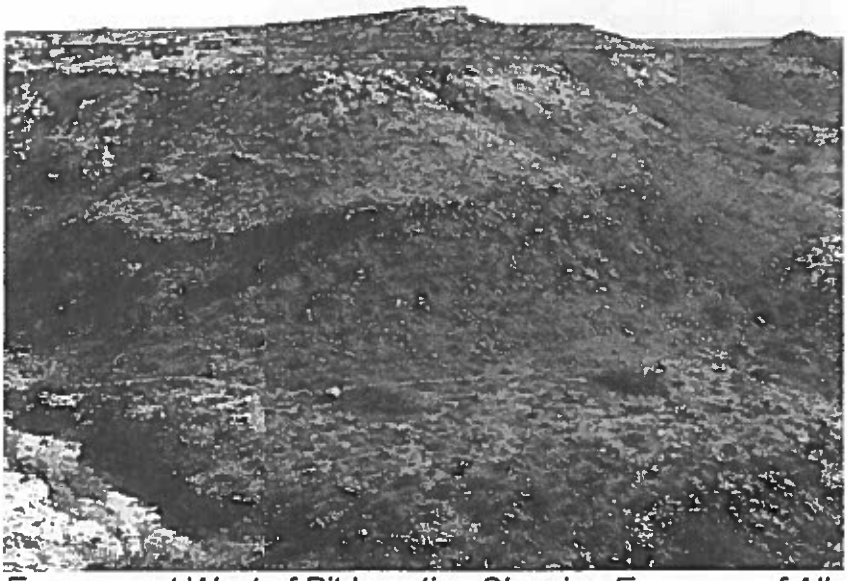
September 2013

C-144 Supplemental Information
Round Tank #1 & #2 Permanent Pits
Section 19 T15S R29E Chaves County



Escarpment West of Pit Location Showing Exposure of Alluvium and Caliche Underlain by Santa Rosa Sandstone (red) and Limestone (light gray)

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Artesia, New Mexico

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Albuquerque, New Mexico

Executive Summary

Mack Energy Corporation proposes to use permanent pits as part of a water re-use program that will minimize the withdrawal of fresh groundwater for exploration and production activities in southern Chaves County. The current program design calls for two permanent pits. Pit #1 will receive less than 6,000 barrels of water per day and store this untreated water for re-use. For 2-3 days every few weeks, Pit #2 will receive treated water from a mobile system on a batch basis (about 15,000 bbls/day). Mack is currently exploring alternative water treatment technologies that do not require batch processing. If an alternative process is selected, only one permanent pit will be needed. Because of the uncertainty regarding the method of treatment, Mack is submitting two permits for two pits.

Considering an operational water level with 3-feet of freeboard, each pit will hold 53,000 barrels (slightly more than 2, 250,000 gallons) of water. Each pit has a total capacity, including freeboard, of 9.98 acre feet.

The design and construction protocols are identical for each pit. With the exception of the proposed liner material and the proposed leak detection system, the design follows the prescriptive mandates of OCD Rules. For the primary and secondary liners, we propose the Raven KB30B, which we believe performs equal to or better than the prescribed liner materials. For the leak detection system, we propose a geotextile drainage system in lieu of placing two feet of compacted soil between the liners.

A two-pit system operates in the following manner. For 10-20 days of each month, Pit #1 fills with untreated water for re-use (2,000-5,000 bbls/day). During this same time, treated water stored in Pit #2 is actively being removed for drilling (about 500 bbls/day), stimulation (about 140 bbls/min for a 25,000 bbl hydraulic fracturing program) or other approved uses. Once every 2-4 weeks, a mobile water treatment unit removes about 15,000 barrels of untreated water per day from Pit #1, treats the water, and discharges the water to Pit #2. The batch treatment of water is the only time when both pits receive water simultaneously: 15,000 bbls/day flows to Pit #2 and 2,000-5,000 bbls/day of untreated water flows to Pit #1. Mack has the ability to control the flow rate of water to the pits – including immediately ceasing all water flow.

Operation of a single pit system calls for continuous flow of treated water to Pit #2 at a rate of less than 5,000 bbls/day. At this flow rate, the treatment system would operate 5-6 days per week to supply the needs of the 2014 exploration and production program.

This application proposes excavation and removal as a closure method. The permanent pits 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 location of the permanent pits meets all of the siting criteria required by OCD Rules. We carefully examined the proposed location for the presence of unstable ground. The location lies within a "low karst potential" as mapped by BLM. The pits are about 1-mile east of the area we would map as "high karst potential" (although BLM identifies this area as medium potential in Chaves County) and several closed depressions exist nearby. Results of auger drilling at the site combined with our geologic examination of the area allows us to conclude with a high degree of certainty that pits lie within a stable platform that is not susceptible to subsidence associated with solution cavities (karst).

To aid the reviewers in understanding the organization of the permit application, we prepared the table below that shows the elements required by the Rule on the left column with the corresponding section of the Supplemental Information in the right column.

Rule Citation	Round Tank Permanent Pits
B. The permit application shall include a detailed plan as follows. **(1)** Permanent pits. A registered professional engineer shall certify engineering, design and construction specifications as contained in the plan for permanent pits. The plan shall include:	Appendix A – Design Drawings Scott Eddings, a Registered Professional Engineer provided the design of both permanent pits and certified the construction specifications presented in Appendix B
(a) a quality control/quality assurance construction and installation plan;	Appendix B is the Construction and installation Plan that includes QC/QA protocols
(b) operating and maintenance procedures;	Appendix C is the O&M Plan that also includes the monitoring and inspection plan
(c) a closure plan;	Appendix D is the closure plan
(d) a hydrogeologic report that provides sufficient information and detail on the site's topography, soils, geology, surface hydrology and ground water hydrology to enable the division's Santa Fe office to evaluate the actual and potential effects on soils, surface water and ground water;	Appendix E contains the hydrogeologic report, demonstration of compliance with siting criteria and the climatological data
(e) detailed information on dike protection and structural integrity; and leak detection, including an adequate fluid collection and removal system	The design drawings of Appendix A provide detailed information on dike protection, leak detection and the fluid collection/removal system that is part of the leak detection system
(f) liner specifications and compatibility	Appendix F provides the liner specifications and data on compatibility of the liner with the untreated water scheduled for re-use
(g) freeboard and overtopping prevention;	Appendix C includes measure to prevent overtopping of the pits and maintenance of required freeboard
(h) prevention of nuisance or hazardous odors, including H2S;	Appendix G addresses the prevention of hazardous odors
(i) an emergency response plan, unless the permanent pit is part of a facility that has an integrated contingency plan	Appendix H is the emergency response plan
(j) type of oil field waste stream;	Appendix I presents laboratory analyses of the untreated water proposed for re-use
(k) climatological factors, including freeze-thaw cycles;	Appendix E contains the climatological data
(l) a monitoring and inspection plan;	Appendix C includes the monitoring and inspection plan
(m) erosion control	Appendix A and B present the design features that will prevent erosion and Appendix C provides for inspections to check for erosion.

Finally, Mack proposes to cause a foundation study of the site overseen by New Mexico Registered Professional Engineers. The purpose of this study is to provide recommendations for the foundation of the liner and recommendations for ensuring dike protection and structural stability. Mack requests that OCD approve the permit application with the condition that the Professional Engineer's foundation report is submitted to OCD and the pit construction protocols follow the recommendations.

Appendix A

Design Drawings including data on
Erosion Control,
Dike protection,
Leak detection/fluid removal

C-144 Supplemental Information: Pit Design
Permanent Pit

We believe the design of the permanent pits adheres to the prescriptive mandates set forth in NMOCD Rules with the exception of two design features:

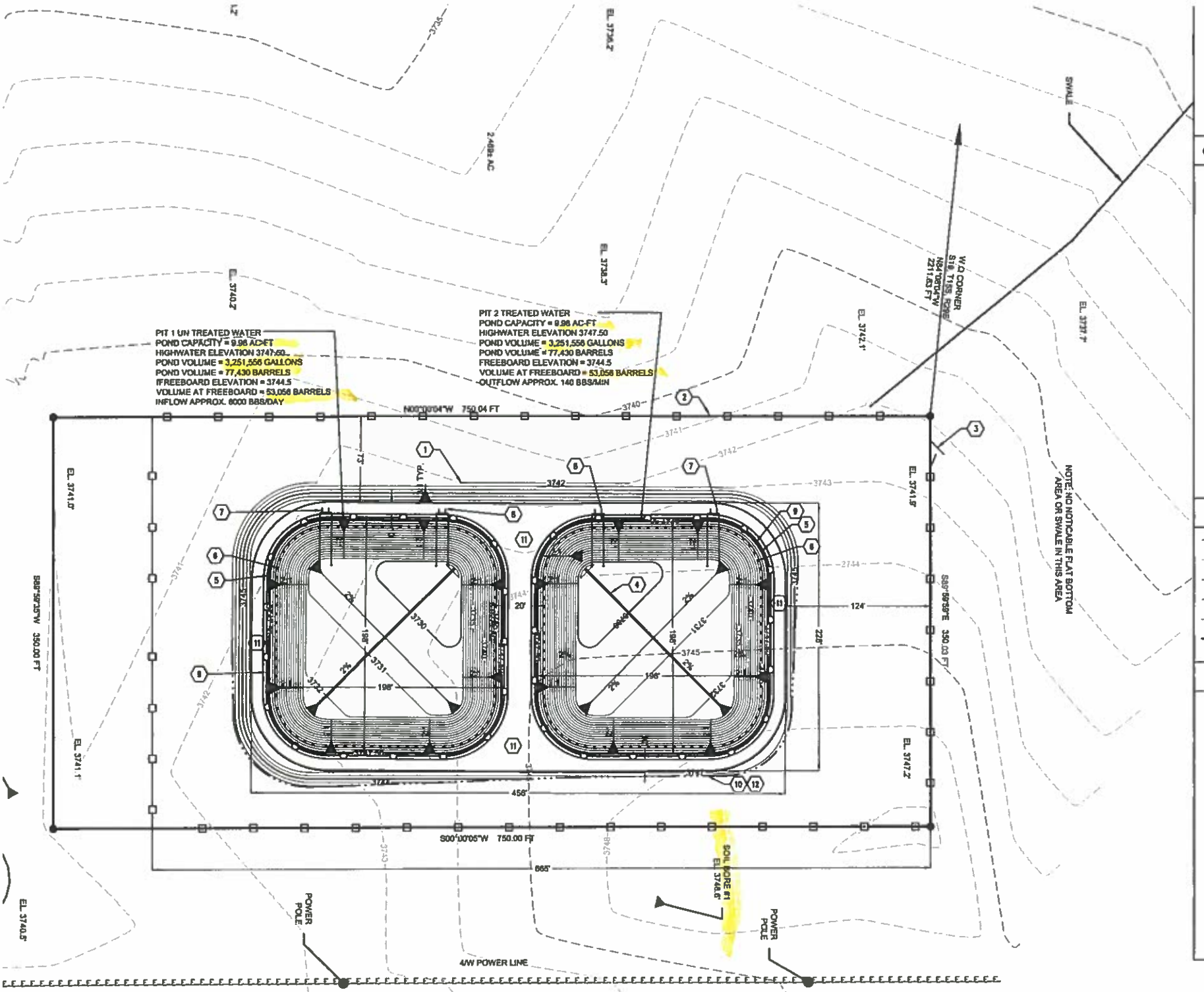
1. The design engineer has selected the Duraskrim K30B (see Appendix F) for the primary and secondary liners. Mr. Eddings discussed the K30B liner with the manufacturer, liner installation professionals and compared the expected performance of the liner with the prescribed liners of the Rule. The design team concludes that the selected liner protects fresh water, public health, and the environment as effectively as 30-mil flexible PVC or 60-mil HDPE.
2. The design engineer selected 12-oz nonwoven geotextile fabric as the drainage layer for the leak detection system in lieu of the prescribed two feet of compacted soil with a saturated hydraulic conductivity of 1 x 10-5 cm/sec or greater. However, due to availability, the 16-oz fabric (see Appendix F) may be used instead of the 12-oz.

With respect to the selected liner material, the Rule states:

> (4) The division's Santa Fe office may approve other liner media if the operator demonstrates to the satisfaction of the division's Santa Fe office that the alternative liner protects fresh water, public health, and the environment as effectively as the specified media.

The K30B liner has been used for fresh water "frac" ponds throughout southeast New Mexico and has performed admirably. The selection of the alternative liner was based on a comparison of characteristics and field performance in New Mexico.

Please note that Mack's transmittal letter calls for a meeting between the design team and OCD to discuss any issues relating to the permit. If the design drawing stamped by a Professional Engineer combined with the specifications included in this application does not provide a sufficient demonstration to satisfy the division's Santa Fe office, we propose that we use this meeting to go over any issues and outline a pathway to creating the requisite demonstration.



4. PERIMETER OF THE PIT SHAL
5. WATER SURFACE OF PIT 1 APPROVED EQUAL.
6. STRIP AND STOCKPILE TOP S OWNER SHALL DIRECT LOCAT
7. EARTHWORK SHALL BE WET COMPACTED TO A MINIMUM (

SHEET KEYN(

1. LIMITS OF DISTURBANCE.
2. 4 STRAND BARBED WIRE FEN
3. 12-FOOT SWING GATE (FENCI
4. LEAK DETECTION SYSTEM PIP
5. HIGH WATER ELEVATION
6. 3' FREEBOARD DEPTH
7. PIPE SUCTION AND DISCHARG
8. PIPE SUCTION AND DISCHARG
9. PLACE BIRD-NETTING ACROS
10. FLOWLINE
11. TOP OF EMBANKMENT
12. DIKE W/ COBBLE SIZE CALIC

LEGEND

- EXISTING CONTOUR
- EXISTING CONTOUR
- PROPOSED CONTOU
- PROPOSED CONTOU
- PROPOSED BARBED
- LEAK DETECTION PI

EROSION CON

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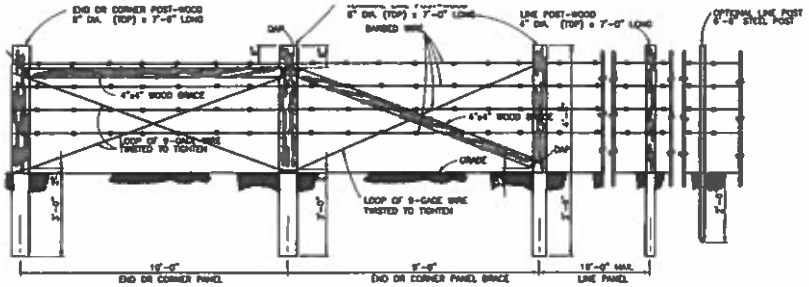
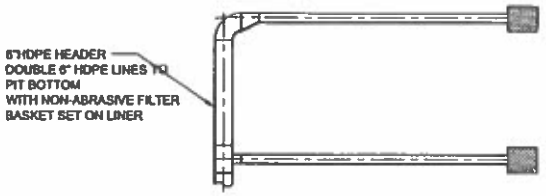
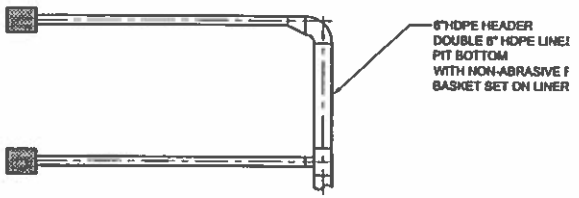
2. STORM WATER SHEET FLOWS PERIMETER OF PIT WITHIN A SWALE SHALL BE INSTALLED EXTEND TO THE LOW POINT. SHALL NOT EXCEED 2% WIT OF FLOWLINE AND SIDE SLO
3. STOCKPILE TOPSOIL ALONG STOCKPILED TOPSOIL (BERM) RUN ON.
4. SEDIMENT SHALL BE FILTERE ACCORDANCE WITH THE STO PREVENTION PLAN.
5. EXPOSED SLOPES SHALL BE MATERIAL.
6. ALL DISTURBED AREAS SHA SEEDS AND STRAW CRIMPED



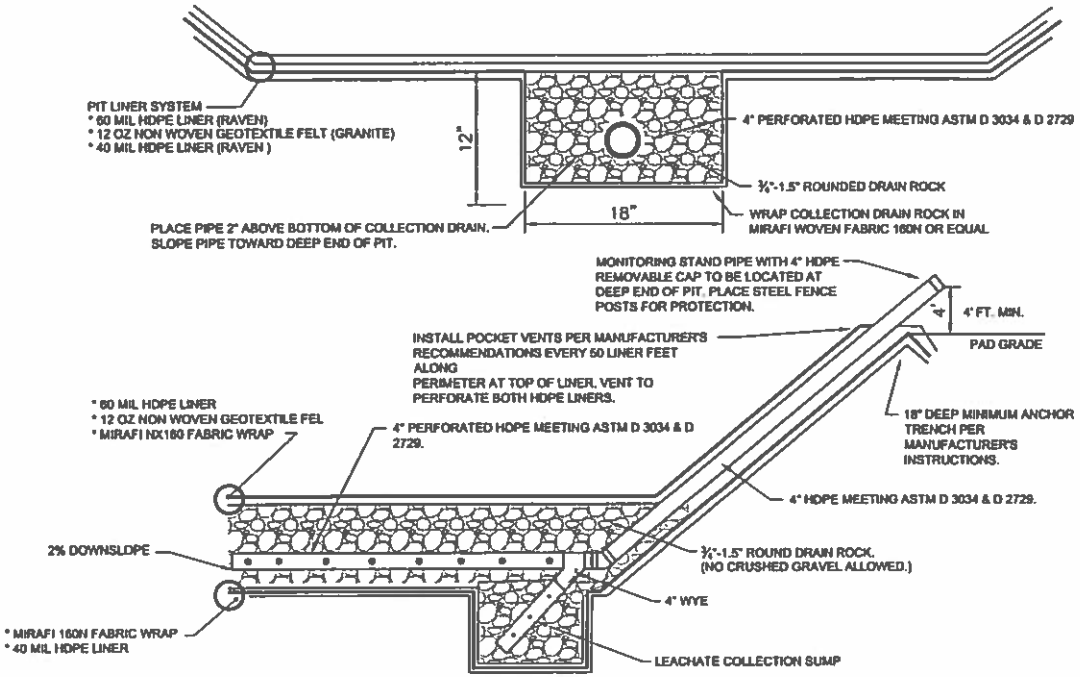
C1 TYPICAL LAYOUT-4 STRAND BARBED-WIRE FENCE
SCALE: N.T.S.



C2 PIPE SUCTION & DISCHARGE PIT INFLOW SIDE
SCALE: N.T.S.



C3 PIPE SUCTION & DISCHARGE PIT OUTFLOW SIDE
SCALE: N.T.S.



Appendix B

Construction and Installation Plan including
Quality Control/Quality Assurance Construction and Installation

C-144 Supplemental Information: Design and Construction Plan
Permanent Pit

This plan addresses construction of the following:

1. One permanent pit for receiving water scheduled for treatment and re-use (if necessary)
2. One permanent pit for the storage of treated water that will be used for drilling, stimulation and other E&P work elements

Both pits share the same design elements and construction protocols. Each pit has a total volume, including freeboard that is less than 10 acre-feet.

Appendix A presents the design drawings for the permanent pits and satisfies the mandate for inclusion of
(1) Certified Engineering Design Plans
(2) Leak Detection Design
(3) Erosion Control Plan

Appendix F provides liner, geotextile, piping and other materials specifications including documentation on the compatibility of the materials with the stored water chemistry

Field conditions may create the need for minor modification of the pit design (e.g. changing the length, width or depth without increasing the maximum volume). If field conditions dictate the need to modify the design, Mack Energy will notify NMOCD of the proposed changes and provide justification. Any design change that does not conform to the prescriptive mandates of NMOCD Rules will be the subject of a minor modification request submitted to the OCD for review and approval.

Dike Protection and Structural Integrity

These design elements will be specifically addressed in the foundation recommendations prepared by a New Mexico Registered Professional Engineer. The recommendations will be based on site-specific data. Mack will submit the recommendations to OCD prior to completing the earthwork.

