April 2025

Rule 34 Registration: Volume 2
Angel RF and Containments
Section 32, T20S, R28E, Eddy County

- ***C-147 Form***
- ***Closure Cost Estimate for the In-Ground and AST Containments***
- ***Stamped Design Drawings with Liner Equivalency Demonstration and Avian Deterrence***
- ***• Recently Approved Plans for Design/Construction, O&M, and Closure***

View southeast toward the Angel RF and Containments Project Area. Near the horizon at the center of the image are topsoil and spoil piles associated with an abandoned caliche pit. This pit will become part of the proposed western containment.

Prepared for:
BTS Management, LLC
Carlsbad, New Mexico

Prepared by:

R.T. Hicks Consultants, Ltd.
Albuquerque, New Mexico

Cascade Services LLC
Midland, Texas

C-147

State of New Mexico
Energy Minerals and Natural Resources
Department Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505
https://www.emnrd.nm.gov/ocd/ocd-e-permitting/

Form C-147
Revised October 11, 2022

Recycling Facility and/or Recycling Containment

Type of Facility: ☑ Recycling Facility ☑ Recycling Containment*

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

*** At the time C-147 is submitted to the division for a Recycling Containment, a copy shall be provided to the surface owner.**

Be advised that approval of this request does not relieve the operator of liability should operations result in pollution of surface water, ground water or the environment. Nor does approval relieve the operator of its responsibility to comply with any other applicable governmental authority's rules, regulations or ordinances.

1.
Operator: BTS Management LLC (For multiple operators attach page with information) OGRID #: 333139
Address: 615 Queens Highway, Carlsbad, NM 88220
Facility or well name (include API# if associated with a well): Angel Recycling Facility and East & AST Containments
OCD Permit Number: 2RF-222 (For new facilities the permit number will be assigned by the district office)
U/L or Qtr/Qtr F Section 32 Township 20S Range 28E County: Eddy
Surface Owner: ☐ Federal ☑ State ☑ Private ☐ Tribal Trust or Indian Allotment East & AST Containments = Private West Containment = State

2.
☑ **Recycling Facility:** and AST Containment
Location of recycling facility (if applicable): Latitude 32.532246 Longitude -103.202337 NAD83
Proposed Use: ☑ Drilling* ☑ Completion* ☑ Production* ☑ Plugging *
The re-use of produced water may NOT be used until fresh water zones are cased and cemented*
☐ Other, ***requires permit for other uses. Describe use, process, testing, volume of produced water and ensure there will be no adverse impact on groundwater or surface water.***
☑ Fluid Storage
☑ Above ground tanks ☑ Recycling containment ☐ Activity permitted under 19.15.17 NMAC explain type_____
☐ Activity permitted under 19.15.36 NMAC explain type:_____ ☐ Other explain _____
☐ For multiple or additional recycling containments, attach design and location information of each containment
☐ **Closure Report (required within 60 days of closure completion):** ☐ Recycling Facility Closure Completion Date:_____

3.
☑ **Recycling Containment:** East and West In-Ground
☐ Annual Extension after initial 5 years (attach summary of monthly leak detection inspections for previous year)
Center of Recycling Containment (if applicable): Latitude East 32.532213 Longitude -104.203477 NAD83
☐ For multiple or additional recycling containments, attach design and location information of each containment
☑ Lined ☐ Liner type: Thickness _____mil ☐ LLDPE ☑ HDPE ☐ PVC ☐ Other 60 mil primary 40 mil secondary
☐ String-Reinforced
AST = 40,000 East Containment = 663,961
Liner Seams: ☑ Welded ☐ Factory ☐ Other _____ Volume: bbls bbl Dimensions: L_____ x W_____ x D_____
See design drawings for dimensions
☐ Recycling Containment Closure Completion Date:_____

4.

Bonding:

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

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

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

5.

Fencing:

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

☑ Alternate. Please specify Game Fence

6.

Signs:

☑ 12"x 24", 2" lettering, providing Operator's name, site location, and emergency telephone numbers

☐ Signed in compliance with 19.15.16.8 NMAC

7.

Variances:

Justifications and/or demonstrations that the proposed variance will afford reasonable protection against contamination of fresh water, human health, and the environment.

Check the below box only if a variance is requested:

☑ Variance(s): Requests must be submitted to the appropriate division district for consideration of approval. If a Variance is requested, include the variance information on a separate page and attach it to the C-147 as part of the application.

If a Variance is requested, it must be approved prior to implementation. Variances for AST Containment

8.

Siting Criteria for Recycling Containment

Instructions: The applicant must provide attachments that demonstrate compliance for each siting criteria below as part of the application. Potential examples of the siting attachment source material are provided below under each criteria.

General siting

Ground water is less than 50 feet below the bottom of the Recycling Containment. NM Office of the State Engineer - iWATERS database search; USGS; Data obtained from nearby wells	☐ Yes ☑ No ☐ NA
Within incorporated municipal boundaries or within a defined municipal fresh water well field covered under a municipal ordinance adopted pursuant to NMSA 1978, Section 3-27-3, as amended. - Written confirmation or verification from the municipality; written approval obtained from the municipality	☐ Yes ☑ No ☐ NA
Within the area overlying a subsurface mine. - Written confirmation or verification or map from the NM EMNRD-Mining and Minerals Division	☐ Yes ☑ No
Within an unstable area. - Engineering measures incorporated into the design; NM Bureau of Geology & Mineral Resources; USGS; NM Geological Society; topographic map	☐ Yes ☑ No
Within a 100-year floodplain. FEMA map	☐ Yes ☑ No
Within 300 feet of a continuously flowing watercourse, or 200 feet of any other significant watercourse, or lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark). - Topographic map; visual inspection (certification) of the proposed site	☐ Yes ☑ No
Within 1000 feet from a permanent residence, school, hospital, institution, or church in existence at the time of initial application. - Visual inspection (certification) of the proposed site; aerial photo; satellite image	☐ Yes ☑ No
Within 500 horizontal feet of a spring or a fresh water well used for domestic or stock watering purposes, in existence at the time of initial application. - NM Office of the State Engineer - iWATERS database search; visual inspection (certification) of the proposed site	☐ Yes ☑ No
Within 500 feet of a wetland. - US Fish and Wildlife Wetland Identification map; topographic map; visual inspection (certification) of the proposed site	☐ Yes ☑ No

9.
Recycling Facility and/or Containment Checklist:
Instructions: Each of the following items must be attached to the application. Indicate, by a check mark in the box, that the documents are attached.

- ☑ Design Plan - based upon the appropriate requirements.
- ☑ Operating and Maintenance Plan - based upon the appropriate requirements.
- ☑ Closure Plan - based upon the appropriate requirements.
- ☑ Site Specific Groundwater Data -
- ☑ Siting Criteria Compliance Demonstrations –
- ☑ **Certify that notice of the C-147 (only) has been sent to the surface owner(s)**

10.
Operator Application Certification:
I hereby certify that the information and attachments submitted with this application are true, accurate and complete to the best of my knowledge and belief.

Name (Print): Dave Andersen Title: President

Signature: Date: 3/20/2025

e-mail address: dave@btsmanagementllc.com Telephone: 575 361 3668

11.
OCD Representative Signature: Victoria Venegas **Approval Date:** 04/15/2025

Title: Environmental Specialist **OCD Permit Number:** 2RF-222

☒ OCD Conditions

☒ Additional OCD Conditions on Attachment

CLOSURE COSTS

R. T. HICKS CONSULTANTS, LTD.
901 Rio Grande Blvd NW ▲ Suite F-142 ▲ Albuquerque, NM 87104 ▲ 505.266.5004 ▲ Since 1996

Angel In-Ground East Containment and AST Containment Financial Assurance Cost Estimate

Attached is the cost estimate for reclamation of the Angel Recycling In-Ground and AST containments. **Total bonding is ($400,100.20+$32,500=) $432,600.20.**

Angel East In-Ground Containment
The contractor's detailed estimate for closure of the in-ground containment immediately follows this outline of closure costs. While not explicitly identified, reclamation of the working pad that houses the AST and Recycling Facility is included in the estimate for the pond reclamation. The earth removed to build the containment is used to construct the working pad. Reclamation of the East Containment requires removal of the working pad to fill the containment at closure.

Closure sampling and analysis cost is estimated at $1725 (sampling) plus $2,700 (laboratory cost) to "test the soils beneath the containment for contamination with a five-point composite sample which includes stained or wet soils, if any, and that sample shall be analyzed for the constituents listed in Table I" of Rule 34.

RT Hicks Consultants will assist with the sampling as necessary and prepare the Closure Report for the site. Total closure sampling costs are estimated at $7500. The cost estimates from Cascade Services (attached) and from RT Hicks Consultants are presented below.

Cascade Services

All work elements required by Rule 34	$392,600.20
Attached estimate includes provision for AST pad reclamation	

RT Hicks Consultants

Preparation of sampling results and closure report	$ 7500.00
Total for in ground Containment Closure Activities	**$400,100.20**

AST Containment
Total estimated cost for closure, reclamation, and restoration of the ASTpursuant to Rule 34 is **$32,500.00** based upon the work elements shown in the table (below). We used the same estimate as previously approved AST Containments. The AST Containment is placed on the treatment pad adjacent to the recycling facility. The cost for reclamation of the AST pad is included in the estimate.

ITEM DESCRIPTION	UNITS	UNIT PRICE	TOTAL PRICE
Angel AST Containment			
Removal of AST and Liner and Disposal	1	$30,000.00	$30,000.00
Assess soil for impacts	1	$2,500.00	$2,500.00
Total for AST Closure Activities			**$32,500.00**

Cascade Services, LLC
952 Echo Ln
Ste 375
Houston, TX 77024-2814
www.cascadeservicesllc.com

Estimate

ADDRESS	SHIP TO	ESTIMATE	1982
BTS Management LLC	BTS Management LLC	DATE	03/20/2025

CUSTOMER PROJECT NAME	PROJECT LOCATION COORDINATES
TPW Angel Closure	32.5327124692, -104.198489024

DESCRIPTION	QTY	UNIT	RATE	AMOUNT
This is pricing a package to reclaim the single 693k bbl Mobilize equipment to site. Dirt reclaim of pond consist of- Bury all material (Caliche, Gypsum, Sand, ect.) below ground level, backfill pond area with uncontaminated soil from pond walls. Pond area will be reclaimed to natural elevations and water flow patterns. All stockpiled strippings will be put down last to ensure ground has been completely returned to native design.	87,962		2.00	175,924.00
Environmental soil sampling This will include digging 6 sample locations for each containment. One composite sample from 0-4 feet below surface and one discrete sample from each location at 4.25 feet Cost include trip, labor, materials, and laboratory testing	1		1,725.00	1,725.00
Environmental Soil testing Before earthwork can begin the soil must be tested for contamination in case of liner leakage. Cost include trip, labor, materials, and laboratory testing of 18 tests.	1		2,700.00	2,700.00
Broadcast seeding of pond area Seed will be a native mix for Eddy County NM Includes purchase of seed mix and placemen	1		3,000.00	3,000.00
Fence removal and disposal Fence estimated at 2,829 ft This includes removal of all posts,	2,829		4.00	11,316.00

braces, wire, fabric, gates, and hardware.			
Remove and dispose of all four layers. Textile, 40 mil, net, and 60 mil	1,319,568	0.15	197,935.20

Preferred payment method: ACH/Wire
Email AR@cascadeservicesllc.com for ACH/Wire details.

Remit Checks To:
Cascade Services LLC
PO Box 200954
Dallas, TX 75320-0954
**THIS ESTIMATE IS SUBJECT TO THE TERMS & CONDITIONS ATTACHED.

**If pumping is needed due to weather conditions, a $350 daily fee will be charged on final invoice.

**Materials will be invoiced upon receipt of customer purchase order or job approval.

**This estimate may not include tax and may be added on invoice unless customer provides a valid tax exemption document.

Questions? Email AR@Cascadeservicesllc.com

SUBTOTAL	392,600.20
TAX	0.00
TOTAL	**$392,600.20**

Accepted By

Accepted Date

RECYCLING CONTAINMENT DESIGN DRAWINGS

SquareRoot services
Engineering | Surveying
Materials Testing

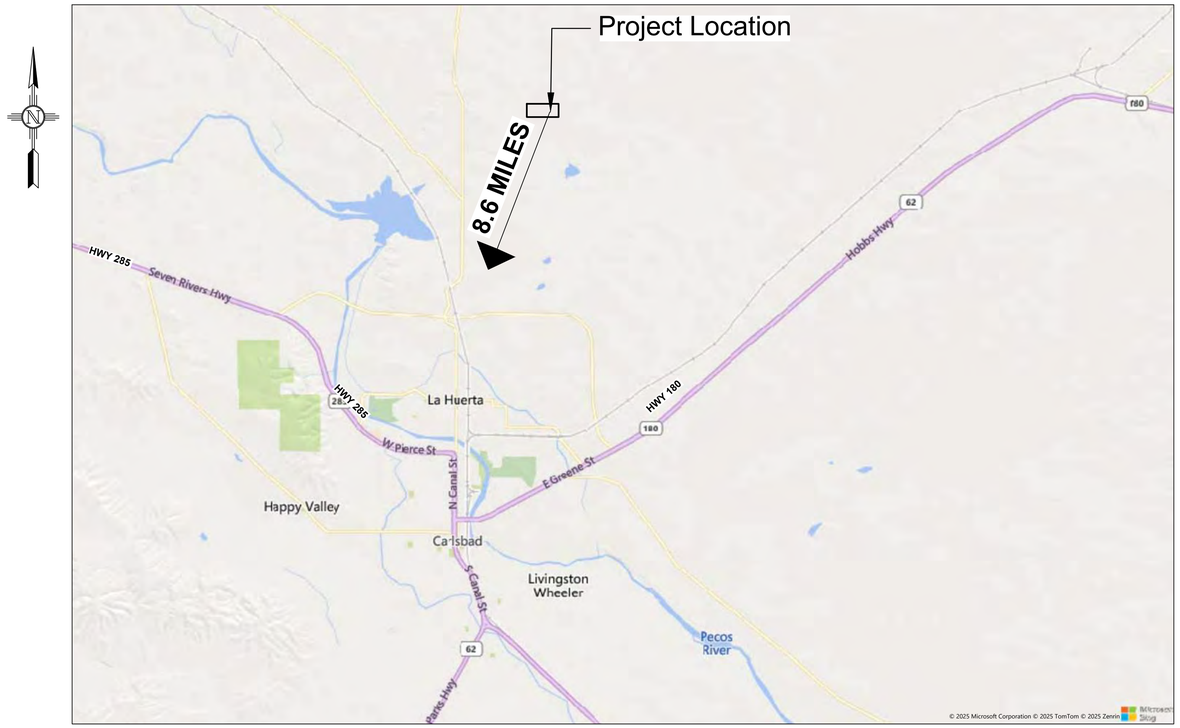
7921 N. World Dr.
Hobbs, NM 88242
Squarerootservices.net
575-231-7347

CIVIL PLANS

BTS MANAGEMENT LLC

TPW ANGEL RECYCLE FACILITY

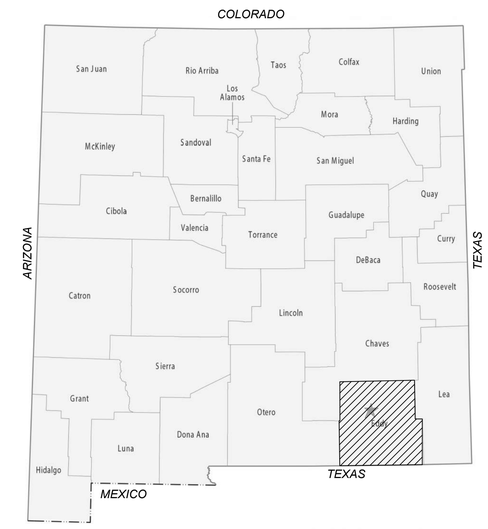
EDDY COUNTY
SECTION 32, TOWNSHIP 20 SOUTH, RANGE 28 EAST
N.M.P.M., EDDY COUNTY, NEW MEXICO



VICINITY MAP
N.T.S.

INDEX OF SHEETS		
SHEET	NAME	DESCRIPTION
1	C-100	COVER SHEET
2	SU-101	TOPOGRAPHIC SURVEY
3	CS-101	CIVIL SITE PLAN
4	CS-102	MASTER LAYOUT
5	CS-103	FENCE LAYOUT
6	CS-104	FUTURE DEVELOPMENT WEST CONTAINMENT WEST TO EAST PROFILE
7	CS-105	FUTURE DEVELOPMENT WEST CONTAINMENT NORTH TO SOUTH PROFILE
8	CS-106	EAST CONTAINMENT NORTH TO SOUTH PROFILE
9	CS-107	EAST CONTAINMENT EAST TO WEST PROFILE
10	CS-108	CONTAINMENTS VOLUME TABLE
11	CS-501	LEAK DETECTION DETAILS
12	CS-502	LINER DETAILS
13	CS-503	FENCE DETAILS

EDDY COUNTY
NEW MEXICO



Know what's below. Call before you dig.

(505)-254-7310

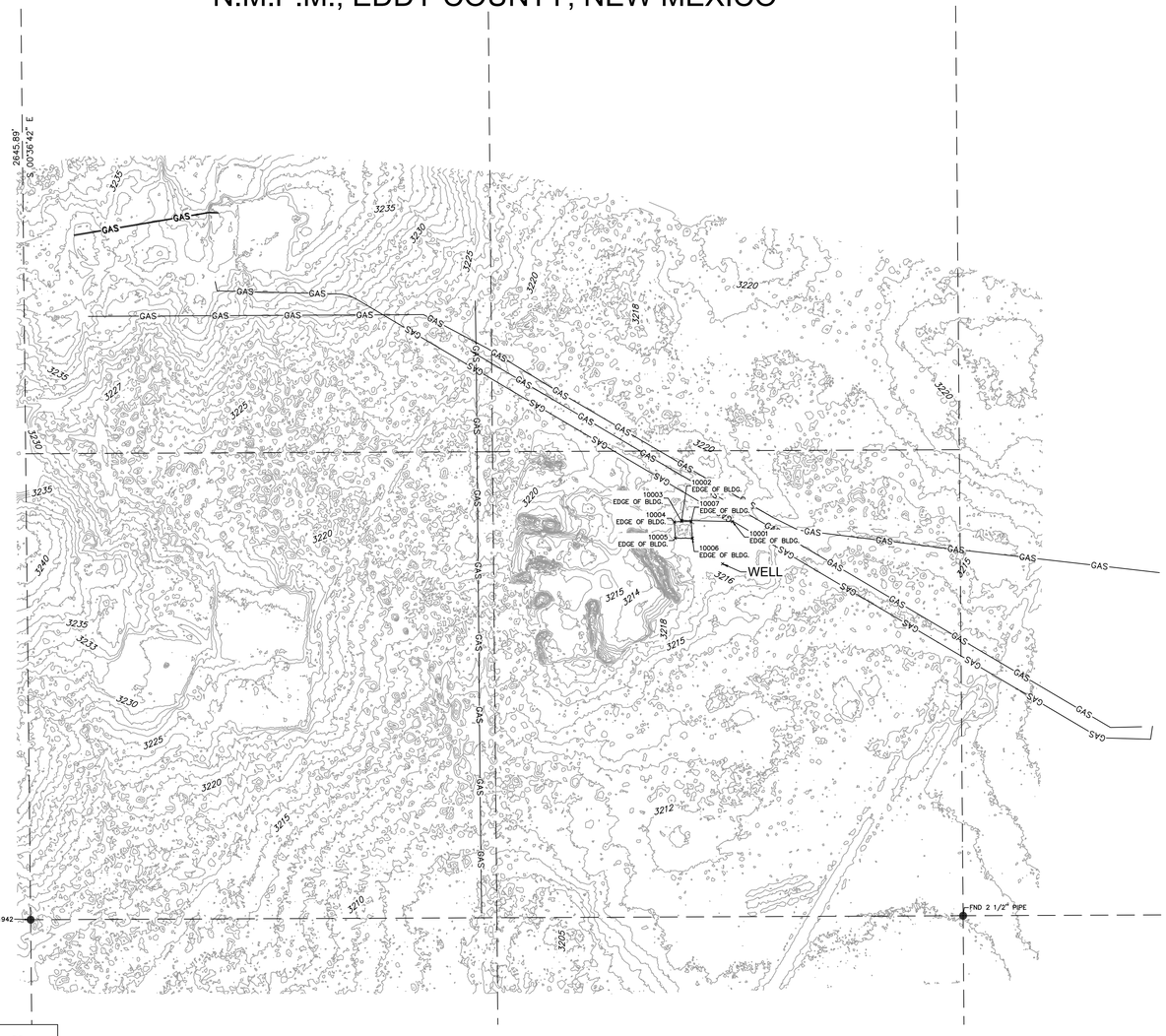
THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

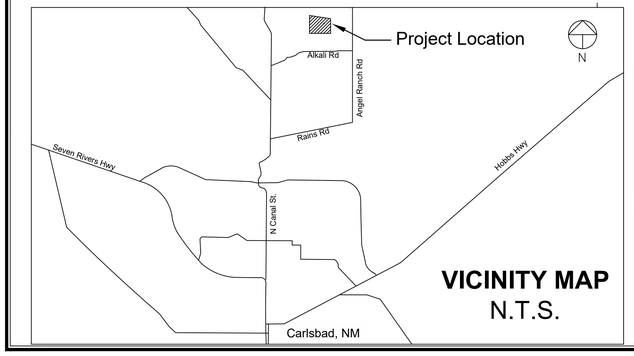
JEREMY BAKER
NEW MEXICO
16207
LICENSED PROFESSIONAL ENGINEER

04/07/2025

TOPOGRAPHIC SURVEY

of TPW ANGEL RECYCLE FACILITY
EDDY COUNTY
SECTION 32, TOWNSHIP 20 SOUTH, RANGE 28 EAST
N.M.P.M., EDDY COUNTY, NEW MEXICO





VICINITY MAP
N.T.S.

UTILITY NOTE

UTILITIES DEPICTED WERE OBTAINED THROUGH EVIDENCE: FROM FIELD OBSERVATIONS, PLANS AND/OR REPORTS PROVIDED BY THE CLIENT, AND MARKINGS COORDINATED BY THE NEW MEXICO 811. HOWEVER, LACKING EXCAVATION, THE EXACT LOCATION OF UNDERGROUND FEATURE CANNOT BE ACCURATELY, COMPLETELY, AND RELIABLY DEPICTED. WHERE ADDITIONAL OR MORE DETAILED INFORMATION IS REQUIRED, THE CLIENT IS ADVISED THAT EXCAVATION MAY BE NECESSARY.

TOPOGRAPHIC NOTE

THE TOPOGRAPHY SHOWN HEREIN IS A COMBINATION OF UAV DATA AND CONVENTIONAL/GPS DATA. THE UAV DATA WAS GENERATED USING INDUSTRY STANDARD QUALITY CHECKS AND IS **WITHIN** THE INDUSTRY RECOGNIZED GROUND SAMPLING DISTANCE (GSD) STANDARD OF BELOW 2.5 CM (1 IN / 0.08 FT). THE ABSOLUTE ACCURACY LEVEL IN STANDARD UAV DATA IS EQUAL TO 3 X GSD (3 X 0.08 FT = 0.24 FT). UAV DATA WAS USED FOR MEASUREMENTS ON NATURAL GROUND AND SUPPLEMENTAL FEATURES.

ONE CALL TICKET NUMBER
25JA240393

NEW MEXICO GAS COMPANY: MARKED IN AREA.
WINDSTREAM: MARKED IN AREA.
HOLLY ENERGY PARTNERS: MARKED IN AREA.
ENERGY TRANSFER: MARKED IN AREA.
XTO ENERGY: MARKED IN AREA.

JEREMY E. BAKER NEW MEXICO 25773 PROFESSIONAL SURVEYOR

I, JEREMY BAKER, NEW MEXICO PROFESSIONAL SURVEYOR NO. 25773, DO HEREBY CERTIFY THAT THIS TOPOGRAPHIC SURVEY PLAT AND THE ACTUAL SURVEY ON THE GROUND UPON WHICH IT IS BASED WERE PERFORMED BY ME OR UNDER MY DIRECT SUPERVISION; THAT I AM RESPONSIBLE FOR THIS SURVEY; THAT THIS SURVEY MEETS THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO; AND THAT IT IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF. I FURTHER CERTIFY THAT THIS SURVEY IS NOT A LAND DIVISION OR SUBDIVISION AS DEFINED IN THE NEW MEXICO SUBDIVISION ACT AND THAT THIS INSTRUMENT IS A TOPOGRAPHIC SURVEY PLAT OF AN EXISTING TRACT OR TRACTS.

Jeremy Baker
Jeremy Baker, N.M. P.S. 25773

04/07/2025
Date

SquareRoot services
Engineering | Surveying
Materials Testing

7921 N World Dr.
Hobbs, NM 88242-9032
Squarerootservices.net
575-231-7347

TYPE OF SURVEY:
TOPOGRAPHIC SURVEY
OF
PROJECT NAME:
CASCADE TPW ANGEL
FOR
CLIENT:
DAVE ANDERSON

PROJECT NUMBER:
24197

PROJECT SURVEYOR:
Jeremy Baker, PS
DRAWN BY:
Brenda Ramirez

GRAPHIC SCALE
0 200' 400'
SCALE: 1" = 200'
(IN FEET)

LEGEND

- FOUND MONUMENT AS NOTED
- GAS — UNDERGROUND GAS
- MAJOR CONTOUR (5 FT)
- MINOR CONTOUR (1 FT)
- BOUNDARY LINE

SHEET: 2 of 12
SU - 101

C:\Users\Xavier.Clark\OneDrive - squarerootservices.net\Project Folder\24197 Cascade TPW Angel (Dave Anderson)\Survey\DWG\24197 Cascade TPW Angel_TOPO.dwg 4/7/2025 2:27 PM

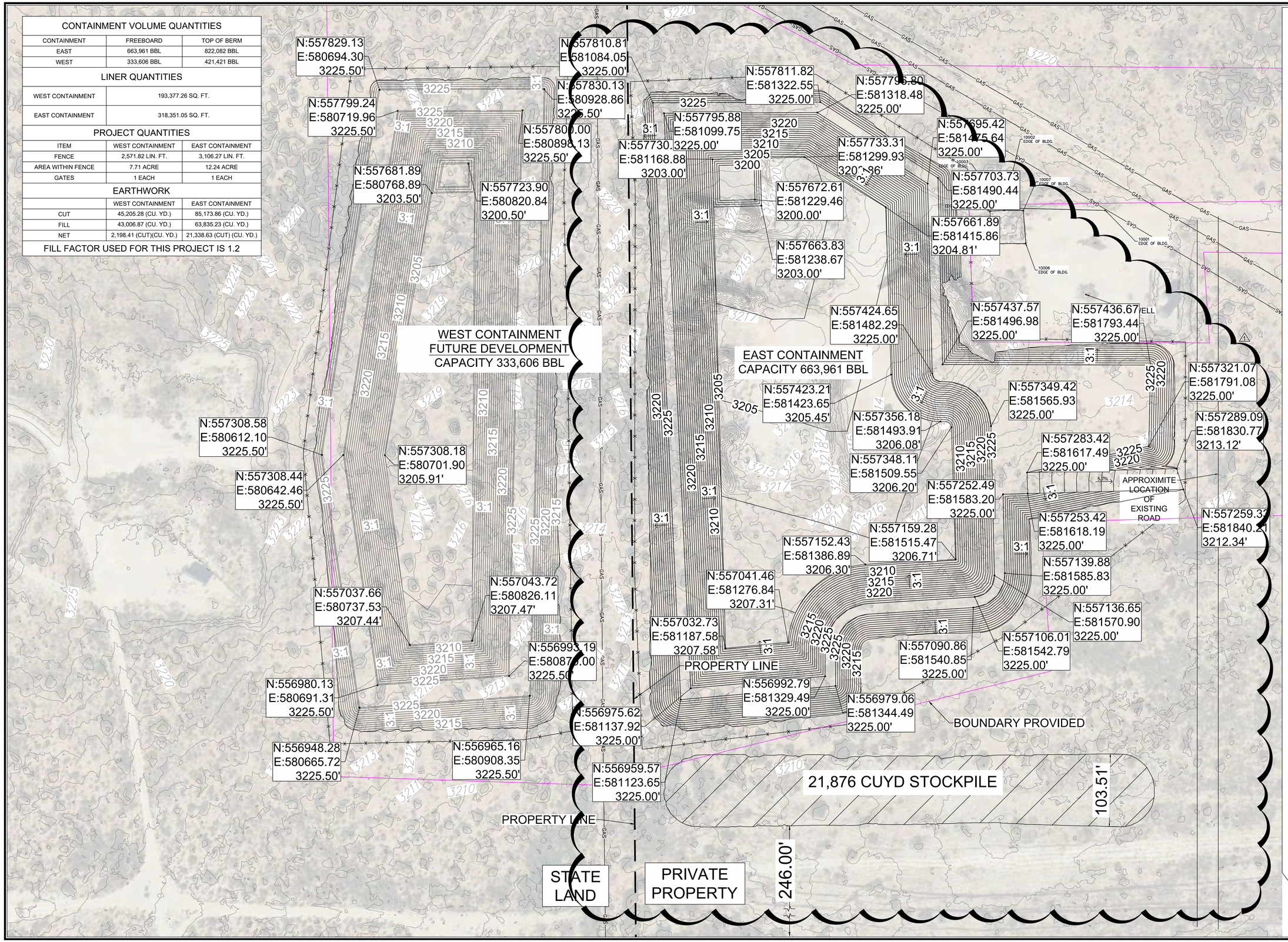
CONTAINMENT VOLUME QUANTITIES		
CONTAINMENT	FREEBOARD	TOP OF BERM
EAST	663,961 BBL	822,082 BBL
WEST	333,606 BBL	421,421 BBL

LINER QUANTITIES	
WEST CONTAINMENT	193,377.26 SQ. FT.
EAST CONTAINMENT	318,351.05 SQ. FT.

PROJECT QUANTITIES		
ITEM	WEST CONTAINMENT	EAST CONTAINMENT
FENCE	2,571.82 LIN. FT.	3,106.27 LIN. FT.
AREA WITHIN FENCE	7.71 ACRE	12.24 ACRE
GATES	1 EACH	1 EACH

EARTHWORK		
	WEST CONTAINMENT	EAST CONTAINMENT
CUT	45,205.28 (CU. YD.)	85,173.86 (CU. YD.)
FILL	43,006.87 (CU. YD.)	63,835.23 (CU. YD.)
NET	2,198.41 (CUT)(CU. YD.)	21,338.63 (CUT) (CU. YD.)

FILL FACTOR USED FOR THIS PROJECT IS 1.2



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Engineering | Surveying
Materials Testing

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Hobbs, NM 88242-9032
Squarerootservices.net
575-231-7347

ENGINEERING SHEET:

CIVIL SITE PLAN

OF

PROJECT NAME:

TPW ANGEL RECYCLE FACILITY

FOR

CLIENT:

BTS MANAGEMENT LLC

PROJECT NUMBER:

24197

PROJECT ENGINEER: JEREMY BAKER, PE

DRAWN BY: C. JIMENEZ

GRAPHIC SCALE

0 60' 120'

SCALE: 1" = 60'
(IN FEET)

REVISIONS		
No.	DATE	DESCRIPTION
1	4/07/2025	UPDATED EAST CONTAINMENT

JEREMY BAKER NEW MEXICO 16207 LICENSED PROFESSIONAL ENGINEER

04/07/2025

SHEET: 3 of 13

CS-101

PROPOSED FENCE

EXISTING GAS LINE

PROPOSED 15 FOOT BERM

PROPOSED 30 FOOT BERM

177.18'

30.00'

RUB SHEET

52.22'

218.74'

15.00'

RUB SHEET

131.10'

50.00'

15.00'

187.01'

136.17'

68.00'

15.00'

496.88'

430.32'

WEST CONTAINMENT
FUTURE DEVELOPMENT
CAPACITY 333,606 BBL

EAST CONTAINMENT
CAPACITY 663,961 BBL

238.81'

270.78'

266.24'

WELL

296.46'

689.36'

807.03'

821.15'

697.70'

153.79'

115.62'

173.48'

50.00'

188.92'

256.08'

30.00'

331.92'

272.70'

RUB SHEET

188.14'

128.77'

152.68'

89.69'

38.76'

15.00'

192.33'

BOUNDARY PROVIDED

PROPERTY LINE

PROPOSED FENCE
MINIMUM DISTANCE
FROM TOE OF POND
TO BE 15'

TOP SOIL STORAGE AREA

10002 EDGE OF BLDG.
10003 EDGE OF BLDG.
10007 EDGE OF BLDG.
10004 EDGE OF BLDG.
10001 EDGE OF BLDG.
10005 EDGE OF BLDG.
10006 EDGE OF BLDG.

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Materials Testing

7921 N World Dr.
Hobbs, NM 88242-9032
Squarerootservices.net
575-231-7347

ENGINEERING SHEET:

MASTER LAYOUT

OF

PROJECT NAME:

TPW ANGEL RECYCLE FACILITY

FOR

CLIENT:

BTS MANAGEMENT LLC

PROJECT NUMBER:

24197

PROJECT ENGINEER: JEREMY BAKER, PE

DRAWN BY: C. JIMENEZ

GRAPHIC SCALE

0 60' 120'

SCALE: 1" = 60'
(IN FEET)

REVISIONS

No.	DATE	DESCRIPTION
1	4/07/2025	UPDATED EAST CONTAINMENT

JEREMY BAKER
NEW MEXICO
16207
LICENSED PROFESSIONAL ENGINEER

04/07/2025

SHEET: 4 of 13

CS-102

PROJECT QUANTITIES		
ITEM	WEST CONTAINMENT	EAST CONTAINMENT
FENCE	2571.82 LIN. FT.	3106.27 LIN. FT.
AREA WITHIN FENCE	7.71 ACRE	12.24 ACRE
GATES	1 EACH	1 EACH

FENCE N:557859.07 E:580654.37

FENCE N:557861.62 E:580963.29

FENCE N:557840.86 E:581051.64

FENCE N:557851.45 E:581316.24

FENCE N:557716.12 E:581532.87

FENCE N:557684.21 E:580956.91

FENCE N:557685.57 E:581058.78

WEST CONTAINMENT
FUTURE DEVELOPMENT
CAPACITY 333,606 BBL

EAST CONTAINMENT
CAPACITY 663,961 BBL

FENCE N:557475.77 E:581540.66

WELL

FENCE N:557469.69 E:581843.18

FENCE N:557407.30 E:580963.06

FENCE N:557310.22 E:580585.48

FENCE N:557139.96 E:581057.83

FENCE N:557244.57 E:581842.89

PROPERTY LINE

FENCE N:557057.04 E:581597.57

BOUNDARY PROVIDED

FENCE N:556896.33 E:580623.69

FENCE N:556902.62 E:580901.33

FENCE N:556914.90 E:580969.63

PROPERTY LINE

FENCE N:556888.70 E:581068.74

FENCE N:556924.17 E:581361.98

SquareRoot services
Engineering | Surveying
Materials Testing

7921 N World Dr.
Hobbs, NM 88242-9032
Squarerootservices.net
575-231-7347

ENGINEERING SHEET:

FENCE LAYOUT

OF

PROJECT NAME:

TPW ANGEL RECYCLE FACILITY

FOR

CLIENT:

BTS MANAGEMENT LLC

PROJECT NUMBER: 24197

PROJECT ENGINEER: JEREMY BAKER, PE

DRAWN BY: C. JIMENEZ

GRAPHIC SCALE
0 60' 120'
SCALE: 1" = 60'
(IN FEET)

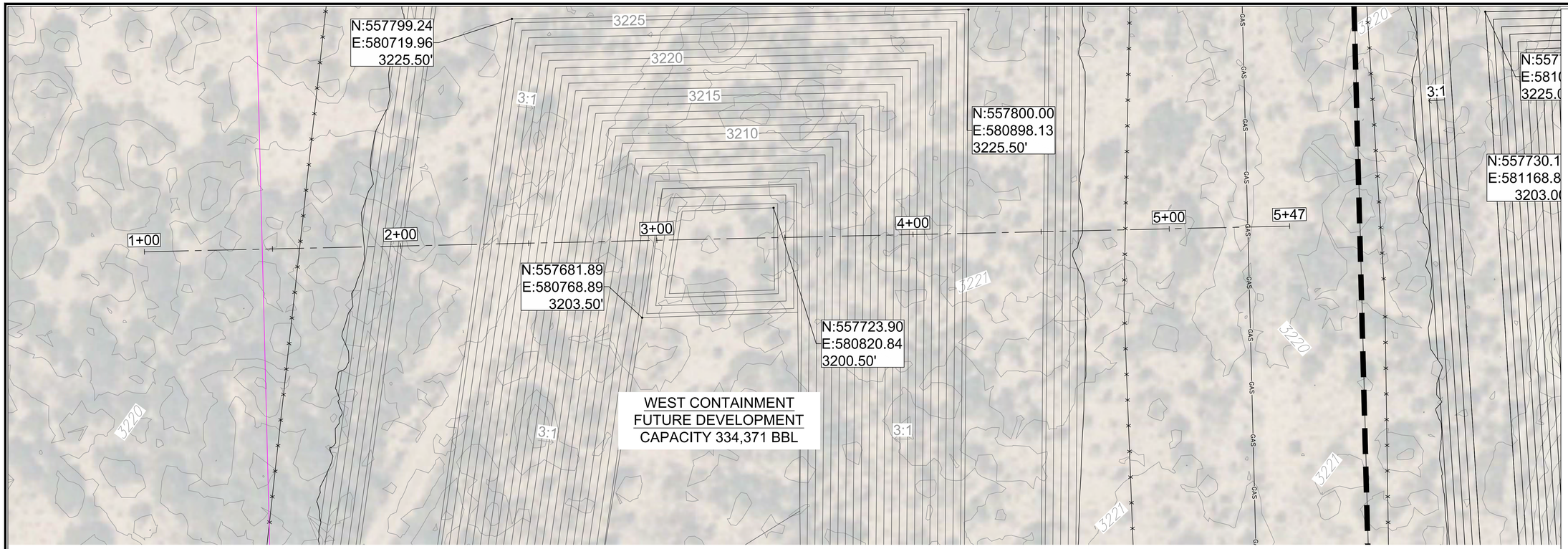
REVISIONS		
No.	DATE	DESCRIPTION
1	4/07/2025	UPDATED EAST CONTAINMENT

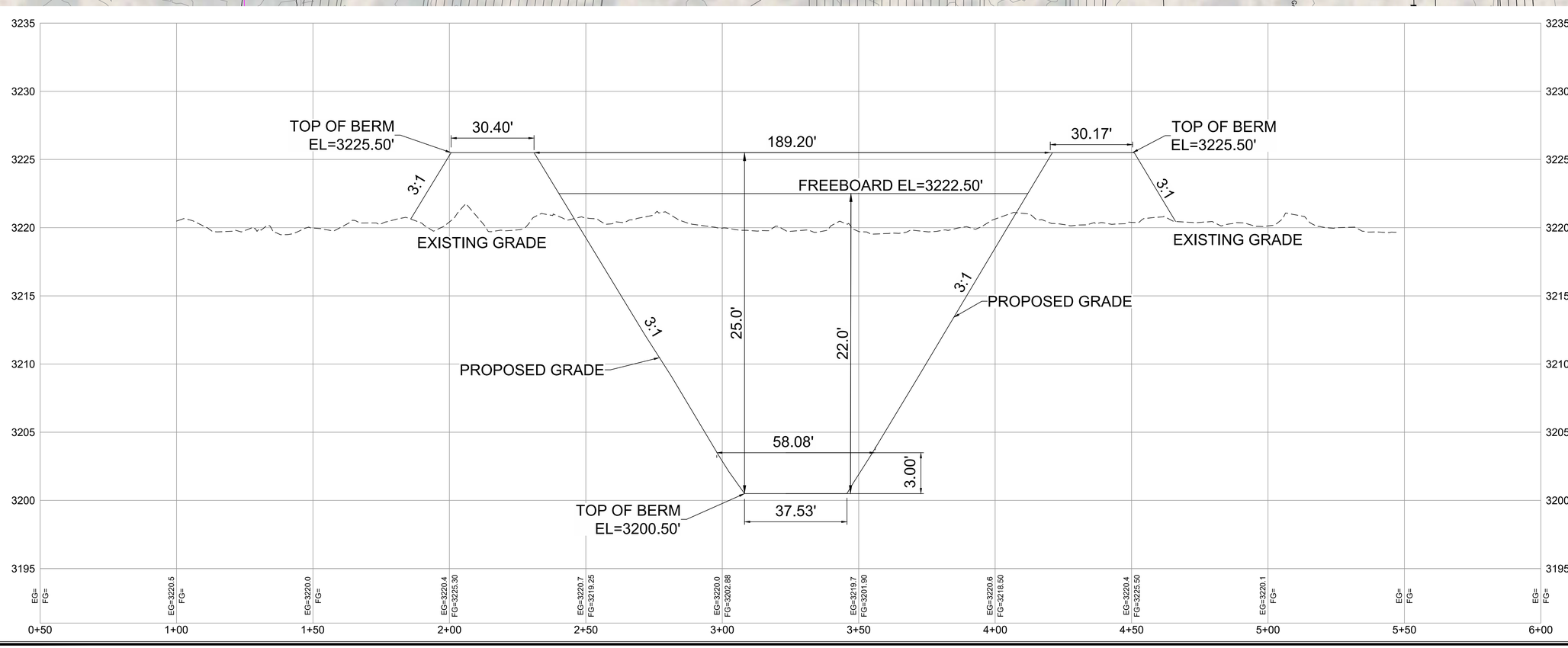
JEREMY BAKER NEW MEXICO 16207 LICENSED PROFESSIONAL ENGINEER

04/07/2025

SHEET: 5 of 13

CS-103





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ENGINEERING SHEET:
FUTURE DEVELOPMENT
WEST CONTAINMENT
WEST TO EAST PROFILE
OF
PROJECT NAME:
TPW ANGEL RECYCLE FACILITY
FOR
CLIENT:
BTS MANAGEMENT LLC

