R. T. HICKS CONSULTANTS, LTD.

901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Fax: 505.266-0745

August 22, 2014

Mr. Mike Bratcher
NMOCD District 2
811 S. First Street
Artesia, New Mexico 88210
Via E-mail and US Mail

RE: Lime Rock Resources II-A, LP All Thorn MWFM Pit for Treated Produced Water

Dear Mike:

Attached is a short report of our observations during the geotechnical boring program at the All Thorn MWFM Pit site and the Pettigrew and Associates description of the geotechnical borings. We believe that the findings presented in the attachment will demonstrate that the ground on which and in which the pit will be constructed is "stable". We believe that OCD can agree that special engineering measures are not necessary to ensure the pit's integrity is not compromised.

Nevertheless, Pettigrew and Associates will be providing pit foundation construction recommendations and will be periodically inspecting construction and testing the foundation. If OCD agrees that the ground is "stable", Pettigrew will provide a report on the foundation to Lime Rock only and will not clog OCD files with unnecessary information.

We believe that this report on the nature of the subsurface is all that is lacking to allow OCD to approve the permit. Please note the following:

1.
2. In the May 7, 2014 submission
    a. The engineering drawings contain the same specifications as those previously-approved by OCD for the Yates Dagger Draw MWFM Pit
    b. The Design/Construction plan is nearly verbatim from the Dagger Draw MWFM Pit permit. The discussion regarding netting is slightly different because Lime Rock did not submit their Avian Protection Plan to OCD until June 6, 2014.
    c. The Operation and Maintenance Plan is verbatim from the previously-approved Yates permit.
    d. The Closure Plan is nearly verbatim from the Yates Permit. Because Lime Rock will harvest the underlying caliche as part of a State Land Office Mining lease, the backfilling of the "quarry" may not be required.
    e. The variance request to use a 30-mil LLDPE secondary liner is verbatim from a similar request from Yates – and OCD has approved this variance request.
3. On July 2, 2014 we submitted a variance request to allow NMOCD additional time to review the permit application to allow Lime Rock to conduct a geotechnical investigation to determine if the area of the proposed pit, which is mapped as "high karst potential" by BLM, translates to "unstable ground". While we requested a 40-day extension, gaining a lease from the SLO to conduct the borings

delayed the process by several weeks. Thus, we attach a second variance request to allow OCD additional time to complete the review of the permit application.

Until today, the NW State 19 workover pit (originally transmitted to OCD on 4/21, then re-submitted to OCD after the "auto-denial" on 6/30) was the first pit that Lime Rock needed to launch their produced water for stimulation project. Now the All Thorn is the more important pit. If we can get an approval from OCD very soon, that would be great!

Thanks.

Sincerely,
R.T. Hicks Consultants

Randall Hicks

Copy: LRE Operating
Scott Dawson NMOCD Santa Fe
State Land Office (surface owner)

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Stability of Subsurface at All Thorn MWFM Pit

Background

The Pit Rule states:

> 19.15.17.10 SITING REQUIREMENTS:
> A. (5) An operator shall not locate a permanent pit or multi-well fluid management pit:
> (a) where ground water is less than 50 feet below …
> (h) within an unstable area, unless the operator demonstrates that it has incorporated engineering measures into the design to ensure that the pit's integrity is not compromised; or…

Since the Pit Rule was first promulgated under the Richardson Administration, the directive from the Santa Fe Environmental Bureau was to consider "high karst" areas mapped by the BLM or USGS as "unstable". The corollary to that directive would be to consider "low karst potential" areas as stable. Neither of these two directions are valid.

Karst potential can certainly contribute to instability - as sinkholes swallowing houses in Florida and water disappearing from frac ponds near Burton Flats can attest. However, karst experts have encouraged the general public to eat lunch at the restaurant within Carlsbad Caverns – an area of obvious high karst potential. This ground in this part of the National Park is stable by anyone's yardstick. In our field examination of sites in "low karst potential" areas, we have witnessed sinkholes, caves and active subsidence. A reasonable person must conclude that a map on a wall cannot replace observation and research by a trained geologist or geotechnical engineer for determining if ground is stable or unstable.