Stockpile Topsoil

Prior to constructing the pit the qualified contractor will strip and stockpile the topsoil for use as the final cover or fill at the time of closure.

Signage

The operator shall post an upright sign not 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 pit. 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.

Fencing:

As the pit is not located within 1000 feet of a permanent residence, school, hospital, institution or church, the design plan shows a fence around the pit to exclude livestock with

four-wire strands evenly spaced in the interval between one foot and four feet above ground level.

Netting

The design plan shows that the pit is netted. Appendix F provides the specifications for the proposed netting.

Earthwork

A professional engineer registered in New Mexico will provide recommendations regarding the foundation for the pit liner. The pit will have a properly constructed foundation and interior slopes consisting of a firm, unyielding base that is smooth and free of rocks, debris, sharp edges or irregularities to prevent the liner's rupture or tear.

Appendix A shows the

a. inside grade of the levee is no steeper than two horizontal feet to one vertical foot (2H:1V).
b. levee has an outside grade no steeper than three horizontal feet to one vertical foot (3H:1V).
c. levee's top is wide enough to install an anchor trench that is at least 18-inches deep and provide adequate room for inspection and maintenance.
d. pit contains a primary (upper) liner and a secondary (lower) liner with a leak detection system between the upper and lower geomembrane liners that is appropriate to the site's conditions and is equivalent to the liner material prescribed in the Rule (see Appendix F).
e. cobble-sized caliche placed on the levee (see note 12 of Appendix A) provides additional erosion control.

Liner Installation

The liner will be installed in a manner consistent with the Manufacture's specifications, which are found at http://ravenefd.com/files/6413/4273/4126/Geo_Install_Guide_w-Appendix.pdf . Protocols for liner installation include measures to:

i. minimize liner seams and orient them up and down, not across a slope.
ii. use factory welded seams where possible
iii. overlap liners four to six inches and orient seams parallel to the line of maximum slope, i.e., oriented along, not across, the slope, prior to any field seaming
iv. minimize the number of welded field seams in comers and irregularly shaped areas
v. utilize only qualified personnel to weld field seams
vi. avoid excessive stress-strain on the liner.
vii. place geotextile under the liner where needed to reduce localized stress-strain or protuberances that may otherwise compromise the liner's integrity.
viii. anchor the edges of all liners in the bottom of a compacted earth-filled

trench that is at least 18 inches deep

ix. place additional material (liner, felt, etc.) to ensure that the liner is protected from any fluid force or mechanical damage at any point of discharge into or suction from the lined temporary pit.

At points of discharge into or suction from the lined permanent pit is a header or diverter or other hardware (see Appendix A). With this equipment in place, during injection or removal of fluids from the pit, the liner is protected from excessive hydrostatic force or mechanical damage. External discharge or suction lines do not penetrate the liner.

Leak Detection Installation

The leak detection and fluid removal system contains the following design elements

a. The geotextile drainage material between the primary and secondary liner is sufficiently permeable to allow the transport of fluids to the drainage pipe (Appendix F).
b. the drainage and collection and removal system placed above the lower geomembrane liner is in a trench. The pit floor is sloped towards the trench to facilitate the earliest possible leak detection.
c. Piping used is designed to withstand chemical attack from the stored water or leachate; structural loading from stresses and disturbances from overlying water, cover materials, equipment operation or expansion or contraction; and to facilitate clean-out maintenance (see Appendix A).
d. The slope of the interior sub-grade and of drainage lines and laterals is at least a two percent grade, i.e., two feet vertical drop per 100 horizontal feet.
e. The piping collection system is comprised of solid and perforated pipe having a minimum diameter of four inches and a minimum wall thickness of schedule 80 (Appendix A).

As shown in Appendix A, the pit elevation is raised above the native site grade and provides a diversion of run-on of surface water to the pit.

C-144 Supplemental Information:
Quality Control/Quality Assurance Construction and Installation Plan
Permanent Pit

The design drawings presented in Appendix A were generated, peer-reviewed and stamped by New Mexico Registered Professional Engineers. Upon permit approval, a New Mexico Registered Professional Engineer will conduct a site study and provide recommendations regarding construction of the

- Earth foundation for the liner
- Dike to provide for structural integrity and protection

A New Mexico Registered Professional Engineer familiar with the NMOCD Rules and this pit permit will monitor the construction and installation to ensure compliance with the approved permit, plans and specifications. The following measures will be taken to ensure Quality Control/Quality Assurance (QA/QC) during construction and liner installation:

1. Pre-construction Meeting: After surveyors complete grade staking the location in anticipation of construction, a pre-construction meeting will be held by the PE or designee, construction contractor and Mack representatives; NMOCD and SLO representatives are invited to attend this pre-construction meeting. The purpose of this meeting is to
    a. discuss the design relative to actual site conditions
    b. address any questions or concerns of the selected construction contractor, surface owner and NMOCD
    c. discuss plans and protocols to address unforeseen subsurface conditions
    d. develop a schedule for construction
2. Earthwork Completion: Following completion of all earthwork, compaction and finish grading, and prior to installation of the liner system, the PE or their designee will complete a visual inspection of the project site, review compaction testing records, finish grade elevations and compliance with the recommendations of the foundation engineer. Any changes to the construction or grade requirements due to unforeseen conditions will be reviewed by the PE prior to initiating installation of the liner and leak-detection system.
3. Liner Installation and Piping Placement: The PE or designee will inspect the liner and leak-detection system installation during the following key phases.
    a. Following completion of the secondary liner installation
    b. Following completion of the leak-detection system and prior to installation of the primary liner
    c. Following completion of the primary liner installation
    d. Following placement of the inlet and outlet piping

    Copies of all QA/QC installation records per the manufacturer's specifications will be provided for review during these inspections. Additional testing or QA required by the PE will be completed and deemed satisfactory by the PE prior to initiating the next phase.
4. Pit Commissioning: After acceptance of the lined pit by Mack, the PE will prepare a final report summarizing the results of the inspections and certifying that the pit meets the criteria set forth by the design (considering any modifications due to site conditions) and criteria set forth by the liner manufacturer's specifications. The report will be submitted to Mack Energy.

Appendix C
Operation and Maintenance Plan

Operating and Maintenance Procedures

Mack Energy (Mack) will operate and maintain the Round Tank Permanent Pits to contain liquids and solids and maintain the integrity of the liner system in a manner that prevents contamination of fresh water and protects public health and the environment as described below.

Permanent Pit #1 will be used for the collection and storage of untreated water. When Pit #1 is full, a mobile unit treats the water and transfers the treated water to Pit #2 for storage for re-use in drilling and well stimulation programs. The purpose of these permanent pits is to facilitate recycling, reuse and reclamation of fluids (water) in a manner approved by Division rules that prevents the contamination of fresh water and protects public health and the environment. During periods when re-use of water is not possible, untreated water will not be directed to Pit #1.

Mack is currently exploring several water treatment systems. One such system does not require batch treatment – thus Pit #1 may not be required. The operation of all permanent pits for the water re-use program will follow the mandates listed below:

1. Mack will not discharge into or store any hazardous waste (as defined by 40CFR 261 and NMAC 19.15.2.7.H.3) in the pits.
2. Only untreated water intended for recycling and treatment will be discharged into permanent Pit #1 for storage prior to batch treatment.
3. The batch treatment procedure calls for water stored in Pit #1 to move through a treatment unit then discharge to Pit #2.
4. Under normal operating conditions, Pit #2 will receive only treated water
5. If a pit liner's integrity is compromised above the water line, then Mack will repair the damage within 48 hours of discovery.
6. If any penetration of the pit liner is visually identified below the normal high water mark of the pits, then Mack will suspend operations of the pit, remove all liquid above the damage or leak within 48 hours, notify the district office within 48 hours (phone or email) of the discovery and repair the damage or replace the pit liner.
7. If any penetration of the pit liner is confirmed by sampling of fluid in the leak detection system (see Inspection and monitoring plan), Mack will
    a. Begin and maintain fluid removal from the leak detection/pump-back system
    b. notify the district office within 48 hours (phone or email) of the discovery
    c. Schedule a shut-down of water treatment/re-use, then
        i. remove all liquids
        ii. identify the location of the leak and
        iii. repair the damage or replace the pit liner prior to continuing operation
8. Mack will report releases of fluid to the subsurface in a manner consistent with NMAC 19.15.29
9. As shown in the engineering drawings (Appendix A), the injection and withdrawal or treated and untreated water is accomplished through engineered hardware to prevent liner damage.
10. Appendix A also demonstrates that the elevation and slopes of the pits prevent the collection of surface water run-on.
11. No oil or floating hydrocarbon shall be present in the permanent pits. Mack will maintain on site an oil absorbent boom to contain and remove oil from the pit's surface.

12. Mack will maintain the permanent pits free of miscellaneous solid waste or debris.
13. Mack will maintain at least three feet of freeboard for the permanent pits and will permanently mark such level on the pit wall.
14. Mack will ensure that all gates associated with the fence are closed and locked when responsible personnel are not on-site.

Monitor, Inspection, and Reporting Plan

Mack will inspect the pits weekly while either pit contains treated or untreated water and document such inspections at least monthly until the pits are closed. In addition to weekly inspections, Mack will perform a more detailed "low water" inspection after

1. movement of untreated water from pit #1 through the treatment system into pit #2 and/or
2. movement of treated water from pit #2 to reuse for drilling and stimulation.

On a weekly basis (see Weekly Inspection Form), Mack will

A. Visually inspect the pits' liners. If a liner's integrity is compromised, or if any penetration of the liner occurs above the water surface, then Mack will notify the appropriate Division district office within 48 hours (phone or email).
B. Mack will inspect the system for injection or withdrawal of liquids from the pits and document that the design prevents damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes is working appropriately (see Design and Construction Plan for data relating to this equipment).
C. Mack will inspect the pond surface for visible oil
D. Mack will measure the freeboard

After the movement of water from pit #1 to pit #2, or after reuse of treated water evacuates much of pit #2 (see Low Water Inspection Form), Mack will

E. Inspect diversion ditches and berms around the pit to check for erosion and collection of surface water run-on.
F. Measure H_2S concentrations on the down-wind side of the pit that is nearly full
G. Inspect the leak detection system for evidence of damage or malfunction and monitor for leakage (see Design and Construction Plan for data relating to this equipment).Mack will inspect the pits for dead migratory birds and other wildlife. Within 30 days of discovery, Mack will report such findings to the appropriate wildlife agency and to the appropriate Division district office in order to facilitate assessment and implementation of measures to prevent incidents from reoccurring.

Mack will maintain a log of all inspections and make the log available for the appropriate Division district office's review upon request. The format of the log for the weekly and low-water inspections is attached to the section of the permit application.

Freeboard and Overtopping Prevention Plan

The method of operation of the pits allows for maintaining freeboard with very few potential problems. Using the batch treatment process, for 10-20 days of each month, operation of the pits consists of filling Pit #1 with untreated water for re-use while Pit #2 contains treated water that is actively being used (removed from Pit #2) for drilling, stimulation or other approved uses. When

Pit #1 receives water, treated water is removed for use from Pit #2. When the capacity of Pit #1 is reached (3-feet of freeboard), the discharge of untreated water to Pit #1 ceases.

For about 5 days of each month, a mobile water treatment unit removes about 15,000 barrels of untreated water per day from Pit #1, treats the water, and discharges the water to Pit #2. During this transfer is the only time when both pits will receive water simultaneously: 15,000 bbls/day flows to Pit #2 and 2,000-5,000 bbls/day of untreated water flows to Pit #1. During treatment operations, staff are present monitoring treatment and the water elevation in each pit. When treated water fills Pit #2 to within 3 feet of the top of the liner, staff cease treatment operations and the discharge to Pit #2.

If an alternative treatment system obviates the need for Pit #1, treated water will continually flow into Pit #2. When treated water fills Pit #2 to within 3 feet of the top of the liner, staff cease treatment operations and the discharge to Pit #2. If the level of treated water rises above the freeboard level, automatic controls will sound and notify Mack staff to cease the discharge to Pit #2. The flow rate of treated water into Pit #2 using the alternative system is less than 6,000 bbls/day. Thus, if the automatic alarms fail and staff do not inspect the pit for 24-hours after minimum freeboard is reached and re-use of treated water for drilling/stimulation is not occurring, the water level will rise only 1 foot in the pit during this 24-hour period. We believe sufficient safeguards will be in place to maintain freeboard.

If rising water levels suggest that 3-feet of freeboard will not be maintained, Mack will implement one or more of the following options

I. Cease discharging water scheduled for recycling to the pit
II. Accelerate re-use of the water for purposes approved by the Division
III. Transfer water from one pit to the other (if two pits are used)
IV. Transfer water from the pit to the Round Tank SWD #1

Appendix D
Closure Plan

The permanent pits 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.

Closure Notice

Mack will not commence closure without first obtaining approval of the closure plan submitted with the C-144 application. To allow for review time and site inspection, Mack will notify the Division's Santa Fe office at least 60 days prior to cessation of operations and provide a proposed schedule for closure. Mack will close the permitted permanent pits within 60 days of cessation of operation of the pit in accordance with an approved closure plan.

At least 72 hours, but not more than one week, prior to any closure activities, Mack will notify the surface owner (State Land Office) by certified mail, return receipt requested. This notice will include the project name and location description.

Excavation and Removal Closure Plan – Protocols and Procedures

1. Mack will remove all liquids from the pits and either:
    a. Dispose of the liquids in a division-approved facility, or
    b. Recycle, reuse or reclaim the water for reuse in drilling and stimulation.
2. Mack will remove all solid pit contents and synthetic pit liners and transfer those materials to the following division-approved facility:
    Disposal Facility Name: R360 Permit Number NM 01-0006
3. After the removal of the pit contents and liners, soils beneath the permanent pits will be tested as follows
    a. Collect a five-point (minimum) composite sample to include any obviously stained or wet soils, or any other evidence of impact from the pits for laboratory analyses for the constituents listed in Table I of 19.15.17.13 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 approval.
4. If all constituents' concentrations are less than or equal to the parameters listed in Table I, then Mack will proceed to backfill the former pit location in accordance with the **Soil Cover Design** (below) with non-waste containing, uncontaminated, earthen material blended to the surrounding topography and arranged in a manner that prevents surface erosion.
5. Re-vegetation as outlined below

Soil Cover Design

Mack will backfill the former pit locations and the soil cover will consist of

1. At least 3-feet of compacted, uncontaminated, non-waste containing earthen fill with chloride concentrations less than 600 mg/kg as analyzed by EPA Method 300.0.
2. Either the background thickness of topsoil or one foot of suitable material to establish vegetation at the site, whichever is greater, over the 3-foot earth material.

3. Contours to blend with the surrounding topography and to prevent erosion of the cover and ponding over the cover.

Closure Documentation

1. Within 60 days of closure completion, Mack will submit a closure report on form C-144, with necessary attachments to document all closure activities including sampling results; information required by 19.15.17 NMAC; a plot plan; and details on back-filling, capping and covering, where applicable.
2. In the closure report, Mack will certify that all information in the report and attachments is correct and that Mack has complied with all applicable closure requirements and conditions specified in the approved closure plan.

Reclamation and Re-vegetation

Mack will reclaim to a safe and stable condition that existed prior to oil and gas operations and that blends with the surrounding undisturbed area

1. the pit locations and associated operating areas, including access roads
2. the burial trench and associated disturbed areas, including access roads

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, the Mack will

1. Replace topsoils and subsoils to their original relative positions
2. Grade so as to achieve erosion control, long-term stability and preservation of surface water flow patterns
3. Reseed in the first favorable growing season following closure

Re-vegetation and reclamation plans imposed by the surface owner will be outlined in communications with the OCD.

Mack will notify the Division when the surface grading work element of reclamation is complete.

Mack 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 percent (70%) of pre-disturbance levels, excluding noxious weeds.

Appendix E

Hydrogeologic Report, Climate Data and Siting Criteria Demonstration

Distance to Groundwater

Figure 1, Figure 2, and the discussion presented below demonstrates that groundwater (fresh water as defined by NMOCD Rules) at the location is greater than 80 feet beneath the permanent pits. Hence, groundwater will be more than 50 feet below the bottom of any buried waste meeting criteria for in place closure.

Figure 1 is an area geologic and topographic map that shows:

1. The location of the permanent pits as an orange square.
2. Water wells from the Misc.Water Wells database appear as colored squares that indicate well depth.
3. Data from the OSE database are shown as triangles within colored circles that indicate the reported depth of the well. OSE wells are often miss-located in the WATERS database as older wells are plotted in the center of the quarter, quarter, quarter, of the Section Township and Range.
4. Water wells from the USGS database as red triangles.
5. The ground water elevation from the most recent available measurement for each well is provided adjacent to the well symbol.
6. The estimated water table surface shown as blue contour lines.

Figure 2 is an area topographic map that shows:

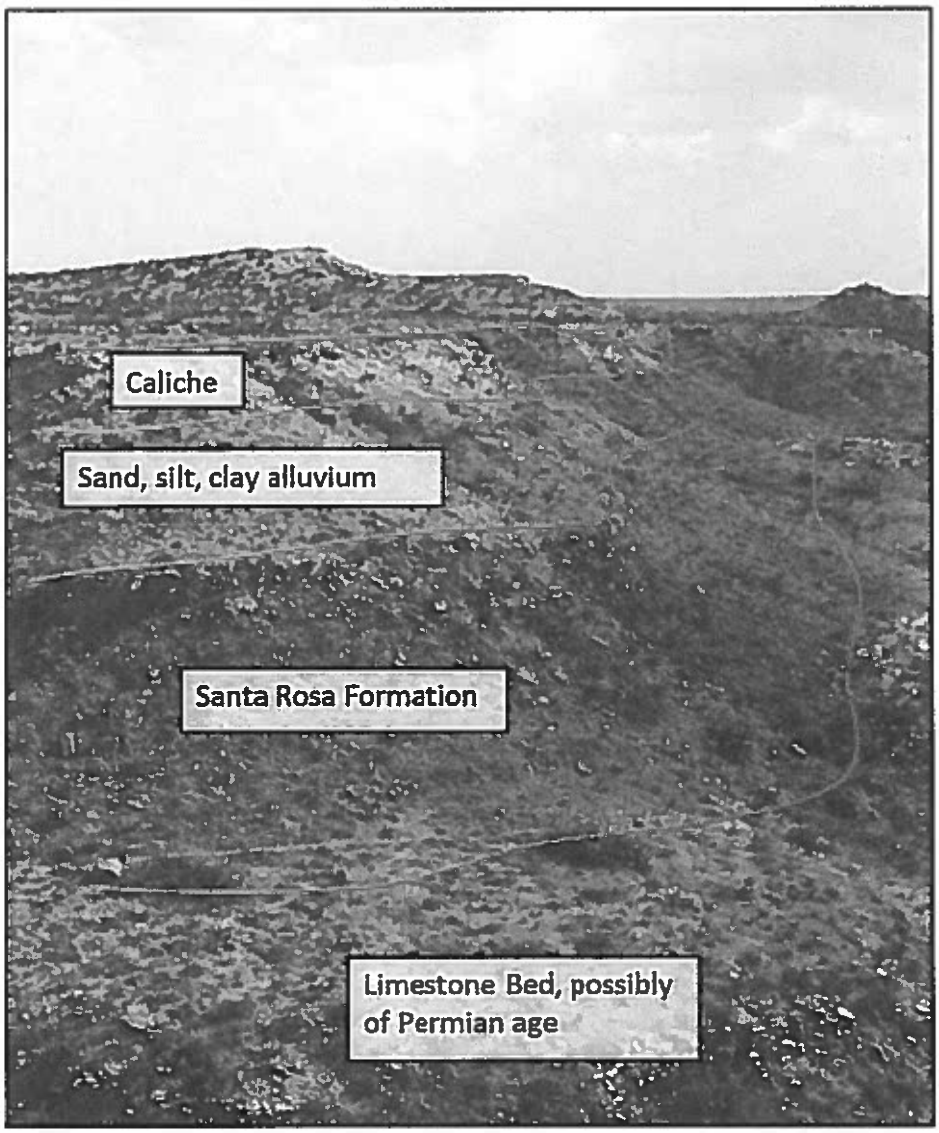
1. The location of the permanent pits as an orange square.
2. Water wells with the same symbols as those shown in Figure 1.
3. The depth to water and the date of the water measurement for each water well and the identifier number of the well.