PROJECT NUMBER: 24197

PROJECT ENGINEER: JEREMY BAKER, PE
DRAWN BY: C. JIMENEZ

GRAPHIC SCALE
VERTICAL
0 4' 8'
SCALE: 1" = 4'
(IN FEET)

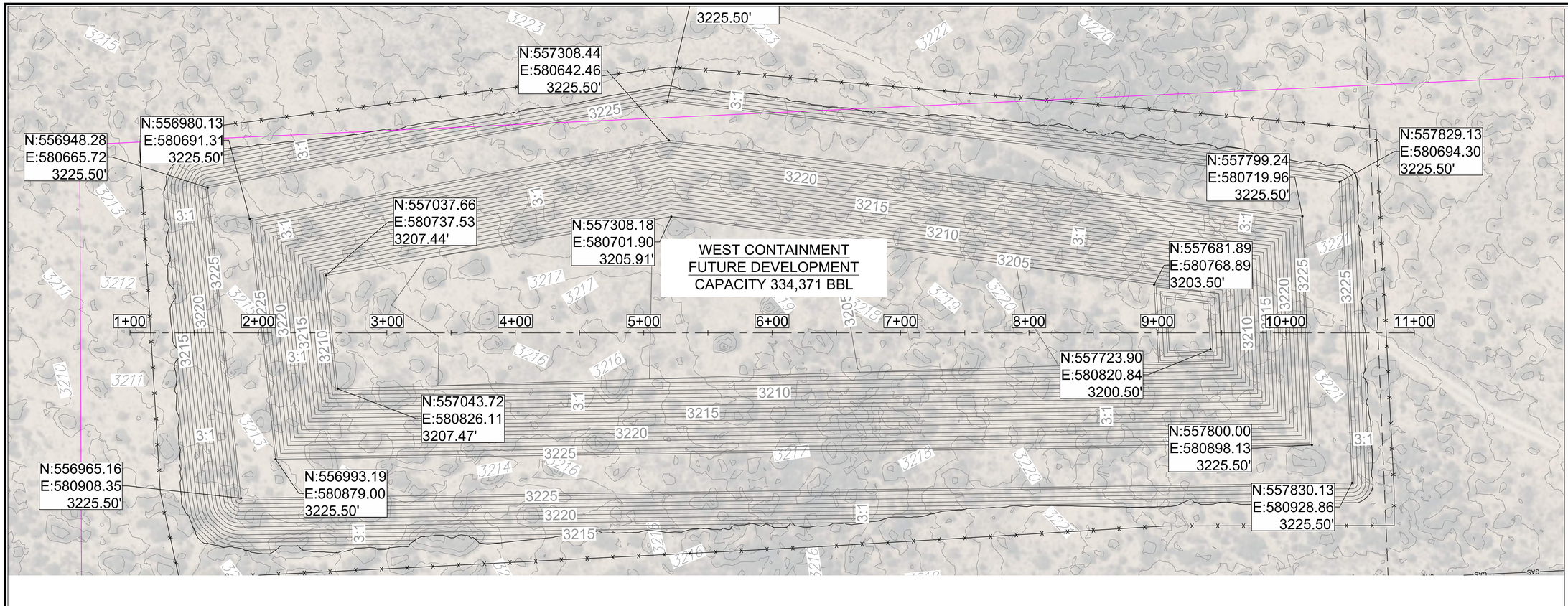
GRAPHIC SCALE
HORIZONTAL
0 20' 40'
SCALE: 1" = 20'
(IN FEET)

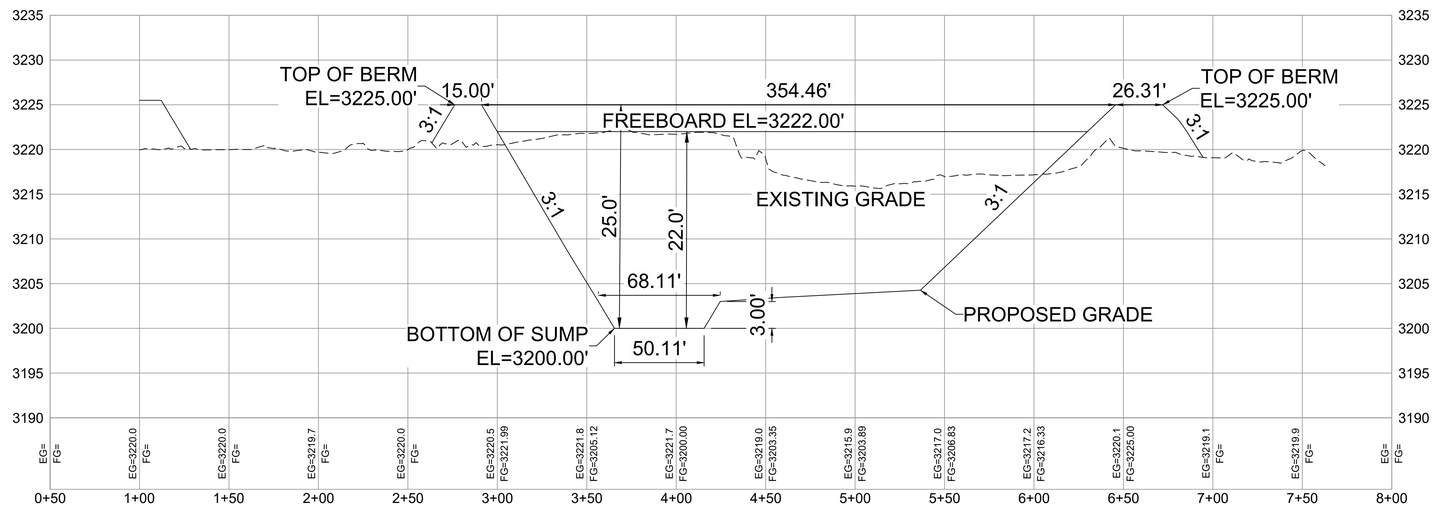
REVISIONS

No.	DATE	DESCRIPTION

JEREMY BAKER NEW MEXICO 16207 LICENSED PROFESSIONAL ENGINEER
04/07/2025

SHEET: 6 of 13
CS-104





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ENGINEERING SHEET:
FUTURE DEVELOPMENT
WEST CONTAINMENT
NORTH TO SOUTH PROFILE
OF
PROJECT NAME:

TPW ANGEL RECYCLE FACILITY

FOR
CLIENT:

BTS MANAGEMENT LLC

PROJECT NUMBER:
24197

PROJECT ENGINEER: JEREMY BAKER, PE
DRAWN BY: C. JIMENEZ

GRAPHIC SCALE
HORIZONTAL
0 40' 80'
SCALE: 1" = 40'
(IN FEET)

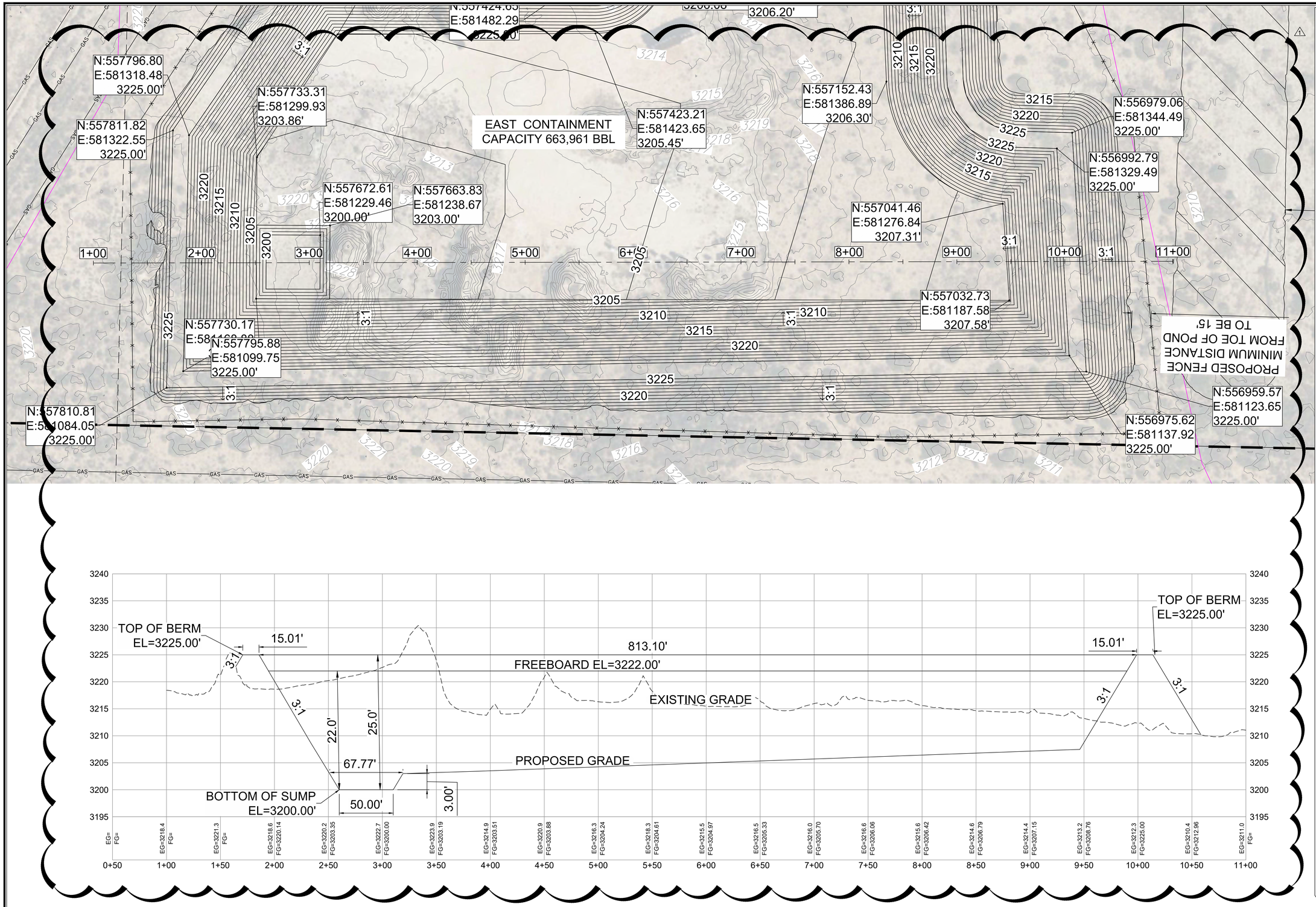
GRAPHIC SCALE
VERTICAL
0 8' 16'
SCALE: 1" = 8'
(IN FEET)

REVISIONS

No.	DATE	DESCRIPTION

JEREMY BAKER NEW MEXICO 16207 LICENSED PROFESSIONAL ENGINEER
04/07/2025

SHEET: 7 of 13
CS-105



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ENGINEERING SHEET:
EAST CONTAINMENT
NORTH TO SOUTH
PROFILE
OF

PROJECT NAME:
TPW ANGEL RECYCLE
FACILITY

FOR

CLIENT:
BTS MANAGEMENT LLC

PROJECT NUMBER:
24197

PROJECT ENGINEER:
JEREMY BAKER, PE

DRAWN BY:
C. JIMENEZ

GRAPHIC SCALE
HORIZONTAL
0 40' 80'
SCALE: 1" = 40'
(IN FEET)

GRAPHIC SCALE
VERTICAL
0 8' 16'
SCALE: 1" = 8'
(IN FEET)

REVISIONS

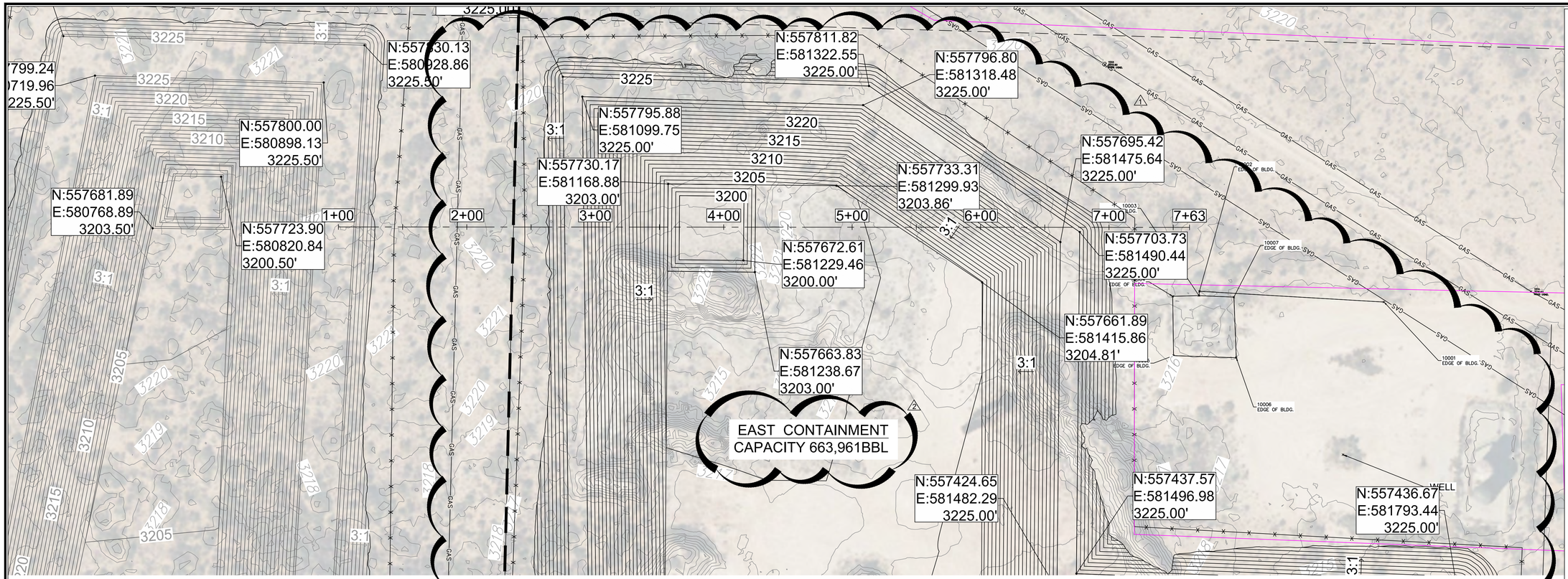
No.	DATE	DESCRIPTION
1	4/07/2025	UPDATED EAST CONTAINMENT

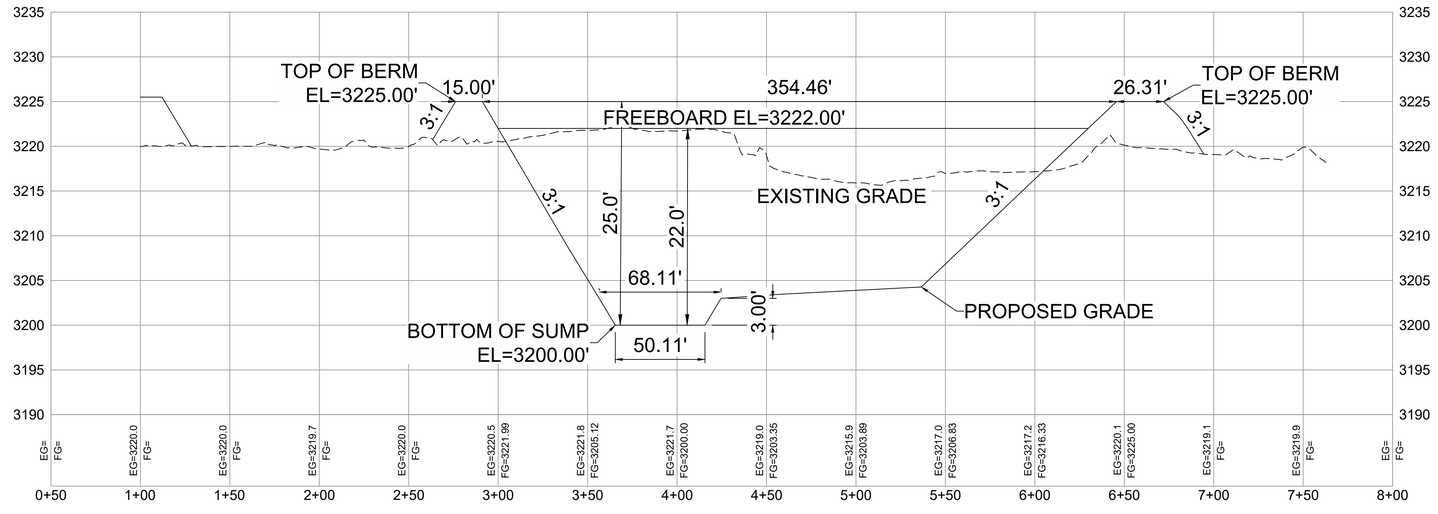
JEREMY BAKER
NEW MEXICO
16207
LICENSED PROFESSIONAL ENGINEER

04/07/2025

SHEET: 8 of 13

CS-106





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ENGINEERING SHEET:
EAST CONTAINMENT
EAST TO WEST
PROFILE
OF

PROJECT NAME:

TPW ANGEL RECYCLE FACILITY

FOR

CLIENT:

BTS MANAGEMENT LLC

PROJECT NUMBER:
24197

PROJECT ENGINEER:
JEREMY BAKER, PE

DRAWN BY:
C. JIMENEZ

GRAPHIC SCALE
HORIZONTAL
0 40' 80'
SCALE: 1" = 40'
(IN FEET)

GRAPHIC SCALE
VERTICAL
0 8' 16'
SCALE: 1" = 8'
(IN FEET)

REVISIONS

No.	DATE	DESCRIPTION
1	4/07/2025	UPDATED EAST CONTAINMENT
2	4/08/2025	UPDATED VOLUME CAPACITY

JEREMY BAKER
NEW MEXICO
16207
LICENSED PROFESSIONAL ENGINEER

04/08/2025

SHEET: 9 of 13
CS-107

EAST CONTAINMENT VOLUME QUANTITIES

1 2

ELEVATION (FT)	CONTAINMENT DEPTH (FT)	REMAINING STORAGE (FT)	REMAINING STORAGE VOL (FT3)	REMAINING STORAGE VOL (GAL)	REMAINING STORAGE VOL (BBL)	PERCENT OF TOTAL VOL (%)	VOL IN CONTAINMENT (FT3)	VOL IN CONTAINMENT (GAL)	VOL IN CONTAINMENT (BBL)	VOL IN CONTAINMENT (AC-FT)	PERCENT OF TOTAL VOL (%)	
3,225.00	0	25	0	-	-	0%	4,577,008	34,240,594	815,139	105.07	100%	
3,224.00	1	24	291,220	2,178,616	51,865	6%	4,285,788	32,061,978	763,275	98.39	94%	FREEBOARD
3,223.00	2	23	575,471	4,305,096	102,488	13%	4,001,537	29,935,498	712,651	91.86	87%	
3,222.00	3	22	848,868	6,350,380	151,179	19%	3,728,140	27,890,213	663,961	85.59	81%	MAX VOLUME
3,221.00	4	21	1,123,335	8,403,670	200,060	25%	3,453,672	25,836,924	615,080	79.29	75%	
3,220.00	5	20	1,387,083	10,376,771	247,032	30%	3,189,924	23,863,823	568,108	73.23	70%	
3,219.00	6	19	1,644,132	12,299,754	292,811	36%	2,932,875	21,940,840	522,329	67.33	64%	
3,218.00	7	18	1,894,549	14,173,122	337,409	41%	2,682,458	20,067,472	477,731	61.58	59%	
3,217.00	8	17	2,138,401	15,997,380	380,837	47%	2,438,606	18,243,214	434,302	55.98	53%	
3,216.00	9	16	2,375,756	17,773,032	423,109	52%	2,201,251	16,467,562	392,031	50.53	48%	
3,215.00	10	15	2,606,681	19,500,582	464,235	57%	1,970,326	14,740,012	350,904	45.23	43%	
3,214.00	11	14	2,831,244	21,180,534	504,229	62%	1,745,764	13,060,060	310,911	40.08	38%	STORAGE
3,213.00	12	13	3,049,511	22,813,392	543,101	67%	1,527,497	11,427,202	272,039	35.07	33%	VOLUME
3,212.00	13	12	3,261,551	24,399,660	580,864	71%	1,315,457	9,840,934	234,276	30.20	29%	
3,211.00	14	11	3,467,430	25,939,842	617,530	76%	1,109,578	8,300,752	197,610	25.47	24%	
3,210.00	15	10	3,667,216	27,434,442	653,111	80%	909,792	6,806,152	162,029	20.89	20%	
3,209.00	16	9	3,860,976	28,883,965	687,618	84%	716,031	5,356,629	127,521	16.44	16%	
3,208.00	17	8	4,048,779	30,288,914	721,065	88%	528,229	3,951,680	94,075	12.13	12%	
3,207.00	18	7	4,227,860	31,628,618	752,958	92%	349,148	2,611,975	62,181	8.02	8%	
3,206.00	19	6	4,381,071	32,774,795	780,244	96%	195,936	1,465,799	34,895	4.50	4%	FLOOR
3,205.00	20	5	4,488,940	33,581,761	799,455	98%	88,067	658,833	15,684	2.02	2%	VOLUME
3,204.00	21	4	4,547,196	34,017,571	809,830	99%	29,812	223,023	5,309	0.68	1%	
3,203.00	22	3	4,566,449	34,161,601	813,259	100%	10,559	78,993	1,881	0.24	0%	
3,202.00	23	2	4,570,689	34,193,322	814,014	100%	6,319	47,272	1,125	0.15	0%	SUMP
3,201.00	24	1	4,574,184	34,219,473	814,637	100%	2,823	21,121	503	0.06	0%	VOLUME
3,200.00	25	0	4,577,008	34,240,594	815,139	100%	0	0	0	0.00	0%	

WEST CONTAINMENT VOLUME QUANTITIES

ELEVATION (FT)	CONTAINMENT DEPTH (FT)	REMAINING STORAGE (FT)	REMAINING STORAGE VOL (FT3)	REMAINING STORAGE VOL (GAL)	REMAINING STORAGE VOL (BBL)	PERCENT OF TOTAL VOL (%)	VOL IN CONTAINMENT (FT3)	VOL IN CONTAINMENT (GAL)	VOL IN CONTAINMENT (BBL)	VOL IN CONTAINMENT (AC-FT)	PERCENT OF TOTAL VOL (%)	
3,225.50	0	25	0	-	-	0%	2,366,277	17,702,120	421,421	54.32	100%	
3,224.50	1	24	170,273	1,273,811	30,325	7%	2,196,005	16,428,310	391,096	50.41	93%	FREEBOARD
3,223.50	2	23	334,609	2,503,207	59,592	14%	2,031,669	15,198,914	361,829	46.64	86%	
3,222.50	3	22	493,077	3,688,711	87,814	21%	1,873,200	14,013,410	333,606	43.00	79%	MAX VOLUME
3,221.50	4	21	645,749	4,830,846	115,004	27%	1,720,529	12,871,274	306,416	39.50	73%	
3,220.50	5	20	792,693	5,930,134	141,174	33%	1,573,585	11,771,986	280,247	36.12	67%	
3,219.50	6	19	933,979	6,987,094	166,336	39%	1,432,299	10,715,027	255,084	32.88	61%	
3,218.50	7	18	1,069,677	8,002,250	190,503	45%	1,296,601	9,699,870	230,917	29.77	55%	
3,217.50	8	17	1,199,856	8,976,123	213,688	51%	1,166,421	8,725,998	207,733	26.78	49%	
3,216.50	9	16	1,324,587	9,909,232	235,901	56%	1,041,691	7,792,889	185,519	23.91	44%	
3,215.50	10	15	1,443,938	10,802,101	257,157	61%	922,339	6,900,019	164,263	21.17	39%	
3,214.50	11	14	1,557,980	11,655,252	277,468	66%	808,297	6,046,869	143,953	18.56	34%	STORAGE
3,213.50	12	13	1,666,783	12,469,205	296,845	70%	699,494	5,232,916	124,576	16.06	30%	VOLUME
3,212.50	13	12	1,770,416	13,244,484	315,301	75%	595,861	4,457,637	106,120	13.68	25%	
3,211.50	14	11	1,868,949	13,981,607	332,849	79%	497,328	3,720,514	88,571	11.42	21%	
3,210.50	15	10	1,962,451	14,681,096	349,502	83%	403,826	3,021,025	71,919	9.27	17%	
3,209.50	16	9	2,050,993	15,343,476	365,270	87%	315,285	2,358,645	56,150	7.24	13%	
3,208.50	17	8	2,134,643	15,969,266	380,168	90%	231,634	1,732,855	41,253	5.32	10%	
3,207.50	18	7	2,213,472	16,558,987	394,207	94%	152,805	1,143,133	27,214	3.51	6%	
3,206.50	19	6	2,280,918	17,063,551	406,219	96%	85,359	638,570	15,202	1.96	4%	FLOOR
3,205.50	20	5	2,325,406	17,396,361	414,142	98%	40,872	305,760	7,279	0.94	2%	VOLUME
3,204.50	21	4	2,350,011	17,580,431	418,524	99%	16,266	121,689	2,897	0.37	1%	
3,203.50	22	3	2,360,161	17,656,364	420,331	100%	6,116	45,756	1,089	0.14	0%	
3,202.50	23	2	2,362,802	17,676,123	420,802	100%	3,475	25,998	619	0.08	0%	SUMP
3,201.50	24	1	2,364,807	17,691,124	421,159	100%	1,470	10,996	262	0.03	0%	VOLUME
3,200.50	25	0	2,366,277	17,702,120	421,421	100%	0	0	0	0.00	0%	

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ENGINEERING SHEET:
CONTAINMENTS VOLUME TABLE
OF
PROJECT NAME:
TPW ANGEL RECYCLE FACILITY
FOR
CLIENT:
BTS MANAGEMENT LLC

PROJECT NUMBER: 24197

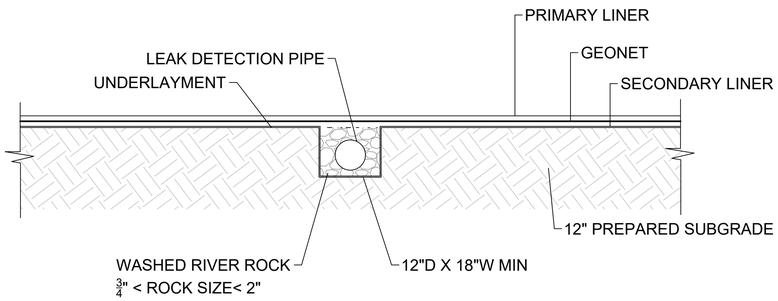
PROJECT ENGINEER: JEREMY BAKER, PE
DRAWN BY: C. JIMENEZ

REVISIONS

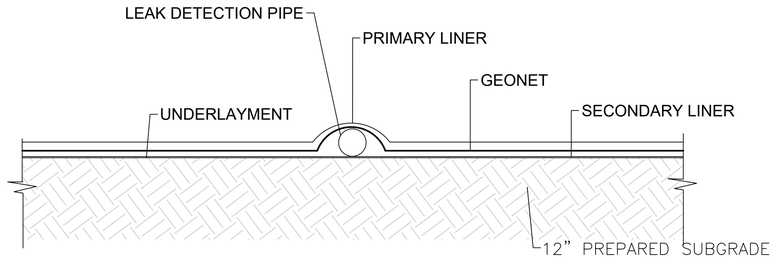
No.	DATE	DESCRIPTION
1	4/07/2025	UPDATED EAST CONTAINMENT
2	4/08/2025	UPDATED VOLUME CAPACITY

JEREMY BAKER NEW MEXICO 16207 LICENSED PROFESSIONAL ENGINEER
04/08/2025

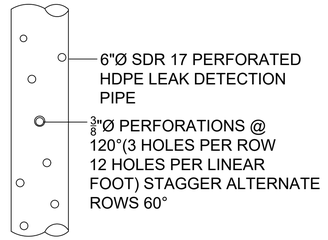
SHEET: 10 of 13
CS-108



1A SUMP DETECTION CROSS SECTION



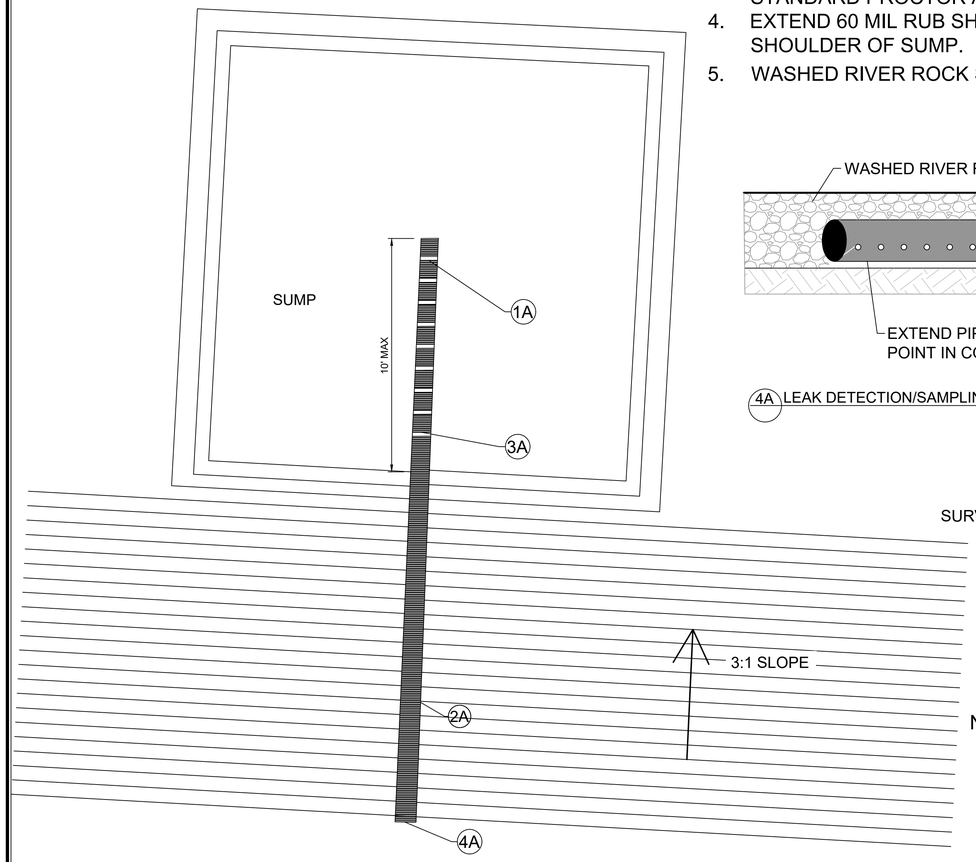
2A SIDE SLOPE LEAK DETECTION PIPE DETAIL



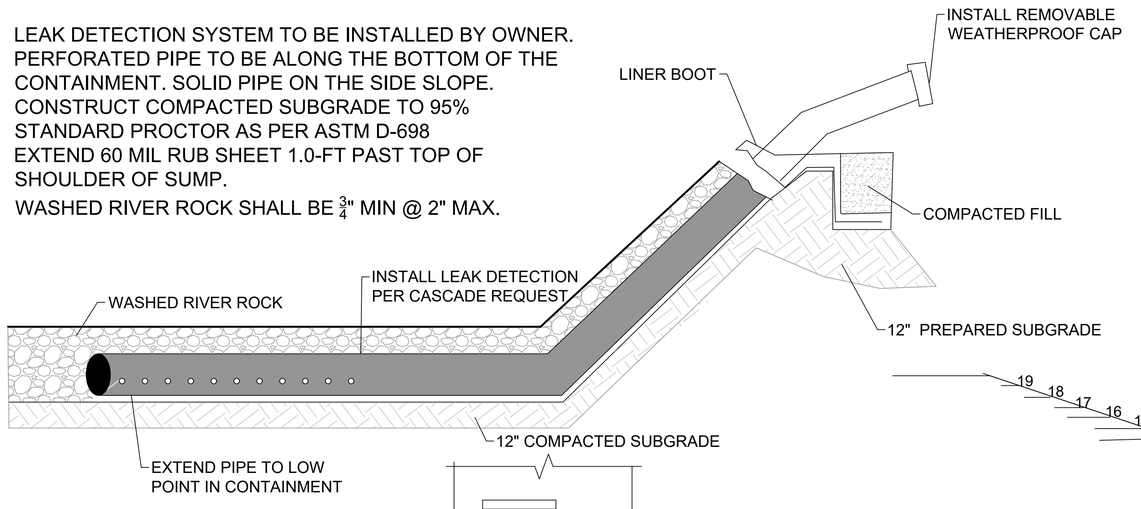
3A PERFORATED PIPE DETAIL

NOTES:

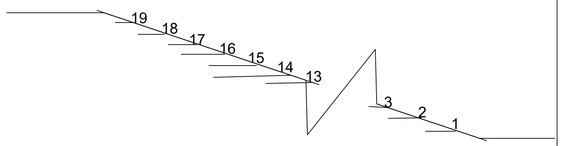
1. LEAK DETECTION SYSTEM TO BE INSTALLED BY OWNER.
2. PERFORATED PIPE TO BE ALONG THE BOTTOM OF THE CONTAINMENT. SOLID PIPE ON THE SIDE SLOPE.
3. CONSTRUCT COMPACTED SUBGRADE TO 95% STANDARD PROCTOR AS PER ASTM D-698
4. EXTEND 60 MIL RUB SHEET 1.0-FT PAST TOP OF SHOULDER OF SUMP.
5. WASHED RIVER ROCK SHALL BE ¾" MIN @ 2" MAX.

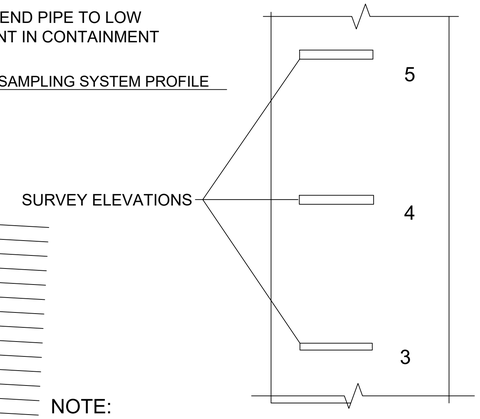


1 CONTAINMENT SUMP PLAN DETAIL



4A LEAK DETECTION/SAMPLING SYSTEM PROFILE





NOTE:

1. LEVEL MARKS TO BE LOCATED BY SURVEYOR
2. MARKS TO BE MADE BY AN EXTRUSION WELDER USING BLACK FILAMENT (OR WHITE FILAMENT ON BLACK LINER)
3. MARKS WILL BE DETERMINE ON THE FIELD BY THE OWNER AND CONTINUE TO THE TOP OF THE BERM.
4. REFERENCE PIT CAPACITY TABLES FOR ACCURATE ELEVATIONS.

