

May 2014  
Updated October 2014

# **C-144 Permit Package for All Thorn Multi-Well Fluid Management Pit Section 36 of T17S, R27E, Eddy County**

**Volume 2  
Appendices A-C**



*View southwest from northeast corner of proposed site showing All Thorn trees*

**Prepared for:  
Lime Rock Resources II-A, LP (LRRII)  
Artesia, New Mexico**

**Prepared by:**

**Huitt-Zollars, Inc  
333 Rio Rancho Blvd  
Suite 101  
Rio Rancho, New Mexico**

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

**Pettigrew and Associates, PA  
100 E. Navajo Drive  
Suite 100,  
Hobbs, NM 88240**

# **Appendix A**

## **Certified Engineering Drawings**



# All Thorn MWFM Pit

Section 36 T17S R27E  
Eddy County, New Mexico

# Permit Plans


100% Submittal  
MAY 7, 2014



NO.	DESCRIPTION	DATE	BY
1	—	—	—
2	—	—	—
3	—	—	—
4			
5			
6			

**HUITT-ZOLLARS**  
Huitt-Zollars, Inc.  
Rio Rancho  
353 Rio Rancho Drive NE, Suite 201  
Rio Rancho, New Mexico 87124  
Phone (505) 882-6141 Fax (505) 882-3259

**LIME ROCK  
RESOURCES**

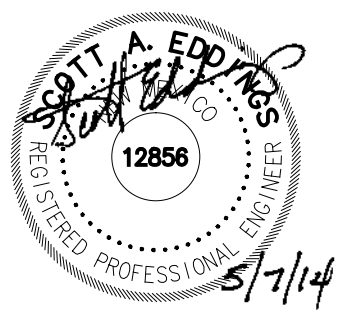


Designed For

**PROJECT COVER SHEET**

---

ALL THORN MWFM PIT  
SECTION 36 T17S R27E  
EDDY COUNTY, NM

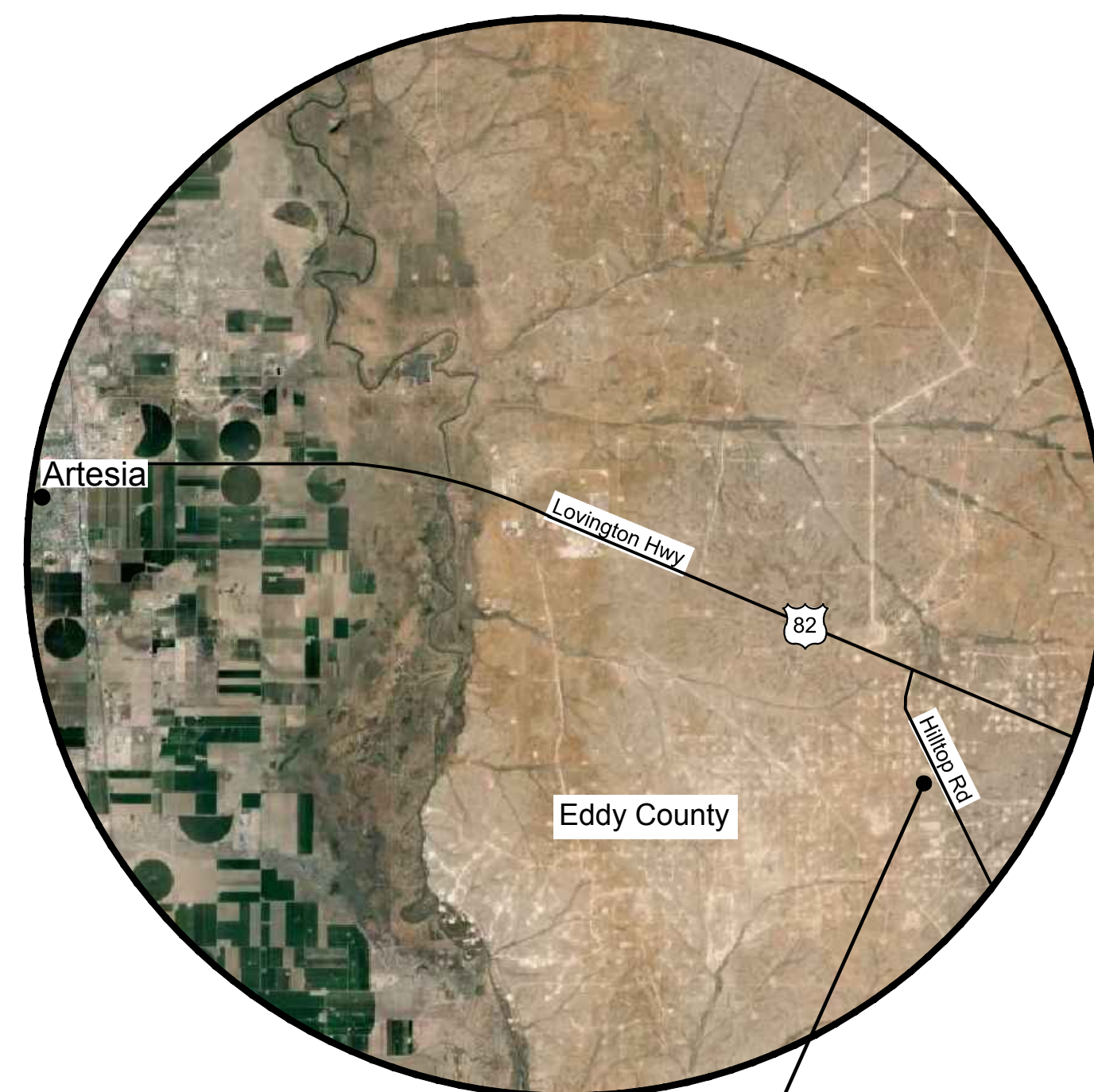


PROJECT NO.	<b>R170976.03</b>
DESIGNED BY:	<b>SAE</b>
DRAWN BY:	<b>LRT</b>
CHECKED BY:	<b>SAE</b>
DATE:	<b>MAY 7, 2014</b>
DPW CHK:	<b>-</b>
<b>SHEET:</b>	
<b>C001</b>	

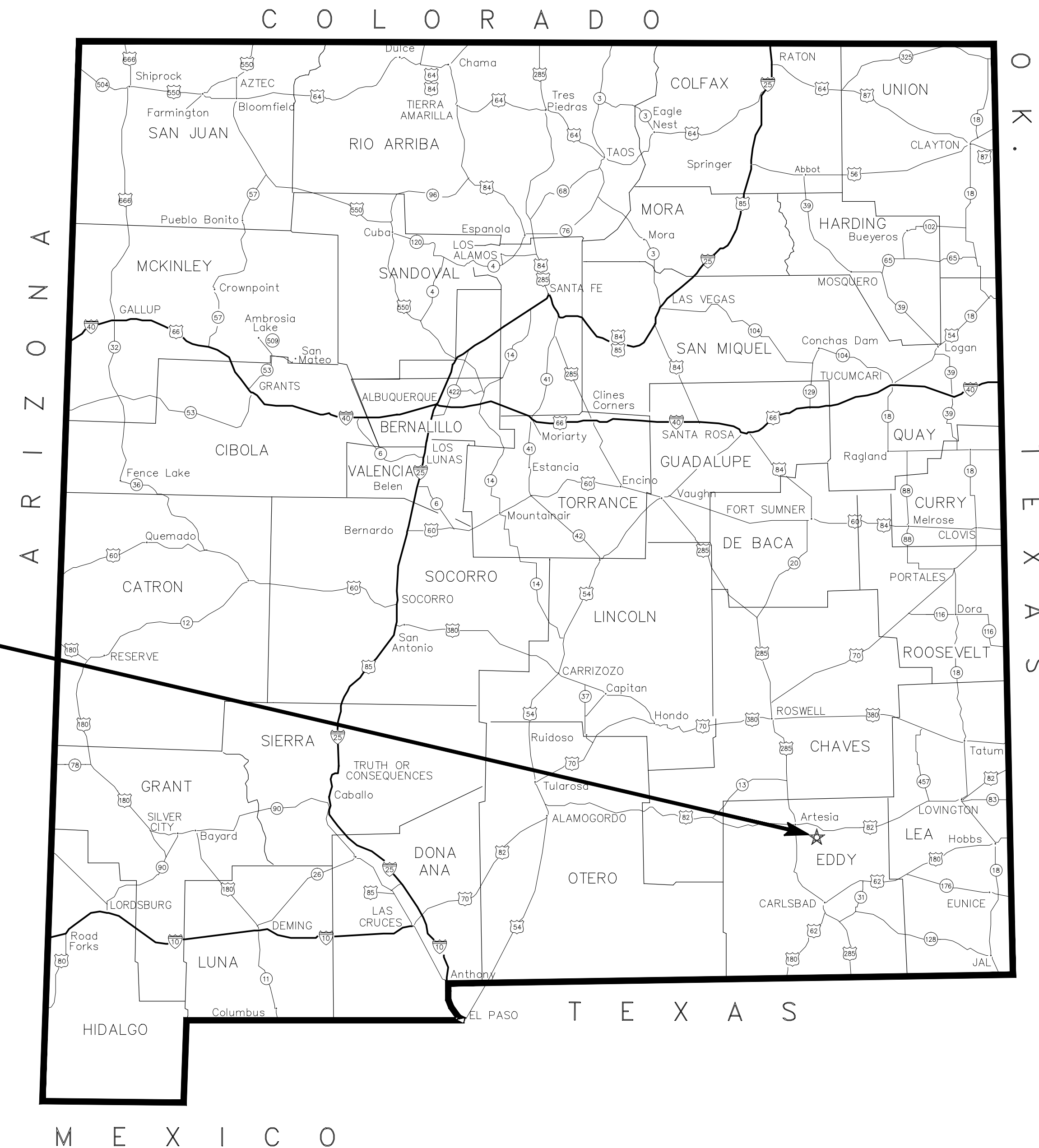
SHEET INDEX	
SHEET	SHEET TITLE
C001	PROJECT COVER SHEET
C101	SITE PLAN
C300	DETAILS
C301	DETAILS
C400	SWPPP NOTES
C401	SWPPP

## APPROVALS

State of New Mexico Oil Conservation Division \_\_\_\_\_ DATE \_\_\_\_\_

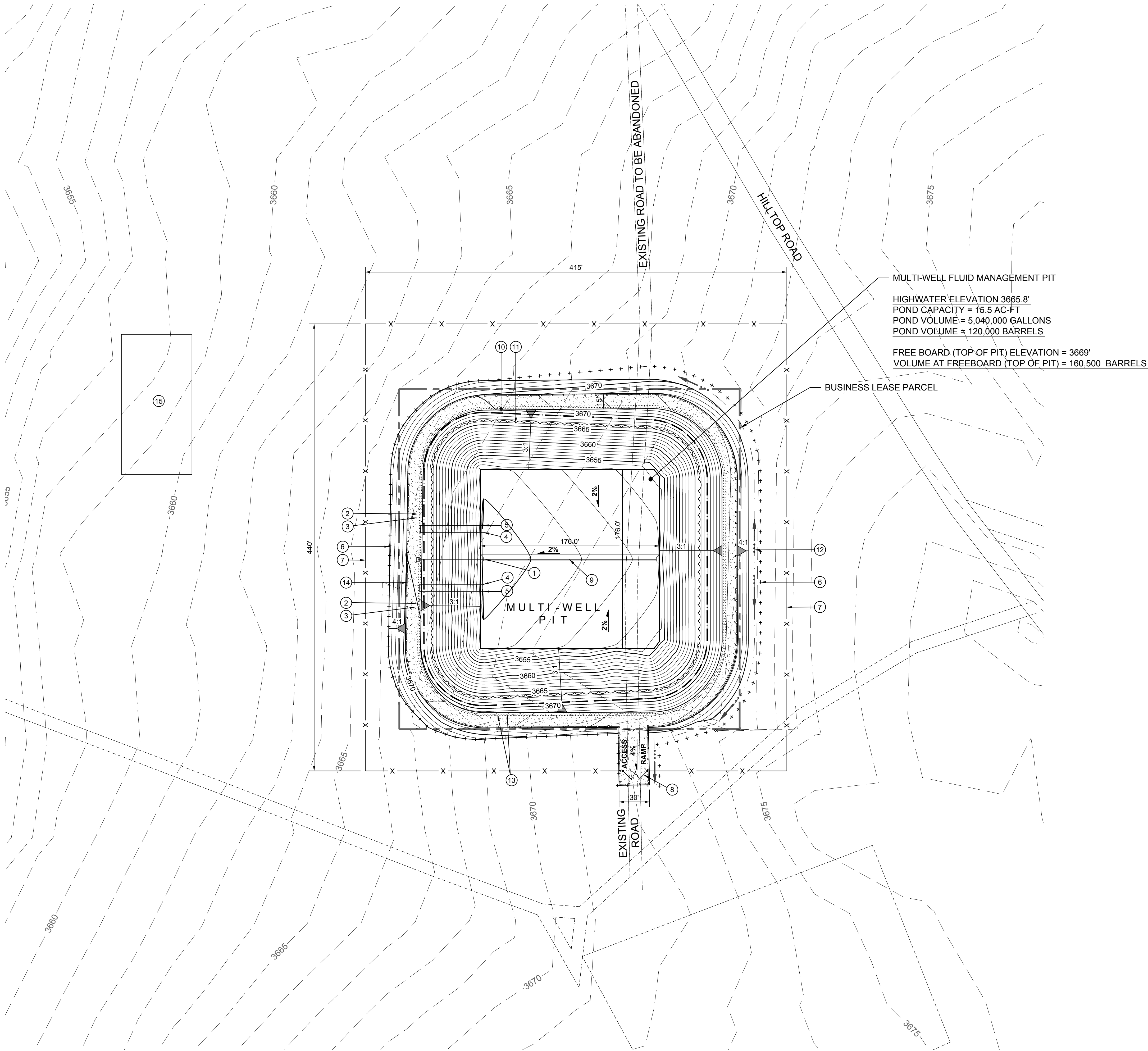


<i>All Thorn MWFM Pit</i>
<i>Eddy County, NM</i>





Plotted: 5/7/2014 4:11:53 PM, By:lorca, dm  
File: R170976.03.dwg, Path: C:\Users\lorca\OneDrive\Documents\Drawings\Site Plans\Site C101\_SP.dwg  
Last Saved: 5/7/2014 4:06:11 PM, Pinned



SITE PLAN

## GENERAL NOTES

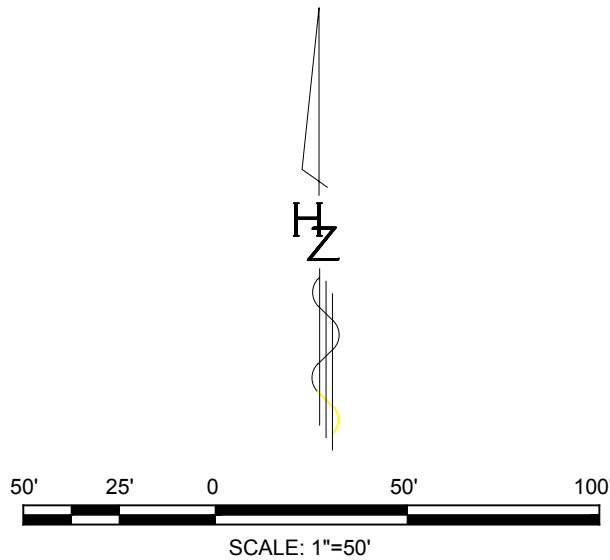
1. ALL CONSTRUCTION SHALL BE PERFORMED IN ACCORDANCE WITH THE PROJECT CONSTRUCTION PLANS, SPECIFICATIONS, AND THE LATEST EDITION OF THE NEW MEXICO STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.
2. OWNER AND CONTRACTOR ARE RESPONSIBLE TO DEVELOP, PERMIT, IMPLEMENT AND MAINTAIN THE STORM WATER POLLUTION PREVENTION PLAN (SWPPP) IN ACCORDANCE WITH FEDERAL AND STATE REQUIREMENTS. SWPPP IS INCIDENTAL TO THE PROJECT.
3. BOTTOM OF PIT SHALL BE SLOPED AT 2% AS SHOWN.
4. PERIMETER OF THE PIT SHALL BE ENCLOSED WITH A BARBED WIRE FENCE.
5. STRIP AND STOCKPILE TOPSOIL FOR FUTURE CLOSURE USE. OWNER SHALL DIRECT LOCATION OF STOCKPILE.
6. EARTHWORK SHALL BE WETTED TO OPTIMUM MOISTURE CONTENT AND COMPACTED TO A MINIMUM OF 95% ASTM D-1557.

## SHEET KEYNOTES

1. 3'x3' SUMP. SEE DETAIL A, SHEET C300.
2. 3'x4.5' SUMP ACCESS. SEE DETAIL B, SHEET C301.
3. BOLLARDS. SEE DETAIL C, SHEET C300.
4. PIPE SUCTION & DISCHARGE PIT INFLOW SIDE. SEE DETAIL G, SHEET C301.
5. PIPE SUCTION & DISCHARGE PIT OUTFLOW SIDE. SEE DETAIL H, SHEET C301.
6. LIMITS OF DISTURBANCE.
7. 4 STRAND BARBED WIRE FENCE. SEE DETAIL I, SHEET C301.
8. 12-FOOT SWING GATE (FENCE HEIGHT AND GUARD TO MATCH). TWO EACH.
9. LEAK DETECTION SYSTEM PIPING - 4" SCHEDULE 80 PVC.
10. 3' FREEBOARD DEPTH.
11. HIGH WATER ELEVATION.
12. EROSION PROTECTION DITCH: 3' WIDTH AND 6" DEPTH.
13. ANCHOR TRENCH. SEE DETAIL A, SHEET C301.
14. GAME FENCE W/36" HIGH "CHICKEN WIRE" FIRMLY ATTACHED TO BOTTOM.
15. STOCKPILE AREA.