Hydrologic Report

The proposed permanent pits are located in the Great Plains physiographic province. The Plains are considered a Cenozoic depositional feature composed of erosional materials from the eastern front of the Rocky Mountains and similarly aligned Basin and Range mountain chains further to the south. In the area of interest, they are uncomformably deposited on top of Triassic beds (Dockum and Santa Rosa Formations) which are in turn unconformably deposited on Permian age marine sediments. Much of the Plains material that comprises the surface was deposited between 40 and 50 million years ago (ma). With some uplift of the Plains, depositional rates slowed to a stop from 30 to 40 ma. Beginning 30 ma, additional deposition spreading from the north to the south and reworking of the earlier materials resulted in the deposition of the Ogallala formation. The later formation of the Pecos Valley by headward erosion due to either uplift to the west or solution/subsidence of the valley resulted in partial stripping of material from the fronts of the mountains (Reeves, 1972). This action has left the Great Plains isolated from the mountain fronts.

The pits location is between the Mescalero rim, the western edge of the Ogallala formation, and the Pecos River. The above mentioned development of the Pecos Drainage removed and reworked the remnants of the Ogallala formation between the Mescalero rim and the Pecos River. This surface is called the Mescalero Plain and is composed of relatively thin pediment deposits and alluvium of fluvial and eolian origins deposited on top of Triassic and older

formations. The Santa Rosa formation (Triassic) and some Rustler formation (Permian) outcrop about 1.5-miles and 4-miles respectively southwest of the location (Figure 1 and Graphic 1).



Graphic 1: *Looking south along the escarpment 0.8 west of the pits locations. Above the Santa Rosa Formation is the caliche and alluvium that will be excavated to construct the pits*

Northwest and south of the location are numerous small depressions and some watercourses draining to the northwest and southwest. Inspection of Figures 3 and 4 suggests some regular spacing of these features. This may be related to regional jointing in underlying formations (Reeves, 1972).

In this area, we believe the closed depressions within the alluvium are formed by the same mechanisms proposed for similar depressions and playas observed east of the Mescalero Rim, on the Ogallala Formation. There are numerous factors and mechanisms contributing to the development of playas (Smith,2003), initially, they begin with surface irregularities or small

depressions. These may be caused by collapse of deep solution voids, such as the soluble anhydrite beds in the underlying Rustler. As these lower areas collect surface water during precipitation events, infiltration of fresh water is greater than the surface as a whole. Higher infiltration can result in caliche dissolution within the alluvium and resultant slumping of the overlying soils – increasing the depth of the depression and widening the affected area.

Sabin (1995) suggests that the deepening and enlarging is due more to wind removal of fine-grained materials washed into the depressions and of the fine-grained materials already present. A number of mechanisms aid this process including prevailing winds producing wave erosion during periods of standing water and plant growth aiding in the production of wind-erodible soil matter.

The relative importance of these mechanisms is not settled at this time. However, the identified processes work within the area of the depression rather than over the entire mesa area.

The site location is approximately in the center of Section 19 on a topographic high (see Figure 2) at an elevation of about 3740-feet above sea level (asl). The western side of the section slopes to the southwest and has numerous closed depressions. The northeastern quadrant of the Section drains to the northwest with a gradient of approximately 45 feet/mile (0.008 foot/foot). The southeastern quadrant is drained to the southwest with a gradient of about 40 feet/mile.

Hydrogeology of the Pits Location

Figure 1 shows a potentiometric surface from the Mescalero Rim (about 12 miles to the east) to the west side of the depression containing Jahie and Ishee Lakes (more than 4 miles to the west). The Mescalero Rim is the divide between groundwater flowing southeast underneath the Llano Estacado (within the Ogallala Aquifer) and groundwater flowing southwest beneath the Mescalero Plain to the Pecos drainage (within alluvium and the Santa Rosa and Rustler Formations). Due to the relatively complicated geology and topography of the Mescalero Plain, groundwater may be locally moving from south-southeast to north-north west. Groundwater does not exist everywhere beneath the Mescalero Plain. About 10 miles southeast of the pits location is an area of no saturation (see Misc-38 in Table 1 and Figure 1).

As can be seen in the potentiometric contours on Figure 1, the pits location is above a local groundwater divide. South and east of the pits location, groundwater is moving south. West of the pits location, groundwater is moving west towards a 15–mile long north-south trending valley (closed depression) parallel to the Pecos drainage.

Table 1 shows the data for OSE, Open File Report 95, USGS, and Miscellaneous wells closest to the location as well as the two soil borings (SB-1, SB-2) drilled adjacent to the pits location.

Summary of Groundwater Data

Well Numbers (see Map)	Well Location						Well Source Information									Groundwater Elevation Data						Gauging Date
	Township (south)	Range (east)	Section	Quarter Section OSE protocol (64,	16,	4)	NM-OSE Database	Misc List	USGS Database	Open File Rpt. 95	GW Report No. 3	GW Report No. 6	USGS Topo Sheet	Aerial Photograph	Field Verification	Surface Elevation (published)	Surface Elevation (Topo Sheet)	Well Total Depth (published)	Depth to Water (published)	Groundwater Elev. (published)	Groundwater Elev. (using topo elev.)	
RA04392	14	27	26		4	3	✓						✓	✓	--		3,470	127	80		3,390	3/31/1961
L 01686	14	27	27		4	4	✓						--	--	--		3,440	115	50		3,390	1/2/1953
Misc-79	14	28	24	1	3	3				✓			✓	✓			3,628	140	122		3,506	1977
RA04897	15	27	1		4	2	✓						--	--			3,510	75	23		3,487	10/5/1961
USGS 1864	15	28	7		3	1			✓				✓	✓			3,532		10		3,522	1/20/2005
Misc-81	15	28	9		3	2		✓					✓	✓	--		3,574		30		3,544	11/1/1977
RA10280	15	28	17	4	3	3	✓						--	--			3,560	70	40		3,520	4/23/2003
RA09248	15	28	17	1	4	3	✓						✓	✓			3,553	150	45		3,508	7/13/1996
Misc 82	15	28	21	2	3	2		✓					✓	✓	--		3,549		18.7		3,530	11/29/1977
Misc-75	15	28	26	1	4	1		✓					✓	✓	✓		3,558					8/19/2013
Misc-25	15	28	31	3	4	4				✓			✓	--	--	3,576	3,575	30	8.17	3,568	3,567	10/14/1977
Misc-73	15	29	3	2	4	4		✓					--	✓	✓		3846		120		3726	8/19/2013
L 12001	15	31	20			3	✓										4,410		67		3726	2/12/2007
Misc-24	16	28	12	1	2	2		✓		✓			✓	--	--	3,579	3,579	49.8	47.22	3,532	<3531	8/19/2013
RA 09342	16	29	19	4	4	3	✓										3,655	220	110		3,545	5/3/1998
Misc-40	16	30	24	2	2	1				✓			✓	--	--	3,828	3,828	380.1	330.7	3,497	3,497	10/17/1977
Misc-49	16	31	14	4	3	3				✓	✓		✓	--	--		4,210		113.4		4,097	12/9/1948
Misc-50	16	31	23	3	4	4				✓			✓	--	--	4,240	4,245	161.8	155	4,085	4,090	3/30/1971
Misc-35	17	28	2	4	2	4								✓	✓		3,574		35.8		3,538	9/6/2012
Misc-2	17	28	14		2	2				✓	✓		✓	✓	✓		3,590	62.4	56.78		3,533	11/27/2012
Misc-2A (new)	17	28	14		2	2				✓				✓	✓		3,592	98	60.13		3,532	11/27/2012
Misc-16	17	28	19			2				✓	✓		✓	✓	✓		3,591		224.3	3,380	3,367	1/2/1948
Misc-17	17	28	22		3	2				✓	✓		✓	✓	✓	--	3,579		45.5	3,520	3,534	1/1/1948
USGS-1222	17	28	22	4	2	4			✓				✓	✓	✓	3,578		95	78.6	3,499		1/13/1999
Misc-0	17	29	8	2	3	1				✓			✓	✓	✓	3,617	3,617	92.7	90.1	3526.9	3,527	10/14/1977
Misc-9	17	29	22	1	1	1				✓	✓		✓	✓	✓	3,550	3,545		79.7	3,470	3,465	11/29/1948
Misc-41 (MW)	17	29	22	3	2	3									✓		3,535		73		3,462	8/15/2004
Misc-38	17	30	16	3	3	3											No Groundwater Saturation (NMOCD Files)					
Misc-37 (MW)	17	30	30	2	1	1								✓	✓		3,615	271.6	264.5		3,351	9/28/2005
SB-1	15	29	19	1	1	3							--	--	✓		3,746	85	Dry		<3661	8/26/2013
SB-2	15	29	19	4	1	3							--	--	✓		3741	80	Dry		<3661	8/26/2013

✓ indicates verified, -- indicates checked but not verified, a blank indicates that this is unknown

Table 1 – Groundwater Data

Depth to Water

Data from the wells close to the permanent pits location shows a general decline in water table elevation.

- Misc.-24 is located adjacent to Jahie Lake and Ishee Lake, both dry lakebeds, about 5 miles southwest of the pits location. They are in the above mentioned north-south running valley. The valley floor is about 160 feet lower than the pits location. Groundwater elevation was 3531 in 1977, 47 feet below ground level. During Hicks Consultants visit of Aug. 19 2013, an older casing was located which was dry at a total depth of 49 feet at this same elevation. Hence groundwater elevation is less than 3530 feet although the actual depth cannot be quantified.

- At Misc-73, located 4.5 miles northeast of the pits location, groundwater was 62 feet below the ground surface in 1977. On Aug. 19, 2013, Hicks Consultants measured a depth of 120 feet showing a decline of almost 60 feet in 36 years.

- Misc-74 is the closest recorded well to the pits location, about one-mile to the north (see Figure 2). We field checked this well on August 19 and found it to be no longer in use and having a collapsed casing at a depth of 15 feet.

- Basin Well (Misc-75) was also checked on this same date (Figure 2). It is an operating windmill on the valley floor about 1.75 miles to the southwest and 180 feet lower than the pits location. Due to the nature of the well construction, it was not possible to obtain a depth to water.

- Misc-81 and Misc-82 are located about 4 miles to the west and northwest of the pits location. From inspection of aerial photographs, both are working windmills. Reported depths to water (1977) are consistent with USGS-1864 measured in 2005.

Misc-73 and Misc-24 are the two closest wells to the site that depth to water was measured both up and down-gradient from the pits location. They are 9.5 miles apart on a line near parallel to the flowlines of the aquifer (see Figure 1). This gradient line passes a half mile southeast of the pits location. A linear interpolation of groundwater elevation between these two wells (both measured on August 19) suggests groundwater elevation will be not more than 3635 feet closest to the pits location, or 95 feet below ground surface.

On August 26, 2013 presence of groundwater was checked for in SB 1 and SB-2, drilled adjacent to the pits locations. The borings were found to be dry more than 72 hours after they were drilled. The bottoms of these borings are 80 and 85 feet below ground surface respectively. The corresponding elevations at the bottoms of the borings are 3666 feet. This finding is consistent with the calculation referred to in the paragraph above.

We conclude with a high degree of certainty that groundwater, as defined by OCD Rules, exists beneath the Permanent Pits location at a depth of more than 80 feet.

Distance to Surface Water

Figure 3 and the site visit demonstrates that the location is not 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). Therefore the permanent pits can be closed by in place closure as it is not within 100 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).

- The nearest streams (intermittent) are more than 1000 feet to the southeast and more than 2000 feet to the northeast (see Figure 2).
- As can be seen on Figure 3, the closest water body to the pits location is Sink Hole Tank, more than 1300 feet south of the southern boundary of the pits location. The Tank has been improved to hold water for livestock.
- More than 600 feet northwest of the northwest corner of the pits location, BLM has marked a "watercourse" within a depression feature. There is no feature qualifying as a

"significant watercourse" by NMOCD rules within 300 feet of the northwest corner of the permanent pits location.

Distance to Permanent Residence or Structures

Figure 4 and the site visit demonstrates that the location is not within 300 feet from a permanent residence, school, hospital, institution, church, or other structure in existence at the time of initial application. This meets a criteria for in-place closure.

- There is a tank battery located on the Round Tank SWD pad about 250 feet west of the pits location. There is another tank battery about 675 feet to the east of the pits location.
- All structures in the area are oil field infrastructure.

Distance to Non-Public Water Supply

Figures 1 and Figure 2 demonstrates that the location is not within 500 horizontal feet of a private, domestic fresh water well or spring that less than five households use for domestic or stock watering purposes, or within 1000 horizontal feet of any other fresh water well or spring, in existence at the time of initial application. In addition, the permanent pits can be closed by in place closure as it is not within 300 feet of a spring or private, domestic fresh water well used for domestic or stock watering purposes.

- Figure 1 and 2 show the locations of all area water wells, active or plugged/abandoned
- The nearest active well is Misc-74 located more than 1 mile west-southwest of the location.
- There are no known domestic water wells located within 1000 feet of the location.
- No springs were identified within the mapping area (see Figure 3).

Distance to Municipal Boundaries and Fresh Water Fields

Figure 5 demonstrates that the location is not within incorporated municipal boundaries or defined municipal fresh water well fields covered under a municipal ordinance adopted pursuant to NMSA 1978, Section 3-27-3, as amended. This also qualifies the location for in-place closure.

- The closest municipality is Artesia, NM approximately 21 miles to the southwest.
- There are no public well fields closer than 15 miles.

Distance to Wetlands

Figure 6 demonstrates the location is not within 500 feet of wetlands. This also qualifies the location for in-place closure.

- The nearest designated wetland is a "freshwater pond" located more than 1000 feet to the south.
- There is a "freshwater emergent wetland" more than one mile to the east.

Distance to Subsurface Mines

Figure 7 and our general reconnaissance of the area demonstrate that the nearest mines are caliche pits. The location is not within an area overlying a subsurface mine.

- The nearest mapped caliche pit is located approximately 6 miles to the southeast.

Distance to High or Critical Karst (Unstable) Areas

Figure 8 shows the location of the permanent pits with respect to BLM Karst areas

- The proposed permanent pits location is in a "Low Potential" karst area. As will be discussed and explained in the following two points, the karst map for this area is more accurate in Eddy County than in Chaves County.
- Within Eddy County southwest of the pits location, a boundary between "High Potential" karst and "Low Potential" karst is located about 2.5 miles southwest of the site. Examination of Figure 8 demonstrates that this boundary follows the base of the escarpment forming the east wall of the enclosed depression containing Jahie and Ishee Lakes. The reason for this is that the caliche and alluvium deposited upon the Santa Rosa Formation is not present within this depression. The depression floor is composed of alluvium deposited upon the Rustler Formation. Lithologies of the Rustler formation are more prone to solution and development of attendant karst features.
- Within Chaves County near the pits location, the karst map approximates area geology with straight lines (along political boundaries like section lines). "Medium Potential" karst is separated from "Low Potential" karst with a north-south boundary 0.5 miles west of the pits location. A more accurate mapping would separate the "Medium Potential" karst from the "Low Potential" karst with a boundary following the base of the escarpment forming the east wall of the enclosed depression containing Jahie and Ishee Lakes as in Eddy County. This boundary is more than 0.9 miles west of the pits location.
- No evidence of solution voids were observed near the site during the field inspection.
- No evidence of unstable ground was observed.
- Site borings encountered no evidence of unstable ground or solution features.

Adjacent to the permanent pits location, SB-1 and SB-2 were drilled to depths of 80-feet and 85-feet respectively on August 20, 2013. The purpose of these borings was to establish a depth to groundwater and to investigate the properties of the subsurface beneath the proposed location for the permanent pits.

The locations of the borings are shown on the site survey, Plate 3. SB-1 was located on the east side of the proposed location 450-feet north of the southern boundary of the pits location. SB-2 was placed at the southeastern corner of the proposed pits location and at the edge of a depression, which is a collection area for overland flow during large precipitation events. After such events, there will be more infiltration to the vadose zone from this depression than from the surrounding mesa. Hence, this location will have the greatest probability of encountering the presence of solution features or voids in the subsurface.

Plates 1 and 2 present the boring logs for SB-1 and SB-2. As can be seen, the upper 12 to 15 feet of both borings was composed of caliche. Beneath this was about 45 feet of alluvium composed of very fine-grained sand and silt. Clay was also present in varying amounts through this section. Beneath the alluvium, the Santa Rosa sandstone was encountered at an approximate depth of 50 to 60 feet. At the depth of 76-feet (SB-1) and 82-feet (SB-2), a limestone bed was encountered. The process of exiting the base of the limestone bed caused the augur drilling tool to have difficulties with borehole alignment beneath the limestone. Because of this, both borings were terminated beneath the limestone bed.

Graphic 1 (see Page 2 above) is a photograph of the escarpment located 0.8 miles west of the pits location. The proposed pits will be excavated into material equivalent to the ground surface at the top of the escarpment. SB-1 and SB-2 were drilled through a section equivalent to this cross section. The limestone bed provides a datum that connects the lithologies of SB-1 and SB-2 with the cross section visible in Graphic 1. No voids or solution features were noted while drilling both SB-1 and SB-2.

Distance to 100-Year Floodplain

Figure 9 demonstrates that the location is within an area that has not yet been mapped by the Federal Emergency Management Agency with respect to the Flood Insurance Rate 100-Year Floodplain.

- Areas that are not mapped are generally considered minimal flood risk
- Our field inspection and examination of the topography permits a conclusion that the location is not within any floodplain

Soil Types at the Permanent Pits Location

Figure 10 is a map of soil types shown over the same extent as the aerial photograph in Figure 4.

- A sandy loam comprises the soil overlying the caliche beds in the area of the proposed permanent pits
- A summary of the map units follows the Figures and Plates.

Climatological Factors Assessment

Information on climate is presented for both Maljamar, New Mexico (about 20 miles east of the pits location - http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?nm5370) and for Hagerman New Mexico (about 16 miles west of the pits location - http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?nm3792).

At Maljamar:

1. The area has a minimum average temperature of 25.8 degrees F in January
2. The data shows a maximum average snowfall of 1.9 inches in December.
3. The area has a maximum average precipitation of 2.42 inches in September.
4. Wind data is not available at this station.

MALJAMAR 4 SE, NEW MEXICO (295370)

Period of Record Monthly Climate Summary

Period of Record : 5/26/1942 to 8/12/2012

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	56.1	61.7	68.7	77.9	85.8	93.3	94.3	92.4	86.3	77.1	65.1	57.5	76.3
Average Min. Temperature (F)	25.8	29.7	35.2	43.2	52.3	60.6	64.1	62.9	56.3	45.6	33.8	27.1	44.7
Average Total Precipitation (in.)	0.42	0.40	0.40	0.44	1.59	1.59	2.37	2.30	2.42	1.17	0.52	0.57	14.18
Average Total SnowFall (in.)	1.7	1.4	0.7	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.5	1.9	6.4
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

Percent of possible observations for period of record.
Max. Temp.: 89.7% Min. Temp.: 89.6% Precipitation: 96.6% Snowfall: 89.7% Snow Depth: 88.1%
Check Station Metadata or Metadata graphics for more detail about data completeness.

At Hagerman, New Mexico:

1 The area has a minimum average temperature of 22.7 degrees F in January
2 The area has a maximum average snowfall of 1.6 inches in February.
3 The area a maximum average precipitation of 2.11 inches in July.
4 Wind data is not available at this station.