2 WATER LEVEL MARKS

PROPOSED PIT REFERENCE TABLE

DETAIL	DESCRIPTION
PRIMARY LINER	60 MIL HDPE LINER
LEAK DETECTION	200 MIL GEONET
SECONDARY LINER	40 MIL HDPE LINER
UNDERLAYMENT	COMPACTED SUBGRADE/10 OZ GEOTEXTILE
WEST CONTAINMENT	
BOTTOM OF CONTAINMENT	3200.50'
BERM (ROAD CREST)	3225.50'
EAST CONTAINMENT	
BOTTOM OF CONTAINMENT	3200.00'
BERM (ROAD CREST)	3225.00'
LEAK DETECTION PIPING	6-IN SDR17 X PERFORATED HEPE PIPE LEAK DETECTION PIPE

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ENGINEERING SHEET:
LEAK DETECTION DETAILS
OF
PROJECT NAME:
TPW ANGEL RECYCLE FACILITY
FOR
CLIENT:
BTS MANAGEMENT LLC

PROJECT NUMBER: 24197

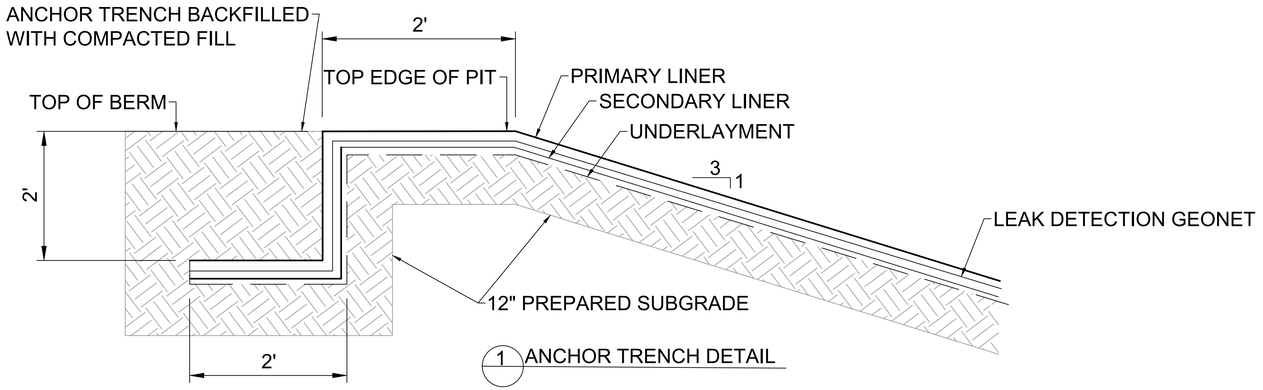
PROJECT ENGINEER: JEREMY BAKER, PE
DRAWN BY: C. JIMENEZ

REVISIONS

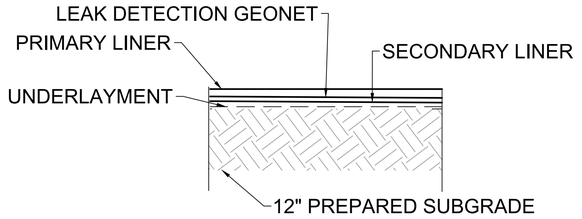
No.	DATE	DESCRIPTION

JEREMY BAKER NEW MEXICO 16207 LICENSED PROFESSIONAL ENGINEER
04/07/2025

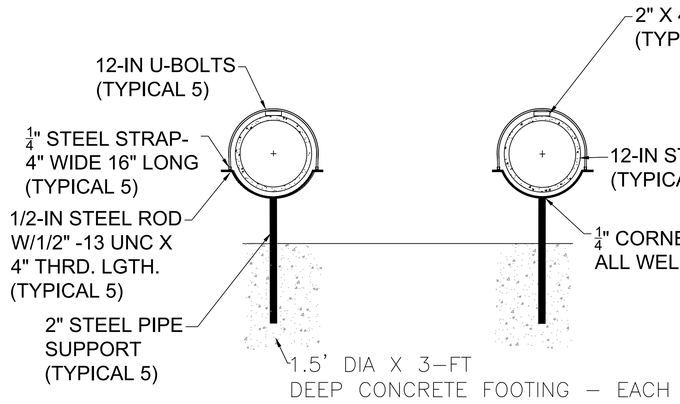
SHEET: 11 of 13
CS-501



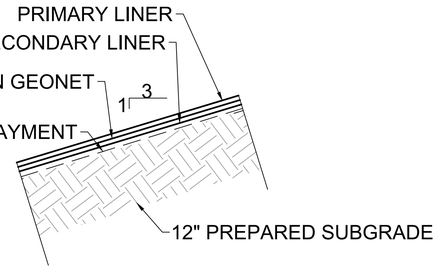
1 ANCHOR TRENCH DETAIL



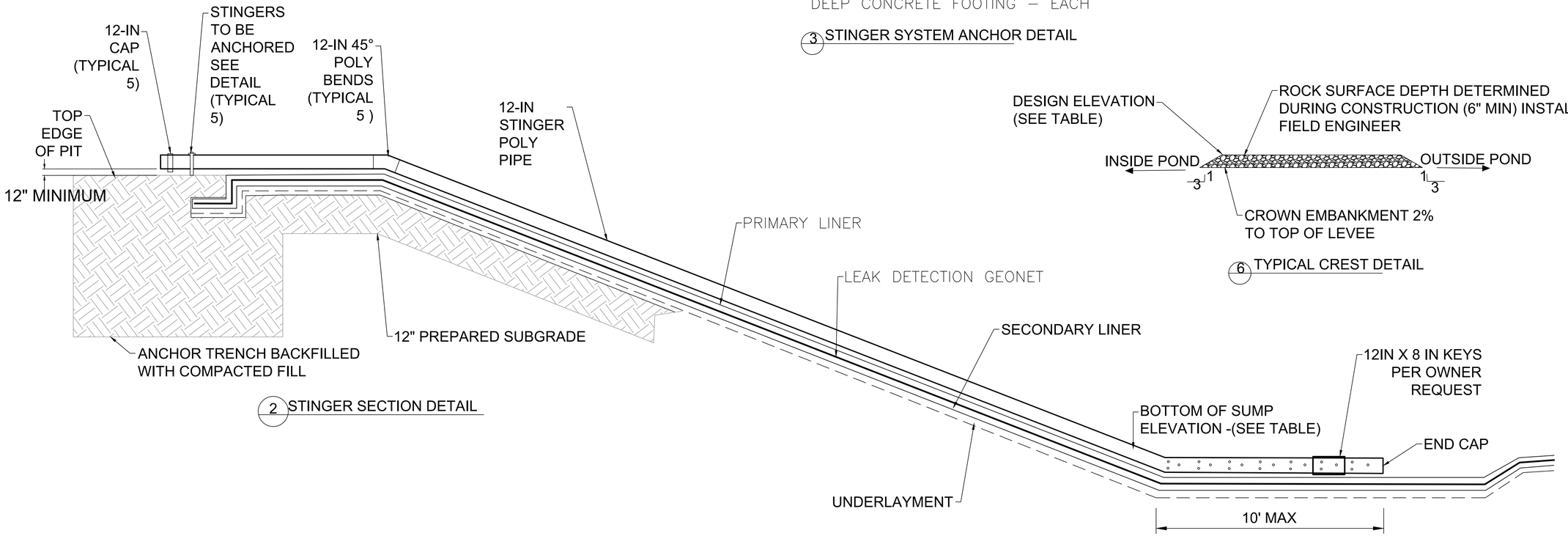
4 LINER SYSTEM FLOOR DETAIL



3 STINGER SYSTEM ANCHOR DETAIL



5 LINER SYSTEM SIDE SLOPE



2 STINGER SECTION DETAIL

6 TYPICAL CREST DETAIL

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ENGINEERING SHEET:

LINER DETAILS

OF

PROJECT NAME:

TPW ANGEL RECYCLE FACILITY

FOR

CLIENT:

BTS MANAGEMENT LLC

PROJECT NUMBER: 24197

PROJECT ENGINEER: JEREMY BAKER, PE

DRAWN BY: C. JIMENEZ

REVISIONS

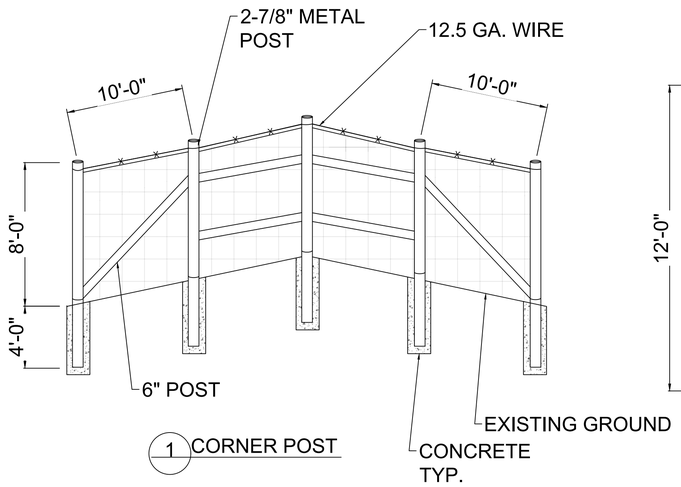
No.	DATE	DESCRIPTION

JEREMY BAKER NEW MEXICO 16207 LICENSED PROFESSIONAL ENGINEER

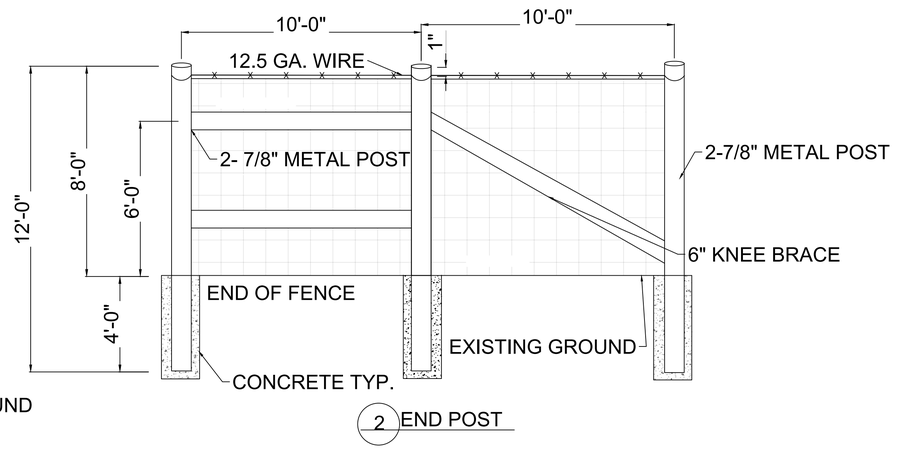
04/07/2025

SHEET: 12 of 13

CS-502



1 CORNER POST



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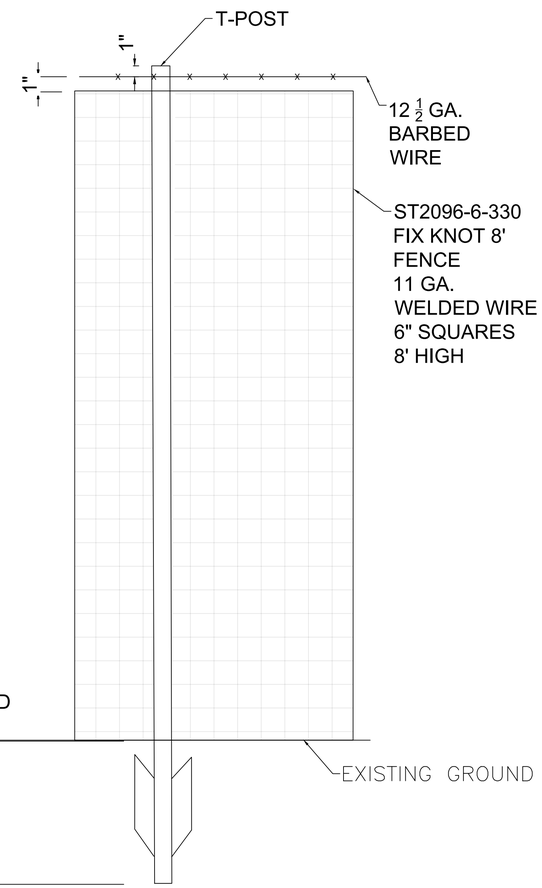


4A METAL POST

3 LINE BRACE POST

4 LINE POST

5 GATE POSTS

SquareRoot services
Engineering | Surveying
Materials Testing
7921 N World Dr.
Hobbs, NM 88242-9032
Squarerootservices.net
575-231-7347

ENGINEERING SHEET:

FENCE DETAILS

OF

PROJECT NAME:

TPW ANGEL RECYCLE FACILITY

FOR

CLIENT:

BTS MANAGEMENT LLC

PROJECT NUMBER:
24197

PROJECT ENGINEER:
JEREMY BAKER, PE

DRAWN BY:
C. JIMENEZ

REVISIONS

No.	DATE	DESCRIPTION

JEREMY BAKER NEW MEXICO 16207 LICENSED PROFESSIONAL ENGINEER

04/07/2025

SHEET: 13 of 13

CS-503

R.K. FROBEL & ASSOCIATES
Consulting Engineers

Technical Memorandum: 40-mil HDPE as Alternative Secondary Liner System for In Ground Recycling Containment Facilities

NMAC 19.15.34.12 A

I have investigated the suitability of application for 40 mil HDPE geomembrane as an equivalent secondary liner to 30 mil scrim reinforced LLDPE (LLDPEr) in the application for In Ground Recycling Containment facilities. *In summary, it is my professional opinion that the specified 40 mil HDPE geomembrane will provide a secondary liner system that is equal to or better than 30 mil scrim reinforced LLDPEr and will provide the requisite protection of fresh water, public health and the environment for many years when engineering design provides requisite site/soil/slope preparation and when used in concert with requisite primary liners and drainage layers.*

It is understood that the lining system under discussion is composed of a 60 mil HDPE Primary liner, geonet drainage layer and a 40 mil HDPE Secondary liner. *In consideration of the secondary lining system application, size of impoundment and depth, design details as well as the chemical nature of typical processed water, it is my professional opinion that the 40 mil HDPE geomembrane will provide the requisite barrier against processed water loss and will function effectively as a secondary liner.*

The following are discussion points that hopefully will exhibit the equivalency of a 40 mil HDPE secondary liner to that of a 30 mil LLDPEr.

The nature and formulation of the 40 mil HDPE resin is the same as the Primary 60 mil HDPE. The major difference is that the 40 mil HDPE is lower in thickness (more flexible and less puncture resistant). However, in covered conditions, HDPE will resist aging and degradation and remain intact for many decades. In fact, a secondary liner of 40 mil HDPE will outlast an exposed 60 mil HDPE liner. According to the Geosynthetic Research Institute (GRI) study on lifetime prediction (GRI Paper No. 6), the half life of HDPE (GRI GM 13) exposed is > 36 years and the half-life of HDPE covered or buried is greater than 100 years. It is understood that in order to ensure compliance of materials, the primary 60 mil HDPE to be used must meet or exceed GRI GM 13 Standards. Likewise, the secondary liner that is not exposed to the same environmental and chemical conditions must meet or exceed GRI GM 13 for non-reinforced HDPE. Adhering to the minimum requirements of the GRI Specifications, 40 mil HDPE when used as a secondary liner will be equally as protective as the primary 60 mil HDPE liner (reference: www.geosynthetic-institute.org/grispecs) and equally as protective as a 30 mil scrim reinforced LLDPEr liner.

Durability of Geomembranes is directly affected by exposure conditions. Buried or covered geomembranes are not affected by the same degradation mechanisms (UV, Ozone, Chemical, Stress, Temperature, etc) as are fully exposed geomembranes. In this regard, the secondary liner material and thickness can be much less robust than the fully exposed primary liner which in this case is 60 mil HDPE. This is also the case for

landfill lining systems where the secondary geomembrane in a bottom landfill cell may be 40 mil HDPE.

Thermal Fusion Seaming Requirements. Thermal seaming and QC seam test requirements for geomembranes are product specific and usually prescribed by the sheet manufacturer. Dual wedge thermal fusion welding is commonly used on HDPE and QC testing by air channel (ASTM D 5820) is fully acceptable and recognized as an industry standard. In this regard, there should be no exception requirement for seaming and QC testing as both the Primary and Secondary geomembranes are HDPE. This is fully covered in comprehensive specifications for both the Primary and Secondary geomembranes (Reference: www.ASTM.org/Standards).

Potential for Leakage through the Primary and Secondary Liners. Leakage through geomembrane liners is directly a function of the height of liquid head above any hole or imperfection. The geonet drainage media provides immediate drainage to a low point or sump and thus no hydrostatic head or driving gradient is available to push leakage water through a hole in the secondary liner. In this regard, secondary geomembrane materials can be (and usually are) much less in thickness and also polymer type. Hydraulic Conductivity through the 40 mil HDPE liner material is extremely low due to the polymer type, structure and crystallinity and exceeds requirements of EPA SW-846 Method 9090A.

Chemical Attack. Chemical attack to polymeric geomembranes is directly a function of type of chemical, temperature and exposure time. Again, the HDPE Primary provides the chemically resistant liner and is QC tested to reduce potential defects or holes. If there is a small hole, the geonet drain takes any leakage water immediately to the sump for extraction. Thus, exposure time is very limited on a secondary liner in addition to low temperature, little volume and virtually no head pressure. In this regard, a chemically resistant geomembrane material such as 40 mil HDPE can be specified for the secondary and is a fully acceptable alternate to 30 mil scrim reinforced LLDPEr.

Mechanical Properties Characteristics. Geomembranes of different polymer and/or structure (i.e., reinforced vs non-reinforced) cannot be readily compared using such characteristics as tensile stress/strain, tear, puncture and polymer requirements. For a 40 mil HDPE liner material to function as a Secondary liner it should meet or exceed the manufacturers minimum requirements for Density, Tensile Properties, Tear, Puncture as well as other properties such as UV resistance. The sheet material must also meet or exceed GRI GM 13 minimum requirements. *In this regard, a 40 mil HDPE will be equivalent to a 30 mil LLDPEr as a secondary liner for the conditions listed below:*

- *The subgrade or compacted earth foundation will be smooth, free of debris or loose rocks, dry, unyielding and will support the lining system.*
- *The side slopes for the containment shall be equal to or less than 3H:1V.*
- *The physical properties and condition of the subgrade or liner foundation*

(i.e., density, slope, moisture) will be inspected and certified by a Professional Engineer that it meets or exceeds specification requirements.

- *Immediately prior to installation, the installation contractor shall inspect and sign off on the subgrade conditions that they meet or exceed the HDPE manufacturer and installers requirements.*
- *A protective geotextile will be placed on the finished and accepted subgrade between subgrade and the 40 mil HDPE Secondary liner.*
- *A 200 mil geonet will be placed over the 40 mil HDPE Secondary Liner.*
- *A 60 mil HDPE Primary liner will be placed over the 200 mil geonet drainage layer.*

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

Sincerely Yours,

R K Frobel

Ronald K. Frobel, MSCE, PE

COLORADO REGISTERED RONALD KENNETH FROBEL 15742 PROFESSIONAL ENGINEER

References:

NMAC 19.15.34.12 A DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT

Geosynthetic Research Institute (GRI) Published Standards and Papers 2017
www.geosynthetic-institute.org

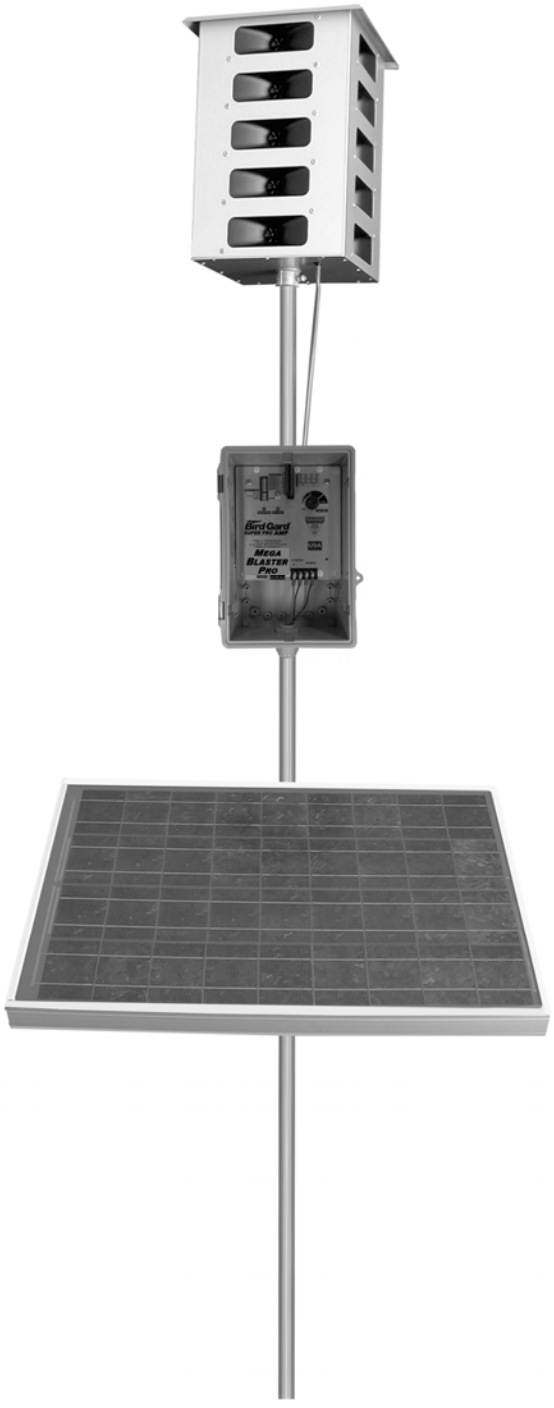
ASTM Geosynthetics Standards 2017
www.ASTM.org/Standards

AVIAN DETERRENT SYSTEM

MEGA BLASTER PRO

BIRD-X

User's Manual



Overview

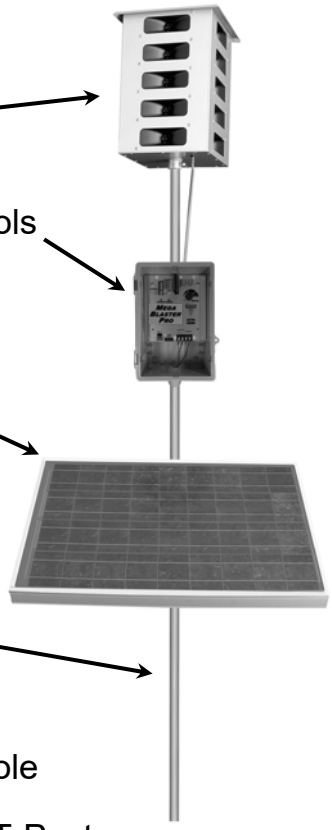
The Bird-X Mega Blaster Pro utilizes the innate power of the natural survival instincts of birds to effectively repel them. Digital recordings of distressed and alarmed birds, along with the sounds made by their natural predators are broadcast through high fidelity weather-resistant speakers over the top of areas. This action triggers a primal fear and flee response. Pest birds soon relocate to where they can feed without feeling threatened.

Your Bird-X Mega Blaster Pro system consists of:

20-Speaker Tower broadcasts the bird sounds

Control Unit produces the bird sounds and contains all operational controls

Solar Panel recharges the 12-volt deep cycle battery



Items needed but not included:

(1) **Mounting Pole** or **Mast** tall enough to raise the 20-Speaker Tower at least 5 feet above the top of the areas, trees or other obstructions

(1) **12-volt Deep Cycle Battery** (RV/Marine) Group 27 or larger wet cell

(1) **T-Post** or similar (Optional) may be needed to support the mounting pole

(1) **Bailing Wire or zip-tie** (Optional) to secure the Mounting Pole to the T-Post

CAUTION: THE MEGA BLASTER PRO IS CAPABLE OF PRODUCING SOUNDS UP TO 125 DECIBELS. PROPER HEARING PROTECTION MUST BE WORN ANYTIME THE UNIT IS TURNED ON.

Bird Control Management Guidelines

An active bird control management program is a key to successfully repelling pest birds. Bird feeding patterns may take several days or weeks to break. Follow all suggestions for maximum effectiveness. Read all instructions prior to installation.

For best results:

- **It is extremely important to fully protect your entire area from birds.** Any areas not fully protected will allow birds to begin feeding at the fringes of the sound coverage. They will soon become bolder and learn the sounds are nothing to fear. This will cause the effectiveness to diminish. Complete Bird-X product coverage forces birds to leave the area entirely.
- Install the Mega Blaster Pro unit at least two weeks before birds are attracted to your area. It is much easier to keep birds away before they have found a food source than it is to repel them once they have developed a feeding pattern.
- Most birds begin feeding from the perimeter of an area. Place Mega Blaster Pro units so the sound protection covers past the edges of the area.
- Birds will often use tall trees for roosting and observation. If birds are in bordering trees it is necessary to position the units so the sound protection covers the trees as well.
- Mount the 20-Speaker Tower at least five feet above trees, areas and structures for maximum coverage. The higher the better. Sound will disperse or reflect off structures or foliage. Mount control unit out of direct sun, if possible.
- When first installed, run Mega Blaster Pro units at FULL volume and on SHORT time off periods. This ensures maximum “bird stress” and creates a hostile environment.
- Watch for changes in bird activity and adjust the location of your Mega Blaster Pro unit if needed.
- **Check the battery and unit settings often to insure continuous bird control. Be certain that the system is not turned down or has a dead battery. Field hands or harvesters may turn down the volume.**
- Changing settings and switches often helps to prevent bird habituation. Periodically change the switch settings of the eight sounds (turning them ON or OFF). NEVER turn OFF the distress calls of the target birds you are trying to repel and always keep at least one predator bird sound turned ON.
- If different bird species enter the protected area and begin causing damage contact us immediately for an updated Sound Recording Card designed to repel the new invading birds.
- Remember that the Mega Blaster Pro system is a management tool, and should be used as part of your overall bird control strategy, sometimes in conjunction with other bird control techniques and devices.

Be aware that under extreme drought or other adverse conditions, birds will disregard all deterrents and risks in order to survive

DESIGN/CONSTRUCTION PLAN

Design and Construction Plan In Ground Containments

This plan addresses construction of the earthen containments.

Magrym Engineers is providing the design of the containment and their plans are presented in this submission.

19.15.34.12 A Design and Construction Specifications
(1). The operator shall design and construct a recycling containment to ensure the confinement of produced water, to prevent releases and to prevent overtopping due to wave action or rainfall.
(8). The operator of a recycling containment shall design the containment to prevent run-on of surface water. The containment shall be surrounded by a berm, ditch or other diversion to prevent run-on of surface water

Dike Protection and Structural Integrity

The design and operation provide for the confinement of produced water, prevention of releases and prevention of overtopping due to wave action or rainfall. Additionally, the design prevents run-on of surface water as the containment is surrounded by an above-grade levee (a berm) and/or diversion ditch (between the levee and the soil stockpile) to prevent run-on of surface water.

Stockpile Topsoil

Where topsoil is present, prior to constructing containment, the operator will strip and stockpile the topsoil for use as the final cover or fill at the time of closure.

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

Signage

The operator will place an upright sign no less than 12 inches by 24 inches with lettering not less than two inches in height in a conspicuous place on the fence surrounding the containment. The sign is posted in a manner and location such that a person can easily read the legend. The sign will 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

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

Fencing

The operator will provide for a fence to enclose the recycling containment in a manner that deters unauthorized wildlife and human access. As specified in the design drawings, the operator will employ a chain-link or game fence. If required by the District Office, the operator will add four-strands of barbed wire to comply with the text of the Rule. Because feral pigs, javelina and deer are present in the area, a chain link or game fence is required in order to comply with Section 19.15.34.12 D.1 of the Rule because pigs will move beneath the lower strand of a 4-strand, 4-foot high barbed wire fence and deer will jump over. However, 19.15.34.12 D.2 requires "a four-foot fence that has at least four strands of barbed wire evenly spaced in the interval between one foot and four feet above ground level". Therefore, a barbed wire specification will be added to the game fence to avoid a variance if required by the OCD District Office.

19.15.34.12 D. Fencing
(1) The operator shall fence or enclose a recycling containment in a manner that deters unauthorized wildlife and human access and shall maintain the fences in good repair. The operator shall ensure that all gates associated with the fence are closed and locked when responsible personnel are not onsite.
(2) Recycling containments shall be fenced with a four-foot fence that has at least four strands of barbed wire evenly spaced in the interval between one foot and four feet above ground level.

ASV = 4,000. East Containment = 663,961 is correct C C-108

As stated in the O&M plan, the operator will ensure that all gates associated with the fence are closed and locked when responsible personnel are not onsite.

Netting and Protection of Wildlife

The perimeter game/chain-link fence will be effective in excluding stock and most terrestrial wildlife. If requested by the surface owner, the game fence can include a fine mesh from the base to 1 foot above the ground to exclude the small reptiles (e.g. dune sagebrush lizard).

19.15.34.12 E Netting.
The operator shall ensure that a recycling containment is screened, netted or otherwise protective of wildlife, including migratory birds. The operator shall on a monthly basis inspect for and, within 30 days of discovery, report the discovery of dead migratory birds or other wildlife to the appropriate wildlife agency and to the division district office in order to facilitate assessment and implementation of measures to prevent incidents from reoccurring.

The recycling containment will be protective of wildlife, including migratory birds through the implementation of an Avian Protection Plan, routine inspections and the perimeter fence.

The avian protection plan includes the use of a Bird-X Mega Blaster Pro[1] as a primary hazing program for avian species. The device will be equipped with sounds suitable for the Permian Basin environment. In addition to this sonic device, staff will routinely inspect the containment for the presence of avian species and, if detected, will use a blank cartridge or shell in a handgun, starter pistol or shotgun as additional hazing. Decoys of birds of prey may be placed on the game fence and other roosts around the open water to provide additional hazing.

The O&M plan calls for the operator to inspect for and, within 30 days of discovery, report the discovery of dead migratory birds or other wildlife to the appropriate wildlife agency and to the division district office in order to facilitate assessment and implementation of measures to prevent incidents from reoccurring.

Earthwork

The containment will have a properly constructed foundation and interior slopes consisting of a firm, unyielding base, smooth and free of rocks, debris, sharp edges or irregularities to prevent the liner's rupture or tear. Geotextile is required under the liner when needed to reduce localized stress-strain or protuberances that otherwise may compromise the liner's integrity.

19.15.34.12 A
(2) A recycling containment shall have a properly constructed foundation and interior slopes consisting of a firm, unyielding base, smooth and free of rocks, debris, sharp edges or irregularities to prevent the liner's rupture or tear. Geotextile is required under the liner when needed to reduce localized stress-strain or protuberances that otherwise may compromise the liner's integrity…

This volume provides the stamped drawings for the containment with the following design/construction specifications:

a) levee has inside grade no steeper than two horizontal feet to one vertical foot (2H: 1V).

b) levee outside grade is no steeper than three horizontal feet to one vertical foot (3H: 1V)
c) top of the levee is wide enough to install an anchor trench and provide adequate room for inspection and maintenance.
d) The containment floor design calls for a slope toward the sump in the corner(s).

19.15.34.12 A
(2) …The operator shall construct the containment in a levee with an inside grade no steeper than two horizontal feet to one vertical foot (2H:1V). The levee shall have an outside grade no steeper than three horizontal feet to one vertical foot (3H:1V). The top of the levee shall be wide enough to install an anchor trench and provide adequate room for inspection and maintenance.

Liner and Drainage Geotextile Installation

The containment has a primary (upper) liner and a secondary (lower) liner with a leak detection system appropriate to the site's conditions.

19.15.34.12 A
(3) Each recycling containment shall incorporate, at a minimum, a primary (upper) liner and a secondary (lower) liner with a leak detection system appropriate to the site's conditions.

The primary (upper) liner is a geomembrane liner composed of an impervious, synthetic material that is resistant to ultraviolet light, petroleum hydrocarbons, salts and acidic and alkaline solutions. It is 60-mil HDPE. The secondary liner is specified in the design drawings and is 40-mil HDPE or thicker and is equivalent to 30-mil LLDPEr (in accordance with a previously approved variance) Liner compatibility meets or exceeds a subsequent relevant publication to EPA SW-846 method 9090A.

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

The recycling containment design has a leak detection system between the upper and lower geomembrane liners of 200-mil geonet to facilitate drainage. The leak detection system consists of a properly designed drainage and collection and removal system placed above the lower geomembrane liner in depressions and sloped to facilitate the earliest possible leak detection. The containment floor design calls for a slope toward the sump in the corner(s) of the containment, as shown in the design drawings. This slope combined with the highly transmissive geonet drainage layer provide for rapid leak detection.

19.15.34.12 A
(7) The operator of a recycling containment shall place a leak detection system between the upper and lower geomembrane liners that shall consist of 200-mil geonet or two feet of compacted soil with a saturated hydraulic conductivity of 1 x 10-5 cm/sec or greater to facilitate drainage. The leak detection system shall consist of a properly designed drainage and collection and removal system placed above the lower geomembrane liner in depressions and sloped to facilitate the earliest possible leak detection.

The liners and drainage material will be installed consistent with the Manufacturer's specifications. In addition to any specifications of the Manufacturer, protocols for liner installation include measures to:

i. minimizing liner seams and orient them up and down, not across, a slope of the levee.
ii. use factory-welded seams where possible.
iii. use field seams in geosynthetic material that are thermally seamed and prior to field seaming, overlap liners four to six inches.
iv. minimize the number of field seams and comers and irregularly shaped areas.
v. provide for no horizontal seams within five feet of the

19.15.34.12 A
(5) The operator of a recycling containment shall minimize liner seams and orient them up and down, not across, a slope of the levee. Factory welded seams shall be used where possible. The operator shall ensure field seams in geosynthetic material are thermally seamed. Prior to field seaming, the operator shall overlap liners four to six inches…

slope's toe.

vi. use qualified personnel to perform field welding and testing.

vii. avoid excessive stress-strain on the liner

viii. The edges of all liners are anchored in the bottom of a compacted earth-filled trench that is at least 18 inches deep

19.15.34.12 A
(5) …The operator shall minimize the number of field seams and corners and irregularly shaped areas. There shall be no horizontal seams within five feet of the slope's toe. Qualified personnel shall perform field welding and testing.

At points of discharge into the lined earthen containment the pipe configuration effectively protects the liner from excessive hydrostatic force or mechanical damage during filling.

19.15.34.12 A
(3) The edges of all liners shall be anchored in the bottom of a compacted earth-filled trench. The anchor trench shall be at least 18 inches deep.

The design shows that at any point of discharge into or suction from the recycling containment, the liner is protected from excessive hydrostatic force or mechanical damage. External discharge or suction lines do not penetrate the liner.

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

Pumping from the containment to hydraulic fracturing operations is the responsibility of stimulation contractors. Typically, lines are permanently placed in the containment with floats attached to prevent damage to the liner system. The containment may be equipped with permanent HDPE stinger (supported by a sacrificial liner or geotextile) for withdrawal of fluid if the owner deems necessary during operations.

Leak Detection and Fluid Removal System Installation

The leak detection system, contains the following design elements

a. The 200-mil HyperNet Geonet drainage material between the primary and secondary liner that is sufficiently permeable to allow the transport of fluids to the observation ports (Appendix A).
b. The containment floor is sloped towards the monitoring riser pipe to facilitate the earliest possible leak detection of the containment bottom. A pump may be placed in the 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).

OPERATIONS AND MAINTENANCE PLAN

CLOSURE PLAN

Operation and Maintenance Plan
In Ground Containments

Overview

The operator will operate and maintain the lined earthen containment to contain liquids and solids (blow sand and minimal precipitates from the produced water) and maintain the integrity of the liner system in a manner that prevents contamination of fresh water and protects public health and the environment as described below. The purpose of the lined earthen containment is to facilitate recycling, reuse and reclamation of produced water derived from oil and gas wells. During periods when water for E&P operations is not needed, produced water will discharge to injection wells or to a pipeline for transfer to another recycling facility. The containment will not be used for the disposal of produced water or other oilfield waste.

19.15.34.10 D
Recycling containments may not be used for the disposal of produced water or other oilfield wastes.

The operation of the containment is summarized below.

A. Produced water generated from nearby oil and gas wells is delivered to a treatment system located as indicated in the C-147.
B. Unless specified in the transmittal letter, after treatment, the produced water discharges into the containment.
C. When required, produced water is removed from the containment for E&P operations. At this time, produced water will be used for drilling beneath the freshwater zones (beneath surface casing), for well stimulation (e.g. hydraulic fracturing) and other E&P uses as approved by OCD.
D. Whenever the maximum fluid capacity of the containment is reached, treatment and discharge to the containment ceases (see Freeboard and Overtopping Plan, below).
E. The operator will keep accurate records and shall report monthly to the division the total volume of water received for recycling, with the amount of fresh water received listed separately, and the total volume of water leaving the facility for disposition by use on form C-148 (see attached example).
F. The operator will maintain accurate records that identify the sources and disposition of all recycled water that shall be made available for review by the division upon request.

19.15.34.9 E
The operator of a recycling facility shall keep accurate records and shall report monthly to the division the total volume of water received for recycling, with the amount of fresh water received listed separately, and the total volume of water leaving the facility for disposition by use on form C-148.

19.15.34.9 F
The operator of a recycling facility shall maintain accurate records that identify the sources and disposition of all recycled water that shall be made available for review by the division upon request.

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

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

The operation of the lined earthen containment will follow the mandates listed below:

1. The operator will not discharge into or store any hazardous waste (as defined by 40 CFR 261 and NMAC 19.15.2.7.H.3) in the containments.
2. If the containment's primary liner is compromised above the fluid's surface, the operator will repair the damage or initiate replacement of the primary liner within 48 hours of discovery or seek an extension of time from the division district office.
3. If the primary liner is compromised below the fluid's surface, the operator will remove all fluid above the damage or leak within 48 hours of discovery, notify the division district office and repair the damage or replace the primary liner.
4. If any penetration of the containment liner is confirmed by sampling of fluid in the leak detection system (see Monitoring, Inspection, and Reporting Plan; below), the operator will:
    a. Begin and maintain fluid removal from the leak detection/pump-back system,
    b. Notify the district office within 48 hours (phone or email) of the discovery,
    c. Identify the location of the leak, and
    d. Repair the damage or, if necessary, replace the containment liner.
5. The operator will install, or maintain on site, an oil absorbent boom or other device to contain an unanticipated release and the operator will remove any visible layer of oil from the surface of the recycling containment.
6. The operator will report releases of fluid in a manner consistent with NMAC 19.15.29
7. The containment will be operated to prevent the collection of surface water run-on.

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

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

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

8. The operator will maintain the containment free of miscellaneous solid waste or debris.
9. The operator will maintain at least three feet of freeboard for the containment and will use a free-standing staff gauge to allow easy determination of the required 3-foot of freeboard.
10. As described in the design/construction plan, the injection or withdrawal of fluids from the containment is accomplished through hardware that prevents damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes.
11. The operator shall ensure that all gates associated with the fence are closed and locked when responsible personnel are not onsite.
12. The operator will maintain the fences in good repair.

19.15.34.13
(6) The containment shall be operated to prevent the collection of surface water run-on.

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

19.15.34.13 B
(3) The injection or withdrawal of fluids from the containment shall be accomplished through a header, diverter or other hardware that prevents damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes.

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

19.15.34.13 A
The operator shall inspect the recycling containment and associated leak detection systems weekly while it contains fluids. The operator shall maintain a current log of such inspections and make the log available for review by the division upon request.

Monitoring, Inspection, and Reporting Plan

The operator will inspect the recycling containment and associated leak detection systems weekly while it contains fluids. The operator shall maintain a current log of such inspections and make the log available for review by the division upon request.

Weekly inspections consist of:

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

As stated above, if a liner's integrity is compromised, or if any penetration of the liner occurs, then the operator will take appropriate action within 48 hours, based on if above or below water surface, as noted above.

Monthly, the operator will:

A. Inspect the containment for dead migratory birds and other wildlife. Within 30 days of discovery, report the discovery of dead migratory birds or other wildlife to the appropriate wildlife agency and to the division district office in order to facilitate assessment and implementation of measures to prevent incidents from reoccurring.
B. Report to the division the total volume of water received for recycling, with the amount of fresh water received listed separately, and the total volume of water leaving the facility for disposition by use on form C-148.
C. Record sources and disposition of all recycled water.

19.15.34.12 E
The operator shall on a monthly basis inspect for and, within 30 days of discovery, report the discovery of dead migratory birds or other wildlife to the appropriate wildlife agency and to the division district office in order to facilitate assessment and implementation of measures to prevent incidents from reoccurring.

19.15.34.9 E
The operator of a recycling facility shall keep accurate records and shall report monthly to the division the total volume of water received for recycling, with the amount of fresh water received listed separately, and the total volume of water leaving the facility for disposition by use on form C-148.

19.15.34.9 F
The operator of a recycling facility shall maintain accurate records that identify the sources and disposition of all recycled water that shall be made available for review by the division upon request.

The operator will maintain a log of all inspections and make the log available for the appropriate Division district office's review upon request. An example of the log is attached to this section of the permit application.

Freeboard and Overtopping Prevention Plan

The method of operation of the containment allows for maintaining freeboard with very few potential problems. When the capacity of the containment is reached (3-feet of freeboard), the discharge of produced water ceases and the produced water generated by nearby oil and gas wells is managed by an injection well(s).

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

I. Cease discharging produced water to the containment.
II.Accelerate re-use of the produced water for purposes approved by the Division.

III. Transfer produced water from the containment to injection wells.

The reading of the staff gauge typically occurs daily when treatment operations are ongoing and weekly when discharge to the containment is not occurring.

Protocol for Leak Detection Monitoring, Fluid Removal and Reporting

As shown in Appendix A, the leak detection system includes a monitoring system. Any fluid released from the primary liner will flow to the collection sump, where fluid level monitoring is possible at the monitoring riser pipe associated with the leak detection system.

Staff may employ a portable electronic water level meter to determine if fluid exists in the monitoring riser pipe. Obtaining accurate readings of water levels in a sloped pipe beneath a containment can be a challenge. An electrician's wire snake may be required to push the probe to the bottom of the port and the probe may be fixed in a 2-inch pipe "dry housing" to avoid false readings due to water condensation on the pipe. There are many techniques to determine the existence of water in the sumps – including low flow pumps and a simple small bailer affixed to an electrician's snake. The operator will use the method that works best for this containment.

If seepage from the containment into the leak detection system is suspected by a positive fluid level measurement, the operator will:

1. Re-measure fluid levels in the monitoring riser pipe on a daily basis for one week to determine the rate of seepage.
2. Collect a water sample from the monitoring riser pipe to confirm the seepage is produced water from the containment via electrical conductivity and chloride measurements.
3. Notify NMOCD of a confirmed positive detection in the system within 48 hours of sampling (initial notification).
4. Install a pump into the monitoring riser pipe sump to continually (manually on a daily basis or via automatic timers) remove fluids from the leak detection system into the containment until the liner is repaired or replaced.
5. Dispatch a liner professional to inspect the portion of the containment suspected of leakage during a "low water" monitoring event.
6. Provide NMOCD a second report describing the inspection and/or repair within 20 days of the initial notification.

If the point of release is obvious from a low water inspection, the liner professional will repair the loss of integrity. If the point of release cannot be determined by the inspection, the liner professional will develop a more robust plan to identify the point(s) of release. The inspection plan and schedule will be submitted to OCD with the second report. The operator will implement the plan upon OCD approval.

Closure Plan
In Ground Containments

Overview

After operations cease, the operator will remove all fluids within 60 days and close the containment within six months from the date the operator ceases operations from the containment for use.

19.15.34.14 A
Once the operator has ceased operations, the operator shall remove all fluids within 60 days and close the containment within six months from the date the operator ceases operations from the containment for use.

The operator shall substantially restore the impacted surface area to

a. the condition that existed prior to the construction of the recycling containment or
b. to a condition imposed by federal, state trust land or tribal agencies on lands managed by those agencies as these provisions govern the obligations of any operator subject to those provisions,

19.15.34.14 E
The operator shall substantially restore the impacted surface area to the condition that existed prior to the construction of the recycling containment.