In areas that collect storm water, subsidence is common if near-surface gypsum or anhydrite (soluble material) is present. About ½ mile north of the All Thorn MWFM pit, we observed obvious subsidence in a small depression due to solution of the underlying gypsum/anhydrite within the underlying Rustler Formation. More than 1000 feet south of the pit site, we observed what may be collapse features in depressions – but subsequent examination showed these depressions to be man-made and what appeared as subsidence was very old digging. Our observations and research allowed us to conclude that the 2-3 square mile area around the All Thorn location has "high karst potential" due to the presence of relatively near-surface soluble rocks; and certain areas are unstable. At the All Thorn pit location, Hicks Consultants opined that this particular area was an island of stability due to its location on a topographic high and the presence of massive caliche beneath the surface.

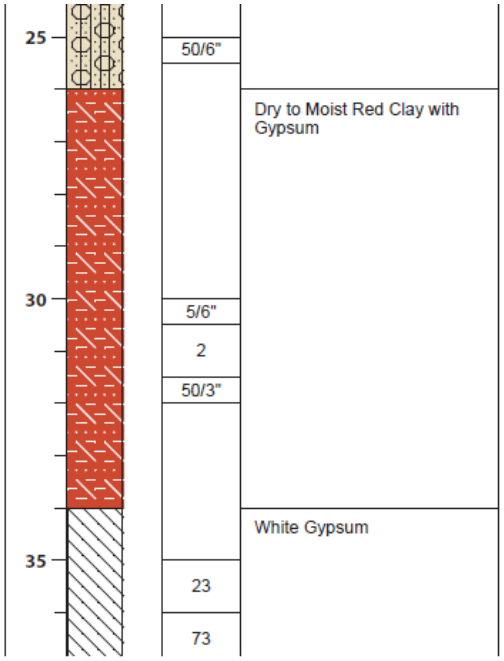
OCD staff requested that we provide site-specific evidence of our opinion of stability prior to their final evaluation of the permit application. The attached report from Pettigrew provides such data and fulfills our commitment in the permit to conduct such a study (page 8 of Site Specific Information Section). This request from OCD was fully appropriate and we should have thought of it sooner.

Lithology and Stability of Subsurface

From ground surface to a depth of at least 20 feet at all boring locations, competent caliche is present. As presented in the attached Pettigrew and Associates report, blow counts document a bearing capacity in excess of 3,000 pounds per square foot for the caliche at depths below 2-4 feet.

Below the caliche is the Rustler Formation, which is comprised of red claystone and gypsum. In these boreholes, the gypsum layers were generally 1-inch to 1-foot thick and were encased in many feet of red claystone. In Borehole 3 (see map attached to the Pettigrew Report), cores and cuttings revealed a 3-foot thick horizon of gypsum at a depth of 34 feet below grade. While the blow counts in this gypsum horizon were significantly lower than in the surrounding claystone (23-73 counts/foot versus 50 counts/6-inches), the bearing capacity of the gypsum still exceeds the 3,000 pounds per square foot criteria (see Pettigrew Report).

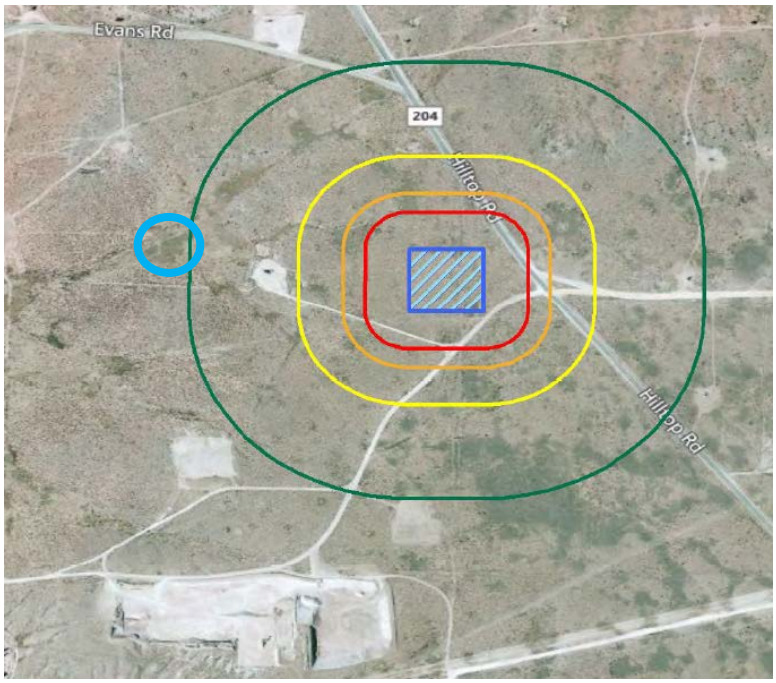
In Borehole #3, we encountered a void at a depth of approximately 30-31.5 feet. As shown in the reproduction of the boring log at this depth, the blow counts were 2 counts/foot; clearly less than the 18 counts/foot that represent competent material.



