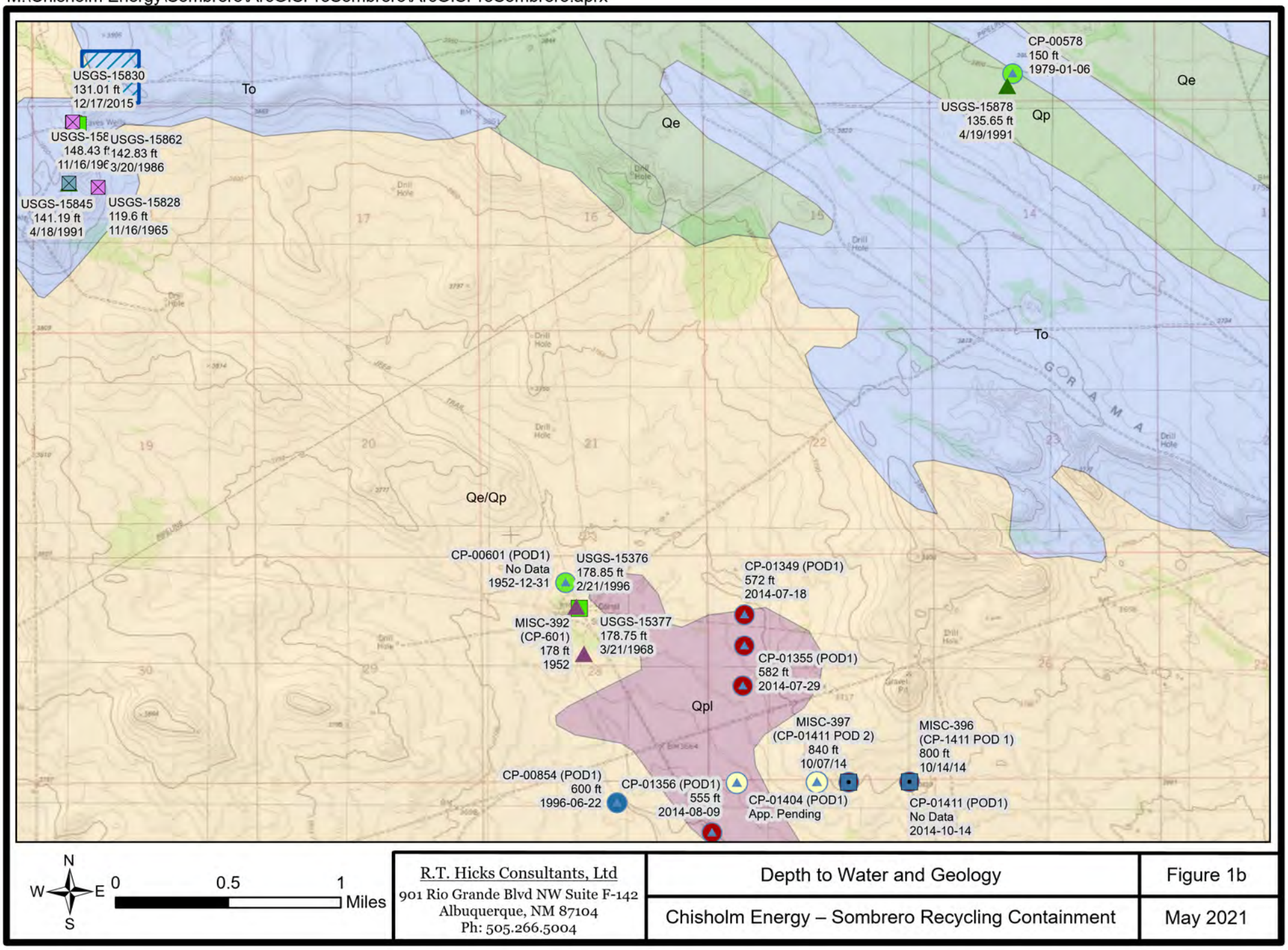
- The nearest mapped wetland is a freshwater pond that is 336.61 feet to the southwest of the edge of the area. Based on inspection of recent aerial images from Google Earth and observations in the field, this is slight topographic depression. It did not contain water at the time of the field observation. The AST will be located more than 300 feet from the edge of this depression.

M:\Chisholm Energy\Sombrero\ArcGISProSombrero\ArcGISProSombrero.aprx



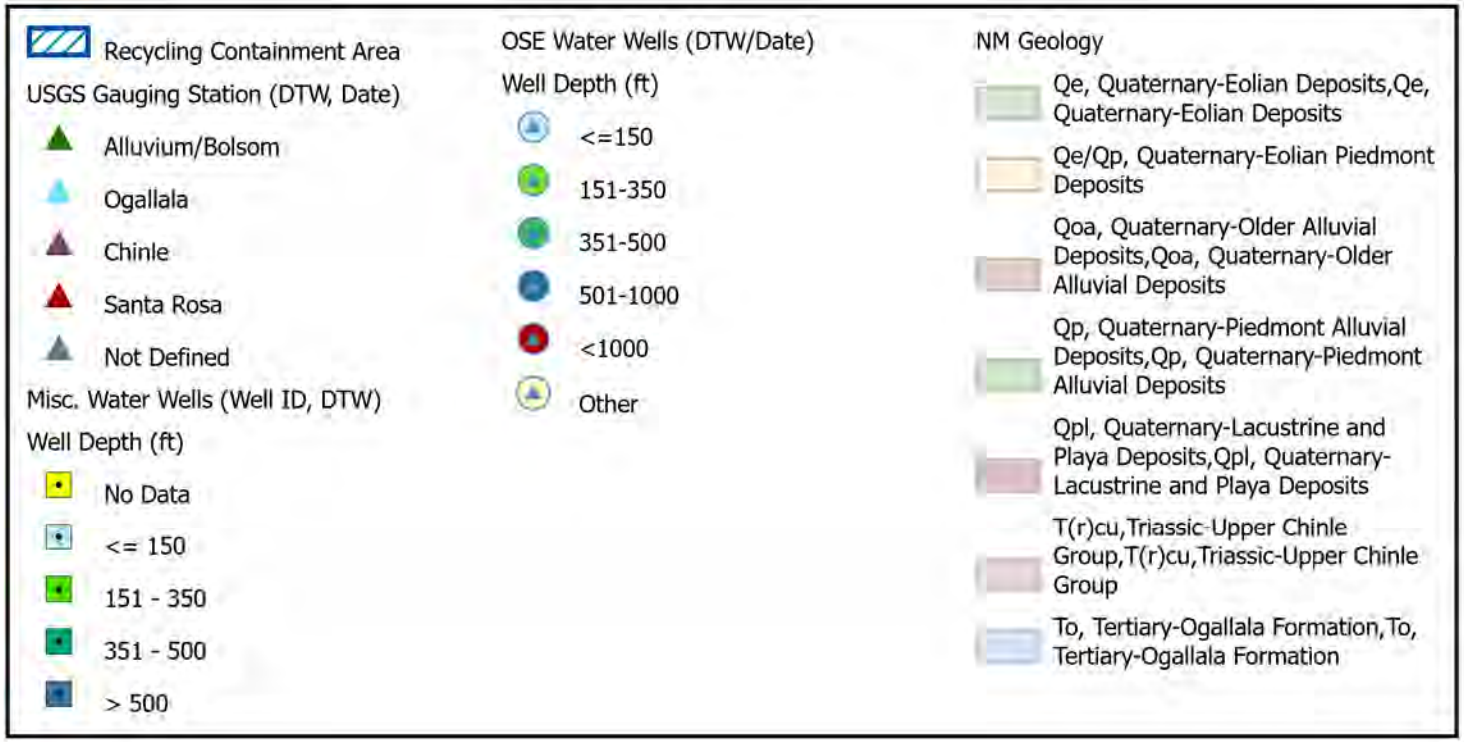
R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Depth to Water and Geology	Figure 1a
	Chisholm Energy – Sombrero Recycling Containment	May 2021

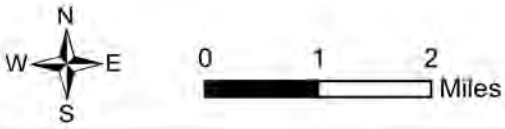
M:\Chisholm Energy\Sombrero\ArcGISProSombrero\ArcGISProSombrero.aprx



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Depth to Water and Geology	Figure 1b
	Chisholm Energy – Sombrero Recycling Containment	May 2021

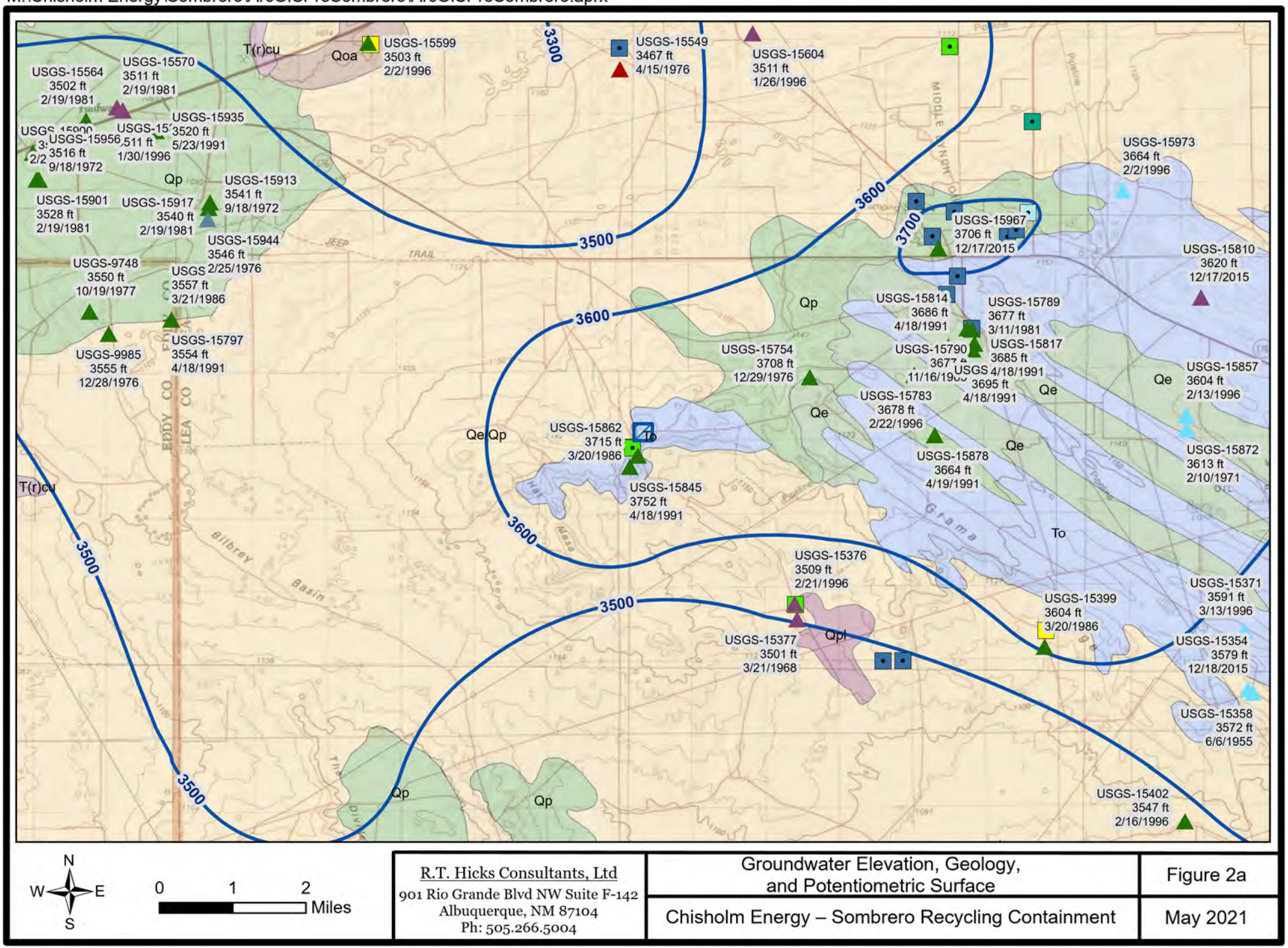
M:\Chisholm Energy\Sombrero\ArcGISProSombrero\ArcGISProSombrero.aprx





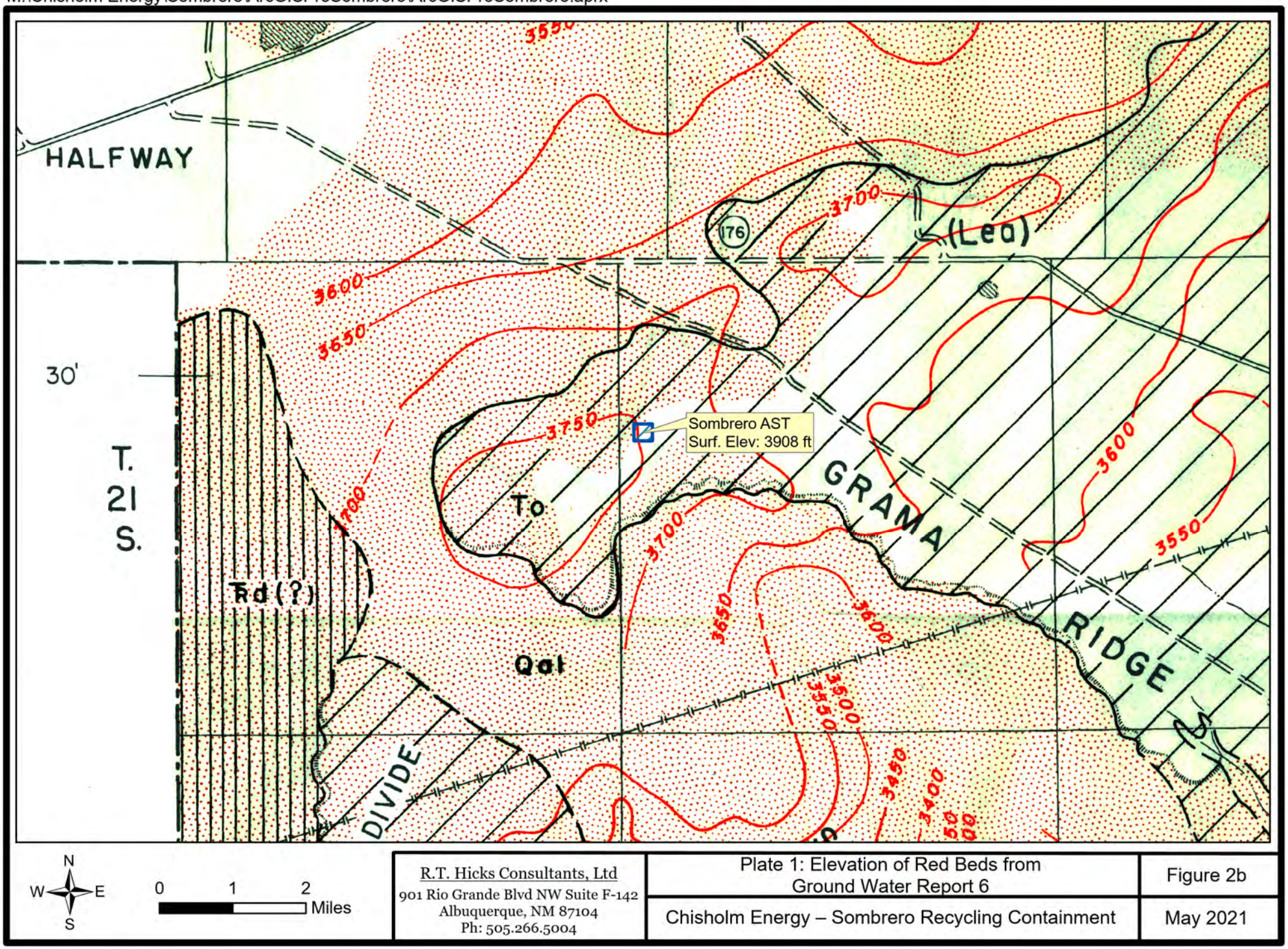
R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Depth to Water and Geology Legend	Figure 1
	Chisholm Energy – Sombrero Recycling Containment	May 2021

M:\Chisholm Energy\Sombrero\ArcGISProSombrero\ArcGISProSombrero.aprx



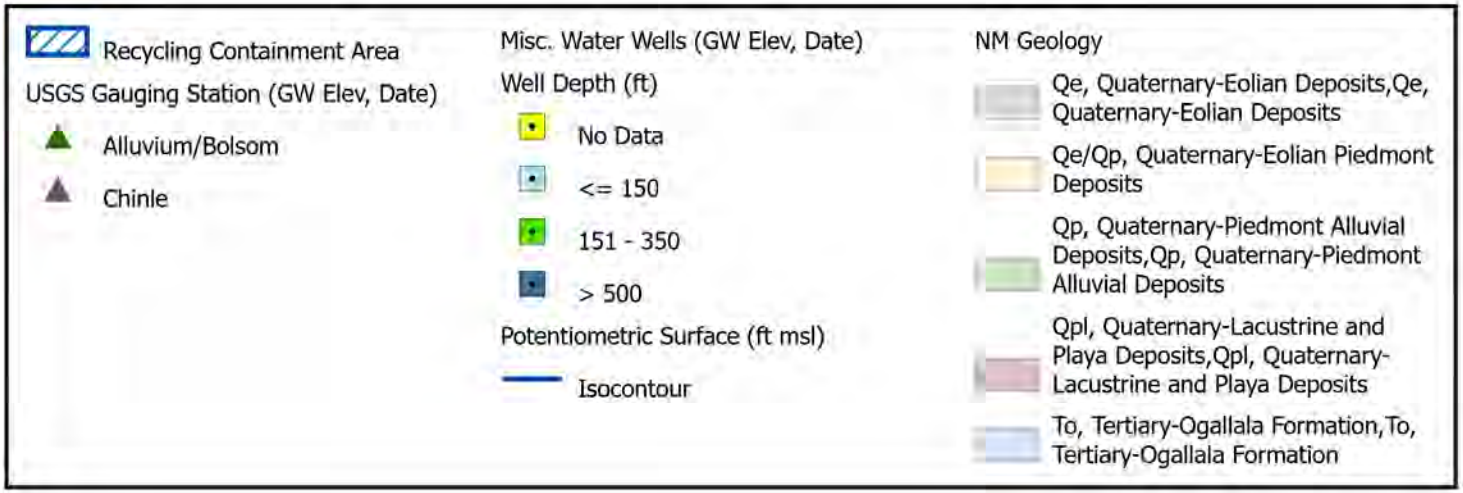
R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Groundwater Elevation, Geology, and Potentiometric Surface	Figure 2a
	Chisholm Energy – Sombrero Recycling Containment	May 2021

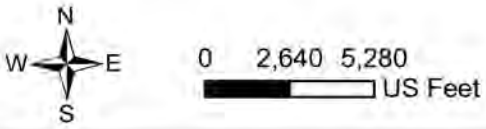
M:\Chisholm Energy\Sombrero\ArcGISProSombrero\ArcGISProSombrero.aprx



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Plate 1: Elevation of Red Beds from Ground Water Report 6	Figure 2b
	Chisholm Energy – Sombrero Recycling Containment	May 2021

M:\Chisholm Energy\Sombrero\ArcGISProSombrero\ArcGISProSombrero.aprx





R.T. Hicks Consultants, Ltd
901 Rio Grande Blvd NW Suite F-142
Albuquerque, NM 87104
Ph: 505.266.5004

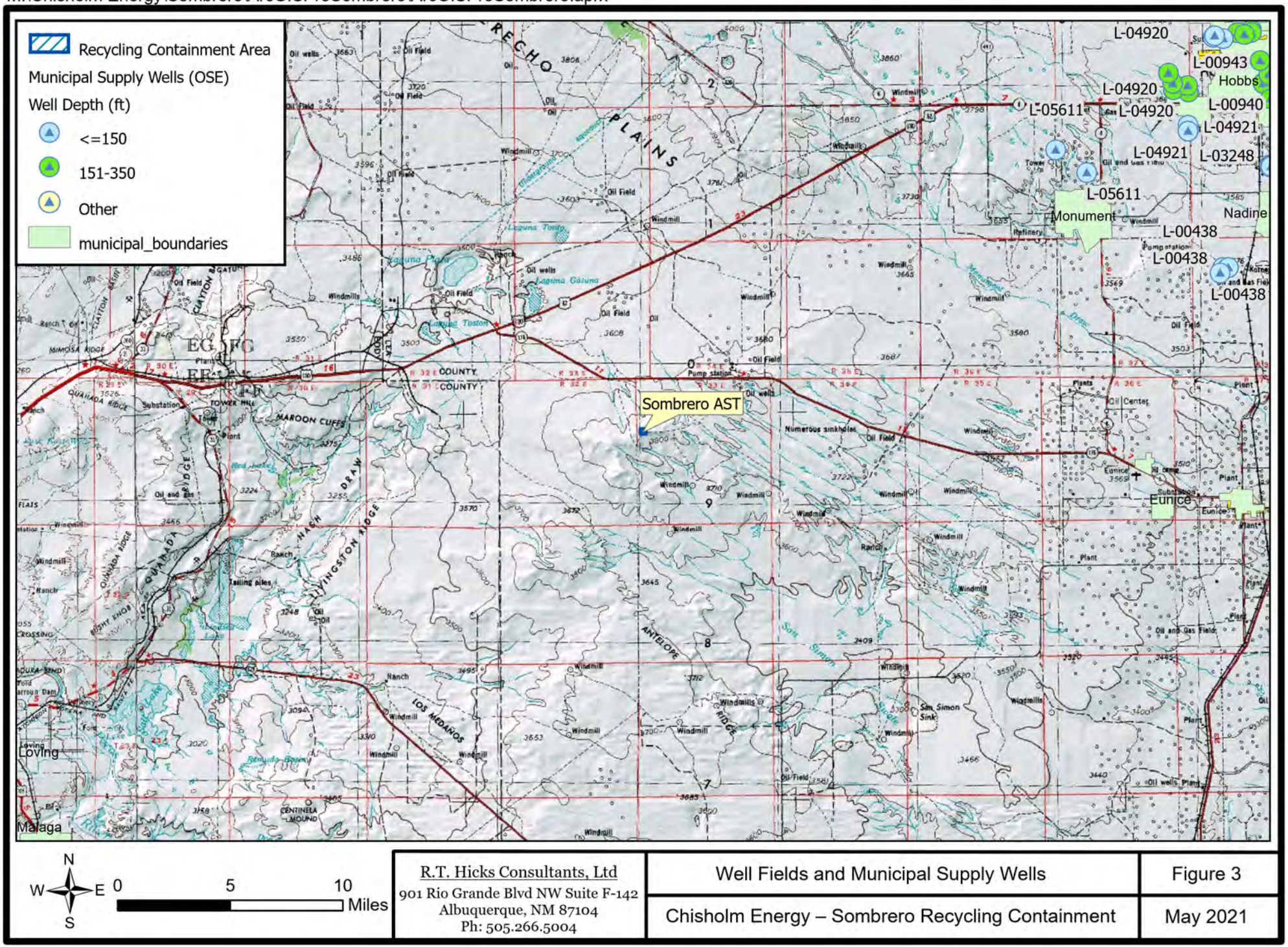
Groundwater Elevation, Geology, and Potentiometric Surface Legend