19.15.34.14 G
The re-vegetation and reclamation obligations imposed by federal, state trust land or tribal agencies on lands managed by those agencies shall supersede these provisions and govern the obligations of any operator subject to those provisions, provided that the other requirements provide equal or better protection of fresh water, human health and the environment.

The surface owner will impose a closure design that conforms to their needs for the site. The operator understands that a variance will be submitted to OCD to allow for any alternative closure protocol.

Excavation and Removal Closure Plan – Protocols and Procedures

The containment is expected to hold a small volume of solids, the majority of which will be windblown sand and dust with some mineral precipitates from the water

1. The operator will remove all liquids from the containment and either:
    a. Dispose of the liquids in a division-approved facility, or
    b. Recycle, reuse or reclaim the water for reuse in drilling and stimulation.
2. The operator will close the recycling containment by first removing all fluids, contents and synthetic liners and transferring these materials to a division approved facility.
3. After the removal of the containment contents and liners, soils beneath the containment will be tested by collection of a five-point (minimum) composite sample which includes stained or wet soils, if any, and that sample shall be analyzed for the constituents listed in Table I of 19.15.34.14.
4. After review of the laboratory results:
    a. If any contaminant concentration is higher than the parameters listed in Table I, additional delineation may be required, and the operator must receive approval before proceeding with closure.

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

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

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

b. If all contaminant concentrations are less than or equal to the parameters listed in Table I, then the operator will proceed to
    i. backfill with non-waste containing, uncontaminated, earthen material - Or
    ii. undertake an alternative closure process pursuant to a variance request after approval by OCD.

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

Reclamation and Re-vegetation

a. The operator will reclaim the containment's location to a safe and stable condition that blends with the surrounding undisturbed area.
b. Topsoils and subsoils shall be replaced to their original relative positions and contoured so as to achieve erosion control, long-term stability and preservation of surface water flow patterns.
c. The disturbed area shall then be reseeded in the first favorable growing season following closure of a recycling containment.

19.15.34.14 E
Once the operator has closed the recycling containment, the operator shall reclaim the containment's location to a safe and stable condition that blends with the surrounding undisturbed area. Topsoils and subsoils shall be replaced to their original relative positions and contoured so as to achieve erosion control, long-term stability and preservation of surface water flow patterns. The disturbed area shall then be reseeded in the first favorable growing season following closure of a recycling containment.

Closure Documentation

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

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

The operator shall notify the division when reclamation and re-vegetation are complete. Specifically the notice will document that all ground surface disturbing activities at the site have been completed, and a uniform vegetative cover has been established that reflects a life-form ratio of plus or minus fifty percent (50%) of pre-disturbance levels and a total percent plant cover of at least seventy percent (70%) of pre-disturbance levels, excluding noxious weeds.

19.15.34.14 H
The operator shall notify the division when reclamation and re-vegetation are complete.

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

April 2025

Rule 34 Registration: Volume 1
Angel RF and Containments
Section 32, T20S, R28E, Eddy County

- ***Transmittal Letter***
- ***Siting Criteria Demonstration with Plates & Appendices***

View southeast toward the Angel RF and Containments Project Area. Near the horizon at the center of the image are topsoil and spoil piles associated with an abandoned caliche pit. This pit will become part of the proposed western containment.

Prepared for:
BTS Management, LLC
Carlsbad, New Mexico

Prepared by:

R.T. Hicks Consultants, Ltd.
Albuquerque, New Mexico

Cascade Services LLC
Midland, Texas

R. T. HICKS CONSULTANTS, LTD.

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

April 4, 2025

Ms. Leigh Barr
EMNRD - Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, NM 87505
Via E-Mail

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

RE: BTS Management, LLC, Angel Recycling Facility and Containments
East In-ground Containment and AST Permit
Section 32 T20S R28E, Eddy County

Dear Ms. Barr and Ms. Venegas:

On behalf of BTS Management, LLC, R.T. Hicks Consultants is pleased to submit a C-147 *permit* for the referenced project. BTS will secure a closure bond for the East in-ground containment upon OCD approval of the closure cost estimate. BTS Management will begin construction of the East in-ground containment and AST as soon as OCD approves this permit. A recycling project that is dependent upon use of the East Containment and AST beginning requires filling the containment beginning on or before May 21, 2025. We respectfully ask your attention to this submission to allow the recycling project to proceed.

The West in-ground containment lies on State land (see Plate 8 of Volume 1). The process of securing a lease from the SLO along with the necessary environmental and cultural surveys require several months and the West containment is not required for the forthcoming recycling project. When the SLO approve the lease for the West containment, BTS Management will submit a modification to this permit for construction and a new closure cost estimate.

Volume 1 of the C-147 package contains:

- Transmittal Letter
- Siting Criteria Demonstration with Plates and Appendices that present excellent data that demonstrates confined groundwater lies more than 50-feet beneath the lowermost liner of the East and West Containment.
- Our standard appendices and
- An appendix generated by Southwest Geophysical Consultants that are critical to compliance with 19.15.34.11.8 as their work is the principal engineering measure to ensure that the containments integrity is not compromised.

Volume 2 contains:

- The C-147 Form to register the East in-ground containment
- Closure cost estimate for the East In-Ground Containment and the AST.
- Stamped Design Drawings with Liner Equivalency Demonstration and Avian Deterrence
- Recently Approved Plans for Design/Construction, O&M, Closure

Volume 3 is a permit that contains

- C-147 Form & AST Design Sketch
- Stamped Design Drawings and Specifications
- Plans for Design/Construction, O&M, and Closure
- AST Set Up SOP
- Variances for AST Storage Containments

This submission refers to the following elements that some OCD reviewers have considered variances for in-ground containments:

1. An equivalency demonstration written by experts for the proposed 40-mil HDPE secondary liner has been previously approved by OCD. We maintain that the language of the Rule is clear, and a variance is not required.
2. OCD has approved the proposed Avian Protection Plan (Bird-X Mega Blaster Pro) for other containments. Thus, the plan meets the requirement of the rule that the "otherwise protective of wildlife, including migratory birds" and a variance is not required.
3. Using the proposed deer fence in lieu of a 4-strand barbed wire fence is not a variance. Because feral pigs, javelina and deer are present in the area, a tall game fence is required to comply with Section 19.15.34.12 D.1 of the Rule. The specification for fencing provided in 19.15.34.12 D.2 contradicts D.1 because pigs will move beneath the lower strand of a 4-foot high barbed wire fence and deer will jump over. Thus, compliance with D.2 results in a violation of D.1. We maintain that compliance with D.1 is the critical component of the Rule and operators need not be required to submit a variance request to follow Best Management Practices and comply with the Rule. Nevertheless, BTS Management will attach 4 strands of barbed wire to the game fence if required by OCD.

BTS Management will transmit the C-147 package for the East Containment and AST to OCD via the OCD.Online portal. In compliance with 19.15.34.10 of the Rule, BTS management provided this package to the surface landowner. If you have any questions or concerns regarding this permit or the attached C-147, please contact me. As always, we appreciate your work ethic and diligence.

Sincerely,
R.T. Hicks Consultants

Randall T. Hicks PG
Principal

Copy: Cascade Services LLC
BTS Management SLO

SITING CRITERIA DEMONSTRATION

Distance to Groundwater

Plate 1, Plate 2, and the discussion below demonstrates that groundwater (fresh water as defined by NMOCD Rules) at the locations is greater than 50 feet beneath any lowermost liner of a Rule 34 containment within the Angel Reuse Facility. The data also demonstrate that groundwater is confined beneath the project area and a release cannot reasonably enter groundwater.

As stated in the transmittal letter, the data quality describing groundwater conditions at the site is excellent. Rarely, perhaps never, have we examined such good and consistent data from existing well logs. While not reluctant to drill a boring to confirm groundwater conditions, Hicks Consultants canceled the rig after reviewing the quality data described in this section--saving time, emissions, and expense in exchange for hydrogeologic thought.

Plate 1 is a topographic map that shows:

1. The project area of the Angel Reuse Facility is identified by the blue diagonally lined polygon.
2. Water wells from the OSE database as a blue triangle inside a colored circle. OSE wells are often mislocated in the WATERS database as older wells are plotted in the center of the quarter, quarter, quarter, of the Section Township and Range. Additionally, the OSE database can include locations of proposed wells or borings (i.e., permit applications) that were never drilled. To eliminate plotting of these permits on Plate 1, we queried the data so only wells with a “start date” are included. Depth to water data for the OSE wells do not necessarily represent static water levels and these can be misleading. Depth to water and the date of measurement are presented in the Plate 1.
3. Water wells that are documented in the public databases, identified by field inspection or listed in published reports appear as a colored squares (Misc. well database) with the depth to water and date of measurement displayed.

Plate 2 is a topographic and geologic map that shows:

1. The project area of the Angel Reuse Facility is identified by the blue diagonally lined polygon. Elevation is about 3215 feet in the center of the area.
2. Water wells measured by the USGS, the year of the measurement and the calculated elevation of the groundwater surface. Water wells from the USGS database are large triangles color-coded to the formation from which the well draws water.
3. The geologic unit exposed at the Angel site is Quaternary eolian deposits (Qe)and Quaternary Pediment (Qp).
4. Also shown on Plate 2 are mapped watercourses and ephemeral lakes. The following sections discuss these water bodies with respect to groundwater.

Hydrogeology

Plate 2 shows the following geologic relationships.

1. The Permian Salado Formation (Psl) crops out in the southwest corner of Plate 2. West of the boundary of Plate 1, the Lake McMillian South 7.5 minute geologic map displays isolated outcrops as lower Rustler/upper Salado undifferentiated (Prlsu). These outcrops lie along a ridge north of Lake Avalon. Based upon the Lake McMillian South map, we

believe the lower Rustler Formation is covered by the Pediment deposits in much of the area of Plate 2 and data from the well logs support this conclusion (see discussion below).

2. Quaternary Older Alluvium (Qoa) crops out east of the Salado along the ridge that divides the Pecos River drainage from drainage to Palmilla Draw. Palmilla Draw enters the Lone Tree Draw drainage that empties into the Pecos below Carlsbad. Older Alluvium is sometimes mapped as Gatuña Formation. In either case, this stratigraphic unit is alluvial and creates an erosional unconformity on the underlying bedrock. In the area of the Angel RF and Containment, we believe Qoa overlies the lower Rustler, probably the Los Medaños Member.
3. Piedmont deposits, which consist of alluvium and caliche, crop out on the western 2/3 of the Angel RF & Containment project area (the blue diagonally lined polygon) and in the eastern 1/3, the map shows aeolian deposits (blow sand) that probably form a thin veneer over the Piedmont. Look carefully at Plate 2 because the color of Qp is nearly identical to that of Qe.
4. The eastern edge of the northwest-southeast cross section from the Lake McMillian South geologic map shows the southeast dip of the strata and the thickening of Prlsu to the east (Figure 1). The eastern edge (right) of the cross section is about 2 miles southwest of the project area.

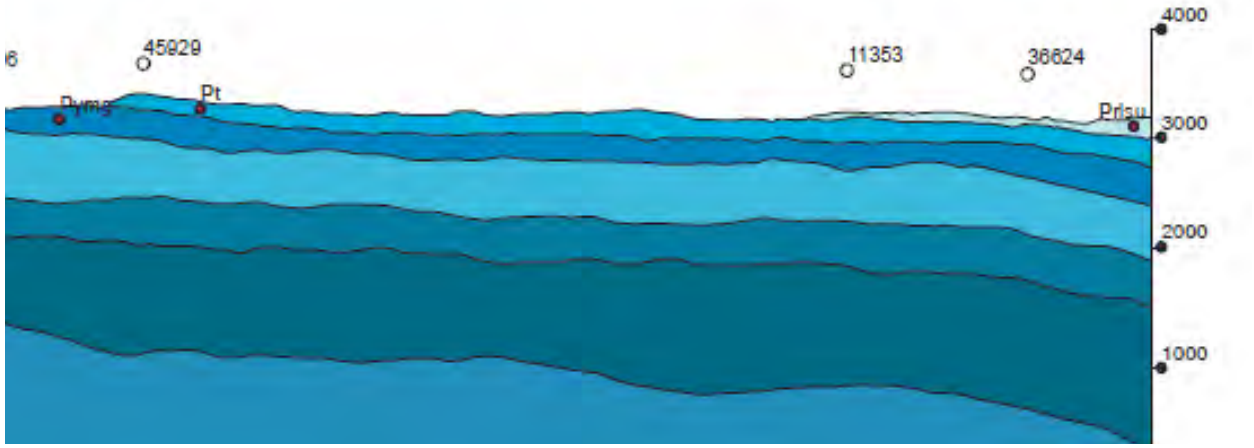


Figure 1- Northwest to Southeast Geologic Cross Section Across Lake McMillian South Quadrangle

As the driller's logs demonstrate, the uppermost water bearing unit in the vicinity of the Angel RF & Containments is a gypsum/anhydrite and/or sandstone horizon at a depth as little as 40-feet to more than 100 feet below land surface. Groundwater resides in the bedrock of this gypsum/anhydrite unit that may be an anhydrite horizon within the Los Medaños or an similar horizon within the Salado Formation. West of the Angel RF & Containments, the lithology and depth to groundwater suggests that well CP-851 may derive water from the Yates Formation.

Lithology and Hydrology Described by OSE Well Logs

We examined drillers' logs from the NM OSE database close to the location. These are described briefly below and presented in *Appendix USGS Data and Well Logs*.

- CP-1849 POD 4 (BH-4) and POD 3 are about 1100 feet northwest of the edge of the Angel RF project area. Atkins Engineering employe a hollow stem auger to drill these

borings. A split spoon may have collected samples from depth. Our experience is that this drilling method and this drilling crew generate excellent and accurate logs. Drilling did not detect groundwater above the clay. While all other wells described below show groundwater above what we believe is this clay layer, we cannot conclude with 100% certainty that groundwater is confined at this location, but the data do permit a conclusion that groundwater is confined. These two borings describe

- 0-28+ feet of brown sand underlain by caliche and s brown and/sandstone. We interpret this as the Older Alluvium overlain by a veneer of aeolian sand.
- 27-36+ feet of dark reddish-brown mudstone with high plasticity and some gypsum veins. We interpret this as a Permian mudstone horizon within the Rustler Formation – probably the lowermost member - Los Medaños.
- The log reports no groundwater above the clay zone.

- CP-1714 POD 4 (aka MISC-515) is 2100 feet northeast of the Angel RF area. As air rotary drilling can produce excellent and accurate lithologic returns, the quality of the log will depend upon the driller and the mood of the driller on a particular day. The uppermost water bearing unit is about 107 feet deep and rose in the boring to 41 feet below surface – thus groundwater is confined. The drillers log and drilling information states:
  - 0-3 feet is aeolian sand
  - 3-18 feet is caliche
  - 38- 85 feet is grey clay (**47 feet thick**). We believe this is the same clay unit observed at this depth in CP-1849.
  - 85-100 feet is dry sandstone
  - 100-180 feet is water-bearing red sand.
  - Because "first water" is at 100 feet and the 70-foot thick unit yields 65 gpm, we suspect the "sandstone" (85-100 feet) may be silt/clay Permian rock and the red sand may be a mix of Permian gypsum/anhydrite and siltstone/sandstone horizons where fractures in the gypsum/anhydrite produce abundant water. This suspicion is supported by other logs presented below.
- CP-1714 POD 3 (aka MISC-514) is 2600 feet east of the Angel RF area. This boring used an air rotary drilling and was drilled under the same driller's license as above. The uppermost water bearing unit is about 107 feet deep and rose in the boring to 41 feet below surface – thus groundwater is confined. The drillers log and drilling information states:
  - 0-3 feet is aeolian sand
  - 3-18 feet is caliche, which correlates to POD 4
  - 18- 84 is described as dry sand and is inconsistent with the description of POD 4 drilled one day earlier and about 1800 feet northwest. POD 4 described this interval as grey clay. The last bullet, below, provides a probable explanation of this lack of correlation.
  - 84-107 feet is dry sandstone that correlates to the 15-foot thick sandstone observed in POE 4.
  - 100-200 feet is water-bearing red sand, which is the same description for this same depth interval as POD 4.
  - Because "first water" is at 107 feet and rose under pressure to cause a static depth to water measurement of 41 feet, the dry sand (18-84 feet) and yellow sandstone

(84-107 feet) must be a low permeability confining horizon – perhaps a mix of red or yellow siltstone/mudstone horizons that drilled like sand (rather than clay) and displayed no evidence of groundwater during drilling. The saturated zone described as red sand is probably gypsum/anhydrite horizons interbedded with red sand. This suspicion is supported by other logs presented below.

- CP 4158 is about 2300 feet due south of the Angel site and about 4800 feet due south of CP-1714 Pod 4. Taylor Water Well Service drilled the boring with air rotary in 2018. We have experience working with Mr. Taylor and can testify of high quality work. This driller's log, which is like CP-1714 POD 4 in lithology and the fact that groundwater is confined, rising in the well from 60 feet deep to 28 feet deep. The log states
  - 0-8 feet is soil and caliche
  - 8-22 feet is a mixture of white, fine/crystalline gypsum/anhydrite with white clay
  - 22-60 feet (**38 feet thick**) is what we believe is the same pink or gray clays described previously
  - 60-134 is interbedded sand, clay and gypsum/anhydrite that yields water to the well
  - 134-160 is clay, gypsum/anhydrite and siltstone that does not yield significant water for a well
- CP 746 was drilled in 1990 by Taylor Well Services and is located near CP-4158. The well log is very brief but agrees with the data presented above. First water is marked at 70 feet with a static water after drilling of 29 feet – thus groundwater is confined at this location. The log shows
  - 0-12 feet of surface deposits described as White Mare
  - 12-59 feet is the red clay described above (**47 feet thick**)
  - 59-60 is a lens of saturated sand/gravel – which we believe is a horizon of gypsum/anhydrite
  - 60-70 is another horizon of red clay, which may contain some gypsum/anhydrite horizons as well but are not described.
- C-4505 is 4700 feet due south of the project area. This air rotary drilled well was completed in one day in 2021 to a depth of 120 feet. The driller identified first water at 50 feet and measured static water after drilling also at 50 feet. Hicks Consultants measured a depth to water of 48.2 feet at this well in 2025 – thus groundwater is unconfined. The log describes the following lithologic column:
  - 0-10 feet is surface deposits and caliche
  - 10-25 feet is described as broken limestone – the same general description in other logs as dry gypsum/anhydrite or sand
  - 25-50 feet is sandy clay, in the same stratigraphic position as clay described above
  - 50-70 feet of saturated sandstone below the clay, as described in several lots above
  - 70-120 is broken limestone – gypsum/anhydrite more than likely
- CP-919 POD 2 This well is near USGS-9299, 4200 feet east-southeast of the Angel RF & Containments. The boring was drilled with mud rotary, which can provide poor returns. However, the log provides descriptions of five different lithologies and one interval is 4-feet thick. Thus, it appears this driller paid close attention and produced a good log. The depth to "first water" and static groundwater is the same: 40 feet below

grade – thus groundwater is unconfined and a water-table aquifer probably because the static water level is lower than the base of the clay. The log shows
  - 0-15 sand and caliche like the borings described above
  - 15-40 is red clay (**25 feet thick**) that is consistent with Permian mudstone interpreted in the first two well borings.
  - 40-70 is a water-bearing sandstone that is at the same stratigraphic horizon as the dry sandstones described above.
  - 70-95 is a depth sequence of a cavity/void, sandstone, cavity. Typical of the Los Medaños Member of the Rustler Formation.
  - 95-104 is described as red clay, which is also common in the Los Medaños.
- CP-671 is less than 800 feet southwest of CP-919 – if the OSE plotted locations are correct. Because this was drilled by cable tool in 1985, the quality of the log depends upon the attention of the driller on that day. This log reports first water at a depth of 35 feet and static water at 35 feet. Hicks Consultants measured a depth to water in 2025 of 35.4 feet. At this location, groundwater is a water table aquifer (unconfined) because . The log states the following.
  - 0-27 feet is caliche, surface sand and a 2-foot horizon of hard caliche
  - 27-35 feet is gypsum/anhydrite that does not yield water
  - 35-40 is "pink sand" that is the same elevation as the sand described in CP-919
  - 40-60 is red clay that is common in the Los Medaños but does not correlate to the red clay in the nearby well at a depth of 15-40 feet or at 95-104 feet.
  - 60-70 is gypsum/anhydrite with water and massive (glassy) gypsum/anhydrite.
- CP-851 is about 3200 feet west-northwest of the project area. Rotary drilling (probably using air) in 1995 drilled and completed the well in one day. The driller identified the water-bearing unit as lime (probably gypsum/anhydrite) at 205-230 feet deep and a static water level after drilling of 115 feet. Thus, groundwater is confined at this location. The well is mis-located on Plate 1 and our examination of Google Earth images along with review of the permit application show that the well is at the tank battery about 1300 feet west of the plotted location. We do not believe this well is hydraulically connected to the wells described above and is not relevant to this discussion. We include the well log and this description because it appears on Plate 1. In general, the driller's log shows:
  - 0-8 feet caliche and surface soil/sand
  - 8-142 interbedded horizons of red clay, sand, conglomerate (probably gypsum/anhydrite) – all of which are not water bearing in the log.
  - 142-205 interbedded red clay, tan or grey lime (probably gypsum/anhydrite) – which the driller reports as not producing water
  - 205-230 is the water-bearing unit described as lime (gypsum/anhydrite) with breaks (voids or open fractures)
  - 230-255 is mostly red clay

USGS Groundwater Data

USGS data for the area shown in Plate 2a are sparse and old. We were able to re-measure USGS-9335 (northeast corner of the map) in 2025, and we obtained groundwater data from wells near to USGS-9299 (east of the project area). The data are presented in *Appendix USGS Data and Well Logs*. The data that groundwater elevations varied by

- about 2.5 feet in USGS-9335 over a 52-year record
- about 7 feet over a 30+ year record in USGS-9299 and
- about 4.5 feet over the 42 year record of USGS-9311

Groundwater elevations in the area have been stable over the decades.

Conclusions and Data

The driller's log data for the area around the Angel RF and Containments is excellent as is it the density of said data. Groundwater measurements in 2025 confirm that groundwater elevations have been stable for decades. The data described above support the following conclusions:

1. Based upon lithology described by drillers and Atkins Engineering, groundwater probably resides in Los Medaños Member of the Rustler Formation gypsum/anhydrite horizons and horizons identified as "sand" in the project area.
2. It is possible that Salado dissolution during the Rustler-age erosional unconformity may have left gypsum/anhydrite horizons that were covered by clay sediments of the Los Medanos Member of the Rustler.
3. Clay horizons of various thicknesses are common in the lithologic column of the Rustler that are described in driller's logs in the project environs and in published literature describing the Rustler Formation elsewhere in Eddy County[1].
4. These lithified Permian clay horizons do not yield groundwater to wells and are aquicludes.
5. The uppermost Permian clay horizon in the project area lies immediately beneath the caliche and surface soil and overlies water-bearing gypsum/anhydrite or sand. This unit is continuous within and adjacent to the project area and groundwater beneath this horizon is confined.
6. Beneath the project area area, groundwater does not exist within the Quaternary alluvium and caliche that rest unconformably over the continuous clay horizon of the Los Medaños described above. Rather, groundwater exists in the gypsum/anhydrite and "sand" horizons beneath the 25-47 foot thick clay horizon.
7. Within and adjacent to the project area, the uppermost groundwater zone is under pressure (confined) and, when penetrated by a boring, rises 30-90+ feet above the bottom of the clay horizon.
8. Three water wells at or below the 3200 foot elevation draw water from a water table (unconfined) portion of the uppermost aquifer. These three wells are than greater than 4000 feet southeast (2 wells) and south of the project area (1 well). We conclude that infiltration of stormwater along Palmilla Draw combined with infiltration from lakes within closed depression west of the Draw and south of the project area have saturated the shallow alluvial material.
9. The four closest borings to the Angel RF and containments project area show:
    a. The Quaternary alluvium and caliche are dry.

[1] https://geoinfo.nmt.edu/publications/periodicals/nmg/21/n4/nmg_v21_n4_p97.pdf - See Figures 3 & 4.

b. In the three boring that penetrated groundwater, confined groundwater exists at depths of:
    i. 100 feet in CP-1714 POD 4
    ii. 107 feet in CP-1714 POD 4
    iii. 60 feet in CP-4158 and
    iv. 59 feet in CP- 746

The average elevation of the Angel containments is 3215 feet asl. C-4158 and CP-746 lie on the 3200 foot elevation contour. Thus, the depth to confined groundwater beneath the containments is at least (59+15=) 74 feet. The elevation of CP-1714 POD 4 and 1714 POD 3 are about 3215 feet asl. Using these data, the depth to confined groundwater is about 100 feet. We conclude with a high degree of scientific certainty that depth to pressurized groundwater is more than 70 feet and less than 107 feet.

Distance to Municipal Boundaries and Fresh Water Fields

Plate 3 demonstrates that the Angel RF & containments project area is not within incorporated municipal boundaries or within defined municipal fresh water well fields covered under a municipal ordinance adopted pursuant to NMSA 1978, Section 3-27-3, as amended.

- The closest municipality is Carlsbad, about 6 miles south.
- The closest mapped public wells are about 9.5 miles to the southwest.

Distance to Subsurface Mines

Plate 4 and our reconnaissance of the site demonstrate that the nearest mines are caliche pits. This site is not within an area overlying a subsurface mine.

- The closest mapped caliche pit\s are almost 5 miles southeast
- An unmapped caliche pit is about and about 2 miles west
- An inactive caliche pit lies within the northwest quadrant of the project area and will be incorporated into the containment design.
- There are no subsurface mines in the area shown in Plate 4.

Distance to High or Critical Karst Areas

Plate 5 shows the Angel project area is within a mapped zone of high Karst with respect to BLM 2025 mapped areas.

- One driller's log in the Appendix reports a "cavity or void" below the upper clay horizon (see CP-919 POD-2) and all logs report sandstone and soluble rock (gypsum/anhydrite) as water-bearing units
- Karst features in the Rustler Formation are common and mapping this area as high karst potential appears appropriate
- *Appendix 2D Resistivity Reports* represents a robust engineering measure incorporated into the design process of the Angel containments to ensure the liner system integrity is not compromised by instability due to potential karst structures.
- The design engineer received the Southwest Geophysical Consultants report and employed the findings into the design of the Angel containments. Specifically
    - The Southwest Geophysical Consultants Resistivity Appendix provides a buffer zone around three possible voids (resistivity anomalies) identified in the two southernmost transects (TPWAP204 and TPWAP205)

- Square Root Services caused the footprint of the Angel containment to avoid the buffer area defined by three suspected voids

Distance to 100-Year Floodplain

Plate 6 demonstrates that the Angel project area is within Zone D as designated by the Federal Emergency Management Agency with respect to the Flood Insurance Rate 100-Year Floodplain.

- FEMA describes the location as an area with possible but undetermined flood hazards. No flood hazard analysis has been conducted.
- The nearest mapped flood hazard is 6200 feet southeast – an intermittent Lake/Pond.

Distance to Surface Water

Plate 7 shows the closest surface water bodies:

- The closest intermittent Lake/Pond is 1.3 miles southeast.
- The named lake, Alkali Lake, receives surface water from an unnamed watercourse. This closed depression held water in 2005 (Google Earth image) and the three mapped waterbodies to the east were dry.
- The closest mapped water course, the intermittent channel of Palmilla Draw 1 mile east.

Distance to Permanent Residence or Structures

Plate 8 and the site visit demonstrates that the location is not within 1000 feet of an occupied permanent residence, school, hospital, institution, church, or other structure in existence at the time of initial application.

- There are no structures within 1000 feet of the site.
- Oil field infrastructure and a caliche quarry are present in the area.

Plate 8 also show surface ownership. Green shading is BLM (Federal) , orange is SLO (State of NM), and no color is private.

Distance to Non-Public Water Supply

Plates 1, 7 and 8 demonstrate that the project area is not within 500 horizontal feet of a spring or freshwater well used for domestic or stock watering purposes, in existence at the time of initial application.

- Plate 1 shows the locations of all area water wells, active or plugged. All water wells are more than 1000 feet from the containments and serve stock and the oil and gas industry.
- No springs were identified within the mapping area (see Plate 7)

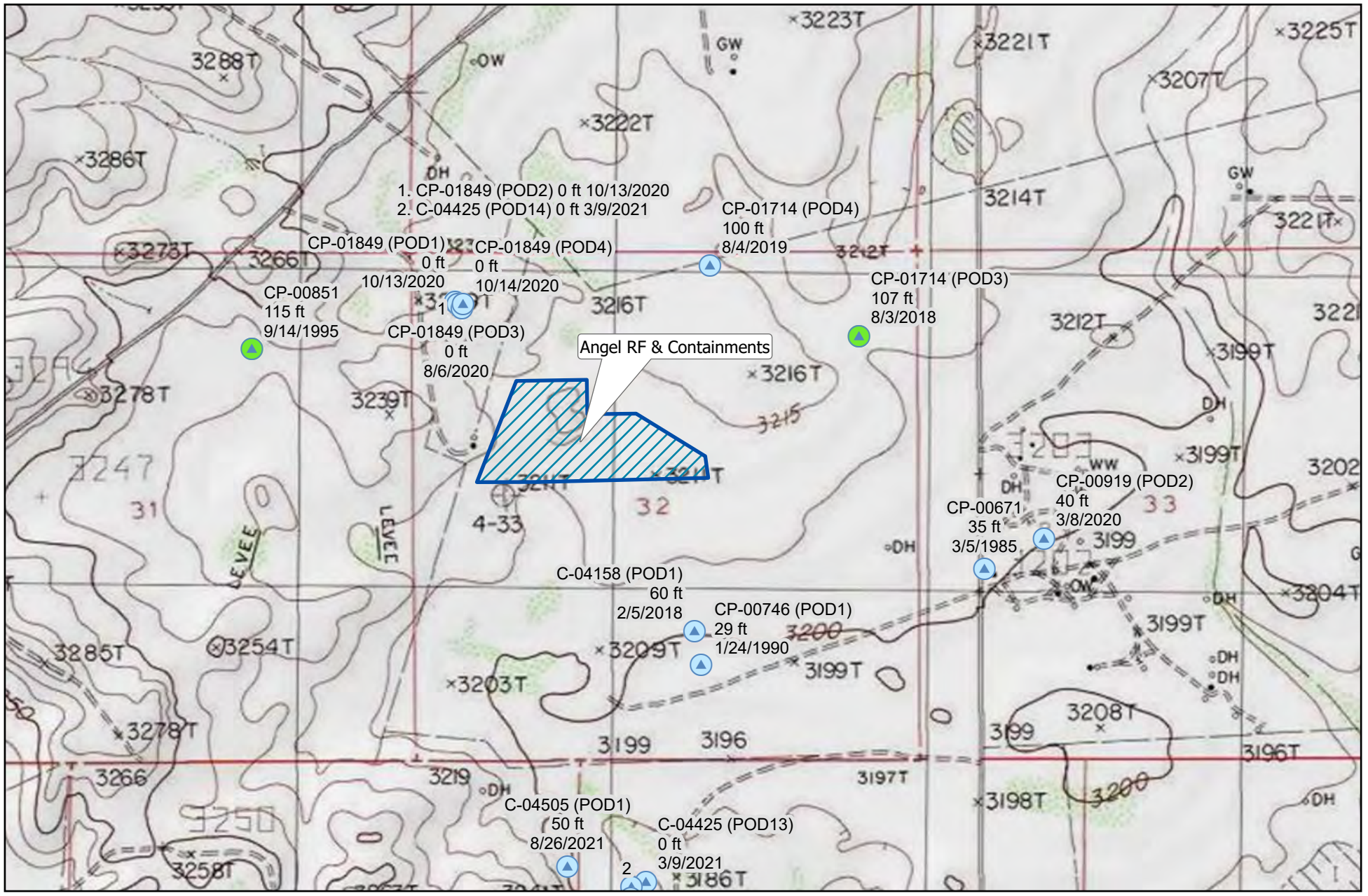
Distance to Wetlands

Plate 9 demonstrates the site is not within 500 feet of mapped wetlands using the USA wetlands database.

- The nearest designated Marsh wetland is about 1800 feet north.
- We used Google Earth to examine all three mapped “marsh” wetlands from 2005 to present and found no standing water in any images. Undoubtedly the wetland mapping is incorrect.

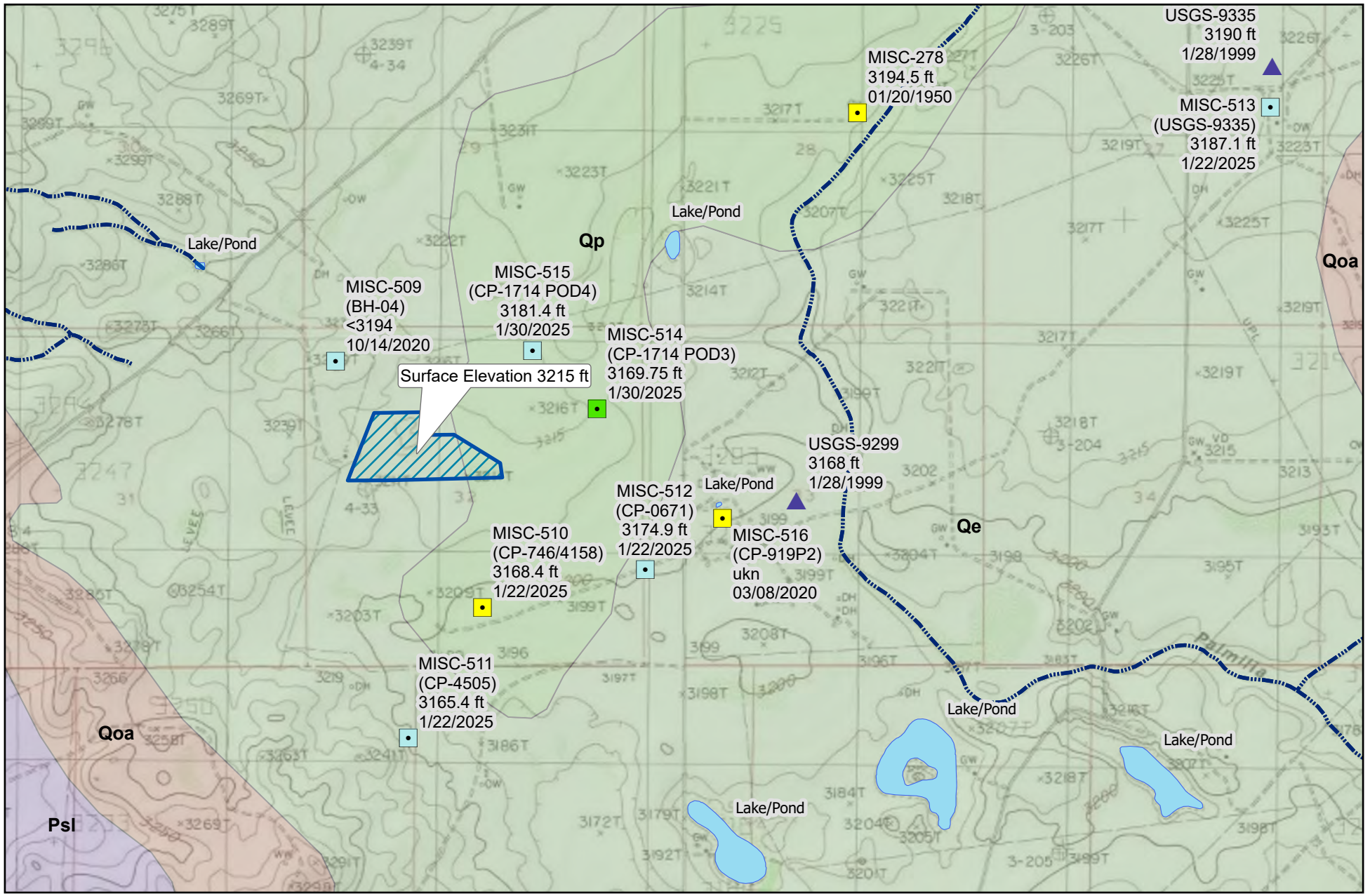
SITING CRITERIA DEMONSTRATION PLATES

P:\Cascade Anderson Angel\Anderson Angel.aprx



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Nearby Wells and Borings with Depth to Water	Plate 1
	BTS Management LLC- Angel RF & Containments	February 2025

P:\Cascade Anderson Angel\Anderson Angel.aprx



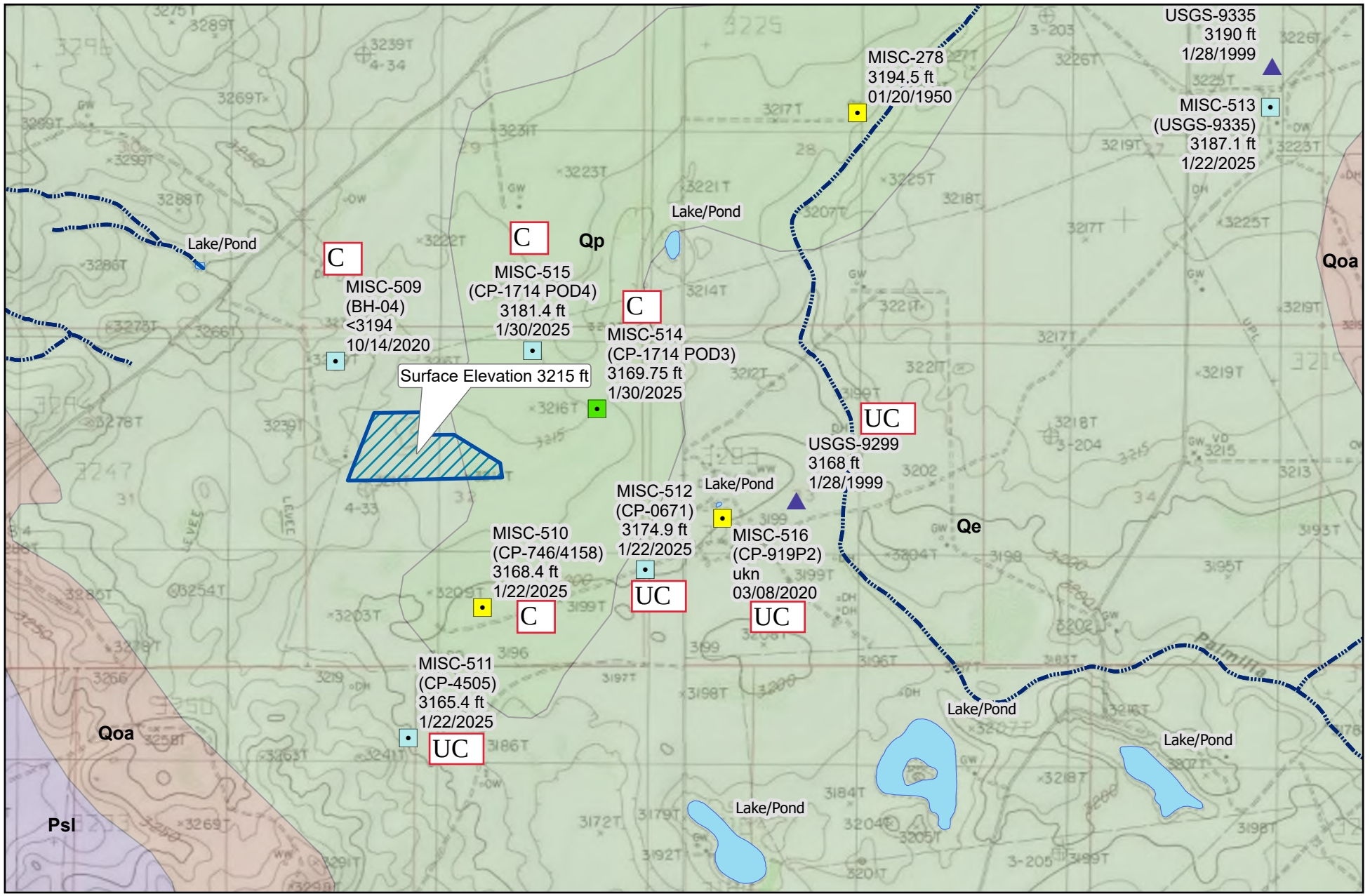
N
W E
S

0 1,500 3,000 US Feet

Scale: 1:30,000

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Groundwater Elevation and Geology	Plate 2a
	BTS Management LLC- Angel RF & Containments	February 2025