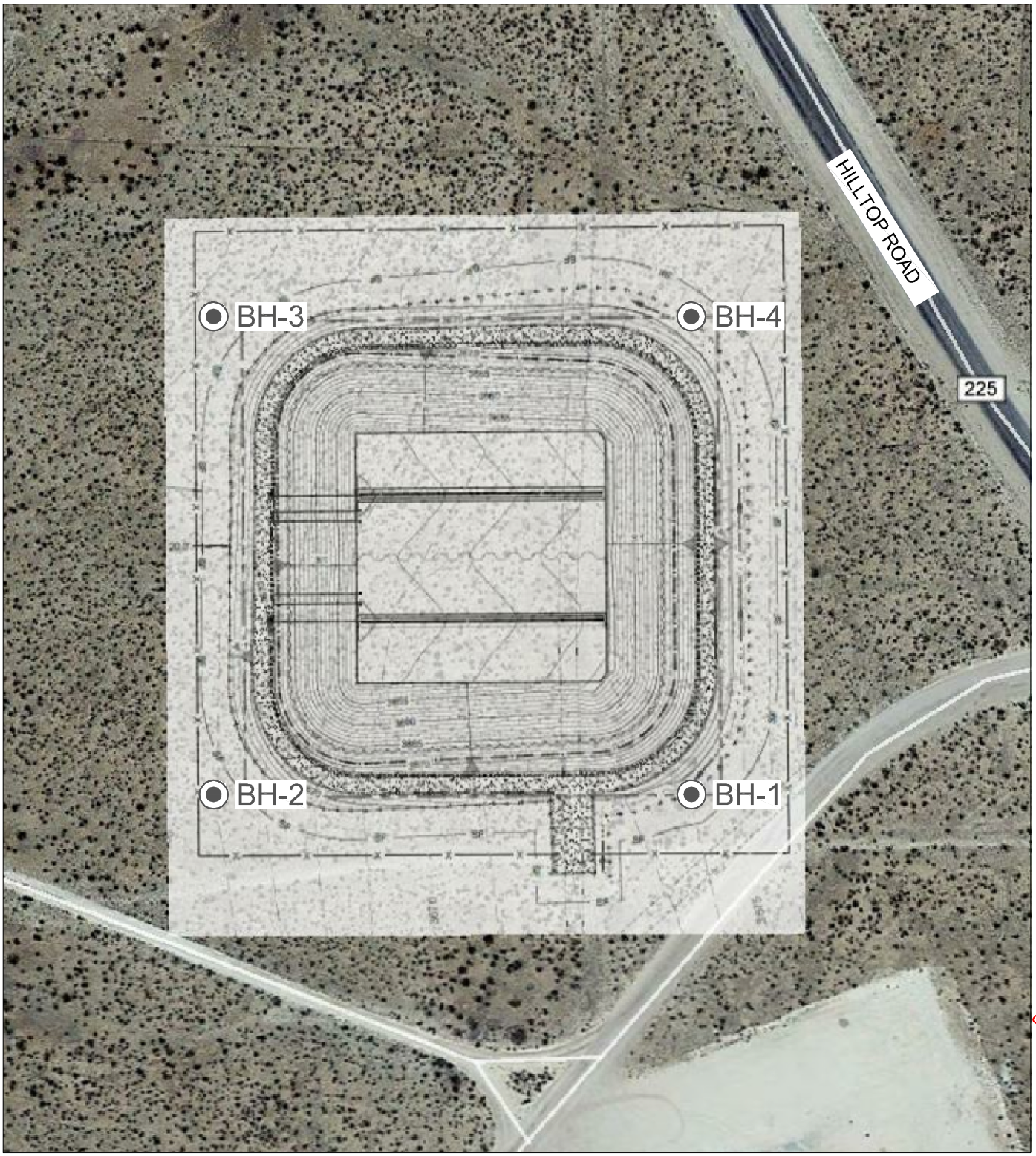
However, immediately below the void, the stability of the Rustler bedrock meets all design criteria. Within the overlying caliche, the sample at 25 feet shows 50 blows with the 140 pound hammer were required to advance the split spoon sampler 6 inches.