Figure 2

Chisholm Energy – Sombrero Recycling Containment

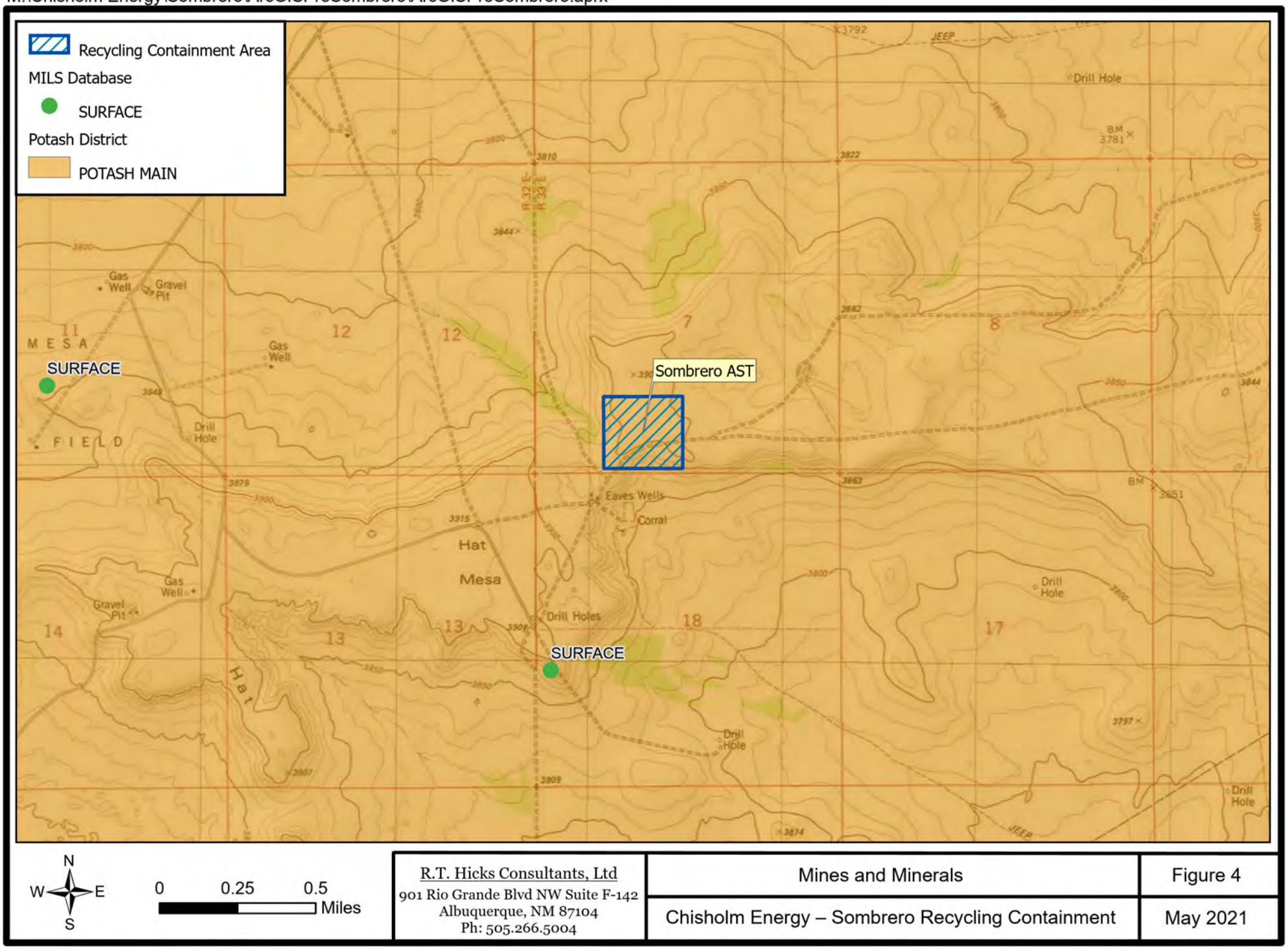
May 2021

M:\Chisholm Energy\Sombrero\ArcGISProSombrero\ArcGISProSombrero.aprx



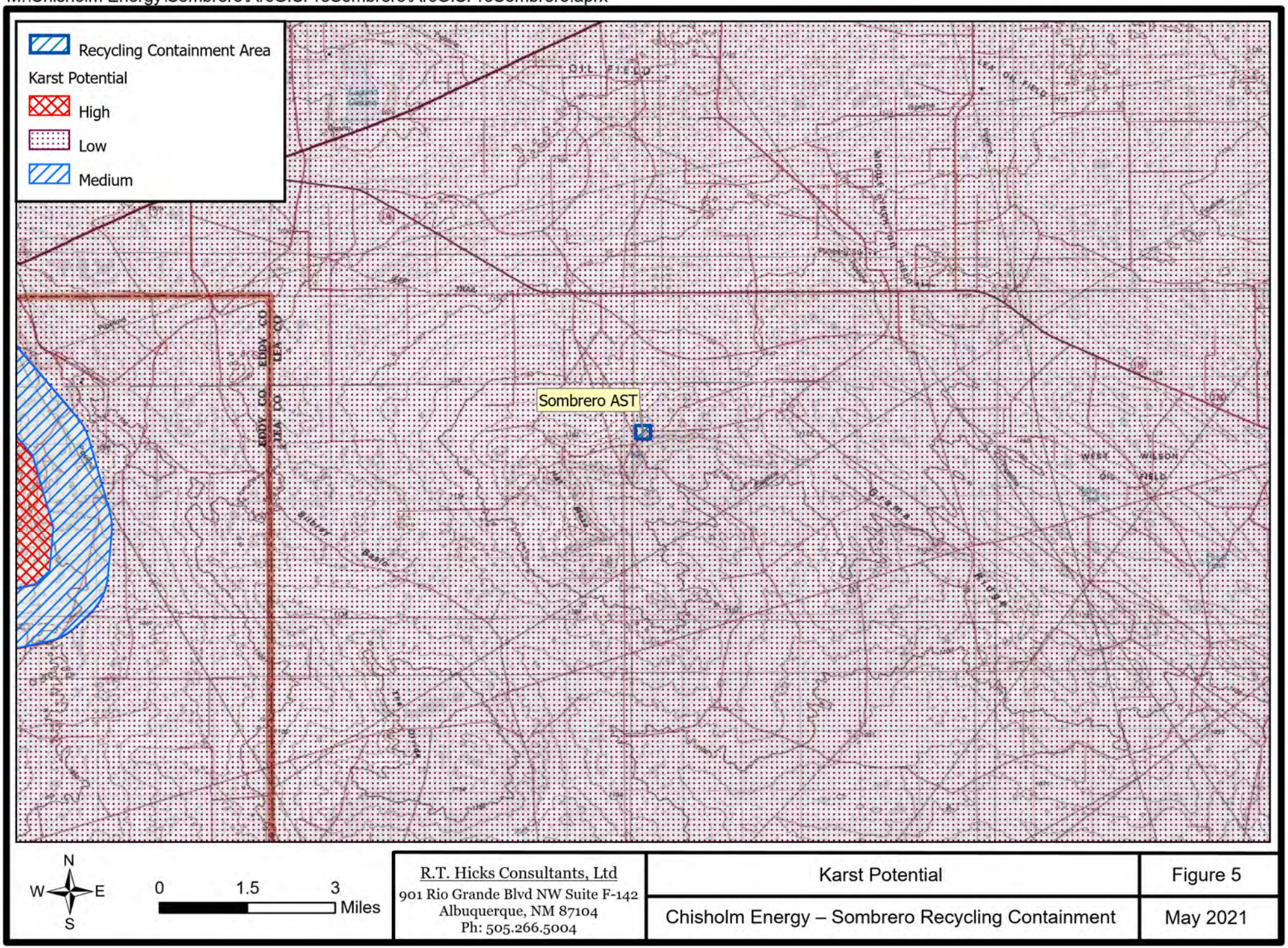
R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Well Fields and Municipal Supply Wells	Figure 3
	Chisholm Energy – Sombrero Recycling Containment	May 2021

M:\Chisholm Energy\Sombrero\ArcGISProSombrero\ArcGISProSombrero.aprx



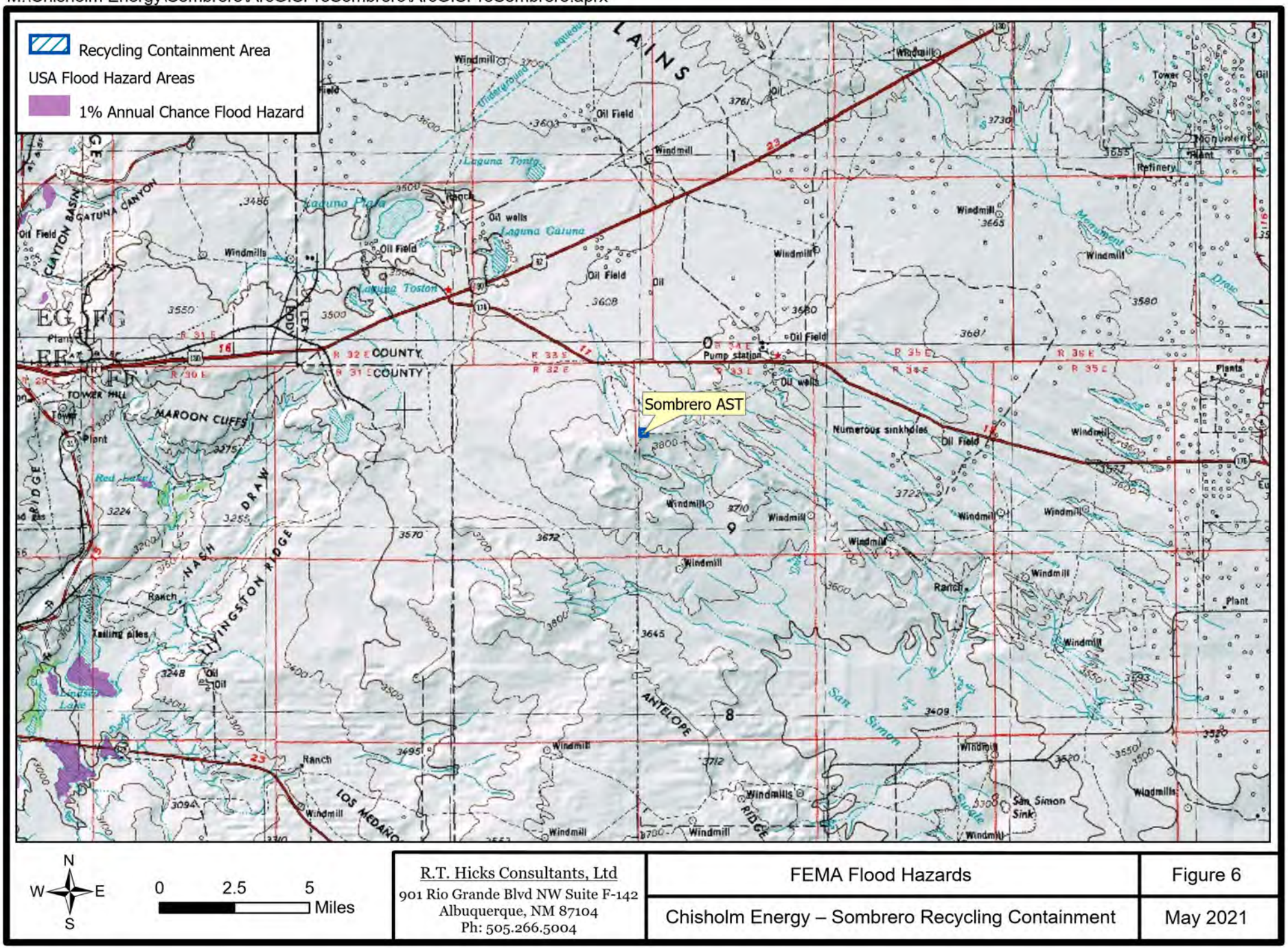
R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Mines and Minerals	Figure 4
	Chisholm Energy – Sombrero Recycling Containment	May 2021

M:\Chisholm Energy\Sombrero\ArcGISProSombrero\ArcGISProSombrero.aprx



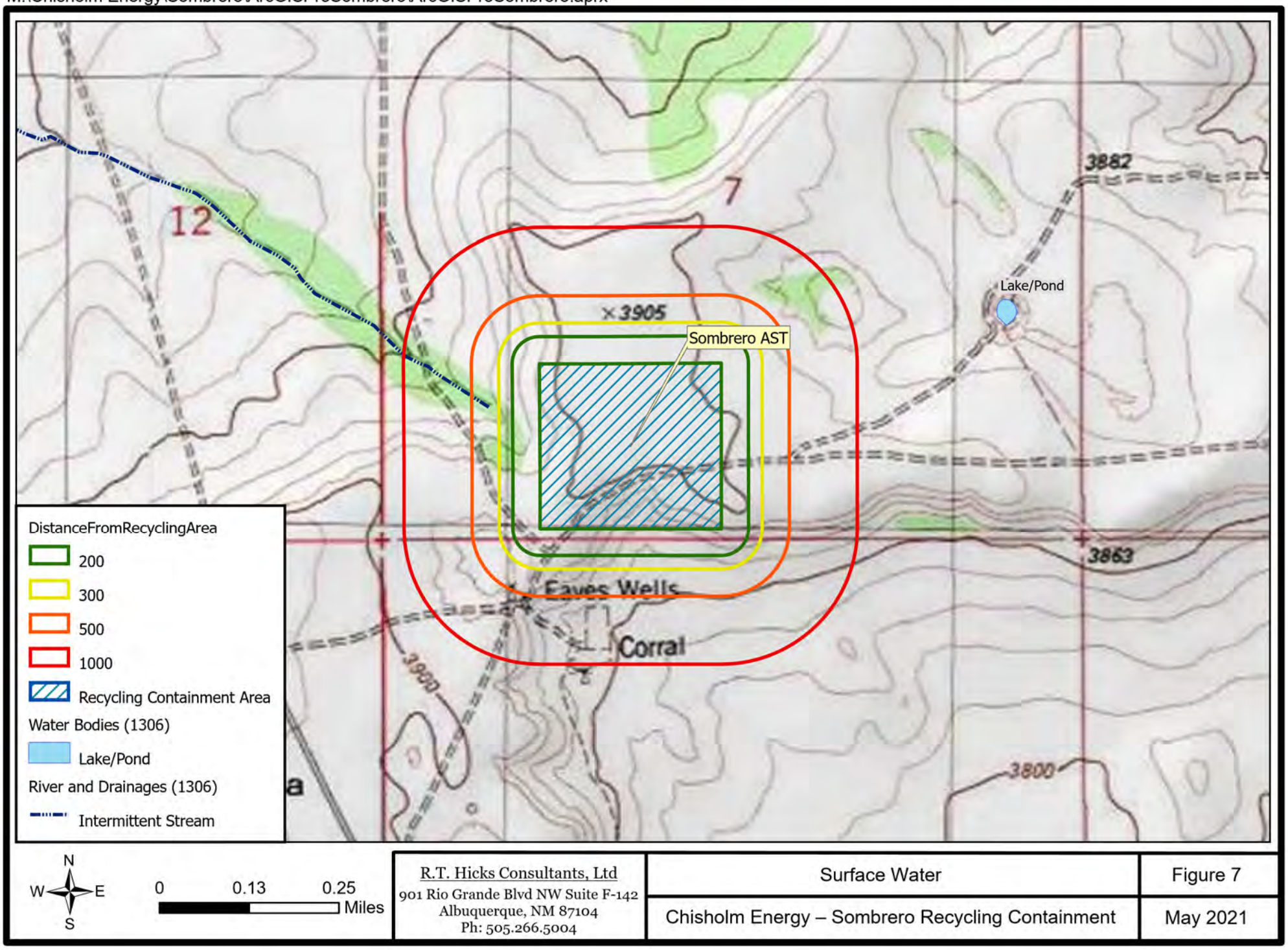
R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Karst Potential	Figure 5
	Chisholm Energy – Sombrero Recycling Containment	May 2021

M:\Chisholm Energy\Sombrero\ArcGISProSombrero\ArcGISProSombrero.aprx



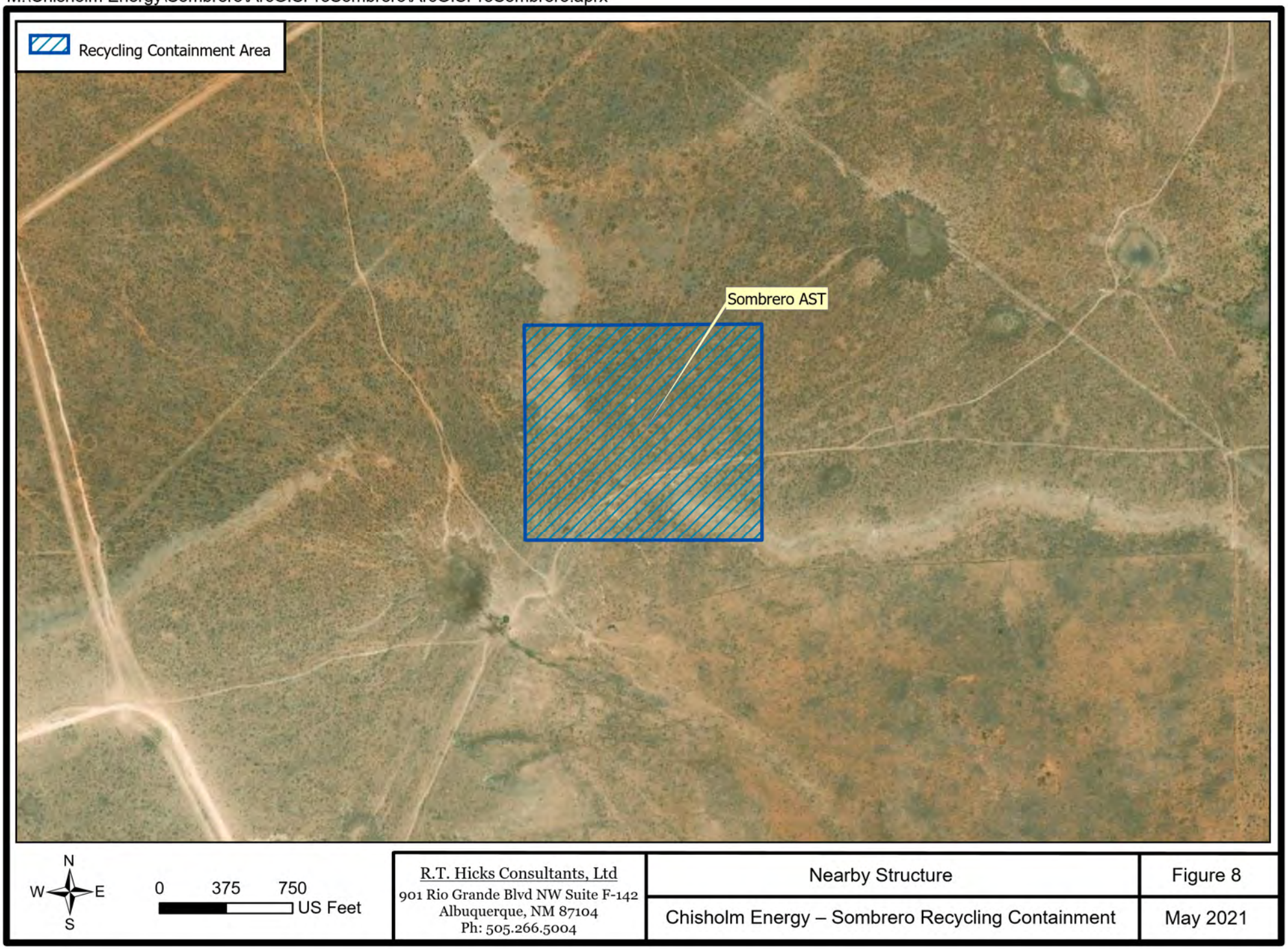
R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	FEMA Flood Hazards	Figure 6
	Chisholm Energy – Sombrero Recycling Containment	May 2021

M:\Chisholm Energy\Sombrero\ArcGISProSombrero\ArcGISProSombrero.aprx



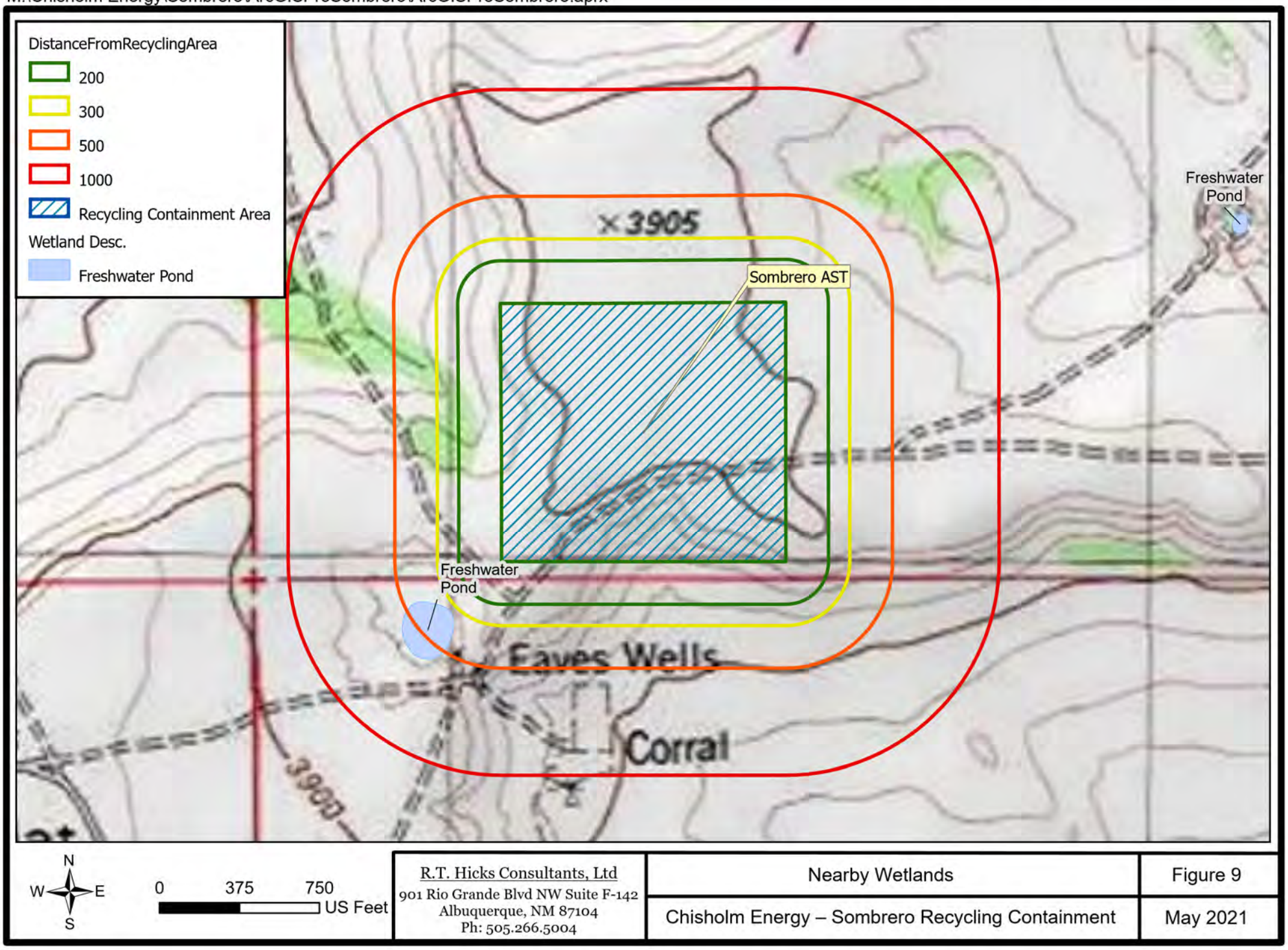
R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Surface Water	Figure 7
	Chisholm Energy – Sombrero Recycling Containment	May 2021