## LEGEND

- 3740 — EXISTING MAJOR CONTOUR
- — — EXISTING MINOR CONTOUR
- 3745 — PROPOSED MAJOR CONTOUR
- — — PROPOSED MINOR CONTOUR
- — — PROPOSED BARBED WIRE FENCE
- — — LEAK DETECTION PIPING
- + + + + + LIMITS OF DISTURBANCE
- ~~~~~ HIGH WATER ELEVATION
- — — DITCH & FLOW DIRECTION



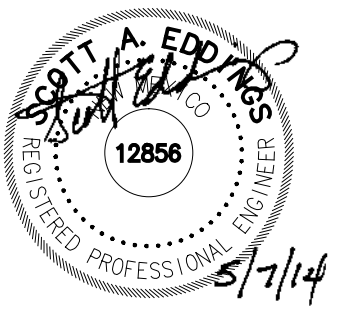
NO.	DESCRIPTION	DATE	BY
7			
6			
5			
4			
3			
2			
1			

Designed By: **HUIT-ZOLARS**  
Huit-Zolars, Inc.  
3600 Camino del Rio NE, Suite 201  
San Diego, CA 92108  
Phone (619) 882-5141 Fax (619) 882-3259

Designed For: **LIME ROCK RESOURCES**

## SITE PLAN

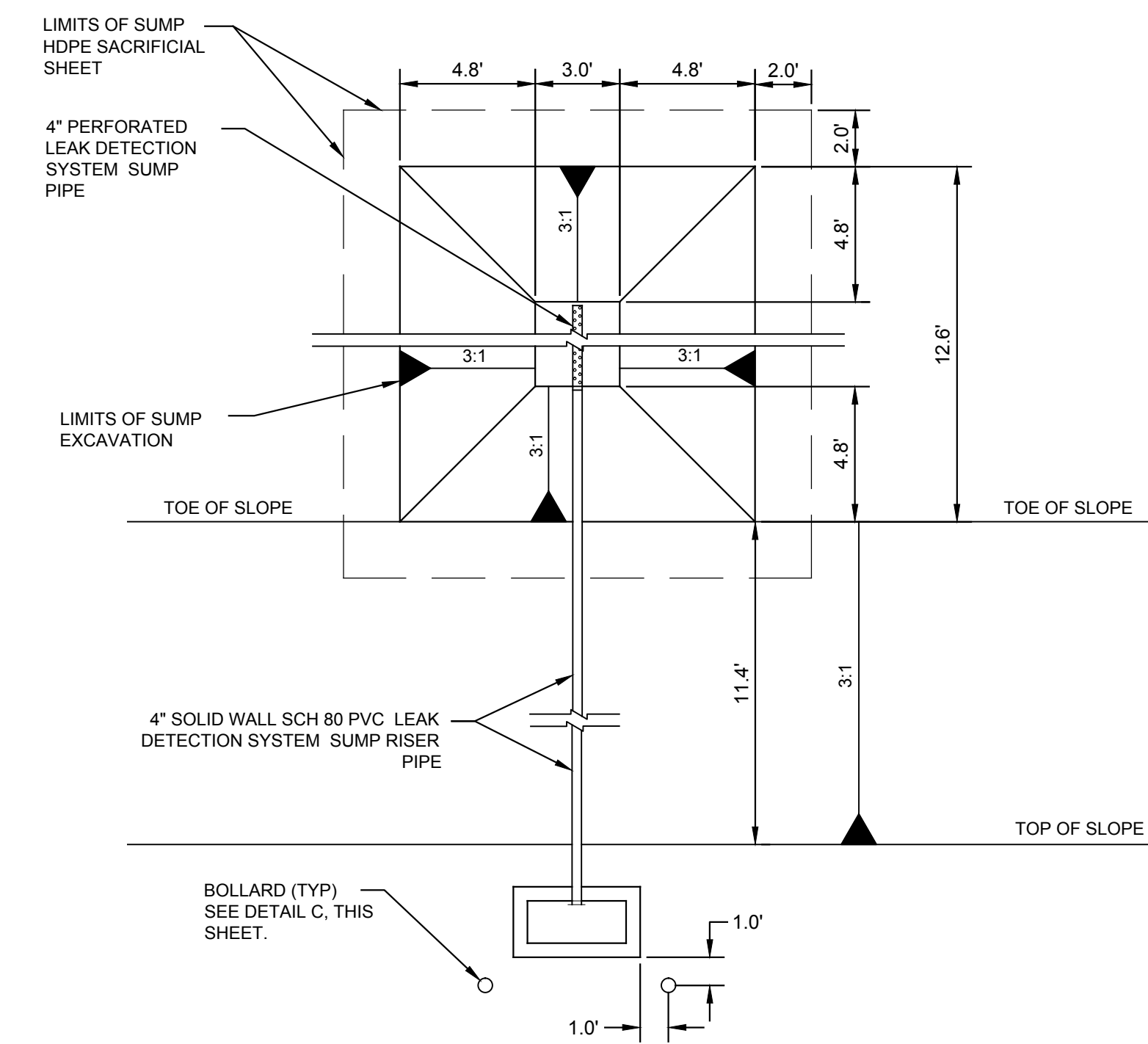
ALL THORN MWFM PIT  
SECTION 36 T17S R27E  
EDDY COUNTY, NM



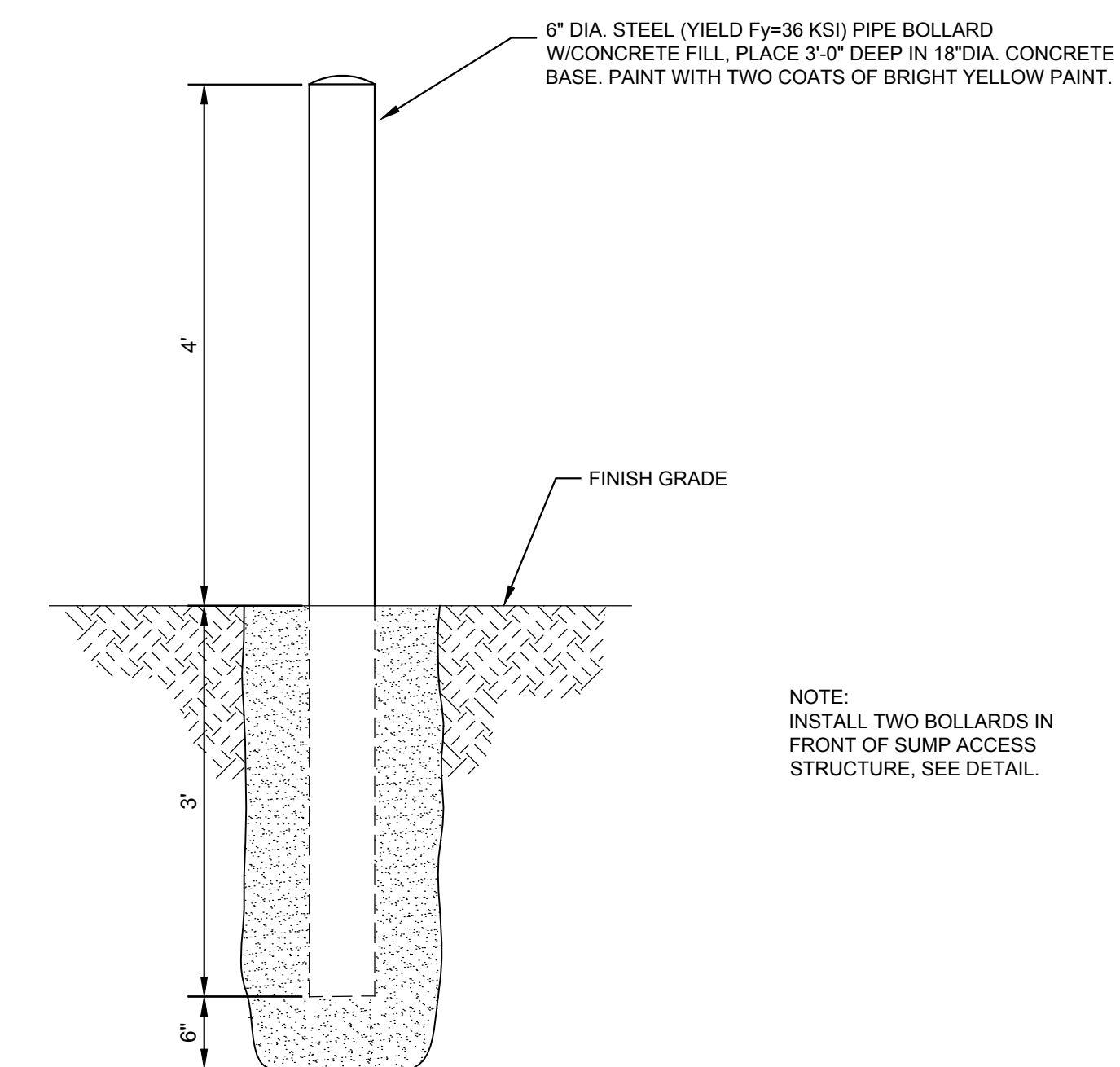
PROJECT NO. **R170976.03**  
DESIGNED BY: **SAE**  
DRAWN BY: **LRT**  
CHECKED BY: **SAE**  
DATE: **MAY 7, 2014**  
DPW CHK: **-**

SHEET:  
**C101**





Scale: 1"=5'



Scale: N.T.S.



Scale: 1"=1'

REVISIONS (OR CHANGE NOTICES)	
NO.	DESCRIPTION
1	—
2	—
3	—
4	—
5	—
6	—
7	—

Designed By:

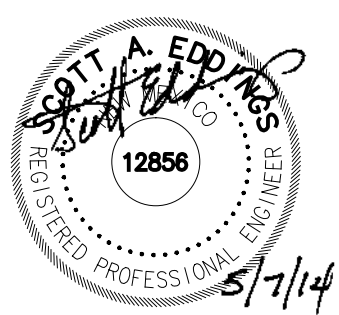
**HUITT-ZOLLARS**  
Huitt-Zollars, Inc.  
333 Rio Rancho Drive NE, Suite 101  
Rio Rancho, New Mexico 87124  
Phone (505) 892-5141 Fax (505) 892-3259

Designed For:

**LIME ROCK  
RESOURCES**

## DETAILS

ALL THORN MWFM PIT  
SECTION 36 T17S R27E  
EDDY COUNTY, NM



PROJECT NO. R170976.03

DESIGNED BY: **SAE**

DRAWN BY: LRT

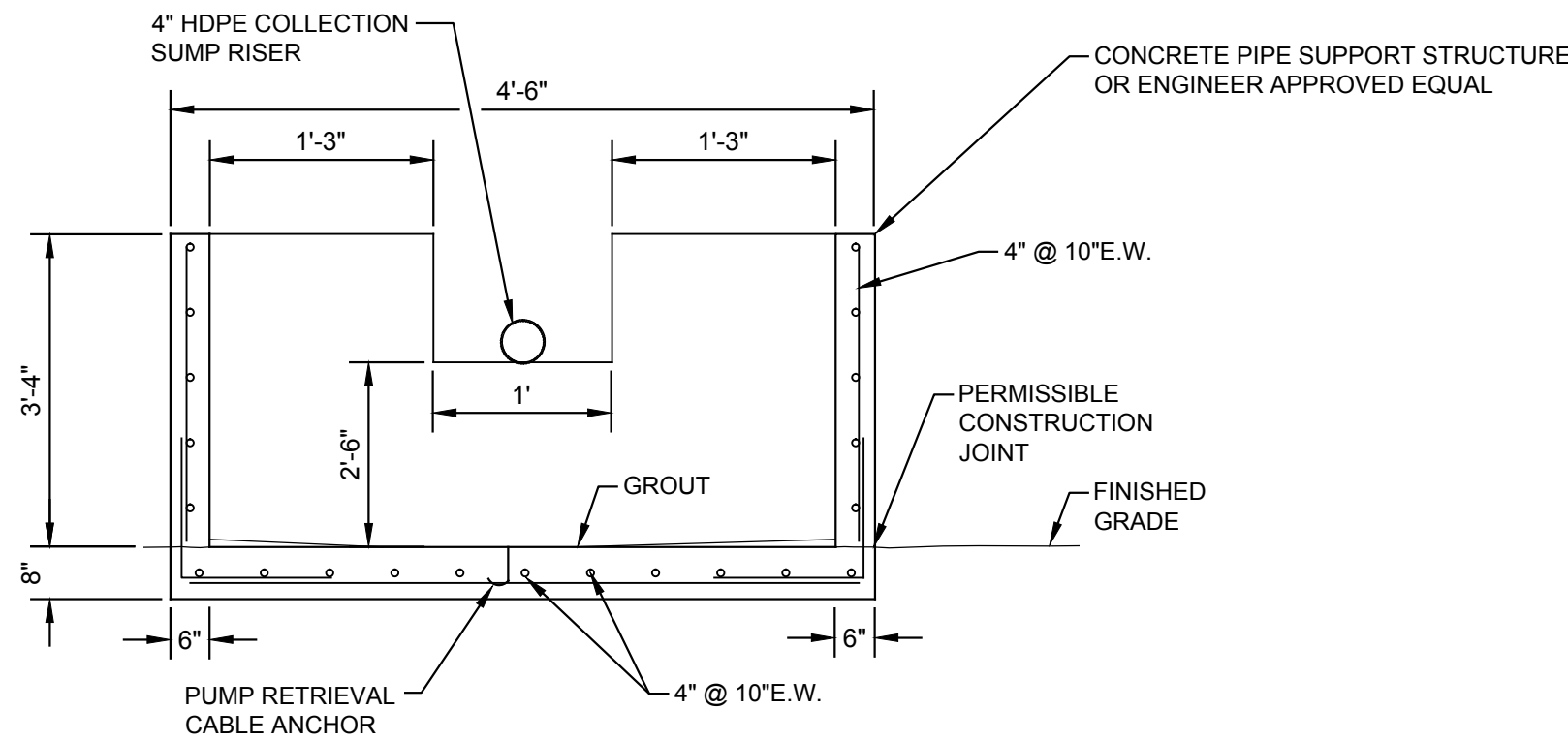
CHECKED BY: **SAE**

DATE: **MAY 7, 2014**

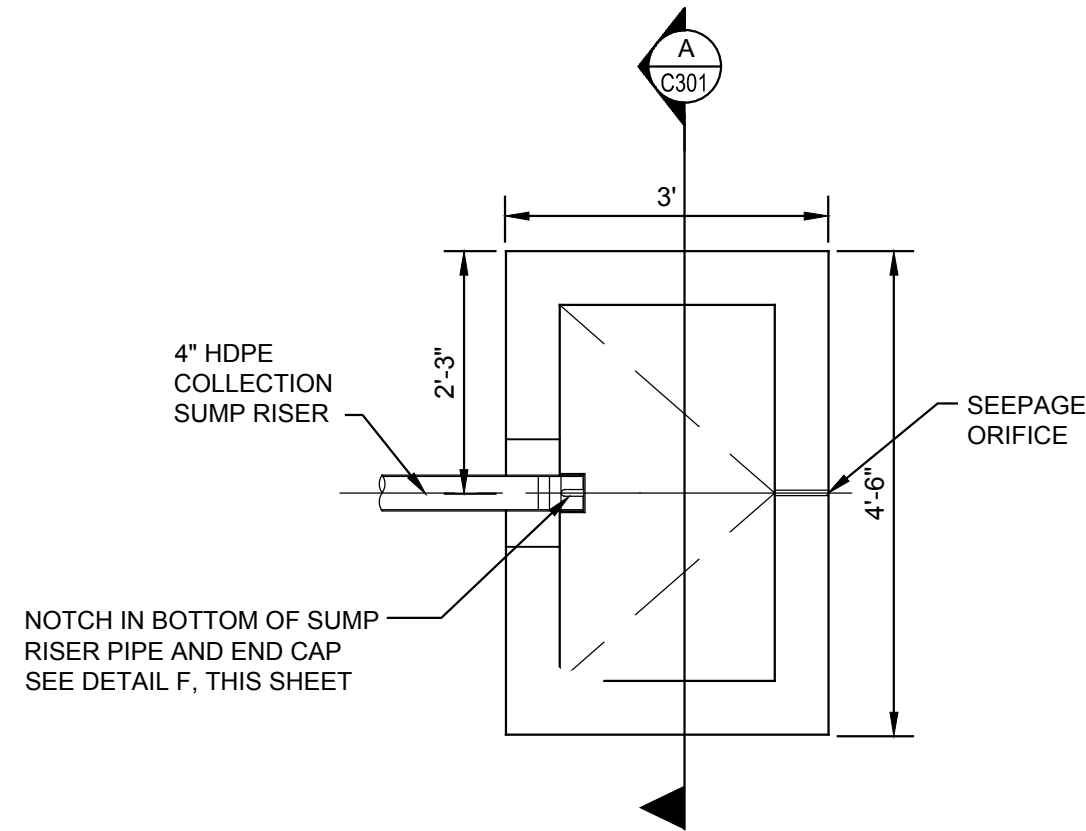
DPW CHK: -

SHEET:

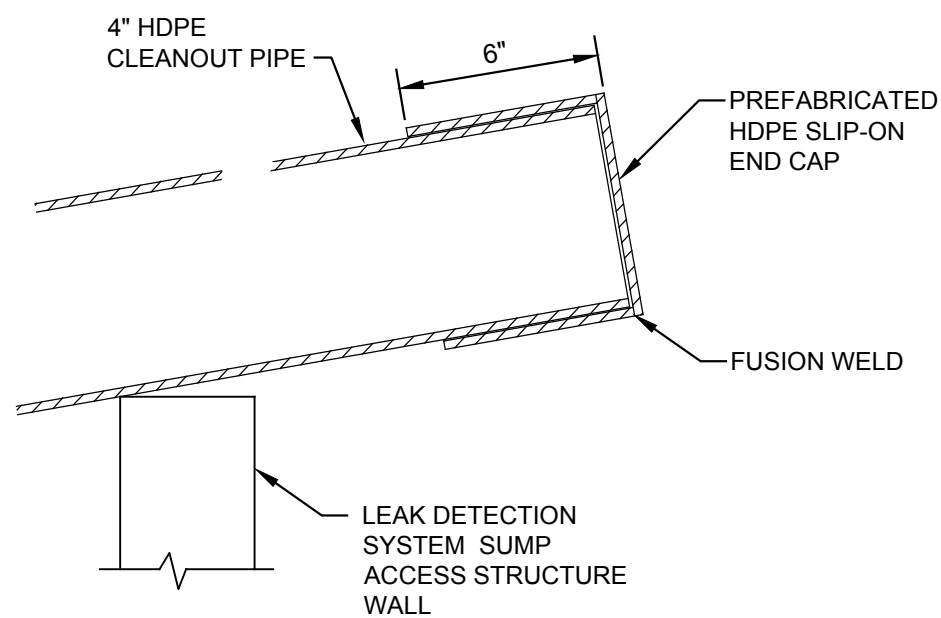
C300



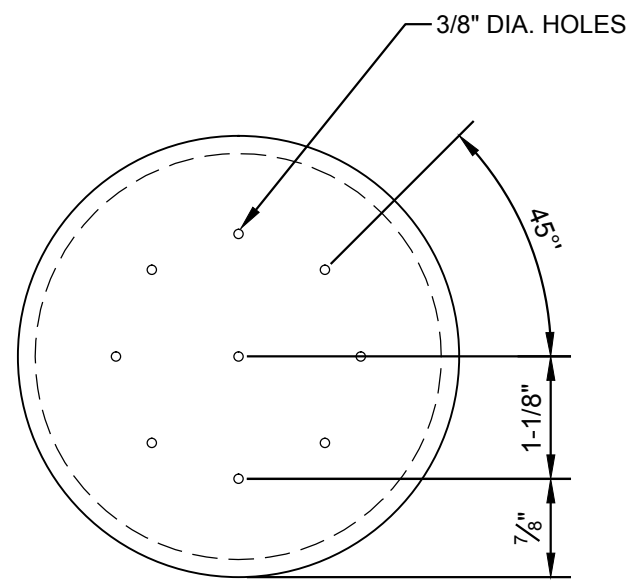
LEAK DETECTION SYSTEM PUMP  
ACCESS STRUCTURE SECTION  
Scale: N.T.S. **A**



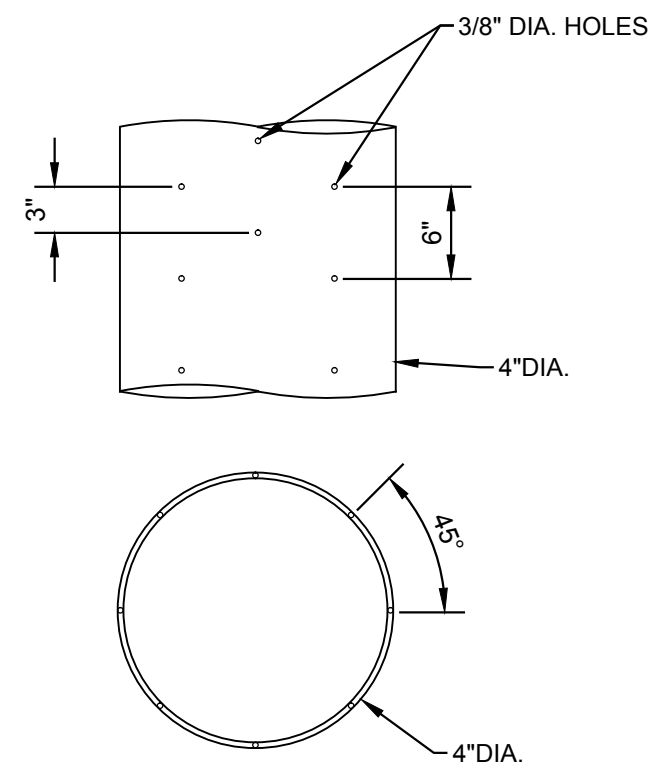
LEAK DETECTION SYSTEM SUMP  
ACCESS STRUCTURE PLAN  
Scale: N.T.S. **C**



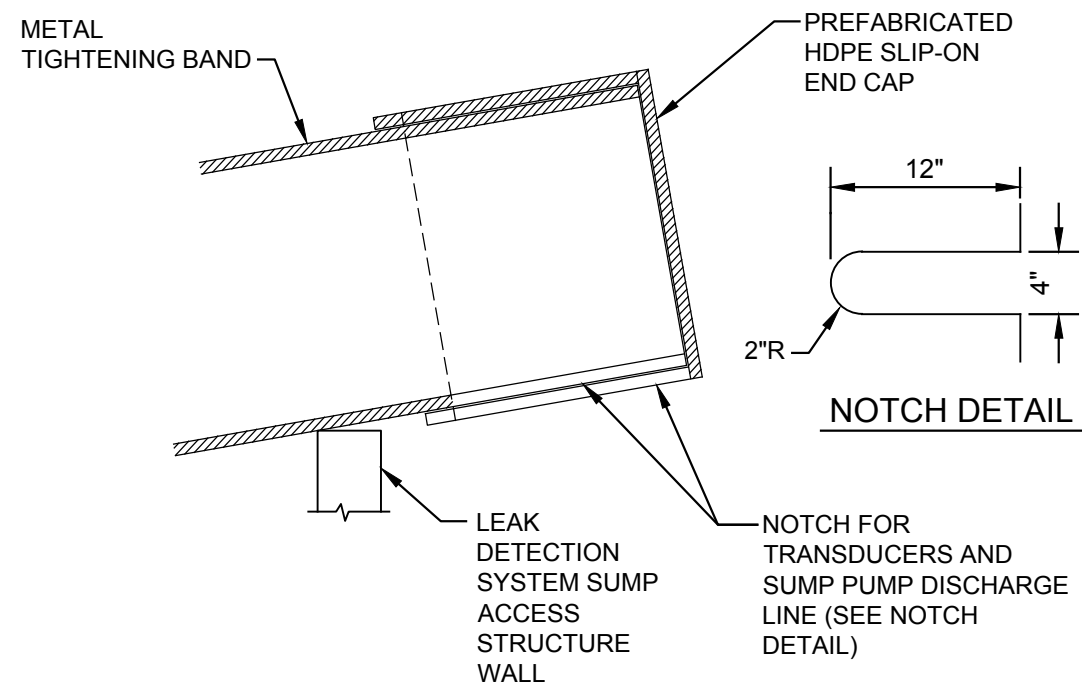
CLEANOUT RISER END  
Scale: N.T.S. **E**



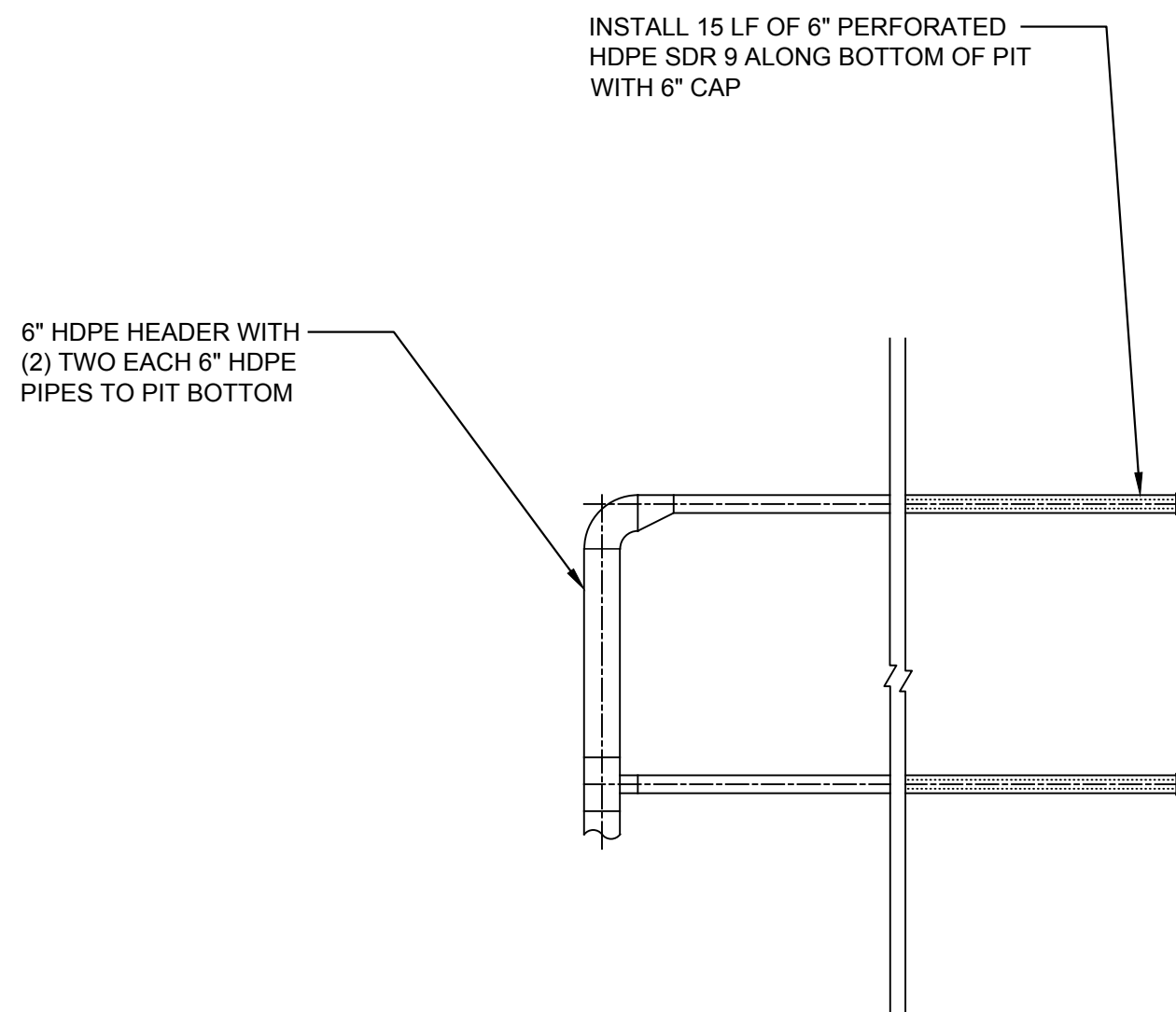
LEAK DETECTION SYSTEM COLLECTION SUMP  
PERFORATED END CAP DETAIL  
Scale: N.T.S. **B**



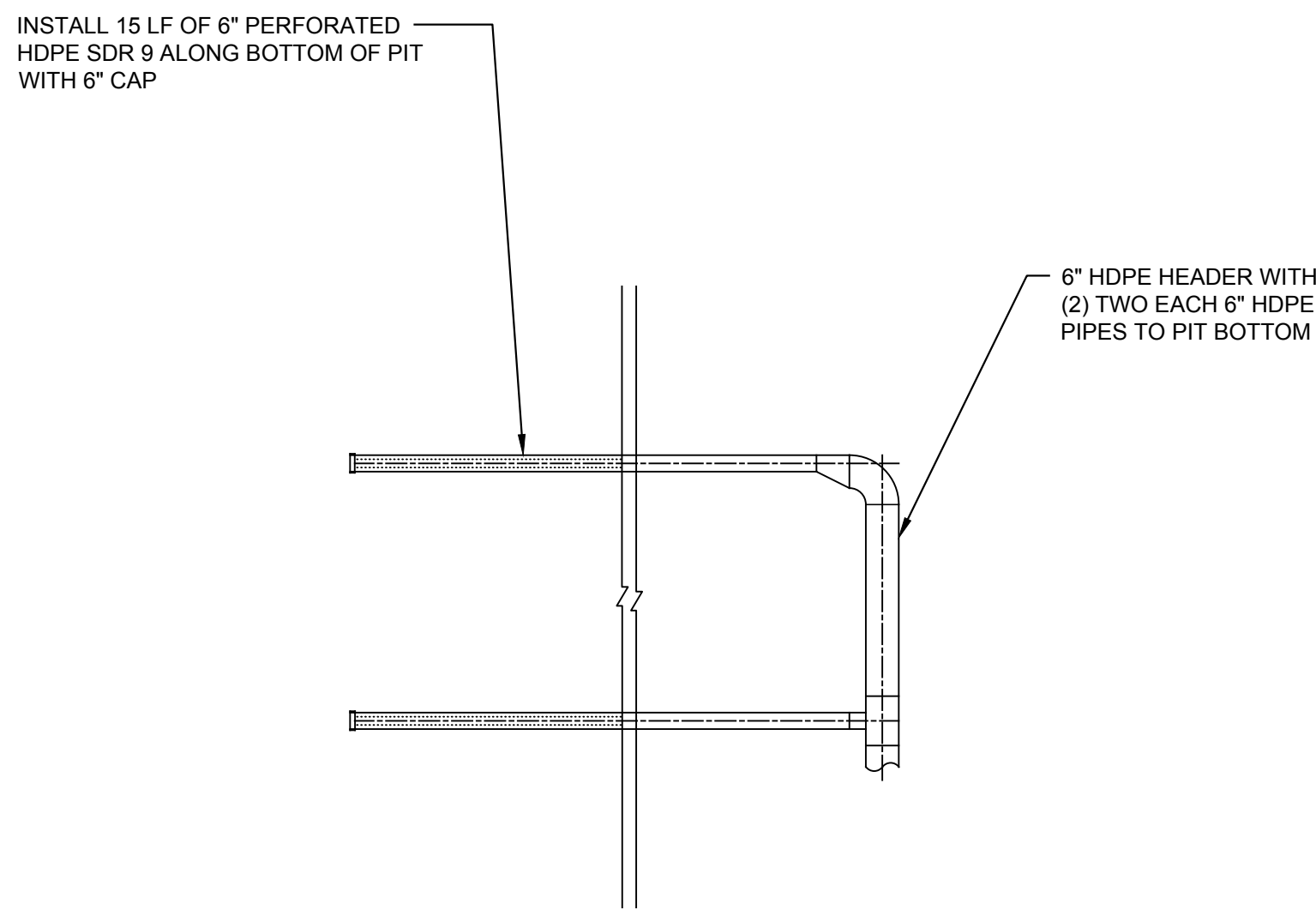
4\"/>



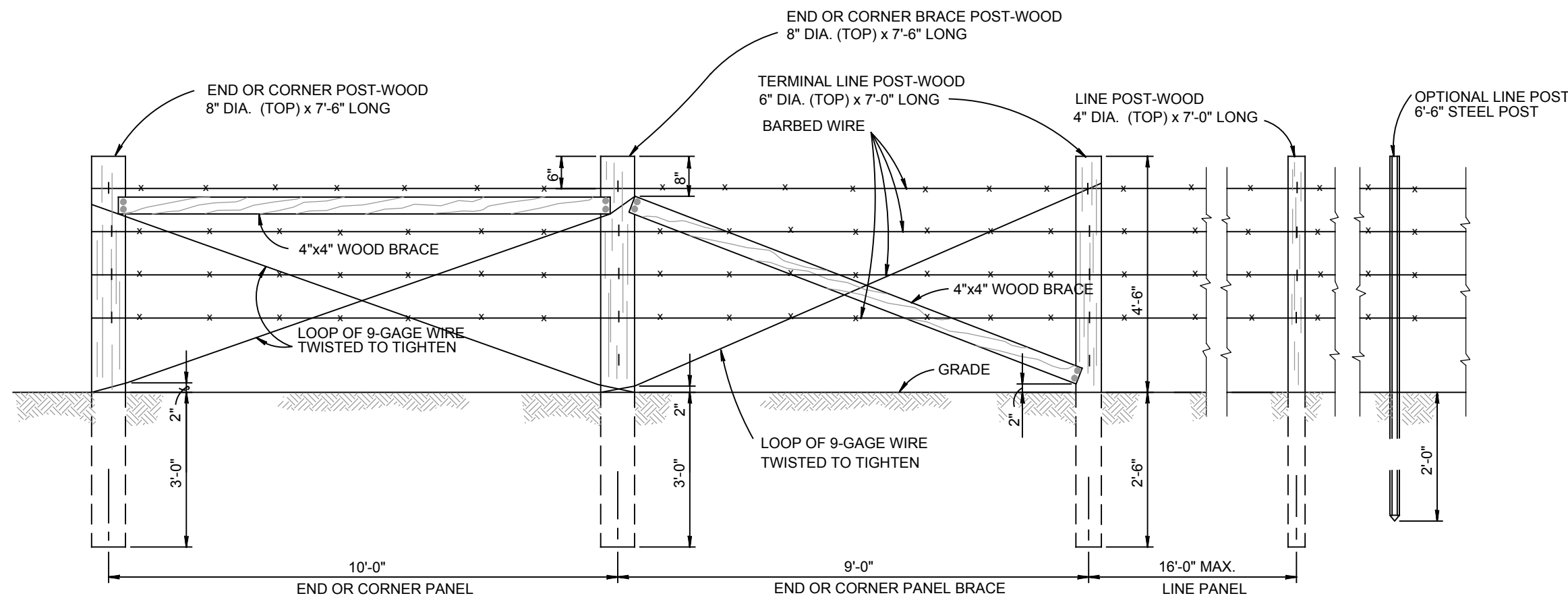
SUMP RISER END CAP  
Scale: N.T.S. **F**



PIPE SUCTION & DISCHARGE  
INFLOW SIDE  
Scale: N.T.S. **G**



PIPE SUCTION & DISCHARGE  
OUTFLOW SIDE  
Scale: N.T.S. **H**



4 STRAND  
BARBED-WIRE FENCE  
Scale: N.T.S. **I**



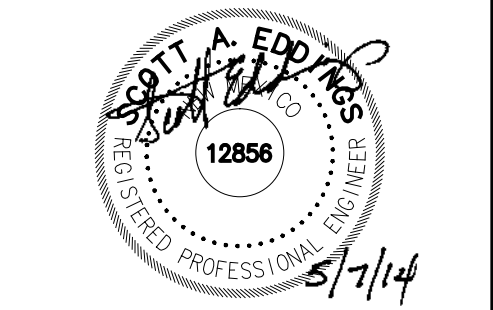
REVISIONS (OR CHANGE NOTICES)	
NO.	DESCRIPTION
7	
6	
5	
4	
3	
2	
1	
NO.	DATE
BY	

Designed By  
**HUIT-ZOLARS**  
Huit-Zolars, Inc.  
3800 S. Alameda Drive NE, Suite 201  
Bozeman, Montana 59704  
Phone (406) 882-5141 Fax (406) 882-3259

Designed For  
**LIME ROCK**  
**RESOURCES**

**DETAILS**

**ALL THORN MWFM PIT**  
**SECTION 36 T17S R27E**  
**EDDY COUNTY, NM**



PROJECT NO.	R170976.03
DESIGNED BY:	SAE
DRAWN BY:	LRT
CHECKED BY:	SAE
DATE:	MAY 7, 2014
DPW CHK:	-
SHEET:	C301



Plotted: 5/7/2014 4:12:08 PM, B:\Thornc, dm  
File: R170976.dwg, User: SAE, Plot: SAE  
Last Saved: 4/29/2014 11:32:12 PM, ltrfyys

SITE DESCRIPTION

PROJECT NAME AND LIMITS: ALL THORN MWFM PIT  
PROJECT IS LOCATED IN PORTIONS OF SECTION 36 T17S R27E

PROJECT DESCRIPTION: CONSTRUCTION OF A PERMANENT PIT.

EXISTING CONDITIONS: THE SITE IS UNDEVELOPED RANGELAND.

MAJOR SOIL DISTURBING ACTIVITIES: CONSTRUCTION ACTIVITIES INCLUDE HEAVY DIRT MOVING AND LINER CONSTRUCTION.

TOTAL PROJECT AREA: 2.6 ARES

TOTAL AREA TO BE DISTURBED: 2.9 ACRES

WEIGHTED RUNOFF COEFFICIENT  
(AFTER CONSTRUCTION): 0.33

EXISTING CONDITION OF SOIL AND VEGETATIVE  
COVER AND % OF EXISTING VEGETATIVE COVER:

NAME OF RECEIVING WATERS: THE SITE IS GENTLY SLOPING TO THE WEST; SURFACE SOILS ON THIS PORTION OF THE SITE ARE BROWN LOAMY FINE SANDS. SITE SOILS ARE OF A POOR QUALITY FOR VEGETATION PRODUCTION. SITE VEGETATION CONSISTS OF SPARSE DESERT SHRUBS. THE SOILS ARE MODERATELY TO VERY PERMEABLE AND SUSCEPTIBLE TO BLOWING.

OWNER CERTIFICATION

I CERTIFY UNDER PENALTY OF LAW THAT THIS DOCUMENT AND ALL ATTACHMENTS WERE PREPARED UNDER MY DIRECTION OR SUPERVISION IN ACCORDANCE WITH A SYSTEM DESIGNED TO ASSURE THAT QUALIFIED PERSONNEL PROPERLY GATHERED AND EVALUATED THE INFORMATION SUBMITTED. BASED ON MY INQUIRY OF THE PERSON OR PERSONS WHO MANAGE THE SYSTEM, OR THOSE PERSONS DIRECTLY RESPONSIBLE FOR GATHERING THE INFORMATION, THE INFORMATION SUBMITTED IS, TO THE BEST OF MY KNOWLEDGE AND BELIEF, TRUE, ACCURATE, AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT FOR KNOWING VIOLATIONS.

OWNER: SIGNED DATE  
OWNER: NAME DATE  
TITLE DATE

EROSION AND SEDIMENT CONTROL

SOIL STABILIZATION PRACTICES

TEMPORARY SEEDING  
PERMANENT PLANTING, SODDING, OR SEEDING  
MULCHING  
SOIL RETENTION BLANKET  
X BUFFER ZONES  
X PRESERVATION OF NATURAL RESOURCES

OTHER:

STRUCTURAL PRACTICES:

X SILT FENCES  
HAY BALES  
ROCK BERMS  
DIVERSION, INTERCEPTOR, OR PERIMETER DIKES  
X DIVERSION, INTERCEPTOR, OR PERIMETER SWALES  
DIVERSION DIKE AND SWALE COMBINATION  
PIPE SLOPE DRAINS  
CONCRETE FLUMES  
ROCK BEDDING AT CONSTRUCTION EXIT  
TIMBER MATTING AT CONSTRUCTION EXIT  
CHANNEL LINERS  
SEDIMENT TRAPS  
SEDIMENT BASINS  
STORM INLET SEDIMENT TRAP  
STONE OUTLET STRUCTURES  
CURBS AND GUTTERS  
STORM DRAINS  
VELOCITY CONTROL DEVICES  
VEGETATED SWALES & NATURAL DEPRESSIONS

OTHER: NEW EARTHEN SWALE

NARRATIVE - SEQUENCE OF CONSTRUCTION (STORM WATER MANAGEMENT) ACTIVITIES:

1. CONSTRUCT TEMPORARY EROSION CONTROLS INCLUDING DITCHES AND FILTER FENCES.
2. STRIP AND STOCKPILE TOPSOIL IN DESIGNATED AREAS. CONSTRUCT APPROPRIATE EROSION CONTROLS TO MAINTAIN NATURAL DRAINAGE PATTERNS TO THE EXTENT POSSIBLE.
3. EXCAVATE TO THE ELEVATIONS SHOWN ON THE ENCLOSED GRADING PLAN AND STOCKPILE SOIL IN DESIGNATED AREAS.
4. CONSTRUCT A COMPOSITE LINER IN ACCORDANCE WITH THE SOIL LINER QUALITY CONTROL PLAN

GENERAL CONTRACTOR CERTIFICATION

I CERTIFY UNDER PENALTY OF LAW THAT I UNDERSTAND THE TERMS AND CONDITIONS OF THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) GENERAL PERMIT THAT AUTHORIZES STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY FROM THE CONSTRUCTION SITE IDENTIFIED AS PART OF THIS CERTIFICATION.

SIGNED: COMPANY:  
NAME: ADDRESS:  
TITLE: TELEPHONE:  
DATE:

SUB - CONTRACTOR CERTIFICATION

I CERTIFY UNDER PENALTY OF LAW THAT I WILL COORDINATE, EITHER THROUGH THE GENERAL CONTRACTOR, OWNER, OR DIRECTLY, WITH THE CONTRACTOR(S) AND/OR SUBCONTRACTOR(S) IDENTIFIED IN THE POLLUTION PREVENTION PLAN HAVING RESPONSIBILITY FOR IMPLEMENTING STORM WATER CONTROL MEASURES TO MINIMIZE ANY IMPACT MY ACTIONS MAY HAVE ON THE EFFECTIVENESS OF THESE STORM WATER CONTROL MEASURES.

SIGNED: SIGNED:  
NAME: NAME:  
TITLE: TITLE:  
COMPANY: COMPANY:  
ADDRESS: ADDRESS:  
TELEPHONE: TELEPHONE:  
DATE: DATE:

BEST MANAGEMENT PRACTICES CONTROLS

I. WASTE MATERIALS:

ALL WASTE MATERIALS, INCLUDING CONSTRUCTION DEBRIS, SHALL BE COLLECTED AND STORED IN A SECURELY LIDDED METAL DUMPSTER. NO CONSTRUCTION WASTE MATERIAL SHALL BE BURIED ON SITE. THE TRANSIT DUMPSTER SHALL COMPLY WITH ORDINANCE 18.52.010 (ENCLOSURE AND REMOVAL OF WASTE MATERIALS DURING CONSTRUCTION). THE DUMPSTER SHALL BE EMPTIED AS NECESSARY OR AS REQUIRED BY ORDINANCE 9.04 (SOLID WASTE MANAGEMENT) AND THE TRASH SHALL BE HAULED TO A LICENSED LANDFILL.

II. HAZARDOUS WASTE:

AT A MINIMUM, ANY PRODUCTS IN THE FOLLOWING CATEGORIES SHALL BE CONSIDERED HAZARDOUS: PAINT, ACIDS FOR CLEANING MASONRY SURFACES, CLEANING SOLVENTS, ASPHALT PRODUCTS, CHEMICAL ADDITIVES FOR SPILL STABILIZATION, CURING COMPOUNDS AND ADDITIVES. IN THE EVENT OF A SPILL WHICH MAY BE HAZARDOUS, THE CONTRACTOR SHALL TAKE IMMEDIATE ACTION AND CONTACT THE FIRE DEPT. AND NMED.

III. SANITARY WASTE:

ALL SANITARY WASTE SHALL BE COLLECTED FROM THE CONSTRUCTION PORTABLE UNITS AS NECESSARY OR AS REQUIRED, CHAPTER 18.08 (BUILDING CODE), BY A LICENSED SANITARY WASTE MANAGEMENT CONTRACTOR. ALL WASTE MATERIAL SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

IV. SPILL PREVENTION:

THE FOLLOWING PRACTICES SHALL BE USED TO REDUCE THE RISK OF SPILLS OR OTHER ACCIDENTAL EXPOSURES OF MATERIALS TO STORM WATER RUNOFF.

V. GOOD HOUSEKEEPING:

- A. STORE ONLY ENOUGH PRODUCTS REQUIRED TO DO THE JOB
- B. NEATLY STORE MATERIALS ON-SITE IN AN ORDERLY MANNER
- C. KEEP PRODUCTS IN THEIR ORIGINAL CONTAINER
- D. DO NOT MIX SUBSTANCES WITH ONE ANOTHER, UNLESS OTHERWISE RECOMMENDED BY THE MANUFACTURER
- E. USE ENTIRE CONTENTS OF A PRODUCT BEFORE DISPOSING THE CONTAINER
- F. FOLLOW MANUFACTURER'S RECOMMENDATIONS FOR PROPER USE AND DISPOSAL

VI. HAZARDOUS PRODUCTS:

- PRACTICES USED TO REDUCE RISKS:
- A. KEEP PRODUCTS IN THEIR ORIGINAL CONTAINER IF AT ALL POSSIBLE
  - B. RETAIN ORIGINAL LABELS, PRODUCT INFORMATION AND MATERIAL SAFETY DATA SHEETS (MSDS)
  - C. DISPOSE SURPLUS PRODUCT IN ACCORDANCE WITH MANUFACTURER'S OR LOCAL & STATE RECOMMENDED METHODS

VII. PETROLEUM PRODUCTS:

ALL ON-SITE VEHICLES SHALL BE MONITORED FOR LEAKS AND RECEIVE REGULAR PREVENTIVE MAINTENANCE TO REDUCE THE CHANCE OF LEAKAGE. PETROLEUM PRODUCTS SHALL BE STORED IN TIGHTLY SEALED CONTAINERS WHICH ARE CLEARLY LABELED. ANY ASPHALT SUBSTANCES USED ON-SITE SHALL BE APPLIED ACCORDING TO THE MANUFACTURER'S RECOMMENDATION.

VIII. SPILL CONTROL PRACTICES:

- A. MANUFACTURER'S RECOMMENDED METHODS FOR SPILL CLEANUP SHALL BE CLEARLY POSTED AND SITE PERSONNEL SHALL BE MADE AWARE OF THE PROCEDURES:
- B. MATERIALS AND EQUIPMENT NECESSARY FOR CLEANUP SHALL BE KEPT IN THE MATERIAL STORAGE AREA ON-SITE:
- C. ALL SPILLS SHALL BE CLEANED UP IMMEDIATELY AFTER DISCOVERY
- D. SPILL AREA SHALL BE WELL VENTILATED AND APPROPRIATE CLOTHING WILL BE WORN:
- E. ANY SPILL SHALL BE REPORTED TO THE APPROPRIATE GOVERNMENTAL AGENCY
- F. MEASURES SHALL BE TAKEN TO PREVENT A SPILL FROM REOCCURRING

IX. MAINTENANCE AND INSPECTION PROCEDURES:

ALL POLLUTION PREVENTION MEASURES SHALL BE INSPECTED AT LEAST ONCE A MONTH OR WITHIN 24-HOURS PRIOR TO ANTICIPATED STORM EVENT AND FOLLOWING A STORM EVENT OF 0.5 INCHES OR MORE. INSPECTION IN FINAL STABILIZED AREAS OR DURING ARID PERIODS WILL BE CONDUCTED MONTHLY, BEST MANAGEMENT PRACTICES AND POLLUTION CONTROL PROCEDURES SHALL BE INSPECTED FOR ADEQUACY.

X. REMARKS:

DISPOSAL AREAS, STOCKPILES, AND HAUL ROADS SHALL BE CONSTRUCTED IN A MANNER THAT WILL MINIMIZE AND CONTROL THE AMOUNT OF SEDIMENT THAT MAY ENTER RECEIVING WATERS. DISPOSAL AREAS SHALL NOT BE LOCATED IN ANY WETLAND, WATERBODY OR STREAMBED. CONSTRUCTION STAGING AREAS AND VEHICLE MAINTENANCE AREAS SHALL BE CONSTRUCTED BY THE CONTRACTOR IN A MANNER TO MINIMIZE THE RUNOFF OF POLLUTANTS. ALL WATERWAYS SHALL BE CLEANED AS SOON AS PRACTICABLE OF TEMPORARY EMBANKMENT, TEMPORARY BRIDGES, MATTING, FALSEWORK, PILING DEBRIS OR OTHER OBSTRUCTIONS PLACED DURING CONSTRUCTION OPERATIONS THAT ARE NOT A PART OF THE FINISHED WORK.

XI. OFFSITE VEHICLE TRACKING:

IN ADDITION TO THE STABILIZED CONSTRUCTION ENTRANCES, THE FOLLOWING MEASURES SHALL BE OBSERVED DURING CONSTRUCTION:  
- HAUL ROADS SHALL BE DAMPENED FOR DUST CONTROL  
- LOADED HAUL TRUCKS SHALL BE COVERED WITH TARPULIN  
- EXCESS DIRT ON ROAD SHALL BE REMOVED IMMEDIATELY  
- STABILIZED CONSTRUCTION ENTRANCE  
- OTHER:

MISCELLANEOUS

X NO BATCH PLANT  
X NO ENDANGERED SPECIES



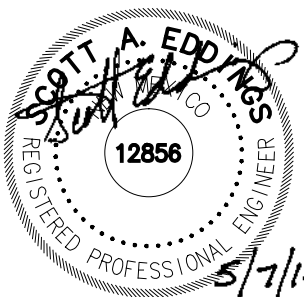
7	6	5	4	3	2	1	NO.	DATE	DESCRIPTION	REVISIONS (OR CHANGE NOTICES)

Designed By  
**HUITT-ZOLIARS**  
Huitt-Zoliars, Inc.  
3000 S. Central Expressway, Suite 200  
San Antonio, TX 78224  
Phone (505) 892-9141 Fax (505) 892-9259



SWPPP NOTES

ALL THORN MWFM PIT  
SECTION 36 T17S R27E  
EDDY COUNTY, NM



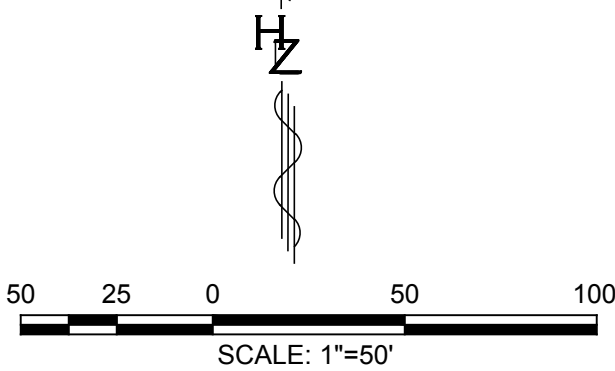
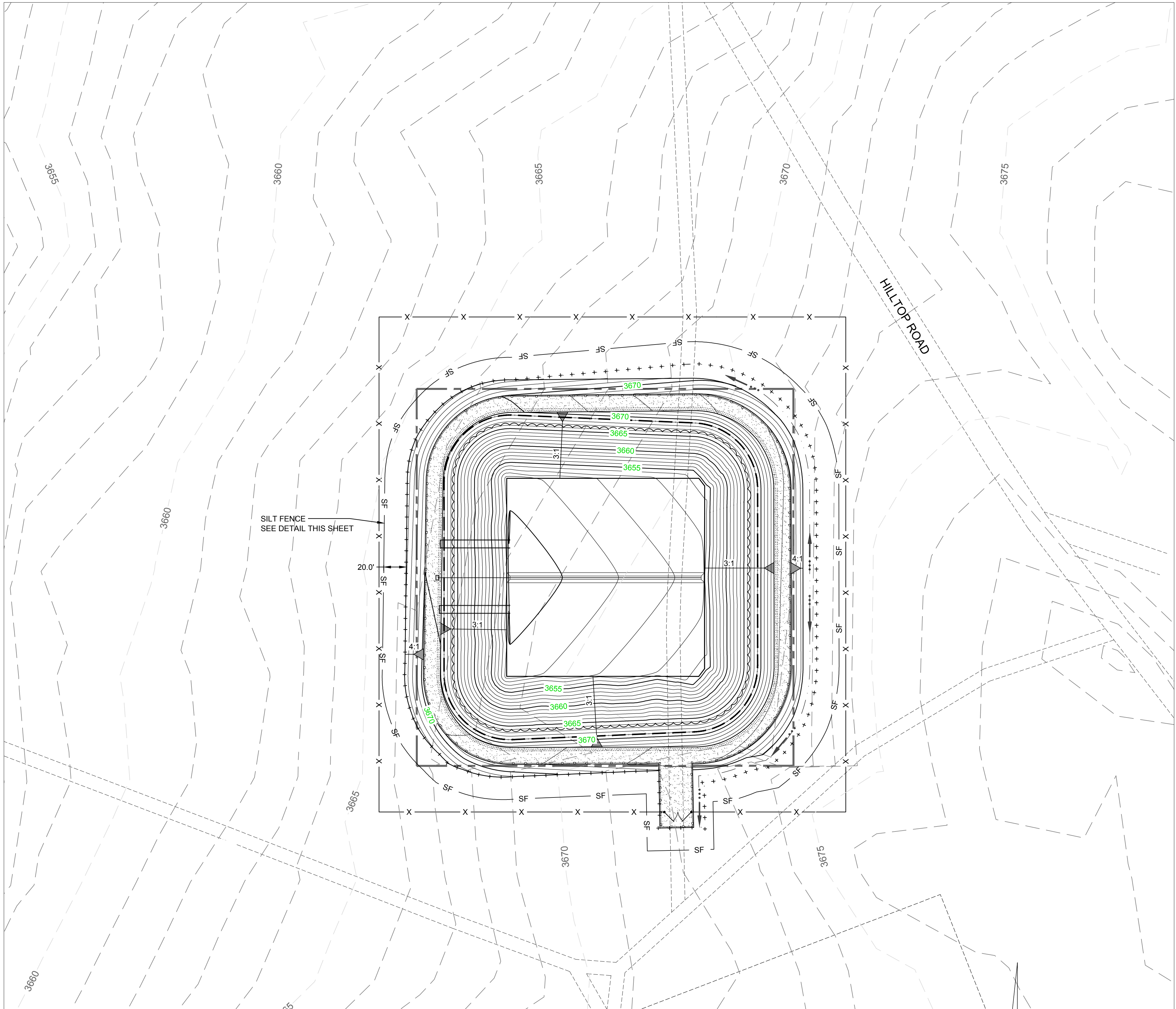
PROJECT NO. R170976.03  
DESIGNED BY: SAE  
DRAWN BY: LRT  
CHECKED BY: SAE  
DATE: MAY 7, 2014  
DPW CHK: -

SHEET:

C400

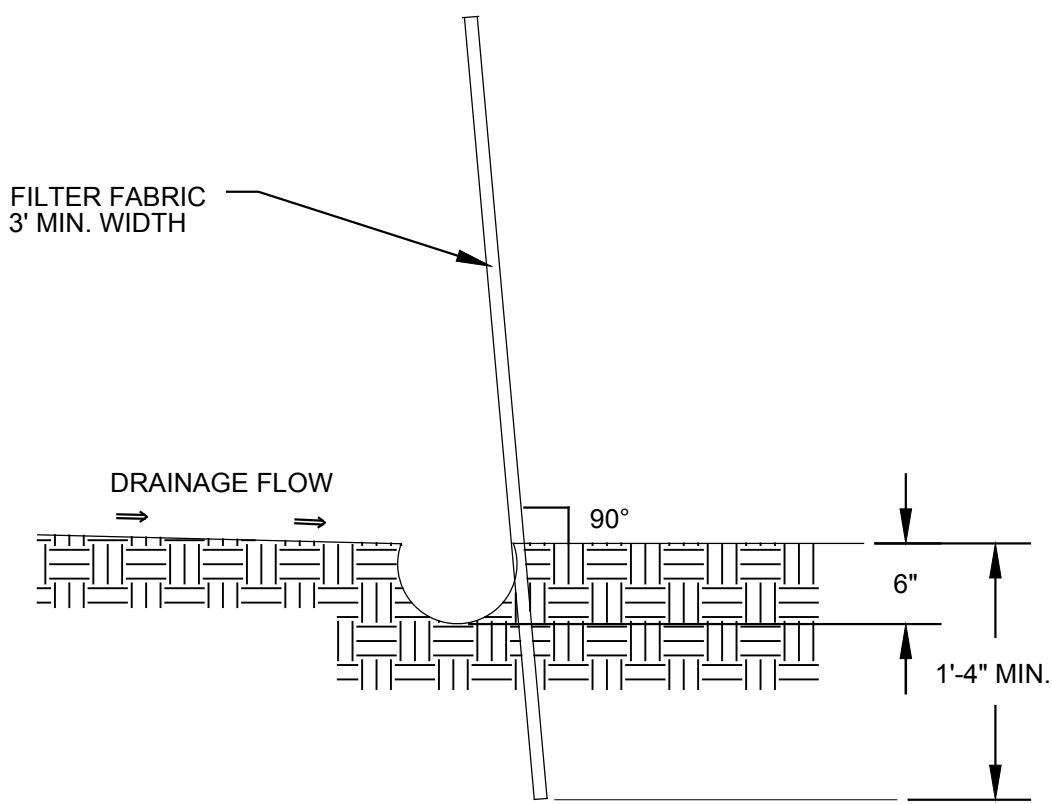
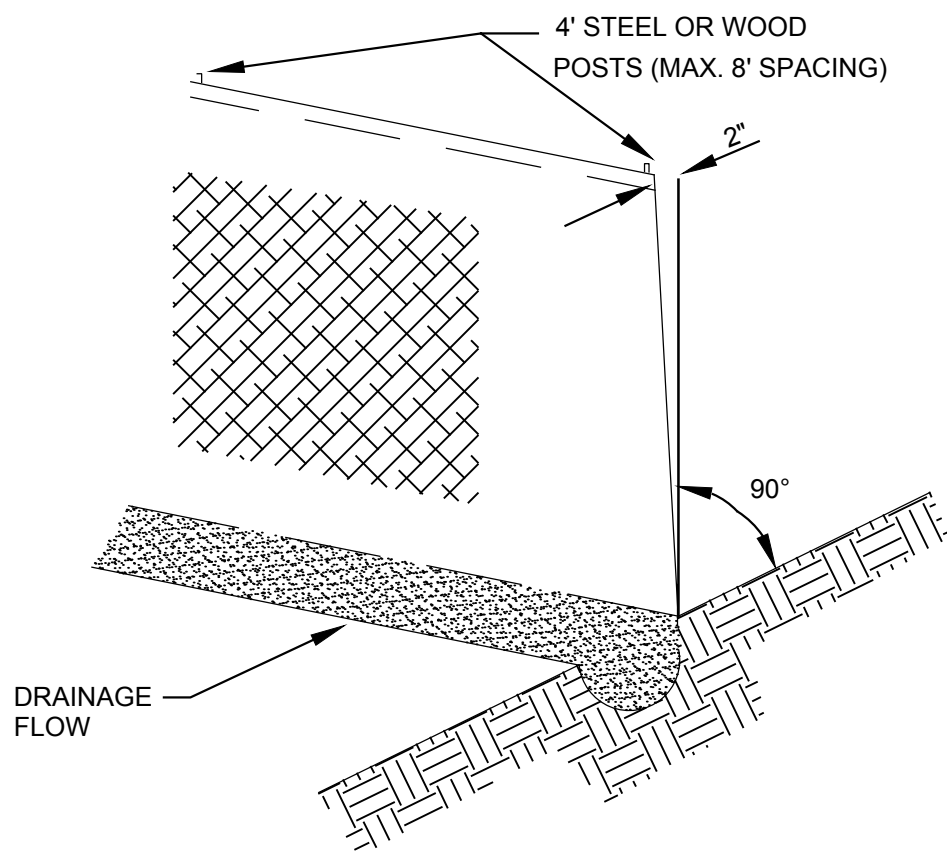
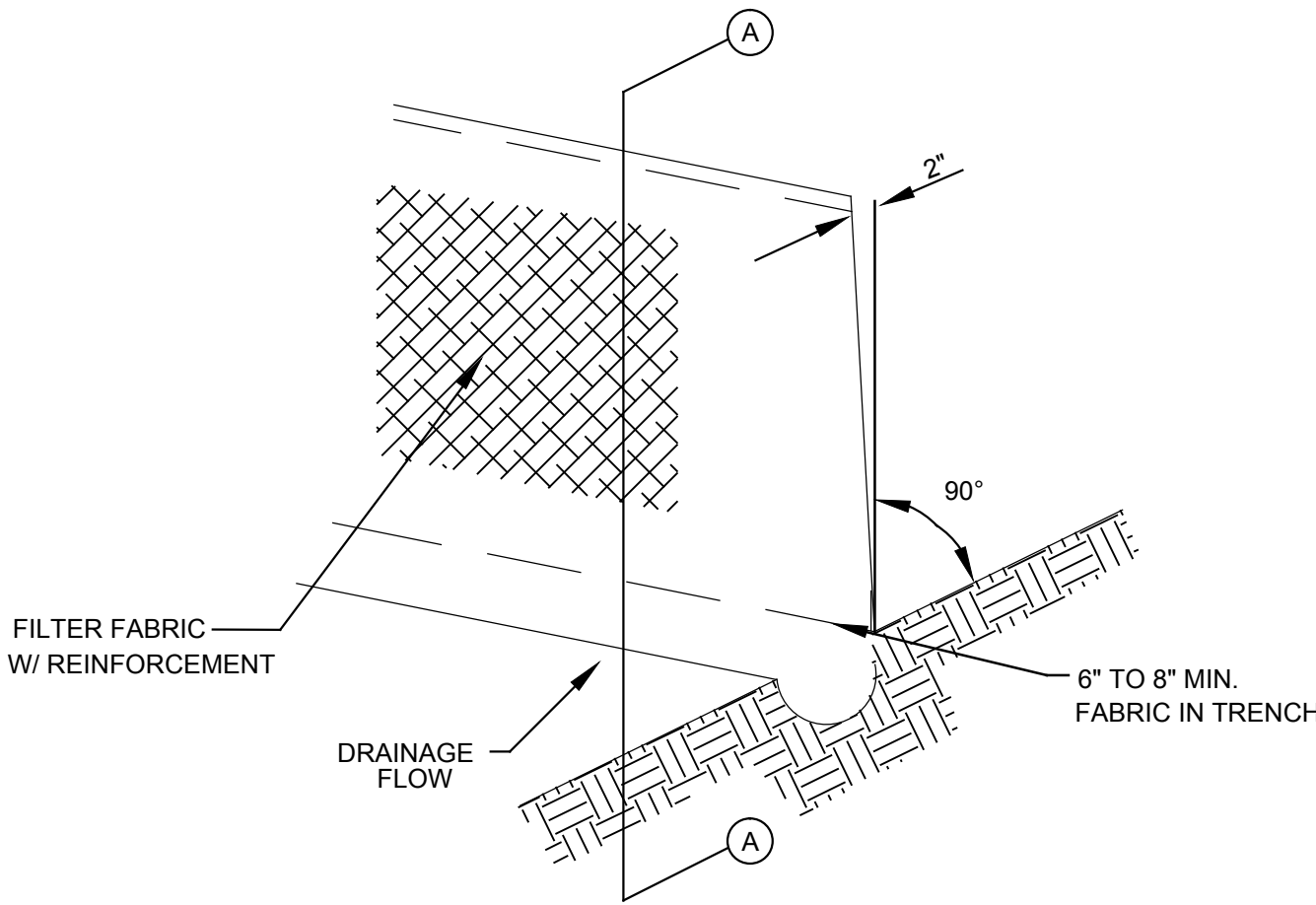


Plotted: 5/7/2014 4:12:11 PM, By: horeca, dm  
File: R170976.dwg, Path: C:\Users\horeca\Documents\Drawings\Setas\C400-C401.dwg  
Last Saved: 4/29/2014 1:32:12 PM, User: horeca



EROSION CONTROL

1. PIT SHALL BE SITED OUTSIDE OF ANY POSSIBILITY TO BE IMPACTED BY CONCENTRATED STORM WATER FLOWS.
2. STORM WATER SHEET FLOWS SHALL BE ROUTED AROUND PERIMETER OF PIT WITHIN AN EARTHEN SWALE. THE SWALE SHALL BE INSTALLED FROM THE HIGH POINT AND EXTEND TO THE LOW POINT. GRADES WITHIN SWALE SHALL NOT EXCEED 2% WITHOUT ADDITIONAL ARMORING OF FLOWLINE AND SIDE SLOPES.
3. STOCKPILE TOPSOIL ALONG FENCE LINE. WINDROW STOCKPILED SOIL TO MINIMIZE STORMWATER RUN ON.
4. SEDIMENT SHALL BE FILTERED FROM SWALE IN ACCORDANCE WITH THE STORM WATER POLLUTION PREVENTION PLAN.
5. EXPOSED SLOPES SHALL BE STABILIZED WITH CALICHE MATERIAL.
6. ALL DISTURBED AREAS SHALL BE SEEDED WITH NATIVE SEEDS AND STRAW CRIMPED UNLESS NOTED OTHERWISE.



REINFORCEMENT AND FILTER FABRIC TO BE DIRECTED BY THE ENGINEER

SEDIMENT CONTROL FENCE  
STRUCTURE SECTION

Scale: N.T.S. A

NOTE: POULTRY NETTING SHALL NOT BE ALLOWED AS A REINFORCEMENT MATERIAL. CONTRACTOR SHALL POST NOTICE OF INTENT AT SITE ENTRANCE.



NO.	DATE	DESCRIPTION	BY
7			
6			
5			
4			
3			
2			
1			

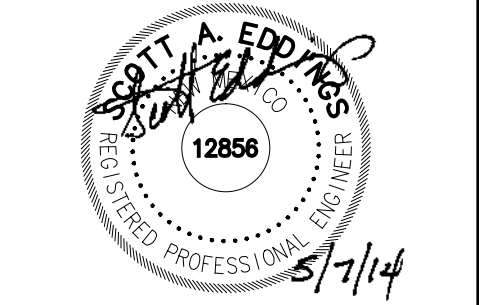
Designed By

**HUIT-ZOLARS**  
Huit-Zolars, Inc.  
3600 Hilltop Drive NE, Suite 201  
Bozeman, MT 59717  
Phone (406) 892-5141 Fax (406) 892-3259

Designed For

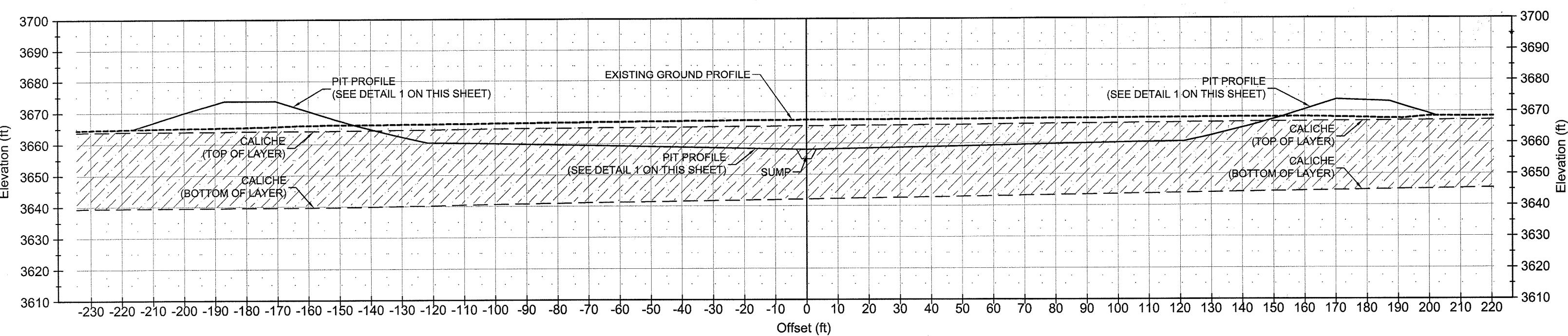
**LIME ROCK**  
RESOURCES

SWPPP  
ALL THORN MWFM PIT  
SECTION 36 T17S R27E  
EDDY COUNTY, NM

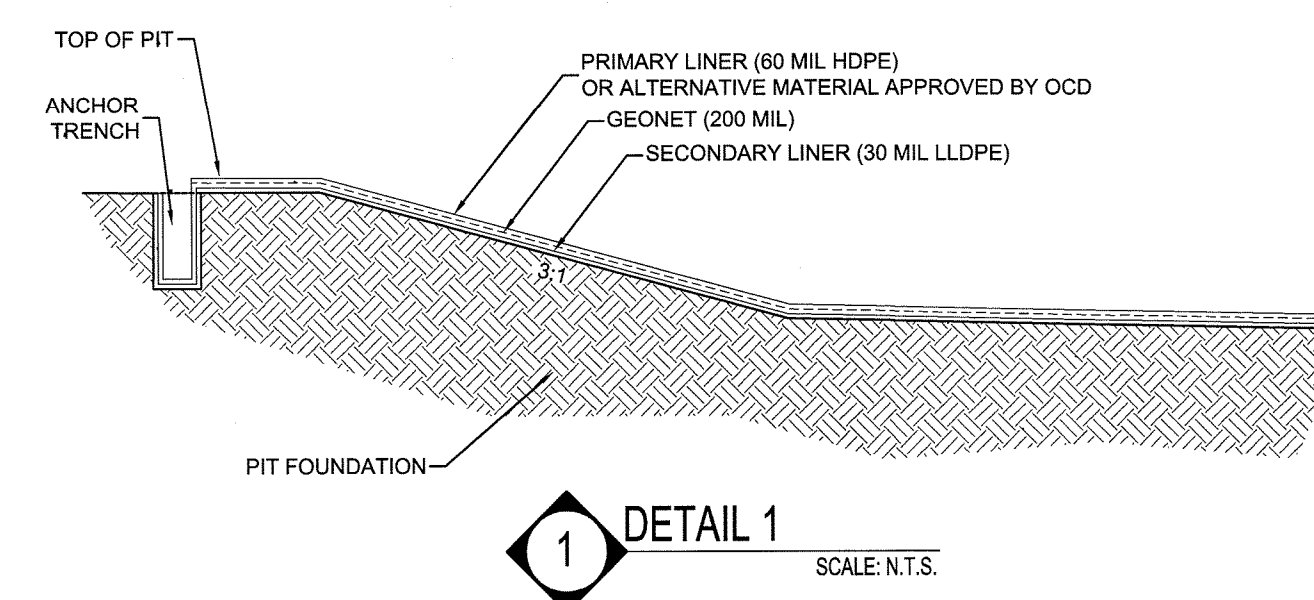


PROJECT NO.	R170976.03
DESIGNED BY:	SAE
DRAWN BY:	LRT
CHECKED BY:	SAE
DATE:	MAY 7, 2014
DPW CHK:	-
SHEET:	C401





1. REDESIGN PERFORMED AT OWNERS REQUEST. THIS SHEET ONLY.
2. DETAILS SHALL REFER TO SEPARATE COVER BY HUITT-ZOLLARS (PROJECT No. R170976.03) DATED MAY 7, 2014.
3. TOPOGRAPHIC SURVEY WAS OBTAINED FROM HUITT-ZOLLARS (PROJECT No. R170976.03) DATED MAY 7, 2014.



# **Appendix B**

## **Design/Construction Plan**



## **C-144 Supplemental Information: Design and Construction Plan Multi-Well Fluid Management Pit**

This plan addresses construction of MWFM pits. Appendix A presents Certified Engineering Design Plans. Also included in Appendix A is an erosion control plan that is not required by NMOCD Rules, and the leak detection design, which is the subject of the Variance Request of Appendix G. Separate from this application are additional documents relating to the design/construction. These are available for examination by OCD if desired. One of these documents is the Quality Plan for the construction of the pit that calls for conducting a geotechnical investigation to provide foundation design/construction recommendations that are specific to this site and this pit.

Appendix C provides liner and geotextile specifications.

Field conditions may create the need for minor modification of the pit design (e.g. changing the length, width or depth). If field conditions dictate the need to modify the design, the operator will notify NMOCD of the proposed changes and provide justification. Any design change that does not conform to the prescriptive mandates of NMOCD Rules or the approved permit will be the subject of a modification request submitted to the OCD for review and approval.

### **Dike Protection and Structural Integrity**

These design elements are addressed in the following section containing the foundation recommendations prepared by a New Mexico Registered Professional Engineer (Pettigrew and Associates). The recommendations are based on site-specific data. The operator and the project P.E. will review the recommendations prior to beginning the earthwork and will adhere to the specific recommendations of the foundation study.

### **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. The topsoil will be stockpiled adjacent to the west side of the perimeter fence surrounding the pit. Until vegetation is established on the stockpile, the topsoil will be protected from wind erosion by placement of silt fences on the stockpile.

### **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 on the fence at the entrance(s) to 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, a chain-link fence is not required. The design plan shows a game fence around the pit to exclude wildlife. This fence is significantly more robust than the required barbed wire fence with four strands evenly spaced in the interval between one foot

## **C-144 Supplemental Information: Design and Construction Plan Multi-Well Fluid Management Pit**

and four feet above ground level. A perimeter fence of 4-strand barbed wire is also proposed to exclude stock from the working area around the pit.

### **Netting and Protection of Wildlife**

The proposed game fence on the upper edge of the pit levee will be effective in excluding antelope, coyotes and most other terrestrial wildlife. Stock is excluded from the working area of the site by the 4-strand barbed wire perimeter fence.

As the size of the proposed MWFM pit is about 300 feet by 300 feet, an effective net over the pit would be difficult to manage and problematic to install. Of greater importance than logistics is the fact that such netting may not be necessary. The pit will contain treated produced water that will not pose a threat to birds due to hydrogen sulfide gas or floating, free-phase hydrocarbons. With respect to protection of birds, Lime Rock Resources will regularly inspect the MWFM pit and report, within 30 days of discovery, any migratory or wildlife death to the appropriate wildlife agency as required by NMAC 19.15.17.11 E.

If the monthly reports present mortality data that show an obvious need to exclude birds from the stored water, the operator will consult with the District Office regarding mitigation options. If the monitoring data suggest that netting is not acutely necessary, the operator will submit annual reports to OCD that discuss the results of the monitoring program and provide an evaluation of the need to exclude avian species from the pit via netting.

The Avian Protection Plan will be implemented by CEHMM as described in detail in the following section.

### **Earthwork**

As part of the QA/QC plan, a professional engineer registered in New Mexico (Pettigrew and Associates) has provided recommendations regarding the foundation for the pit liner (see following section). 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 (3H:1V).
- b. levee has an outside grade no steeper than three horizontal feet to one vertical foot (4H:1V).
- c. levee's top is wide enough to install an anchor trench that is at least 18-inches deep
- d. the 10-foot wide top of the levee provides adequate room for inspection of the liner and maintenance of the pit.