HAGERMAN, NEW MEXICO (293792)

Period of Record Monthly Climate Summary

Period of Record : 4/ 1/1920 to 3/31/1960

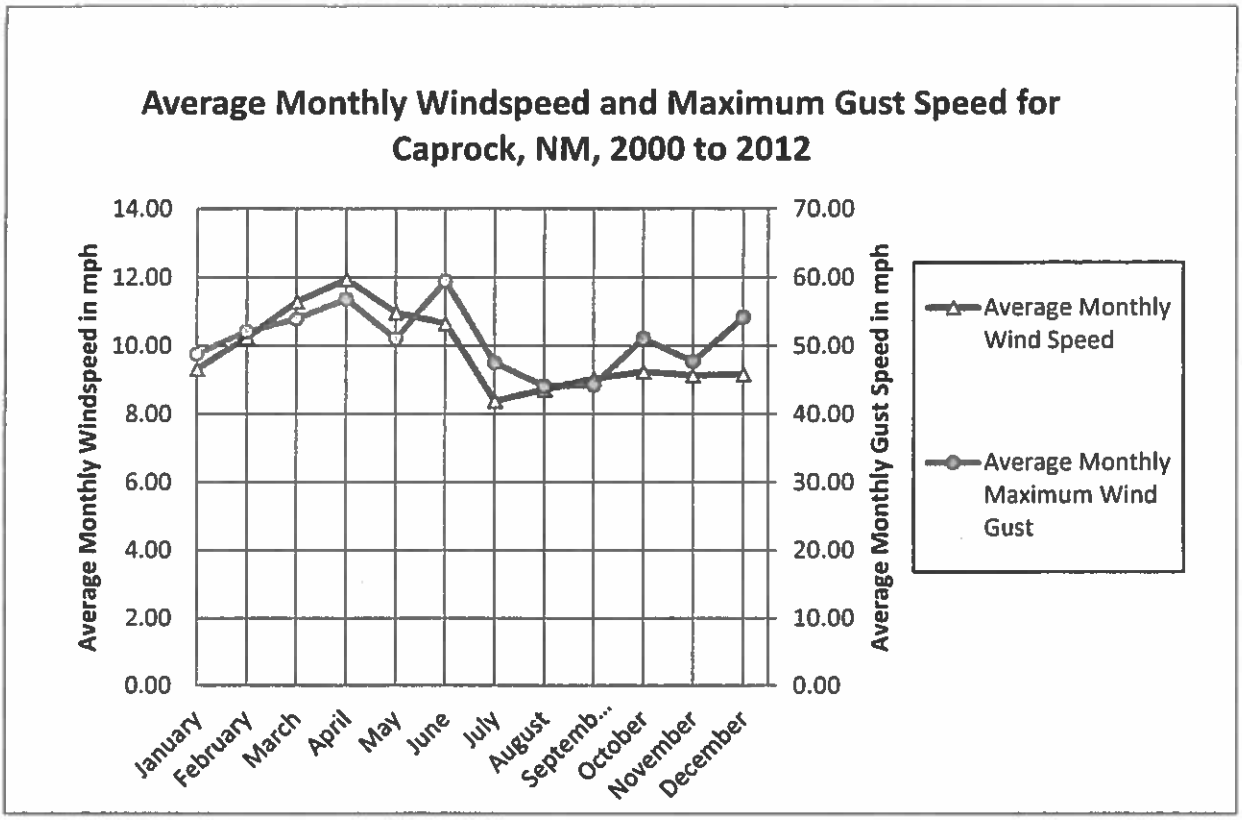
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	58.3	62.0	69.3	77.8	87.0	95.3	95.3	95.2	89.9	79.3	67.3	61.5	78.2
Average Min. Temperature (F)	22.7	26.3	33.0	41.8	51.0	60.8	64.6	62.7	55.0	42.6	27.7	22.6	42.6
Average Total Precipitation (in.)	0.38	0.34	0.34	0.54	1.62	1.60	2.11	1.73	1.79	1.04	0.23	0.38	12.09
Average Total SnowFall (in.)	0.9	1.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.9	4.1
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

Percent of possible observations for period of record.
Max. Temp.: 68.4% Min. Temp.: 68.1% Precipitation: 71.7% Snowfall: 69.3% Snow Depth: 28.9%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Data for wind speed and freeze-thaw cycles are not available from either the Hagerman Station or the Maljamar Station. The closest available locale for which this information is available is at Caprock, New Mexico. (http://www.raws.dri.edu/nmF.html). Caprock is approximately 33 miles northeast of the pits location. From this station, we obtained data over the time span from January 1, 2000 through January 1, 2013.

- Within the time interval, there were 297 days for which temperature data did not exist. Assuming that freeze-thaw cycles occurred with the same regularity as on days for which the data did exist, there have been an average of **39.7 freeze-thaw days/year** over the most recent 12 years.

- Graphic 2 presents the average daily wind speed by month for the same 12 year period of data from Caprock, New Mexico. In addition, the average daily peak gust by month is also graphed on the secondary axis.



Graphic 2

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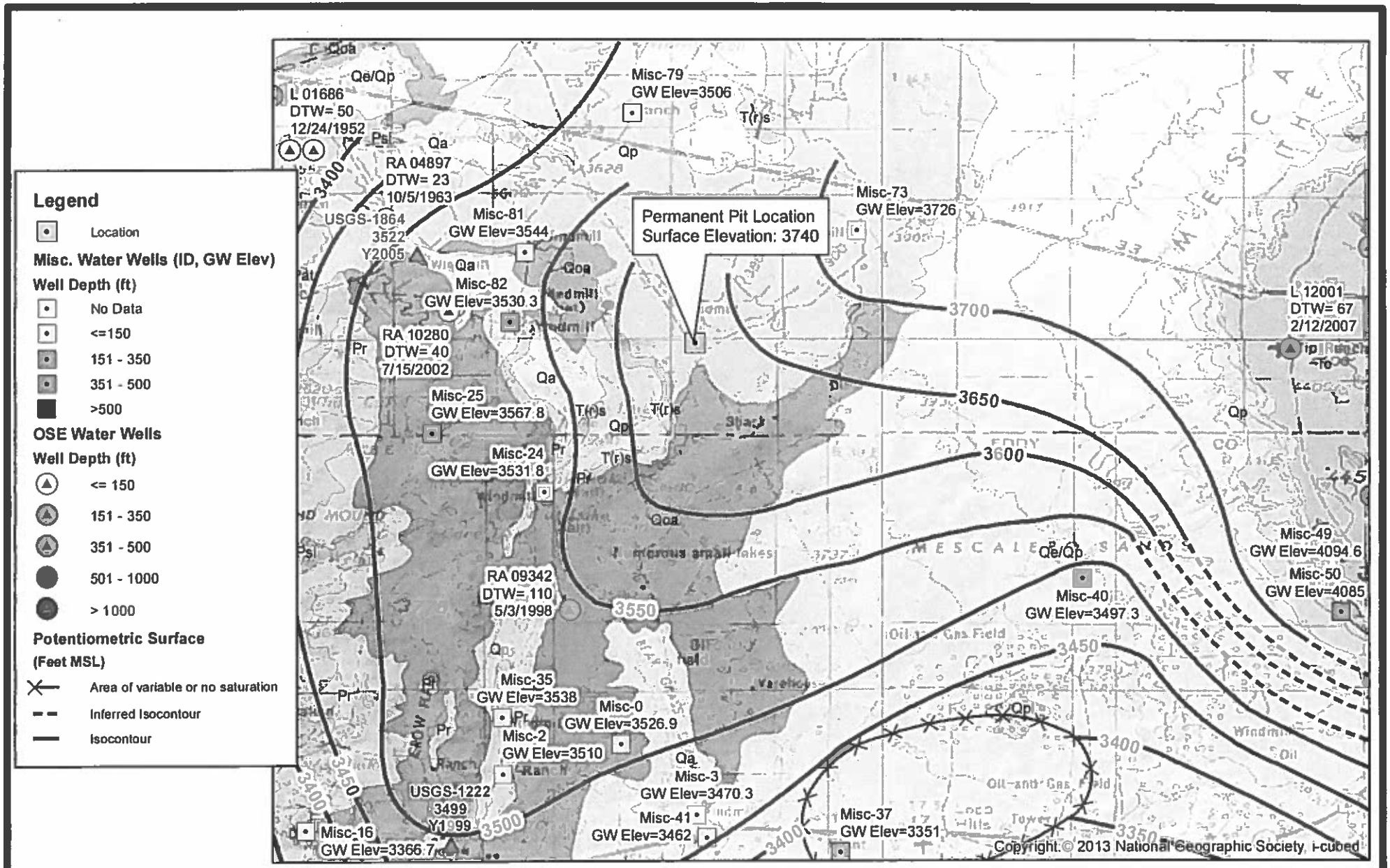
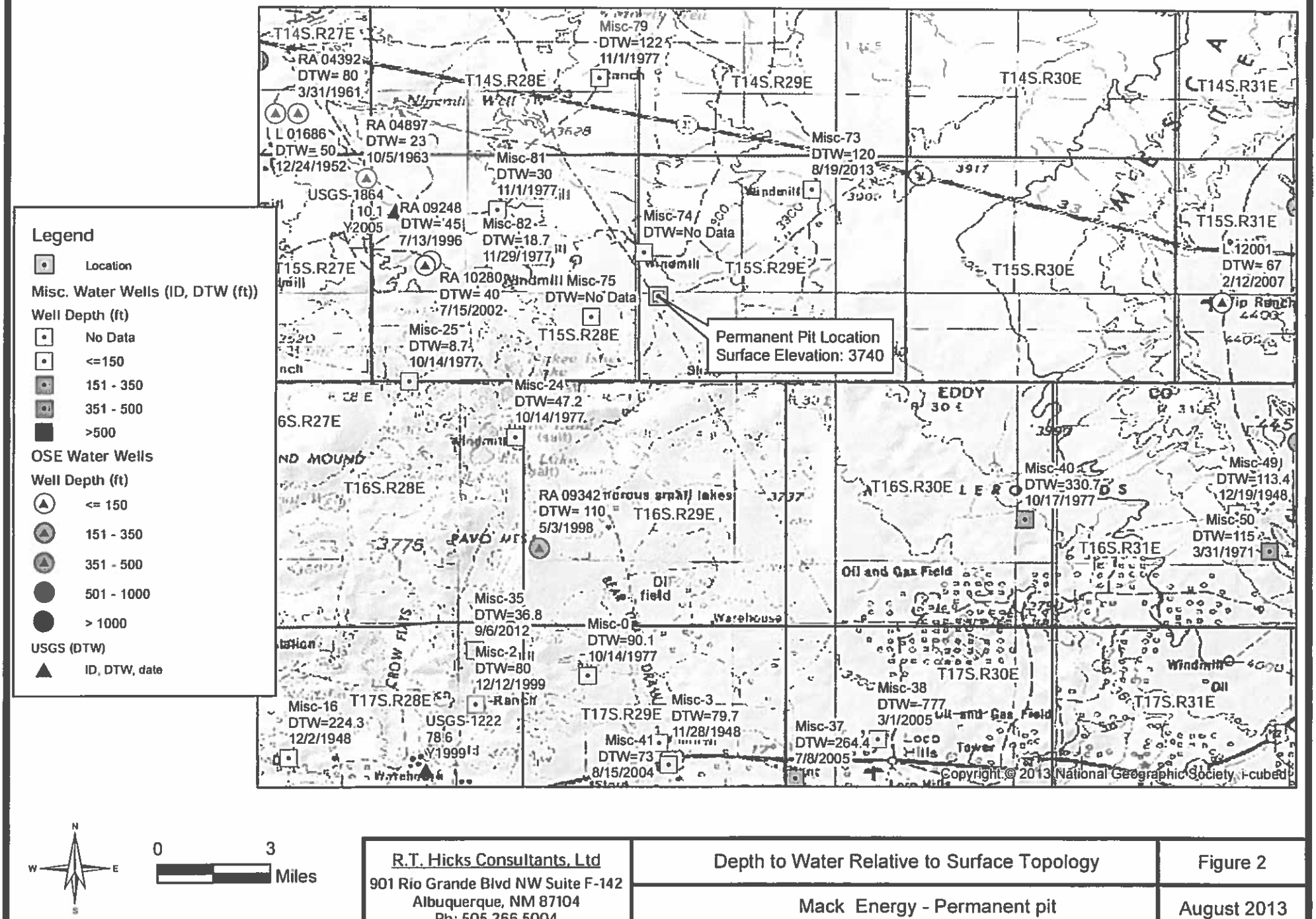
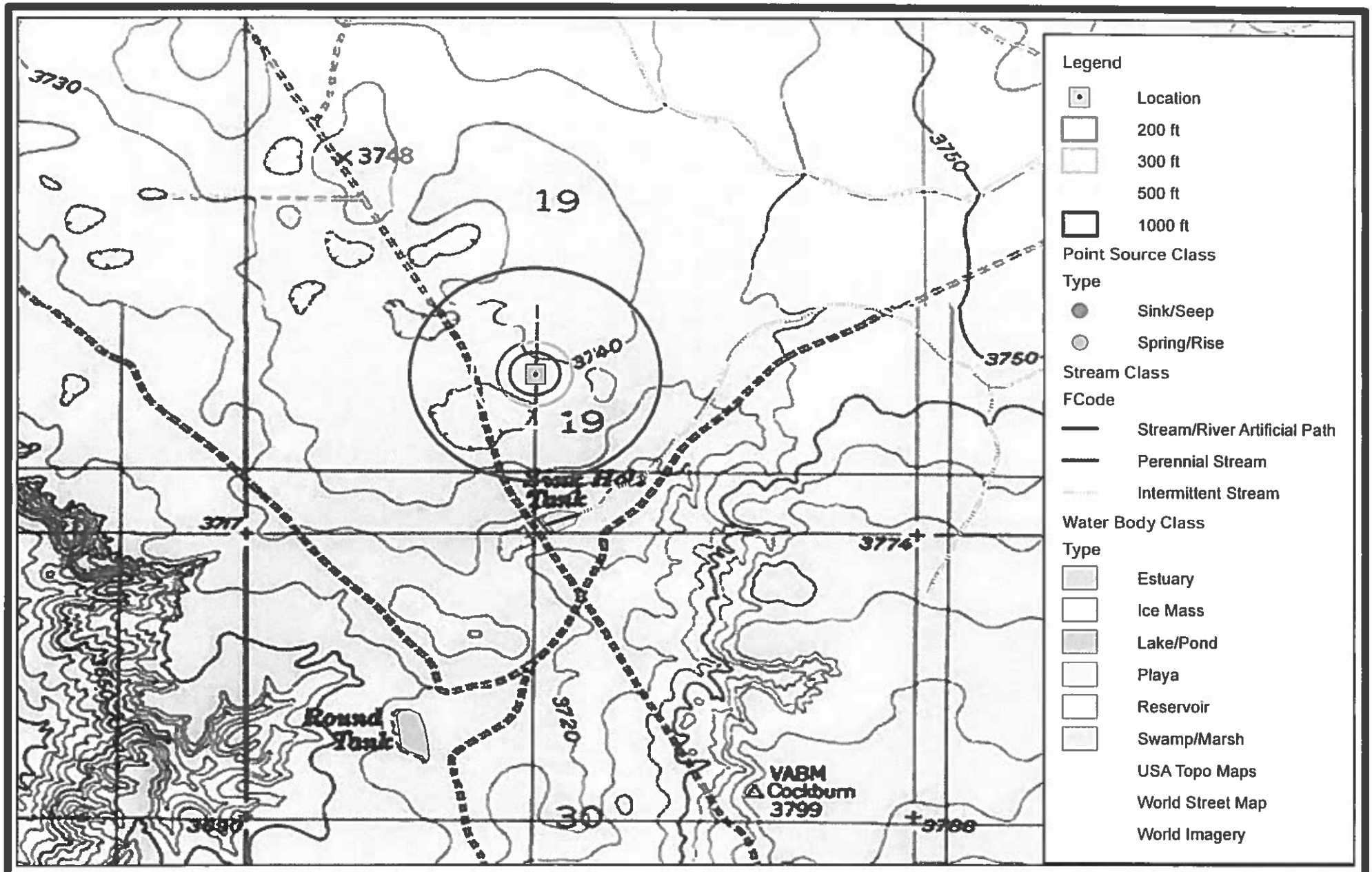


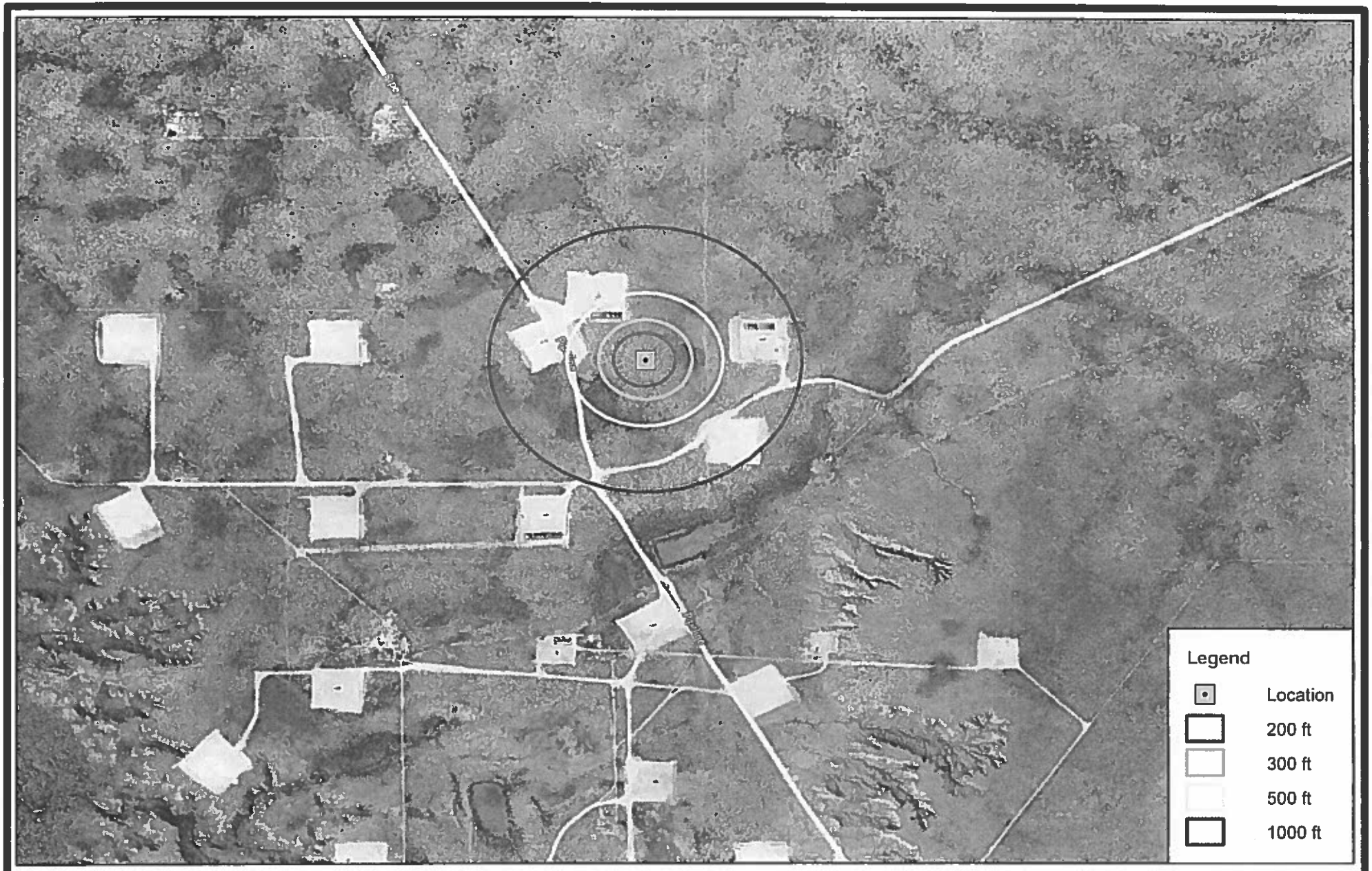
R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Regional Geology and Water Table Elevation	Figure 1
	Mack Energy - Permanent pit	August 2013



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Depth to Water Relative to Surface Topology	Figure 2
	Mack Energy - Permanent pit	August 2013



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Topography and Surface Water Near Pit Location	Figure 3
	Mack Energy - Permanent Pit	August 2013