M:\Chisholm Energy\Sombrero\ArcGISProSombrero\ArcGISProSombrero.aprx



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Nearby Structure	Figure 8
	Chisholm Energy – Sombrero Recycling Containment	May 2021

M:\Chisholm Energy\Sombrero\ArcGISProSombrero\ArcGISProSombrero.aprx



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Nearby Wetlands	Figure 9
	Chisholm Energy – Sombrero Recycling Containment	May 2021

APPENDIX WELL LOGS

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

1. GENERAL AND WELL LOCATION

OSE POD NO. (WELL NO.)	WELL TAG ID NO.	OSE FILE NO(S).
CP-1701-POD1		

WELL OWNER NAME(S)	PHONE (OPTIONAL)
The Jimmy Mills GST and 2005 GST Trusts	

WELL OWNER MAILING ADDRESS	CITY	STATE	ZIP
c/o Stacey Mills PO Box 1359	Loving	NM	88256-1358

WELL LOCATION (FROM GPS)		DEGREES	MINUTES	SECONDS	
	LATITUDE	32	26	0.5	N
	LONGITUDE	103	39	10.1	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND

* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS – PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE

2. DRILLING & CASING INFORMATION

LICENSE NO.	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD1706	Bryce Wallace	Elite Drillers Corporation

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
10/15/18	11/29/18	840	880	560

COMPLETED WELL IS: [x] ARTESIAN [ ] DRY HOLE [ ] SHALLOW (UNCONFINED)

STATIC WATER LEVEL IN COMPLETED WELL (FT): 457

DRILLING FLUID: [x] AIR [ ] MUD ADDITIVES – SPECIFY:

DRILLING METHOD: [x] ROTARY [ ] HAMMER [ ] CABLE TOOL [ ] OTHER – SPECIFY:

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE (add coupling diameter)	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	20	12.75	ASTM53 Grade B Steel	N/A	12.57	.188	
+2	460	12.25	ASTM53 Grade B steel	Welded	6.065	.28	
460	840	12.25	SDR17 PVC	Spline	6	SDR17	.032

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT
0	20	12.75	Portland I/II Cement	17	Pour
0	453	12.25	Baroid Benseal Grout	247	Trimmie
453	860	12.25	8/16 Silica Sand	285	Pour

FOR OSE INTERNAL USE WR-20 WELL RECORD & LOG (Version 06/30/17)

FILE NO.	CP-1701	POD NO.	1	TRN NO.	619305
LOCATION	Exp1	21S.32E.35.31		WELL TAG ID NO.	—

PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES **(attach supplemental sheets to fully describe all units)**	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	5	5	Topsoil	Y N	
5	8	3	Caliche	Y N	
8	80	72	Tan/Red sandy caliche	Y N	
80	190	110	Red clay	Y N	
190	400	210	Tan/Red sandstone	Y N	
400	560	160	Red siltstone	Y N	
560	575	15	Red siltstone/Gyp	✓ Y N	5.00
575	750	175	Red siltstone	Y N	
750	770	20	Red siltstone/Gyp	✓ Y N	25.00
770	840	70	Red siltstone	Y N	
840	880	40	Red Shale	Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA:

☑ PUMP ☐ AIR LIFT ☐ BAILER ☐ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm): 30.00

5. TEST; RIG SUPERVISION

WELL TEST — TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Bryce Wallace — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

12/10/2018 — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/30/2017)

FILE NO. CP-1701	POD NO. 1	TRN NO. 619305	
LOCATION Exp1 215.32E.35.31		WELL TAG ID NO. —	PAGE 2 OF 2

madison@rthicksconsult.com

From: Christopher Cortez <chris@atkinseng.com>
Sent: Tuesday, May 4, 2021 4:54 PM
To: r@rthicksconsult.com
Cc: madison@rthicksconsult.com
Subject: RE: Solaris - Zeus - Depth to Water Measurement

Randall,

I find Bryce Wallace to be a good driller. I think his water level measurement in this well is accurate as described in the log.

Chris

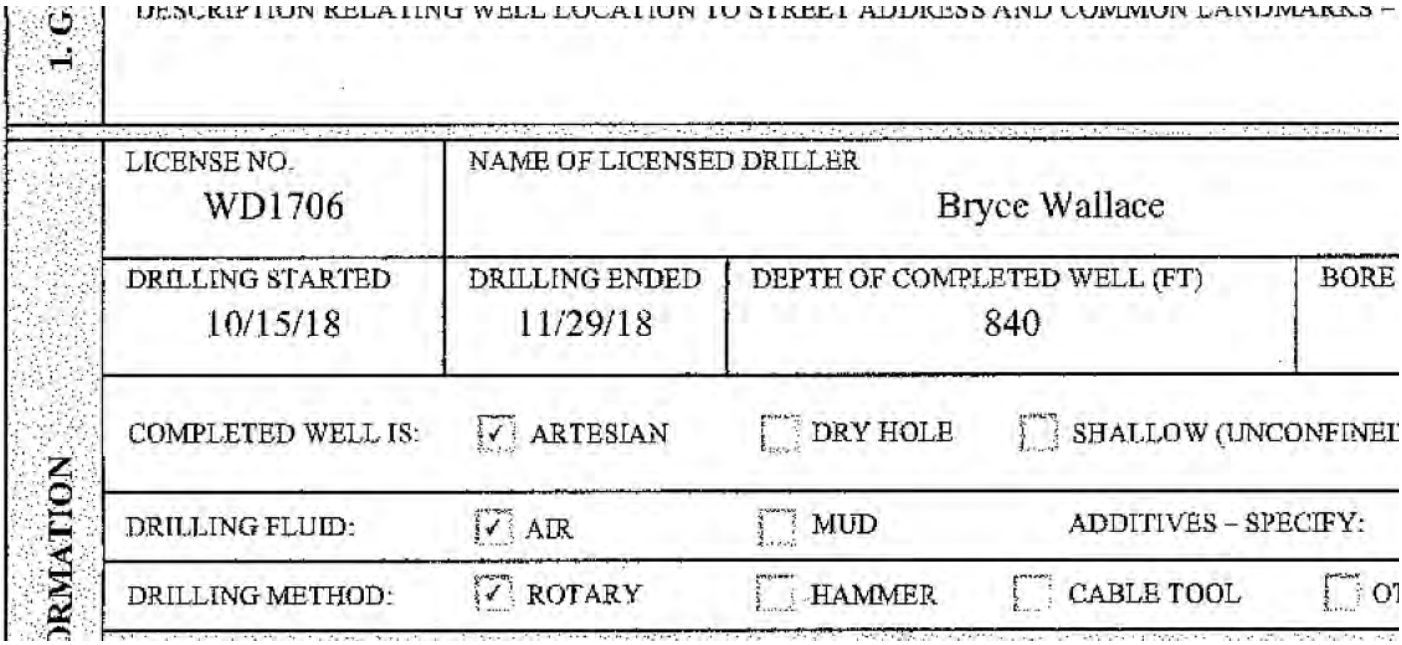
From: r@rthicksconsult.com <r@rthicksconsult.com>
Sent: Tuesday, May 4, 2021 4:44 PM
To: Christopher Cortez <chris@atkinseng.com>
Cc: madison@rthicksconsult.com
Subject: Solaris - Zeus - Depth to Water Measurement

Chris

You are listed as the agent for the application associated with this well drilled in 2018. How accurate is the listed static water level – in your opinion? I do not want my folks to bother with asking permission to lower a 500-foot Powers Water Level meter down this hole if you think the static is accurate to within 100 feet.

This is for a permit of a recycling facility that is about a mile to the east.

I appreciate your help.



1. G	DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS –			
	LICENSE NO. WD1706	NAME OF LICENSED DRILLER Bryce Wallace		
	DRILLING STARTED 10/15/18	DRILLING ENDED 11/29/18	DEPTH OF COMPLETED WELL (FT) 840	BORE
	COMPLETED WELL IS: ☑ ARTESIAN	☐ DRY HOLE	☐ SHALLOW (UNCONFINED	
	DRILLING FLUID: ☑ AIR	☐ MUD	ADDITIVES – SPECIFY:	
ORMATION	DRILLING METHOD: ☑ ROTARY	☐ HAMMER	☐ CABLE TOOL	☐ OT

Randall Hicks, PG
505-238-9515 (cell)
505-266-5004
901 Rio Grande Blvd. NW
Suite F-142
Albuquerque, NM 87104

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

STATE ENGINEER OFFICE

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER): 1	OSE FILE NUMBER(S): CP-1151
WELL OWNER NAME(S): Caza Operating LLC, Richard Wright	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: 200 North Loraine	CITY: Midland, STATE: Tx, ZIP: 79701

WELL LOCATION (FROM GPS)

	DEGREES	MINUTES	SECONDS	
LATITUDE	32	32	0.446	N
LONGITUDE	-103	38	3827	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE

N½ Sec. 32 Township 22S Range 36E

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1292	Billy L. Bentle	Bentle Water Well Ser.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
2-21-13	4-12-13		823	

STATIC WATER LEVEL IN COMPLETED WELL (FT):

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED)

DRILLING FLUID: ( ) AIR (•) MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER (•) CABLE TOOL ( ) OTHER – SPECIFY:

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
+1	6	18	A-53 B	PE	12¼	.250	—
0	823	6	none dry hole				

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT
0	6	18	~~Cement~~ Cement	3	Tremie
0	823	6	Cement	340	Tremie

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	CP-1151	POD NUMBER	1	TRN NUMBER	520275
LOCATION	OWD	22S.35E.35.222			PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	3	3	Top Soil	○ Y ● N	
3	11	8	Caliche	○ Y ● N	
11	20	9	Sandy Clay	○ Y ● N	
20	28	8	Dry Sand	○ Y ● N	
28	31	3	Rock	○ Y ● N	
31	53	22	Red Sandy Clay	○ Y ● N	
53	131	78	Red Bed	○ Y ● N	
131	162	31	Lime	○ Y ● N	
162	193	31	Sand	○ Y ● N	
193	260	67	Red Bed	○ Y ● N	
260	336	76	Rock	○ Y ● N	
336	484	148	Red Bed w/sand stringers	○ Y ● N	
484	519	35	Red & Blue Clay	○ Y ● N	
519	529	10	Sand	○ Y ● N	
529	543	14	Hard Red & Blue Clay	○ Y ● N	
543	638	95	Red & Blue clay w/tight sand stringers	○ Y ● N	
638	730	92	Red & Blue Clay	○ Y ● N	
730	732	2	Rock	○ Y ● N	
732	823	95	Red Bed	○ Y ● N	
				○ Y ○ N	
				○ Y ○ N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ○ PUMP ● AIR LIFT ○ BAILER ○ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm): Dry

5. TEST; RIG SUPERVISION

WELL TEST — TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

!!!!!!!!!!!!!

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Billy Bantle — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

4-27-13 — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	CP-1151	POD NUMBER	1	TRN NUMBER	520275
LOCATION	OWD	225.35E.35.222			PAGE 2 OF 2

Locator Tool Report

General Information:

Application ID:29 Date: 02-24-2017 Time: 10:27:10

WR File Number: CP-01151
Purpose: POINT OF DIVERSION

Applicant First Name: RANDALL
Applicant Last Name: HICKS

GW Basin: CAPITAN
County: LEA

Critical Management Area Name(s): NONE
Special Condition Area Name(s): NONE
Land Grant Name: NON GRANT

PLSS Description (New Mexico Principal Meridian):

SE 1/4 of SE 1/4 of NW 1/4 of SE 1/4 of Section 27, Township 20S, Range 33E.

Coordinate System Details:

Geographic Coordinates: Well Drillers Lat and Long

Latitude:	32 Degrees	32 Minutes	26.8 Seconds	N
Longitude:	103 Degrees	38 Minutes	49.6 Seconds	W

Universal Transverse Mercator Zone: 13N

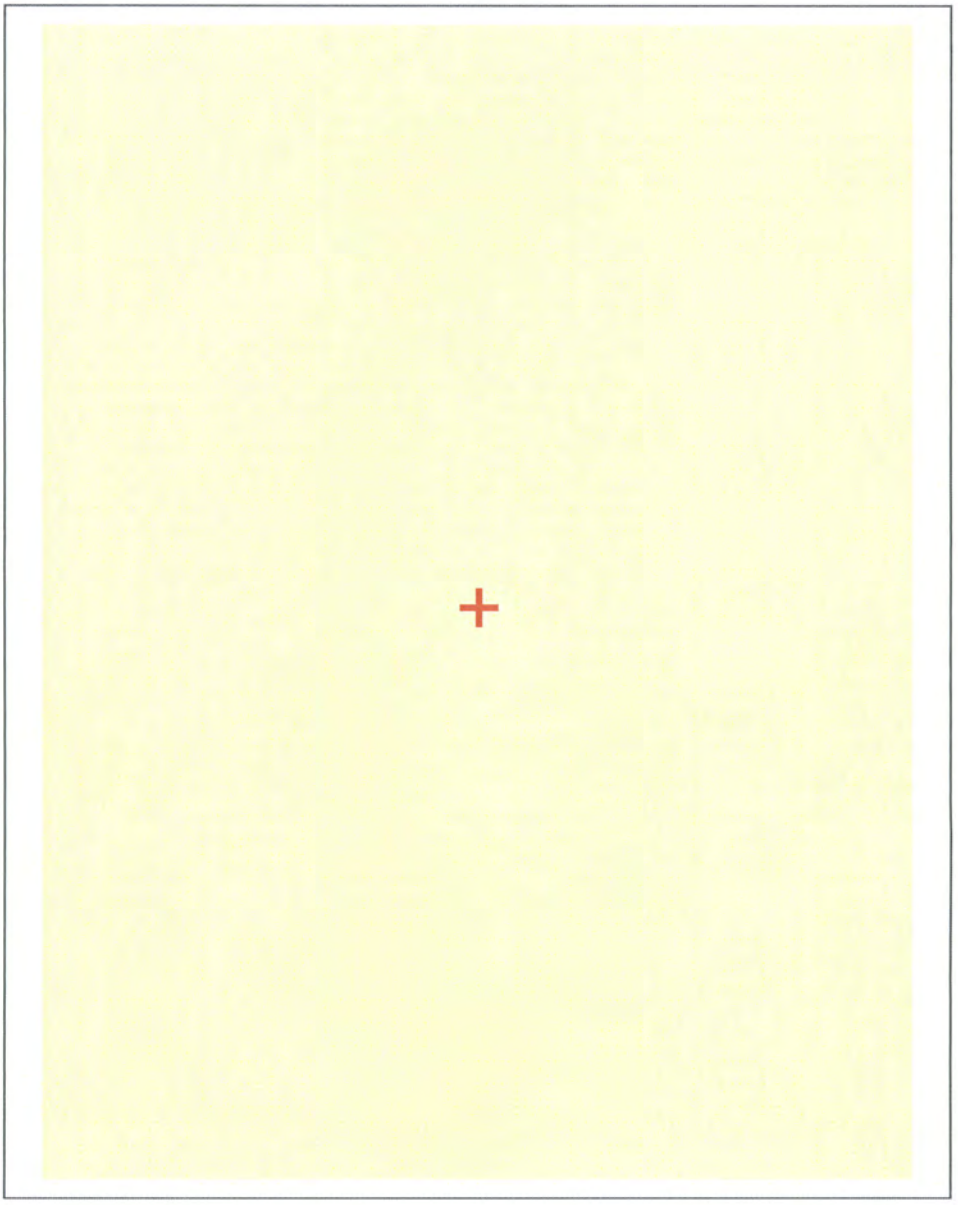
NAD 1983(92) (Meters)	N: 3,601,185	E: 627,036
NAD 1983(92) (Survey Feet)	N: 11,814,888	E: 2,057,202
NAD 1927 (Meters)	N: 3,600,982	E: 627,086
NAD 1927 (Survey Feet)	N: 11,814,223	E: 2,057,363

State Plane Coordinate System Zone: New Mexico East

NAD 1983(92) (Meters)	N: 171,037	E: 229,454
NAD 1983(92) (Survey Feet)	N: 561,143	E: 752,801
NAD 1927 (Meters)	N: 171,018	E: 216,902
NAD 1927 (Survey Feet)	N: 561,081	E: 711,620

NEW MEXICO OFFICE OF STATE ENGINEER

Locator Tool Report



WR File Number: CP-01151 Scale: 1:57,473

Northing/Easting: UTM83(92) (Meter): N: 3,601,185 E: 627,036

Northing/Easting: SPCS83(92) (Feet): N: 561,143 E: 752,801

GW Basin: Capitan

Scott A. Verhines, P.E.
State Engineer

well Office
1900 WEST SECOND STREET
ROSWELL, NM 88201

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER

Trn Nbr: 520275
File Nbr: CP 01151
Well File Nbr: CP 01151 POD1

Apr. 29, 2013

RANDALL T HICKS
CAZA OPERATING LLC
901 RIO GRANDE NW, F-142
ALBUQUERQUE, NM 87104

Greetings:

The above numbered permit was issued in your name on 01/22/2013.

The Well Record was received in this office on 04/24/2013, stating that it had been completed on 04/12/2013, and was a dry well. The well is to be plugged or capped or otherwise maintained in a manner satisfactory to the State Engineer.

Please note that another well can be drilled under this permit if the well is completed and the well log filed on or before 01/31/2014.

If you have any questions, please feel free to contact us.

Sincerely,

Yolanda Mendiola
(575)622-6521

STATE ENGINEER OFFICE

WELL RECORD

Revised June 1972

476275

Section 1. GENERAL INFORMATION

(A) Owner of well Glenn's Water Well Service Owner's Well No. _____

Street or Post Office Address P.O. Box 692

City and State Tatum, New Mexico 88267

Well was drilled under Permit No. CP-854 and is located in the:

a. ____ ¼ ____ ¼ NW ¼ NE ¼ of Section 33 Township 21-S. Range 33-E. N.M.P.M.

b. Tract No. _____ of Map No. _____ of the _____

c. Lot No. _____ of Block No. _____ of the _____
Subdivision, recorded in _____ County.

d. X= _____ feet, Y= _____ feet, N.M. Coordinate System _____ Zone in the _____ Grant.

(B) Drilling Contractor Glenn's Water Well Service License No. WD -421

Address P.O. Box 692 Tatum, New Mexico 88267

Drilling Began 6-22-96 Completed 6-22-96 Type tools rotary Size of hole 7 7/8 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 950 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 600 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
755	805	50	brown sand (coarse)	100 gpm
860	890	30	brown sand (coarse)	

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
8 5/8	.188		1	16	16			
6 5/8	.188		1	950	950	none	760	950

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement

Section 5. PLUGGING RECORD

Plugging Contractor _____

Address _____

Plugging Method _____

Date Well Plugged _____

Plugging approved by:

_____
State Engineer Representative

No.	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY 21.33.33.211413 #130944

Date Received 07-11-96

Quad _____ FWL _____ FSL _____

CP-854

File No. _____ Use OWD Location No. 21.33.33.211413

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	6	6	sand
6	20	14	caleche
20	30	10	white clay
30	45	15	red clay
45	68	23	green sandrock
68	72	4	hard rock
72	105	33	red clay
105	128	23	brown shale
128	195	67	red clay
195	300	105	brown shale
300	520	220	brown and red clay
520	555	35	blue sandy shale
555	560	5	red and brown shale
560	630	70	brown shale
630	735	105	red clay
735	745	10	brown sandy shale
745	755	10	brown sand rock
755	805	50	brown sand (coarse-some gravel-water)
805	860	55	brown sandrock (with stringers of brown shale)
860	890	30	brown sand (coarse-water)
890	910	20	brown sandrock
910	930	20	brown shale
930	950	20	red clay

Section 7. REMARKS AND ADDITIONAL INFORMATION

well drilled with air and foam to 300'

well drilled (dusted) with air only to 735'

no water to 735'

went back to foam after getting water at 755'

STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO
'96 JUL 11 AM 10 25

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

Corky Glenn
Driller

INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

June 2021

Volume 2
C-147 Registration Package for Sombrero Above-Ground Storage Tank
Section 7, T21S, R33E, Lea County

Engineering Drawings and Liner Specifications

Design/Construction Plan

Select Energy Services Manual

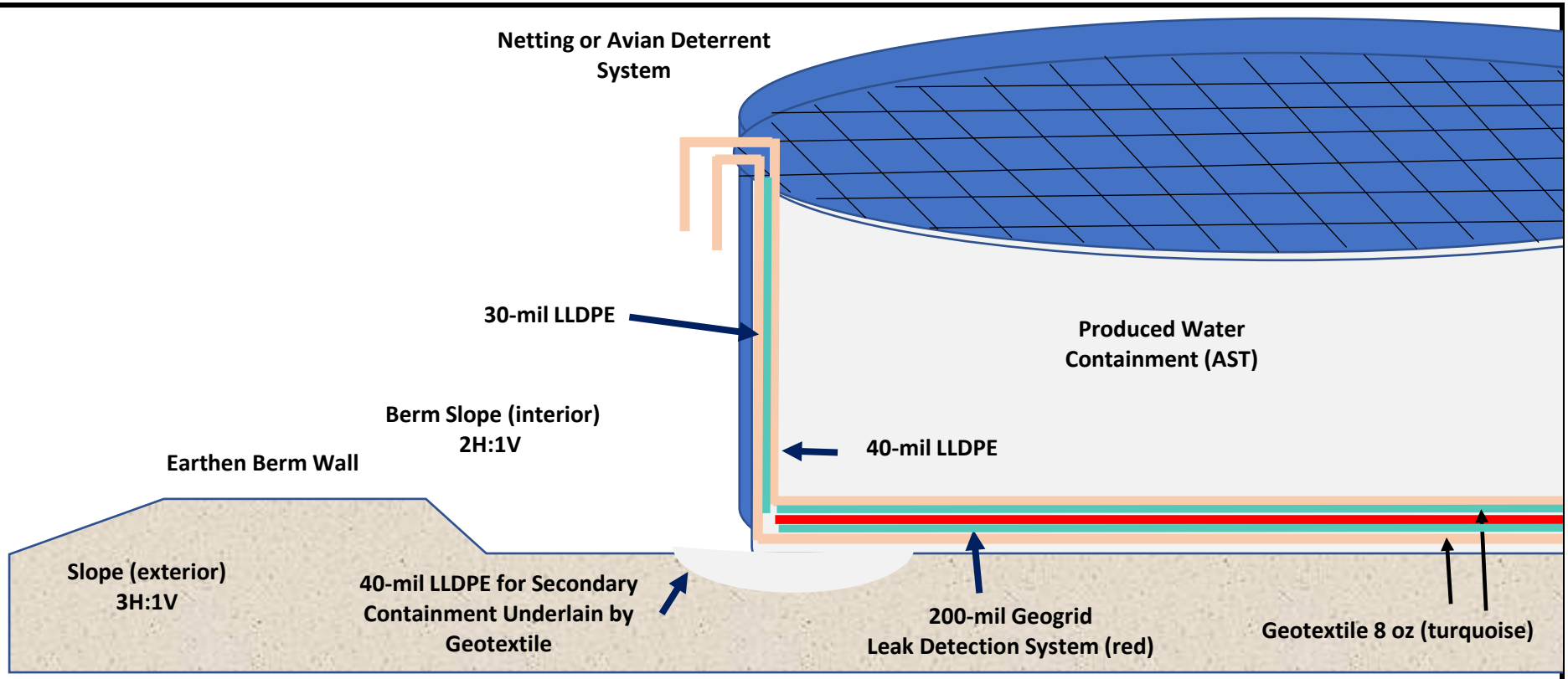
Variances for AST Storage Containments

Applicability of Engineering Variances to Variety of Site Conditions in Permian Basin

Existing pad with current drilling.