About ¾ of a mile west of the All Thorn Pit location, a caliche pit and some well pad locations show evidence of 2- to 3-foot thick beds of gypsum. Like the gypsum layer observed at 35 feet in Borehole 3, the gypsum boulders excavated in this area appear competent.

We also conducted a foot survey of several small depressions that collect storm water west-northwest of the proposed pit location; from the turquoise circle on the adjacent aerial photograph (see Figure 4 of the C-144 Application) to Borehole #3. The small depression within the turquoise circle is at an elevation of about 3630 feet asl (see Figure 3 of the C-144 Application) and the elevation of Borehole #3 (NW corner of the proposed pit location) is 3682, about 50 feet higher. Thus, as we walked the small drainage that led to Borehole #3, we were able to observe the complete stratigraphic section penetrated by the boring. In several small depressions between the turquoise circle and the pit area, we found no evidence of subsidence or instability.



Pettigrew and Associates are finalizing their foundation design for the pit and will use the findings of the boreholes and samples to develop a foundation that will minimize the potential of liner failure. Hicks Consultants believes that Pettigrew's analysis will concur with ours – the ground is suitably stable to permit construction and operation of the proposed Multi-Well Fluid Management Pit.



BOREHOLE MAP

PROJECT NAME:	ALL THORN MWFM PIT
CLIENT:	RT HICKS CONSULTANTS LTD
PROJECT NUMBER:	2014.1120
PROJECT MANAGER:	EH/DPH

PETTIGREW & ASSOCIATES PA
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DEFINING QUALITY SINCE 1965
100 E. Navajo Drive Suite 100 Hobbs New Mexico 88240
T 575 393 9827 | F 575 393 1543 | Pettigrew.us

R. T. Hicks Consultants, Ltd.
All Thorn MWFM Pit (Lime Rock)
P&A Project No. 2014.1120

Standard Penetration Test (spt N)

The standard penetration resistance (N) in blows per foot is obtained by ASTM D1586 procedure using 2" O.D., 1-3/8" I.D. samplers. A 140 lb. hammer is used and free falls 30 inches onto the sampler. Values are recorded in 6 inch increments and summed for the one foot spt (N) count.

The terminology used when describing the relative density of cohesionless, uncemented sands and sand-gravel mixtures are shown below:

N	Relative Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
50+	Very Dense

We typically recommend an allowable bearing capacity of 3,000 pounds per square foot (psf) for most designs. For a sandy soil, a (N) value of 18 would correlate to an estimated allowable bearing capacity of 3,180 psf. Higher values would yield higher allowable bearing capacities. As shown on the attached logs, the majority of the N-values exceed 18 blows per foot beyond 5 feet below ground surface. Low bearing values, at an approximate depth of 30 feet below ground surface, are present in Borehole 3.