N
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Feet

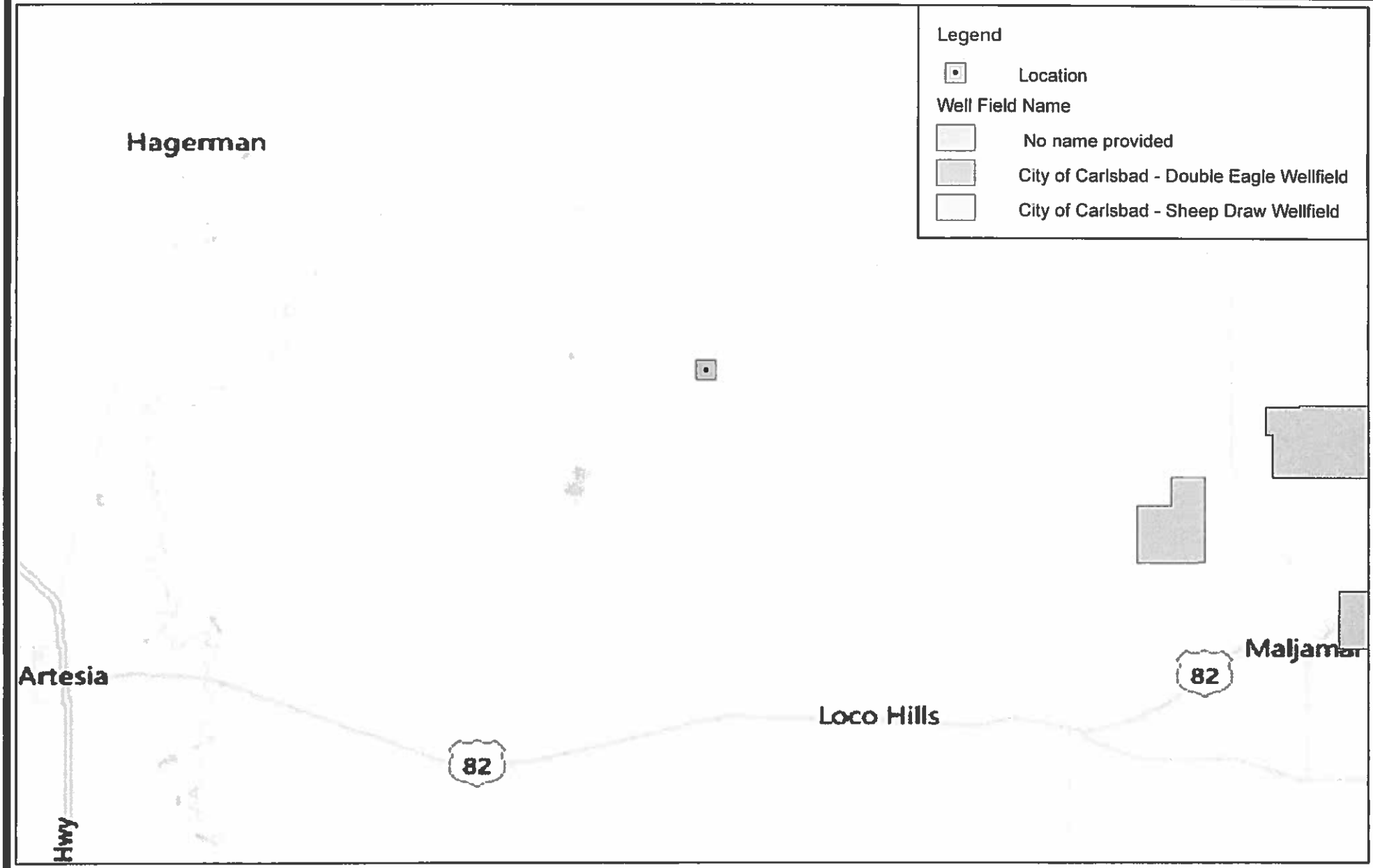
R.T. Hicks Consultants, Ltd
901 Rio Grande Blvd NW Suite F-142
Albuquerque, NM 87104
Ph: 505.266.5004

Nearest Structures

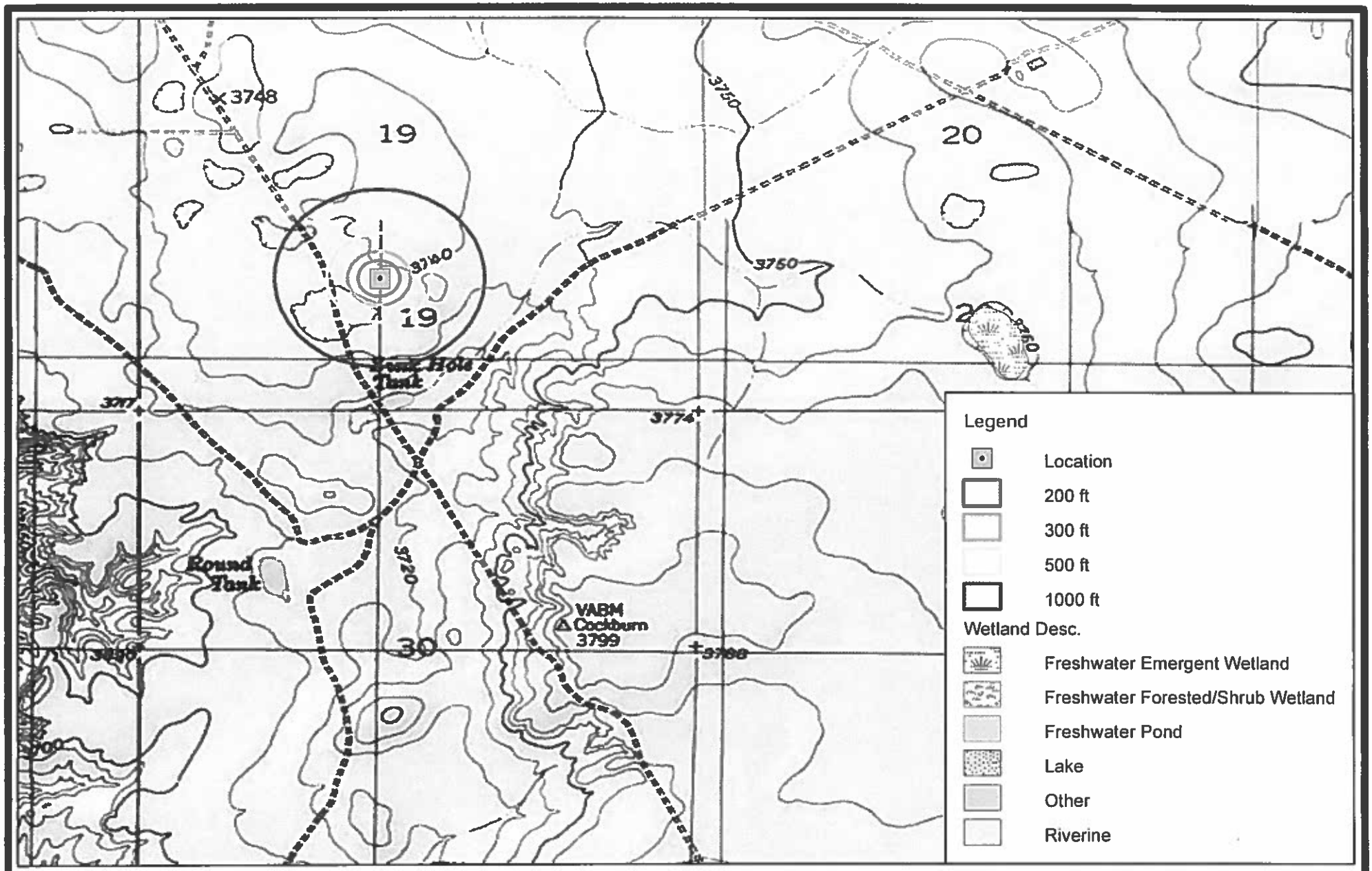
Figure 4

Mack Energy - Permanent Pit

August 2013



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Nearest Municipalities and Wellfields	Figure 5
	Mack Energy - Permanent Pit	August 2013



N W E S

0 500 1,000 Feet

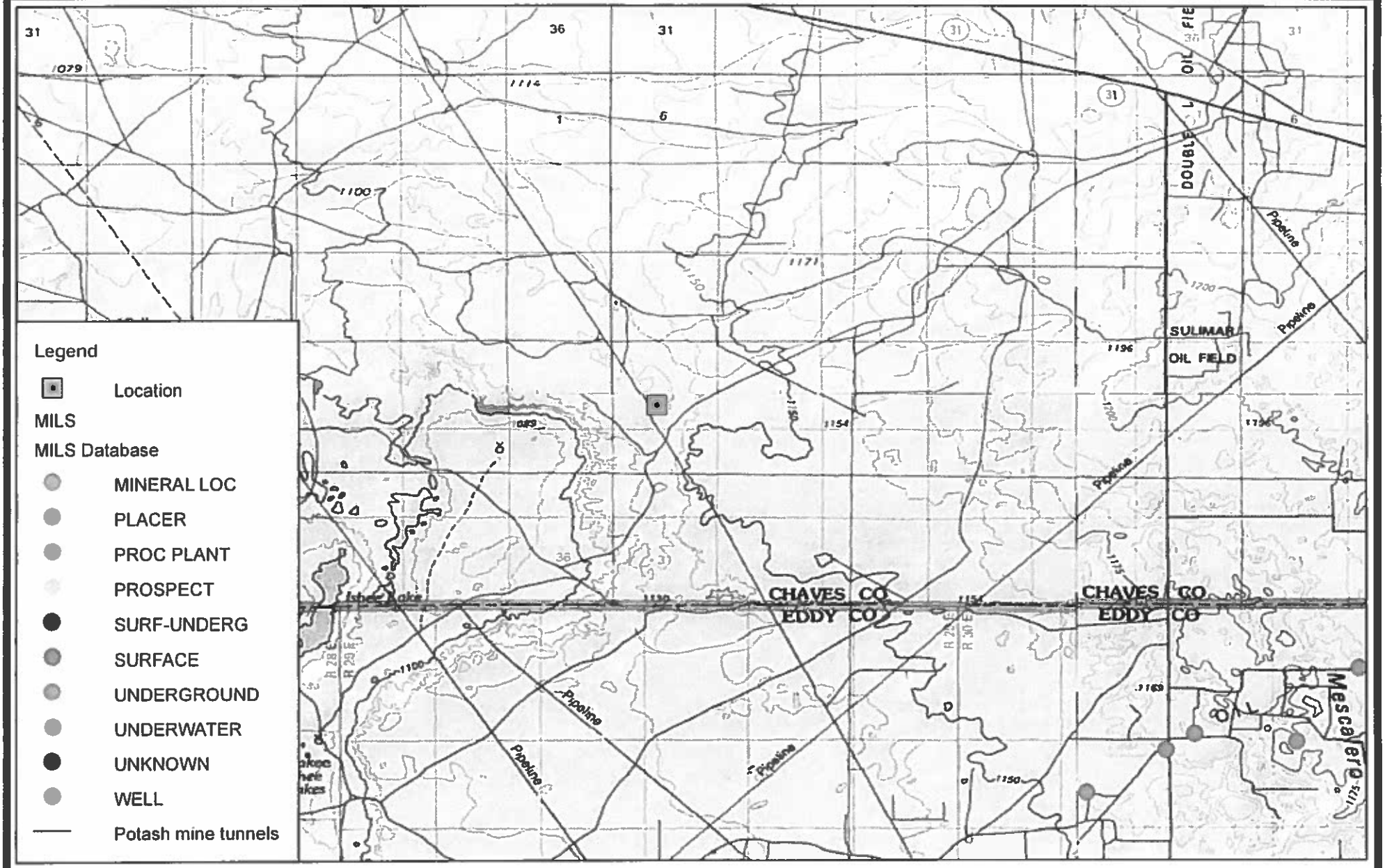
R.T. Hicks Consultants, Ltd
901 Rio Grande Blvd NW Suite F-142
Albuquerque, NM 87104
Ph: 505.266.5004

Nearest Wetlands to Pit Location

Figure 6

Mack Energy - Permanent Pit

August 2013



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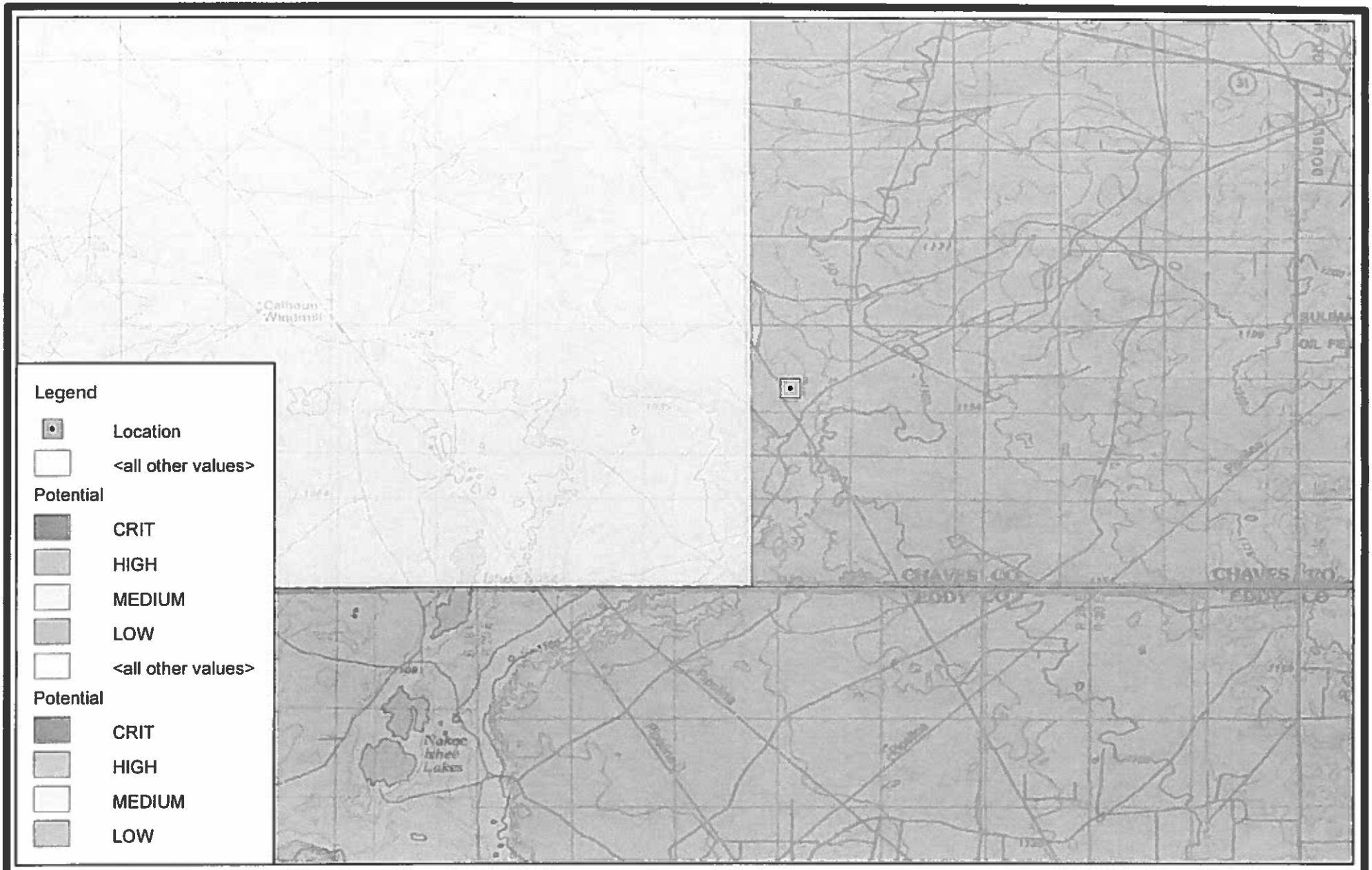
Albuquerque, NM 87104
Ph: 505.266.5004

Nearest Mines to Pit Location

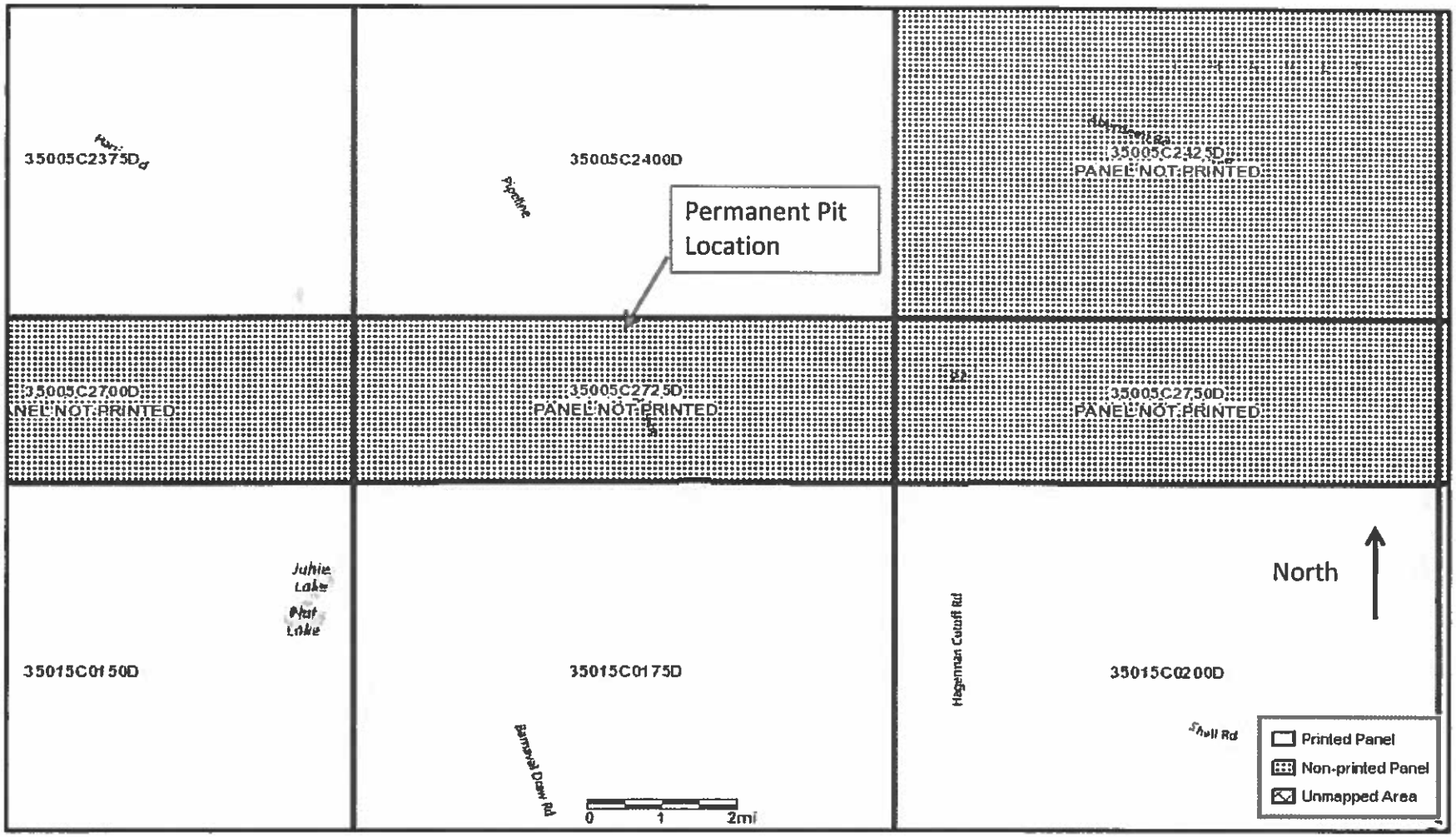
Figure 7

Mack Energy - Permanent Pit

August 2013



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	BLM Cave/Karst Potential Map	Figure 8
	Mack Energy - Permanent Pit	August 2013



R.T. Hicks Consultants 901 Rio Grande Blvd. NW Suite F-142 Albuquerque, N. M. 87104	**Index Map of FEMA Maps for Location**	**Plate 9a**
	Mack Energy	**August, 2013**