- e. 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 material prescribed in the Rule (see Appendix G). The primary and secondary liners are 60-mil HDPE as specified in the Rule or alternate material/thickness as approved by OCD.



## **C-144 Supplemental Information: Design and Construction Plan Multi-Well Fluid Management Pit**

- f. caliche gravel placed on the levee (see sheet C-400) provides additional erosion control.
- g. The pit is excavated into the ground such that all fluid force lies against native earth and the engineered foundation (see last pages of Appendix A)

As always, field conditions may create the need for changes to the design. Any changes to the construction or grade requirements due to unforeseen conditions will be reviewed and approved by the PE then reported to OCD at least 5-days prior to initiating installation of the secondary liner and leak-detection system.

### **Liner Installation**

The liners will be installed in a manner consistent with the Manufacture's specifications, which are found in Quality Plan, which is available for OCD review. As outlined in Quality Plan, 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 directed by the independent field inspector (Pettigrew Engineers) 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

At points of discharge into the lined MWFM pit the pipe configuration (see Appendix A) effectively protects the liner from excessive hydrostatic force or mechanical damage during filling. Note that the single 6-inch inflow pipe shown in the design drawings moves from a manifold at the top of the levee into two 6-inch solid pipes that transfer fluid to (or from) the bottom of the pit. Along the bottom of the pit, 6-inch perforated pipe distributes the liquid flow to minimize the hydraulic force on the liner.

Pumping from the pit to hydraulic fracturing operations is the responsibility of stimulation contractors. Typically, numerous lines are permanently placed in the pit with floats attached to keep the lines off of the pit liner.

External discharge or suction lines do not penetrate the liner.

### **Leak Detection and Fluid Removal Installation**

The leak detection system, which is the subject of an variance request, contains the following design elements

## **C-144 Supplemental Information: Design and Construction Plan Multi-Well Fluid Management Pit**

- a. The 200-mil Hypernet drainage material between the primary and secondary liner that is sufficiently permeable to allow the transport of fluids to the drainage pipes and observation ports (Appendices A and G).
- b. The pit floor is sloped towards the center perforated pipe/swale to facilitate the earliest possible leak detection of the pit bottom. A pump may be placed in an observation port to provide for fluid removal.
- c. Piping will withstand chemical attack from any seepage; structural loading from stresses and disturbances from overlying water, cover materials, equipment operation or expansion or contraction (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 PVC pipe having a minimum diameter of four inches and a minimum wall thickness of schedule 80 (Appendix A).





**PETTIGREW**  
& ASSOCIATES PA

ENGINEERING | SURVEYING | TESTING  
DEFINING QUALITY SINCE 1965

XXXXXXXXXXXXXXXXXXXX

XXXXXXXXXX X XXXXX XXXXXXXX X XXXXXXXX XXXXXXXX  
XXXXXXXXXX XX XXXXX XXXXX  
XXXXXX XXXXXXXXXX XX X XXXXX



Debra P. Hicks, PE/LSI  
NM 10871

PREPARED FOR:

R. T. Hicks Consultants, Ltd.  
Attn: Randall Hicks  
910 Rio Grande Boulevard, STE F-142  
Albuquerque, New Mexico 87104

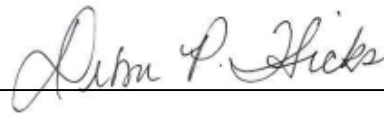
LAB No. 14 7043  
PROJECT No. 2014.1120

September 23, 2014



XXXXXX

This report is generated specifically for the purpose of providing design criteria for the All Thorn Multi-Well Fluid Management (MWFM) Pit – Section 36 T17S R27E, Eddy County, New Mexico. Under no circumstances shall it be used for any other project on or off the site. This report is meant to provide information that will inform Lime Rock Resources II-A, LP (LRRII) of appropriate design criteria for the planned use. The conditions encountered in field exploration and reported herein are accurate for the test location(s), time and conditions. It is not meant to eliminate the uncertainty regarding the potential for variation or changes in subsurface conditions at the site. Subsurface descriptions contained herein are of a generalized nature to provide highlights of major strata and conditions revealed in the soil samples, however, it represents only the conditions at the actual boring locations.



---

Debra P. Hicks, PE/LSI

NM 10871



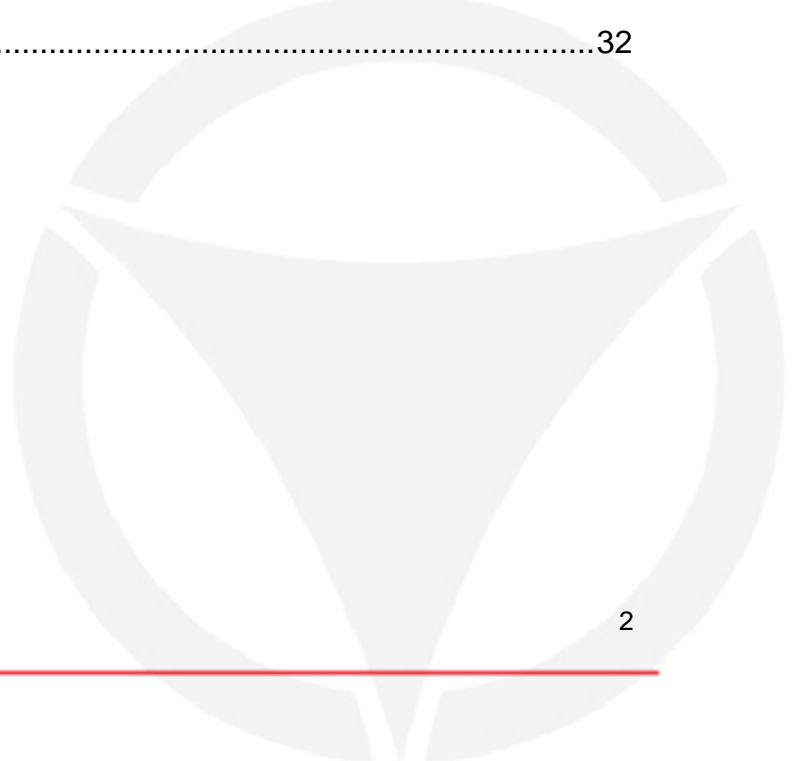
XXXXXXXXXXXXXXXXXXXX

XXXXXXXXXXXXXXXXXXXX

---

---

Introduction .....	3
Proposed Development .....	3
Field Exploration.....	3
Laboratory Analysis.....	4
Site Conditions .....	4
Site Geologic History .....	5
Subsurface Soil Conditions .....	5
Discussion and Recommendations.....	6
Construction Quality Assurance .....	10
Closure.....	10
Boring Location Map.....	11
Logs and Summaries .....	13
APPENDIX A – UNIFIED SOIL CLASSIFICATION .....	31
APPENDIX B – TERMINOLOGY .....	32





## EXECUTIVE SUMMARY

Lime Rock Resources proposes to construct the All Thorn MWFM Pit in Section 36, T17S R27E, Eddy County, NM. The site is approximately 2.6 acres. This investigation was performed at the direction and authorization of Mr. Randall Hicks of R.T. Hicks Consultants, Ltd.

The purpose of this investigation is to determine the characteristics of the subsoils and provide recommendations for foundation design. This report provides an overview of existing geotechnical/geologic conditions at the proposed demonstration site and geotechnical design parameters for the proposed facilities. The geotechnical site conditions presented herein are based on our field exploration as well as literature review from available geotechnical/geologic reports in the project vicinity. This report does not include environmental site characterization, hazardous materials testing, or other environmental services.

## INTRODUCTION

The proposed development includes construction of one multi-well fluid management pit to facilitate the re-use of produced water for well stimulation and well drilling.

## EXPLORATORY BORINGS

Four (4) exploratory borings were drilled on July 29, 2014. The exploratory borings were drilled to approximate depths listed in Table 1 of this Report. Boring locations are shown on the Boring Location Map. Drilling was carried out using a truck-mounted drill rig contracted with Enviro-Drill, Inc. – Albuquerque, New Mexico.

TABLE – 1 Boring Dates and Depths

BORING ID	DATE	DEPTH (FEET)	DEPTH (FEET)
BH-1	7/29/14	3684.05	41'9"
BH-2	7/29/14	3684.45	41'10"
BH-3	7/29/14	3682.83	51'0"
BH-4	7/29/14	3683.73	36'5"



Subsurface materials were sampled at varying intervals by split spoon sampler and/or drill cuttings where applicable.

Air-rotary/auger drilling methods were employed to cut the test borings. During the drilling, the soils encountered were continuously examined, visually classified and, where applicable, sampled.

Standard penetration tests (SPT) were performed at varying depths. Penetration resistance was measured in accordance with ASTM D 1586 by driving a standard 2" split tube sampler having a 30" free fall drop hammer weighing 140 pounds. The penetration resistance value is a useful index in estimating the consistency, relative density or hardness of the materials encountered.

XXXXXXXXXX XXXXXXXX



Representative samples were tested in the laboratory to determine certain engineering properties of the soils. Mechanical analysis and soil constant determinations were performed for classification and identification of each soil type encountered. Classifications are in accordance with the Unified Soil Classification System ASTM D 2487. The results of the laboratory tests are presented on the Logs.

The following tests were conducted on selected soil samples:

- Moisture Content
- Sieve Analysis
- Atterberg Limits

XXXX XXXXXXXX



As previously described, the project site is located near the intersection of Arco and Hilltop Road, approximately 1.7 miles south of Highway 82, Eddy County, New Mexico. The topography of the site slopes mildly to the north. The vegetation consists of tall brush and short grasses.





XXXX X XXXXXXXX XXXXXX

---

The proposed MWFM pit 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 weathered Triassic and Permian formations<sup>1</sup>.

XXXXXXXXXX XXXXXXXXXX

---

XXXXXXXXXX

XXXXXX X – Stratum 1 is classified as silty sand (SM). These surface soils are very loose to medium dense. This stratum is present at approximately 0'0" to 0'6" +/- below ground surface (bgs). Soils are typically brown and moist.

XXXXXX X – Stratum 2 is classified as silty sand with gravel (SM). For engineering purposes Stratum 2 was defined to include medium dense to very dense soils. This stratum is appears at a depth of 0'6" to 20'0" +/- bgs. The determination of the thickness was based mostly upon SPT blow count data, degree of cementation, plasticity and color of the soil samples. Soils in Stratum 2 are moist, non-plastic and tan in color.