Prepared for:
Chisholm Energy Operating LLC
801 Cherry St Suite 1200 Unit 20
Fort Worth, TX 76102

Prepared by:
R.T. Hicks Consultants, Ltd.
901 Rio Grande NW F-142
Albuquerque, New Mexico



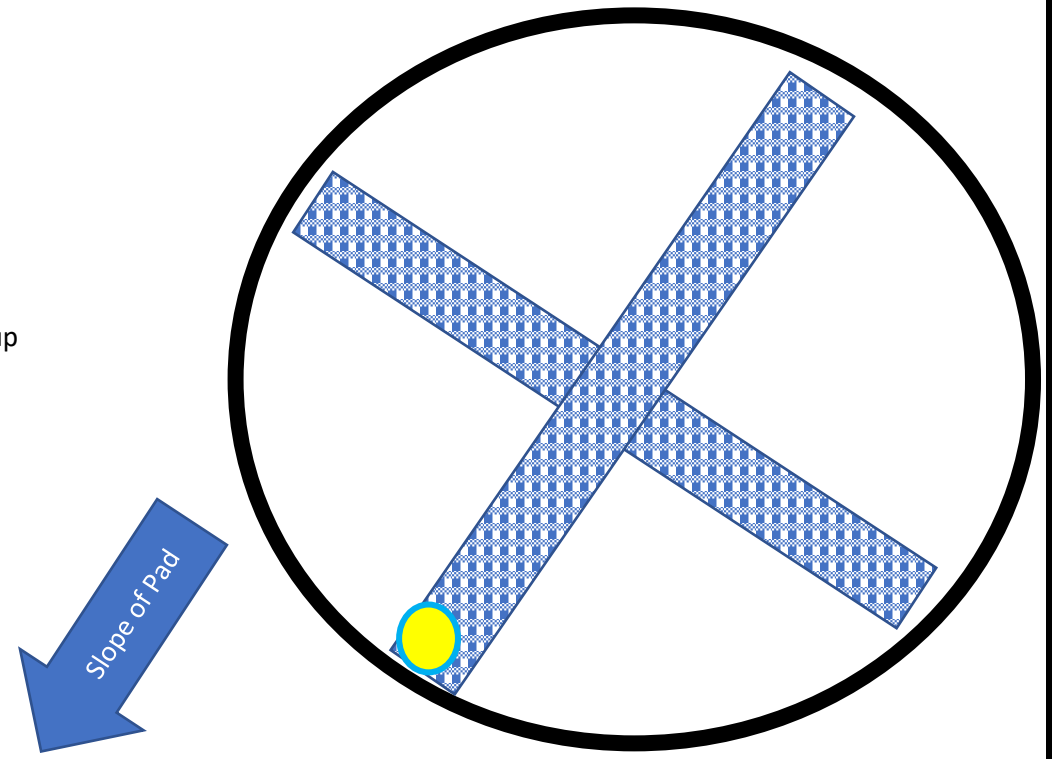
Description of Leak Detection System

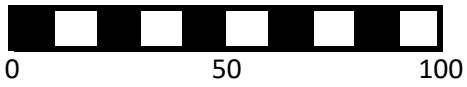
- 2 30-mil LLDPE comprise primary liner and 30-mil LLDPE comprise the secondary liner
- 200-mil geogrid drainage layer lies between the primary and secondary liner per Plate 2
- Geotextile between the geogrid and each liner
- > 3-inch deep sump excavated on four sides of AST as a collection points for any seepage
- A ¾-inch aqua braid line runs from the collection sump beneath the geogrid drainage system to the outside of the AST
- Every week, a portable self-priming peristaltic pump connects to the leak detection system.
- The self-priming pump discharges into a ¾" aqua braid line, through a turbine meter, and back into the AST, on top of the primary liner
- If fluid is detected, it is tested for conductance to determine the origin of the water (i.e. produced water or condensation)

R.T. Hicks Consultants Albuquerque, NM	**Design Sketch**	**Plate 1**
	Peak Oilfield Services	**May-21**

Use laser level to determine slope of pad and low point of AST

Sump at lowest point of the AST set up





Sump Location

R.T. Hicks Consultants Albuquerque, NM	Layout of Geogrid Drainage Mat	Plate 2
	Peak Oilfield Services- Sombrero AST	May 21

STEPHEN N. VALERO, P.E.
4010 New Chapel Hill Way, Cumming, GA 30041
P: 404-557-5884
E: svalero@Wall-Eval.com

March 19, 2015

Matt Smiley
General Manager -Fluids Management, Above-Ground Storage Tanks
Rockwater Energy Solutions
6000 Town Center Boulevard, Suite 165
Canonsburg, PA 15317

Subject: Transmittal - Analysis of Atlantis 48m +3, 18 Panel Above Ground Storage Tank

Dear Mr. Smiley:

As requested, I have analyzed the impact of adding three panels to the standard 48m Atlantis above ground storage tank such the resulting tank diameter is approximately 57.5m (188.6-ft). Results indicate that the loads imparted on the system by this configuration are within acceptable limits under the conditions analyzed. Key information related to this configuration is as follows:

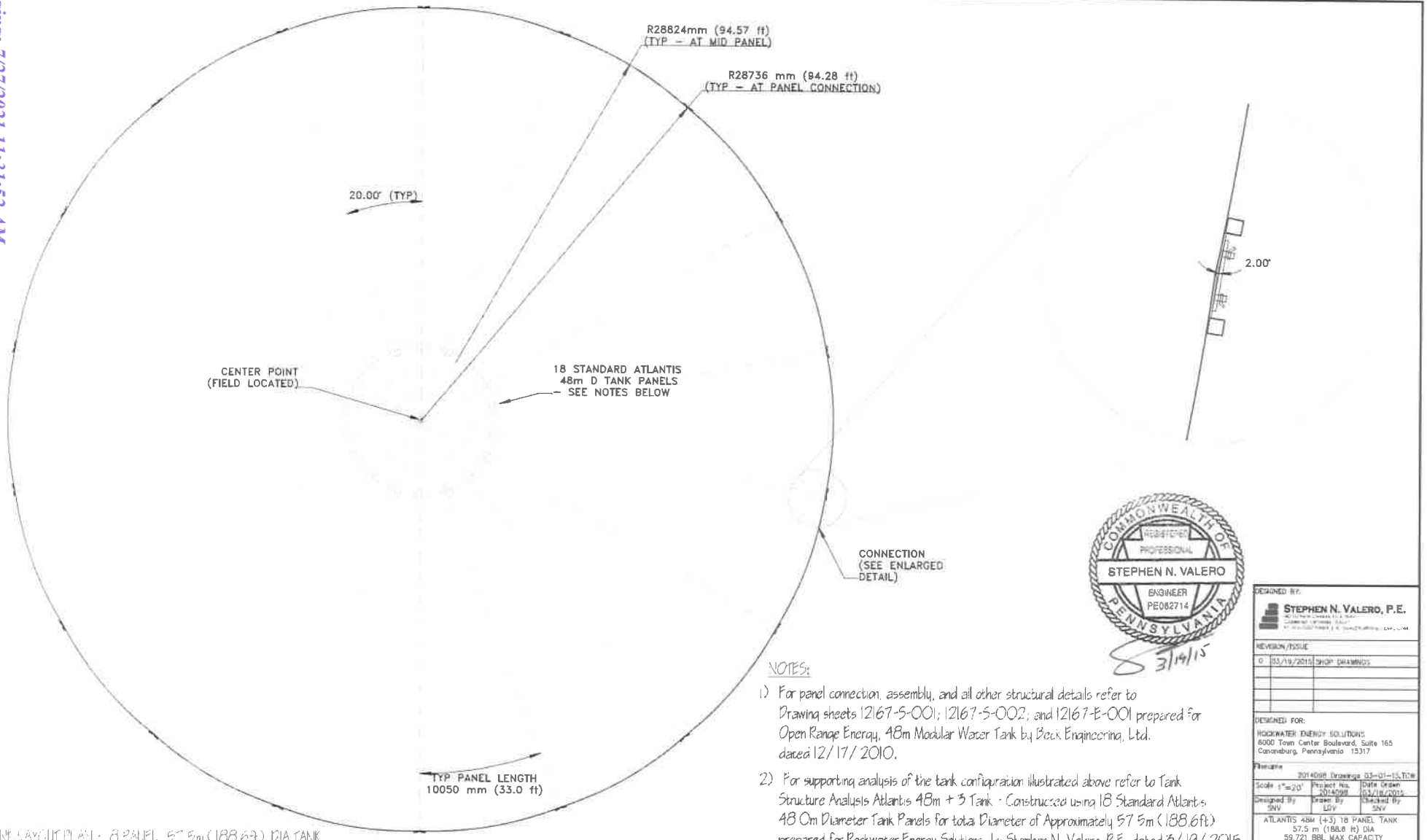
- Minimum (Empty) Diameter: 188.46 ft
- Maximum (Full) Diameter: 188.60 ft
- Maximum (Full) Capacity: 59,721 BBL
- Capacity w/12-in Freeboard: 54,748 BBL
- Capacity w/24-in Freeboard: 49,774 BBL

Supporting calculations and shop drawings listing the basis of the analysis, applicable codes and standards and limitations are provided in the Enclosure. Please review the analysis carefully to ensure that site specific conditions meet the limitations and assumptions of the analysis before installing this system. Thank you for the opportunity to work with you on this project. Please contact me if you have any questions or require additional information.

Sincerely,

Stephen N. Valero, P.E.
Enclosure: Supporting Calculations & Shop Drawings

Enclosure - Supporting Calculations & Shop Drawings



TANK LAYOUT PLAN - 18 PANEL 57.5m (188.6ft) DIA TANK

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
STEPHEN N. VALERO
ENGINEER
PE062714
3/19/15

NOTES:

1) For panel connection, assembly, and all other structural details refer to Drawing sheets 12167-S-001; 12167-S-002; and 12167-E-001 prepared for Open Range Energy, 48m Modular Water Tank by Beck Engineering, Ltd. dated 12/17/2010.

2) For supporting analysis of the tank configuration illustrated above refer to Tank Structure Analysis Atlantis 48m + 3 Tank - Constructed using 18 Standard Atlantis 48.0m Diameter Tank Panels for total Diameter of Approximately 57.5m (188.6ft) prepared for Rockwater Energy Solutions by Stephen N. Valero, P.E. dated 3/19/2015.

DESIGNED BY:
STEPHEN N. VALERO, P.E.

REVISION/ISSUE		
0	03/19/2015	SHOP DRAWINGS

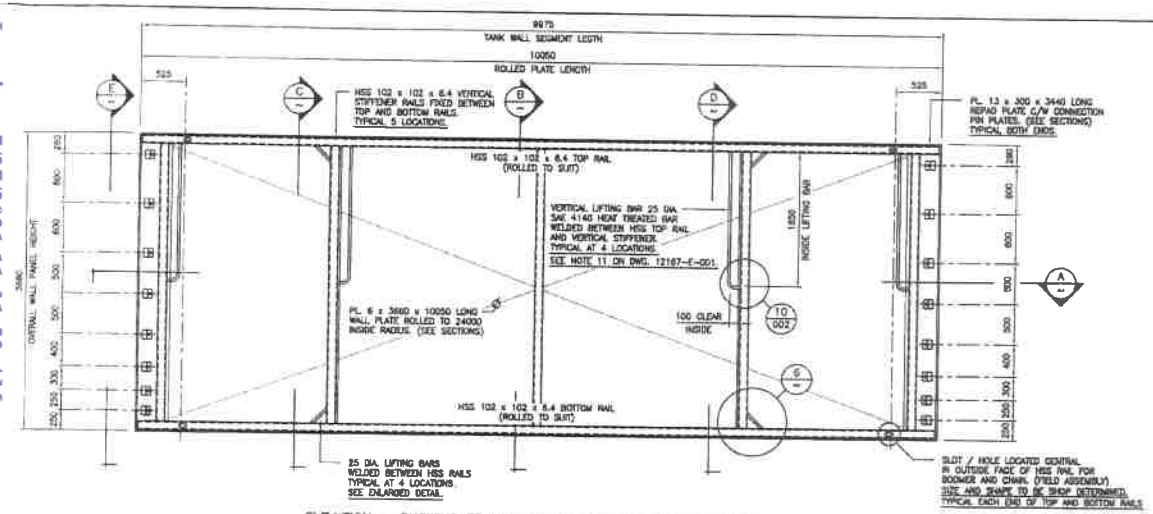
DESIGNED FOR:
ROCKWATER ENERGY SOLUTIONS
8000 Town Center Boulevard, Suite 165
Canonsburg, Pennsylvania 15317

Filename: 20140098 Drawings 03-01-15.TCW

Scale 1"=20'	Project No. 20140098	Date Drawn 03/19/2015
Designed By SNV	Drawn By LDV	Checked By SNV

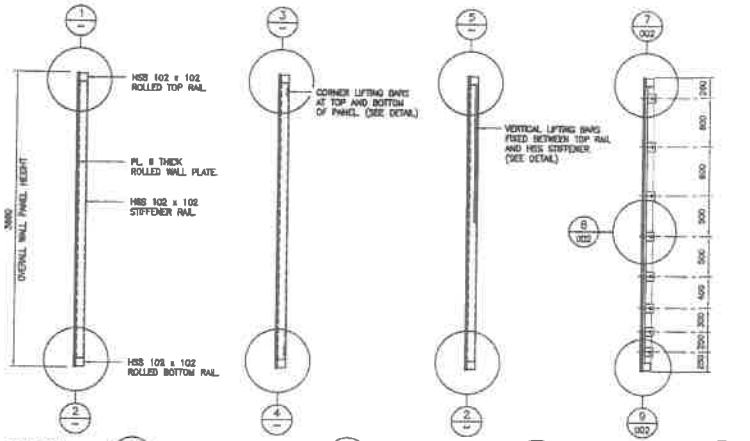
ATLANTIS 48M (+3) 18 PANEL TANK
57.5 m (188.6 ft) DIA
59,721 BBL MAX CAPACITY

TANK LAYOUT PLAN | SH1



ELEVATION – SHOWING FRAMING TO OUTSIDE FACE OF WALL PANEL
SCALE 1 : 30

(x15 PANELS REQUIRED AS DRAWN)

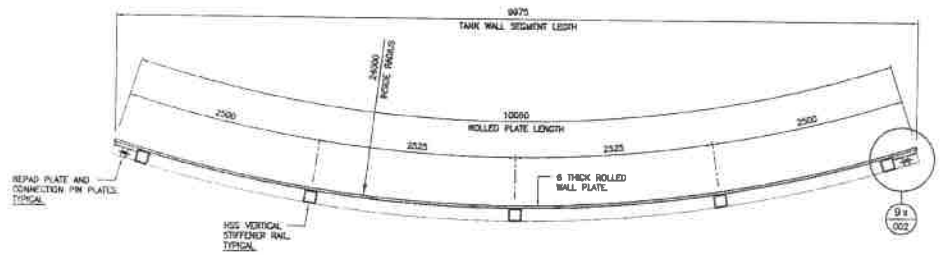


SECTION B SCALE 1 : 30

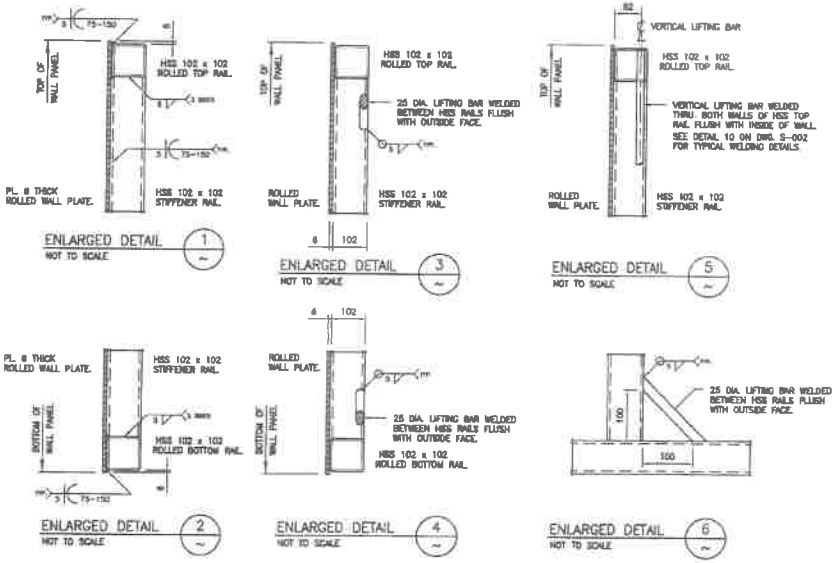
SECTION C SCALE 1 : 30

SECTION D SCALE 1 : 30

ELEVATION E SCALE 1 : 30



TYPICAL PLAN SECTION A SCALE 1 : 30



ENLARGED DETAIL 1 NOT TO SCALE

ENLARGED DETAIL 3 NOT TO SCALE

ENLARGED DETAIL 5 NOT TO SCALE

ENLARGED DETAIL 2 NOT TO SCALE

ENLARGED DETAIL 4 NOT TO SCALE

ENLARGED DETAIL 6 NOT TO SCALE

GENERAL NOTES :

1. STRUCTURAL STEEL DESIGN, FABRICATION AND ERECTION SHALL COMPLY WITH THE LATEST EDITION OF :
   - CSA-S16-01 LIMIT STATES DESIGN OF STRUCTURAL STEEL
   - CISC HANDBOOK OF STEEL CONSTRUCTION
   - CSA W59 WELDED STEEL CONSTRUCTION
2. MATERIALS SHALL CONFORM TO THE FOLLOWING GRADES OF CSA G40.21 :
   - HOLLOW STRUCTURAL SECTIONS – 350W
   - W SHAPES – 350W
   - C AND L SHAPES – 300W
   - PLATE AND ALL OTHER SECTIONS – 300W (Fy = 300 MPa / 44 KSI)
3. ALL WELDING SHALL BE IN ACCORDANCE WITH CSA W59-M 'WELDED STEEL CONSTRUCTION (METAL ARC WELDING)'.
4. FRAMING TO BE OF SOLID WELDED CONSTRUCTION (E-48XX) COPE FRAMING MEMBERS INTO ONE ANOTHER.

APEGGA PERMIT NO. 2042

DWG. NO.	REFERENCE DRAWINGS	REV	REVISIONS	DATE	BY	CHK'D	APP'D	CLIENT APP'D
12167-S-002	TANK WALL PANEL FRAMING DETAILS	A	ISSUED FOR REVIEW	14.12.10	RP	MH		
12167-E-001	TANK ASSEMBLY LAYOUT PLAN & SECTIONS	0	ISSUED FOR CONSTRUCTION	17.12.10	MH			

FILE : 12167-S-001

ENGINEER AND PERMIT STAMPS

Designed :	Date :	Drawn :	Date :	Checked :	Date :
MH	08.12.10	RP	11.12.10	MH	14.12.10

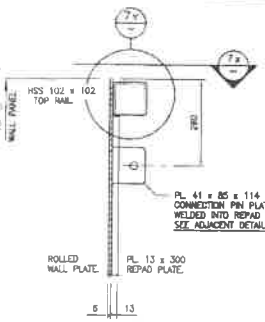
Client : OPEN RANGE ENERGY CORP

Project : 48m dia. MODULAR WATER TANK

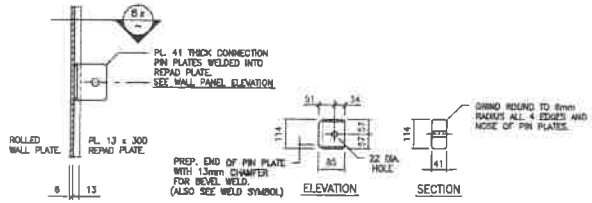
TYPICAL TANK WALL PANEL
FRAMING PLAN, ELEVATION, SECTIONS & DETAILS

Job No.	Scale :	Dwg. No.
12167	AS NOTED	12167-S-001

Beck
ENGINEERING (1992) LTD.
www.beckeng.ab.ca

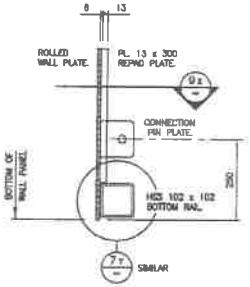


ENLARGED DETAIL 7 / 001
NOT TO SCALE

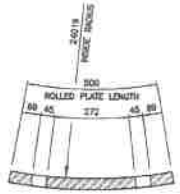


(x16 REQUIRED PER WALL PANEL)

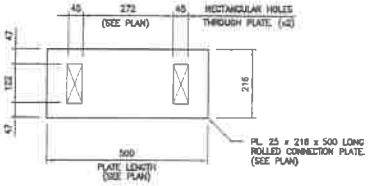
ENLARGED DETAIL 8 / 001
NOT TO SCALE



ENLARGED DETAIL 9 / 001
NOT TO SCALE



PLAN
(EXAGGERATED SCALE)

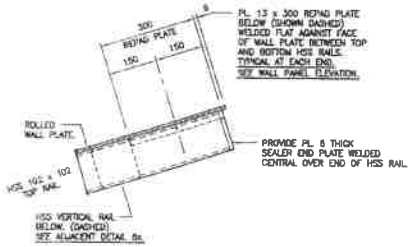


ELEVATION

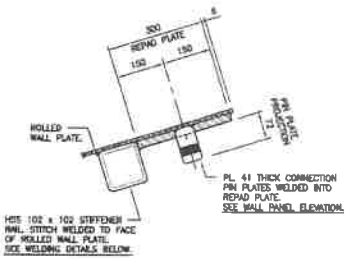
WALL PANEL CONNECTION PLATES

(x8 REQUIRED PER WALL PANEL)

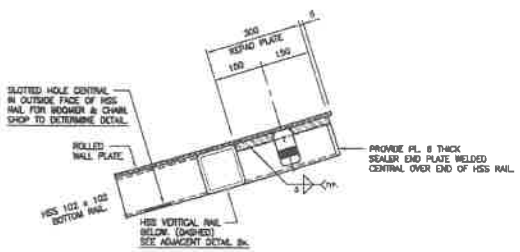
NOTE :
PAINT OUTSIDE FACE OF PLATE FOR IDENTIFICATION PURPOSES ONLY.