Figure 9b

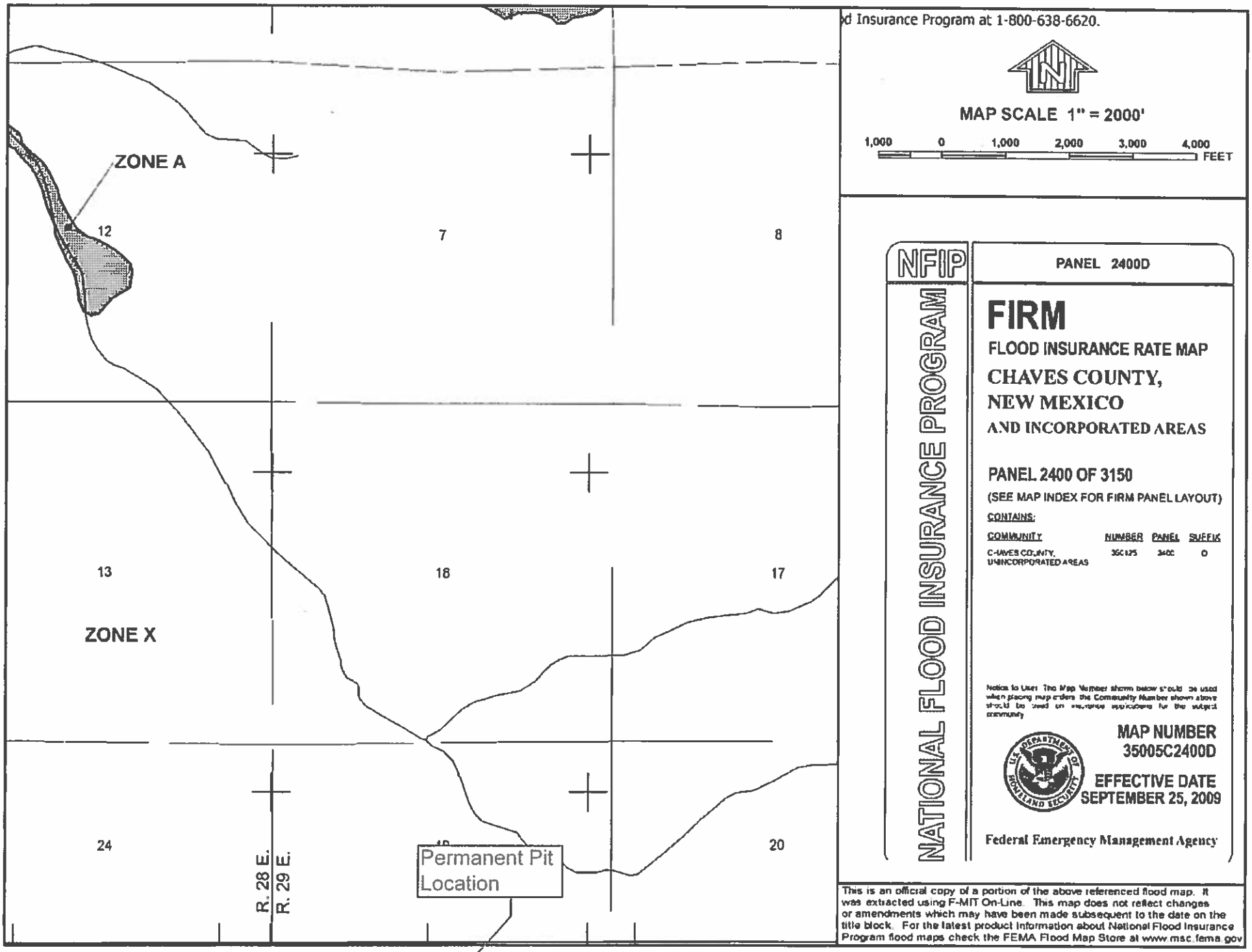
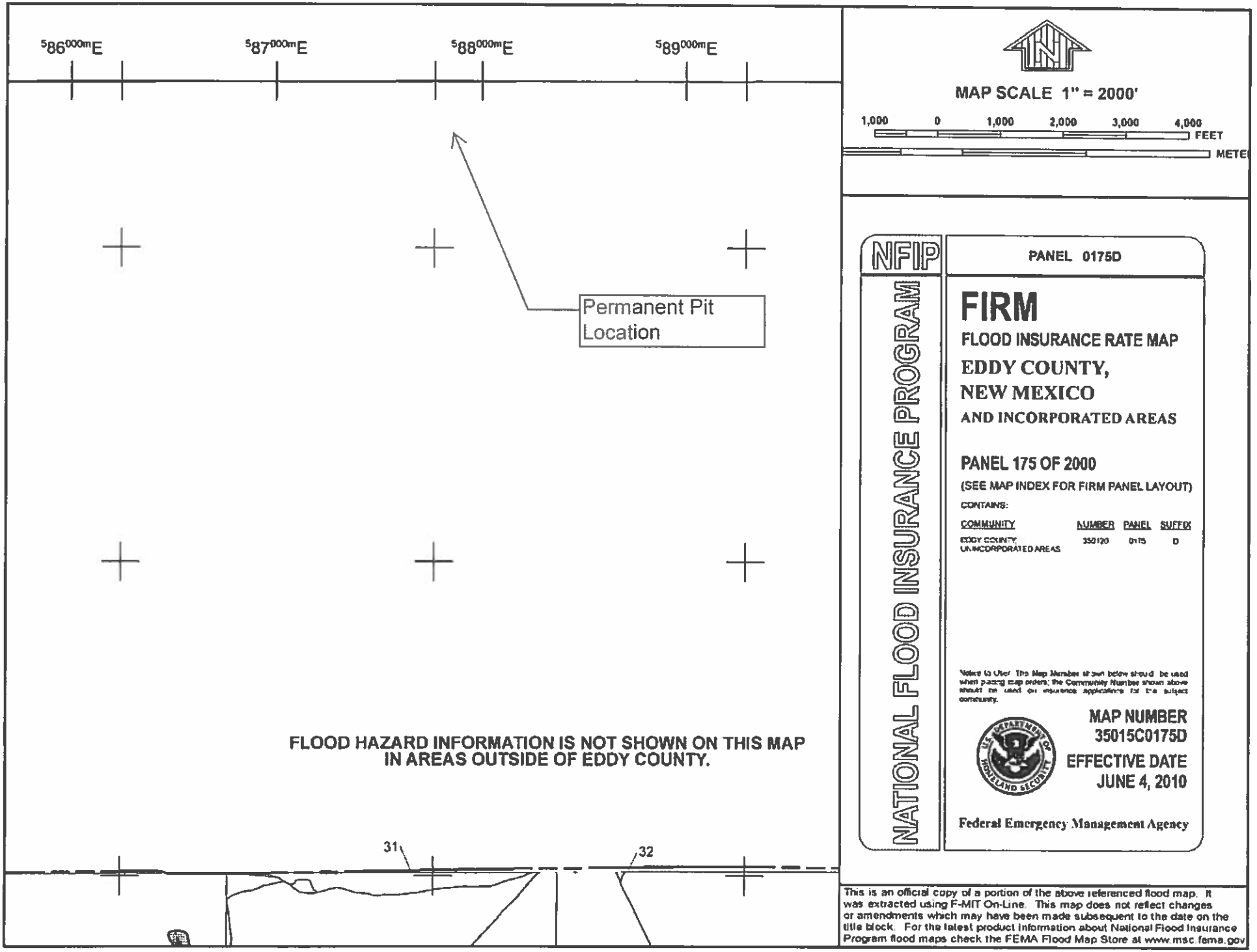
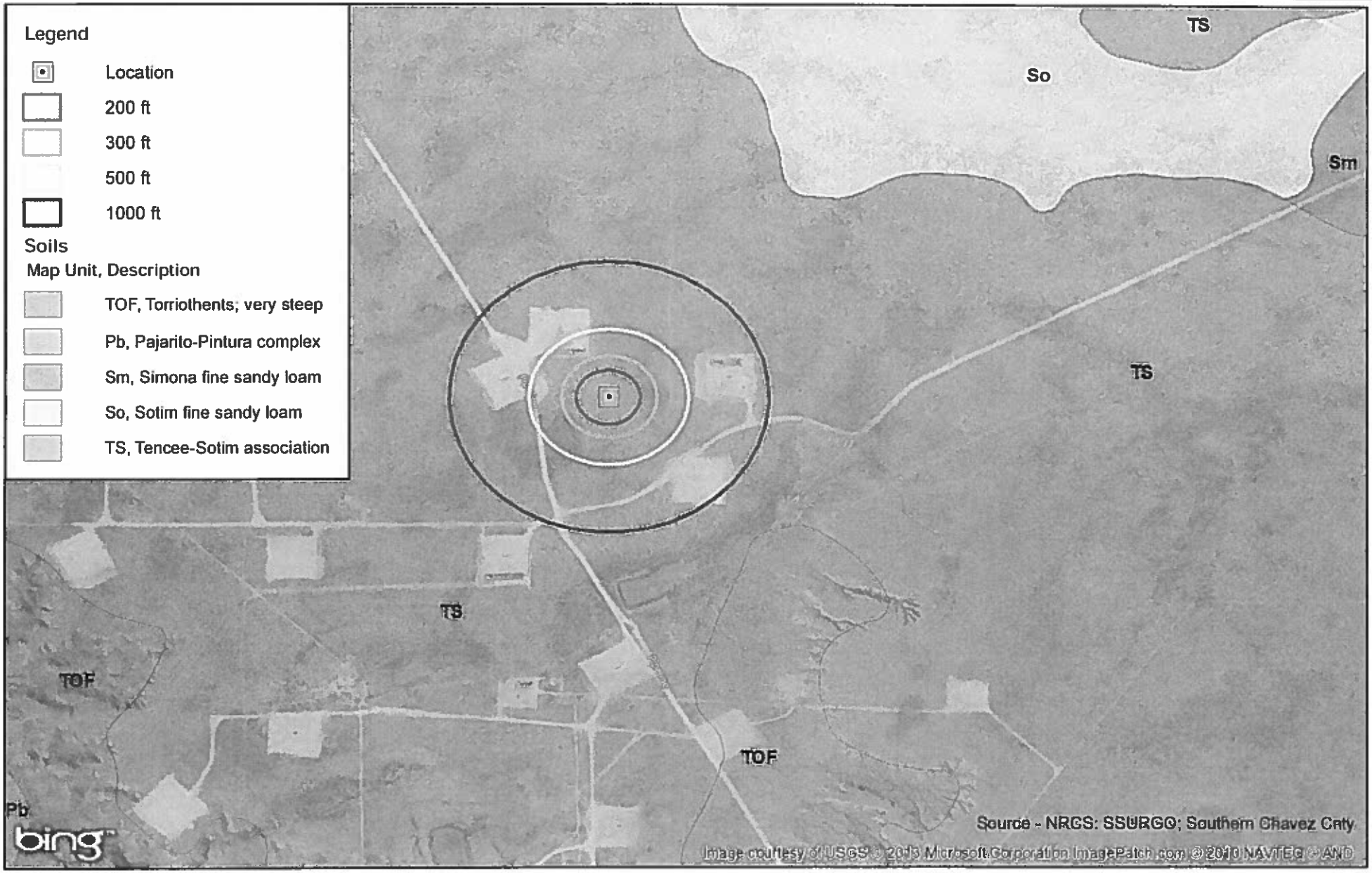

d Insurance Program at 1-800-638-6620.
MAP SCALE 1" = 2000'
1,000 0 1,000 2,000 3,000 4,000
FEET
ZONE A
12
7
8
13
18
17
ZONE X
24
20
R. 28 E.
R. 29 E.
Permanent Pit Location
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 2400D
FIRM
FLOOD INSURANCE RATE MAP
CHAVES COUNTY, NEW MEXICO
AND INCORPORATED AREAS
PANEL 2400 OF 3150
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
CHAVES COUNTY, UNINCORPORATED AREAS 350125 2400 D
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.
MAP NUMBER
35005C2400D
EFFECTIVE DATE
SEPTEMBER 25, 2009
Federal Emergency Management Agency
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Figure 9c


586000mE
587000mE
588000mE
589000mE
Permanent Pit Location
FLOOD HAZARD INFORMATION IS NOT SHOWN ON THIS MAP IN AREAS OUTSIDE OF EDDY COUNTY.
31
32
MAP SCALE 1" = 2000'
1,000 0 1,000 2,000 3,000 4,000
FEET
METE
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 0175D
FIRM
FLOOD INSURANCE RATE MAP
EDDY COUNTY, NEW MEXICO
AND INCORPORATED AREAS
PANEL 175 OF 2000
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
EDDY COUNTY, UNINCORPORATED AREAS 350120 0175 D
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.
MAP NUMBER
35015C0175D
EFFECTIVE DATE
JUNE 4, 2010
Federal Emergency Management Agency
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



N
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0 500 1,000
Feet

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Soils	Figure 10
	Mack Energy - Permanent Pit	August 2013

Logger:	David Hamilton	Client:	Well ID:
Driller:	Mack Energy Rathole Drilling Group	Mack Energy	SB-1
Drilling Method:	Augur	Project Name:	
Start Date:	8/20/2013	Round Tank Permanent Pits	
End Date:	8/20/2013	Location:	
		Section 19, T 15S, R 29E	

Depth (feet)	Description	Lithology	Comments	Depth (feet)
0.0	Surface, tan to red, 0 - 0.5 feet			0.0
1.0	Fine-grained sand, silt, caliche, white-tan, 0.5 - 7 feet		Caliche almost continuous in this interval	1.0
2.0				2.0
3.0				3.0
4.0				4.0
5.0				5.0
6.0				6.0
7.0	Very fine-grained sand, silt , some caliche, red-tan, 7- 12 feet			7.0
8.0				8.0
9.0				9.0
10.0				10.0
11.0				11.0
12.0	Very fine-grained sand, silt , red- brown, 12- 23 feet			12.0
13.0				13.0
14.0				14.0
15.0				15.0
16.0				16.0
17.0				17.0
18.0				18.0
19.0				19.0
20.0				20.0
21.0				21.0
22.0				22.0
23.0	Very fine-grained sand, silt, some clay (depth intervals with higher percentage clay shown on Lithology), red-brown, 23-44 feet			23.0
24.0				24.0
25.0				25.0
26.0				26.0
27.0				27.0
28.0				28.0
29.0				29.0
30.0				30.0
31.0				31.0
32.0				32.0
33.0				33.0
34.0				34.0
35.0				35.0
36.0				36.0
37.0				37.0
38.0				38.0
39.0				39.0
40.0				40.0
41.0				41.0
42.0				42.0
43.0				43.0
44.0	Very fine-grained sandstone,well sorted, tan-red, 44- 47 feet		Possible Upper Santa Rosa Formation contact	44.0
45.0				45.0
46.0				46.0
47.0	Fine-grained sand, tan, 47 - 52 feet			47.0
48.0				48.0
49.0				49.0
50.0				50.0
51.0				51.0
52.0	Fine-grained sand, some clay, red-tan, 52-60 feet,			52.0
53.0				53.0
54.0				54.0
55.0				55.0
56.0				56.0
57.0				57.0
58.0				58.0
59.0			Hard Drilling	59.0
60.0	Very fine-grained sand, silt, tan, 60-63 feet			60.0
61.0				61.0
62.0				62.0
63.0	Very fine-grained sand, silt, some clay, red-brown, 63-71 feet			63.0
64.0				64.0
65.0				65.0
66.0				66.0
67.0			Hard Drilling, Some pinning of the Dri Tools flights was necessary.	67.0
68.0				68.0
69.0				69.0
70.0				70.0
71.0	Limestone, tan-grey, 71-73 feet			71.0
72.0				72.0
73.0	Very fine-grained sand, silt, some clay, red-brown, 73-80 feet			73.0
74.0				74.0
75.0				75.0
76.0			Misalignment of hole beneath the limestone caused drilling difficulties. Boring was terminated at 80 feet.	76.0
77.0				77.0
78.0				78.0
79.0				79.0
80.0				80.0

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 505-266-5004	Mack Energy	Plate 1
	SB-1 Drilling Log	August 2013

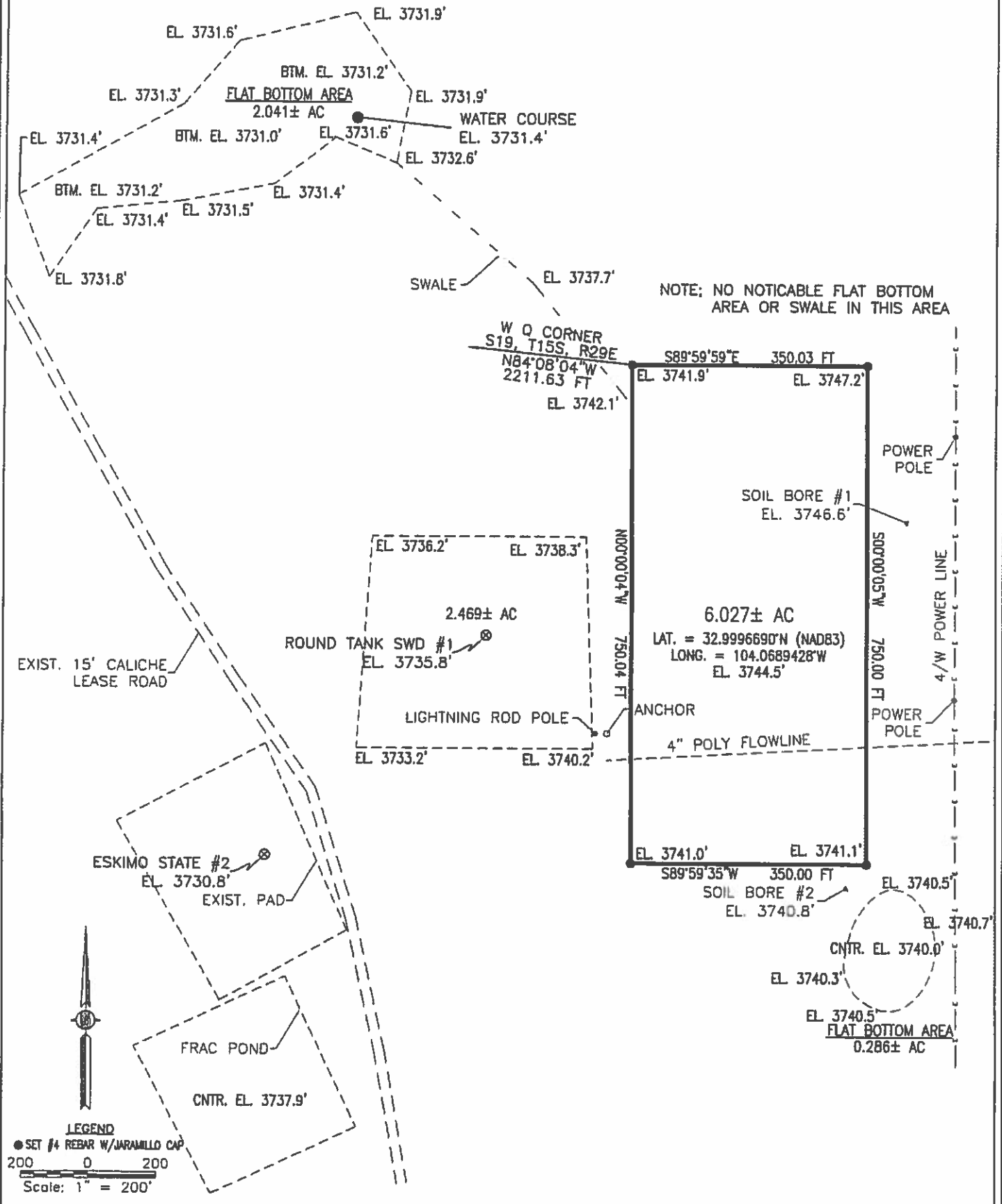
Logger:	David Hamilton	Client:	Well ID:
Driller:	Mack Energy Rathole Drilling Group	Mack Energy	SB-2
Drilling Method:	Augur	Project Name:	
Start Date:	8/20/2013	Round Tank Permanent Pits	
End Date:	8/20/2013	Location:	
		Section 19, T 15S, R 29E,	