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BORING NO.: BH-1

CLIENT: R.T. Hicks Consultants, Ltd.
PROJECT NAME: All Thorn MWFM Pit (Lime Rock)
PROJECT NO.: 2014.1120
DATE DRILLED: 7/29/14

COORDINATES: N 650143.337' E 574349.734'
SURFACE ELEVATION: 3684.05'
BOREHOLE DEPTH: 41'9"
DEPTH TO WATER: N/A

DEPTH (FT)	LITHOLOGIC SYMBOL	BLOWS PER FOOT	DESCRIPTION	SOIL CLASSIFICATION	LABORATORY TEST DATA									BEARING CAPACITY (psf)	qu (psf)	SHEAR STREGTH (tsf)
					% MOISTURE	% PASSING 3/4"	% PASSING #4	% PASSING #10	% PASSING #40	% PASSING #200	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)			
0		3	Dry Brown Silty Sand (Topsoil)													
		24	Dry Tan Silty Sand with Gravel (Caliche)													
		15														
		15														
		24														
5		23														
		29														
		57														
		51														
		60														
10		47														
		46														
15		60/11"														

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DEFINING QUALITY SINCE 1965

BORING NO.: BH-1

CLIENT: R.T. Hicks Consultants, Ltd.
PROJECT NAME: All Thorn MWFM Pit (Lime Rock)
PROJECT NO.: 2014.1120
DATE DRILLED: 7/29/14

COORDINATES: N 650143.337' E 574349.734'
SURFACE ELEVATION: 3684.05'
BOREHOLE DEPTH: 41'9"
DEPTH TO WATER: N/A

DEPTH (FT)	LITHOLOGIC SYMBOL	BLOWS PER FOOT	DESCRIPTION	SOIL CLASSIFICATION	LABORATORY TEST DATA									BEARING CAPACITY (psf)	qu (psf)	SHEAR STREGTH (tsf)
					% MOISTURE	% PASSING 3/4"	% PASSING #4	% PASSING #10	% PASSING #40	% PASSING #200	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)			
20		50/9"	Dry to Moist Red Clay with Gypsum													
25		37														
		60/9"														
30		50/3"														
35		22														
		51														

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DEFINING QUALITY SINCE 1965

BORING NO.: BH-1

CLIENT: R.T. Hicks Consultants, Ltd.
PROJECT NAME: All Thorn MWFM Pit (Lime Rock)
PROJECT NO.: 2014.1120
DATE DRILLED: 7/29/14

COORDINATES: N 650143.337' E 574349.734'
SURFACE ELEVATION: 3684.05'
BOREHOLE DEPTH: 41'9"
DEPTH TO WATER: N/A

DEPTH (FT)	LITHOLOGIC SYMBOL		BLOWS PER FOOT	DESCRIPTION	SOIL CLASSIFICATION	LABORATORY TEST DATA									BEARING CAPACITY (psf)	qu (psf)	SHEAR STREGTH (tsf)
						% MOISTURE	% PASSING 3/4"	% PASSING #4	% PASSING #10	% PASSING #40	% PASSING #200	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)			
40			40 74/9"														

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BORING NO.: BH-2

CLIENT: R.T. Hicks Consultants, Ltd.
PROJECT NAME: All Thorn MWFM Pit (Lime Rock)
PROJECT NO.: 2014.1120
DATE DRILLED: 7/29/14

COORDINATES: N 650143.201' E 574014.592'
SURFACE ELEVATION: 3684.45'
BOREHOLE DEPTH: 41'10"
DEPTH TO WATER: N/A

DEPTH (FT)	LITHOLOGIC SYMBOL	BLOWS PER FOOT	DESCRIPTION	SOIL CLASSIFICATION	LABORATORY TEST DATA									BEARING CAPACITY (psf)	qu (psf)	SHEAR STREGTH (tsf)
					% MOISTURE	% PASSING 3/4"	% PASSING #4	% PASSING #10	% PASSING #40	% PASSING #200	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)			
0		10/6"	Dry Brown Silty Sand (Topsoil)													
		45/6"														
		72	Dry Tan Silty Sand with Gravel (Caliche)													
		27														
		16														
		18														
5		27														
		41														
		50/6"														
		67/11"														
10		80/11"														
15		75/8"														

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BORING NO.: BH-2

CLIENT: R.T. Hicks Consultants, Ltd.
PROJECT NAME: All Thorn MWFM Pit (Lime Rock)
PROJECT NO.: 2014.1120
DATE DRILLED: 7/29/14