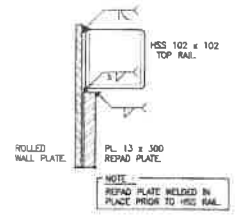
PLAN DETAIL 7x / ~
NOT TO SCALE



PLAN DETAIL 8x / ~
NOT TO SCALE

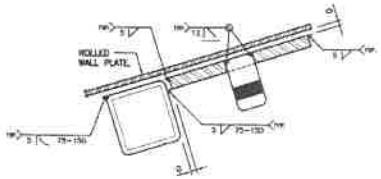


PLAN DETAIL 9x / ~
NOT TO SCALE

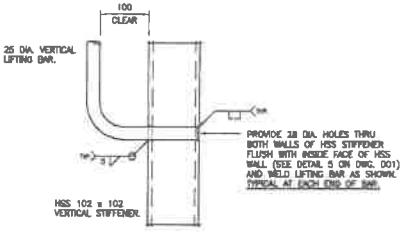


ENLARGED DETAIL 7Y / ~
NOT TO SCALE

EXPLODED TO SHOW WELD DETAILS.



ENLARGED TYPICAL PLAN – EXPLODED TO SHOW WELD DETAILS
NOT TO SCALE



ENLARGED DETAIL 10 / 001
NOT TO SCALE

NOTE :
REFER TO DRAWING 12167-S-001 FOR ALL MATERIAL SPECIFICATIONS AND CONSTRUCTION NOTES.

APEGGA PERMIT NO. 2042

DWG. NO.	REFERENCE DRAWINGS	REV	REVISIONS	DATE	BY	CHK'D	APP'D	CLIENT APP'D
12167-S-001	TANK WALL PANEL FRAMING LAYOUTS	A	ISSUED FOR REVIEW	14.12.10	RP	MH		
		0	ISSUED FOR CONSTRUCTION	17.12.10	MH	MH		

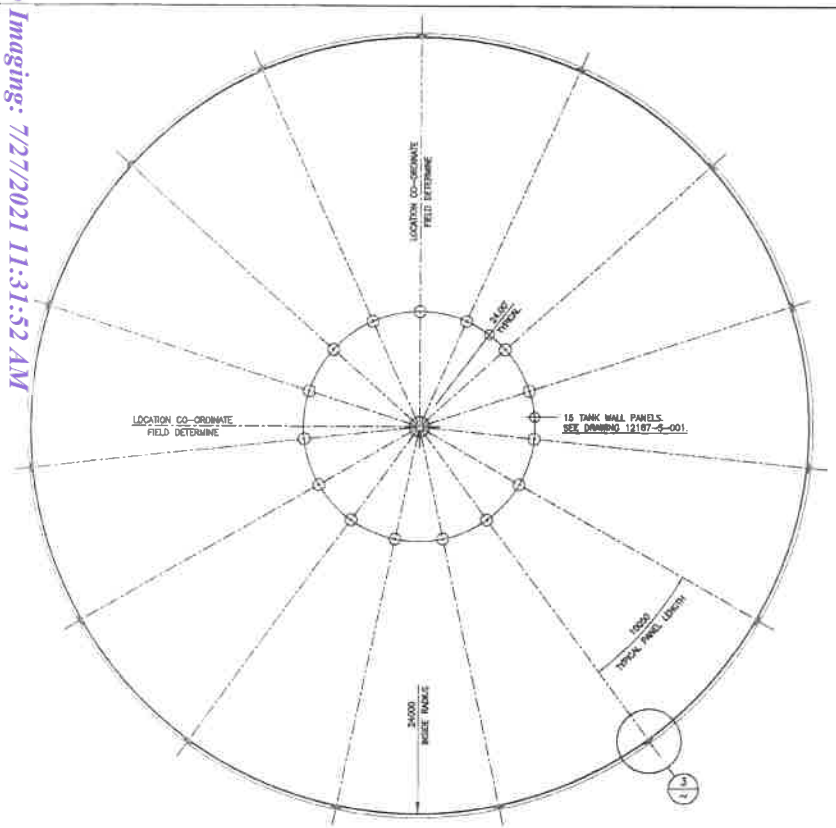
ENGINEER AND PERMIT STAMPS

Client : OPEN RANGE ENERGY CORP
Project : 48m dia. MODULAR WATER TANK
TYPICAL TANK WALL PANEL FRAMING SECTIONS AND DETAILS

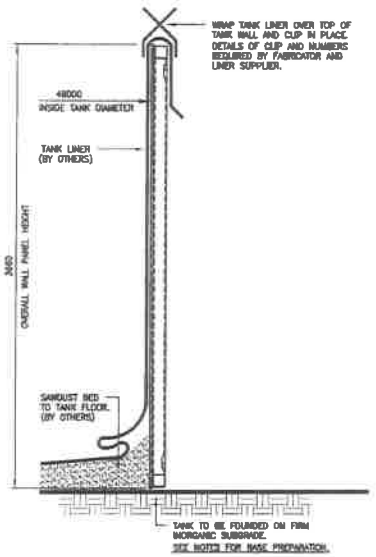
Designed :	Date :	Drawn :	Date :	Checked :	Date :	Job No.	Scale :	Dwg. No.	Rev.
MH	08.12.10	RP	11.12.10	MH	14.12.10	12167	AS NOTED	12167-S-002	0

FILE : 12167-S-002

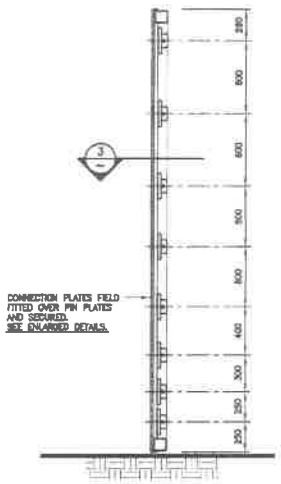
Beck
ENGINEERING (1992) LTD.
www.beckeng.ab.ca



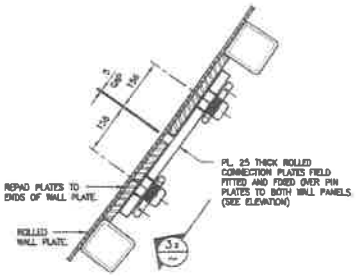
TANK LAYOUT PLAN (A) — SCALE 1 : 75



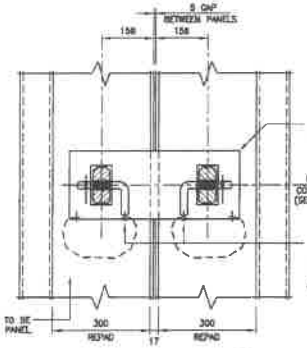
TYPICAL TANK WALL SECTION (1) — SCALE 1 : 20



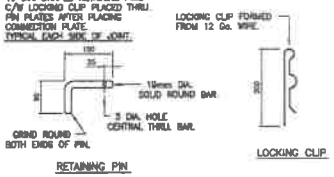
WALL SECTION AT PANEL JOINT (2) — SCALE 1 : 20



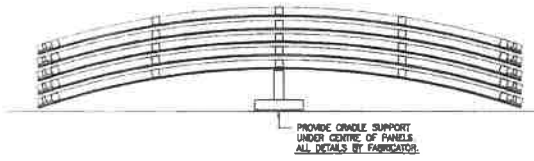
ENLARGED PLAN DETAIL (3) — NOT TO SCALE



ENLARGED ELEVATION (3x) — NOT TO SCALE



SUGGESTED PIN AND CLIP DETAILS
SHOP TO CONFIRM ALL DETAILS



TRANSPORT AND STORAGE DETAILS
NOT TO SCALE

APEGGA PERMIT NO. 2042

NOTES :

1. CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR THE STABILITY OF THE STRUCTURE AND FOR THE SAFETY OF ALL PERSONNEL DURING ASSEMBLY AND DISASSEMBLY. ALL WORK SHALL BE IN STRICT ACCORDANCE WITH OCCUPATIONAL HEALTH AND SAFETY REGULATIONS.
2. THE CONTRACTOR SHALL ENSURE ALL THE PANELS ARE ADEQUATELY SUPPORTED OR BRACED UNTIL THE ENTIRE STRUCTURE IS ASSEMBLED.
3. ALL TOPSOIL, ORGANICS, SOFT OR WET SOILS, DEBRIS OR OTHER DELETERIOUS MATERIALS SHALL BE REMOVED FROM THE TANK SITE.
4. THE FINISHED GRADES ALONG THE PERIMETER OF THE TANK SHALL BE LEVEL AND TRUE TO PLANE. THE MAXIMUM ELEVATION DIFFERENCE ACROSS ANY TWO DIAMETRICAL POINTS SHALL BE LESS THAN 250mm.
5. THE MAXIMUM DEVIATION FROM PLANE OVER ANY 3.0 METERS OF CIRCUMFERENCE SHALL BE LESS THAN 5mm AND LESS THAN 12mm OVER ANY 10.0 METERS OF CIRCUMFERENCE.
6. THE AREA SURROUNDING THE TANKS SHALL BE GRADED TO DIRECT SURFACE WATER AWAY FROM THE TANK.
7. THE EDGE OF ANY (EXCAVATED) SUMP SHALL BE A MINIMUM OF 600mm FROM THE EDGE OF THE TANK WALL.
8. THE PANELS SHALL BE ERECTED PLUMB. THE MAXIMUM OUT-OF-PLUMBNESS OF THE TOP OF THE PANEL RELATIVE TO THE BOTTOM SHALL BE LESS THAN 25mm.
9. THE MAXIMUM DEVIATION FROM THE THEORETICAL RADIUS SHALL BE LESS THAN 50mm AT ANY POINT ALONG THE TANK WALL.
10. THE LINER SHALL BE SECURELY FASTENED TO THE TOP OF EACH PANEL IN ACCORDANCE WITH THE LINER'S MANUFACTURER'S RECOMMENDATIONS. THE LINER SHALL BE INSTALLED WITH SUFFICIENT SLACK AT THE BASE OF THE PANEL TO PREVENT ANY TENSION IN THE LINER.
11. THE VERTICAL LIFTING BAR SHALL ONLY BE USED TO LIFT THE PANELS INTO THE VERTICAL POSITION. THE LIFT RIGGING MUST BE WITHIN 250mm OF THE TOP RAIL PRIOR TO LIFTING THE PANEL.

DWG. NO.	REFERENCE DRAWINGS	REV	REVISIONS	DATE	BY	CHK'D	APP'D	CLIENT APP'D
12167-S-001	TANK WALL PANEL FRAMING LAYOUTS	A	ISSUED FOR REVIEW	14.12.10	RP	MH		
12167-S-002	TANK WALL PANEL FRAMING DETAILS	0	ISSUED FOR CONSTRUCTION	17.12.10	MH	MH		

ENGINEER AND PERMIT STAMPS

Designed :	Date :	Drawn :	Date :	Checked :	Date :
MH	08.12.10	RP	11.12.10	MH	14.12.10

Client : OPEN RANGE ENERGY CORP

Project : 48m dia. MODULAR WATER TANK

TANK INSTALLATION AND ASSEMBLY
LAYOUT PLAN, SECTIONS AND DETAILS

Job No.	Scale :	Dwg. No.	
12167	AS NOTED	12167-E-001	0

Beck
ENGINEERING (1992) LTD.
www.beckeng.ab.ca

FILE : 12167-E-001

Inland
TARP & LINER

TECHNICAL DATA SHEET
Geomembrane 30mil LLDPE

Property	Test Method	Frequency (A)	Unit Metric	Solmax 130-2000
Thickness (min. avg.)	ASTM D 5199	Every roll	mm	0.75
Thickness (min.)	ASTM D 5199	Every roll	mm	0.68
Resin Density	ASTM D 1505	1/Batch	g/cc	<0.926
Melt Index-190/2.16(max)	ASTM D1238	1/Batch	g/10min	1.0
Sheet Density (C)	ASTM D1505	Every 2 rolls	g/cc	<0.939
Carbon Black Content (D)	ASTM D 4218	Every 2 rolls	%	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	Every 6 rolls	Category	Cat. 1 / Cat. 2
Oxidative Induction Time (min. avg)	ASTM D3895	1/Batch	min	100
Tensile Properties (min. avg)(B)	ASTM D 6693	Every 2 rolls		
Strength as Break			kN/m	20
Elongation at Break			%	750
2% Modulus (max.)	ASTM D 5323	PerFormulation	kN/m	315
Tear Resistance (min. avg.)	ASTM D 1004	Every 6 rolls	N	70
Puncture Resistance (min. avg.)	ASTM D 4833	Every 6 rolls	N	200
Dimensional Stability	ASTM D 1204	Every 6 rolls	%	+/- 2
Multi-Axial Tensile (min.)	ASTM D 5617	PerFormulation	%	90
Oven Aging-% retained after 90 days	ASTM D 5721	PerFormulation		
STD OIT (min. avg.)	ASTM D 3895		%	35
HP OIT (min. avg.)	ASTM D 5885		%	60
UV Resistance-% retained after 1600 hr	GRI-GM-11	PerFormulation		
HP-OIT (min. avg.)	ASTM D 5885		%	35

Note;

(A) Testing frequency based on standard roll dimensions and one batch is approximately 180,000 lbs (or one railcar)

(B) Machine Direction (MD) and Cross Machine Direction (XMD or TD) average values should be on the basis of 5 specimens each direction

(C) Correlation table is available for ASTM D792 vs. ASTM D1505 Both methods give the same results.

(D) Correlation table is available for ASTM D1603 vs ASTM D4218 Both methods give the same results

*All values are nominal test results, except when specified as minimum of maximum

* The information contained herein is provided for reference purposes only and is not intended as warranty of guarantee Final determination of suitability for use contemplated is the sole responsibility of the user Solmax along with Inland Tarp & Liner assumes no liability in connection with the use of this information.

ATARFIL geomembranes

ISO 9001 ISO 14001 BUREAU VERITAS Certification

(1)

ATARFIL LTM-LTMT V1

Raw Material	Linear Low Density Polyethylene

ATARFIL LTM-LTMT is a **structured geomembrane** manufactured from maximum quality linear low density polyethylene LLDPE resins, duly contrasted, that comply with the most rigurous requirements established for their use.

ATARFIL LTM-LTMT contains 97,5% of pure polymer, and approximately 2,5% of Carbon Black, antioxidants and thermal stabilizers. The product does not contain plasticizers or fillers that can migrate over time.

The geomembrane **ATARFIL** LTM-LTMT is manufactured under rigurous quality controls.

Surface	TM Structured 1 side TMT Structured 2 sides	Colour	Black
		RAL Code	-

	Tested Property	Unit	Test Method	Value
Raw Material Identification	Density of Raw Material	g/cm³	ASTM D 792	0,915-0,926
	Density of Geomembrane	g/cm³	ASTM D 792	0,925-0,939
	Melt Flow Index	g/10 min	ASTM D 1238 (190°C/2,16 Kg)	< 1,0
	Carbon Black Content	%	ASTM D 4218	2,0 - 2,5
	Carbon Black Dispersion	-	ASTM D 5596	Note (2)
Durability	Oxidative Induction Time (OIT) Standard OIT High Pressure OIT	min	ASTM D 3895 (200°C) ASTM D 5885	≥ 100 ≥ 400
	Oven aging at 85°C HP O.I.T, % retained after 90 days	%	ASTM D 5721 ASTM D 5885	≥ 60
	UV Resistance. HP OIT, % retained after 1600 hrs	%	ASTM D 7238 ASTM D 5885	≥ 35

	Tested Property	Unit	Test Method	Value
Functional Properties	Low Temperature Brittleness (t°: -40°C)	-	ASTM D 746	No cracks
	Water Permeability	m³/m²-day	EN 14150	$< 1 \cdot 10^{-6}$
	Coefficient of Linear Thermal Expansion	1/K	ASTM D 696	$2,15 \cdot 10^{-4}$
	Water Absorption	%	ASTM D 570 (24h)	≤ 0,2
			ASTM D 570 (6 days)	≤ 1
	Asperity Height	mils	ASTM D 7466	≥ 35
	Friction Angle(3)	°	ISO 12957-1	≥ 29
	Spikes Density	spikes/ft²	-	7775

	Tested Property	Unit	Test Method	Value				
Strength Characteristics Quality of Final Product	Thickness	mils	ASTM D 5994	40	60	80	100	120
	Tolerance	%		-10				
	Mechanical Properties							
	Tensile strength at Break(*)	lb/in	ASTM D 6693 (Type IV), lo: 2.0 in	64 (60)	95 (90)	125 (120)	152 (150)	185 (180)
	Elongation at Break	%		≥ 250				
	Tear Resistance	lb	ASTM D 1004	≥ 21	≥ 32	≥ 43	≥ 53	≥ 64
	Puncture Resistance	lb	ASTM D 4833	≥ 42	≥ 64	≥ 85	≥ 112	≥ 128
	2% Modulus	lb/in	ASTM D 5323	≤ 2400	≤ 3600	≤ 4800	≤ 6000	≤ 7200
	Axi-Symmetric Break Resistance Strain	%	ASTM D 5617	≥ 30				
	Dimensional Stability	%	ASTM D 1204 (100°C, 1h)	± 1,5				

	Parameter	Units	40		60		80		100		120	
			LTM	LTMT	LTM	LTMT	LTM	LTMT	LTM	LTMT	LTM	LTMT
140717 PRESENTATION (Standard Sizes)	Roll width	ft	19.7		19.7		19.7		19.7		19.7	
	Roll Length	ft	864	570	669	495	504	432	405	384	339	333
	Surface	ft²	17,020.8	11,229	13,179.3	9,751.5	9,928.8	8,510.4	7,978.5	7,564.8	6,678.3	6,560.1

(*) Values indicated are MEDIUM. In brackets minimum values.
(1) Certificates belonging to the Environmental and Quality Integrated System of Atarfil.
(2) Carbon black dispersion (only near spherical agglomerates) for 10 different views: 9 in Categories 1 or 2 and 1 in Category 3.
(3) Using a polypropylene geotextile of 1000gr

Headquarters: Ctra. de Córdoba, Km 429 - Complejo El Rey – E-18230 Atarfe – GRANADA – SPAIN – Tel.: +34 958 439 200 – Fax: +34 958 439 128
Middle East: P.O. Box 263 122 - Jebel Ali - DUBAI - U.A.E.
USA Branch: Telf: +1 7578483431
www.atarfil.com

Inland TARP & LINER

Premium Quality - Built To Last

www.inlandtarp.com

Geotextile Product Description Sheet
8oz ONG Nonwoven Geotextile

8oz ONG is a needle-punched nonwoven geotextile made of 50% polypropylene and 50% polyester staple fibers, which are formed into a random network for dimensional stability.

PROPERTY	TEST METHOD	UNIT
Weight (Typical)	ASTM D 5261	oz/yd$_2$ (g/m$_2$)
Thickness	ASTM D 4491	mils (mm)
Grab Tensile	ASTM D 4632	lbs (kN)
Grab Elongation	ASTM D 4632	
Trapezoid Tear Strength	ASTM D 4533	lbs (kN)
CBR Puncture Resistance	ASTM D 6241	lbs (kN)
Permittivity*	ASTM D 4491	sec-1
AOS*	ASTM D 4751	US Sieve (mm)
UV Resistance	ASTM D 4355	%/hrs

Weight (Typical) ASTM D 5261 oz/yd$_2$ (g/m$_2$)	7.75 (220)
Thickness ASTM D 4491 mils (mm)	87 (2.21)
Grab Tensile ASTM D 4632 lbs (kN)	151 (0.673)
Grab Elongation ASTM D 4632	80%
Trapezoid Tear Strength ASTM D 4533 lbs (kN)	65 (0.287)
CBR Puncture Resistance ASTM D 6241 lbs (kN)	351 (1.56)
Permittivity* ASTM D 4491 sec-1	1.57
AOS* ASTM D 4751 US Sieve (mm)	140 (0.102)
UV Resistance ASTM D 4355 %/hrs	70/500

PACKAGING

Roll Dimensions (W x L) – ft 15 x 300
Square Yards Per Roll 500
Estimated Roll Weight - lbs 250

* At the time of manufacturing. Handling may change these properties.

U.S. Fabrication & Distribution Centers

Moses Lake, Washington . . . 4172 North Frontage Road E, Moses Lake, WA 98837 • 800.346.7744 • Fax 509.766.0414
Fostoria, Ohio . . . 1600 North Main Street, Fostoria, OH 44830 • 888.377.5640 • Fax 419.436.6007
Odessa, Texas . . . 8784 W. Interstate 20, Odessa, TX 79763 • 432.272.9413

Tank Structure Analysis
Atlantis 48m +3 Tank - Constructed using 18 Standard Atlantis 48.0m Diameter Tank Panels for total Diameter of Approximately 57.5m (188.6ft)

Date: 3/19/2015

Prepared for:

Rockwater Energy Solutions
6000 Town Center Blvd, Suite 165
Canonsburg, PA 15317

Prepared by:

STEPHEN N. VALERO, P.E.
4010 New Chapel Hill Way, Cumming, GA 30041
P: 404-557-5884 | F: 678-807-2902
E: svalero@Wall-Eval.com

PROBLEM STATEMENT:

Evaluate the feasibility of using standard panels designed for the Atlantis 48m diameter tank to construct a 51.2m diameter tank by adding 1 panel from the standard set up configuration (Atlantis 48m +1). The analysis that follows will consider the adequacy of the following parts of the tank configuration:

1) Wall shell capacity
2) Wall panel connection assembly capacity
3) Impact of difference in tank radius and panel radius of curvature on system

Adequacy of lifting hooks, etc. will not be evaluated as this is not changed from standard Atlantis 48m tank.