Depth (feet)	Description	Lithology	Comments	Depth (feet)
0.0	Surface, tan, 0 - 1 feet			0.0
1.0	Very fine-grained sand, silt, caliche, light tan, 0.5 - 8 feet		Caliche almost continuous in this interval	1.0
2.0				2.0
3.0				3.0
4.0				4.0
5.0				5.0
6.0				6.0
7.0				7.0
8.0	Very fine-grained sand, silt , some caliche, red-tan, 8-18 feet			8.0
9.0				9.0
10.0				10.0
11.0				11.0
12.0				12.0
13.0				13.0
14.0				14.0
15.0				15.0
16.0				16.0
17.0				17.0
18.0	Very fine-grained sand, silt , intermittent clay beds, red-tan, 18- 34 feet			18.0
19.0				19.0
20.0				20.0
21.0				21.0
22.0				22.0
23.0				23.0
24.0				24.0
25.0				25.0
26.0				26.0
27.0				27.0
28.0				28.0
29.0				29.0
30.0				30.0
31.0				31.0
32.0				32.0
33.0				33.0
34.0	Fine-grained sand, silt, red-tan, 34-38 feet		Sand is "soft' in touch	34.0
35.0				35.0
36.0				36.0
37.0				37.0
38.0	Fine-grained sand, silt, some induration red-brown, 38-41 feet		Possible upper Santa Rosa Formation contact	38.0
39.0				39.0
40.0				40.0
41.0	Very fine-grained sand, silt, some clay, red-brown, 41-58 feet			41.0
42.0				42.0
43.0				43.0
44.0				44.0
45.0				45.0
46.0				46.0
47.0				47.0
48.0				48.0
49.0				49.0
50.0				50.0
51.0				51.0
52.0				52.0
53.0				53.0
54.0				54.0
55.0				55.0
56.0				56.0
57.0				57.0
58.0	Very fine-grained sand, silt, little clay, red-brown, 58-63 feet			58.0
59.0				59.0
60.0				60.0
61.0				61.0
62.0				62.0
63.0	Very fine-grained sand, silt, light-brown, 63-72 feet			63.0
64.0				64.0
65.0				65.0
66.0				66.0
67.0				67.0
68.0				68.0
69.0				69.0
70.0				70.0
71.0				71.0
72.0	Very fine-grained sand, silt, red-brown, 72-76 feet			72.0
73.0				73.0
74.0				74.0
75.0				75.0
76.0	Very fine-grained sand, silt, some clay, red-brown, 76-83 feet			76.0
77.0				77.0
78.0				78.0
79.0				79.0
80.0				80.0
81.0				81.0
82.0				82.0
83.0	Limestone, grey, 83-84 feet			83.0
84.0	Fine-grained sand, silt, red-brown, 84-85 feet		Drilling difficulties beneath the limestoneresulted in boring termination at 85 feet.	84.0
85.0				85.0

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 505-266-5004	Mack Energy	Plate 2
	SB-2 Drilling Log	August 2013

CHAVES COUNTY, STATE OF NEW MEXICO

AUGUST 20, 2013



GENERAL NOTES

1.) THE INTENT OF THIS SURVEY IS TO ACQUIRE A BUSINESS LEASE FOR THE PURPOSE OF BUILDING A FRAC POND

Map Unit Description (Brief, Generated)

Chaves County, New Mexico, Southern Part

[Minor map unit components are excluded from this report]

Map unit: Pb - Pajarito-Pintura complex

Component: Pajarito (55%)

The Pajarito component makes up 55 percent of the map unit. Slopes are 1 to 3 percent. This component is on plains, plains. The parent material consists of mixed alluvium and/or eolian deposits derived from sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R042XC004NM Sandy ecological site. Nonirrigated land capability classification is 7e. Irrigated land capability classification is 2e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 9 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Component: Pintura (30%)

The Pintura component makes up 30 percent of the map unit. Slopes are 3 to 15 percent. This component is on dunes, dune fields. The parent material consists of mixed eolian deposits derived from sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R042XC005NM Deep Sand ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 5 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Map unit: Sm - Simona fine sandy loam

Component: Simona (85%)

The Simona component makes up 85 percent of the map unit. Slopes are 0 to 5 percent. This component is on plains, plains. The parent material consists of mixed alluvium and/or eolian deposits derived from sedimentary rock. Depth to a root restrictive layer, petrocalcic, is 7 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R042XC002NM Shallow Sandy ecological site. Nonirrigated land capability classification is 7e. Irrigated land capability classification is 4s. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 5 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Map Unit Description (Brief, Generated)

Chaves County, New Mexico, Southern Part

Map unit: So - Sotim fine sandy loam

Component: Sotim (85%)

The Sotim component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on plains, plains. The parent material consists of mixed alluvium and/or eolian deposits derived from sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R042XC004NM Sandy ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 26 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Map unit: TOF - Torriorthents, very steep

Component: Torriorthents (85%)

Generated brief soil descriptions are created for major soil components. The Torriorthents is a miscellaneous area.

Map unit: TS - Tencee-Sotim association

Component: Tencee (50%)

The Tencee component makes up 50 percent of the map unit. Slopes are 1 to 9 percent. This component is on hillslopes, hills. The parent material consists of calcareous alluvium and/or eolian deposits derived from sedimentary rock. Depth to a root restrictive layer, petrocalcic, is 7 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. This component is in the R042XC025NM Shallow ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 35 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Component: Sotim (30%)

The Sotim component makes up 30 percent of the map unit. Slopes are 0 to 5 percent. This component is on plains, plains. The parent material consists of mixed alluvium and/or eolian deposits derived from sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R042XC004NM Sandy ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 25 percent. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Engineering Properties

Chaves County, New Mexico, Southern Part

[Absence of an entry indicates that the data were not estimated. This report shows only the major soils in each map unit]

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percent passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 Inches	3-10 Inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
Pb:												
Pajarito	0-5	Fine sandy loam	SC	A-2, A-4	0	0	100	100	85-100	30-45	15-20	8-10
	5-46	Fine sandy loam, sandy loam	SC	A-2, A-4	0	0	90-100	85-100	60-100	25-45	15-20	8-10
	46-60	Fine sandy loam, loam, sandy loam	CL, SC	A-2, A-4	0	0	90-100	85-100	60-95	20-55	20-30	8-10
Pintura	0-3	Loamy fine sand	SM	A-2	0	0	100	100	80-95	25-35	13-19	2-5
	3-38	Loamy fine sand	SM	A-2	0	0	100	100	70-95	15-35	13-19	2-5
	38-60	Fine sand	SM	A-2	0	0	100	100	65-80	20-35	13-19	2-5
Sm:												
Simona	0-10	Fine sandy loam	SM	A-4	0	0	100	100	70-100	35-50	20-25	NP-5
	10-13	Fine sandy loam, gravelly fine sandy loam, sandy loam	GM, ML, SM	A-2, A-4	0	0-10	60-95	55-90	50-75	30-55	20-25	NP-5
	13-17	Cemented material	—	—	—	—	—	—	—	—	—	—
So:												
Sotim	0-7	Fine sandy loam	SC, SC-SM	A-4	0	0	95-100	95-100	65-85	35-50	20-25	5-10
	7-70	Clay loam, loam	CL	A-6	0	0	95-100	95-100	80-100	60-80	25-40	10-20
TOF:												
Torriorthents	0-6	Gravelly loam	GM, SM	A-4	0	5-10	70-75	60-65	55-60	40-45	20-25	NP-5
	6-20	Gravelly sandy clay loam	SC, SC-SM	A-2	0	5-10	70-75	60-65	50-55	30-35	25-30	5-10
	20-24	Bedrock	—	—	—	—	—	—	—	—	—	—

Engineering Properties

Chaves County, New Mexico, Southern Part

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percent passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 Inches	3-10 Inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
TS:												
Tencee	0-2	Gravelly fine sandy loam	GM, SM	A-4	0	0-10	60-80	55-75	45-65	35-50	20-25	NP-5
	2-9	Very gravelly loam, extremely gravelly loam	GC, GC-GM	A-2	0	10-15	25-50	20-45	15-35	10-25	25-30	5-10
	9-13	Cemented material	---	---	---	---	---	---	---	---	---	---
Sotim	0-7	Fine sandy loam	SC, SC-SM	A-4	0	0	95-100	95-100	65-85	35-50	20-25	5-10
	7-70	Clay loam, loam	CL	A-6	0	0	95-100	95-100	80-100	60-80	25-40	10-20

Engineering Properties

Physical Soil Properties

Chaves County, New Mexico, Southern Part

[Entries under "Erosion Factors--T" apply to the entire profile. Entries under "Wind Erodibility Group" and "Wind Erodibility Index" apply only to the surface layer. Absence of an entry indicates that data were not estimated. This report shows only the major soils in each map unit]

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
Pb:														
Pajarito	0-5	---	---	15-20	1.45-1.55	14.11-42.34	0.13-0.15	0.0-2.9	0.5-0.8	.24	.24	5	3	86
	5-46	---	---	15-20	1.45-1.55	14.11-42.34	0.13-0.15	0.0-2.9	0.5-0.8	.24	.24			
	46-60	---	---	15-24	1.45-1.55	14.11-42.34	0.13-0.15	0.0-2.9	0.1-0.5	.24	.24			
Pintura	0-3	---	---	3-10	1.40-1.50	42.34-141.14	0.05-0.08	0.0-2.9	0.0-0.5	.37	.37	5	2	134
	3-38	---	---	3-10	1.40-1.50	42.34-141.14	0.05-0.08	0.0-2.9	0.5-0.8	.28	.28			
	38-60	---	---	0-6	1.55-1.65	42.34-141.14	0.04-0.06	0.0-2.9	0.1-0.5	.32	.32			
Sm:														
Simona	0-10	---	---	15-20	1.45-1.55	14.11-42.34	0.11-0.15	0.0-2.9	0.4-0.7	.28	.28	1	3	86
	10-13	---	---	15-20	1.45-1.55	14.11-42.34	0.09-0.15	0.0-2.9	0.5-0.8	.24	.24			
	13-17	---	---	---	---	0.00-0.42	---	---	---	---	---			
So:														
Sotim	0-7	---	---	10-17	1.45-1.55	14.11-42.34	0.13-0.15	0.0-2.9	0.5-1.0	.28	.28	3	3	86
	7-70	---	---	18-35	1.40-1.50	1.41-4.23	0.16-0.19	3.0-5.9	0.5-0.8	.37	.37			
TOF:														
Torriorthents	0-6	---	---	18-20	---	4.23-14.11	0.12-0.14	0.0-2.9	1.0-2.0	.20	.43	---	5	56
	6-20	---	---	20-25	---	4.23-14.11	0.11-0.13	0.0-2.9	---	.15	.32			
	20-24	---	---	---	---	0.00-0.42	---	---	---	---	---			
TS:														
Tencee	0-2	---	---	10-20	1.60-1.65	14.11-42.34	0.09-0.11	0.0-2.9	0.3-0.6	.15	.28	1	4	86
	2-9	---	---	18-27	1.55-1.60	4.23-14.11	0.08-0.10	0.0-2.9	0.5-0.8	.10	.43			
	9-13	---	---	---	---	0.00-0.42	---	---	---	---	---			
Sotim	0-7	---	---	10-17	1.45-1.55	14.11-42.34	0.13-0.15	0.0-2.9	0.5-1.0	.28	.28	3	3	86
	7-70	---	---	18-35	1.40-1.50	1.41-4.23	0.16-0.19	3.0-5.9	0.5-0.8	.37	.37			

Physical Soil Properties

Appendix F
Liner Specifications

RAVEN
INDUSTRIES

Raven Industries
1813 E Ave
Sioux Falls, SD 57104

8/29/13

K30B Compatibility with Components in Water Analysis

Dear RT Hicks Consultants,

The materials that Raven K30B is comprised of are compatible with the chemical components described in the water analysis provided by the RT Hicks Consulting firm. These compounds included ions: sodium, calcium, magnesium, barium, potassium, iron, strontium, manganese, chloride, sulfate, carbonate, and bicarbonate. The analysis also included a small amount of hydrogen sulfide and carbon dioxide. Stating these chemical species are compatible with the liner in this context means beneficial properties such as strength, elongation, and flexibility of the liner would not be significantly affected by long-term contact with the components described in the water analysis.

Sincerely,

Justin Norberg

Justin Norberg
Product Development Chemist
Engineered Films Division
Raven Industries
1813 E Ave.
Sioux Falls, SD 57104
(605)335-0288
Justin.Norberg@Ravenind.com

DURA•SKRIM® K30B, K36B & K45B

Scrim Reinforced Polyethylene - NSF/ANSI Standard 61 Certified

RAVEN INDUSTRIES

Product Description

DURA•SKRIM® K30B, K36B and K45B are linear low density polyethylene geomembranes reinforced with a heavy dense scrim reinforcement. In addition to excellent dimensional stability the K-Series reinforcement provides unmatched tear and tensile strength. DURA•SKRIM® K-Series membranes are formulated with thermal and UV stabilizers to assure a long service life.

Product Use

DURA•SKRIM® K30B, K36B and K45B are used in applications that require exceptional outdoor life and demand high tear strength and resistance to thermal expansion.

DURA•SKRIM® K30B, K36B and K45B are manufactured from a very chemical-resistant, Linear Low Density Polyethylene with excellent cold crack performance. The DURA•SKRIM®, K30B, K36B & K45B are certified under the NSF/ANSI Standard 61, Drinking Water System Components - Health Effects.

Size & Packaging

DURA•SKRIM® K30B, K36B and K45B are available in a variety of widths and lengths to meet the project requirements. Large diameter mill rolls are available to assure an efficient seaming process. Factory welded panels are accordion folded and tightly rolled on a heavy-duty core for ease of handling and time saving installation.

Containment Liner

Product	Part #
DURA•SKRIM	K30B
DURA•SKRIM	K36B
DURA•SKRIM	K45B

APPLICATIONS

- Waste Lagoon Liners
- Floating Covers
- Daily Landfill Covers
- Modular Tank Liners
- Tunnel Liners
- Remediation Liners
- Earthen Liners
- Interim Landfill Covers
- Remediation Covers
- Landfill Caps
- Erosion Control Covers
- Canal Liners
- Disposal Pit Liner
- Water Containment Ponds
- Heap Leach Liner
- Secondary Containment Fertilizer

DURA•SKRIM® K30B, K36B & K45B

ISO 9001:2008 CERTIFIED MANAGEMENT SYSTEM

Scrim Reinforced Polyethylene - NSF/ANSI Standard 61 Certified

PRO-FORMA DATA SHEET

PROPERTIES	TEST METHOD	DURA•SKRIM K30B		DURA•SKRIM K36B		DURA•SKRIM K45B	
		Minimum Roll Averages	Typical Roll Averages	Minimum Roll Averages	Typical Roll Averages	Minimum Roll Averages	Typical Roll Averages
Appearance		Black	Black	Black	Black	Black	Black
Thickness		27 mil	30 mil	32 mil	36 mil	40 mil	45 mil
Weight lbs/msf, (oz/yd²)		116 (16.7)	125 (18.0)	136 (19.6)	155 (22.3)	175 (25.2)	200 (28.8)
Construction		Dense scrim reinforced polyethylene					
*Ply Adhesion - lbf/in	ASTM D 6636	17 or FTB	20 or FTB	21 or FTB	28 or FTB	24 or FTB	32 or FTB
Tensile Strength - lbf/in	ASTM D 7003	165 MD 159 TD	182 MD 170 TD	170 MD 166 TD	186 MD 175 TD	178 MD 170 TD	195 MD 180 TD
Tensile Elongation at Break % (film break)	ASTM D 7003	480 MD 430 TD	540 MD 500 TD	500 MD 450 TD	575 MD 520 TD	520 MD 470 TD	590 MD 550 TD
Tensile Elongation at Break % (scrim break)	ASTM D 7003	32 MD 32 TD	35 MD 35 TD	32 MD 32 TD	35 MD 35 TD	32 MD 32 TD	35 MD 35 TD
Tongue Tear Strength - lbf	ASTM D 5884	185 MD 160 TD	195 MD 185 TD	160 MD 120 TD	180 MD 140 TD	140 MD 120 TD	175 MD 145 TD
Grab Tensile - lbf (scrim break)	ASTM D 7004	260 MD 245 TD	270 MD 255 TD	280 MD 270 TD	300 MD 290 TD	260 MD 245 TD	270 MD 255 TD
Grab Tensile Elongation at Break % (scrim break)	ASTM D 7004	25	32	25	32	25	32
High Pressure OIT (HPOIT)	ASTM D 5885	1000 min	2400 min	1000 min	2400 min	1000 min	2400 min
Puncture Resistance - lbf	ASTM D 4833	85	100	110	120	120	133
Maximum Use Temperature		180° F		180° F		180° F	
Minimum Use Temperature		-70° F		-70° F		-70° F	

*Raven modified QC procedure

PRO-FORMA Sheet Contents:

The data listed in this Pro-Forma data sheet is representative of initial production runs. These values may be revised at anytime without notice as additional test data becomes available.

DURA•SKRIM® K30B, K36B and K45B are linear low density polyethylene geomembranes reinforced with a heavy dense scrim reinforcement. In addition to excellent dimensional stability the K-Series reinforcement provides unmatched tear and tensile strength. DURA•SKRIM® K-Series membranes are formulated with thermal and UV stabilizers to assure a long service life.

Note: To the best of our knowledge, unless otherwise stated, these are typical property values and are intended as guides only, not as specification limits. Chemical resistance, odor transmission, longevity as well as other performance criteria is not implied or given and actual testing must be performed for applicability in specific applications and/or conditions. RAVEN INDUSTRIES MAKES NO WARRANTIES AS TO THE FITNESS FOR A SPECIFIC USE OR MERCHANTABILITY OF PRODUCTS REFERRED TO, no guarantee of satisfactory results from reliance upon contained information or recommendations and disclaims all liability for resulting loss or damage. Limited Warranty available at www.RavenEFD.com

RAVEN INDUSTRIES

Engineered Films Division
P.O. Box 5107
Sioux Falls, SD 57117-5107
Ph: (605) 335-0174 • Fx: (605) 331-0333

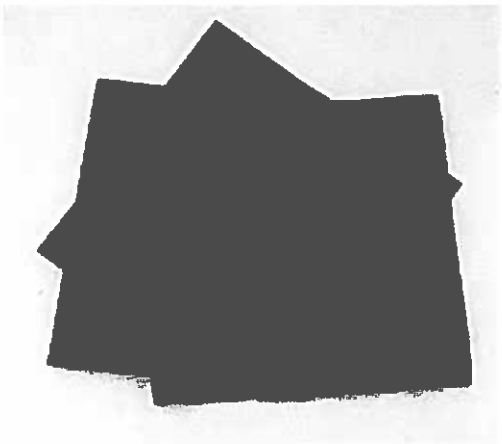
Toll Free: 800-635-3456
Email: efdsales@ravenind.com
www.ravenefd.com

1/11 EFD 1251

Scan QR Code to download current technical data sheets via the Raven website.

GRANITE environmental

Non Woven Geotextiles



The Non Woven Geotextile is needle punched fabric designed to help with stabilization, separation, filtration and drainage in your location. Made in several different weights and filtration levels, these geotextiles have been used in drainage areas, road stabilization, aggregate separation, cushioning and more.