XXXXXX X – Stratum 3 is classified as clayey sand (SC) and fat clay (CL) interbedded with gypsum. Some gypsum layers are up to 3' thick. For engineering purposes Stratum 3 was defined to include very soft to hard soils in relative firmness. This stratum is appears at a depth of 20'0" to 51'0" +/- bgs. The determination of the thickness was based mostly upon SPT blow count data, degree of cementation, plasticity and color of the soil samples. Soils in Stratum 3 are moist, plastic and red in color.

---

<sup>1</sup> Hicks, RT, 2014, C-144 Permit Package for All Thorn MWFM Pit Section 36 T17S R27E Eddy County, pg.2.



TABLE – 2 Soil Parameters

S-1	SM	0'0"	131.2	0.80	30.8	445.6
S-2	SM	0'6"	136.9	0.00	42.1	355.1
S-3	SC/CL	20'0"	140.2	7.50	0.00	2906.0

XXXXXXXXXX

Groundwater was not encountered in any of the borings.

XXXXXXXXXX

In accordance with the 2009 International Building Code - Section 1803.5.3 Soil Classification in the bearing strata (Stratum 2) is not considered expansive.

XXXXXXXXXX

Soils to depths explored of up to 51' +/- are damp to moist ranging from 1.7 to 12.4 percent in the samples tested. Subsurface soil and current groundwater conditions indicate that there is minimal potential for liquefaction to occur within the confined bearing stratum.

XXXXXXXXXX XXXX XXXXX X XXXXXXXXXX

The following discussion and recommendations are based upon the results of field and laboratory testing, engineering analyses, experience with similar soil conditions, and our understanding of the proposed project.

XXXXX XXX XXXXX XXXXX XXXXX

In accordance with the 2009 International Building Code®, Section 1613.5.5, Site Class D is applicable.





## Soils

In general, field test results indicate that the silty sands and clayey sands vary from very loose to very dense in relative density as indicated by measured SPT-N Values of 2 blows in 12" to 50 blows per 1". Very dense materials ( $N > 30$ ) were encountered at various depths.

Frost penetration approximates 15" to 18".

The MWFM Pit is anticipated to be below 10' to 15' below ground. The general contractor will excavate the insitu soils to the depths and grades shown on the construction plans. This material will be stockpiled for use in construction of roads, pads, etc.

## Construction Methods

- 1) **Vegetation and deleterious materials** All vegetation and other deleterious materials should be removed from the construction site prior to construction activities. Stripped materials consisting of vegetation and organic materials (estimated depth of 8") should be wasted from the site, or stockpiled for reuse during pit closure. Deleterious material should be removed from the site.
- 2) **MWFM Pit** The MWFM Pit is anticipated to be approximately 10' to 15' below ground. The general contractor will excavate the insitu soils to the depths and grades shown on the construction plans. This material (caliche) will be stockpiled for use in construction of roads, pads, etc.
- 3) **Soils for foundation elements** All soils that are to receive foundation elements including primary liner and dike should be scarified a minimum of 10" and compacted, at approximately optimum moisture (plus 2% to minus 2%), to not less than 95% of Laboratory Density as determined by ASTM D 698. The entire site should then be proofrolled to observe for unsuitable or weak soils. At least five passes with a heavy vibratory roller should be made during proofrolling. Soft materials or loose soils indicated during proofrolling should be stripped or further compacted. Areas of subgrade in which pumping or significant deflections are observed should be removed or stabilized. Use of lime, fly ash, kiln dust, cement or geotextiles could be considered as a stabilization technique.
- 4) **Fill and/or backfill** All fill and/or backfill be placed in lifts not to exceed 8" (loose), and compacted at approximately optimum moisture (plus 2% to minus 2%), to not less than 95% of Laboratory Density as determined by ASTM D 698.





- 11) ~~Portland Cement Concrete shall be proportioned~~ Portland Cement Concrete shall be proportioned in accordance with ACI 211.1-81; all portland cement shall be an approved American (USA) brand conforming to ASTM C150, Type II, or Type V with Class F flyash, where concrete is to be placed against high sulfate content soils, low alkali; and, all exposed Portland Cement Concrete or Portland Cement Concrete slabs on grade shall be air entrained.



Pettigrew & Associates shall perform construction observation and testing of the following:

- Subgrade preparation and proof-rolling;
- Suitability of Engineered fill and controlled fill;
- Backfill and compaction of excavations;
- Fill placement and compaction; and
- Compliance with the geotechnical recommendations.

Subgrade (Insitu soils) - One (1) soil density every 5,000 square feet of prepared surface for dike or pit bottom and side slopes (ASTM D 698 and ASTM D 2922)

Engineered Fill/Primary Liner Bedding - One (1) soil density every 5,000 square feet of prepared pit surface including bottom and side slopes per compacted lift (ASTM D 698 and ASTM D 2922)

Controlled Fill - One (1) soil density every 300 lineal feet of dike per lift of compacted material (ASTM D 698 and ASTM D 2922)

One (1) sieve analysis and plasticity index per material (subgrade, engineered fill, controlled fill) (ASTM C 136 and ASTM D 4318)

One (1) moisture density determination (proctor) per each type of material (ASTM D 698)

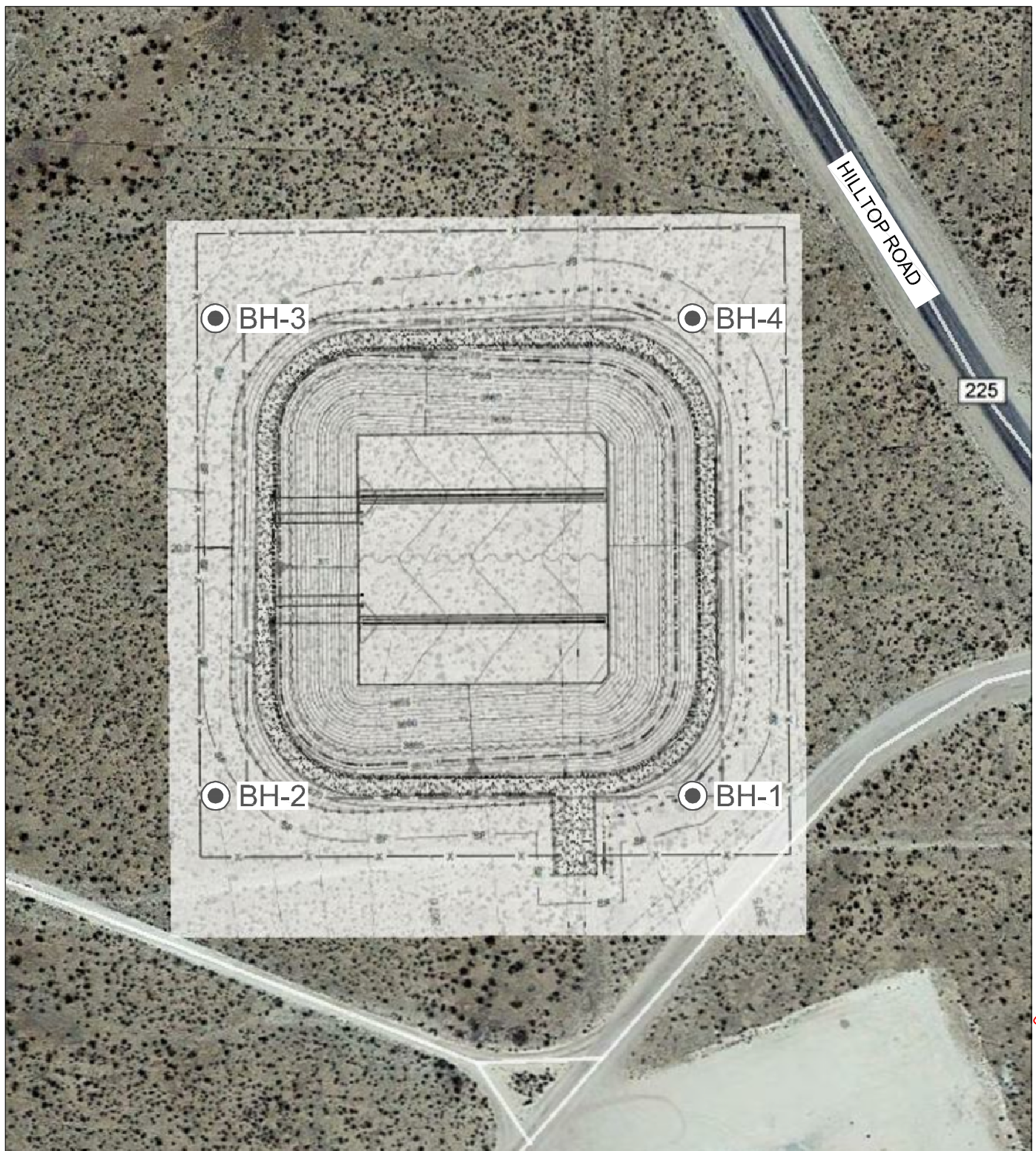
Our conclusions, recommendations and opinions presented herein are based upon our evaluation and interpretation of the findings of the field and laboratory investigation. [REDACTED] Pettigrew & Associates, P.A appreciates the opportunity to provide our services on this project and looks forward to working with you during construction and on future projects. Should you have any questions, please do not hesitate to contact us.





XXXXXXXXXXXXXXXXXXXX





SCALE 1" = 100'

0' 50' 100' 200'



### BOREHOLE MAP

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

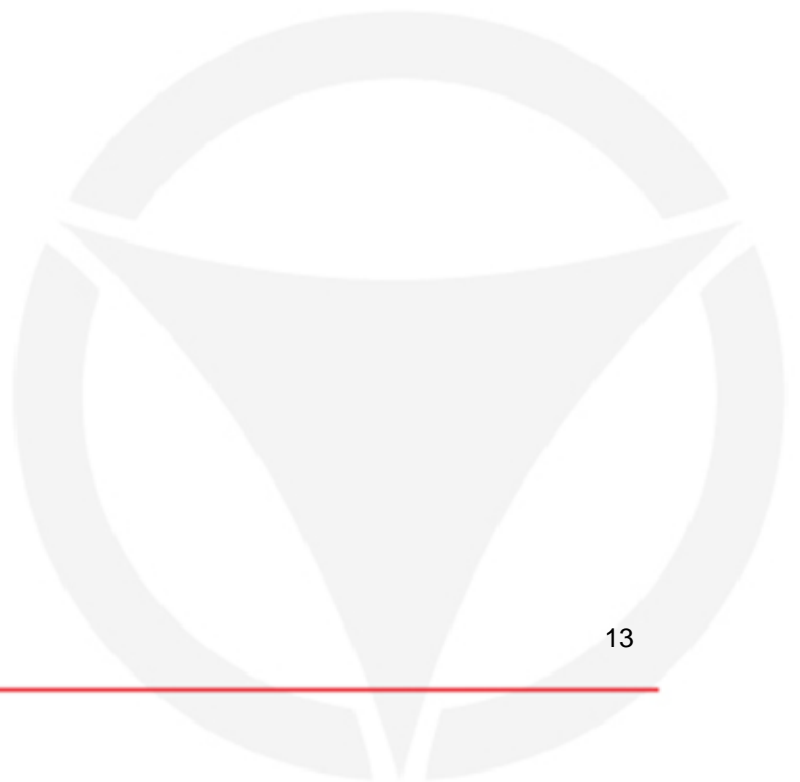
 **PETTIGREW**  
& ASSOCIATES PA

ENGINEERING | SURVEYING | TESTING  
DEFINING QUALITY SINCE 1965

100 E. Navajo Drive Suite 100 Hobbs New Mexico 88240  
T 575 393 9827 | F 575 393 1543 | Pettigrew.us



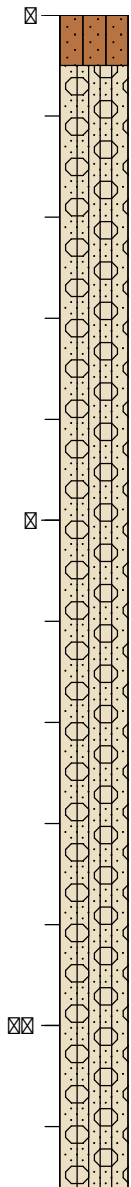
XXXXXXXXXX XXXX X XXXXXXX



XXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX  
 XXX XXXXX XXX XXX XXXXXXXXXXX XXX XXX XXXXXXX XXXXXXXXXXX  
 XXX XXXXX XXX XXX XXXXXXXXXXXXXXX  
 XXXXX XXXXXXX XXX XXXXXXX

XXXXXXXXXXXXXXXXXXXX  
 XXXXXXXXXXXXXXX  
 XXXXXXXXXXXXXXXXXXXXXXX XXX XXXXXXX  
 XXX XXXXX XXX XXXXXXXXXXXXXXXXXXX  
 XXXXXXX XXX XXXXXXX XXX

						XXXXXXXXXXXX XXXXXXXXXXXXXXX										
XXXX	XXXX		XXXX		XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

	3	Dry Brown Silty Sand (Topsoil)	--	3.6	94	80	75	71	50.0	--	--	--	0	
	24	Dry Tan Silty Sand with Gravel (Caliche)		1.7									4,500	
	15			4.0									2,510	
	15			5.7									2,510	
	24			8.9									4,500	
	23			8.9									4,280	
	29			--									5,600	
	57			--									>8,000	
	51	SM		7.3									>8,000	
	60			7.3	84	60	47	35	18.8	SNP	SNP	SNP	>8,000	
	47			7.4									>8,000	
	46			7.4									>8,000	



□□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□  
 □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□  
 □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□  
 □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□  
 □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□ □□

[illegible][illegible]




[illegible][illegible][illegible]

XXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX XXX XXX XXXXXXX XXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXXXXXX

XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXX XXXXXXX  
XXXX XXXXX XXX XXXXXXX XXXXXXX  
XXXXXXXX XXX XXXXXXX XXX

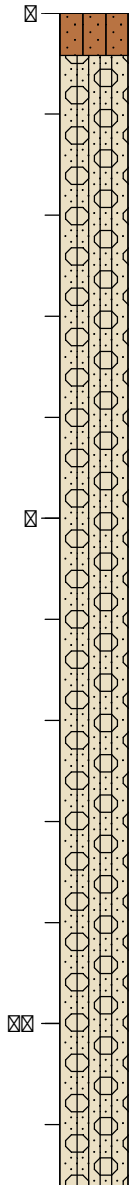
						XXXXXXXXXXXX XXXXXXX XXXXX										
XXXX	XXXX		XXXX		XXXXXXXXXXXX XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

	22	CH	11.5	100	90	81	73	68.5	60	29	31	5,410	
	51		--									>8,000	
	40		--									>8,000	
	74/9"		--									>8,000	

XXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX XXX XXX XXXXXXX XXX XXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX  
XXXXXX XXXXXXXXXX XXXXXXXXXX

XXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXX XXXXXXXXXX  
XXXX XXXXX XXX XXXXXXXXXX XXXXXXXXXX  
XXXXXXXX XXX XXXXXXXXXX XXX

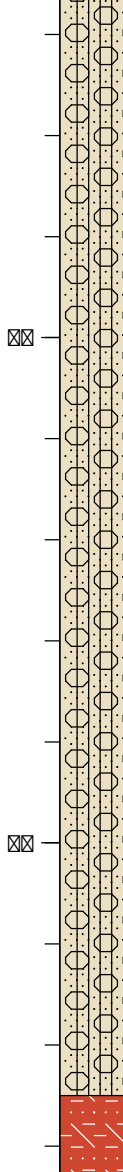
						XXXXXXXXXXXX XXXXXXXXXXXXXXX										
XXXXXX	XXXXXX		XXXXXX	XXXXXXXXXXXXXXX		XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX

	10/6"	Dry Brown Silty Sand (Topsoil)	--	--	94	80	75	71	50.0	--	--	--	3,620		
	45/6"	Dry Tan Silty Sand with Gravel (Caliche)		--									>8,000		
	72			--									>8,000		
	27			9.1									5,160		
	16			9.1									2,730		
	18			9.2									3,180		
	27			9.2									5,160		
	41			10.6									>8,000		
	50/6"			10.6									>8,000		
	67/11"			9.3									>8,000		
	80/11"			8.8									>8,000		
			SM		84	60	47	35	18.8	SNP	SNP	SNP			

XXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX XXX XXX XXXXXXXXXX XXXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX  
XXXXXX XXXXXXXXXX XXX XXXXXXXXXX

XXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXXXXX XXX XXXXXXXXXX  