COORDINATES: N 650143.201' E 574014.592'
SURFACE ELEVATION: 3684.45'
BOREHOLE DEPTH: 41'10"
DEPTH TO WATER: N/A

DEPTH (FT)	LITHOLOGIC SYMBOL	BLOWS PER FOOT	DESCRIPTION	SOIL CLASSIFICATION	LABORATORY TEST DATA									BEARING CAPACITY (psf)	qu (psf)	SHEAR STREGTH (tsf)
					% MOISTURE	% PASSING 3/4"	% PASSING #4	% PASSING #10	% PASSING #40	% PASSING #200	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)			
20		50/3"														
		50/1"	Dry to Moist Red Clay with Gypsum													
25		35/3"														
30		50/4"														
35		50/3"														

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BORING NO.: BH-2

CLIENT: R.T. Hicks Consultants, Ltd.
PROJECT NAME: All Thorn MWFM Pit (Lime Rock)
PROJECT NO.: 2014.1120
DATE DRILLED: 7/29/14

COORDINATES: N 650143.201' E 574014.592'
SURFACE ELEVATION: 3684.45'
BOREHOLE DEPTH: 41'10"
DEPTH TO WATER: N/A

DEPTH (FT)	LITHOLOGIC SYMBOL		BLOWS PER FOOT	DESCRIPTION	SOIL CLASSIFICATION	LABORATORY TEST DATA									BEARING CAPACITY (psf)	qu (psf)	SHEAR STREGTH (tsf)
						% MOISTURE	% PASSING 3/4"	% PASSING #4	% PASSING #10	% PASSING #40	% PASSING #200	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)			
40			17 59/10"														

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BORING NO.: BH-3

CLIENT: R.T. Hicks Consultants, Ltd.
PROJECT NAME: All Thorn MWFM Pit (Lime Rock)
PROJECT NO.: 2014.1120
DATE DRILLED: 7/29/14

COORDINATES: N 650478.437' E 574014.506'
SURFACE ELEVATION: 3682.83'
BOREHOLE DEPTH: 51'0"
DEPTH TO WATER: N/A

DEPTH (FT)	LITHOLOGIC SYMBOL	BLOWS PER FOOT	DESCRIPTION	SOIL CLASSIFICATION	LABORATORY TEST DATA									BEARING CAPACITY (psf)	qu (psf)	SHEAR STREGTH (tsf)
					% MOISTURE	% PASSING 3/4"	% PASSING #4	% PASSING #10	% PASSING #40	% PASSING #200	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)			
0		8/6"	Dry Brown Silty Sand (Topsoil)													
		32														
		50/6"	Dry Tan Silty Sand with Gravel (Caliche)													
		37														
		29														
		23														
5		24														
		63														
		61														
		39														
		71														
10		83														
		50/6"														
15		50/6"														

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BORING NO.: BH-3

CLIENT: R.T. Hicks Consultants, Ltd.
PROJECT NAME: All Thorn MWFM Pit (Lime Rock)
PROJECT NO.: 2014.1120
DATE DRILLED: 7/29/14

COORDINATES: N 650478.437' E 574014.506'
SURFACE ELEVATION: 3682.83'
BOREHOLE DEPTH: 51'0"
DEPTH TO WATER: N/A

DEPTH (FT)	LITHOLOGIC SYMBOL	BLOWS PER FOOT	DESCRIPTION	SOIL CLASSIFICATION	LABORATORY TEST DATA									BEARING CAPACITY (psf)	qu (psf)	SHEAR STREGTH (tsf)
					% MOISTURE	% PASSING 3/4"	% PASSING #4	% PASSING #10	% PASSING #40	% PASSING #200	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)			
20		50/4"														
		75/3"														
25		50/6"														
			Dry to Moist Red Clay with Gypsum													
30		5/6"														
		2														
		50/3"														
			White Gypsum													
35		23														
		73														

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BORING NO.: BH-3

CLIENT: R.T. Hicks Consultants, Ltd.
PROJECT NAME: All Thorn MWFM Pit (Lime Rock)
PROJECT NO.: 2014.1120
DATE DRILLED: 7/29/14