P:\Cascade Anderson Angel\Anderson Angel.aprx



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Confined and Unconfined Groundwater and Geology	Plate 2b
	BTS Management LLC- Angel RF & Containments	February 2025

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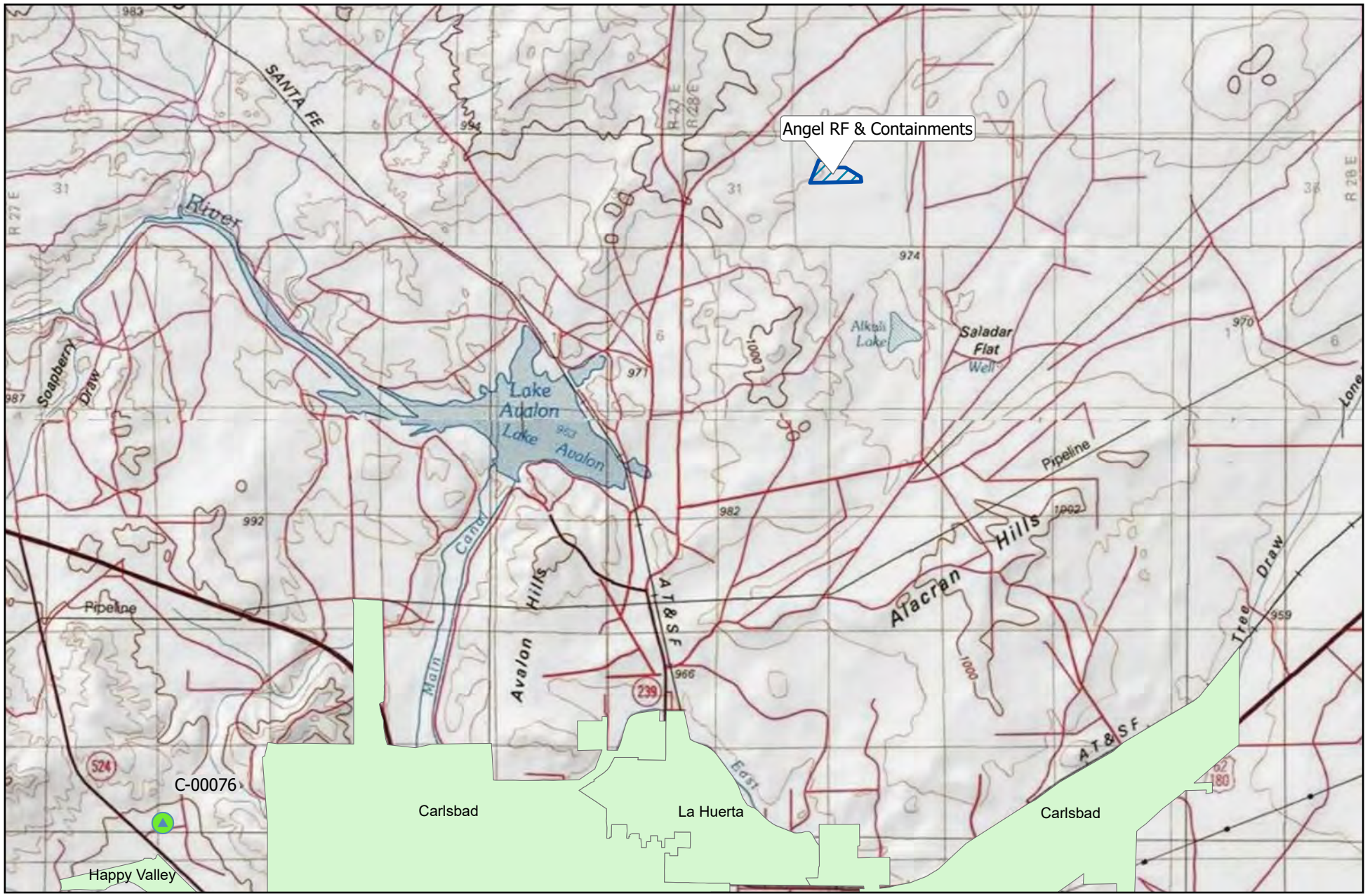
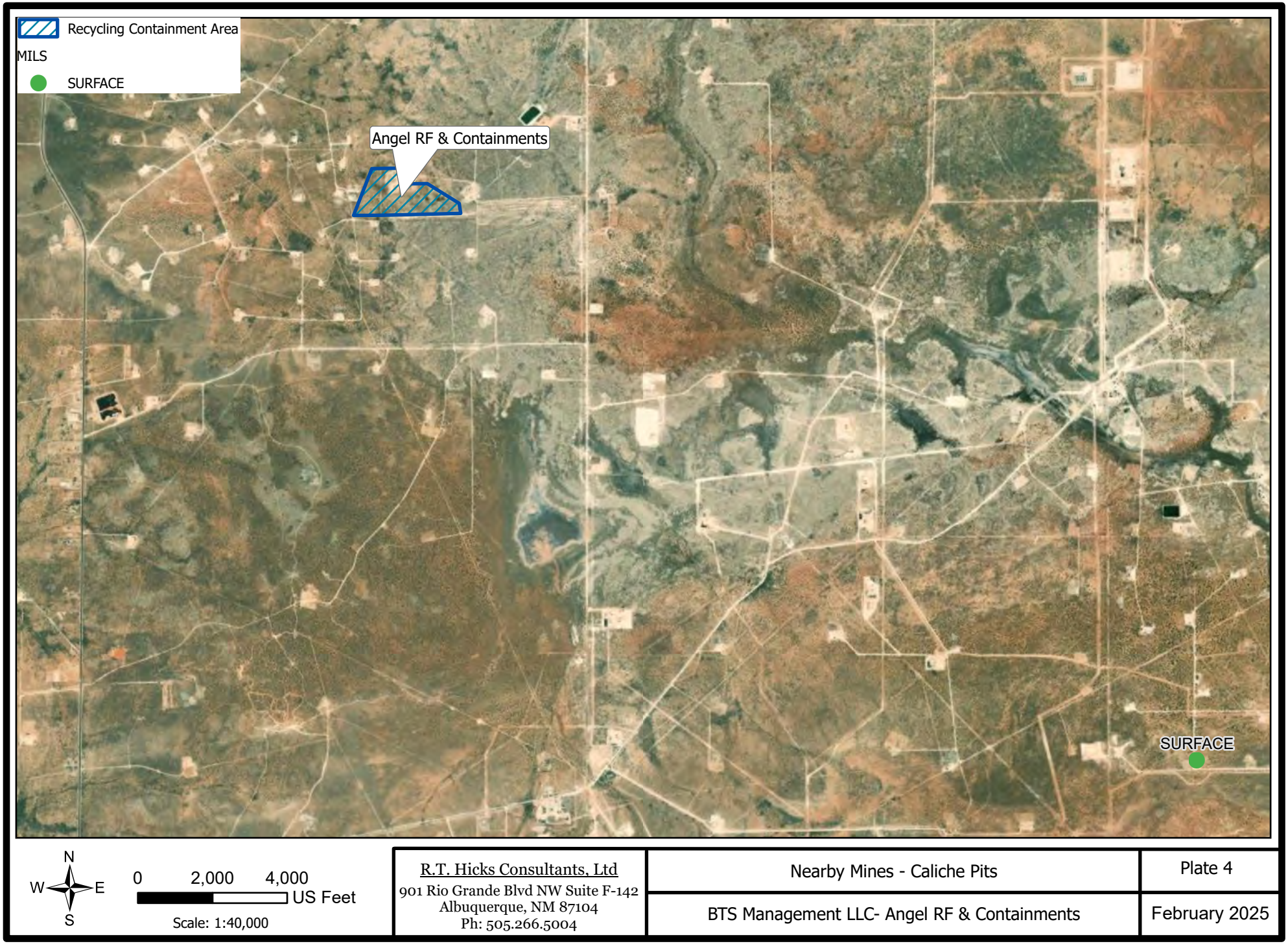


R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Nearest Municipalities & Public Water Supplies	Plate 3
	BTS Management LLC- Angel RF & Containments	February 2025

P:\Cascade Anderson Angel\Anderson Angel.aprx



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Nearby Mines - Caliche Pits	Plate 4
	BTS Management LLC- Angel RF & Containments	February 2025

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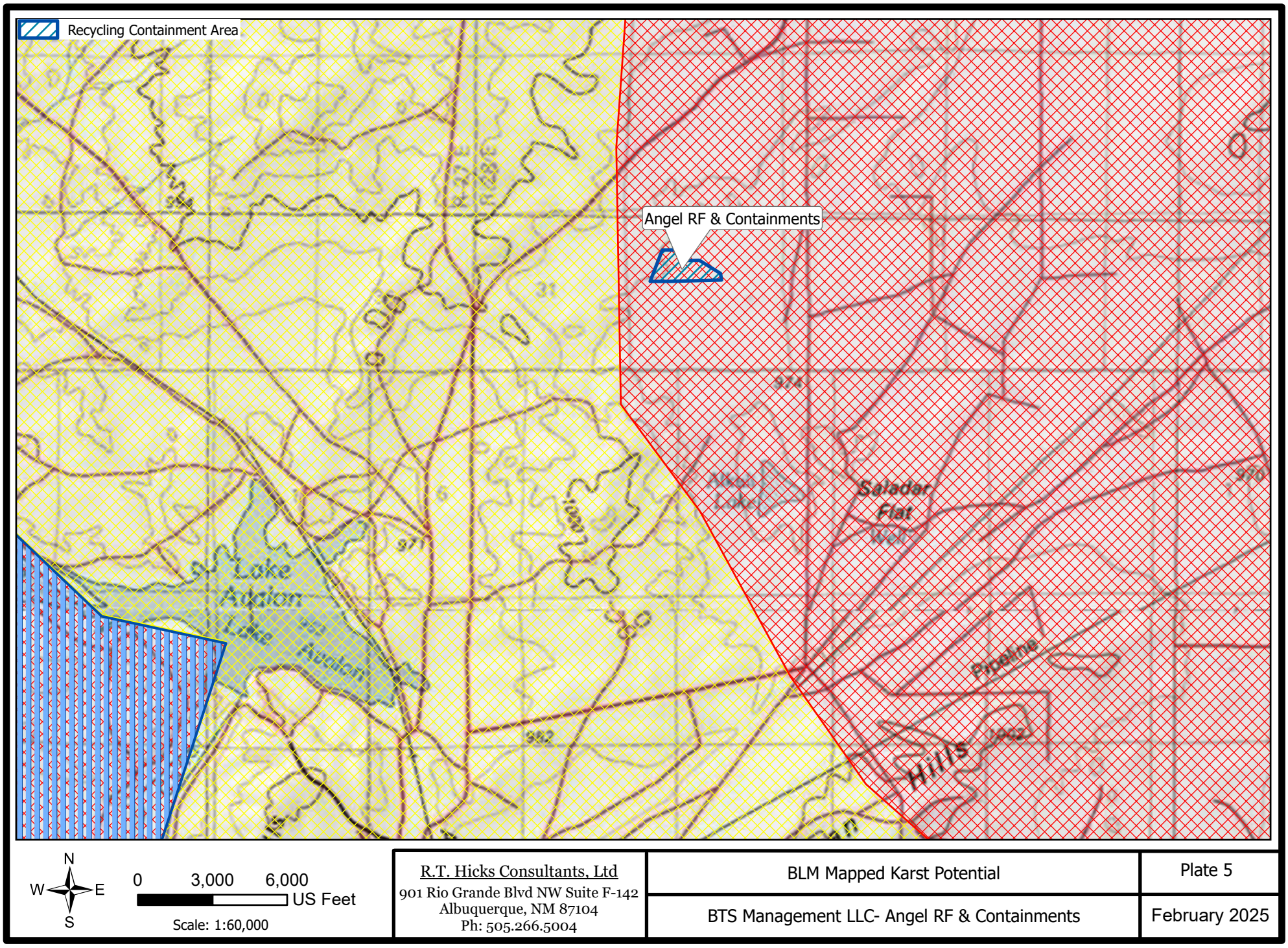

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	BLM Mapped Karst Potential	Plate 5
	BTS Management LLC- Angel RF & Containments	February 2025

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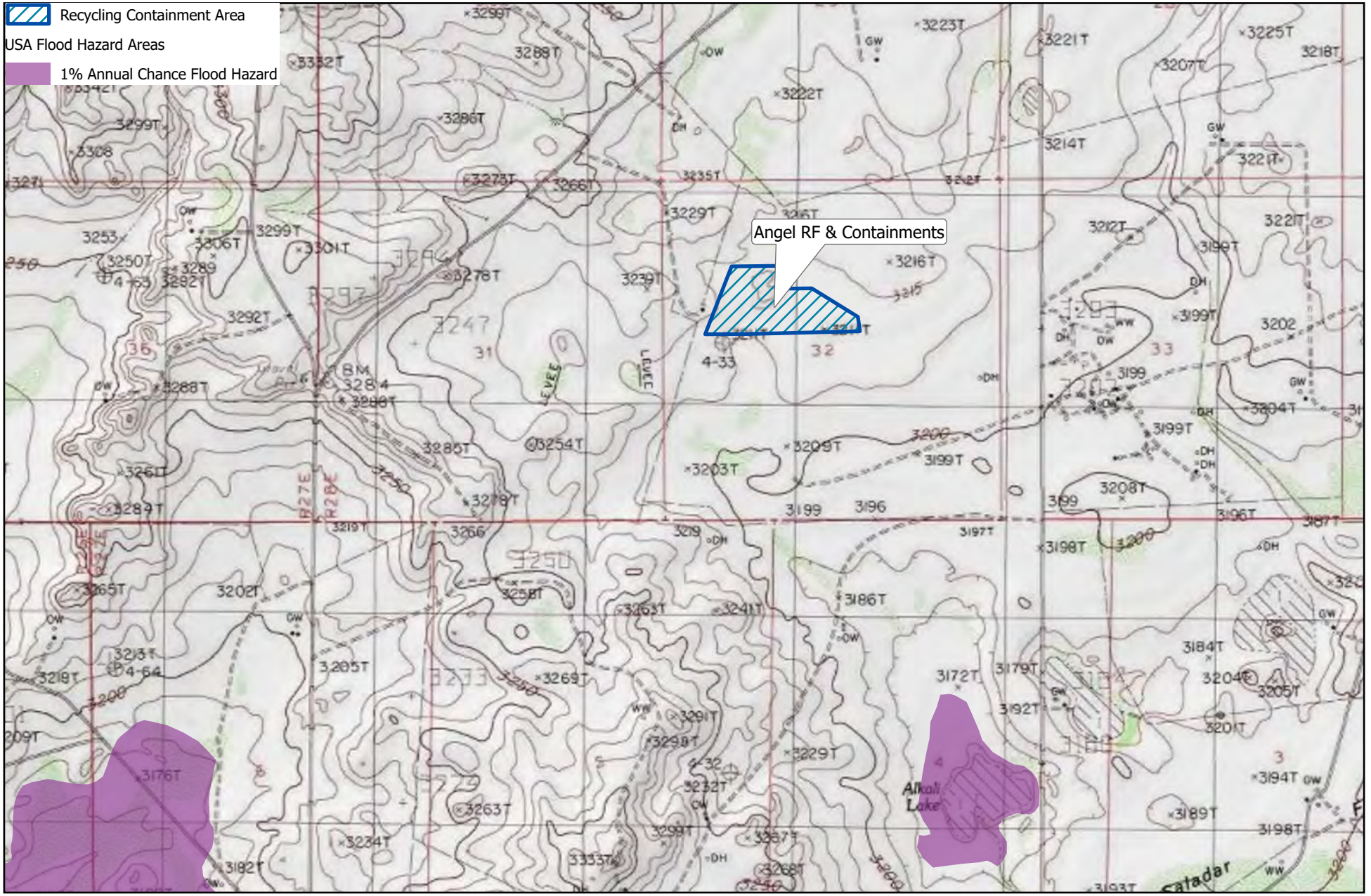

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	FEMA Mapped Flood Zones	Plate 6
	BTS Management LLC- Angel RF & Containments	February 2025

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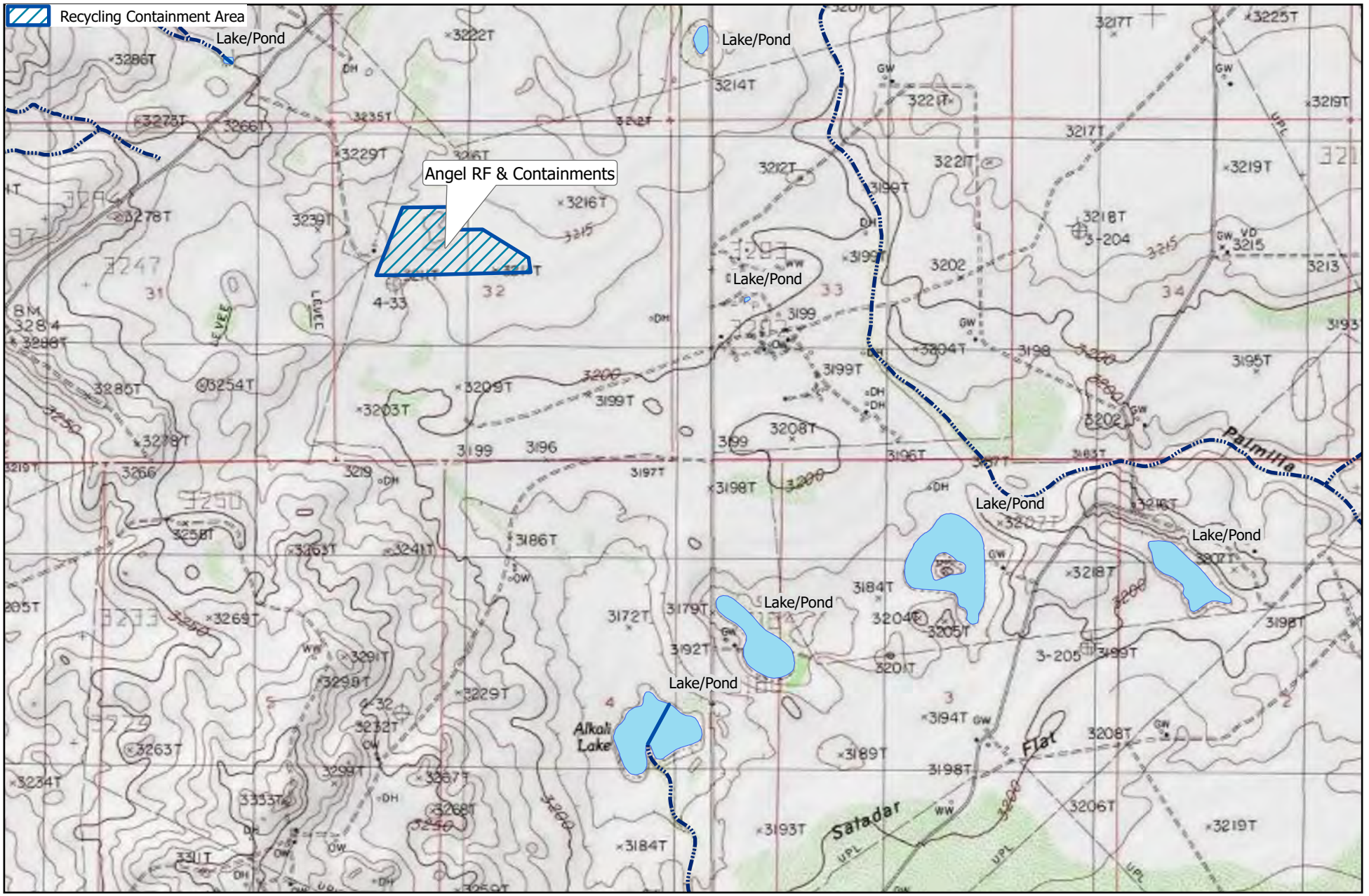


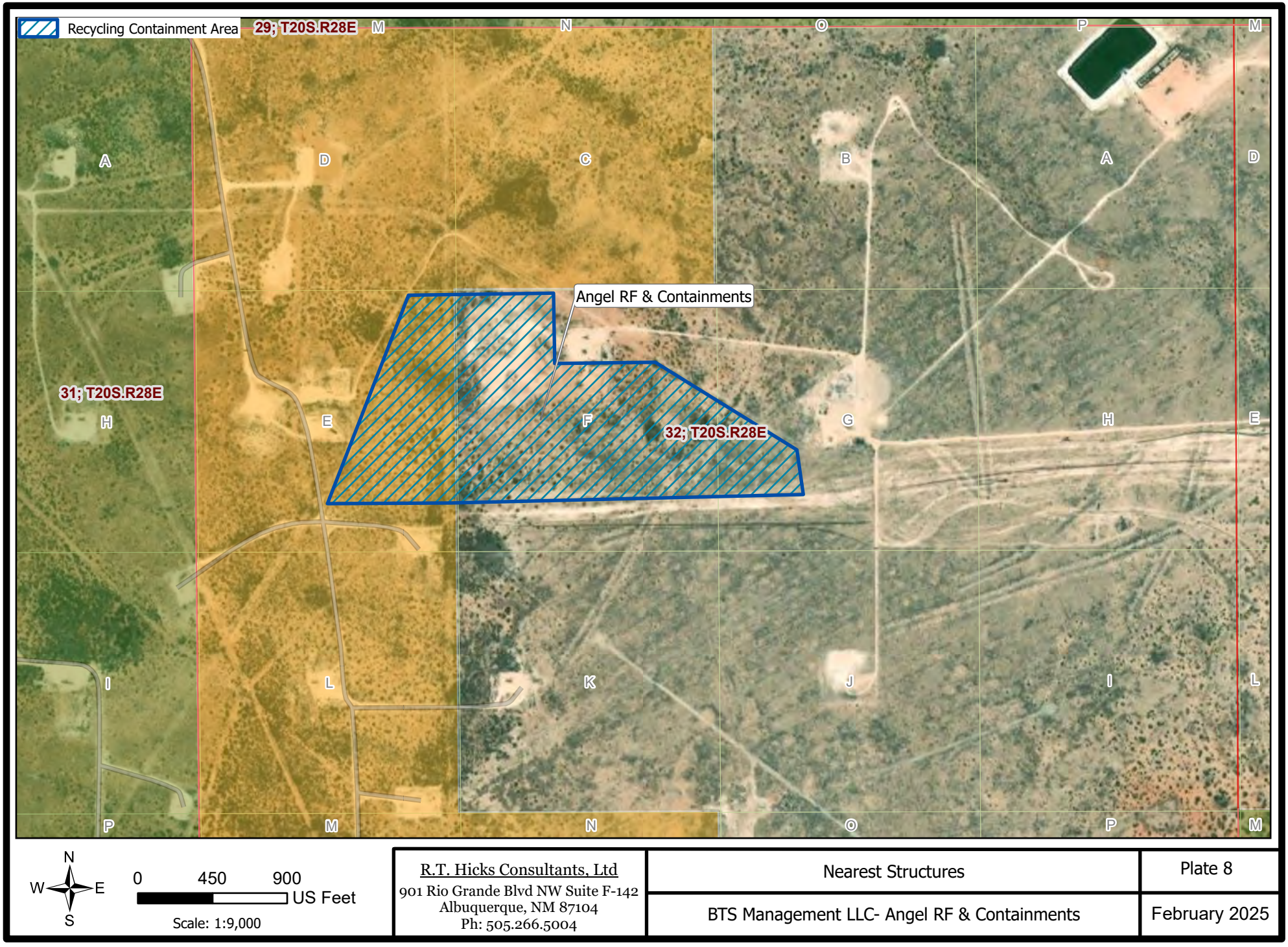
N
W E
S

0 1,500 3,000 US Feet

Scale: 1:30,000

R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Mapped Surface Water	Plate 7
	BTS Management LLC- Angel RF & Containments	February 2025

P:\Cascade Anderson Angel\Anderson Angel.aprx



R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Nearest Structures	Plate 8
	BTS Management LLC- Angel RF & Containments	February 2025

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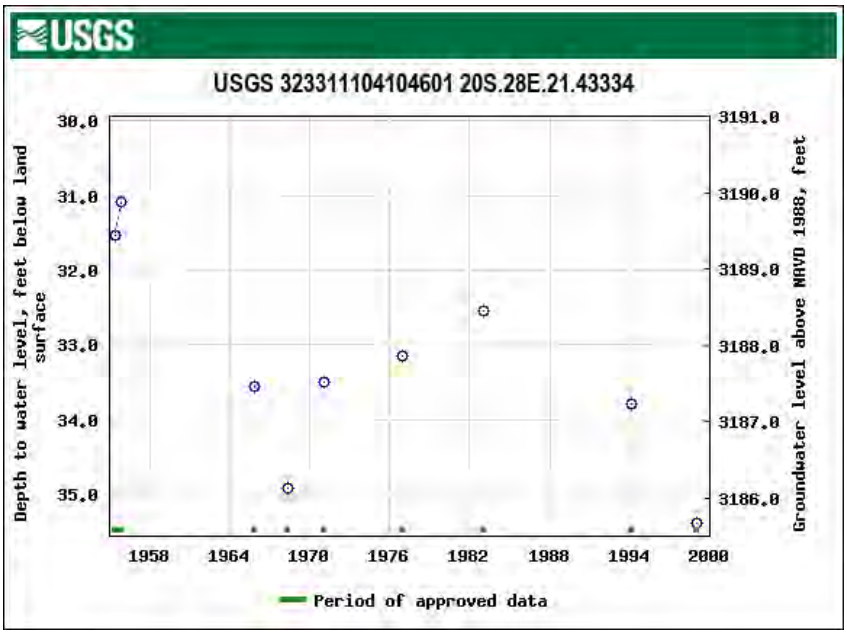
R.T. Hicks Consultants, Ltd 901 Rio Grande Blvd NW Suite F-142 Albuquerque, NM 87104 Ph: 505.266.5004	Mapped Wetlands	Plate 9
	BTS Management LLC- Angel RF & Containments	February 2025

APPENDIX WELL LOGS & USGS DATA

USGS 323311104104601 20S.28E.21.43334 AKA USGS-9331

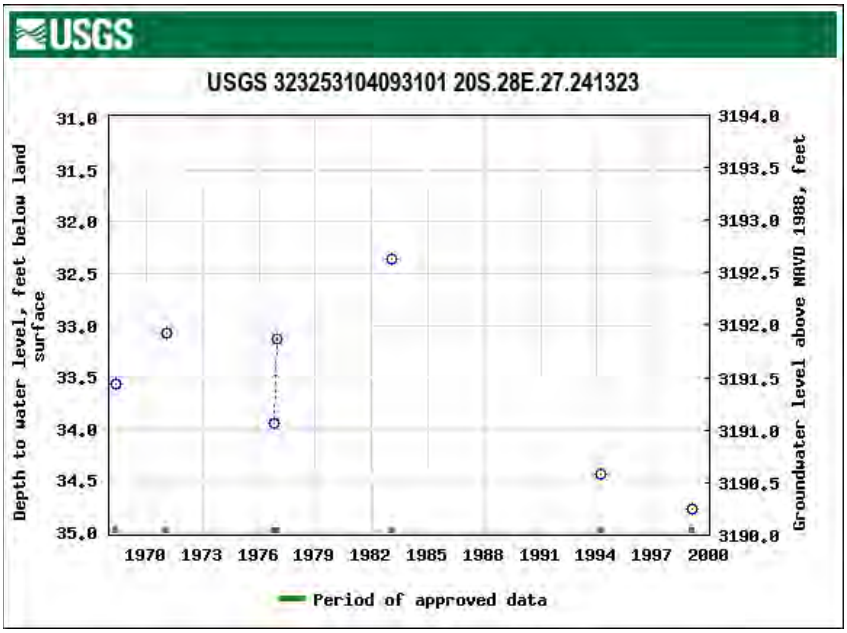
Eddy County, New Mexico
Hydrologic Unit Code 13060011
Latitude 32°33'11", Longitude 104°10'46"
NAD27
Land-surface elevation 3,221 feet above NAVD88
This well is completed in the Other aquifers (N9999OTHER) national aquifer.
This well is completed in the Rustler Formation (312RSLR) local aquifer.



USGS 323253104093101 20S.28E.27.241323 AKA USGS-9335

Eddy County, New Mexico
Hydrologic Unit Code 13060011
Latitude 32°32'53", Longitude 104°09'31"
NAD27
Land-surface elevation 3,225 feet above NAVD88
The depth of the well is 80 feet below land surface.
This well is completed in the Other aquifers (N9999OTHER) national aquifer.
This well is completed in the Rustler Formation (312RSLR) local aquifer.

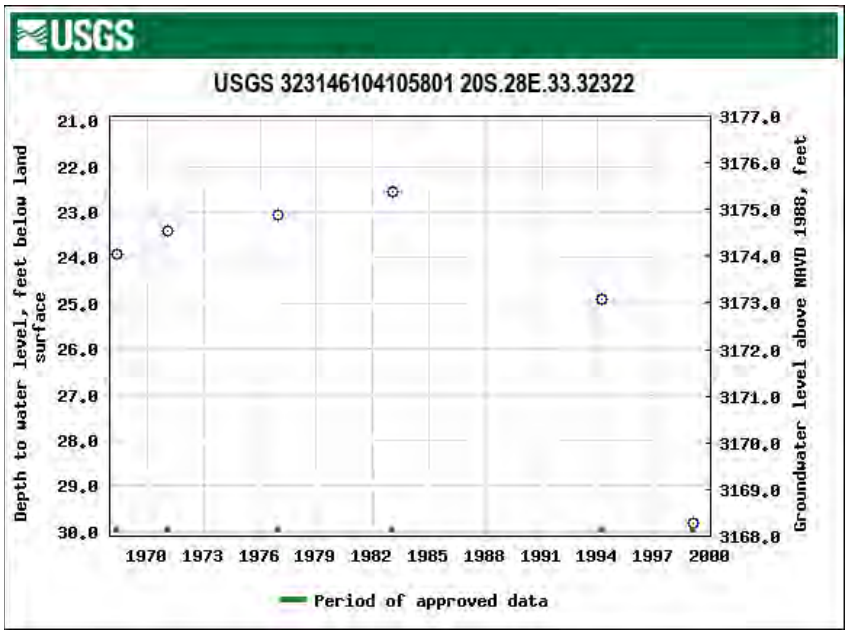
This well is located 3000 feet south of the USGS plotted location and was measured by Hicks Consultants in 2025 showing
Groundwater Elevation = 3187.1 v. 3190 in 1999



Ground elevation is essentially the same for the USGS plotted location and the Hicks Consultants measured location.

USGS 323146104105801 20S.28E.33.32322 AKA USGS-9299

Eddy County, New Mexico
Hydrologic Unit Code 13060011
Latitude 32°31'46", Longitude 104°10'58"
NAD27
Land-surface elevation 3,198 feet above NAVD88
The depth of the well is 43 feet below land surface.
This well is completed in the Other aquifers (N9999OTHER) national aquifer.
This well is completed in the Rustler Formation (312RSLR) local aquifer.



WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

1. GENERAL AND WELL LOCATION

OSE POD NO. (WELL NO.)	WELL TAG ID NO.	OSE FILE NO(S).
POD4 (BH-04)	n/a	CP-1849

WELL OWNER NAME(S)	PHONE (OPTIONAL)
XTO Energy (Kyle Littrell)	

WELL OWNER MAILING ADDRESS	CITY	STATE	ZIP
6401 Holiday Hill Dr.	Midland	TX	79707

WELL LOCATION (FROM GPS)		DEGREES	MINUTES	SECONDS	
	LATITUDE	32°	32'	8.29"	N
	LONGITUDE	-104°	12'	25.33"	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND

* DATUM REQUIRED: WGS 84

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

NW NW Sec. 32 T20S R28E

2. DRILLING & CASING INFORMATION

LICENSE NO.	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
1249	Jackie D. Atkins	Atkins Engineering Associates, Inc.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
10/14/20	10/14/20	Boring	36	n/a

COMPLETED WELL IS: ☐ ARTESIAN ☑ DRY HOLE ☐ SHALLOW (UNCONFINED)

STATIC WATER LEVEL IN COMPLETED WELL (FT): n/a

DRILLING FLUID: ☑ AIR ☐ MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ☑ ROTARY ☐ HAMMER ☐ CABLE TOOL ☐ OTHER – SPECIFY: Hollow Stem Auger

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE (add coupling diameter)	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	36	±8.5	Boring- HSA	--	--	--	--

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/30/17)

FILE NO.	CP-1849	POD NO.	4	TRN NO.	675486
LOCATION	20S.28E.32.111			WELL TAG ID NO.	—

PAGE 1 OF 2

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4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	2	2	SAND, dry, brown-light brown, poorly graded, fine grained, some caliche gravel	Y ✓ N	
2	15	13	CALICHE, dry, tan, off-white, moderately consolidated, some subangular gravel	Y ✓ N	
15	-	-	SANDSTONE, moist, reddish brown, poorly graded, fine grained,	Y ✓ N	
-	29	14	poorly consolidated, trace fine crystalline white gypsum,	Y ✓ N	
29	-	-	MUDSTONE, moist, reddish dark brown, poorly consolidated, high plasticity,	Y ✓ N	
-	36	7	cohesive, some trace cystalline gypsum veins, blocky,	Y ✓ N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA:

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

TOTAL ESTIMATED WELL YIELD (gpm): 0.00

5. TEST; RIG SUPERVISION

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

MISCELLANEOUS INFORMATION: Temporary well materials removed and the soil boring backfilled using drill cuttings from total depth to ten feet below ground surface, then hydrated bentonite chips from ten feet below ground surface to surface. Logs adapted from LTE on-site geologist.

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

Shane Eldridge

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 30 DAYS AFTER COMPLETION OF WELL DRILLING:

Jack Atkins — Jackie D. Atkins — 10/26/2020

SIGNATURE OF DRILLER / PRINT SIGNEE NAME — DATE

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

FILE NO. CP-1849	POD NO. 4	TRN NO. 675485
LOCATION	WELL TAG ID NO.	PAGE 2 OF 2

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WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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1. GENERAL AND WELL LOCATION

OSE POD NO. (WELL NO.)	WELL TAG ID NO.	OSE FILE NO(S).
POD3 (BH03)	n/a	CP-1849

WELL OWNER NAME(S)	PHONE (OPTIONAL)
XTO Energy, Inc.	

WELL OWNER MAILING ADDRESS	CITY	STATE	ZIP
6401 Holiday Hill Road	Midland	TX	79707

WELL LOCATION (FROM GPS)		DEGREES	MINUTES	SECONDS	
	LATITUDE	32	32	7.88	N
	LONGITUDE	-104	12	25.46	W

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

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

NW NW Sec. 32 T20S R28E

2. DRILLING & CASING INFORMATION

LICENSE NO.	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
1249	Jackie D. Atkins	Atkins Engineering Associates, Inc.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
08/06/20	08/06/20	n/a	30	n/a

COMPLETED WELL IS: ☐ ARTESIAN ☒ DRY HOLE ☐ SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT): n/a

DRILLING FLUID: ☐ AIR ☐ MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ☐ ROTARY ☐ HAMMER ☐ CABLE TOOL ☑ OTHER – SPECIFY: Hollow Stem Auger

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE (add coupling diameter)	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	30	±6.5	Boring	--	--	--	--

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

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

FILE NO. CP-1849	POD NO. 3	TRN NO. 675486	
LOCATION 111 T20S R28E Sec 32		WELL TAG ID NO. NA	PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	1	1	SAND, dry, brown-light brown, poorly graded, find grained, trace caliche grave,	Y ✓ N	
1	11	10	CALICHE, dry, off white, moderately consolidated, some sub-angular gravel	Y ✓ N	
11	19	8	SAND, dry, brown-light brown, poorly graded, fine-very fine grained, sub round	Y ✓ N	
19	27	8	SANDSTONE, dry, reddish brown, moderately consolidated, fine-rained,	Y ✓ N	
27	30	3	MUDSTONE, moist, light gray-gray, poorly consolidated, high plasticity, cohesi	Y ✓ N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA:

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

TOTAL ESTIMATED WELL YIELD (gpm): 0.00

5. TEST; RIG SUPERVISION

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

MISCELLANEOUS INFORMATION: Soil boring backfilled from total depth to surface with hydrated bentonite chips.
Log adapted from LTE on-site geologist.