XXXX XXXXX XXX XXXXXXXXXX XXXXXXXXXX  
XXXXXXXXXX XXX XXX XXXXXXXXXX XXX

						XXXXXXXXXXXXXXX XXXXXXXXXX XXXXXXXXXX										
XXXX XXXXX	XXXX XXXXX		XXXX XXXXX		XXXX XXXXX	XXXX XXXXX	XXXX XXXXX	XXXX XXXXX	XXXX XXXXX	XXXX XXXXX	XXXX XXXXX	XXXX XXXXX	XXXX XXXXX	XXXX XXXXX	XXXX XXXXX	XXXX XXXXX
				XXXXXXXXXXXXXXX XXX												

																
	75/8"														>8,000	
	50/3"														>8,000	
	50/1"	Dry to Moist Red Clayey Sand with Gravel and Gypsum													>8,000	


[illegible][illegible][illegible]



XXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX XXX XXX XXXXXXX XXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXXXXXXX

XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXX XXXXXXXXXX  
XXXX XXXXX XXX XXXXXXXXXX XXXXXXXX  
XXXXXXXX XXX XXXXXXX XXX

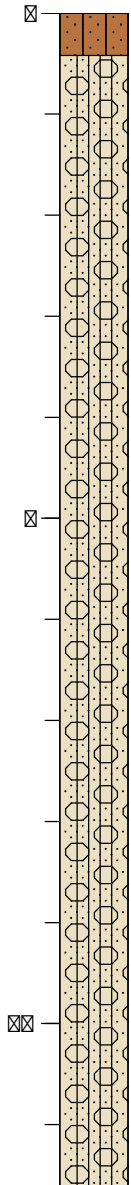
						XXXXXXXXXXXX XXXXXXX XXXXX										
XXXX	XXXX		XXXX		XXXXXXXXXXXX XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

	50/3"		9.8										>8,000		
	17		--										3,940		
	59/10"		--										>8,000		

XXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX XXX XXX XXXXXXX XXX XXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX  
XXXXXX XXXXXXXXXX XXX XXXXXXX

XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXX XXXXXXXXXX  
XXXX XXXXX XXX XXXXXXXXXX XXXXXXX  
XXXXXXXX XXX XXXXXXX XXX

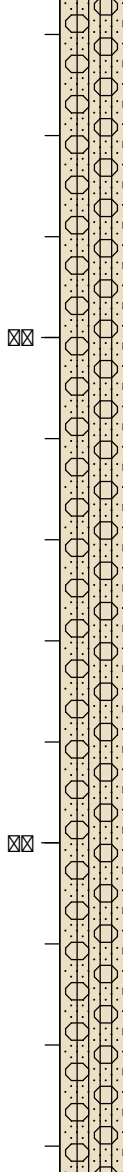
						XXXXXXXXXXXX XXXXXXX XXXXXXX										
XXXX	XXXX		XXXX		XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
				XXXXXXXXXXXX XXX												

	8/6"	Dry Brown Silty Sand (Topsoil)	2.6	94	80	75	71	50.0	--	--	--	2,730		
	32	Dry Tan Silty Sand with Gravel (Caliche)	4.3									6,260		
	50/6"		4.3									>8,000		
	37		3.6									7,360		
	29		3.6									5,600		
	23		4.5	84	60	47	35	18.8	SNP	SNP	SNP	4,280		
	24		4.5									4,500		
	63		5.3									>8,000		
	61		7.6									>8,000		
	39		6.7									7,800		
	71		6.7									>8,000		
	83		4.2									>8,000		
	50/6"		--									>8,000		

XXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXXX XXX XXX XXXXXXX XXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXXXXXX

XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXX XXXXXXX  
XXXX XXXXX XXX XXXXXXXXXXXXXXX  
XXXXXXXX XXX XXXXXXX XXX

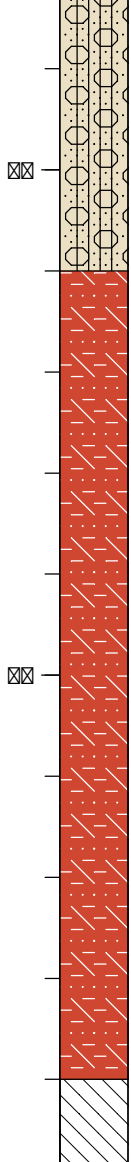
						XXXXXXXXXXXX XXXXXXX XXXXXXX										
XXXX	XXXX		XXXX		XXXXXXXXXXXX XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

																
	50/6"	5.2											>8,000			
	50/4"	8.4											>8,000			
	75/3"	5.5											>8,000			

XXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX XXX XXX XXXXXXX XXX XXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXXXXXXXXX

XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXX XXXXXXXXXX  
XXXX XXXXX XXX XXXXXXXXXX XXXXXXX  
XXXXXXXX XXX XXXXXXX XXX

						XXXXXXXXXXXX XXXXXXX XXXXX										
XXXX XXXXX	XXXX XXXXX		XXXX XXXXX		XXXX XXXXX	XXXX XXXXX	XXXX XXXXX	XXXX XXXXX	XXXX XXXXX	XXXX XXXXX	XXXX XXXXX	XXXX XXXXX	XXXX XXXXX	XXXX XXXXX	XXXX XXXXX	XXXX XXXXX

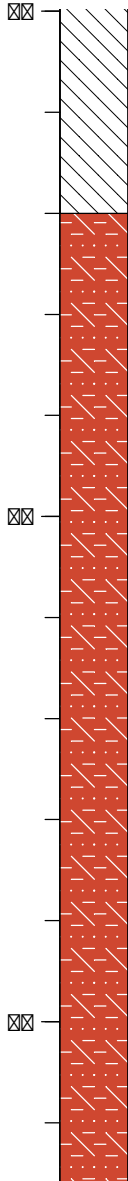
	50/6"	Dry to Moist Red Clayey Sand with Gravel and Gypsum	7.2											>8,000		
	5/6"		8.1											1,890		
	2		8.1											0		
	50/3"		--											>8,000		
		White Gypsum														



XXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX XXX XXX XXXXXXX XXX XXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXXXXXXX

XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXX XXXXXXXXXX  
XXXX XXXXX XXX XXXXXXXXXX XXXXXXX  
XXXXXXXX XXX XXXXXXX XXX

						XXXXXXXXXXXX XXXXXXX XXXXXXX										
XXXXXX	XXXXXX		XXXXXX		XXXXXXXXXXXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX

	23	Moist Red Sandy Fat Clay with Gypsum	--									4,280	
	73		--									>8,000	
	50/6"		10.3	100	90	81	73	68.5	60	29	31	>8,000	
	50/6"		--									>8,000	

XXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX XXX XXX XXXXXXXXXX XXXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXXXXXXX

XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXX XXXXXXXXXX  
XXXX XXXXX XXX XXXXXXXXXX XXXXXXXX  
XXXXXXXX XXX XXXXXXXXXX XXX

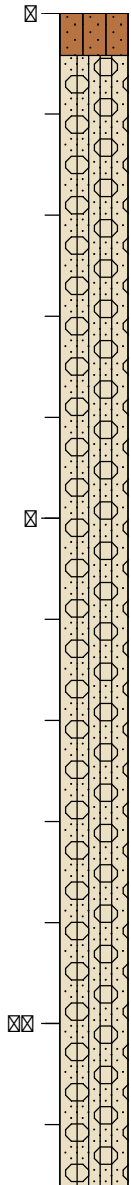
XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXXXXXXXX XXXXXXXXXX								XXXXXX	XXXXXX	XXXXXX
						XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX			
XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX

XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

XXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX XXX XXX XXXXXXX XXX XXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX  
XXXXXX XXXXXXXXXX XXX XXXXXXX

XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXX XXXXXXXXXX  
XXXX XXXXX XXX XXXXXXXXXX XXXXXXX  
XXXXXXXX XXX XXXXXXX XXX

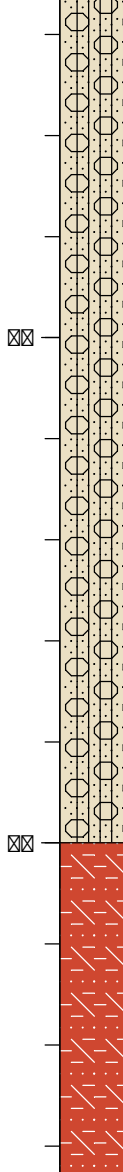
						XXXXXXXXXX XXX XXXXXXX XXX										
XXXXXX	XXXXXX		XXXXXX		XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
				XXXXXXXXXXXXXXX												

	7/6"	Dry Brown Silty Sand (Topsoil)	--	2.8	94	80	75	71	50.0	--	--	--	2,290		
	70	Dry Tan Silty Sand with Gravel (Caliche)		1.9									>8,000		
	29			6.9									5,600		
	19			6.9									3,400		
	54			8.7	84	60	47	35	18.8	SNP	SNP	SNP	>8,000		
	92			8.7									>8,000		
	50/6"			6.9									>8,000		
	66		SM	12.4									>8,000		
	50/4"			12.4									>8,000		
	50/5"			9.6									>8,000		

XXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX XXX XXX XXXXXXXXXX XXXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXXXXXXX

XXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXX

						XXXXXXXXXXXX XXXXXXXXXXXXXXX										
XXXXXX	XXXXXX		XXXXXX		XXXXXXXXXXXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX

	50/3"		--											>8,000		
	50/6"	Dry to Moist Red Clayey Sand with Gravel and Gypsum	7.1	95	79	68	48	31.4	32	18	14			>8,000		




XXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX XXX XXX XXXXXXX XXX XXXXXXX  
XXXX XXXXX XXX XXX XXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXXXXXXX

XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX  
XXXXXXXXXXXXXXXXXXXX XXX XXXXXXXXXX  
XXXX XXXXX XXX XXXXXXXXXX XXXXXXX  
XXXXXXXX XXX XXXXXXX XXX

XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXXXXXXXXXXX	XXXXXX	XXXXXXXXXXXXXXX XXXXXXXXXX								XXXXXX	XXXXXX	XXXXXX
						XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX			
XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXXXXXXXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX

XXXX	XXXX	50/5"	--											>8,000		
		35	--											>8,000		
		60	--											>8,000		

[illegible][illegible]

									
	52	SC	10.3					>8,000	
	50/5"		10.3					>8,000	



## TERMINOLOGY USED TO DESCRIBE THE RELATIVE DENSITY, CONSISTENCY, OR FIRMNESS OF SOILS

### TERMINOLOGY USED TO DESCRIBE THE RELATIVE DENSITY, CONSISTENCY, OR FIRMNESS OF SOILS

The terminology used on the boring logs to describe the relative density, consistency, or firmness of soils relative to the standard penetration resistance is presented below. 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.

1. Relative Density. Terms for description of relative density of cohesionless, uncemented sands and sand-gravel mixtures.

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

2. Relative Consistency. Terms for the description of clays which are saturated or near saturation.

SPR	Consistency	Penetration
0 - 2	Very Soft	Easily penetrated several inches with fist
3 - 4	Soft	Easily penetrated several inches
5 - 8	Medium Stiff	Can be penetrated several inches with thumb with moderate effort
9 - 15	Stiff	Readily indented with thumb, but penetrated only with great effort
16 - 30	Very Stiff	Readily indented with thumbnail
30+	Hard	Indented only with difficulty with thumbnail

3. Relative Firmness. Terms for the description of partially saturated and/or cemented soils which commonly occur in the Southwest including clays cemented granular materials, silts, and silty and clayey granular soils.

SPR	Relative Firmness
0 - 4	Very Soft
5 - 8	Soft
9 - 15	Moderately Firm
16 - 30	Firm
31 - 50	Very Firm
50+	Hard



Task Order #1- May 30, 2014  
Avian Protection Program for Treated Produced Water Storage Pits  
By  
Center of Excellence for Hazardous Materials Management  
Carlsbad, New Mexico

This TASK ORDER is submitted in regards to mitigating the take of or harm to protected waterfowl, other avian species and bats, during the operation of the Lime Rock All Thorn MWFM Pit. Additionally, the deliverable associated with this TASK ORDER fulfills the requirements as defined in the OCD Pit Rule:

*19.15.17.11 E. Netting. The operator shall ensure that a permanent pit, a multi-well fluid management pit, or an open top tank is screened, netted or otherwise rendered non-hazardous to wildlife, including migratory birds. Where netting or screening is not feasible, the operator shall on a monthly basis inspect for, and within 30 days of discovery, report discovery of dead migratory birds or other wildlife 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.*