COORDINATES: N 650478.437' E 574014.506'
SURFACE ELEVATION: 3682.83'
BOREHOLE DEPTH: 51'0"
DEPTH TO WATER: N/A

DEPTH (FT)	LITHOLOGIC SYMBOL	BLOWS PER FOOT	DESCRIPTION	SOIL CLASSIFICATION	LABORATORY TEST DATA									BEARING CAPACITY (psf)	qu (psf)	SHEAR STREGTH (tsf)
					% MOISTURE	% PASSING 3/4"	% PASSING #4	% PASSING #10	% PASSING #40	% PASSING #200	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)			
			Moist Red Clay with Gypsum													
40		50/6"														
45		50/6"														
50		67														

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BORING NO.: BH-4

CLIENT: R.T. Hicks Consultants, Ltd.
PROJECT NAME: All Thorn MWFM Pit (Lime Rock)
PROJECT NO.: 2014.1120
DATE DRILLED: 7/29/14

COORDINATES: N 650478.428' E 574349.564'
SURFACE ELEVATION: 3683.73'
BOREHOLE DEPTH: 36'5"
DEPTH TO WATER: N/A

DEPTH (FT)	LITHOLOGIC SYMBOL	BLOWS PER FOOT	DESCRIPTION	SOIL CLASSIFICATION	LABORATORY TEST DATA									BEARING CAPACITY (psf)	qu (psf)	SHEAR STREGTH (tsf)
					% MOISTURE	% PASSING 3/4"	% PASSING #4	% PASSING #10	% PASSING #40	% PASSING #200	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)			
0		7/6"	Dry Brown Silty Sand (Topsoil)													
		70	Dry Tan Silty Sand with Gravel (Caliche)													
		29														
		19														
		54														
5		92														
		50/6"														
		66														
		50/4"														
10		50/5"														
15		50/3"														

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BORING NO.: BH-4

CLIENT: R.T. Hicks Consultants, Ltd.
PROJECT NAME: All Thorn MWFM Pit (Lime Rock)
PROJECT NO.: 2014.1120
DATE DRILLED: 7/29/14

COORDINATES: N 650478.428' E 574349.564'
SURFACE ELEVATION: 3683.73'
BOREHOLE DEPTH: 36'5"
DEPTH TO WATER: N/A

DEPTH (FT)	LITHOLOGIC SYMBOL	BLOWS PER FOOT	DESCRIPTION	SOIL CLASSIFICATION	LABORATORY TEST DATA									BEARING CAPACITY (psf)	qu (psf)	SHEAR STREGTH (tsf)
					% MOISTURE	% PASSING 3/4"	% PASSING #4	% PASSING #10	% PASSING #40	% PASSING #200	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)			
20		50/6"	Dry to Moist Red Clay with Gypsum													
25		50/5"														
30		35														
		60														
35		52														
		50/5"														

Statement Explaining Why the Applicant Seeks a Variance

The prescriptive mandates of the Rule that are the subject of this variance request are the following subsections of 19.15.17.16 [emphasis added]:

> B. Whether or not the division deems an application to be administratively complete within the 30 day evaluation period, the division shall also have an additional 30 days to approve, deny or approve with conditions an application. <u>If the division does not take action within the 60 days review period, then the application is deemed denied and the operator may file an application for hearing with the division clerk.</u>

It is our understanding that the intent of this mandate of the Pit Rule is to limit the time of review of a permit application. In general, limiting the review time is good for all.

In July, Lime Rock requested an extra 40 days from the 60-day limit to provide more detailed site-specific data regarding the stability of the ground (i.e. potential of collapse due to karst features). Gaining a permit from the State Land Office to conduct this investigation took several weeks longer than anticipated and the transmission of the geotechnical data to OCD occurred on August 22, 2014. Therefore, we request that OCD take an additional 15 days to evaluate the data (September 6, 2014) and render a decision on the permit application. .

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

We believe that conducting geotechnical borings and gaining the site-specific information in advance of final permit approval provides equal or better protection of fresh water, public health and the environment. Allowing OCD sufficient time to review the findings also provides better protection of fresh water, public health and the environment.