INPUT INFORMATION:

Tank & Panel Geometry

$L := 10050mm = 32.97\ ft$ Single wall panel length, per Ref 1

$H := 3.66m = 12.01\ ft$ Tank height, per Ref 1

$n := 18$ Number of Panels used to construct tank, per Ref 2

$Gap := 5mm = 0.02\ ft$ Gap between panel shells when tank is in service, per Ref 1

$\alpha_{org} := 24deg$ Original sector angle for panels in standard configuration, per Ref 1

$C_{org} := 9975mm = 32.73\ ft$ Chord length of panels, per Ref 1

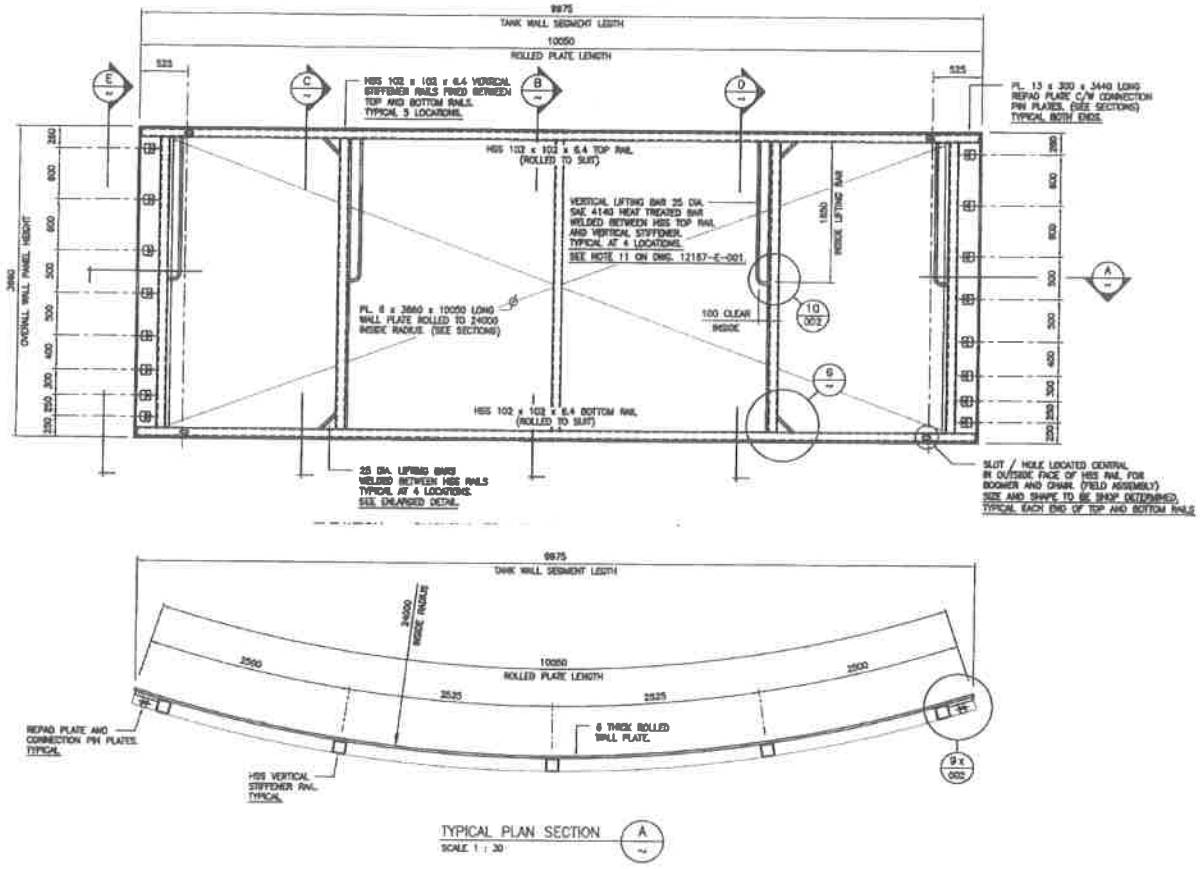
$c := 8$ Number of connection pin plates per panel side, per Ref 1

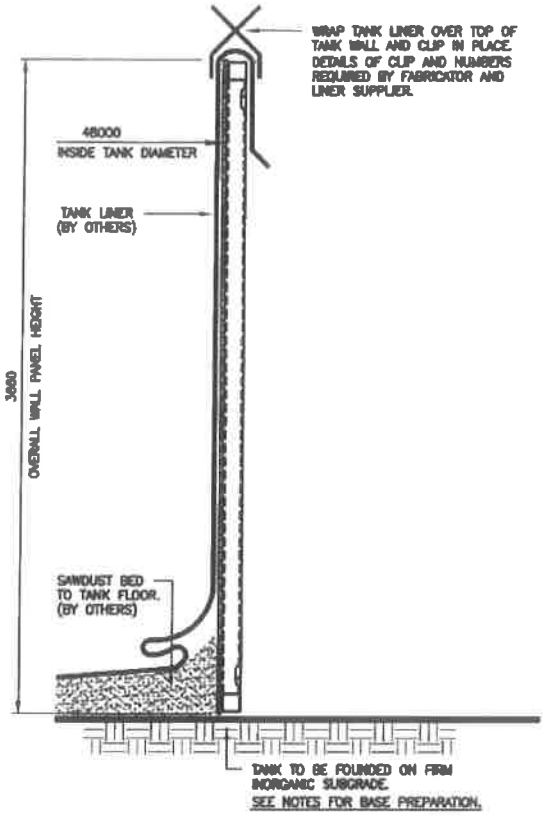
$i := 1 .. c + 1$

$d_i :=$ Vertical distances between connection pin points on panel, per Ref 1

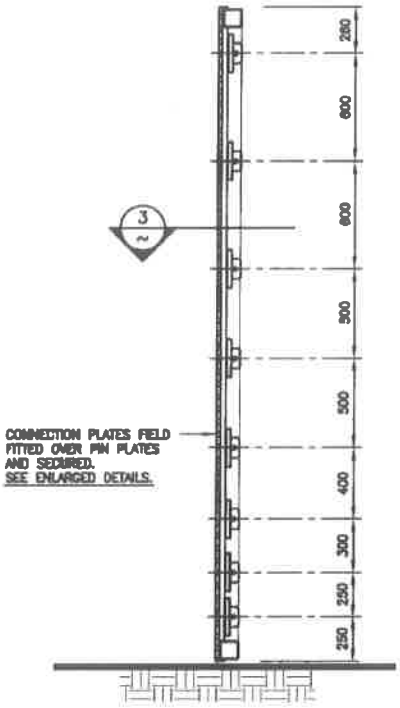
260mm	Top of Panel to Con 1
600mm	Con 1 to Con 2
600mm	Con 2 to Con 3
500mm	Con 3 to Con 4
500mm	Con 4 to Con 5
400mm	Con 5 to Con 6
300mm	Con 6 to Con 7
250mm	Con 7 to Con 8
250mm	Con 8 to Bottom of Panel

Tank Panel Layout and Connection Details are as follows, After Ref 1:

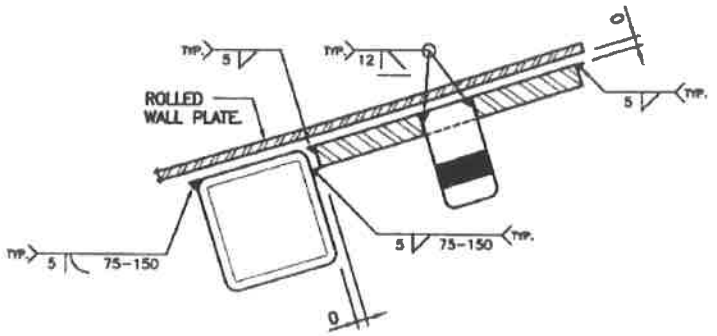




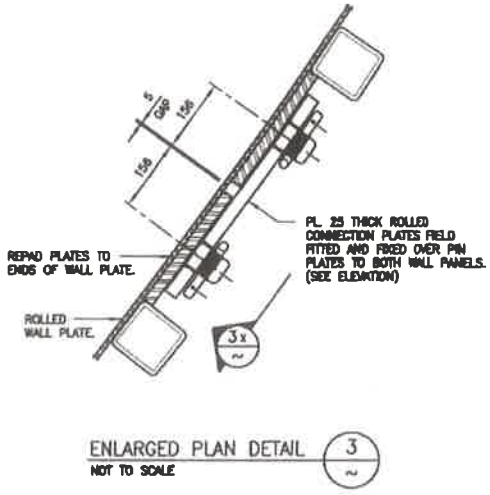
TYPICAL TANK WALL SECTION (1)
SCALE 1 : 20

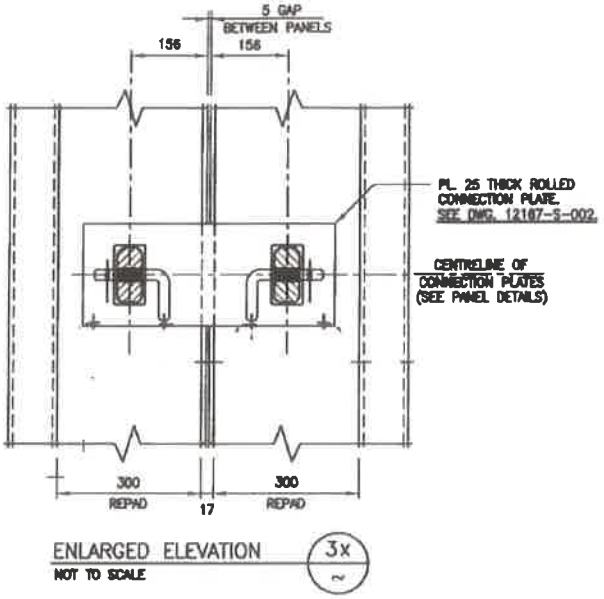


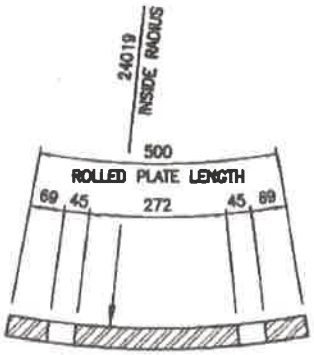
WALL SECTION AT PANEL JOINT (2)
SCALE 1 : 20



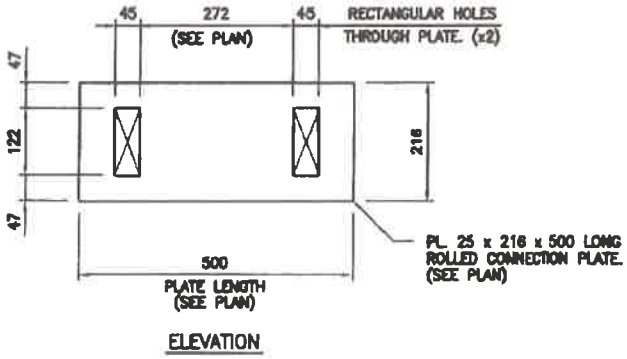
ENLARGED TYPICAL PLAN – EXPLODED TO SHOW WELD DETAILS.
NOT TO SCALE





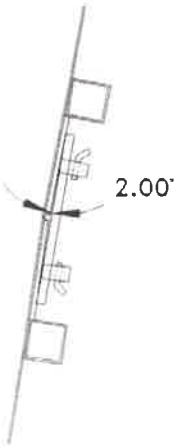


PLAN
(EXAGGERATED SCALE)



ELEVATION

WALL PANEL CONNECTION PLATES
(x8 REQUIRED PER WALL PANEL)



The figure to the right shows the impact on tank/connection roundness due to the difference in panel radius of curvature and tank curvature due to changing the number of standard panels used. By inspection, the impact of this geometry is insignificant with regard to mid-panel bending failure. However, the small angle between the connection plate and repad plate will be taken into consideration when calculating maximum stress to be carried by the connection assembly.

$\beta := 2.0\text{deg}$ Angle between connection plate and repad plate for this tank configuration

Tank shell, Repad Plate, Connection Pin Plate and Connection Plate Steel Specifications

Steel := "CSA G40.21 300W Steel"	Steel specification, per Ref 1
Fu := 450MPa = 65266.98 psi	Ultimate strength, per Ref 3
Fy := 300MPa = 43.51·ksi	Yield strength, per Ref 3

Tank shell/rail specifications:

$t_{shell} := 6mm = 0.24 \cdot in$	Thickness, per Ref 1
$d_{rail} := 102mm = 4.02 \cdot in$	Depth of top/bottom rails connected to shell

Repad plate specifications:

$t_{rpad} := 13mm = 0.51 \cdot in$	Thickness, per Ref 1
$de_{rpad} := 129.5mm = 5.1 \cdot in$	Distance from connection pin plate hole to outside edge of plate, per Ref 1
$b_{rpad} := 300mm = 11.81 \cdot in$	Width of repad plate, per Ref 1
$d_{rpad} := 3440mm = 135.43 \cdot in$	Length of repad plate, per Ref 1
$s_{rpad} := 5mm = 0.2 \cdot in$	Weld leg dimension for fillet welds between repad plate and shell, per Ref 1

Connection pin plate specifications

$t_{pin} := 41mm = 1.61 \cdot in$	Thickness, per Ref 1
$h_{pin} := 114mm = 4.49 \cdot in$	Height, per Ref 1
$dph_{pin} := 27mm = 1.06 \cdot in$	Distance from repad to inside of retaining pin hole, Per Ref 1

Connection plate specifications:

$t_{cplate} := 25mm = 0.98 \cdot in$	Thickness, per Ref 1
$h_{cplate} := 216mm = 8.5 \cdot in$	Height, per Ref 1
$de_{cplate} := 69mm = 2.72 \cdot in$	Distance from pin hole to outside edge of plate, per Ref 1
$h_{pinhole} := 122mm = 4.8 \cdot in$	Dimensions of pin hole slots in connection plate, per Ref 1
$w_{pinhole} := 45mm = 1.77 \cdot in$	

ASSUMPTIONS:

The following assumptions were required in order to complete this analysis:

$Freeboard := 0ft$ Maximum permissible liquid depth (overflow condition)

$G_s := 1.0$ Specific gravity of contained liquid, assumed to be fresh water

$\gamma_{water} := 62.4pcf$ Unit weight of water

Resisting forces are provided by hoop tension in the wall panels/connections only.

$F_{E60} := 413MPa = 59.9 \cdot ksi$ 60 ksi electrodes used for all arc welding

The applied liquid pressure is considered a dead load as its maximum depth is limited by the maximum height of the tank walls. It is highly unlikely that the tank would remain full to the struck capacity for an extended period. Therefor, the following load factor will apply throughout these calculations

$LF := 1.4$

The only load applied to the system is due to the contained liquid. This analysis does not consider:

- Ice load
- Wind load
- Impact load
- Seismic load
- or any other potential internal/external load.

It is assumed that the tank is installed properly, on firm, level ground and that all steel, welds, etc. are in good condition.

REFERENCES:

1) Drawing sheets 12167-S-001; 12167-S-002; and 12167-E-001 prepared for Open Range Energy, 48m Modular Water Tank by Beck Engineering, Ltd. dated 12/17/2010.

2) CSA G40.20-13/G40.21-13 - General requirements for rolled or welded structural quality steel / Structural quality steel.

3) AISC Manual of Steel Construction, 13th Ed.

CALCULATIONS:

1) Determine the average (design) diameter of the tank:

$\alpha := \frac{360deg}{n} = 20 \cdot deg$ Sector angle for each panel

$C_{tot} := C_{org} + Gap = 32.74\ ft$ Total segment length for each panel

$R := \frac{C_{tot}}{\sqrt{2 - 2\cos(\alpha)}} = 94.28\ ft$ New radius of tank constructed with n panels

$D := 2 \cdot R = 188.56\ ft$ Inside diameter of tank

2) Check stress level vs. capacity of tank shell:

$z_{cpshell} := H - Freeboard - d_{rail} = 140.08 \cdot in$ Depth from top of tank to top of bottom rail, critical unsupported point of tank shell

$\gamma := LF \cdot G_s \cdot \gamma_{water} = 87.36 \cdot pcf$ Factored unit weight of contained liquid

$Pcp_{shell} := (z_{cpshell} - Freeboard) \cdot \gamma = 7.08\ psi$ Maximum internal tank pressure at critical unsupported point in shell (between vertical stiffener rails and just above bottom rail).

$\sigma_{shell} := \frac{Pcp_{shell} \cdot D}{2 \cdot t_{shell}} = 33917.21\ psi$ Use diameter Equation to estimate hoop tensile stress in shell at critical point (valid since tshell/tank radius << 0.10)

$Ta_{shell} := \min(0.9 \cdot Fy, 0.75 \cdot Fu) = 39160.19\ psi$ Allowable axial tensile stress per Ref 4

$Check_{shell} := if(\sigma_{shell} < Ta_{shell}, "OK", "Shell thickness is insufficient")$

$Check_{shell} = "OK"$ Check shell thickness

3) Check stress level vs. capacity of panel connection assembly:

The connection assembly consists of: Repad plate welds to shell; repad plate, connection pins and connection plates.

3a) Check sufficiency of welds between repad plate and tank shell:

$Pmax_{rpad} := (H - Freeboard)\cdot\gamma = 7.28\,psi$

Maximum internal tank pressure at critical unsupported point in shell (between vertical stiffener rails and just above bottom rail).

$Tmax_{rpad} := \frac{\frac{1}{2}\cdot Pmax_{rpad}\cdot H\cdot D}{2} = 593786.38\,lbf$

Use Young-Laplace Equation to estimate total hoop tension to be transferred from shell to repad plate (valid since tshell/tank radius << 0.10)

$M_{rpad} := \left(\frac{H}{2} - \frac{H}{3}\right)\cdot Tmax_{rpad} = 14260223.97\cdot lbf\cdot in$

Torque on line welds transferring stress from shell to repad (5mm fillet along both sides)

$C := \frac{\sqrt{b_{rpad}^{\ 2} + d_{rpad}^{\ 2}}}{2} = 67.97\cdot in$

Distance from neutral axis to extreme fibers of welds

$J_w := \frac{H}{6}\cdot\left(3b_{rpad}^{\ 2} + d_{rpad}^{\ 2}\right) = 450550.26\cdot\frac{in^4}{in}$

Polar moment of inertia of line welds

$f := \frac{M_{rpad}\cdot C}{J_w} = 2151.41\cdot\frac{lbf}{in}$

Force of extreme fibers of welds

$f_t := 0.75\left(0.6F_{E60}\right)\cdot\left(s_{rpad}\cdot 0.707\right) = 3751.45\cdot\frac{lbf}{in}$

Maximum allowable stress of welds

$Check_{rpadwelds} := if\left(f < f_t, "OK", "Welds insufficient"\right)$

$Check_{rpadwelds} = "OK"$

Check repad plate welds

3b) Determine critical connection pin location and load:

$j := 2 .. c - 1$

$z_0 := 0in \qquad z_1 := d_1 + \frac{d_2}{2}$

$z_j := z_{j-1} + \left(\frac{d_j + d_{j+1}}{2}\right)$

Depth from top of wall panel to the bottom of contributory load area carried by each connection plate/pin set:

$z_8 := z_7 + \frac{d_8}{2} + d_9$

$j := 0 .. c$

$z_j =$

0	Top of tank
22.05	Bottom of contributory area where load is carried by Connection 1
45.67	
67.32	
87.01	
104.72	
118.5	
129.33	
144.09	Bottom of contributory area where load is carried by Connection 8

in

$P_j := if\left[z_j - Freeboard > 0in, \gamma \cdot \left(z_j - Freeboard\right), 0psi\right]$

$P_j =$

0.00	Top of tank
1.11	Con 1
2.31	Con 2
3.40	Con 3
4.40	Con 4
5.29	Con 5
5.99	Con 6
6.54	Con 7
7.28	Con 8

psi

Pressure distribution inside tank at the bottom of contributory area carried by each connection point

$k := 1 .. c$

$$T_{con_k} := \left[P_{k-1}\cdot\left(z_k - z_{k-1}\right) + \frac{1}{2}\left(P_k - P_{k-1}\right)\cdot\left(z_k - z_{k-1}\right)\right]\cdot\frac{D}{2} = \ldots$$

Use Young-Laplace Equation to estimate total hoop tension to be transferred from repad plate to each connection (valid since tshell/tank radius << 0.10)

$T_{con_k} =$

13900.94	lbf	Con 1
45745.43		Con 2
69970.12		Con 3
86880.86		Con 4
97142.56		Con 5
87966.87		Con 6
76735.53		Con 7
115444.06		Con 8

Estimate of total tension carried at each connection point (actual load distribution is likely more evenly spread from repad plate to connections reducing total load carried by bottom connections). For this analysis, bottom connection will be considered critical and analyzed vs. total contribution load (conservative).

$T_{con} := T_{con_c} = 115444.06\,\text{lbf}$ Critical connection load, bottom connection

$T_{con} := \frac{T_{con}}{\cos(\beta)} = 115514.42\,\text{lbf}$ Effect of load vector due to change in geometry at connection point induced by difference in tank radius and radius of curvature of panels

$d_{rpad} := z_c - z_{c-1} = 14.76\cdot\text{in}$ Contributory length of repad plate carrying critical load

3c) Check the repad plate for sufficient strength to transfer critical load to connection pins:

$Ag_{rpad} := d_{rpad}\cdot t_{rpad} = 7.56\cdot\text{in}^2$ Theoretical gross section area subject to tension

$An_{rpad} := \left(d_{rpad} - h_{pin}\right)\cdot t_{rpad} = 5.26\cdot\text{in}^2$ Theoretical net section area subject to tension

$Ans_{rpad} := 2\cdot de_{rpad}\cdot t_{rpad} = 5.22\cdot\text{in}^2$ Theoretical net section area subject to shear (tear out)

$Tn_{rpad} := \min\left[0.9\cdot Fy\cdot Ag_{rpad}, 0.75\cdot Fu\cdot An_{rpad}, 0.75\cdot(0.6\cdot Fu)\cdot Ans_{rpad}\right] = 153278.67\,\text{lbf}$

Allowable tension on the repad considering yielding on the gross section, fracture on the net section and tear out.

$Check_{rpad} := \text{if}\left(T_{con} < Tn_{rpad}, \text{"OK"}, \text{"Repad insufficient"}\right)$

$Check_{rpad} = \text{"OK"}$ Check on thickness of repad plate

3d) Check the connection pin plates for sufficient strength to transfer critical load to connection plates.