Applications:

- Drainage Areas
- Rip Rap
- Stabilization
- Cushioning
- Asphalt Overlay
- Erosion Protection
- Underlayment
- Sediment Control
- Liner Underlay

Non Woven Geotextile Typical Specifications	
Fabric	Non Woven
Typical Weight Options	3.1 oz. to 16 oz.
Roll Sizing Options	12.5' W x 360' L 15' W x 360' L

GRANITE environmental

Product Solutions for a Cleaner World

P.O. Box 780928 Sebastian, FL 32978 Toll Free: (1) 888.703.9889 Fax: (+1) 772.589.3343 Int: (+1) 772.646.0597 info@GraniteEnvironmental.com
www.GraniteEnvironmental.com

Non Woven Specification Sheet

12 oz. Non Woven Geotextile Fabric

The Non Woven Geotextile is a non-biodegradable filter fabric designed to help with stabilization, separation and other erosion control, stabilization, and drainage applications. Offering a needle-punched fabric design, the 12 oz. nonwoven geotextile meets the following minimum average roll values:

Property	Test Method	Roll Value
Tensile Strength	ASTM-D-4632	300 lbs.
Elongation	ASTM-D-4632	50 %
Trapezoidal Tear	ASTM-D-4533	115 lbs.
CBR Puncture Strength	ASTM-D-6241	850 lbs.
AOS	ASTM-D-4751	100 Sieve
Permittivity	ASTM-D-4491	1.0 Sec-1
Water Flow Rate	ASTM-D-4491	75 gpm/ft
UV Resistance	ASTM-D-4355	70%/500 hours

Unless otherwise noted, this certification is based on testing conducted at the time of manufacturing.

P.O. Box 780928 Sebastian, FL 32978 Toll Free: (1) 888.703.9889 Fax: (+1) 772.589.3343 Int: (+1) 772.646.0597 info@GraniteEnvironmental.com

www.GraniteEnvironmental.com

Non Woven Specification Sheet

16 oz. Non Woven Geotextile Fabric

The Non Woven Geotextile is a non-biodegradable filter fabric designed to help with stabilization, separation and other erosion control, stabilization, and drainage applications. Offering a needle-punched fabric design, the 16 oz. nonwoven geotextile meets the following minimum average roll values:

Property	Test Method	Roll Value
Tensile Strength	ASTM-D-4632	380 lbs.
Elongation	ASTM-D-4632	50 %
Trapezoidal Tear	ASTM-D-4533	145 lbs.
CBR Puncture Strength	ASTM-D-6241	1080 lbs.
AOS	ASTM-D-4751	100 Sieve
Permittivity	ASTM-D-4491	0.7 Sec-1
Permeability	ASTM-D-4491	0.22 cm/sec
Water Flow Rate	ASTM-D-4491	50 gpm/ft
UV Resistance	ASTM-D-4355	70%/500 hours

Unless otherwise noted, this certification is based on testing conducted at the time of manufacturing.

P.O. Box 780928 Sebastian, FL 32978 Toll Free: (1) 888.703.9889 Fax: (+1) 772.589.3343 Int: (+1) 772.646.0597 info@GraniteEnvironmental.com

www.GraniteEnvironmental.com

Appendix G
Plan to Prevent Hazardous Odors

C-144 Supplemental Information: Prevention of Nuisance or Hazardous Odors Permanent Pit

While H2S gas may exist at the site as a "hazardous odor", nuisance odors cannot exist near the permanent pits based upon land use and ownership. One definition of public nuisance is abstracted from http://www.nuisancelaw.com/learn/tort is:

> The classic black-letter definition of a public nuisance is "an act or omission which obstructs or causes inconvenience or damage in the exercise of rights common to all."
>
> A public nuisance is an unreasonable interference with a right common to the general public. Circumstances that may sustain a holding that an interference with a public right is unreasonable include the following:
>
> 1. whether the conduct involves a significant interference with the public health, the public safety, the public peace, the public comfort or the public convenience, or
> 2. whether the conduct is proscribed by a statute, ordinance or administrative regulation, or
> 3. whether the conduct is of a continuing nature or has produced a permanent or long lasting effect, and, as the actor knows or has reason to know, has a significant effect upon the public right.

The pits lie in the middle of an oil field on public land. There are no dwellings, offices or gathering places nearby. It is our opinion that any odor that may emanate from the pit will not interfere with the public rights of the occasional hunter or oilfield worker.

As stated above, hydrogen sulfide is present in the untreated water scheduled for storage in Pit 1. The H2S concentrations, presented in Appendix I, were not obtained from an open vessel, similar to the proposed pond. We believe that the concentrations of H2S in the proposed pond could be less than what is currently reported for the untreated water.

As stated in the attachment, the team believes the best approach for creating a gas prevention plan is to monitor and observe the chemistry of the water in the pit and the air quality downwind from the pit for a short period of time. Armed with real data, we will submit an appropriate plan to OCD.

Legacy Safety & Consulting, LLC

3229 Industrial Dr. • Hobbs, NM 88240
(575) 393-7233 • Fax: (575) 393-7232

10325 HWY 87 E. #2 • Adkins, TX 78101
(210) 649-3900 • Fax: (210) 649-3915
www.legacysafetyandconsulting.com

September 4, 2013

RE: 06/28/2013 NMAC 19.15.17.9.B.(1)(h)

To Whom It May Concern,

On August 29, 2013 I received analysis information presented by Randall Hicks of RT Hicks Consultants on behalf of Mack Energy Corporation for the construction of two lined pits that will store untreated water which will be treated prior to re-use located in Chaves County, NM. The analysis information that I received were independent water analysis and an aerial photo of the location where the pits are proposed to be located.

Based upon the analysis presented it is my estimation that the amount of Hydrogen Sulfide (H_2S) present in both analysis, approximately 35 and 59ppm respectively, are below the IDLH amount of 100ppm according to NIOSH. The amounts of H_2S in the two analysis would probably not be enough to cause a "nuisance or hazardous odor, including H_2S"to the public or environment downwind and outside of the barbed wire fenced perimeter. In addition, nuisance odors do not appear to be an issue at this isolated location according to the photo presented.

The H_2S levels observed in the water analysis provided are at low/moderate levels for workers on the facility site, but would appear to be insignificant/low for the public or environment outside of the fence. At this time it is premature to develop an appropriate H_2S prevention plan that would accurately reflect the nature of the operation.

In conclusion, it is my recommendation that the most appropriate action to take with the my analysis of the information presented to me, if a H_2S prevention plan is deemed required by a regulatory body, due to the proposed location and low public hazard amount of possible H_2S is to:

1. Wait until the ponds are operating for real-time live observations and testing can be conducted during normal operation;
2. Monitor and measure at multiple points around the facility inside and outside of the facility fence to determine true airborne H_2S amounts during normal operation by qualified H_2S technician(s);
3. Develop an appropriate "H_2S Prevention of Nuisance or Hazardous Odors" or "H_2S Site Operation Safety" plan, if either is determined to be required given the final live operation data observed, that considers the nature of the operation and the observed concentrations during full-scale live normal operation.

Best Regards,

Jeffrey J. Painter, CSHO
EHS Director

Appendix H
Emergency Response Plan

Introduction

The actions taken in the initial minutes of an emergency are critical. A prompt warning to employees to evacuate, shelter or lockdown can save lives. A call for help to public emergency services that provides full and accurate information will help the dispatcher send the right responders and equipment. An employee trained to administer first aid or perform CPR can be lifesaving. Action by employees with knowledge of building and process systems can help control a leak and minimize damage to the facility and the environment.

Goals and Objectives

When an emergency occurs, the first priority is always life safety.

The second priority is the stabilization of the incident.

In addition to the immediate notification of responsible individuals, there are many actions that can be taken to stabilize an incident and minimize potential damage. First aid and CPR by trained employees can save lives. Use of fire extinguishers by trained employees can extinguish a small fire. Containment of a small chemical spill and supervision of utilities and systems can minimize or prevent environmental damage.

Foreseeable Emergencies and Response

The nature of the construction and the proposed operation of the pits create few conditions that may result in emergencies requiring a response. The pits are composed of earthen dikes, synthetic geotextile material, water, pipes to convey water in and out of the pits and netting over the pit to discourage migratory birds from landing. There is no:

- machinery,
- fuel storage
- hazardous chemicals
- high voltage
- confined space
- vehicular traffic that would cause an accident
- highly flammable material

Emergencies associated with Hydrogen Sulfide Gas are reasonably probable at any oil field facility and are addressed in the H2S plan for the permanent pits. The H2S prevention and safety plan is a separate document to which the readers are referred. The emergency situations discussed below are reasonably foreseeable at the Round Tank Permanent Pit site.

Geological hazards

Earthquakes of small magnitude occur in this portion of New Mexico. The probability that such an earthquake would cause an emergency relating to the permanent pits that creates an imminent threat to life or property is so low as to be nil. Such an event may cause some structural damage

to the liner or delivery pipes, resulting in a spill. Responses to Spills of treated or untreated water are addressed in a later section of this plan.

In the event of an earthquake, Mack will conduct a detailed inspection of the pit and piping for damage or displacement. Mack will also contact a Professional Engineer to inspect the site and determine if testing is required to evaluate the structural integrity of the dike.

Meteorological Hazards

All work stops whenever a tornado, lightning storm or other natural disaster occurs.

Flash floods are common in the area. Because of the 3-foot freeboard requirement and the fact that the top of the pit lies more than six feet above natural grade, an emergency situation could develop only by erosion of the pit dikes. Emergency response relating to a failure of the dikes is discussed in a following section of this plan.

Windstorms and dust storms are common. Dust storms do not pose a risk to the operation of the permanent pits, unless poor visibility creates a common workplace accident, such as trip/fall. Prevention and response to workplace accidents are addressed in the Medical Emergency Plan (below). Windstorms can create wave action on the pits that could create problems with liner integrity over a very long-term. Because the liners are inspected regularly and the pit is equipped with leak detection system, such problems with liner integrity are an operation and maintenance issue, not an emergency response.

Lightning strikes are not uncommon in the oil field. Because of the nature of the pit operation, the risk of a fire due to a lighting strike of the pit or bird-net structure is so small as to be nil. A lightning strike could create a breach of liner integrity, which is an operation and maintenance issue and does not require an emergency response.

Since 1951, 43 tornados were reported in all of Chaves County. Obviously a tornado at the pit site would be a very rare event and responding to this emergency is not specifically addressed in this plan.

Biological hazards

The operation of the pit does not create any biological hazards. Hazards such as heat stroke and snakebite are addressed in the Mack Energy Safety Manual (available upon request).

Accidents

Hazardous material releases are not anticipated as the only liquid substance in the pits is untreated water stored for treatment and treated water stored for re-use. However, the chemistry of the stored water is saline and will damage the environment if released. With the possible exception of H2S, which is addressed separately, the chemistry of the water will not cause immediate harm to human health. The force of a catastrophic release, like a natural flash flood, could injure humans. Any large release caused by a structural failure (dike collapse) that inures humans will be addressed through the Medical Emergency Plan.

Temporary entrapment in the pit is possible. A slip on a wet liner can result in a worker or inspector falling into the pit, if the worker is beneath the bird netting. While escape from the pit via the piping system area is relatively straight-forward for a conscious individual, an individual with a broken bone or similar injury may be trapped for a period of time. Recovery of a trapped individual will be accomplished by trained individuals following the Medical Emergency Plan.

Threats to Pit Dike Structural Integrity

The top of the pit berm is at an elevation of 3747.5 feet above sea level, which is denoted on the engineering drawings as the "high water elevation". With the mandate to maintain 3-feet of freeboard, the maximum operating water elevation is 3744.5 feet asl. The toe of the outside dike on the downhill (southwest) side of the pit is 3742 and the toe of the dike on the uphill (northeast) side of the pit is 3745. Therefore, a release of liquid due to erosion or structural failure is theoretically possible if the fluid in the pits is near the maximum operating level.

Because the width of the access road at the top of the dike is 15 feet, creating a release due to erosion or a structural failure requires removal or collapse of a very large volume of earth. The earth must be removed faster than the water level can be lowered.

If an emergency event threatens the structural integrity of the pit dike, the fluid level in the pit will be lowered to below 3742. Lowering of the water level can be attained by transfer of water to the Round Tank SWD #1 or to another lined pit.

Medical Emergency Plan

If a medical emergency is reported, dial 9-1-1 and request an ambulance. Provide the following information:

- Number and location of victim(s)
- Nature of injury or illness
- Hazards involved
- Nearest entrance (emergency access point)
- Directions to the location (see below)

From Hagerman, NM
From the intersection of State Highway 249 and Co. Rd. #30 (Jemina), go northwest on State Highway 249 for 2.1 miles, turn right/south on caliche lease road approximately 4.4 mile, go southeast approximately 0.5 mile, go southwest approximately 1.1 miles, go northwest 0.2 mile, turn right on location.

From Artesia, NM
From the intersection of U.S. Hwy #82 and County Road #217 (in Loco Hills), go north on #217 10.5 miles, turn northwest/left on lease road for 5 miles, turn right and go northwest 1 mile, and turn right onto location.

All Mack field staff are trained to administer first aid and CPR, as are many individuals in the field working for others. First aid kits reside in all trucks operated by Mack personnel. Contact the nearest Mack Energy staff member to obtain assistance with the emergency.

Procedures

- Only trained responders should provide first aid assistance.
- Before rendering first aid, be certain that you are not placing yourself in jeopardy. Remember that the hazard(s) that caused the accident must be under control before emergency aid can be rendered.
- Do not move the victim unless the victim's location is unsafe.
- Control access to the scene.
- Take "universal precautions" to prevent contact with body fluids and exposure to blood-borne pathogens.
- Meet the ambulance at the nearest entrance or emergency access point; direct them to victim(s).

Fire Emergency Plan

Because the pit is composed of non-flammable materials and water, the possibility of a fire is so remote as to be nil. If a fire is observed near the pit, dial 911 to alert Fire Department. Provide the following information:

- Location: Round Tank Permanent Pits
- Directions to the location

  From Hagerman, NM
  From the intersection of State Highway 249 and Co. Rd. #30 (Jemina), go northwest on State Highway 249 for 2.1 miles, turn right/south on caliche lease road approximately 4.4 mile, go southeast approximately 0.5 mile, go southwest approximately 1.1 miles, go northwest 0.2 mile, turn right on location.

  From Artesia, NM
  From the intersection of U.S. Hwy #82 and County Road #217 (in Loco Hills), go north on #217 10.5 miles, turn northwest/left on lease road for 5 miles, turn right and go northwest 1 mile, and turn right onto location.
- Nature of fire
- Name of person reporting fire
- Telephone number for return call

Procedures

- Evacuate site crew via H2S Plan evacuation routes to primary assembly areas.
- Site supervisor will account for employees and visitors at the assembly area.
- Meet Fire Department Incident Commander (IC). Inform the IC if everyone has been accounted for and if there are any injuries. Provide an update on the nature of the emergency and actions taken. Provide gate keys and other assistance as requested.

- Assign personnel to verify that fire protection systems are operating normally and utility and protection systems as directed by the fire department.

Additional Contact Information

Mack Energy Corporation Call List, Chaves County

Mack Energy Artesia Office.....575-748-1288

Agency Call List (575)

Roswell

State Police.....622-7200
Sheriff's Office.....624-7590
Ambulance.....624-7590
Fire Department.....624-7590
LEPC (Local Emergency Planning Committee.....624-6770
NMOCD.....748-1283
Bureau of Land Management.....627-0272

Emergency Services

Flight for Life-Lubbock, TX..... (806)743-9911
Aerocare-Lubbock, TX..... (806)747-8923
Med Flight Air Amb-Albuquerque, NM..... (505)842-4433
Lifeguard Air Med Svc. Albuquerque, NM..... (505)272-3115

Plan Distribution & Access

The Plan will be distributed to members of the emergency response team and department heads. A master copy of the document should be maintained by the emergency response team leader. The plan will be available for review by all employees.

Provide print copies of this plan at the primary and secondary assembly areas. Multiple copies should be stored within the facility to ensure that team members can quickly review roles, responsibilities, tasks, and reference information when the team is activated.

An electronic copy of this Plan should be stored on a secure and accessible website that would allow team member access if company servers are down.

Electronic copies should also be stored on a secured USB flash drive for printing on demand.

Appendix I

Laboratory Analyses of Untreated Water Scheduled for Treatment and Re-Use

C-144 Supplemental Information: Waste Stream Characterization
Permanent Pits

The attached analyses show that the untreated water scheduled for re-use is dominated by sodium chloride and exhibits a total dissolved solids concentration greater than 150,000 mg/L.

Hydrogen sulfide concentration in this untreated water is less than 75 mg/L

The treated water scheduled for storage in Pit #2 will exhibit the same salinity, but a lower concentration of hydrogen sulfide.

Catalyst Oilfield Services
11999 E Hwy 158
Gardendale, TX 79758
(432) 563-0727
Fax: (432) 224-1038

Water Analysis Report

Customer:	Mack Energy Corporation	Sample #:	13927
Area:	Artesia	Analysis ID #:	16055
Lease:	Roundtank		
Location:	#1 SWD 0		
Sample Point:	Wellhead		

Sampling Date:	8/20/2013
Analysis Date:	8/22/2013
Analyst:	Catalyst
TDS (mg/l or g/m3):	157548.8
Density (g/cm3):	1.109
Hydrogen Sulfide:	59
Carbon Dioxide:	73
Comments:	

Anions	mg/l	meq/l
Chloride:	95423.1	2691.54
Bicarbonate:	285.5	4.68
Carbonate:		
Sulfate:	370.0	7.7

Cations	mg/l	meq/l
Sodium:	58420.0	2541.13
Magnesium:	592.4	48.73
Calcium:	2119.0	105.74
Potassium:	297.5	7.61
Strontium:	41.3	0.94
Barium:		
Iron:		
Manganese:		

pH at time of sampling:	7
pH at time of analysis:	
pH used in Calculation:	7
Temperature @ lab conditions (F):	75
Conductivity (micro-ohms/cm):	185456
Resistivity (ohm meter):	.0539

Values Calculated at the Given Conditions - Amounts of Scale in lb/1000 bbl

Temp	Calcite $CaCO_3$		Gypsum $CaSO_4 * 2H_2O$		Anhydrite $CaSO_4$		Celestite $SrSO_4$		Barite $BaSO_4$	
°F	Index	Amount	Index	Amount	Index	Amount	Index	Amount	Index	Amount
80	0.53	13.23	-1.10	0.00	-1.10	0.00	-1.11	0.00	0.00	0.00
100	0.57	15.94	-1.18	0.00	-1.10	0.00	-1.13	0.00	0.00	0.00
120	0.61	18.64	-1.24	0.00	-1.09	0.00	-1.15	0.00	0.00	0.00
140	0.64	21.95	-1.29	0.00	-1.05	0.00	-1.16	0.00	0.00	0.00
160	0.67	25.56	-1.34	0.00	-0.99	0.00	-1.16	0.00	0.00	0.00
180	0.71	29.47	-1.37	0.00	-0.91	0.00	-1.16	0.00	0.00	0.00
200	0.75	33.38	-1.40	0.00	-0.82	0.00	-1.15	0.00	0.00	0.00
220	0.80	37.59	-1.43	0.00	-0.72	0.00	-1.14	0.00	0.00	0.00

Water Analysis

Chemplex
2811 SCR 1257 Midland,Tx 79711
(432) 561-8344 FAX (432) 561-8642

Date: 15-Mar-13 **Test #:** MC13080
Company: Elite **Formation:** N/G
Well #: Round Tank SWD #1
State: N/G
Depth: N/A **Source:** Source

pH:	7.06	**Temp (F):**	70
Specific Gravity	1.105	**H_2S:**	35 mg/L

CATIONS	**mg/l**	**me/l**	**ppm**
Sodium (calc.)	53900	2344.5	53792
Calcium	2800	139.7	2794
Magnesium	608	50.0	606
Barium	< 25	----	----
Potassium	< 10	----	----
Iron	0	0.0	0
ANIONS			
Chloride	85459	2410.7	85288
Sulfate	5799	120.7	5788
Carbonate	< 1	----	----
Bicarbonate	732	12.0	731
Total Dissolved Solids(calc.)	149298		149000
Total Hardness as CaCO3	9494	189.7	9475

COMMENTS: Treat H2S with Plexgel Breaker XPA
1gpt= 5.5 mg/L H2S 2gpt= 4 mg/L H2S

SCALE ANALYSIS:

CaCO3 Factor	2049600	**Calcium Carbonate Scale Probability->**	Probable
CaSO4 Factor	16270800	**Calcium Sulfate Scale Probability --->**	Probable

Stiff Plot