CEHMM will meet or exceed criteria for the subject mitigation by evaluating and if necessary recommending accepted contemporary hazing or netting protocols endorsed by the US Fish and Wildlife Service and New Mexico Department of Game and Fish for effectiveness and safety to resident avian species. As the pit employs a game fence surround, protection of terrestrial wildlife is not part of this plan. The intent of this action is to determine if protected birds and bats would be harmed by the existence of the pit by establishing nests or reoccupying existing nests in an area designated for construction and operation of the proposed pit or by landing on or drinking from the pit. CEHMM proposes to implement this mitigation in three phases.

Phase I: CEHMM will contact the appropriate regulatory agencies (e.g., Oil Conservation Division, US Fish and Wildlife Service, New Mexico Department of Game and Fish) in order to inform respective agencies of intent, and to secure the appropriate permit authorizations for destruction of any existing nests from prior seasons' nesting and new nest starts without eggs or young. All regulatory implications for this project will be in accordance with state and federal guidelines for such an action.

Phase II: CEHMM will dispatch technicians to the subject area to conduct a reconnaissance of existing nests, nest structures and suitable habitat. This reconnaissance will require technicians to follow grid lines spaced on 50 meter intervals across the 5-10 acre parcel identified for construction and attendant produced water management operations (see attached Figure). Any old nests will be torn down with nest remnants placed on ground. Technicians will photograph the nests for later identification and document the location with handheld GPS devices. Any feathers, skeletal remains, or other parts will be collected and remanded to the property regulatory agency for identification and archive. Active nests (e.g., those nests either visibly occupied by a parent bird in incubation posture or with eggs or young) will be

documented by location and species with survey flagging tied on branches in near proximity (5 meters) in each cardinal direction. This means that an active nest can be located in the nucleus of the survey tape array and shall be left alone and undisturbed.

The deliverable for this phase of the project is a short report identifying possible protected species, including migratory waterfowl that could be potentially impacted by the operation of the proposed pits.

Phase III: During operation of the pit, CEHMM technicians will deploy to the pit area 6-12 times during the course of the first year of operation to evaluate the need to conduct hazing protocols or to install netting over the pit. CEHMM staff will

1. Periodically monitor the pit at dusk, dawn and during the day, as necessary, in order to observe any activity of protected avian species or bats
2. Interview staff regarding any mortality of protected species
3. Evaluate the chemistry of the treated produced water to determine if the water poses a hazard to protected species and
4. Prepare reports in the form of field notes and data sheets that will be provided to OCD upon request.

In the event that CEHMM personnel encounter protected wildlife mortalities such as dead birds, reptiles, amphibians, or mammals, they will be collected using sanitary, scientifically and regulatory acceptable protocols. Specimen transmittals will be to the appropriate regulatory agency or to an agency representative such as Wildlife Rescue. Based upon the observations over the course of 12 months, CEHMM will prepare an annual report summarizing the findings and making recommendations regarding the need for hazing protocols, netting or continued monitoring.

The estimated cost for each phase is provided on the next page.

# **Appendix C**

## **Material Specifications Including Proposed Alternatives**

## Herculine<sup>Sigma</sup> Smooth HDPE Product Specifications

Properties	Test Method	Minimum Average Values				
		12 mil	20 mil	30 mil	40 mil	60 mil
Thickness*, mil	ASTM D 5199	12	20	30	40	60
Lowest individual reading		10	18	27	36	54
Density, g/cm <sup>3</sup>	ASTM D 1505	.940	.940	.940	.940	.940
Tensile Properties (Each Direction)	ASTM D 6693, Type IV					
Strength at Break, lb/in width (N/mm)		42 (7)	76 (13)	114 (20)	152 (27)	228 (40)
Strength at Yield, lb/in width (N/mm)		23 (4)	42 (7)	63 (11)	84 (15)	126 (22)
Elongation at Break, %		700	700	700	700	700
Elongation at Yield, %		12	12	12	12	12
Tear Resistance, lb. (N )	ASTM D 1004	7 (33)	13 (59)	21 (93)	28 (125)	42 (187)
Puncture Resistance, lb. (N)	ASTM D 4833	19 (86)	34 (152)	54 (240)	72 (320)	108 (480)
Carbon Black Content, % (minimum)	ASTM D 1603	2.0	2.0	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	Note <sup>(1)</sup>	Note <sup>(1)</sup>	Note <sup>(1)</sup>	Note <sup>(1)</sup>	Note <sup>(1)</sup>

<sup>(1)</sup> 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.

\*Custom material thicknesses also available.

*This data is provided for informational purposes only. In-Line Plastics, LC makes no warranties as to the suitability or 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 from resulting loss or damage. This information is subject to change without notice, please check with In-Line Plastics for current updates.*

# GSE HyperNet Geonet

GSE HyperNet geonet is a synthetic drainage material manufactured from a premium grade high density polyethylene (HDPE) resin. The structure of the GSE HyperNet geonet is formed specifically to transmit fluids uniformly under a variety of field conditions. The geonet is formulated to be resistant to ultraviolet light for a period of time necessary to complete the installation.



## AT THE CORE:

A synthetic geonet engineered specifically to transmit fluids consistently under a variety of field conditions.

## Product Specifications

Tested Property	Test Method	Frequency	Minimum Average Roll Value			
			HyperNet	HyperNet HF	HyperNet HS	HyperNet UF
Transmissivity <sup>(1)</sup> , gal/min/ft (m <sup>2</sup> /sec)	ASTM D 4716	1/540,000 ft <sup>2</sup>	9.66 (2 x 10 <sup>-3</sup> )	14.49 (3 x 10 <sup>-3</sup> )	28.98 (6 x 10 <sup>-3</sup> )	38.64 (8 x 10 <sup>-3</sup> )
Density, g/cm <sup>3</sup>	ASTM D 1505	1/50,000 ft <sup>2</sup>	0.94	0.94	0.94	0.94
Tensile Strength (MD), lb/in	ASTM D 5035/7179	1/50,000 ft <sup>2</sup>	45	55	65	75
Carbon Black Content, %	ASTM D 1603 <sup>(3)</sup> /4218	1/50,000 ft <sup>2</sup>	2.0	2.0	2.0	2.0
NOMINAL ROLL DIMENSIONS						
Geonet Thickness, mil	ASTM D 5199	1/50,000 ft <sup>2</sup>	200	250	275	300
Roll Width <sup>(2)</sup> , ft			15	15	15	15
Roll Length <sup>(2)</sup> , ft			330	290	270	250
Roll Area, ft <sup>2</sup>			4,950	4,350	4,050	3,750

### NOTES:

- <sup>(1)</sup>Gradient of 0.1, normal load of 10,000 psf, water at 70° F, between steel plates for 15 minutes. Contact GSE for performance transmissivity value for use in design.
- <sup>(2)</sup>Roll widths and lengths have a tolerance of ±1%.
- <sup>(3)</sup>Modified.

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

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

**[ DURABILITY RUNS DEEP ]** For more information on this product and others, please visit us at [GSEworld.com](http://GSEworld.com), call 800.435.2008 or contact your local sales office.





## Mirafi® 160N



Mirafi® 160N is a needlepunched nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. Mirafi® 160N is inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids. Mirafi® 160N meets AASHTO M288-06 Class 2 for Elongation > 50%.

TenCate Geosynthetics Americas Laboratories are accredited by [a2La](#) (The American Association for Laboratory Accreditation) and Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP). NTPEP Number: GTX-2012-01-003

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Grab Tensile Strength	ASTM D4632	lbs (N)	160 (712)	160 (712)
Grab Tensile Elongation	ASTM D4632	%	50	50
Trapezoid Tear Strength	ASTM D4533	lbs (N)	60 (267)	60 (267)
CBR Puncture Strength	ASTM D6241	lbs (N)	410 (1825)	
Apparent Opening Size (AOS) <sup>1</sup>	ASTM D4751	U.S. Sieve (mm)	70 (0.212)	
Permittivity	ASTM D4491	sec <sup>-1</sup>	1.5	
Flow Rate	ASTM D4491	gal/min/ft <sup>2</sup> (l/min/m <sup>2</sup> )	110 (4481)	
UV Resistance (at 500 hours)	ASTM D4355	% strength retained	70	

<sup>1</sup> ASTM D4751: AOS is a Maximum Opening Diameter Value

Physical Properties	Unit	Typical Value <sup>2</sup>
Roll Dimensions (width x length)	ft (m)	15 x 300 (4.5 x 91)
Roll Area	yd <sup>2</sup> (m <sup>2</sup> )	500 (418)
Estimated Roll Weight	lb (kg)	199 (90)

<sup>2</sup> ASTM D4439 Standard Terminology for Geosynthetics: typical value, *n*—for geosynthetics, the mean value calculated from documented manufacturing quality control test results for a defined population obtained from one test method associated with on specific property.

**Disclaimer:** TenCate assumes no liability for the accuracy or completeness of this information or for the ultimate use by the purchaser. TenCate disclaims any and all express, implied, or statutory standards, warranties or guarantees, including without limitation any implied warranty as to merchantability or fitness for a particular purpose or arising from a course of dealing or usage of trade as to any equipment, materials, or information furnished herewith. This document should not be construed as engineering advice.

Mirafi® is a registered trademark of Nicolon Corporation.

Copyright © 2013 Nicolon Corporation. All Rights Reserved.



365 South Holland Drive  