$Rn_{pin} := 0.75 \cdot (0.6 \cdot Fu) \cdot h_{pin} \cdot t_{pin} = 212778.29\ lbf$ Allowable shear load on pin plate

$M_{pin} := T_{con} \cdot \left(dph_{pin} - \frac{t_{cplate}}{2} \right) = 65943.27 \cdot lbf \cdot in$ Factored maximum moment on pin plate at intersection with repad plate (critical point) under worst case conditions (plate contacts retaining pin)

$Mn_{pin} := 0.9 \cdot \frac{h_{pin} \cdot t_{pin}^2}{6} \cdot Fy = 76324.67 \cdot lbf \cdot in$ Allowable bending moment on pin plate

$Check_{pin} := if\left(T_{con} < Rn_{pin}, if\left(M_{pin} < Mn_{pin}, "OK", "Pin Insufficient"\right), "Pin Insufficient"\right)$

$Check_{pin} = "OK"$ Check on pin dimensions

3e) Check the connection plate for sufficient strength to transfer critical load from connection pins to next panel:

$Ag_{cplate} := h_{cplate} \cdot t_{cplate} = 8.37 \cdot in^2$ Gross section area subject to tension

$At_{cplate} := \left(h_{cplate} - h_{pinhole}\right) \cdot t_{cplate} = 3.64 \cdot in^2$ Net section area subject to tension

$Anbs_{cplate} := \left(de_{cplate} + \frac{h_{cplate} - h_{pinhole}}{2} \right) \cdot t_{cplate} = 4.5 \cdot in^2$ Net section area subject to block shear (tear out)

$Avg_{cplate} := \left(de_{cplate} + \frac{w_{pinhole}}{2} \right) \cdot t_{cplate} = 3.55 \cdot in^2$ Gross section area subject to shear yield

$Atg_{cplate} := \left(\frac{h_{cplate}}{2} \right) \cdot t_{cplate} = 4.19 \cdot in^2$ Gross section area subject to tensile yield

$Ans_{cplate} := de_{cplate} \cdot t_{cplate} = 2.67 \cdot in^2$ Net section area subject to shear fracture

$Ant_{cplate} := \left(\frac{h_{cplate} - h_{pinhole}}{2} \right) \cdot t_{cplate} = 1.82 \cdot in^2$ Net section area subject to tensile fracture

$Tngen_{cplate} := \min\left(0.9 \cdot Fy \cdot Ag_{cplate}, 0.75 \cdot 1.0Fu \cdot At_{cplate}\right) = 178301.59\ lbf$ Allowable general yield/fracture limit tension

$Tnbs_{cplate} := 0.75 \cdot (0.6 \cdot Fu) \cdot Anbs_{cplate} = 132019.05\ lbf$ Allowable block shear tension

$Tnsy_{cplate} := \min\left[0.75 \cdot \left(0.6Fy \cdot Avg_{cplate} + Fu \cdot Ant_{cplate}\right), 0.75 \cdot \left(0.6Fu \cdot Ans_{cplate} + Fy \cdot Atg_{cplate}\right)\right] = 158574.61\ lbf$

Allowable yield/fracture tension

$Tn_{cplate} := \min\left(Tngen_{cplate}, Tnbs_{cplate}, Tnsy_{cplate}\right) = 132019.05\ lbf$ Block shear controls

$Check_{cplate} := if\left(T_{con} < Tn_{cplate}, "OK", "Connection plate insufficient"\right)$

$Check_{cplate} = "OK"$ Check on dimensions of connection plate

4) Summary of final Capacity and Dimensions

$D = 188.56\ ft$ Design inside diameter of tank

$\alpha = 20 \cdot deg$ Arc intersected by each panel

$D_{min} := \frac{2C_{org}}{\sqrt{2 - 2\cos(\alpha)}} = 188.46\ ft$ Minimum inside diameter of tank when empty

$D_{max} := \frac{2\left[C_{tot} + \left(\frac{w_{pinhole} - t_{pin}}{2}\right)\right]}{\sqrt{2 - 2\cos(\alpha)}} = 188.60\ ft$ Maximum inside diameter of tank when full

$Freeboard = 0 \cdot in$ Design freeboard used in analysis

$V_{design} := (H - Freeboard) \cdot \frac{\pi \cdot D^2}{4} = 59721 \cdot BBL$ Design capacity (No freeboard)

$V_{max} := H \cdot \pi \cdot \frac{D^2}{4} = 59721 \cdot BBL$ Maximum capacity (filled to top)

Design capacity (with varying freeboard):

$Freeboard := 12in$ $V_{design} := (H - Freeboard) \cdot \frac{\pi \cdot D^2}{4} = 54748 \cdot BBL$

$Freeboard := 24in$ $V_{design} := (H - Freeboard) \cdot \frac{\pi \cdot D^2}{4} = 49774 \cdot BBL$

Design and Construction Plan
Above Ground Tank (AST) Containments

General

Examination of the engineering drawings and the SOP for set-up (Engineering Drawings, Liner Specifications, Set Up) plus the history of solid performance of these AST Containments demonstrates that the AST Containment is designed and will be assembled to ensure the confinement of produced water, to prevent releases and to prevent overtopping due to wave action or rainfall. As the AST Containments are generally less than 190 feet in diameter, wave action is not a meaningful consideration.

19.15.34.12 A
(1) The operator shall design and construct a recycling containment to ensure the confinement of produced water, to prevent releases and to prevent overtopping due to wave action or rainfall.

These AST Containments are constructed of 12-foot high steel panels, are netted (netting no larger than 1.5 inch per square per BLM COA) ~~and employ the Mega Blaster Pro avian deterrent system~~ to prevent ingress of migratory birds. AST Containments will be enclosed by a 4-strand barbed wire fence or better. Thus, complies with the Rule to fence or enclose a recycling containment in a manner that deters unauthorized wildlife and human access and shall maintain the fences in good repair.

19.15.34.12 D
(1) The operator shall fence or enclose a recycling containment in a manner that deters unauthorized wildlife and human access and shall maintain the fences in good repair. The operator shall ensure that all gates associated with the fence are closed and locked when responsible personnel are not onsite.

The operator shall post an upright sign no less than 12 inches by 24 inches with lettering not less than two inches in height in conspicuous places surrounding the containment. The operator shall post the sign in a manner and location such that a person can easily read the legend. The sign shall provide the following infom1ation: the operator's name, the location of the site by quarter-quarter or unit letter, section, township and range, and emergency telephone numbers.

19.15.34.12 C
Signs. The operator shall post an upright sign no less than 12 inches by 24 inches with lettering not less than two inches in height in a conspicuous place on the fence surrounding the containment. The operator shall post the sign in a manner and location such that a person can easily read the legend. The sign shall provide the following information: the operator's name, the location of the site by quarter-quarter or unit letter, section, township and range, and emergency telephone numbers.

Site Preparation

Foundation for AST Containment

Preparation of the soils on site is required to form a dependable base for the AST Containment in accordance with NMAC 19.15.34 and the SOP and is the responsibility of the operating company. If the location of the AST Containment is on an existing pad, the operator has stripped and stockpiled the topsoil for use as the final cover or fill at the time of closure. If the pad is new construction, the operator will strip and stockpile the soil for reclamation upon cessation of site activities.

19.15.34.12 B
Stockpiling of topsoil. Prior to constructing containment, the operator shall strip and stockpile the topsoil for use as the final cover or fill at the time of closure.

The foundation soils must be roller compacted Compaction characteristics must meet or exceed 95% of Standard Proctor Density in accordance with ASTM D 698 or modified Proctor Test (ASTM Standard D1557).

Examination of the SOP shows that the AST Containment contractor will conform to the following mandates of the Rule:

- the AST Containment will have a properly constructed compacted earth foundation and interior slopes (vertical steel) consisting of a firm, unyielding base, smooth and free of rocks, debris, sharp edges or irregularities to prevent the liner's rupture or tear.
- Geotextile will be placed under the liner where needed to reduce localized stress-strain or protuberances that otherwise may compromise the liner's integrity.
- If the AST containment is within a levee, the inside grade is no steeper than two horizontal feet to one vertical foot (2H: 1V) and the outside grade no steeper than three horizontal feet to one vertical foot (3H: IV). The vertical steel walls of the AST Containment are the subject of *a variance included in Volume 3* of this submission. OCD.

19.15.34.12 A
(2) A recycling containment shall 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. Geotextile is required under the liner when needed to reduce localized stress-strain or protuberances that otherwise may compromise the liner's integrity. The operator shall construct the containment in a levee with an inside grade no steeper than two horizontal feet to one vertical foot (2H:1V). The levee shall have an outside grade no steeper than three horizontal feet to one vertical foot (3H:1V). The top of the levee shall be wide enough to install an anchor trench and provide adequate room for inspection and maintenance.

The Operator will ensure that at a point of discharge into or suction from the recycling containment, the liner is protected from excessive hydrostatic force or mechanical damage and external discharge or suction lines shall not penetrate the liner.

19.15.34.12 A
(6) At a point of discharge into or suction from the recycling containment, the operator shall insure that the liner is protected from excessive hydrostatic force or mechanical damage. External discharge or suction lines shall not penetrate the liner.

Liner and Leak Detection Materials

The liner and geotextile specifications show that all primary (upper) liners in a recycling containment shall be geomembrane liners composed of an impervious, synthetic material that is resistant to ultraviolet light, petroleum hydrocarbons, salts and acidic and alkaline solutions. All primary liners shall be *an equivalent liner [to that stated in Rule 34] and are pursuant to a requested variance.* The liner system is presented in an earlier section of this submission.

19.15.34.12 A
(4) All primary (upper) liners in a recycling containment shall be geomembrane liners composed of an impervious, synthetic material that is resistant to ultraviolet light, petroleum hydrocarbons, salts and acidic and alkaline solutions. All primary liners shall be 30-mil flexible PVC, 45-mil LLDPE string reinforced or 60-mil HDPE liners. Secondary liners shall be 30-mil LLDPE string reinforced or equivalent with a

All secondary liners shall be *an equivalent liner [to that stated in Rule 34] approved by OCD pursuant to a*

variance. The liner system is presented in an earlier section of this submission.
Liner compatibility shall meet or exceed the EPA SW-846 method 9090A or subsequent relevant publications.

hydraulic conductivity no greater than 1 x 10-9 cm/sec. Liner compatibility shall meet or exceed the EPA SW-846 method 9090A or subsequent relevant publications.

Variance request for liner system (two 40 mil LLDPE for primary and secondary liners) included in Volume 3.

The AST Containment will have a leak detection system between the upper and lower geomembrane liners that shall consist of 200-mil geonet to facilitate drainage.

Install Secondary Liner, Leak Detection System and Secondary Containment

All AST containments holding produced water will have a primary (upper) liner and a secondary (lower) liner with a leak detection system appropriate to the site's conditions. The rule states that the edges of all secondary liners shall be anchored in the bottom of a compacted earth-filled trench. The anchor trench shall be at least 18 inches deep. The lack of an anchor trench with an AST Containment *is pursuant to a requested variance.*

19.15.34.12 A
(3) Each recycling containment shall incorporate, at a minimum, a primary (upper) liner and a secondary (lower) liner with a leak detection system appropriate to the site's conditions. The edges of all liners shall be anchored in the bottom of a compacted earth-filled trench. The anchor trench shall be at least 18 inches deep.

The AST Containment Contractor will cause the recycling containment will have a leak detection system between the upper and lower geomembrane liners that shall consist of 200-mil geonet 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 (see attached drawing).

19.15.34.12 A
(7) The operator of a recycling containment shall place a leak detection system between the upper and lower geomembrane liners that shall consist of 200-mil geonet or two feet of compacted soil with a saturated hydraulic conductivity of 1 x 10-5 cm/sec or greater 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.

The presence of the secondary containment levee ~~or pre-fabricated secondary containment~~ meets the OCD Rule mandate that a recycling containment shall design the containment to prevent run-on of surface water. The containment shall be surrounded by a berm, ditch or other diversion to prevent run-on of surface water.

19.15.34.12 A
(8) The operator of a recycling containment shall design the containment to prevent run-on of surface water. The containment shall be surrounded by a berm, ditch or other diversion to prevent run-on of surface water.

AST Containment Setup

As with the secondary liner, AST Containment contractor will minimize liner seams and orient them up and down, as much as possible, not across, a slope.

Factory welded seams shall be used where possible. AST Containment contractor will employ field seams in geosynthetic material that are thermally seamed. Prior to field seaming, AST Containment contractor shall overlap liners four to six inches and minimize the number of field seams and corners and irregularly shaped areas. There shall be no horizontal seams within five feet of the AST Containment bottom. Qualified personnel shall perform field welding and testing.

19.15.34.12 A
(5) The operator of a recycling containment shall minimize liner seams and orient them up and down, not across, a slope of the levee. Factory welded seams shall be used where possible. The operator shall ensure field seams in geosynthetic material are thermally seamed. Prior to field seaming, the operator shall overlap liners four to six inches. The operator shall minimize the number of field seams and corners and irregularly shaped areas. There shall be no horizontal seams within five feet of the slope's toe. Qualified personnel shall perform field welding and testing.

Fluid Injection/Withdrawal Flow Diverter

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 or pipes.

19.15.34.13 B
(3) 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 or pipes.

March 2020

Variances and/or Equivalency Demonstrations for Above Ground Steel Tank Modular Recycling Storage Containments (AST) Primary and Secondary Liners

Liner for Above Ground Steel Tank Modular Recycling Storage Containments

STATEMENT EXPLAINING WHY THE APPLICANT SEEKS A VARIANCE FOR 40 MIL NON-REINFORCED LLDPE GEOMEMBRANE AS AN ALTERNATIVE PRIMARY AND 30 MIL NON-REINFORCED AS ALTERNATIVE SECONDARY LINER FOR MODULAR STEEL AST CONTAINMENT

The prescriptive mandates of the Rule that are the subject of this variance request are the following subsections of 19.15.34.12

NMAC 19.15.34.12 A DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT

(4) All primary (upper) liners in a recycling containment shall be geomembrane liners composed of an impervious, synthetic material that is resistant to ultraviolet light, petroleum hydrocarbons, salts and acidic and alkaline solutions. *All primary liners shall be 30-mil flexible PVC, 45-mil LLDPE string reinforced or 60-mil HDPE liners. Secondary liners shall be 30-mil LLDPE string reinforced or equivalent with a hydraulic conductivity no greater than 1 x 10-9 cm/sec. Liner compatibility shall meet or exceed the EPA SW-846 method 9090A or subsequent relevant publications.*

The applicant proposes one layer of 40-mil LLDPE non-reinforced as a primary liner and a secondary liner comprised of one layer of 30-mil LLDPE non-reinforced material

Rule 34 did not consider Above Ground Steel Storage Tanks that employ liners as a primary and secondary containment method.

This material is more readily available than the prescribed liners in the Rule and provides superior flexibility and conformity characteristics. Due to the vertical steel walls, 60-mil HDPE, 45 or 30-mil LLDPE string reinforced liners and 30-mil PCV liners are not sufficiently flexible for use in these modular containments.

All liners will have a hydraulic conductivity no greater than 1 x 10 -9 cm/sec and meet or exceed EPA SW-846 method 9090A.

Demonstration That the Variance Will Provide Equal or Better Protection of Fresh Water, Public Health and the Environment

The following technical documents provide supportive data to demonstrate that this liner system *(with integrated leak detection system)* provides equal or better protection of fresh water, public health and the environment by providing the requisite containment and protection. Attached is a technical comparison of the proposed material is compared to what is advised through Rule 34. A second memorandum provides clarification that the engineering requirements for site preparation, which ensures functionality of the liner system, is crosscutting to varied locations/sites within the Permian Basin. Liner specifications are also included in submission.

R.K. FROBEL & ASSOCIATES
Consulting Engineers

Technical Memorandum: 40-mil LLDPE as Alternative Primary with 30-mil LLDPE as Alternative Secondary Liner System for Modular Steel AST Recycling Containment

NMAC 19.15.34.12 A (4)

In consideration of the liner application for modular AST impoundments, size and depth of the AST, design details for modular tanks as well as estimated length of at least five years of service time, it is my professional opinion that a 40 mil LLDPE (non-reinforced) and a 30 mil LLDPE (non-reinforced) geomembrane system will provide the requisite barrier against produced water loss as an alternative primary and secondary liner system. *The two proposed liners, 40 mil LLDPE as Primary liner and 30 mil LLDPE Secondary liner, will function equal to or better than 45 mil String Reinforced LLDPE, 30 mil PVC, or 60 mil HDPE liners as a primary liner and 30 mil LLDPE string reinforced as a secondary liner system. Additionally, this two-layer system with integrated leak detection system, will provide requisite protection for the environment that is equal to or better than the above primary and secondary liner systems referenced in OCD rule 34.* The following are discussion points that will exhibit the attributes of a 40 mil/30 mil LLDPE lining system:

The nature and formulation of LLDPE resin is very similar to HDPE. The major difference is that LLDPE is lower density, lower crystallinity (more flexible and less chemical resistant). However, LLDPE will resist aging and degradation and remain intact for many years in exposed conditions. The LLDPE resin is virtually the same for non-reinforced 30 or 40 mil LLDPE and string reinforced 30 or 45 mil LLDPE geomembranes and both will provide requisite containment and be equally protective for this application, enduring UV and chemical degradation in the produced water environment.

Flexibility Requirements. Non-reinforced LLDPE geomembranes are less stiff and far more flexible than string reinforced geomembranes as well as 60 mil HDPE and in this regard are preferred for installations in vertical wall tanks such as this proposed installation. LLDPE provides a very flexible sheet that enables it to be fabricated into large panels, folded for shipping and installed on vertical walls transitioned to flat bottom. Non-reinforced LLDPE sheet will conform better than a string reinforced LLDPE to the tank dimensions under hydrostatic loading and will exhibit less wrinkling and creasing during and after installation.

Thermal Fusion Seaming Requirements. Thermal seaming and QC seam test requirements for geomembranes are product specific and usually prescribed by the sheet manufacturer. Both dual wedge and single wedge thermal fusion welding is commonly used on LLDPE and QC testing by air channel (ASTM D 5820) or High Pressure Air Lance (ASTM D 4437) is fully acceptable and recognized as industry standards. In this regard, either non-reinforced LLDPE or string-reinforced LLDPE will be acceptable as far as QC and thermal fusion seaming methods are concerned.

32156 Castle Court / Suite 211 / Evergreen, CO 80439
Ph 303-679-0285 Fx 303-679-8955 geosynthetics@msn.com

R.K. FROBEL & ASSOCIATES
Consulting Engineers

Potential for Leakage through the Primary and Secondary Liners. Leakage through geomembrane liners is directly a function of the height of liquid head above any hole or imperfection. The geonet drainage media between the primary and secondary LLDPE geomembranes at the base of the AST in this application provides immediate drainage to a low point or outside the Modular AST Impoundment and thus no hydrostatic head or driving gradient is available to push leakage water through a hole in the Secondary LLDPE liner .

Leakage through any Primary geomembrane is driven by size of hole and depth and will be detected by the increase of water in the drainage system and the volume being pumped out of the secondary containment. In this regard and for this variance, the Primary consists of 40 mil LLDPE geomembrane which will perform equal to or better than a single layer of string reinforced LLDPE for potential leakage. Thus, if a leak occurs through the top layer, it will be effectively contained by the second layer of 30 mil LLDPE geomembrane. If required, location of holes in the Primary can be found by Electrical Leak Location Survey (ELLS) using a towed electrode (ASTM D 7007). Holes found can then be repaired and thus water seepage into the leakage collection and drainage system will be kept to a minimum. Dependent on OCR requirements for Action Leakage Rate (ALR), the leakage volumes may only be monitored. For example, a typical ALR is < 20 gpad whereas a rapid and large leak (RLL) may be > 100 gpad.
Most states specify maximum ALR values for waste and process water impoundments usually in the range of 100 to 500 gpad. However, New Mexico does not specify an ALR for waste or process water impoundments (GRI Paper No. 15).

LLDPE (and string reinforced LLDPE) can be prefabricated into large panels and thus both types offer the following for Containment:

- Prefabrication in factory-controlled conditions into very large panels (up to 30,000 sf) results in ease of installation, less thermal fusion field seams and less on site QC and CQA. (It should be noted that HDPE cannot be prefabricated into panels and requires considerably more on-site welding and QC).

- Large prefabricated panels will provide better control of thermal fusion welding in a factory environment that will improve the liner system integrity for the long term. Ease of installation of large prefabricated custom size panels results in a greater reduction of installation time and associated installation and QC costs

- The Non-reinforced LLDPE geomembrane provides superior lay flat characteristics and conformability which allows for more intimate contact with the underlying soil, geonet, or geotextile and tank walls as well as overlying materials thus providing better flow characteristics for drainage of water. String reinforced LLDPE exhibits more wrinkling and when overlaid or in contact with a geonet drain, wrinkles tend to form pockets and dams affecting drainage of any leakage water to the exterior of the Modular AST Impoundment.

32156 Castle Court / Suite 211 / Evergreen, CO 80439
Ph 303-679-0285 Fx 303-679-8955 geosynthetics@msn.com

- Both types of LLDPE geomembrane are easily repaired using the same thermal fusion bonding method without the need for special surface grinding preparation for extrusion welding as is typically used in repair of HDPE geomembranes. However, string reinforced LLDPE requires that all cut edges with exposed scrim must be encapsulated with extrusion bead. No encapsulation is required on non-reinforced LLDPE.

In summary, it is my professional opinion that the liner system of 40 mil non-reinforced LLDPE geomembrane as Primary liner and 30 mil non reinforced LLDPE Secondary liner, with integrated leak detection system, will provide protection that is equal to or better than 45 mil string reinforced LLDPE, 30 mil PVC, 60 mil HDPE (primary liner) and 35 mil LLDPEr (secondary liner) and meets requirements as defined by the rule as an alternative liner system (resistance to UV and chemical exposure and required hydraulic conductivity). Additionally, this liner system will provide a superior installation in the AST environment and function better than liners referenced in the OCD rule and will provide the requisite protection of fresh water, public health and the environment for at least 5 years in the produced water recycling environment.

If you have any questions on the above technical memorandum or require further information, give me a call at 720-289-0300 or email geosynthetics@msn.com

Sincerely Yours,

R K Frobel

Ronald K. Frobel, MSCE, PE

References:

NMAC 19.15.34.12 DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT

Geosynthetic Research Institute (GRI) Published Standards and Papers 2018

ASTM Standards 2018

Attachments:

R. K. Frobel C.V.

Slope and Anchor Variance Request for Above Ground Steel Tank Modular Recycling Storage Containments

STATEMENT EXPLAINING WHY THE APPLICANT SEEKS A VARIANCE FOR SLOPE AND ANCHOR FOR MODULAR STEEL AST CONTAINMENT

Statement Explaining Why the Applicant Seeks a Variance

The prescriptive mandates of the Rule that are the subject of this variance request are the following subsections of NMAC 19.15.34.12.

NMAC 19.15.34.12 DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT:

A. An operator shall design and construct a recycling containment in accordance with the following specifications.

(2) A recycling containment shall 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. Geotextile is required under the liner when needed to reduce localized stress-strain or protuberances that otherwise may compromise the liner's integrity. *The operator shall construct the containment in a levee with an inside grade no steeper than two horizontal feet to one vertical foot (2H:1V). The levee shall have an outside grade no steeper than three horizontal feet to one vertical foot (3H:1V).* The top of the levee shall be wide enough to install an anchor trench and provide adequate room for inspection and maintenance.

(3) Each recycling containment shall incorporate, at a minimum, a primary (upper) liner and a secondary (lower) liner with a leak detection system appropriate to the site's conditions. *The edges of all liners shall be anchored in the bottom of a compacted earth-filled trench. The anchor trench shall be at least 18 inches deep*.

The applicant requests a variance to prescribed slope and anchor in the setting of above ground modular steel containments.

With respect to storage of produced water for use in lieu of fresh water, Rule 34 is written for earthen, lined pits, not free-standing modular impoundments that employ liners as their primary fluid containment system. A modular impoundment consists of a professionally designed steel tank ring with vertical walls. There is no slope to consider as the segmental steel sections are set vertical.

There is no anchor trench as envisioned by the Rule, liners are anchored to the top of the steel walls with clips, no anchor trench is required.