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

Shane Eldridge

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 30 DAYS AFTER COMPLETION OF WELL DRILLING:

Jack Atkins — Jackie D. Atkins — 08/19/2020

SIGNATURE OF DRILLER / PRINT SIGNEE NAME — DATE

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

FILE NO. CP-1849	POD NO. 3	TRN NO. 675486	
LOCATION 111 T20S R28E Sec 32		WELL TAG ID NO. NA	PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

1. GENERAL AND WELL LOCATION

OSE POD NO. (WELL NO.): CP-1714 POD4	WELL TAG ID NO.	OSE FILE NO(S).
WELL OWNER NAME(S): Dave Andersen		PHONE (OPTIONAL)
WELL OWNER MAILING ADDRESS: 616 Queens Hwy	CITY: Carlsbad STATE: NM ZIP: 88220	

WELL LOCATION (FROM GPS): DEGREES MINUTES SECONDS
LATITUDE 32.53620 N
LONGITUDE -104.19707 W

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

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

2. DRILLING & CASING INFORMATION

LICENSE NO.: WD1778	NAME OF LICENSED DRILLER: Travis Mann		NAME OF WELL DRILLING COMPANY: Third Generation Drilling
DRILLING STARTED: 08-04-19	DRILLING ENDED: 08-04-19	DEPTH OF COMPLETED WELL (FT): 140	BORE HOLE DEPTH (FT): 180
DEPTH WATER FIRST ENCOUNTERED (FT): 100			
STATIC WATER LEVEL IN COMPLETED WELL (FT): 41			

COMPLETED WELL IS: ☐ ARTESIAN ☐ DRY HOLE ☒ SHALLOW (UNCONFINED)

DRILLING FLUID: ☒ AIR ☐ MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ☒ ROTARY ☐ HAMMER ☐ CABLE TOOL ☐ OTHER – SPECIFY:

DEPTH (feet bgl) FROM	TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE (add coupling diameter)	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	80	9 7/8	PVC SDR17	Slip	5	0.25	
80	140	9 7/8	PVC SDR17	Slip	5	0.25	.032

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT
0	20	9 7/8	Cement	7.88	Poured
20	140	9 7/8	Pea gravel	47.322	Poured

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/30/17)

FILE NO. CP-1714	POD NO. 4	TRN NO. 627376	
LOCATION 26S.28E.32.211	WELL TAG ID NO. —	PAGE 1 OF 2	

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	3	3	Top Soil	Y (N)	
3	18	15	Caliche	Y (N)	
38	85	47	Grey Clay	Y (N)	
85	100	15	Sand Stone	Y (N)	
100	180	80	red Sand	(Y) N	65
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA:

[X] PUMP [ ] AIR LIFT [ ] BAILER [ ] OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm): 65 / 0.00

5. TEST; RIG SUPERVISION

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

MISCELLANEOUS INFORMATION:

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

Travis Mann

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 30 DAYS AFTER COMPLETION OF WELL DRILLING:

Travis Mann /Travis Mann — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

09/25/2019 — DATE

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

FILE NO.	CP-1714	POD NO.	4	TRN NO.	627376
LOCATION	20S.28E.32.211			WELL TAG ID NO.	PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

1. GENERAL AND WELL LOCATION

OSE POD NO. (WELL NO.): CP-1714 POD 3	WELL TAG ID NO.	OSE FILE NO(S).
WELL OWNER NAME(S): Dave Andersen		PHONE (OPTIONAL)
WELL OWNER MAILING ADDRESS: 616 Queens Hwy	CITY: Carlsbad	STATE: NM ZIP: 88220

WELL LOCATION (FROM GPS): DEGREES / MINUTES / SECONDS
- LATITUDE: 32.53376 N
- LONGITUDE: -104.19383 W

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

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

2. DRILLING & CASING INFORMATION

LICENSE NO.: WD1778	NAME OF LICENSED DRILLER: Travis Mann	NAME OF WELL DRILLING COMPANY: Third Generation Drilling
DRILLING STARTED: 8-3-18	DRILLING ENDED: 8-3-18	DEPTH OF COMPLETED WELL (FT): 160
BORE HOLE DEPTH (FT): 200	DEPTH WATER FIRST ENCOUNTERED (FT): 107	
COMPLETED WELL IS: ☐ ARTESIAN ☐ DRY HOLE ☒ SHALLOW (UNCONFINED)	STATIC WATER LEVEL IN COMPLETED WELL (FT): 41	
DRILLING FLUID: ☒ AIR ☐ MUD	ADDITIVES – SPECIFY:	
DRILLING METHOD: ☒ ROTARY ☐ HAMMER ☐ CABLE TOOL ☐ OTHER – SPECIFY:		

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE (add coupling diameter)	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	100	9 7/8	PVC SDR 17	Slip	5	0.25	
100	160	9 7/8	PVC SDR 17	Slip	5	0.25	0.32

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT
0	20	9 7/8	Cement	7.88	Poured
20	160	9 7/8	Pea gravel	55.34	Poured

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

FILE NO.: CP-1714	POD NO.: 3	TRN NO.: 627374	
LOCATION: 20S.28E.32.224	WELL TAG ID NO.: —	PAGE 1 OF 2	

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	3	3	Top Soil	Y (N)	
3	18	15	Caliche	Y (N)	
18	84	66	Sand	Y (N)	
84	107	23	Yellow sandstone	Y (N)	
107	200	93	Red Sand	(Y) N	65
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA:

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

TOTAL ESTIMATED WELL YIELD (gpm): 65.00 / 0.00

5. TEST; RIG SUPERVISION

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

MISCELLANEOUS INFORMATION:

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

Travis Mann

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 30 DAYS AFTER COMPLETION OF WELL DRILLING:

Travis Mann / Travis Mann — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

09/25/2019 — DATE

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

FILE NO. CP-1714	POD NO. 3	TRN NO. 627376
LOCATION 20S.28E.32.224	WELL TAG ID NO.	PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

OSE DIT APR 13 2020 AM 11:33

1. GENERAL AND WELL LOCATION

OSE POD NO. (WELL NO.)	WELL TAG ID NO.	OSE FILE NO(S).
POD-2		CP-919

WELL OWNER NAME(S)	PHONE (OPTIONAL)
ANDERSEN INVESTMENTS LLC C/O DAVID ANDERSEN	575-361-3668

WELL OWNER MAILING ADDRESS	CITY	STATE	ZIP
616 QUEENS HWY	CARLSBAD	NM	88220

WELL LOCATION (FROM GPS)		DEGREES	MINUTES	SECONDS	
	LATITUDE	W104	11	14.38	N
	LONGITUDE	N32	31	44.16	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND

* DATUM REQUIRED: WGS 84

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

NE 1/4 of NW 1/4 of SW 1/4 of SECTION 33, TOWNSHIP 20 S, RANGE 28 E

2. DRILLING & CASING INFORMATION

LICENSE NO.	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1737	JUSTIN MULLINS	SHADE TREE DRILLING

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
3-8-20	3-8-20	104	104	40

COMPLETED WELL IS: ☐ ARTESIAN ☐ DRY HOLE ☑ SHALLOW (UNCONFINED)

STATIC WATER LEVEL IN COMPLETED WELL (FT): 40

DRILLING FLUID: ☐ AIR ☑ MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ☑ ROTARY ☐ HAMMER ☐ CABLE TOOL ☐ OTHER – SPECIFY:

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE (add coupling diameter)	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	44	10	SDR 17 PVC	GLUE	6	1/4	
44	104	10	SDR 17 PVC	GLUE	6	1/4	.030

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT
0	20	10	PORTLAND CEMENT	7	HAND
20	104	10	3/8" PEA GRAVEL	30	HAND

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 04/30/19)

FILE NO. CP-919	POD NO. 2	TRN NO. 667395	
LOCATION 132 T20S R28E Sec 33		WELL TAG ID NO. 2233E	PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	5	5	TOPSOIL	Y N	
5	15	10	CALICHE ROCK	Y N	
15	40	25	RED CLAY	Y N	
40	70	30	SANDSTONE	✔ Y N	10.00
70	74	4	CAVITY OR VOID	✔ Y N	30.00
74	80	6	SANDSTONE	✔ Y N	10.00
80	95	15	CAVITY OR VOID	✔ Y N	30.00
95	104	9	RED CLAY	Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA:

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

TOTAL ESTIMATED WELL YIELD (gpm): 80.00

5. TEST; RIG SUPERVISION

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

MISCELLANEOUS INFORMATION:

RECEIVED APR 10 2025 PM 1:52

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

BEN LOEWEN

6. SIGNATURE

BY SIGNING BELOW, I CERTIFY THAT TO THE BEST OF MY KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED WELL. I ALSO CERTIFY THAT THE WELL TAG, IF REQUIRED, HAS BEEN INSTALLED AND THAT THIS WELL RECORD WILL ALSO BE FILED WITH THE PERMIT HOLDER WITHIN 30 DAYS AFTER THE COMPLETION OF WELL DRILLING.

Justin Mullins — JUSTIN MULLINS — 3-28-20

SIGNATURE OF DRILLER / PRINT SIGNEE NAME — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 04/30/2019)

FILE NO. CP-919	POD NO. 2	TRN NO. 673395	
LOCATION 132 T20S R28E Sec 33		WELL TAG ID NO. 2233E	PAGE 2 OF 2

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

475396

Section 1. GENERAL INFORMATION

(A) Owner of well David & MARY WALKER Owner's Well No. CP-671

Street or Post Office Address PO BOX 1252

City and State CARLSBAD NM 88220

Well was drilled under Permit No. CP-671 and is located in the:

a. W½ ¼ NW ¼ SW ¼ ¼ of Section 33 Township 20 S Range 28 E N.M.P.M.

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

c. Lot No. _____ of Block No. _____ of the _____

Subdivision, recorded in _____ County.

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

(B) Drilling Contractor EDGAR W. MAGBY License No. 969

Address Rt 1 Box 197 A CARLSBAD, N.M. 88220

Drilling Began 2-28-85 Completed 3-5-85 Type tools CABLE TOOL Size of hole 6 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 70 ft.

Completed well is ☑ shallow ☐ artesian. Depth to water upon completion of well 35 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
35	40	5	PINK SAND W/WATER	7 GAL

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
6"		Welded	0	54			35	54

Section 4. RECORD OF MUDDING AND CEMENTING

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

Section 5. PLUGGING RECORD

Plugging Contractor _____

Address _____

Plugging Method _____

Date Well Plugged _____

Plugging approved by: _____

State Engineer Representative

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

FOR USE OF STATE ENGINEER ONLY

Date Received March 12, 1985

Quad _____ FWL _____ FSL _____

File No. CP-671 Use DOMESTIC & STK Location No. 20.28.33.31342

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	1	1	SERFICE DIRT
1	25	24	Soft White CALICHE
25	27	2	HARD Cemented Rock & Caliche
27	35	8	White GYPSON
35	40	5	PINK SAND W/WATER
40	60	20	Red Bed CLAY
60	63	3	CRUMBLY GYPSON W/WATER
63	70	7	GLASSEY GYPSON

Section 7. REMARKS AND ADDITIONAL INFORMATION

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

Edgar W. Mogley
Driller

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

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2018 MAR -5 AM 11:00

1. GENERAL AND WELL LOCATION

OSE POD NO. (WELL NO.)	WELL TAG ID NO.	OSE FILE NO(S).
C-4158	2065C	

WELL OWNER NAME(S)	PHONE (OPTIONAL)
Winston Ballard	

WELL OWNER MAILING ADDRESS	CITY	STATE	ZIP
1819-2 N. Canal	Carlsbad	NM	88220

WELL LOCATION (FROM GPS)		DEGREES	MINUTES	SECONDS	
	LATITUDE	32	31	34.63	N
	LONGITUDE	104	11	57.07	W

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

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

On ranch off of Alkali Rd.

2. DRILLING & CASING INFORMATION

LICENSE NO.	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1348	Clinton E Taylor	Taylor Water Well Service

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
1/10/2018	2/5/2018	137	160	60

COMPLETED WELL IS: ☐ ARTESIAN ☐ DRY HOLE ☑ SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT): 28

DRILLING FLUID: ☑ AIR ☐ MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ☑ ROTARY ☐ HAMMER ☐ CABLE TOOL ☐ OTHER – SPECIFY:

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE (add coupling diameter)	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	57	11	PVC	Glue Joint	6	SCH 40	
57	137	11	PVC	Glue Joint	6	SCH 40	.050

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT
0	20	11	20% Bentonite Grout	3 Sacks	Tremie
20	137	11	3/8" Pea Gravel	3 Yards	Dump

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

FILE NO.	C-4158	POD NO.	1	TRN NO.	615692	
LOCATION	SFR	20S.28E.32.413		WELL TAG ID NO.	2065C	PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	4	4	Soil	Y ✓ N	
4	8	4	Caliche	Y ✓ N	
8	22	14	Anhydrite:wht,fn xln,sme clr gyp,sme wht clay	Y ✓ N	
22	60	38	Clay:pnk,slty-sndy	Y ✓ N	
60	134	74	Thin Layers of Sand, Clay+Anhydrite	✓ Y N	20.00
			Sand:clr,frstd,rd,vfn grn,unconsl,mod wl srtd	Y N	
			Clay:rd,vry sndy	Y N	
			Anhydrite:wht,pnk,vfn-fn xln	Y N	
134	138	8	Clay:blu gry,smth,stky	Y ✓ N	
138	144	6	Anhydrite:wht,frstd,vfn-fn xln	Y ✓ N	
144	152	8	Clay:blu gry,smth,stky	Y ✓ N	
152	160	8	Siltstone:blu gry,calc	Y ✓ N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA:

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

TOTAL ESTIMATED WELL YIELD (gpm): 20.00

5. TEST; RIG SUPERVISION

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

MISCELLANEOUS INFORMATION: With pump set at 100' well makes 20 gpm, but water is very red and sandy. With pump set at 80' well makes 13 gpm and is clear. Water quality is 3200 PPM TDS.

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

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 30 DAYS AFTER COMPLETION OF WELL DRILLING:

CE Taylor — 3/1/2018

SIGNATURE OF DRILLER / PRINT SIGNEE NAME — DATE

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

FILE NO.	POD NO.	TRN NO.
LOCATION	WELL TAG ID NO.	PAGE 2 OF 2

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Bruce Riggs Owner's Well No. _____
Street or Post Office Address P.O Box 322
City and State Carlsbad, New Mexico 88220

Well was drilled under Permit No. CP-746 and is located in the:

a. _____ ¼ NW ¼ SW ¼ SE ¼ of Section 32 Township 20 S Range 28 E N.M.P.M.

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

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

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

(B) Drilling Contractor W.H. Taylor,Sr. License No. WD-604

Address 1401 W. Fox, Carlsbad, New Mexico 88220

Drilling Began 1/11/1990 Completed 1/24/1990 Type tools Rotary Size of hole 8" in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 70' ft.

Completed well is ☒ XX shallow ☐ artesian. Depth to water upon completion of well 29' ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
59'	60'	1'	sand, gravel, water (salty)	5 gal.

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
5½ ''			1'6"	71' 6"			50'	70'

Section 4. RECORD OF MUDDING AND CEMENTING

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

'91 AUG 30 AM 9 26
STATE ENGINEER OFFICE
SANTA FE, NEW MEXICO

Section 5. PLUGGING RECORD

Plugging Contractor _____
Address _____
Plugging Method _____
Date Well Plugged _____
Plugging approved by:
_____
State Engineer Representative

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

FOR USE OF STATE ENGINEER ONLY

Date Received JANUARY 31, 1990

Quad _____ FWL _____ FSL _____

File No. CP-746 Use STOCK Location No. 20.28.32.43144

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	12	12	White Mare
12	59	47	Red Clay
59	60	1	Sand, Gravel, and Water
60	70	10	Red Clay

Section 7. REMARKS AND ADDITIONAL INFORMATION

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

W R Taylor Sr
Driller

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

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

1. GENERAL AND WELL LOCATION

OSE POD NO. (WELL NO.)	WELL TAG ID NO.	OSE FILE NO(S).
~~C-4505~~ POD 1	ID 20D81	C-4505

WELL OWNER NAME(S)	PHONE (OPTIONAL)
Winston Ballard	

WELL OWNER MAILING ADDRESS	CITY	STATE	ZIP
620 E Greene St	Carlsbad	NM	88220

WELL LOCATION (FROM GPS)		DEGREES	MINUTES	SECONDS	
	LATITUDE	32	31	10.372984	N
	LONGITUDE	104	12	12.571665	W

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

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

2. DRILLING & CASING INFORMATION

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

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
08/26/21	08/26/21	95	120	50

COMPLETED WELL IS: ☐ ARTESIAN ☐ DRY HOLE ☑ SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT): 50

DRILLING FLUID: ☑ AIR ☐ MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ☑ ROTARY ☐ HAMMER ☐ CABLE TOOL ☐ OTHER – SPECIFY:

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE (add coupling diameter)	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	60	11	SCH40 PVC	SPLINE	6	SCH40	
60	95	11	SCH40 PVC	SPLINE	6	SCH40	.032

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT
0	20	11	PORTLAND I/II	18	TOP POUR
20	95	11	8/16 SILICA SAND	65	TOP POUR

OSE DII MAY 26 2022 PM1:17

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

FILE NO. C-4505-POD 1	POD NO. 1	TRN NO. 684747	
LOCATION SK 21.27.05.422		WELL TAG ID NO. 20D81	PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	4	4	TOPSOIL	Y N	
4	10	6	CALICHE	Y N	
10	25	15	BROKEN LIMESTONE	Y N	
25	50	25	SANDY CLAY	Y N	
50	70	30	SANDSTONE	✓ Y N	10.00
70	120	50	BROKEN LIMESTONE	✓ Y N	15.00
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	
				Y N	

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

TOTAL ESTIMATED WELL YIELD (gpm): 25.00

5. TEST; RIG SUPERVISION

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

MISCELLANEOUS INFORMATION:

OSE DII MAY 26 2022 PM1:17

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

6. SIGNATURE

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

Bryce Wallace — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

09/01/21 — DATE

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

FILE NO. C-4505-POD 1	POD NO. 1	TRN NO. 684747	
LOCATION STK 21.27.05.422		WELL TAG ID NO. 20081	PAGE 2 OF 2

STATE ENGINEER OFFICE

WELL RECORD

Revised June 1972

47623 1

Section 1. GENERAL INFORMATION

(A) Owner of well Exxon Company USA Owner's Well No. _____

Street or Post Office Address P.O. Box 1600

City and State Midland, Texas 79702-1600

Well was drilled under Permit No. ~~CP-850~~ CP-851 and is located in the:

a. _____ ¼ ~~NW~~ SE ¼ ~~NW~~ NW ¼ ~~SW~~ NE ¼ of Section ~~32~~ 31 Township 20-S. Range 28-E. N.M.P.M.

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

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

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

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

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

Drilling Began 9/14/95 Completed 9/14/95 Type tools rotary Size of hole 7 7/8 in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 255 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 115 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
205	230	25	lime	12

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
6 5/8	.188		1	257	257	orange peel	181	257

Section 4. RECORD OF MUDDING AND CEMENTING

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

Section 5. PLUGGING RECORD

Plugging Contractor _____

Address _____

Plugging Method _____

Date Well Plugged _____

Plugging approved by:

_____
State Engineer Representative

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

FOR USE OF STATE ENGINEER ONLY

Date Received 09-21-95

Quad _____ FWL _____ FSL _____

File No. ~~CP-850~~ CP-851 Use ~~OWD~~ Location No. 20.28.31.21411

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	8	8	caleche and dirt
8	18	10	red clay
18	24	6	sand
24	65	41	sandy clay
65	84	19	rocky conglomerate
84	92	8	clay conglomerate
92	110	18	red clay
110	142	32	tan rocky clay
142	162	20	tan lime
162	164	2	red clay
164	167	3	break
167	182	15	red clay (some rocks)
182	188	6	lime (grey)
188	205	17	lime with red clay breaks
205	230	25	white lime with breaks (water)
230	240	10	tan lime and red clay
240	255	15	red clay

Section 7. REMARKS AND ADDITIONAL INFORMATION

'95 SEP 21 AM 10 34
STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

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

Corky J Lem
Driller

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

APPENDIX SITE PHOTOGRAPHS

Google Earth image showing project area boundary (green line) and image locations (enlarge to see image numbers)


SP1 – View west from northwest project area toward State Land under evaluation of proposed western containment.

SP2 – View west from northeast corner of proposed western pond. Note the spoil piles and

SP-3 View south of abandoned caliche pit that will become part of the proposed western containment.

SP4 View north from near the center of the western containment showing nature of abandoned caliche pit.

SP5 View south from same location as above showing nature of vegetation and landscape.

SP6 View north from center of east pond toward tank battery and producing well.

SP7 View south from same location as above.

SP8 View east from southwest quadrant of project area. Fee surface is in this image and State Land is behind camera.

SP9 View west from southeast corner of proposed east pond.

AP10 View west from southeast corner of the project area.

April 2025

Rule 34 Registration: Volume 3
Angel RF and Containments
Section 32, T20S, R28E, Eddy County

- ***C-147 in Volume 2***
- ***AST Design Sketch***
- ***Design/Construction Plan***
- ***O&M and Closure Plans***
- ***Design Drawings & Set-Up SOP***
- ***Variances and Equivalency Demonstrations***

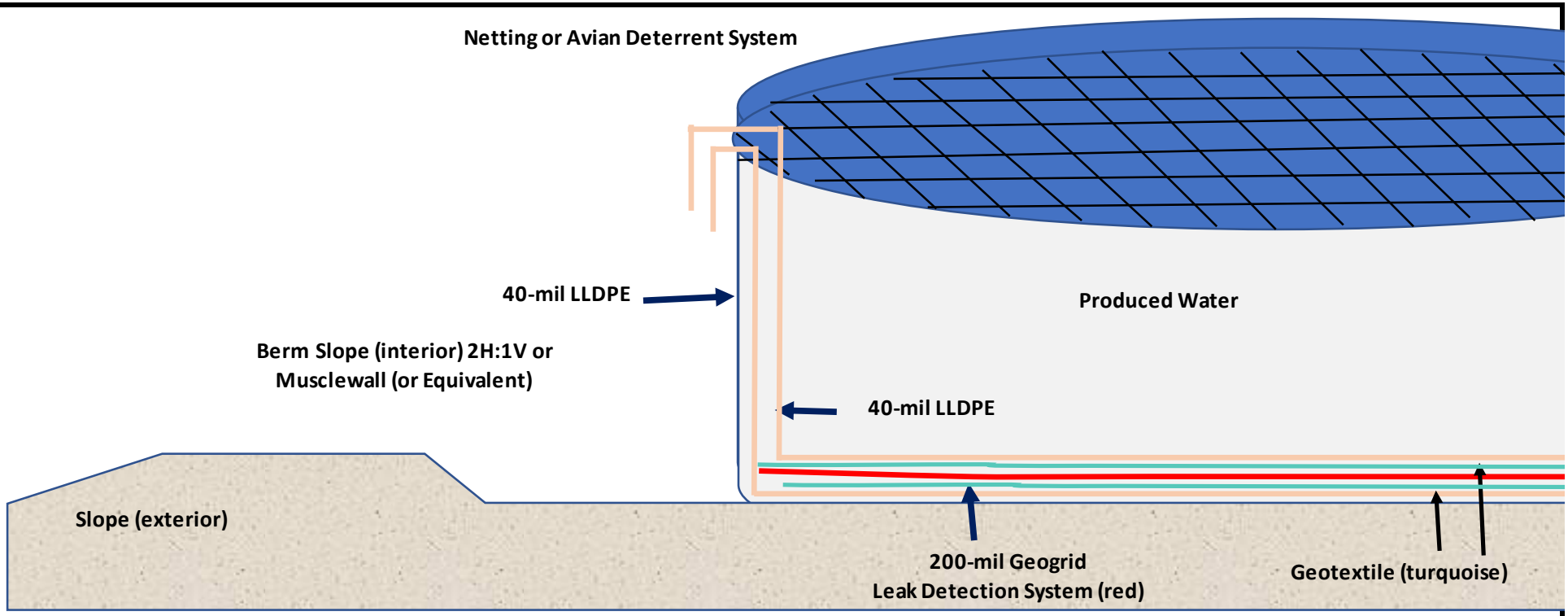
View southeast toward the Angel RF and Containments Project Area. Near the horizon at the center of the image are topsoil and spoil piles associated with an abandoned caliche pit. This pit will become part of the proposed western containment.

Prepared for:
BTS Management, LLC
Carlsbad, New Mexico

Prepared by:

R.T. Hicks Consultants, Ltd.
Albuquerque, New Mexico

Cascade Services LLC
Midland, Texas



Description of Typical Leak Detection System

- 40-mil LLDPE comprise primary liner and 30-mil LLDPE comprise the secondary liner
- 200-mil geogrid drainage layer lies between the primary and secondary liner per Plate 2
- Geotextile between the geogrid and each liner
- > 3-inch deep sump excavated on down slope side of AST per Sump Design Drawing
- A small hose or pipe runs from the collection sump to top of AST via tube
- Every week, a portable self-priming peristaltic pump (or equivalent) connects to the leak detection system.
- The pump discharge hose runs back into the AST, on top of the primary liner
- If fluid is detected, it is tested for conductance to determine the origin of the water (i.e. produced water or condensation)

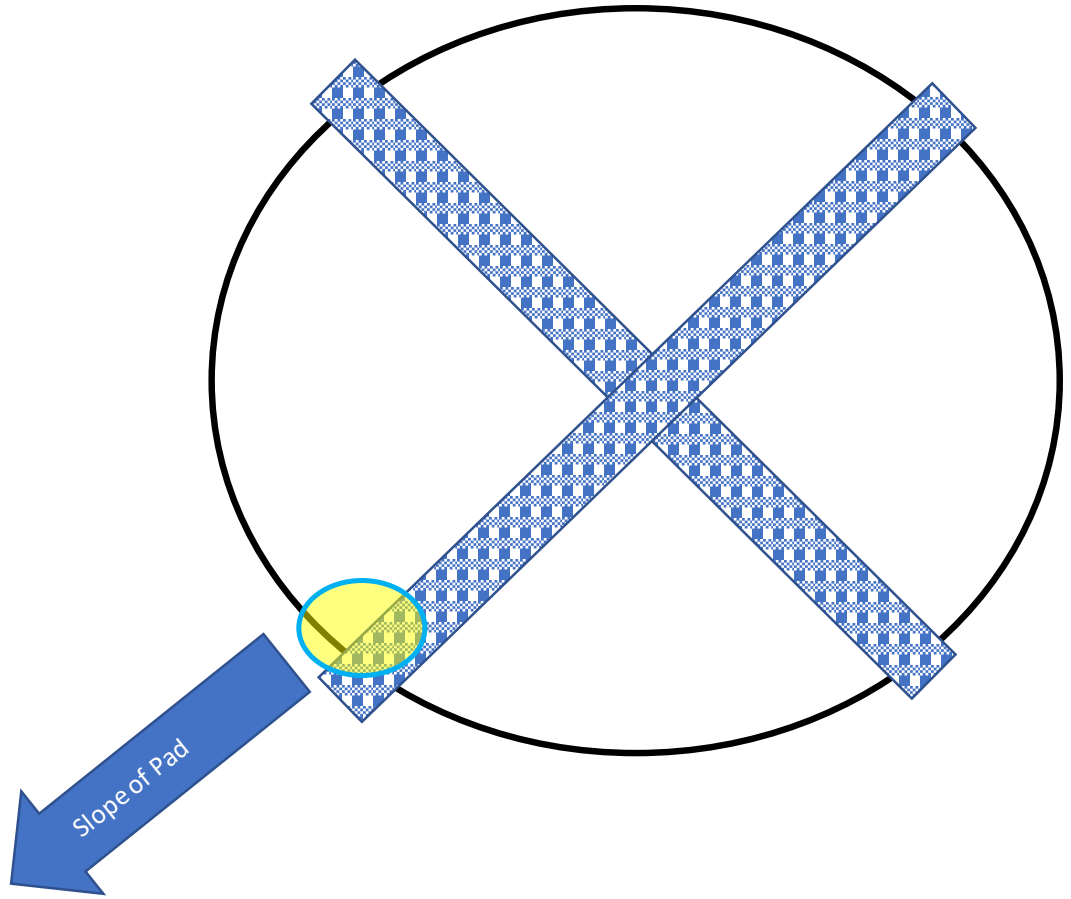
R.T. Hicks Consultants Albuquerque, NM	**Design Sketch**	**Plate 1**
	BTS Management - Angel AST	**Nov 2024**

Determine slope of pad and low point of AST

200 mil geogrid placed
above 8-oz geotextile and 30-mil secondary liner
inside of AST after set up, before installation of primary liner
below two 40-mil primary liner system
geotextile is placed around the 200-mil geogrid drainage system

Sump at lowest point of the AST set up
Leak detection riser pipe/hose installed per SOP

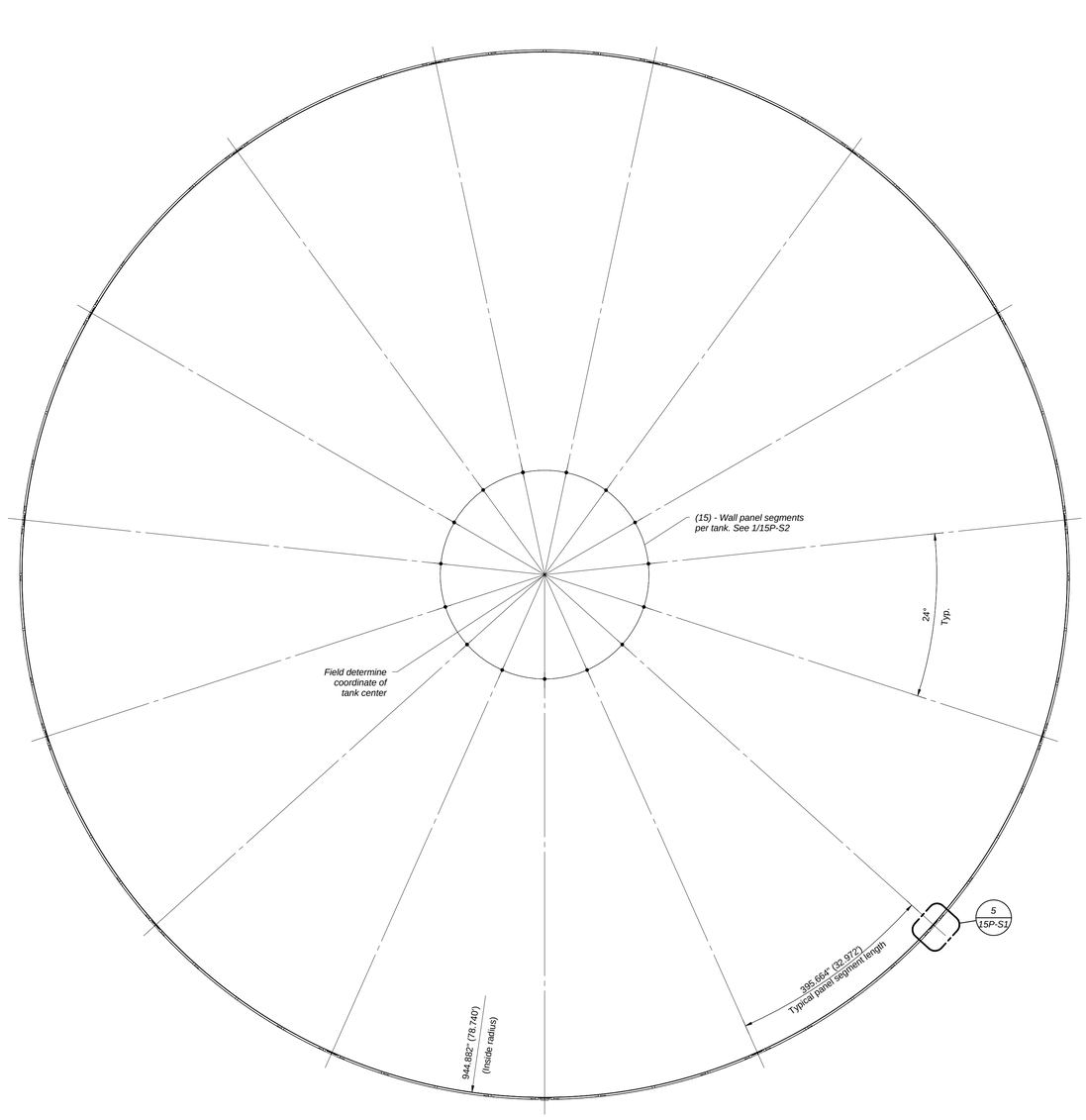
Sump Location



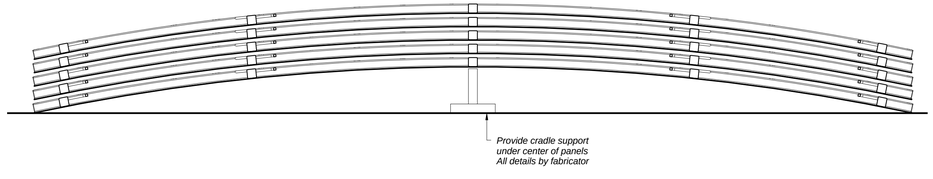
0 50 100

R.T. Hicks Consultants Albuquerque, NM	Layout of Geogrid Drainage Mat	Plate 2
	BST Management - Angel AST	Nov 2024

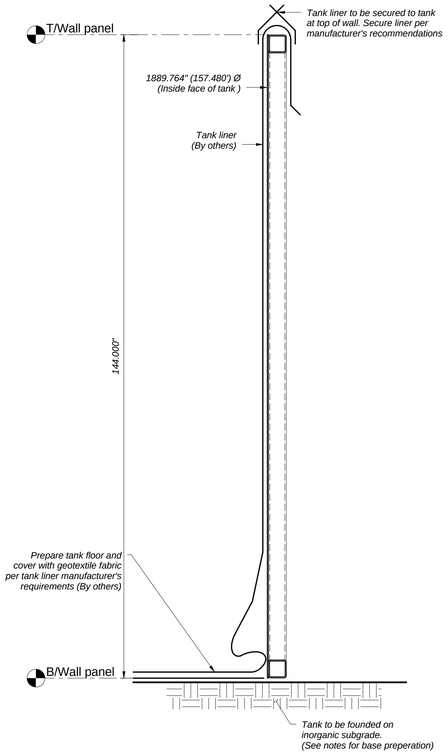
STAMPED DESIGN DRAWINGS



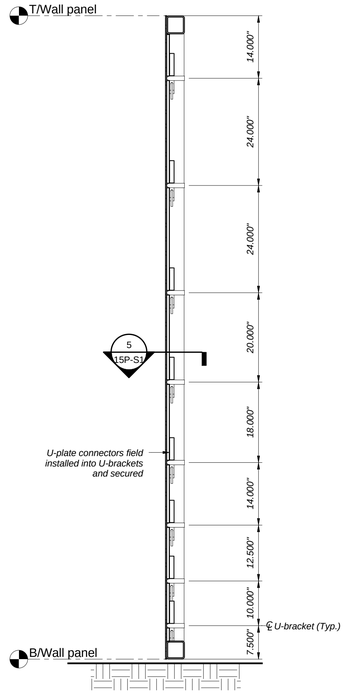
1 Tank Layout Plan
SCALE: 3/32" = 1'-0"



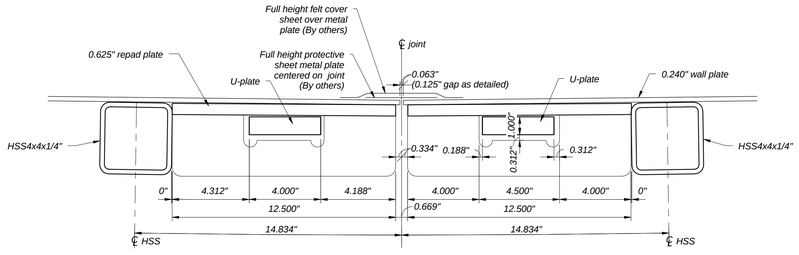
4 Transport and Storage Detail
SCALE: N.T.S.



2 Typical Tank Wall Section
SCALE: 3/4" = 1'-0"

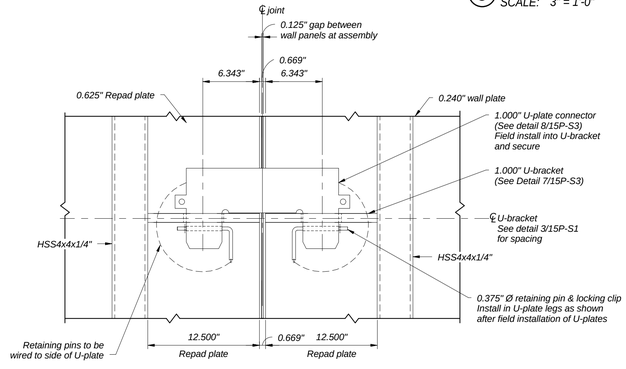


3 Wall Section at Panel Joint
SCALE: 3/4" = 1'-0"



Note: Max. estimated gap between adjacent panels is 0.500" under full hydrostatic load as detailed.

5 Enlarged Plan Detail
SCALE: 3" = 1'-0"



Note: U-plate connection to accomodate max. 0.500" variation between heights of adjacent panels. Field shim panels vertically to within 0.500" prior to installing U-plates.

6 Enlarged Elevation
SCALE: 1 1/2" = 1'-0"

Notes:

1. Contractor is responsible for means and methods of construction during tank erection and disassembly and for the safety of all personnel. All work shall be completed in strict accordance with all state and federal occupational safety and health administration requirements.
2. Contractor is responsible for the stability of tank during assembly and disassembly and shall provide shoring as required until the tank is fully assembled or disassembled.
3. The Contractor shall ensure all the panels are adequately supported or braced until the entire structure is assembled.
4. All topsoil, organics, soft or wet soils, debris or other deleterious materials shall be removed from the tank site.
5. The finished grades along the perimeter of the tank shall be level and true to plane. The maximum elevation difference across any two diametrical points shall be less than 9.000".
6. The maximum deviation from plane over any 118.00" of circumference shall be less than 0.1875" and less than 0.500" over any 390.000" of circumference.
7. The area surrounding the tanks shall be graded to direct surface water away from the tank.
8. The edge of any (excavated) sump shall be a minimum of 36.000" from the edge of the tank wall.
9. All wall panels shall be erected plumb. The maximum out-of-plumbness of the top of the panel relative to the bottom shall be less than 1.000".
10. The maximum deviation from the theoretical radius shall be less than 2.000" at any point along the tank wall.
11. The liner shall be securely fastened to the top of each panel in accordance with the liner's manufacturer's recommendations. The liner shall be installed with sufficient slack at the base of the panel to prevent any tension in the liner.
12. The vertical lifting bar shall only be used to lift the panels into the vertical position. The lift rigging must be within 12.000" of the top rail prior to lifting the panel.

Frost Engineering & Consulting

Frost Engineering & Consulting Company
R. Jerry Frost, PE, MS, MBA
Troy A. Madlem, PE, MLSE

201 Lincolnway West
Mishawaka, Indiana 46544
Phone: 574.344.5900
Email: contactus@frosteng.net
Web: www.frosteng.net

Hydrena Energy Modular Tanks
15P Water Tank (157.480' Dia.)

COLORADO LICENSED TROY A. MADLEM 47546 PROFESSIONAL ENGINEER

CERTIFIED BY: Troy A. Madlem, P.E.

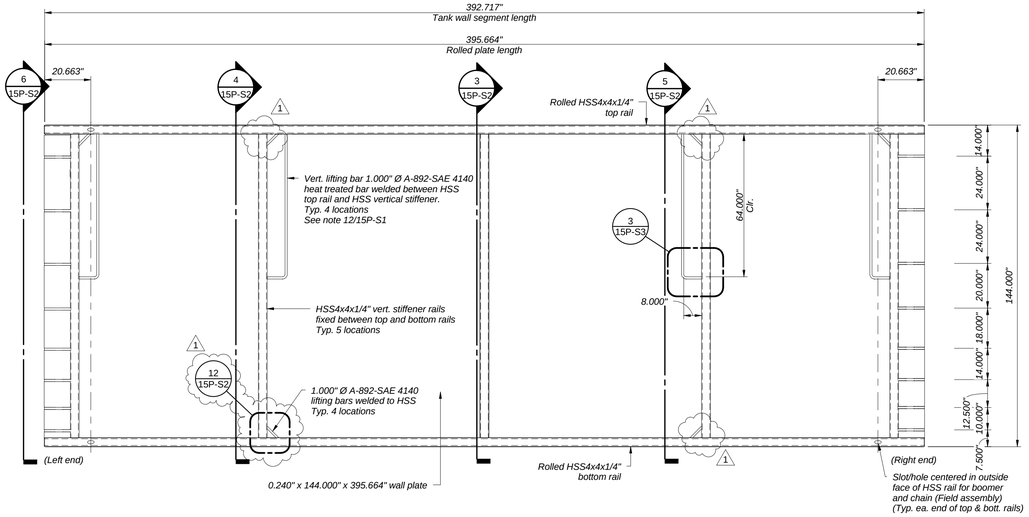
Revision:

Project:
Designed: FEC
Drawn: TCM
Checked: TAM
Scale: As indicated
Issue Date: 06/24/13

Tank Installation & Assembly

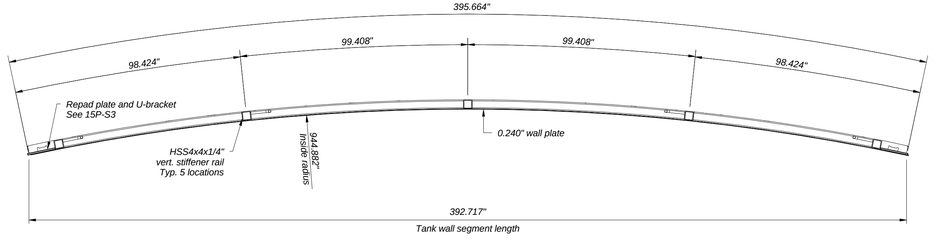
15P-S1

Highest level of Quality and Commitment for our Clients

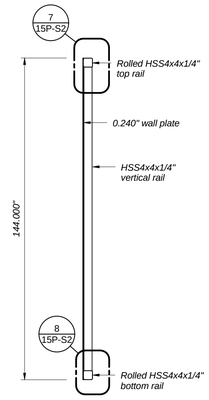


Note: Framing shown to outside face of panel.

1 Wall Panel elevation (15 total)
SCALE: 3/8" = 1'-0"

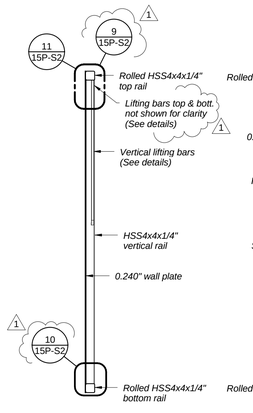


2 Typical Plan Section
SCALE: 3/8" = 1'-0"

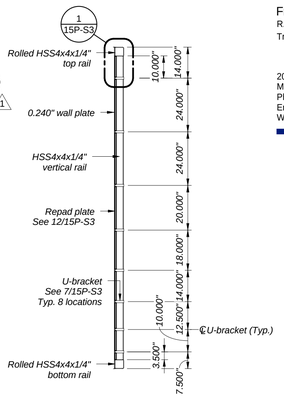


3 Section
SCALE: 3/8" = 1'-0"

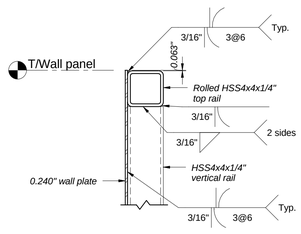
4 Section
SCALE: 3/8" = 1'-0"



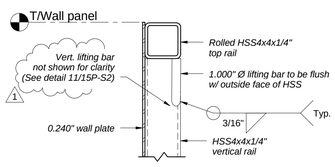
5 Section
SCALE: 3/8" = 1'-0"



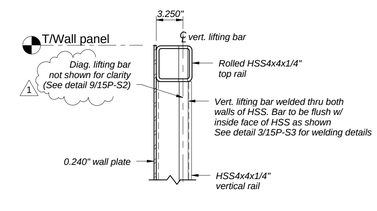
6 Elevation
SCALE: 3/8" = 1'-0"



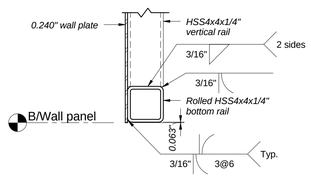
7 Enlarged Detail
SCALE: 1 1/2" = 1'-0"



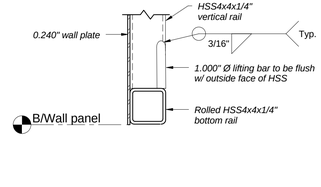
9 Enlarged Detail
SCALE: 1 1/2" = 1'-0"



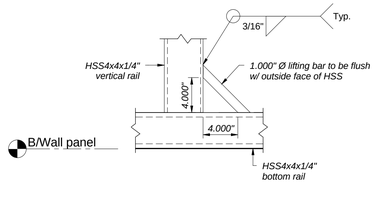
11 Enlarged Detail
SCALE: 1 1/2" = 1'-0"



8 Enlarged Detail
SCALE: 1 1/2" = 1'-0"



10 Enlarged Detail
SCALE: 1 1/2" = 1'-0"



12 Enlarged Detail
SCALE: 1 1/2" = 1'-0"

General Notes:

1. Tank design based on a design liquid with specific gravity of 1.0.
2. All structural steel design, fabrication and erection shall comply with American Institute of Steel Construction (AISC) specification 303 and 360, latest editions.
3. All welding shall be performed in strict accordance with American Welding Society (AWS) D1.1, latest edition.
4. Structural steel materials shall comply with the following minimum requirements:
   - Wall plate.....ASTM A-572 w/ min. Fy = 44 ksi.
   - HSS tubing.....ASTM A-500, Gr. B w/ min. Fy = 46 ksi.
   - Repad plates.....ASTM A-572, Gr. 50 w/ min. Fy = 50 ksi.
   - U-plates.....ASTM A-514, Gr. B w/ min. Fy = 100 ksi.
   - U-brackets.....ASTM A-514, Gr. B w/ min. Fy = 100 ksi.
   - Lifting bars.....ASTM A-892-SAE 4140 w/ min. Fy = 135 ksi.
5. Fabrication of wall panels shall be of solid welded construction, as shown, using appropriate weld electrodes with minimum tensile strength equal to or greater than the yield strength of the strongest connected parts.