Pendergrass, GA 30567

Tel 706 693 2226  
Tel 888 795 0808

Fax 706 693 4400  
[www.tencate.com](http://www.tencate.com)

FGS000361  
ETQR83

**Brawler Industries, LLC**  
PO Box 60004  
Midland, TX 79711



GAI-LAP-25-97



Testing Lab 1291.01 & 1291.02

**TENCATE**  
materials that make a difference

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

# DURA♦SKRIM® K30B, K36B & K45B



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/YD <sup>2</sup> )		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](http://www.RavenEFD.com)



**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](mailto:efdsales@ravenind.com)**  
**[www.ravenefd.com](http://www.ravenefd.com)**  
1/11 EFD 1251



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

## Appendix A

### REINFORCED POLYETHYLENE GEOMEMBRANE SPECIFICATION

Reinforced Polyethylene Geomembranes serve as liners and covers to contain water, leachate or other liquids. As a liner they can contain the liquid to prevent leakage or environmental impact and as a cover to minimize evaporation or contamination. It is of great importance that the Reinforced Polyethylene Geomembrane be free from defects and installed without damage.

#### A. DESCRIPTION

1. General:

The purpose of this specification is to provide details of Manufacturing Quality Control (MQC), Manufacturing Quality Assurance (MQA), Construction Quality Control (CQC), and Construction Quality Assurance (CQA) for the manufacture and pre-assembly of geomembrane products. The Contractor shall furnish all labor, material, and equipment to install the Reinforced Polyethylene Geomembrane including all necessary and incidental items as detailed or required to complete the installation in accordance with the Contract Drawing and these Specifications

2. Related Work:

Related Contract Work is described in the following section of the specification as approved by the CQA Engineer.

3. Reference Standards:

ASTM D5199 *Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.*

ASTM D5261 *Standard Test Method for Measuring Mass per Unit Area of Geotextiles.*

ASTM D6636 *Standard Test Method for Determination of Ply Adhesion Strength of Reinforced Geomembranes.*

ASTM D7003 *Standard Test Method for Strip Tensile Properties of Reinforced Geomembranes.*

ASTM D5884 *Standard Test Method for Determining Tearing Strength of Internally Reinforced Geomembranes.*

ASTM D7004 *Standard Test Method for Grab Tensile Properties of Reinforced Geomembranes.*

*ASTM D4533 Standard Test Method for Trapezoid Tearing Strength of Geotextiles.*

*ASTM D4833 Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.*

4. Quality Assurance:

Quality Assurance during installation of Reinforced Polyethylene Geomembrane will be provided by the Owner as described in the accompanying Project CQA Manual.

5. Manufacturers Qualifications:

- a. The Manufacturer shall have previously demonstrated his ability to produce the required Reinforced Polyethylene Geomembrane by having successfully manufactured a minimum of 10,000,000 ft<sup>2</sup> of scrim reinforced Polyethylene Geomembrane.
- b. Manufacturer must be ISO 9001 certified

6. Installer Qualifications:

The Reinforced Polyethylene Geomembrane Installer shall have installed a minimum of 500,000 ft<sup>2</sup> of Reinforced Polyethylene Geomembrane (or similar material).

7. Warranties:

The manufacturer of the Reinforced Polyethylene Geomembrane will warrant the material to the installer on a pro rata basis for up to 20 years after the final acceptance of the work, based on thickness of product, the application and location of the installation. This warranty shall include but not be limited to defects related to workmanship and manufacturing.

**B. MATERIALS**

1. General:

The materials supplied under these Specifications shall consist of first-quality 100% virgin products designed and manufactured specifically for the purpose of this work, which shall have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes.

2. Reinforced Polyethylene Geomembrane Materials:



- a. Reinforced Polyethylene Geomembrane shall be manufactured to meet the following requirements:
  - (1) Provide finished product free from holes, pin holes, bubbles, blisters, excessive gels, undispersed resins and/or carbon black, or contamination by foreign matter.
  - (2) Reinforced Polyethylene Geomembrane shall be a Linear Low Density Polyethylene Geomembrane composed of a heavy encapsulated 1300 denier polyester tri-directional reinforcement for the 30 ml geomembrane and bi-directional for the 36ml and 45ml geomembrane.
- b. Approved Reinforced Polyethylene Geomembrane:
  - (1) Dura-Skrim J30BB  
Dura-Skrim K36B  
Dura-Skrim K45B  
  
As manufactured by Raven Industries of Sioux Falls, SD.
  - (2) Equal material, as approved by the Engineer.

**C. FACTORY FABRICATION**

- 1. The Reinforced Polyethylene Geomembrane shall be supplied in panels which shall be of maximum size to provide the largest manageable sheet for the fewest seams.
- 2. Factory seams are produced by thermal sealing methods and shall have a minimum seam width of 1 ½ inch scrim to scrim.
- 3. Factory seams are 100% visually inspected and destructive testing is done to verify quality compliance.
- 4. Labels on the panels shall identify the thickness, length, width, lot and panel numbers, and name of Manufacturer.
- 5. Factory pre-assembled panels are accordion folded and rolled on a cardboard core. Rolled panels are wrapped in a protective layer for shipment.

**D. SUBMITTALS**

The Contractor shall submit the following to the CQA Engineer:

1. Pre-Installation Requirements:

Prior to Reinforced Polyethylene Geomembrane installation the Contractor shall submit the following:

- a. Certificate of Conformance and Sample: Prior to shipping to the site, the Contractor shall submit a certificate or affidavit signed by a legally authorized official of the Manufacturer for the Reinforced Polyethylene Geomembrane attesting that the Reinforced Polyethylene Geomembrane meets the physical and manufacturing requirements stated in these Specifications. The Contractor shall also submit a sample of the Reinforced Polyethylene Geomembrane to be used (sample may be of different color). The sample shall be labeled with the product name and be accompanied by the Manufacturer's specifications.
- b. Shipping, Handling, and Storage Instructions: The Manufacturer's plan for shipping, handling, and storage shall be submitted for review.
- c. Installation Procedures:  
  
Submit installation procedures for carrying out the work. Installation procedures to be addressed shall include but not be limited to material installation, repair, and protection to be provided in the event of rain or strong winds. With regard to protection, the Contractor shall provide a plan of anchoring the Reinforced Polyethylene Geomembrane sufficient to satisfy the Contractor's Performance Warranty. This plan shall be approved by the Engineer prior to construction.
- d. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into the construction.

2. Post-Installation Requirements:

Upon completion of the Reinforced Polyethylene Geomembrane installation, the Contractor shall submit the following:

- a. Completed material performance warranty.

**E. SITE PREPERATION AND INSTALLATION**

1. Installation shall be in done in accordance with the manufactures Geomembrane Installation Guidelines.

**TABLE 1:**  
**REQUIRED REINFORCED POLYETHYLENE GEOMEMBRANE**  
**PROPERTIES 30 MIL.**

<b>PROPERTY</b>	<b>TEST METHOD</b>	<b>UNITS</b>	<b>MIMUMUM ROLL AVERAGES</b>	<b>TYPICAL ROLL AVERAGES</b>
Thickness	ASTM D5199	Mils	27	30
Weight	ASTM D5261	Lbs.	126	140
Ply Adhesion	ASTM D6636	Lbs.	16	20
1" strip tensile	ASTM D7003	Lbf.	88 MD 63 DD	110 MD 79 DD
Tongue Tear	ASTM D5884	Lbf.	75 MD 75 DD	97 MD 90 DD
Grab Tensile Strength	ASTM D7004	Lbf.	180 MD 180 DD	218 MD 210 DD
Trap Tear	ASTM D4533	Lbf.	120 MD 120 DD	146 MD 141 DD
Puncture Resistance	ASTM D4833	Lbf.	50	64

MD Machine Direction DD Diagonal Direction

**TABLE 2:**  
**REQUIRED REINFORCED POLYETHYLENE GEOMEMBRANE**  
**PROPERTIES 36 MIL.**

<b>PROPERTY</b>	<b>TEST METHOD</b>	<b>UNITS</b>	<b>MIMUMUM ROLL AVERAGES</b>	<b>TYPICAL ROLL AVERAGES</b>
Thickness	ASTM D5199	Mils	32	36
Weight	ASTM D5261	Lbs.	156	173
Ply Adhesion	ASTM D6636	Lbs.	31	34
1" strip tensile	ASTM D7003	Lbf.	183 MD 165 DD	201 MD 180 DD
Tongue Tear	ASTM D5884	Lbf.	112 MD 96 DD	122 MD 106 DD
Grab Tensile Strength	ASTM D7004	Lbf.	340 MD 325 DD	354 MD 338 DD

Puncture Resistance	ASTM D4833	Lbf.	138	153
---------------------	------------	------	-----	-----

MD Machine Direction DD Diagonal Direction

**TABLE 3:  
REQUIRED REINFORCED POLYETHYLENE GEOMEMBRANE  
PROPERTIES 45 MIL.**

<b>PROPERTY</b>	<b>TEST METHOD</b>	<b>UNITS</b>	<b>MINIMUM ROLL AVERAGES</b>	<b>TYPICAL ROLL AVERAGES</b>
Thickness	ASTM D5199	Mils	40	45
Weight	ASTM D5261	Lbs.	198	220
Ply Adhesion	ASTM D6636	Lbs.	34	38
1" strip tensile	ASTM D7003	Lbf.	187 MD 182 DD	211 MD 195 DD
Tongue Tear	ASTM D5884	Lbf.	150 MD 123 DD	159 MD 132 DD
Grab Tensile Strength	ASTM D7004	Lbf.	378 MD 361 DD	408 MD 372 DD
Puncture Resistance	ASTM D4833	Lbf.	144	163

MD Machine Direction DD Diagonal Direction

Notes:

1. The Engineer may allow alternates to these requirements.