Demonstration That the Variance Will Provide Equal or Better Protection of Fresh Water, Public Health and the Environment

The following technical memorandum provides supportive data to demonstrate equal or better protection of fresh water, public health and the environment by providing the requisite containment and protection.

R.K. FROBEL & ASSOCIATES
Consulting Engineers

Technical Memorandum: Slope and Anchor Trench Variance for Above Ground Steel Modular Containments

NMAC 19.15.34.12 A (2), (3)

Side Slope

The design of soil side slope (inclination) is a geotechnical engineering design consideration. Liquid impoundments such as fresh water or process water containments are usually built within an excavation or with raised earthen embankments. For a liquid impoundment with an exposed liner system, the slope soils and construction dictate slope inclination and very detailed slope stability analysis may be required to determine if slope failure within the embankment will occur once loaded with impounded water. Slope failure may also occur during construction or when the impoundment is empty. A maximum slope is usually specified and is dependent on soil type and cohesive strength, saturated or unsaturated conditions, etc. Detailed analysis for slope stability can be found in "Designing with Geosynthetics" by R.M Koerner as well as many geotechnical books.

A modular impoundment, on the other hand, consists of a professionally designed steel tank ring with vertical walls. *There is no slope to consider as the segmental steel sections are set vertical.* Design of steel tanks, in regard to hydrostatic loading, wind loading, seismic loads, etc. are thoroughly referenced with detailed procedures in the design code - American Petroleum Institute (API) 650-98 "Welded Steel Tanks for Oil Storage". *There are no requirements for maximum slope inclination other than perhaps 90 degrees or vertical wall.*

Anchor Trench

All earthen impoundments with a geomembrane lining system require some form of top of slope anchor, the most common of which is an excavated and backfilled anchor trench usually set back at least 3 ft from the top of slope. Again, there are detailed procedures for anchor trench design in "Designing with Geosynthetics" by R.M Koerner.

A Modular Impoundment requires mechanical anchoring of the geomembrane at the top of the vertical steel wall using standard liner clips that prevent the geomembrane or geomembrane layers from slipping down the side wall. These are detailed in the Tank Installation Manual. *There are no requirements for an "anchor trench" as this is not an in-ground impoundment.*

In summary, based on the design and specifications of a modular steel impoundment, there is no requirement for a maximum interior slope angle of 2H:1V due to the fact that this impoundment is a steel tank with vertical walls. Additionally, there is no requirement for an anchor trench as the geomembrane is attached to the top of the Modular Impoundment vertical walls with large steel clips. This provides the requisite protection of fresh water, public health and the environment for many years.

32156 Castle Court / Suite 211 / Evergreen, CO 80439
Ph 303-679-0285 Fx 303-679-8955 geosynthetics@msn.com

R.K. FROBEL & ASSOCIATES
Consulting Engineers

If you have any questions on the above technical memorandum or require further information, give me a call at 303-679-0285 or email geosynthetics@msn.com

Sincerely Yours,

R K Frobel

Ronald K. Frobel, MSCE, PE

References:

NMAC 19.15.34.12 DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT

American Petroleum Institute (API) 650-98 "Welded Steel Tanks for Oil Storage"

Koerner, R.M., 2005 "Designing With Geosynthetics" Prentice Hall Publishers

Attachments:

R. K. Frobel C.V.

32156 Castle Court / Suite 211 / Evergreen, CO 80439
Ph 303-679-0285 Fx 303-679-8955 geosynthetics@msn.com

Freeboard Variance Request for Above Ground Steel Tank Modular Recycling Storage Containments

STATEMENT EXPLAINING WHY THE APPLICANT SEEKS A VARIANCE FOR FREEBOARD FOR MODULAR STEEL AST CONTAINMENT

Statement Explaining Why the Applicant Seeks a Variance

The prescriptive mandates of the Rule that are the subject of this variance request are the following subsections of NMAC 19.15.34.13

> **19.15.34.13 OPERATIONAL REQUIREMENTS FOR RECYCLING CONTAINMENTS:**
> **B.** The operator shall maintain and operate a recycling containment in accordance with the following requirements.
> **(2)** The operator *shall maintain at least three feet of freeboard at each containment*.

The applicant requests variance to allow for a freeboard of 2 feet as opposed to the prescribed 3 feet in the setting of an above ground steel tank modular system.

Rule 34 did not take into consideration above ground steel tank modular containment systems. With respect to lined earthen impoundments that may hold 25-acre feet of produced water, a 3-foot freeboard stipulation makes sense. For example, wave action and other factors could focus stress on the upper portion of the levee or the liner system in these large impoundments. The smaller diameter steel tank (modular impoundment) does not share the same characteristics as these large earthen pits.
We believe 3-feet of freeboard is not necessary – especially during active hydraulic stimulation of wells when maximum storage volume provides the highest value. Moreover, meeting the 3-foot freeboard requirement at all times significantly reduces the storage capacity of a single modular impoundment – negatively impacting the economics of using produced water in lieu of fresh water for E&P activities.

Demonstration That the Variance Will Provide Equal or Better Protection of Fresh Water, Public Health and the Environment

The attached technical memorandum by Ron Frobel, PE, describes how the proposed 2-foot freeboard limit in the permit application for the modular impoundment provides the same protection afforded by the 3-foot freeboard mandate for a large earthen pit. The attached equations and supporting email from Mr. Jason Henderson, PE, shows that a 2-foot freeboard limit on the steel impoundment meets the manufacturer's design criteria.

R.K. FROBEL & ASSOCIATES
Consulting Engineers

Freeboard Requirements for Above Ground Steel Tank Modular Recycling Storage Containments

NMAC 19.15.34.13 B (2)

Liquid impoundments such as fresh water or process water containments are usually built within an excavation or with raised earthen embankments. For a liquid impoundment with an exposed liner system, the slope soils and construction dictate slope inclination and very detailed slope stability analysis may be required to determine if slope failure within the embankment will occur once loaded with impounded water. Freeboard or the vertical height between the maximum water surface elevation and the top of slope is important for earthen impoundments. Specified freeboard requirements take into consideration high precipitation events and prevent wave run-up on slopes that result in over-topping and potential saturation of embankments. This is particularly important on large earthen impoundments. Detailed design considerations including freeboard requirements for lined earthen impoundments can be found in "Designing with Geosynthetics" by R.M Koerner as well as other publications on reservoir design.

A modular impoundment, on the other hand, consists of a professionally designed steel tank ring with vertical walls. There is no slope to consider as the segmental steel sections are set vertical. Design of steel tanks as regards hydrostatic loading, wind loading, seismic loads, etc. are thoroughly referenced with detailed procedures in the design code - American Petroleum Institute (API) 650-98 "Welded Steel Tanks for Oil Storage". *There are requirements for operational freeboard to prevent over-topping but due to the relatively small surface area and fetch of cylindrical tanks, wave heights are much less than large earthen impoundments. Thus, freeboard is usually within the range of 0.5 to 2 ft.* I have reviewed the Tank Design Calculation Summary and regarding the structural stability of the tank walls, a freeboard of 0.5 ft was assumed. Thus, the variance request of 2.0 ft for a Modular Impoundment is well within the Tank Design requirements.

In summary, it is my professional opinion that the design freeboard of 2.0 ft will provide requisite storage volume and prevent overtopping due to wind and wave action, potential seismic events and high precipitation.

If you have any questions on the above technical memorandum or require further information, give me a call at 303-679-0285 or email geosynthetics@msn.com

Sincerely Yours,

R K Frobel

Ronald K. Frobel, MSCE, PE

COLORADO REGISTERED RONALD KENNETH FROBEL 15742 PROFESSIONAL ENGINEER

References:

NMAC 19.15.34.13 OPERATIONAL REQUIREMENTS FOR RECYCLING CONTAINMENTS

32156 Castle Court / Suite 211 / Evergreen, CO 80439
Ph 303-679-0285 Fx 303-679-8955 geosynthetics@msn.com

American Petroleum Institute (API) 650-98 “Welded Steel Tanks for Oil Storage”

Koerner, R.M., 2005 “Designing With Geosynthetics” Prentice Hall Publishers

Attachments:

R. K. Frobel C.V.

The modular impoundment is designed for use with fluids that are 8.34 pounds/gallon (62.4 pounds per cubic foot) or lighter. Exceeding this specification for fluid weight at full tank capacity (12') could lead to failure at the connection plate(s).

Assuming a freeboard of 0.5 ft (minimum modular impoundment freeboard requirement) the Hyrdo Pressure (p) of water is 718 pounds per square foot (psf), where

$$p = Design\ Density\ X\ Height$$

$$= 62.4\ PCF * 11.5\ ft$$

$$(design\ density = 8.34\ \frac{lb}{gal}\ X\ 7.48\ \frac{ft^3}{gal})$$

The density of the conditioned produced water is 9.3 pounds/gallon. Assuming a freeboard of 3-ft (19.15.17.12.F(3) NMAC) , the Hyrdo Pressure (p) of conditioned produced water is 626 psf, where

$$p = Design\ Density\ X\ Height$$

$$= 69.64\ PCF * 9\ ft$$

$$(design\ density = 9.3\ \frac{lb}{gal}\ X\ 7.48\ \frac{ft^3}{gal})$$

Using conditioned produced water with the Pit Rule freeboard requirements of 3-feet results in a Hydro Pressure 92 psf less than the engineered design.

The operator asks the District Division to allow for a 2-foot freeboard, which yields a Hydro Pressure (p) of 696.4 psf, where

$$p = Design\ Density\ X\ Height$$

$$= 69.64\ PCF * 10\ ft$$

$$(design\ density = 9.3\ \frac{lb}{gal}\ X\ 7.48\ \frac{ft^3}{gal})$$

January 2020

Applicability of Variances for Modular AST Containments in the Permian Basin of New Mexico

R.K. FROBEL & ASSOCIATES
Consulting Engineers

Technical Memorandum: Applicability of Variances for Modular AST Containments in the Permian Basin of New Mexico

NMAC 19.15.34.12 A (2)

I have reviewed the most recent historical variances for AST Containments in the document titled "Variances for C-147 Registration Packages Permian Basin of New Mexico" (January 2020) and examined the applicable design drawings and permits for the following modular AST containments located in the Permian Basin of New Mexico.

- C-147 Registration Package for Myox Above Ground Storage Tank Section 32, T25S, R28E, Eddy County (January 20, 2020)
- C-147 Registration Package for Fez Recycling Containment and Recycling Facility Area (100+ acres) Section 8, T25-S, R35-E, Lea County, Volume 2 – Above-Ground Storage Tank Containments
- Hackberry 16 Recycling Containments and Recycling Facility Section 16, T19S, R31E, Eddy County

Locations of the modular containments range from west of the Pecos River to slightly west of Jal, NM. All locations exhibit different surface and subsurface geology, different topography and are of various sizes and volumes. *However, in regard to structural integrity of the base soils that support the AST and in particular the geomembrane containment system, the specification requirements are the same*. The foundation soils must be roller compacted smooth and free of loose aggregate over ½ inch. Compaction characteristics must meet or exceed 95% of Standard Proctor Density in accordance with ASTM D 698. This specification requirement is specific and causes the general or earthworks contractor to meet this standard regardless of the site- specific geology or topography. Provided that the design drawings and associated specifications call out the minimum requirements for subsoils compaction (i.e., 95% Standard Proctor Density – ASTM D 698), the design engineer or owners representative will carry out soils testing on the foundation materials to provide certainty to the AST containment owner that the earthworks contractor has met these obligations.

Thus, provided that the contractor meets the minimum specified requirements for foundation soils preparation and density, the location, geology or depth to groundwater will make no difference in regard to geomembrane liner equivalency as demonstrated by the AST variances presented in this volume and are considered valid for meeting NMOCD Rule 34 requirements for all locations within the Permian Basin of New Mexico.

If you have any questions on the above technical memorandum or require further information, give me a call at 720-289-0300 or email geosynthetics@msn.com

32156 Castle Court / Suite 211 / Evergreen, CO 80439
Ph 303-679-0285 Fx 303-679-8955 geosynthetics@msn.com

Sincerely Yours,

R K Frobel

Ronald K. Frobel, MSCE, PE

References:

NMAC 19.15.34.12 DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT

ASTM Standards 2019

32156 Castle Court / Suite 211 / Evergreen, CO 80439 Ph
303-679-0285 Fx 303-679-8955 geosynthetics@msn.com

RONALD K. FROBEL, MSCE, P.E.

CIVIL ENGINEERING
GEOSYNTHETICS
EXPERT WITNESS
FORENSICS

FIRM: R. K. FROBEL & ASSOCIATES
Consulting Civil / Geosynthetics Engineers

TITLE: Principal and Owner

PROFESSIONAL AFFILIATIONS:

American Society for Testing and Materials (ASTM) -
Founding member of Committee D 35 on Geosynthetics
Chairman ASTM D35 Subcommittee on Geomembranes 1985-2000
ASTM Award of Merit Recipient/ASTM Fellow - 1992
ASTM D18 Soil and Rock - Special Service Award - 2000
Transportation Research Board (TRB) of The National Academies
Appointed Member A2K07 Geosynthetics 2000 - 2003
National Society of Professional Engineers (NSPE) - Member
American Society of Civil Engineers (ASCE) - Member
Colorado Section - ASCE - Member
International Society of Soil Mechanics and Foundation Engineers
(ISSMFE) - Member
International Geosynthetics Society (IGS) - Member
North American Geosynthetics Society (NAGS) - Member
International Standards Organization (ISO) - Member TC 221
Team Leader - USA Delegation Geosynthetics 1985 - 2001
European Committee for Standardization (CEN) - USA Observer
EPA Advisory Committee on Geosynthetics (Past Member)
Association of State Dam Safety Officials (ASDSO) – Member
U. S. Committee on Irrigation and Drainage (USCID) - Member
Technical Advisory Committee - Geosynthetics Magazine
Editorial Board - Geotextiles and Geomembranes Journal
Fabricated Geomembrane Institute (FGI) – Board of Directors
Co-Chairman International Conference on Geomembranes
Co-Chairman ASTM Symposium on Impermeable Barriers
U.S. Naval Reserve Officer (Inactive)
Registered Professional Engineer – Civil (Colorado)
Mine Safety Health Administration (MSHA) Certified

ACADEMIC BACKGROUND:

University of Arizona: M.S. - Civil Engineering - 1975
University of Arizona: B. S. - Civil Engineering – 1969
Wentworth Institute of Technology: A.S. Architecture – 1966

PROFESSIONAL EXPERIENCE:

R. K. Frobel & Associates - Consulting Engineers
Evergreen, Colorado, Principal and Owner, 1988 - Present

Chemie Linz AG and Polyfelt Ges.m.b.H., Linz, Austria
U. S. Technical Manager Geosynthetics, 1985 - 1988

U.S. Bureau of Reclamation, Engineering and Research Center
Denver, Colorado, Technical Specialist in Construction Materials Research and Application, 1978 - 1985

Water Resources Research Center (WRRC), University of Arizona
Tucson, AZ, Associate Research Engineer, 1975 - 1978

Engineering Experiment Station, University of Arizona
Tucson, AZ, Research Assistant, 1974 - 1975

United States Navy, Commissioned Naval Officer, 1970 - 1973

REPRESENTATIVE EXPERIENCE:

R.K. Frobel & Associates: Civil engineering firm specializing in the fields of geotechnical, geo-environmental and geosynthetics. Expertise is provided to full service civil/geotechnical engineering firms, federal agencies, municipalities or owners on a direct contract, joint venture or sub-consultant basis. Responsibilities are primarily devoted to specialized technical assistance in design and application for foreign and domestic projects such as the following:
Forensics investigations into geotechnical and geosynthetics failures; providing expert report and testimony on failure analysis; providing design and peer review on landfill lining and cover system design, mine waste reclamation, water treatment facilities, hydro-technical canal, dam, reservoir and mining projects, floating reservoir covers; oil and gas waste containment; design of manufacturers technical literature and manuals; development and presentation of technical seminars; new product development and testing; MQA/CQA program design and implementation.

Polyfelt Ges.m.b.H., Linz, Austria and Denver Colorado: As U.S. technical manager, primary responsibilities included technical development for the Polyfelt line of geosynthetics for the U.S. civil engineering market as well as worldwide applications.

U.S. Bureau of Reclamation, Denver, Colorado: As technical specialist, responsibilities included directing laboratory research, design and development investigations into geosynthetics and construction materials for use on large western water projects such as dams, canals, power plants and other civil structures. Included were material research, selection and testing, specification writing, large scale pilot test programs, MQA/CQA program design and supervision of site installations. Prime author or contributor to several USBR technical publications incorporating geosynthetics.

University of Arizona, Tucson, Arizona: As research engineer at the Water Resources Research Center, responsibilities included research, design and development of engineering materials and methods for use in construction of major water projects including potable water reservoirs, canals and distribution systems. Prime author or contributor to several WRRC technical publications.

Northeast Utilities, Hartford, Connecticut: As field engineer for construction at Northeast Utilities, responsibilities included liason for many construction projects including additions to power plants, construction of substations, erection of fuel oil pipelines and fuel oil storage tanks. Responsibilities also included detailed review, inspection and reporting on numerous construction projects.

U.S. Navy: Commissioned Naval Officer – Nuclear Program

PUBLICATIONS: Over 85 published articles, papers and books.

CONTACT DETAILS:

Ronald K. Frobel, MSCE, P.E.
R. K. Frobel & Associates
Consulting Civil/Geosynthetics Engineers
PO Box 2633
Evergreen, Colorado 80439 USA
Phone 720-289-0300
Email: geosynthetics@msn.com

Additional VARIANCE FOR RECYCLING STORAGE CONTAINMENTS (Inground and AST)

- **Alternative Testing Methods**

Request for OCD Approval of Alternative Test Methods to Analyze Concentrations of TPH and Chloride

The prescriptive mandates of the Rule that are the subject of this request are the following subsections of NMAC 19.15.17.13 [emphasis added], 19.15.34.14 and 19.15.29. 12 D

> **19.15.17.13 CLOSURE AND SITE RECLAMATION REQUIREMENTS:**
> **D.(5)** The operator shall collect, at a minimum, a five point composite of the contents of the temporary pit or drying pad/tank associated with a closed-loop system to demonstrate that, after the waste is solidified or stabilized with soil or other non-waste material at a ratio of no more than 3:1 soil or other non-waste material to waste, the concentration of any contaminant in the stabilized waste is not higher than the parameters listed in Table II of 19.15.17.13 NMAC.

The referenced Table II, which is reproduced in part below, notes the Method with asterisk signifying: "*Or other test methods approved by the division".

Table II
Closure Criteria for Burial Trenches and Waste Left in Place in Temporary Pits

Depth below bottom of pit to groundwater less than 10,000 mg/l TDS	Constituent	Method*	Limit**
25-50 feet	Chloride	EPA Method 300.0	20,000 mg/kg
	TPH	EPA SW-846 Method 418.1	100 mg/kg

> **19.15.34.14 CLOSURE AND SITE RECLAMATION REQUIREMENTS FOR RECYCLING CONTAINMENTS:**
> **C.** The operator shall 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.
> **(1)** If any contaminant concentration is higher than the parameters listed in Table I, the division may require additional delineation upon review of the results and the operator must receive approval before proceeding with closure.

The referenced Table I, which is reproduced in part below, notes the Method with asterisk signifying: "*Or other test methods approved by the division".

Table I
Closure Criteria for Recycling Containments

Depth below bottom of containment to groundwater less than 10,000 mg/l TDS	Constituent	Method*	Limit**
51 feet - 100 feet	Chloride	EPA 300.0	10,000 mg/kg
	TPH (GRO+DRO+MRO)	EPA SW-846 Method 8015M	2,500 mg/kg

After sampling solids of more than 50 drilling pits in the Permian Basin, we have observed and reported to OCD on numerous occasions significant problems with non-petroleum drilling additives (e.g. starch) interfering with the laboratory method 418.1. It is not surprising that in many instances we found no correlation between the laboratory results using 418.1 and the results using Method 8015.

We request approval of Method 8015 (GRO + DRO + MRO) for Method 418.1.

> **19.15.29.12 D. CLOSURE REQUIREMENTS.** The responsible party must take the following action for any major or minor release containing liquids.
> **(1)** The responsible party must test the remediated areas for contamination with representative five-point composite samples from the walls and base, and individual grab samples from any wet or discolored areas. The samples must be analyzed for the constituents listed in Table I of 19.15.29.12 NMAC or constituents from other applicable remediation standards.

The referenced Table I, is reproduced in part below.

Table I
Closure Criteria for Soils Impacted by a Release

Minimum depth below any point within the horizontal boundary of the release to ground water less than 10,000 mg/l TDS	Constituent	Method*	Limit**
≤ 50 feet	Chloride***	EPA 300.0 or SM4500 Cl B	600 mg/kg
	TPH (GRO+DRO+MRO)	EPA SW-846 Method 8015M	100 mg/kg
	BTEX	EPA SW-846 Method 8021B or 8260B	50 mg/kg
	Benzene	EPA SW-846 Method 8021B or 8260B	10 mg/kg

We request approval of EPA 300.0 or SM4500 for the analysis of chloride.

Demonstration that OCD Approval Will Provide Equal or Better Protection of Fresh Water, Public Health and the Environment

The purpose of TPH analyses in the Pit Rule is to measure total petroleum hydrocarbons not all non-polar compounds, such as starch or cellulose that can interfere with Method 418.1. While Method 418.1 may provide some useful data for transportation of crude oil or condensate spills to disposal, the addition of non-polar organic materials in drilling fluids, especially for horizontal wells, renders Method 418.1 highly problematic to determine compliance with the Rule. Using Method 8015 for TPH (GRO+DRO+MRO) provides a better measurement of what we believe the Commission intended operators to measure.

In hearings before the Oil Conservation Commission technical arguments were presented regarding the use of SM4500 in lieu of EPA 300.00 for chloride analysis for Rule 29. The Division and the Commission agreed that these two methods provide equal or better protection of fresh water, public health and the environment.

District I
1625 N. French Dr., Hobbs, NM 88240
Phone:(575) 393-6161 Fax:(575) 393-0720
District II
811 S. First St., Artesia, NM 88210
Phone:(575) 748-1283 Fax:(575) 748-9720
District III
1000 Rio Brazos Rd., Aztec, NM 87410
Phone:(505) 334-6178 Fax:(505) 334-6170
District IV
1220 S. St Francis Dr., Santa Fe, NM 87505
Phone:(505) 476-3470 Fax:(505) 476-3462

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

CONDITIONS

Action 31286

CONDITIONS

Operator: CHISHOLM ENERGY OPERATING, LLC 801 Cherry Street Fort Worth, TX 76102	OGRID: 372137
	Action Number: 31286
	Action Type: [C-147] Water Recycle Long (C-147L)

CONDITIONS

Created By	Condition	Condition Date
vvenegas	NMOCD has reviewed and approved with conditions, the recycling containment permit application submitted by CHISHOLM ENERGY OPERATING, LLC [372137] on June 10, 2021 for 1RF-470 - SOMBRERO RECYCLING FACILITY AND CONTAINMENT, FACILITY ID [fVV2120750814], in Unit Letter N, Section 07, Township 21S, Range 33E, Lea County, New Mexico.	7/27/2021