Frost Engineering & Consulting Company
R. Jerry Frost, PE, MS, MBA
Troy A. Madlem, PE, MLSE

201 Lincolnway West
Mishawaka, Indiana 46544
Phone: 574.344.5900
Email: contactus@frosteng.net
Web: www.frosteng.net

Hydrena Energy Modular Tanks
15P Water Tank (157.480' Dia.)

COLORADO LICENSED TROY A. MADLEM 47546 PROFESSIONAL ENGINEER

CERTIFIED BY: Troy A. Madlem, P.E.

Revision:

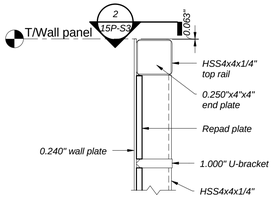
1	Revisions	07/30/13

Project:
Designed: FEC
Drawn: TCM
Checked: TAM
Scale: As indicated
Issue Date: 06/24/13

Framing Plan, Elevation, Sections & details

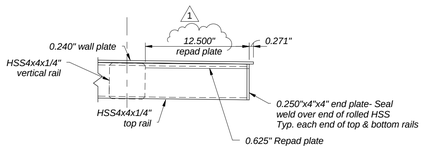
15P-S2

Highest level of Quality and Commitment for our Clients

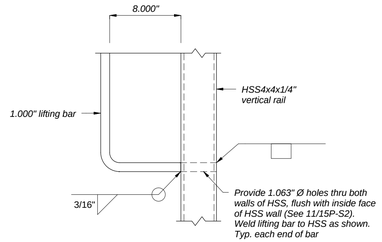


Note: Detail at bottom rail similar.

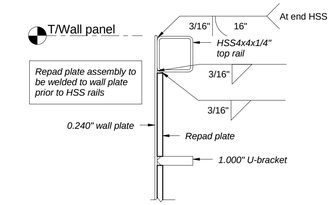
1 Enlarged Detail
SCALE: 1 1/2" = 1'-0"



2 Plan Detail
SCALE: 1 1/2" = 1'-0"

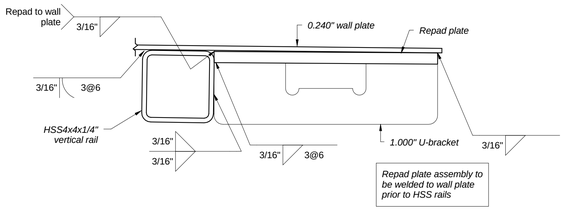


3 Enlarged Detail
SCALE: 1 1/2" = 1'-0"

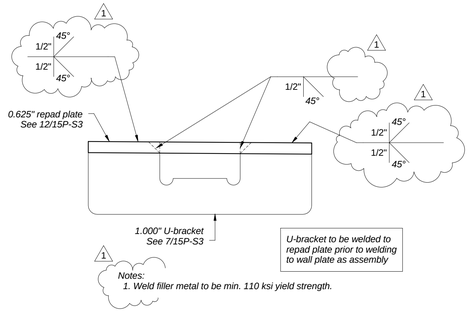


Note: Connection detail at bottom rail similar.

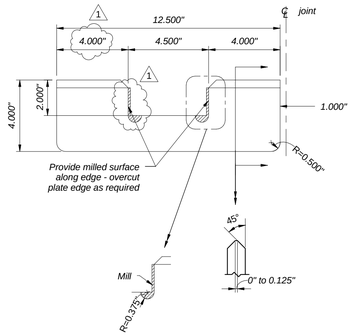
4 Panel Connection Welds - Section
SCALE: 1 1/2" = 1'-0"



5 Repad Connection
SCALE: 3" = 1'-0"

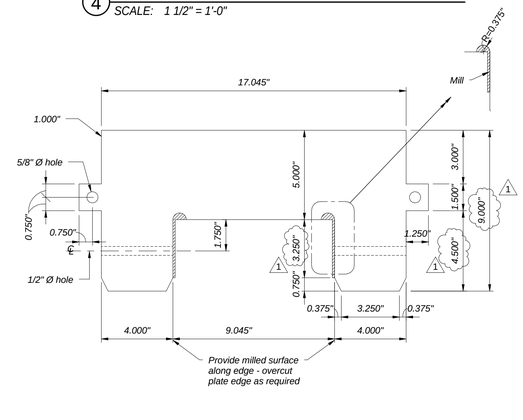


6 U-Bracket to Repad Connection
SCALE: 3" = 1'-0"



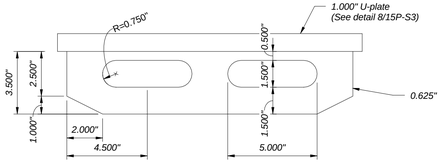
Note: U-bracket shall be ASTM A-514-B w/ min. Fy = 100 ksi.

7 U-Bracket
SCALE: 3" = 1'-0"



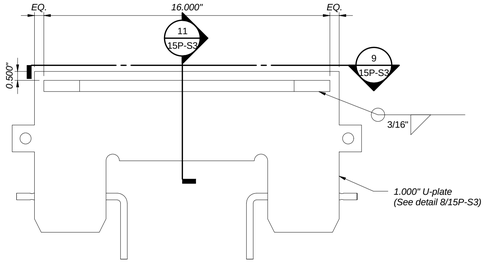
Note: U-plate shall be ASTM A-514-B w/ min. Fy = 100 ksi.

8 U-Plate
SCALE: 3" = 1'-0"

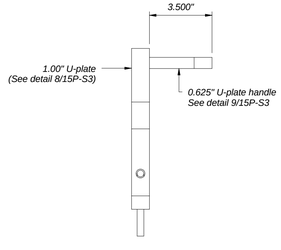


Note: U-plate handle shall be ASTM A-572, Gr. 50 w/ min Fy = 50 ksi.

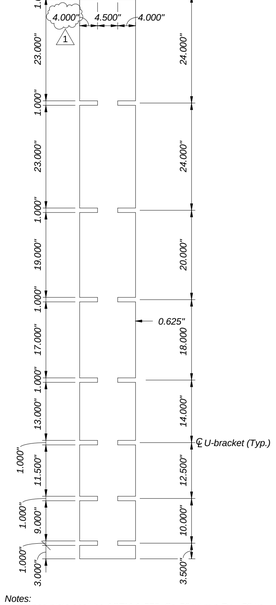
9 U-Plate Handle
SCALE: 3" = 1'-0"



10 U-Plate w/ Handle Assembly
SCALE: 3" = 1'-0"



11 U-Plate Section
SCALE: 3" = 1'-0"



Notes:
1. Repad plate shall be ASTM A-572, Gr. 50 w/ min Fy = 50 ksi.

12 Repad Elevation
SCALE: 3/4" = 1'-0"

Frost Engineering & Consulting Company
R. Jerry Frost, PE, MS, MBA
Troy A. Madlem, PE, MLSE

201 Lincolnway West
Mishawaka, Indiana 46544
Phone: 574.344.5900
Email: contactus@frosteng.net
Web: www.frosteng.net

Hydrera Energy Modular Tanks
15P Water Tank (157.480' Dia.)

COLORADO LICENSED TROY A. MADLEM 47546 PROFESSIONAL ENGINEER

CERTIFIED BY: Troy A. Madlem, P.E.

Revision:
1 Revisions 07/30/13

Project:
Designed: FEC
Drawn: TCM
Checked: TAM
Scale: As indicated
Issue Date: 06/24/13

Framing Sections & Details

15P-S3

Highest level of Quality and Commitment for our Clients

Inland TARP & LINER

Premium Quality - Built to Last

www.inlandtarp.com

Geotextile Product Description Sheet
GT-110
Nonwoven Geotextile

GT-110 is a needle-punched nonwoven geotextile made of 100% polypropylene staple fibers, which are formed into a random network for dimensional stability. SKAPS GT-110 resists ultraviolet deterioration, rotting, biological degradation, naturally encountered basics and acids. Polypropylene is stable within a pH range of 2 to 13. SKAPS GT-110 conforms to the physical property values listed below:

PROPERTY	TEST METHOD	UNIT	M.A.R.V. (Minimum Average Roll Value)
Weight (Typical)	ASTM D 5261	oz/yd^2 (g/m^2)	10.0 (339)
Grab Tensile	ASTM D 4632	lbs (kN)	250 (1.11)
Grab Elongation	ASTM D 4632	%	50
Trapezoid Tear Strength	ASTM D 4533	lbs (kN)	100 (0.444)
CBR Puncture Resistance	ASTM D 6241	lbs (kN)	700 (3.11)
Permittivity*	ASTM D 4491	sec^{-1}	1.2
Water Flow*	ASTM D 4491	gpm/ft^2 ($l/min/m^2$)	80 (3251)
AOS*	ASTM D 4751	US Sieve (mm)	100 (0.150)
UV Resistance	ASTM D 4355	%/hrs	70/500

PACKAGING

Roll Dimensions (W x L) – ft. 12.5 x 360 / 15 x 300
Square Yards Per Roll 500
Estimated Roll Weight – lbs. 320

* At the time of manufacturing. Handling may change these properties.
This information is provided for reference purposes only and is not intended as a warranty or guarantee. SKAPS assumes no liability in connection with the use of this information.

Made in U.S.A.

Inland TARP & LINER
4172 North Frontage Rd E Moses Lake, WA 98837
(800) 346-7744 (509) 766-7024 Fax (509) 766-0414
www.inlandtarp.com

TECHNICAL DATA SHEET
Geomembrane 40mil LLDPE

Property	Test Method	Frequency (A)	Unit Metric		Solmax 140-7000
Thickness (Nominal +/- 10%) (E)	ASTM D 5199	Every roll	mm		1.00
Resin Density	ASTM D 1505	1/Batch	g/cc		<0.926
Melt Index-190/2.16(max)	ASTM D 1238	1/Batch	g/10min		1.0
Sheet Density (C)	ASTM D 1505	Every 2 rolls	g/cc		<0.939
Carbon Black Content (D)	ASTM D 4218	Every 2 rolls	%		2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	Every 6 rolls	Category		Cat. 1 / Cat. 2
Oxidative Induction Time (min. avg)	ASTM D3895	1/Batch	min		100
Tensile Properties (min. avg)(B)	ASTM D 6693	Every 2 rolls			
Strength as Break			kN/m		23
Elongation at Break			%		800
2% Modulus (max.)	ASTM D 5323	PerFormulation	kN/m		420
Tear Resistance (min. avg.)	ASTM D 1004	Every 6 rolls	N		85
Puncture Resistance (min. avg.)	ASTM D 4833	Every 6 rolls	N		215
Dimensional Stability	ASTM D 1204	Every 6 rolls	%		+/- 2
Multi-Axial Tensile (min.)	ASTM D 5617	PerFormulation	%		90
Oven Aging-% retained after 90 days	ASTM D 5721	PerFormulation			
STD OIT (min. avg.)	ASTM D 3895		%		35
HP OIT (min. avg.)	ASTM D 5885		%		60
UV Resistance-% retained after 1600 hr	GRI-GM-11	PerFormulation			
HP-OIT (min. avg.)	ASTM D 5885		%		35

Note;

(A) Testing frequency based on standard roll dimensions and one batch is approximately 180,000 lbs (or one railcar).
(B) Machine Direction (MD) and Cross Machine Direction (XMD or TD) average values should be on the basis of 5 specimens each direction.
(C) Correlation table is available for ASTM D792 vs. ASTM D1505. Both methods give the same results.
(D) Correlation table is available for ASTM D1603 vs. ASTM D4218. Both methods give the same results.
(E) The minimum average thickness is +/- 10% of the nominal value.

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

SKAPS TRANSNET™

HDPE GEONET TN 220

SKAPS TRANSNET™ geonet consists of SKAPS Geonet made from HDPE resin.

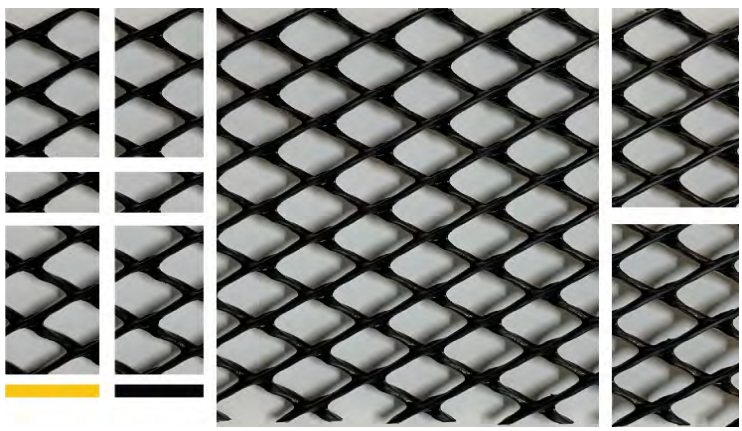
PROPERTY	TEST METHOD	UNIT	VALUE	QUALIFIER
Thickness	ASTM D 5199	mm	5.08	MAV(3)
Carbon Black	ASTM D 4218	%	2.0	MAV
Tensile Strength	ASTM D 7179	N/mm	7.87	MAV
Melt Flow	ASTM D 1238(2)	g/10 min	1.0	Maximum
Density	ASTM D 1505	g/cm^3	0.94	MAV
Transmissivity(1)	ASTM D 4716	m^2/sec	2.0×10^{-3}	MAV

Notes:

(1) Transmissivity measured using water at 21 ± 2 °C (70 ± 4 °F) with a gradient of 0.1 and a confining pressure of 479 kPa between steel plates after 15 minutes. Values may vary with individual labs.

(2) Condition 190/2.16

(3) Minimum average value



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SKAPS assumes no liability in connection with the use of this information.

571 Industrial Pkwy,Commerce, GA 30529
Ph: (706)-336-7000, Fax: (706)-336-7007, Email: contact@skaps.com
www.skaps.com

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(800) 346-7744 (509) 766-7024 Fax (509) 766-0414
www.inlandtarp.com

TECHNICAL DATA SHEET
Geomembrane 30mil LLDPE

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

Note;

(A) Testing frequency based on standard roll dimensions and one batch is approximately 180,000 lbs (or one railcar).
(B) Machine Direction (MD) and Cross Machine Direction (XMD or TD) average values should be on the basis of 5 specimens each direction.
(C) Correlation table is available for ASTM D792 vs. ASTM D1505. Both methods give the same results.
(D) Correlation table is available for ASTM D1603 vs. ASTM D4218. Both methods give the same results.

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

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

DESIGN/CONSTRUCTION PLAN

Design and Construction Plan
Above Ground Tank (AST) Containments

General

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

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

These AST Containments are constructed of 12-foot high steel panels and are netted or employ the Mega Blaster Pro avian deterrent system to prevent ingress of migratory birds. AST Containments will be enclosed by a 4-strand barbed wire fence. Thus, complies with the Rule to fence or enclose a recycling containment in a manner that deters unauthorized wildlife and human access and shall maintain the fences in good repair.

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

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

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

Site Preparation

Foundation for AST Containment

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

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

The foundation soils must be roller compacted smooth and free of loose aggregate over ½ inch. Compaction characteristics must meet or exceed 95% of Standard Proctor Density in accordance with ASTM D 698.

19.15.34.12 A
(2) A recycling containment shall have a properly constructed foundation and interior slopes consisting of a firm, unyielding base, smooth and free of rocks, debris, sharp edges or irregularities to prevent the liner's rupture or tear. Geotextile is required under the liner when needed to reduce localized stress-strain or protuberances that otherwise may compromise the liner's integrity. The operator shall construct the containment in a levee with an inside grade no steeper than two horizontal feet to one vertical foot (2H:1V). The levee shall have an outside grade no steeper than three horizontal feet to one vertical foot (3H:1V). The top of the levee shall be wide enough to install an anchor trench and provide adequate room for inspection and maintenance.

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

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

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

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

Liner and Leak Detection Materials

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

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

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

variance. The liner system is presented in an earlier section of this submission.

Liner compatibility shall meet or exceed the EPA SW-846 method 9090A or subsequent relevant publications.

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

Install Secondary Liner, Leak Detection System and Secondary Containment

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

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

The AST Containment Contractor will cause the recycling containment will have a leak detection system between the upper and lower geomembrane liners that shall consist of 200-mil geonet to facilitate drainage. The leak detection system shall consist of a properly designed drainage and collection and removal system placed above the lower geomembrane liner in depressions and sloped to facilitate the earliest possible leak detection (see attached design sketch).

19.15.34.12 A
(7) The operator of a recycling containment shall place a leak detection system between the upper and lower geomembrane liners that shall consist of 200-mil geonet or two feet of compacted soil with a saturated hydraulic conductivity of 1 x 10-5 cm/sec or greater to facilitate drainage. The leak detection system shall consist of a properly designed drainage and collection and removal system placed above the lower geomembrane liner in depressions and sloped to facilitate the earliest possible leak detection.

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

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

AST Containment Setup

As with the secondary liner, AST Containment contractor will minimize liner seams and orient them up and down, as much as possible, not across, a slope. Factory welded seams shall be used where possible. AST Containment contractor will employ field seams in

19.15.34.12 A
(5) The operator of a recycling containment shall minimize liner seams and orient them up and down, not across, a slope of the levee. Factory welded seams shall be used where possible. The

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

operator shall ensure field seams in geosynthetic material are thermally seamed. Prior to field seaming, the operator shall overlap liners four to six inches. The operator shall minimize the number of field seams and corners and irregularly shaped areas. There shall be no horizontal seams within five feet of the slope's toe. Qualified personnel shall perform field welding and testing.

Fluid Injection/Withdrawal Flow Diverter

The injection or withdrawal of fluids from the containment shall be accomplished through a header, diverter or other hardware that prevents damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes.

19.15.34.13 B
(3) The injection or withdrawal of fluids from the containment shall be accomplished through a header, diverter or other hardware that prevents damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes.

Operations and Maintenance Plan

Closure Plan

Operations and Maintenance Plan
Above Ground Tank Containment (AST)

General Specifications

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

19.15.34.10 B
Recycling containments may hold produced water for use in connection with drilling, completion, producing or processing oil or gas or both.
19.15.34.8 A
(6) All releases from the recycling and re-use of produced water shall be handled in accordance with 19.15.29 NMAC.

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

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

- The operator will use the treated produced water in the containments for drilling, completion (stimulation), producing or processing oil or gas or both. If other uses are planned, the operator will notify the OCD though the submission of a modified C-147.

- For all exploration and production operations that use produced water, the operator will conduct these activities in a manner consistent with hydrogen sulfide gas provisions in 19.15.11 NMAC or NORM provisions in 19.15.35 NMAC, as applicable.

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

- The operator will address all releases from the recycling and re-use of produced water in accordance with 19.15.29 NMAC.

19.15.29.6
To prohibit releases and require persons who operate or control the release or the location of the release to report the unauthorized release of oil, gases, produced water, condensate or oil field waste including regulated NORM or other oil field related chemicals, contaminants or mixtures of those chemicals or contaminants that occur during drilling, producing, storing, disposing, injecting, transporting, servicing or processing and to establish procedures for reporting, site assessment, remediation, closure, variance and enforcement.

• The operator will not discharge into or store any hazardous waste in the recycling containments, but they may hold fluids such was freshwater, brackish water, recycled and treated water, water generated by oil or gas processing facilities, or other waters that are gathered for well drilling or completion. The recycling facility will not be used for the disposal of produced water. The operator will maintain the containments free of miscellaneous solid waste or debris.	19.15.34.9 G Recycling facilities may not be used for the disposal of produced water.
• The operator will verify that no oil is on the surface of the contained fluid. If oil is observed, the oil shall be removed using an absorbent boom or other device and properly disposed at an approved facility. An absorbent boom or other device will be maintained on site.	19.15.34.13 B (1) The operator shall remove any visible layer of oil from the surface of the recycling containment (7) The operator shall install, or maintain on site, an oil absorbent boom or other device to contain an unanticipated release.
• The operator will install and use a header and diverter described in the design/construction plan in order to prevent damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes during injection or withdrawal of liquids.	19.15.34.13 B (3) The injection or withdrawal of fluids from the containment shall be accomplished through a header, diverter or other hardware that prevents damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes.
• The operator shall maintain at least three feet of freeboard at each containment.	19.15.34.13 B (2) The operator shall maintain at least three feet of freeboard at each containment.
• If the liner develops a leak or if any penetration of the liner occurs above the liquid's surface, then the operator will repair the damage or initiate replacement of the liner within 48 hours of discovery or will seek a variance from the division district office within this time period.	19.5.34.13 B (4) If the containment's primary liner is compromised above the fluid's surface, the operator shall repair the damage or initiate replacement of the primary liner within 48 hours of discovery or seek an extension of time from the division district office.
• If visible inspection suggests that the liner developed a leak or if any penetration of the liner occurs below the liquid's surface, then the operator will remove all liquid above the damage or leak line within 48 hours of discovery. The operator will also notify the district division office within this same 48 hours of the discovery and repair the damage or replace the liner.	(5) If the primary liner is compromised below the fluid's surface, the operator shall remove all fluid above the damage or leak within 48 hours of discovery, notify the division district office and repair the damage or replace the primary liner.

- In the event of a leak due to a hole in the liner, the following steps will be followed:
  1. If the source of the fluid is uncertain, comparative field tests may need to be performed on both the water in the containment and that which may have been released (e.g. pH, conductance, and chloride).
  2. If the fluid is found to be coming from the containment, determine the location from which the leak is originating.
  3. Mark the point where the water is coming out of the tank.
  4. Locate the puncture or hole in the liner.
  5. Empty the containment to the point of damage in liner.
  6. Clean area of liner that needs to be repaired.
  7. Cut out piece of material (patch or tape) to overlay liner.
  8. Either weld the patch to the injured area in the liner or apply tape over the rupture.
  9. Make sure rupture is completely covered.
  10. Monitor as needed.

19.15.29.8 B.
Requirements. For all releases regardless of volume, the responsible party shall comply with 19.15.29.8 NMAC and shall remediate the release. For major and minor releases, the responsible party shall also comply with 19.15.29.9, 19.15.29.10, 19.15.29.11, 19.15.29.12 and 19.15.29.13 NMAC.

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

19.15.34.13
(6) The containment shall be operated to prevent the collection of surface water run-on.

Monitoring, Inspections, and Reporting

An inspection log will be maintained by the operator and will be made available to the division upon request. Inspection will include: freeboard monitoring, leak detection, identifying potential hazards that may have developed, change in site conditions or if the contents of the containment change from the initial use.

19.15.34.13 A.
The operator shall inspect the recycling containment and associated leak detection systems weekly while it contains fluids. The operator shall maintain a current log of such inspections and make the log available for review by the division upon request.

Weekly inspections consist of:

- Reading and recording the fluid height of staff gauges and freeboard
- Recording any evidence of visible oil on surface

- Visually inspecting the containments exposed liners
- Checking the leak detection system for any evidence of a loss of integrity of the primary liner
- Inspect any diversion ditches and berms around the containment to check for erosion and collection of surface water run-on.
- Inspect the leak detection system for evidence of damage or malfunction and monitor for leakage.

- Inspect netting (may not be used if Mega Blaster Pro avian deterrent is used) for damage or dead wildlife, including migratory birds. Operator shall report the discovery of a dead animal to the appropriate wildlife agency and to the district within 30 days of discovery. Further prevention measures may be required.

19.15.34.12 E
Netting. The operator shall ensure that a recycling containment is screened, netted or otherwise protective of wildlife, including migratory birds. The operator shall on a monthly basis inspect for and, within 30 days of discovery, report the discovery of dead migratory birds or other wildlife to the appropriate wildlife agency and to the division district office in order to facilitate assessment and implementation of measures to prevent incidents from reoccurring.

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

- If observed conditions indicate a potential tank failure is imminent, the vicinity will be immediately cleared and the AST will be drained.

Monthly, the operator will:

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

19.15.34.9 E
The operator of a recycling facility shall keep accurate records and shall report monthly to the division the total volume of water received for recycling, with the amount of fresh water received listed separately, and the total volume of water leaving the facility for disposition by use on form C-148.

Cessation of Operations

If less than 20% of the total fluid capacity is utilized every six months, beginning from the first withdraw, operation of the facility has ceased and the division district office will be

19.15.34.13 C
A recycling containment shall be deemed to have ceased operations if less than 20% of the total fluid capacity is used every six

notified. The division district may grant an extension not to exceed six months to determine the cessation of operations.

months following the first withdrawal of produced water for use. The operator must report cessation of operations to the appropriate division district office. The appropriate division district office may grant an extension to this determination of cessation of operations not to exceed six months.

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

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

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

Closure Plan

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

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

Excavation and Removal Closure Plan – Protocols and Procedures

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

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

19.15.34.14 C
The operator shall test the soils beneath the containment for contamination with a five-point composite sample which includes stained or wet soils, if any, and that sample shall be analyzed for the constituents listed in Table I below.
(1) If any contaminant concentration is higher than the parameters listed in Table I, the division may require additional delineation upon review of the results and the operator must receive approval before proceeding with closure.
(2) If all contaminant concentrations are less than or equal to the parameters listed in Table I, then the operator can proceed to backfill with non-waste containing, uncontaminated, earthen material.

Closure Plan
Above Ground Tank Containment (AST)

Closure Documentation

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

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

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

Reclamation and Revegetation

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

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

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

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

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

The operator will notify the division when the site meets the surface owner's requirements or exhibits a uniform vegetative cover that reflects a life-form ratio of plus or minus fifty percent (50%) of pre-disturbance levels and a total percent plant cover of at least seventy percent (70%) of pre-disturbance levels, excluding noxious weeds. The operator will notify the Division when reclamation and re-vegetation is complete.

19.15.34.14 E
Once the operator has closed the recycling containment, the operator shall reclaim the containment's location to a safe and stable condition that blends with the surrounding undisturbed area. Topsoils and subsoils shall be replaced to their original relative positions and contoured so as to achieve erosion control, long-term stability and preservation of surface water flow patterns. The disturbed area shall then be reseeded in the first favorable growing season following closure of a recycling containment. The operator shall substantially restore the impacted surface area to the condition that existed prior to the construction of the recycling containment.

19.15.34.14 G
The re-vegetation and reclamation obligations imposed by federal, state trust land or tribal agencies on lands managed by those agencies shall supersede these provisions and govern the obligations of any operator subject to those provisions, provided that the other requirements provide equal or better protection of fresh water, human health and the environment.

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

AST SET UP SOP

Above Ground Storage Tank - Standard Operating Procedure

1. Planning for an AST Project

Achieving the efficient deployment, installation and removal of an AST lies in our ability to effectively plan for each phase of the project. Engagement of the proper personnel from each company involved and discussing the essential planning categories as listed below will increase the opportunity to achieve an incident-free, desired result.

Essential Planning Steps:

- Request for Quote
- Pre-Order and Deployment Requirements
- Ground Preparation
- Pre-Assembly Requirements

Request for Quote

Discussing and obtaining the following details is essential in building accurate AST project pricing.

1. Total Fluid Storage (barrels. or gallons) and Free-board Requirements
2. Anticipated Install Date and Rental Duration
3. Location GPS Coordinates or Physical Address
4. Location Size, Adequacy or Restrictions
5. Type of Fluid Being Stored and Material Package Strategy (liner mil thickness, single or double lined)
6. Accessory(ies) Strategy (Fill Piping, Suction Piping/Drain, Bird Netting, Lid, Leak Detection)
7. On-Site Orientation(s), Specific Certification(s), and Training Required to Gain Clearance to Access Location
8. Initial Fill Strategy (source, availability of fluid, fill rate, turn-around time for trucks)
9. Site Access Restrictions

Pre-Order and Deployment Requirements

Once pricing has been submitted and accepted by the customer, a PO must be obtained from the customer prior to placing an order for the material package or accessories. Only thereafter should the project coordination be set into motion and scheduled.

Pre-Deployment Discussion:
A meeting with the customer should be held prior to the tank and/or crew deployment for installation or removal. The below should be used a guidance for the customer meeting prior to installation:

- AST Delivery and Installation Schedule
- Confirmation of Proper Ground Preparation
- Adequate Clearances Around the Tank for Crew and Equipment - 25' or greater around perimeter of tank
- Standard Equipment or Crane Installation Confirmation
- Strategy to pin the floor of the tank (fresh water, source type, fill rate, etc.)
- Customer roles/responsibilities/contact information including customer’s project manager, key on site staff, and EHS staff.
- Review AST intended use and customer safety requirements.
- Review AST accessories required (fill lines, suction, egress, etc.)
- Site access and truck route requirements
- Crew start and stop time requirements or limitations.
- Forecast rental duration.
- Confirm AST size to be deployed.
- 2' minimum fluid requirement in AST always
- Conditions that could result in standby time charges or additional charges, and what prior customer approvals are required.
- Rental Start Date Strategy
- Rental End Date Strategy
- AST component storage on-site while tank is in operation.

- Ground Preparation

Preparation of the soil and location is required to form a dependable base for the AST. This base is also imperative in achieving the proper operation of the AST once fluid is introduced - Proper seating of the liner on the floor of the tank; Adequate, ongoing suction of the stored fluid; Favorable draining/"bottoming-out" of the tank at the end of the project.

*Preparation of the soil and location is the sole responsibility of the customer. Ensuring proper slope and compaction prior to AST installation is the sole responsibility of the customer.

Location preparation requirements are as follows:

- Use laser level to grade pad to within one inch, up and down.
- Confirm that there is 25' of clearance around the parameter of the tank, based on the diameter of the specific AST being installed.
- Use center pin, tape measure and marking paint to mark the diameter of the tank on the pad as per measurement chart.
- Check area for sharp objects, rocks, or any other potential hazards to the liner.
- Speak with the consultant to determine where the suction will be located and mark out where the “Y” trench will be situated.
- The suction branch of the “Y” trench should be at least twelve inches (12”) deep with the depth tapering out to six at center and level at the two other points of the “Y” trench.
- Ensure the start of the suction trench is at least three feet from the edge of the tank and the ends of “Y” trench are 10 feet from the edge.

Soil preparation requirements are as follows:

- A minimum soil compaction of 95% compaction. Soil testing results are normally shared with the installation Supervisor or Field Operations Manager.

*Soil compaction testing to be conducted via Standard Proctor Test (American Society for Testing and Materials {ASTM} Standard D698) or Modified Proctor Test (ASTM Standard D1557).

CALL BEFORE YOU DIG - 811

*It is the responsibility of the excavating company to ensure 811 - Call Before You Dig has been notified and proper clearances obtained prior to digging sump.

Installation Crew:

The installation crew may have basic equipment on-site to double check that location is graded to within one inch, up and down, however does not have access to compaction testing equipment or methods. It is good practice for the installation crew to check location grade and confirm compaction testing results prior to installing the AST.

*Inadequate ground preparation should be documented and discussed with the customer and project halted until ground preparation is complete per SOP.

- Pre-**A**ssembly Requirements

Prior to starting the assembly process, use the steps below as guidance to achieve an incident free, efficient installation of the tank, while meeting customer and SOP requirements:

1. Conduct Job Safety Analysis
2. All 3rd party personnel, sub-contractors, customers, end user representatives, and tank operators (if available) are encouraged to participate in JSA and/or pre-job meetings.
3. Inspect location/soil conditions and review compaction test results with customer.
4. If applicable, installation crew to check grade using a laser level - document slope in inches around parameter of tank.
5. Confirm a 30’ clear work area around the perimeter of the tank is possible to provide access for equipment and lay-down area for AST materials and installation equipment.
6. Check that the minimum distances to existing wells, power lines, etc. are met.
7. Establish final location for the suction tube and stairs.
8. Confirm trash bin is available to dispose of packaging, cut-off materials and installation garbage.
9. Confirm that fluid is available, per initial fill strategy, to seat the floor of the tank at the desired time.

Standard Equipment:

All equipment is subject to daily inspection. (Check condition, rigging, oil, water, fuel and cleanliness.) The below represents a list of the recommended, standard equipment required for assembly of the tank.

- Two (2) - 40’ extending straight boom man-lifts.
- One (1) - 12,000 lb. capacity extending boom, rough terrain powered telehandler.
- One (1) - 310 backhoe or comparable.

Hand and Power Tools:

- Two extension ladders
- One Push and one house broom
- One Paint wand
- One 24" pipe wrench
- One 36" pipe wrench
- Two 4 lb. sledgehammers
- 100’ and 300’ tape measure
- Set of wrenches ¼” – 1 ½”
- Set of deep impact sockets ¼” – 1 ½” (3/4" drive)
- Two 36” pry bars
- 8’ Dig/Frost Bar
- Two round nose shovels
- Four safety harnesses with retractable lanyards
- 300’ of 3/8” rope
- Self-retracting utility knife (one per Installer)
- One 3/4" drive impact
- Patch tape, Rubbing alcohol, Patch Roller
- Wire brush
- Crescent and channel lock wrench set
- Little Giant 2,000 lb. wagon

Rigging:

- Two tag lines
- Four 4" x 4" x 2' blocks
- Four-way chain sling
- Four 3/8" x 2' cable slings
- Four - 10' continuous loop slings (yellow)
- 2 - 1-1/4" shackles
- 4 - 3/4" shackles
- 1 - 10,000 lb. swivel
- 1 - 4" x 15' schedule 80 pipe with eyelets

Consumables:

- Three cans of orange marking paint
- PB Blaster or Lubricant
- Gorilla tape
- Zip ties

2. AST Installation Process

Laying Out the Tank:

1. Establish the center of the tank with a sandbag. This will be used to determine the tank's perimeter using model/size specific radius/diameter, using paint wand and marking paint. In addition, the center of the tank will be identifiable after the geo ground pad and liner have been rolled out as well.
2. Measure and paint perimeter circle for tank panels and measure where geo and liner(s) will begin and end including width.
3. Measure and paint where the sump or bottom drain is to be set.
4. Once layout is complete, confirm minimum distances are met for on-site hazards - existing wells, power lines, production equipment, etc.

Sump or Bottom Drain Excavation:

1. 811 must be called, with confirmation that all utilities have responded to the request before excavation commences.
2. Sump or bottom drain should be excavated on the low side of location, using a backhoe or excavator.
3. If multiple suctions are required, a minimum of 8' of separation should be placed in-between excavations.
4. Barricade any excavation with cones and tape if left unattended overnight.
5. Excavation will vary depending on what type of suction is to be installed (candy cane, bottom drain, etc.)

Geo Ground Pad and Liner Installation:

1. All sharp objects are to be removed from inside the tank layout (rocks, sticks, debris, roots, etc.)
2. Using a 12,000# telehandler, approved rigging and liner bar, unroll the geo ground pad, placing the edge of the roll on the designated geo ground pad line marked during the layout stage. Unroll from one end of the tank to the other using a spotter, to unroll over the center of the tank.
3. Per prefabricated design, unfold the geo ground pad in both directions and pull until centered on the tank floor.
4. Steps #2 and #3 should be repeated as to roll-out and unfold the primary liner, using the designated liner marked during the layout stage.
    - Follow double lined AST SOP for installation of multiple liners.
5. Perform a visual inspection of the liner. If defects are found, document, take photos and repair. Take post repair photos.
6. If a bird net is required set the bird net, stands, and cables on liner. Make sure stands have protective covering on base to ensure no damage to liner is done.
7. Starting at the sump and moving counterclockwise, fold the liner inward around perimeter. The liner edge should be pulled inside the painted tank wall no less than 2'.
8. Next, holding onto the inner most edge of the liner, fold the liner back over itself, toward the outside of the tank and around the entire perimeter (creating a pocket for fluid to be trapped, eliminating escape from the floor of the tank)

*It is critical that customer and regulatory requirements are met when storing flowback, production, waste or treated fluid

*Geo and/or liner should not be installed in winds of 15 mph or more

Sand or Geotextile Transition: Enough sand or geotextile should be placed in the ground to wall transition, around the inside perimeter of the AST to achieve a 1:1 transitional slope.

Standing Panels (Building Tank Walls):

1. Using a 12,000# telehandler and approved rigging, begin standing panels per AST engineering requirement or forecast wind direction (if applicable)
2. Once the first panel is stood, with cribbing blocks installed under each end, use a backhoe or excavator to hold and secure the panel, allowing the telehandler to safely disconnect from the panel without losing stability or securement. The equipment used should remain connected until enough panels are installed to safely stand on their own (varies per tank size and panel engineering)
3. Establish which direction the walls will be stood up and stand one panel at a time until the last seam is joined together, ensuring a 1:1 transitional slope of sand or geotextile is installed at each panel's interior base.

Note:

- Spotters should be used while connecting panel seams (ladder use, falling objects, moving equipment, etc.)
- Two taglines are to be used when transporting each panel from their stacked state to upright position/installation.
- Rigging should be inspected with each lift to ensure the safe handling of the suspended load.
- Pre-cut strips of 10 oz. geotextile should be installed on the inside of each seam to protect the liner from sharp edges.

Liner Placement and Clamp Installation:

1. Unfold the liner in sections, toward the base of each panel, ensuring that the transitional material is installed properly.
2. After liner is pulled toward the base of the panel, a two-man crew in a 40' straight boom on the outside of the tank works with the team members inside the tank to begin pulling the liner edge up and over the top of each panel. The man lift crew lifts the liner edge using ropes attached by the inside crew. The man boom crew lifts a small liner section to the top of the panel and folds it over the top of the panel, while the crew inside the tank ensures that there is enough slack in the liner inside the panel wall (typically 1' of slack).
3. Once a section of liner is positioned properly (with liner slack inside the tank) and over the top of each panel wall, the man lift crew secures the top of the liner with liner clamps.
    - NOTE: The number of clamps per panel is dependent on the panel length and specific engineering of the tank
4. Both inside and man lift crews continue this process, working around the tank, one or two panels at a time, until the entire liner is in place.
    - NOTE: The crew must allow sufficient slack in the liner at the wall to allow for liner movement during filling and draining.

Stairs, Fill Tubes, and Suction/Bottom Drain:

1. Install safety stair system, fill tubes, and suction or complete bottom drain. Ensure that stair system and tubes are appropriately secured to the tank walls according to customer specifications.
2. Upon completion of the stair system installation, the stairs should be secured as per the operating company requirements.

Bird Net Installation

1. Erect bird net stand(s) and run security cables through D-rings of each stand and secure cables to panel wall D-rings. Be sure cables are straight across the diameter of the tank.
2. Spread out bird net on liner floor. A 2-man crew in man boom will pull a section with tag line up to clamps to secure edge of net on top of panels. Continue pulling and securing bird net going around the tank. Continue to pull and secure until desired tautness is obtained.

Final Steps and Initial Fill:

1. Trim liner around perimeter of tank, allowing for 2' - 5' of liner to hang over edge of tank. Longer trim strategy includes the installation of a perimeter cable.
2. Inspect all connections and equipment.
3. Pump a minimum of 18" of FRESH or approved water onto the floor of the tank and monitor for leaks.
4. As soon as reasonably possible, complete the initial fill on the tank, monitoring for leaks.

Ongoing Inspection Guidance:

1. When the fluid levels are lowered, it is good practice to have the operating company perform an inspection on the exposed liner. Take photos if necessary and send to the installation crew.
2. As the tank is operated day-to-day, visibly inspect each panel.
3. Inspect the accessories, piping, valves and liner clamps installed.
4. Water must NEVER go below 24 inches at the LOWEST level in the tank. 2' water marks can be painted on the inside of the tank as a reminder to the operating company.
5. Do not leave liner exposed inside tank for long periods of time. The wind will cause the liner to rub on itself. This friction will create potential pinholes.
6. All water present on the ground around the tank should be inspected to ensure it is not coming from the tank. Water spots can be traced to identify growth, if visible fluid is not running from under the tank wall or down a panel.

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

Additional Variance for Recycling storage Containments (In-Ground and AST)

- Alternative Testing Methods
- Fencing AST Containments

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

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

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

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

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

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

> **19.15.34.14 CLOSURE AND SITE RECLAMATION REQUIREMENTS FOR RECYCLING CONTAINMENTS:**
> **C.** The operator shall test the soils beneath the containment for contamination with a five-point composite sample which includes stained or wet soils, if any, and that sample shall be analyzed for the constituents listed in Table I below.
> **(1)** If any contaminant concentration is higher than the parameters listed in Table I, the division may require additional delineation upon review of the results and the operator must receive approval before proceeding with closure.

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

Table I
Closure Criteria for Recycling Containments

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

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

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

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

The referenced Table I, is reproduced in part below.

Table I
Closure Criteria for Soils Impacted by a Release

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

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

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

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

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

Statement Explaining Why the Applicant Seeks a Variance

The prescriptive mandates of the Rule that are the subject of this variance request are presented below with emphasis **added**:

> D. Fencing.
> (1) The operator shall fence **or enclose** a recycling containment in a manner that deters unauthorized **wildlife** and human access and shall maintain the fences in good repair. The operator shall ensure that all gates associated with the fence are closed and locked when responsible personnel are not onsite.
> (2) Recycling containments shall be fenced with a four foot fence that has at least four strands of barbed wire evenly spaced in the interval between one foot and four feet above ground level.
> E. Netting. The operator shall ensure that a recycling containment is screened, netted or otherwise protective of **wildlife**, including migratory birds. The operator shall on a monthly basis inspect for and, within 30 days of discovery, report the discovery of dead migratory birds or other wildlife to the appropriate wildlife agency and to the division district office in order to facilitate assessment and implementation of measures to prevent incidents from reoccurring**.**

The subject AST employs netting or sonic bird hazing (Mega Bird X with bird calls specific to the Permian Basin). These methods effectively protect avian species such as waterfowl and bats. OCD and BLM have approved both methods per Rule 34 and by BLM Rules respectively.

The steel structure of the AST is 11-feet high, which obviously encloses the containment "in a manner that deters…[terrestrial] wildlife." Thus, the steel structure meets the mandate of the Rule for enclosure. Thus, netting and the steel structure meet the mandate of Rule 34 for deterring/protecting avian and terrestrial wildlife.

Because AST Containments have a steel stairway between ground surface and the open top, the operator proposes the following deterrent to unauthorized human access:

1. Install gate (e.g. https://www.saferack.com/saferack-yellowgate-adjustable-safety-swing-gates/) or chain across the stairway
2. Place an appropriate sign on the gate or chain to help deter unauthorized human access to the open top of the containment
3. Provide for a mechanism to lock the gate when responsible personnel are not onsite.

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

We believe the proposed protocol provides equal protection of Public Health as a 4-strand barbed wire fence.

40-MIL NON-REINFORCED LLDPE LINER AS ALTERNATE PRIMARY AND 30-MIL NON-REINFORCED LLDPE AS SECONDARY LINER FOR ABOVE GROUND STEEL TANK MODULAR RECYCLING STORAGE CONTAINMENTS

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

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

NMAC 19.15.34.12 A DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT

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

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

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

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

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

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

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

R.K. FROBEL & ASSOCIATES
Consulting Engineers

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

NMAC 19.15.34.12 A (4)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Sincerely Yours,

RK Frobel

Ronald K. Frobel, MSCE, PE

COLORADO REGISTERED RONALD KENNETH FROBEL 15742 PROFESSIONAL ENGINEER

References:

NMAC 19.15.34.12 DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT

Geosynthetic Research Institute (GRI) Published Standards and Papers 2018

ASTM Standards 2018

Attachments:

R. K. Frobel C.V.

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

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

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

NMAC 19.15.34.12 A DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT

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

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

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

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

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

The following technical documents provide supportive data to demonstrate equal or better protection of fresh water, public health and the environment by providing the requisite containment and protection. Technical comparison of the proposed material is compared to what is advised through Rule 34 is discussed. A second memorandum provides clarification that the engineering requirements for site preparation, which ensures functionality of the liner system, is crosscutting to varied locations within the Permian Basin. Stamped plans from design engineer confirm applicability of this liner system to this specific site.

R.K. FROBEL & ASSOCIATES
Consulting Engineers

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

NMAC 19.15.34.12 A (4)

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

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

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

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

Potential for Leakage through the Primary and Secondary Liners. Leakage through geomembrane liners is directly a function of the height of liquid head above any hole or imperfection. The geonet drainage media between the primary and secondary LLDPE

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

geomembranes at the base of the AST in this application provides immediate drainage to a low point or outside the Modular AST Impoundment and thus no hydrostatic head or driving gradient is available to push leakage water through a hole in the Secondary LLDPE liner .

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

Both non-reinforced LLDPE and string reinforced LLDPE can be prefabricated into large panels and thus both types offer the following for Containment:

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

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

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

- Both types of LLDPE geomembrane are easily repaired using the same thermal fusion bonding method without the need for special surface grinding/preparation for extrusion welding as is typically used in repair of HDPE geomembranes.

R.K. FROBEL & ASSOCIATES
Consulting Engineers

However, string reinforced LLDPE requires that all cut edges with exposed scrim must be encapsulated with extrusion bead. No encapsulation is required on non-reinforced LLDPE.

In summary, it is my professional opinion that the two layers of 40 mil non-reinforced LLDPE geomembranes will provide a Primary/Secondary liner system that is equal to or better than 45 mil string reinforced LLDPE, 30 mil PVC, 60 mil HDPE (primary liner) and 35 mil LLDPEr (secondary liner). Additionally, the two layers of 40 mil LLDPE will provide a superior installation and function better than liners referenced in the OCD rule. The two layers of 40 mil non- reinforced LLDPE will provide the requisite protection of fresh water, public health and the environment for at least 5 years in the frack water environment.

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

Sincerely Yours,

R K Frobel

Ronald K. Frobel, MSCE, PE

COLORADO REGISTERED
RONALD KENNETH FROBEL
15742
PROFESSIONAL ENGINEER

References:

NMAC 19.15.34.12 DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT

Geosynthetic Research Institute (GRI) Published Standards and Papers 2018

ASTM Standards 2018

Attachments:

R. K. Frobel C.V

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

SLOPE AND ANCHOR VARIANCE REQUEST FOR ABOVE GROUND STEEL TANK MODULAR RECYCLING STORAGE CONTAINMENTS

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

Statement Explaining Why the Applicant Seeks a Variance

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

NMAC 19.15.34.12 DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT:

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

(2) A recycling containment shall have a properly constructed foundation and interior slopes consisting of a firm, unyielding base, smooth and free of rocks, debris, sharp edges or irregularities to prevent the liner's rupture or tear. Geotextile is required under the liner when needed to reduce localized stress-strain or protuberances that otherwise may compromise the liner's integrity. *The operator shall construct the containment in a levee with an inside grade no steeper than two horizontal feet to one vertical foot (2H:1V). The levee shall have an outside grade no steeper than three horizontal feet to one vertical foot (3H:1V).* The top of the levee shall be wide enough to install an anchor trench and provide adequate room for inspection and maintenance.

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

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

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

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

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

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

R.K. FROBEL & ASSOCIATES
Consulting Engineers

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

NMAC 19.15.34.12 A (2), (3)

Side Slope

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

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

Anchor Trench

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

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

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

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

R.K. FROBEL & ASSOCIATES
Consulting Engineers

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

Sincerely Yours,

R K Frobel

Ronald K. Frobel, MSCE, PE

References:

NMAC 19.15.34.12 DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT

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

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

Attachments:

R. K. Frobel C.V.

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

January 2020

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

R.K. FROBEL & ASSOCIATES
Consulting Engineers

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

NMAC 19.15.34.12 A (2)

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

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

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

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

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

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

R.K. FROBEL & ASSOCIATES
Consulting Engineers

Sincerely Yours,

R K Frobel

Ronald K. Frobel, MSCE, PE

References:

NMAC 19.15.34.12 DESIGN AND CONSTRUCTION SPECIFICATIONS FOR A RECYCLING CONTAINMENT

ASTM Standards 2019

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

RONALD K. FROBEL, MSCE, P.E.

CIVIL ENGINEERING
GEOSYNTHETICS
EXPERT WITNESS
FORENSICS

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

TITLE: Principal and Owner

PROFESSIONAL AFFILIATIONS:

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

ACADEMIC BACKGROUND:

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

PROFESSIONAL EXPERIENCE:

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

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

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

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

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

United States Navy, Commissioned Naval Officer, 1970 - 1973

REPRESENTATIVE EXPERIENCE:

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

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

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

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

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

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

PUBLICATIONS: Over 85 published articles, papers and books.

CONTACT DETAILS:

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

April 2025

Rule 34 Permit
Angel RF and Containments
Section 32, T20S, R28E, Eddy County

Karst Investigation Appendix

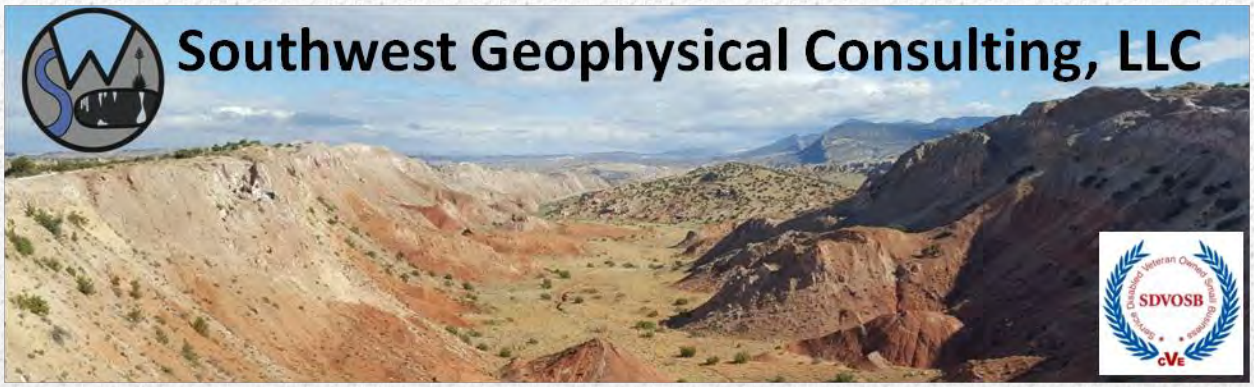
View southeast toward the Angel RF and Containments Project Area. Near the horizon at the center of the image are topsoil and spoil piles associated with an abandoned caliche pit. This pit will become part of the proposed western containment.

Prepared for:
BTS Management, LLC
Carlsbad, New Mexico

Prepared by:

R.T. Hicks Consultants, Ltd.
Albuquerque, New Mexico

Cascade Services LLC
Midland, Texas



Cave and Karst Resource Inventory Report
BTS Management Angel Pond
Eddy County, New Mexico

Prepared for:

Cascade Services, LLC
4400 North Big Spring Street, Suite 114
Midland, TX 79705

☑ **Positive**

- ☐ **Relocation/Realignment Recommended**
- ☐ **Karst Monitor Recommended**
- ☑ **Relocation/Realignment Not Required**

☐ **Negative**

February 12, 2025

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Southwest Geophysical Consulting, LLC
5117 Fairfax Dr. NW
Albuquerque, NM 87114
(505) 585-2550
www.swgeophys.com

Prepared by:
Britt Bommer
Field Geologist
britt@swgeophys.com

Reviewed by:
David D. Decker, PhD, PG, CPG
Principal, Chief Executive Officer
dave@swgeophys.com

Prepared for:
Cascade Services, LLC
4400 North Big Spring Street, Suite 114
Midland, TX 79705

Point of Contact:
Ms. Bobbi Jo Crain
(210)-632.8670
Bobbijo@CascadeServicesLLC.com

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1.0 INTRODUCTION

An aerial karst survey was commissioned by Cascade Services, LLC, Inc. (hereinafter referred to as "the client"), on January 23, 2025, for the purpose of determining the presence of karst-related surface features within the BTS Management Angel Pond containment (hereinafter termed “BTSMAP”).

As indicated in section ***1.3 Affected Environment***, the bedrock and overlying soil at the survey site are susceptible to sinkhole development and karst features may be hidden beneath the existing soil stratum. Risk associated with sinkhole formation can be minimized during development with proper foundation design and construction, and the control of site hydrology. The owner/ developer must recognize, however, that a risk of sinkhole-induced damage to infrastructure does exist. The owner/developer must evaluate the risks and attendant costs of not performing a geophysical survey prior to development and must be willing to accept these risks if it is decided that a surface karst survey is sufficient. Southwest Geophysical Consulting can provide a geophysical survey. If the decision is made to conduct a geophysical survey, a cost estimate and timeline will be provided upon request.

1.1 Goals of this Study

To provide the client with the location and description of any surface karst-related features within a 200-meter survey boundary surrounding the BTSMAP containment as agreed upon by the client during the January 22, 2025, client meeting.

1.2 Summary of Findings

Three recognized and two high-likelihood surface karst features are located within the aerial survey area. Please see the section entitled ***2.4 Description of Karst Features*** and **Table 1** for details of the located feature.

Remain clear of these features while planning infrastructure. (**Figure 4**, see section **3.0 RECOMMENDATIONS** for further information).

The presence of these and other nearby surface features indicates that this area is karstified and may contain buried karst features. Caution should be exercised while clearing brush and during any excavation, trenching, or construction operations. Employing a Bureau of Land Management approved karst monitor on site while operating near karst features should be considered.

1.3 Affected Environment

The proposed BTSMAP project is located in evaporite karst terrain, a landform that is characterized by underground drainage through solutionally enlarged conduits. Evaporite karst terrain may contain sinkholes, sinking streams, caves, and springs. Sinkholes leading to underground drainages and voids are common. These karst features, as well as occasional fissures and discontinuities in the bedrock, provide the primary sources for rapid recharge of the groundwater aquifers of the region. Additionally, karst may develop by hypogene processes involving dissolution by upwelling fluids from depth independent of recharge from the overlying or immediately adjacent surface. Hypogene karst systems may not be connected to the surface and can remain undiscovered unless encountered during drilling or excavation.

Karst features are delicate resources that are often of geological, hydrological, biological, and archeological importance, and should be protected. The four primary concerns in these types of terrain are environmental issues, worker safety, equipment damage, and infrastructure integrity.

The Bureau of Land Management (BLM) categorizes all areas within the Carlsbad Field Office (CFO) zone of responsibility as having either low, medium, high, or critical cave potential based on geology, occurrence of known caves, density of karst features, and potential impacts to freshwater aquifers[1]. These designations are also recognized by the New Mexico State Land Office (NMSLO). This project occurs within a **HIGH** karst occurrence zone (HKOZ)[2] (**Figure 1**).

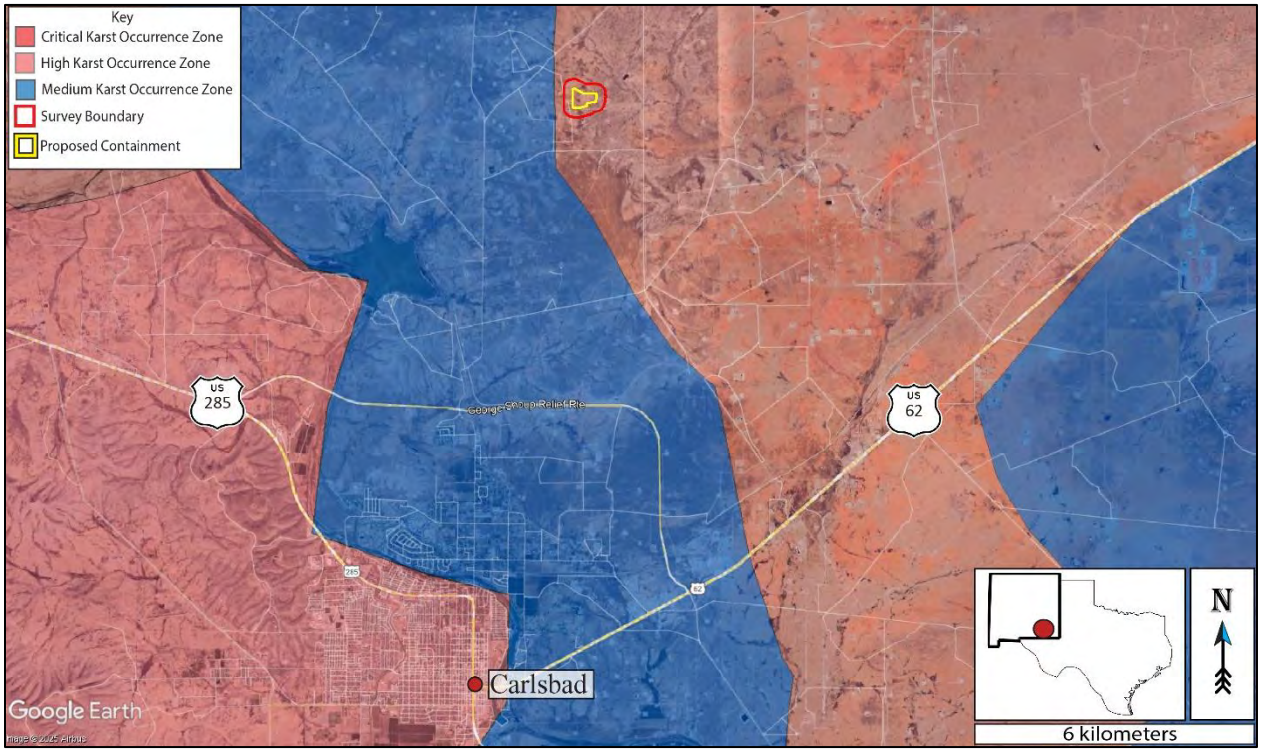

Figure 1: Karst occurrence overview. Background image: Google Earth. Image date: August 21, 2024. Datum: WGS-84.

A high karst occurrence zone is defined as an area in known soluble rock types that contains a high frequency of significant caves and karst features such as sinkholes, bedrock fractures that provide rapid recharge of karst aquifers, and springs that provide riparian habitat[1].

1.4 Limitations of Report

This report should be read in full. No responsibility is accepted for the use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

This report has been prepared for the use of Cascade Services, LLC, Inc., in accordance with generally accepted consulting practices. Every effort has been made to ensure the information in this report is accurate as of the time of its writing. This report has not been prepared for use by parties other than the client, their contracting party, and their respective consulting advisors. It may not contain sufficient information for the purposes of other parties or for other uses.

This report was prepared upon completion of the associated fieldwork using a standard template prepared by Southwest Geophysical Consulting and is based on information collected prior to fieldwork, conditions encountered on site, and data collected during the fieldwork and reviewed at the time of preparation. Southwest Geophysical Consulting disclaims responsibility for any changes that might have occurred at the site after this time. The interpreted results, locations, and depths noted in this report (if applicable) should be taken as an interpretation only and no decision should be based solely on this information. Physical verification of aerial imagery analysis results in the field should be conducted prior to moving any planned infrastructure.

To the best of our knowledge, information contained in this report is accurate at the date of issue; however, conditions on the site can change in a limited time and, therefore, the information in this report shall not be used beyond three years past the date of imagery collection (see section ***2.3 Description of Survey***).

2.0 LOCATION AND DESCRIPTION OF STUDY AREA

2.1 Description of Site

The BTSMAP project site is located in Eddy County, New Mexico, 13.0 kilometers (8.1 miles) north of Carlsbad, New Mexico, east of Illinois Camp Road (**Figure 1** and **Figure 2**). The proposed infrastructure is located within the NW ¼ section of section 32, NM T20S R28E[3]. The region is semi-arid with an average annual precipitation of approximately 13 inches, of which about two-thirds falls as rain during summer thunderstorms from June to October. Summers are hot and sunny while winters are generally mild, with an average maximum temperature of 96°F in July and an average minimum temperature of 28°F in January[4]. This area is within the Chihuahuan Desert Thornscrub as defined by the Southwestern Regional ReGAP Vegetation map[5] and the vegetation consists mostly of areas of grass, sparse creosote, and sparse yucca, with very good visibility in most locations. See section ***2.2 Local Geology Summary*** for the geology of the area. The entirety of the survey area is located within an HKOZ[2] (**Figure 1**) and within NMSLO and privately managed land[6] (**Figure 2**).

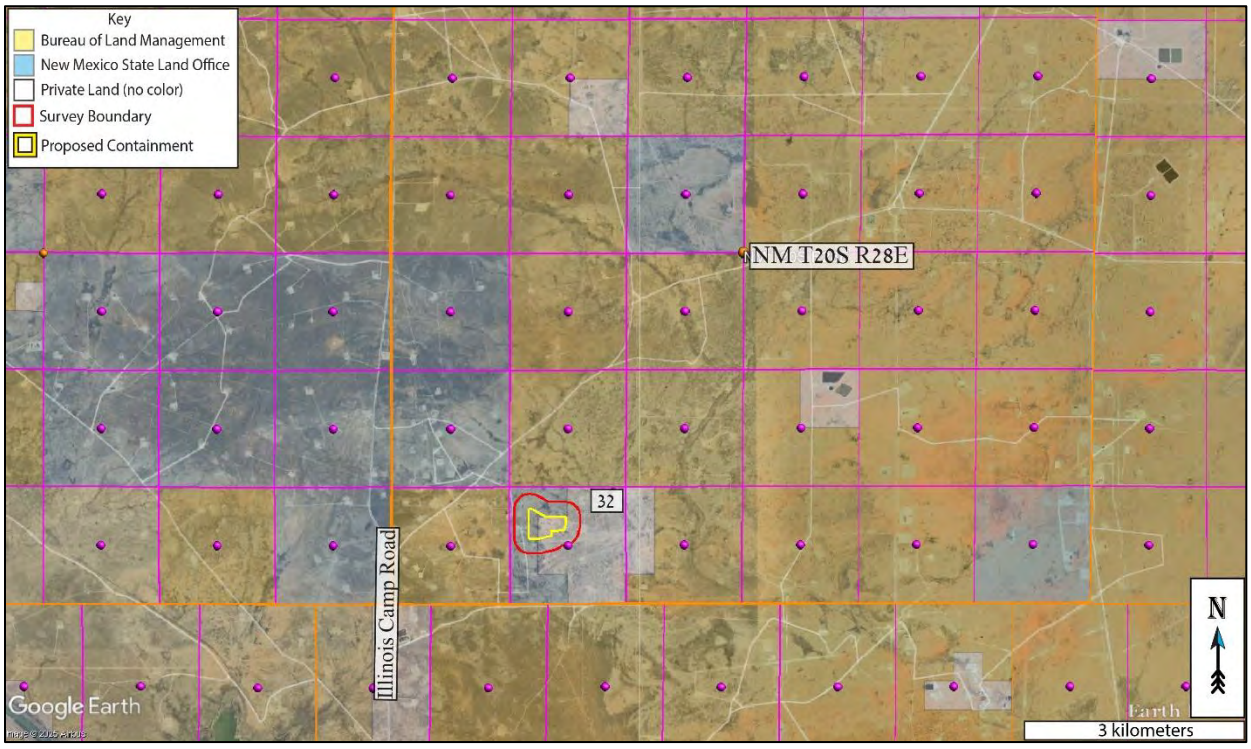

Figure 2: Land ownership and PLSS overview. Background image credit: Google Earth. Image date: August 21, 2024. Datum: WGS-84.

2.2 Local Geology Summary

The area surveyed for the BTSMAP project is located at an elevation of 981 meters (3,217 feet), ± 10 meters (33 feet), and is underlain by the Permian Rustler (Pru) Formation (not pictured as it does not outcrop in this area). The area is mantled by thin gypsiferous soils (gypsite), Quaternary alluvium (Qal), eolian deposts, and piedmont alluvial gravels (Qp)[13] between 0 and 6 meters in depth (**Figure 3**).

The Rustler Formation is an evaporite facies composed mainly of thin siltstones and sandstones interbedded with claystones, dolomite, and gypsum, and contains both karst-forming strata (the Forty-niner and Tamarisk members) and two shallow aquifers (the Magenta and Culebra Dolomite members)[9].

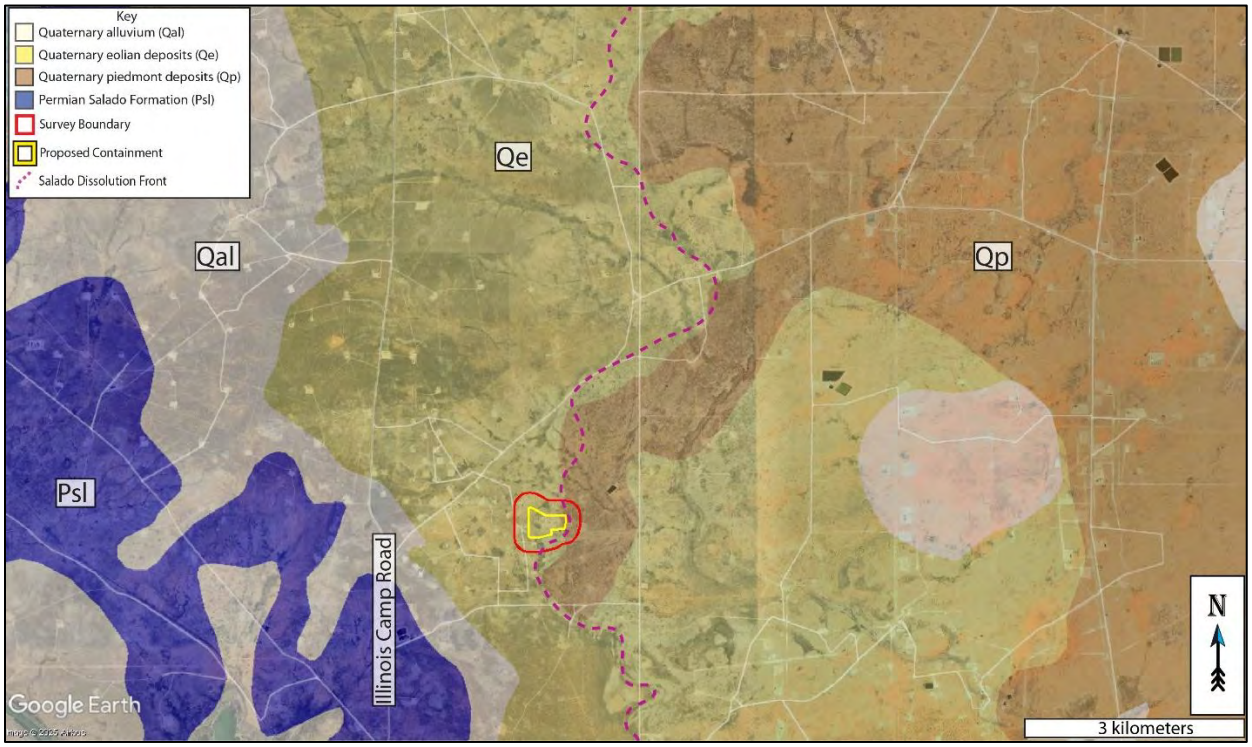

Figure 3: Geology overview. Map credit: The Digital Geologic Map of New Mexico in ARC/INFO Format, and Google Earth. Image date: August 21, 2024. Datum: WGS-84.

The Pru overlies the Permian Salado Formation (Psl), a layer of extremely soluble halite which can readily dissolve to create caves, sinkholes, and other karst features; however, due to its extremely soluble nature, only non-soluble silt and sand remain from the dissolution of this layer at the surface[9]. The Rustler Formation may be subject to collapse if a void has developed beneath it in the Salado Formation[14].

In areas around the contact between the upper Salado and lower Rustler Formations, the Salado dissolution front may be present. As the halite in the Salado Formation is dissolved by fresh meteoric waters and groundwater travelling along the Pecos River corridor, the Rustler Formation subsides, forming jumbled blocks of bedrock, crevices, and fractures. The edges of these blocks, crevices, and fractures are prone to further dissolution, forming small subsurface voids that may be encountered during trenching or construction operations[14]. Areas to the east of the Salado dissolution front are more prone to karst development than areas to the west.

The survey area is covered by the easily accessible Geologic Map of New Mexico (2003) at 1:500,000 scale[7] and the Digital Geologic Map of New Mexico in ARC/INFO Format[13].

2.3 Description of Survey

Southwest Geophysical Consulting, in partnership with SWCA Environmental Consultants, provides aerial karst surveys using drones that are flown by qualified, FAA licensed drone pilots and that meet the stringent Bureau of Land Management – Carlsbad Field Office requirements for both pedestrian and aerial karst surveys.

Aerial karst surveys are conducted at low elevation following a preplanned raster pattern flightpath designed for the purpose of generating at least 75% imagery overlap. The collected high-resolution, georeferenced imagery is stitched together to develop orthomosaic imagery which is further developed into a digital elevation model (DEM); the DEM is then processed into a local relief model (LRM) (**Figure 4**). This LRM is color coded to enhance differences in elevation of as little as five centimeters. The orthoimagery, DEM, and LRM are uploaded to a server where they are analyzed by a highly qualified karst geologist. Finally, the data is reviewed by a senior karst geologist for quality assurance and downloaded into a table for inclusion in a written report[11].

Resolution of the orthoimagery is clear enough that features as small as 10 centimeters can be positively identified in most circumstances. Occasionally there are ambiguous features identified during an aerial survey that will need to be checked in the field if they impact the facility's location. Specifically, it is difficult to tell the difference between solution tubes, abandoned uncased well bores, and some burrows in drone imagery. If an ambiguous feature is located during imagery analysis, it is marked with a yellow dot in **Figure 4**. If a feature of any likelihood is subsequently verified in the field prior to publication of the report, the dot will be changed to a red triangle if confirmed as a karst feature or deleted if not.

The imagery for this study was collected via aerial survey by Pat Lagodney of SWCA on January 26, 2025. Surface karst features may have developed after this date and will not be noted in this report. Imagery analysis was completed by Dave Decker of Southwest Geophysical Consulting on January 28, 2025.

Prior to conducting the aerial karst surveys, a surface karst desk study was performed by Southwest Geophysical Consulting. The study was performed using satellite and aerial imagery from Google Earth Pro dated January 27, 2023, and July 13, 2024 (please note features less than one meter in diameter are generally not visible using this method); the Southwest Geophysical Cave and Karst Database dated November 26, 2024[12]; the Angel Draw, NM, 1:24,000 quad, 1985, USGS topographic map; and the latest lidar imagery from CalTopo.com. Please note that we use older topographic maps because newer maps have had caves removed from them. These searches and queries returned no results within the survey boundary.

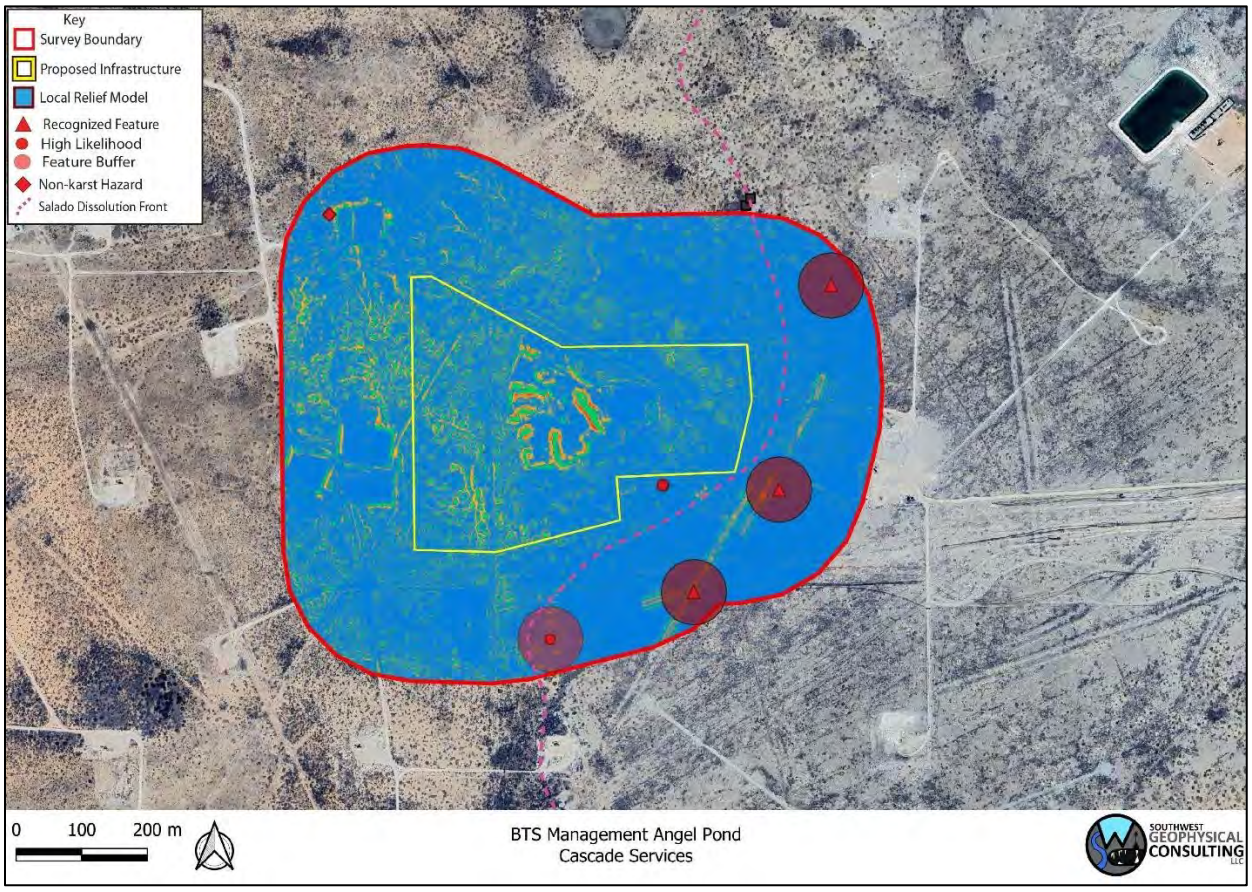

Figure 4: Survey overview. Background image credit: Google Earth. Image date: August 21, 2024. Datum: WGS-84.

2.4 Description of Karst Features

Three recognized surface karst features are located within the aerial survey area (**Figure 4**, **Table 1**). Recognized surface karst features are features that are positively identified in either satellite or aerial imagery as karst features and the features have been visited by a qualified karst professional in the field and fully identified. Images for the features are available on request.

Two high-likelihood surface karst features are located within the aerial survey area (**Figure 4**, **Table 1**). High-likelihood surface karst features are features that are positively identified in either satellite or aerial imagery as karst features but have not been field checked.

Remain clear of these features while planning infrastructure. (**Figure 4**, see section **3.0 RECOMMENDATIONS** for further information).

The presence of these and nearby surface features indicates that this area is karstified and may contain buried karst features. Caution should be exercised while clearing brush and during any excavation, trenching, or construction operations. Employing a Bureau of Land Management approved karst monitor on site while operating near karst features should be considered.

Table 1 contains a list of features identified during the aerial karst survey and subsequent imagery analysis. Each feature is identified with a feature identification number (Feature ID), the type of feature, estimated size (in meters), recommended buffer (in meters), the likelihood of this feature being a surface karst feature (modifiers H/M for high or medium likelihood, V for field verified), and its location in WGS-84/UTM-13 (EPSG: 32613).

Table 1: Karst Feature Data Table

Karst Status	Feature ID	Type	Size (m)	Buffer (m)	Modifier	Easting	Northing
RKF	**230610-D26**	**Cover-collapse sinkhole**	**1.4**	**50**	**V**	**575132.674**	**3599639.778**
RKF	**230610-D27**	**Solution chimney**	**0.5**	**50**	**V**	**575002.448**	**3599483.490**
PKF	**230610-D31**	**Sinkhole**	**4**	**50**	**V**	**574783.736**	**3599411.688**
NKF	*250128-D01*	*Hydrovac hole or release*	*4.1*	*0*	*Z*	*574446.555*	*3600058.771*
PKF	250128-D02	Suffosion sinkhole	3.8	10	M	574955.329	3599646.188
PKF	250128-D03	Cover-collapse sinkhole	2.1	50	H	575211.867	3599950.661

NOTE: Location data provided in WGS-84/UTM 13N. PKF – possible karst feature. RKF – recognized karst feature. NKF – non-karst feature

3.0 RECOMMENDATIONS

3.1 Summary

- Three recognized and two high-likelihood surface karst features are located within the aerial survey area.
- **Remain clear of these features while planning infrastructure**
- The presence of these and other nearby surface karst features indicates that this area is karstified and likely contains buried karst features.
- Caution should be exercised while clearing brush and during any excavation, trenching, or construction operations.
- Employing a BLM-CFO approved karst monitor during excavation near these features should be considered.

3.2 Best Practices

This area may be prone to rapid karst formation in the underlying stratigraphy and warrants careful planning and engineering to mitigate karst-forming processes that could be accelerated by poor design considerations. Proper engineering of petroleum-related facilities following karst guidelines should be implemented during both excavation and construction. Mitigation measures for any karst features revealed during excavation shall be approved by the Bureau of Land Management – Carlsbad Field Office and follow the Natural Resources Conservation Service Conservation Practice Standard for Karst Sinkhole Treatment, Code 527, or the Bureau of Land Management Cave and Karst Management Handbook, H-8380-1.

Keep in mind that any flow of gypsum-undersaturated waters into a small crack or crevice can rapidly dissolve any underlying gypsum and cause failure of an impoundment or infrastructure within a matter of months to a few years. It is imperative that any dikes, buffers, or liners installed are checked regularly for integrity, with repairs made immediately upon discovery of failure.

Vigilance during construction is paramount. If voids are encountered during excavation, contact the Bureau of Land Management Karst Division at (575) 234-5972, the New Mexico State Land Office Surface Resources Division at (505) 827-5768, or a BLM-CFO approved karst vendor and request an on-site investigation from a karst expert if one is not already on site. A karst consultant can generally be available in Eddy County within five hours.

Approved karst monitors should have karst feature identification training, at least two years of supervised experience identifying karst features, wilderness first aid training, SRT training, confined space training, gas monitor training, and a minimum of SPAR cave rescue training through NCRC. They should have with them the proper gear and be prepared both physically and mentally to enter a collapse feature within minutes to perform a rescue if needed. Monitoring services with qualified karst monitors, as well as cave surveys and geophysical surveys, are available from Southwest Geophysical Consulting.

Under no circumstances should an untrained, inexperienced person enter a cave, pit, sinkhole, or collapse feature. All field employees of Southwest Geophysical Consulting have extensive caving experience and the ability to determine whether entry into a karst feature is safe or presents a hazard. In the event it is necessary to enter a karst feature, Southwest Geophysical Consulting can provide these services on request.

Cave and karst resource inventory reports for the BLM-CFO should be submitted to:

blm_nm_karst@blm.gov

Cave and karst resource inventory reports for the NMSLO should be submitted to the respective project manager.

4.0 REFERENCES

1 Goodbar, J. R. Vol. BLM Management Handbook H-8380-1 (ed Carlsbad Field Office) 59 (Bureau of Land Management, Denver, CO, 2015).

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5.0 GLOSSARY OF TERMS AND ABBREVIATIONS

ACEC	Area of Critical Environmental Concern
AGI	Advanced Geosciences Inc.
BLM-CFO	Bureau of Land Management - Carlsbad Field Office
brecciated	Fractured rock caused by faulting or collapse.
caprock-collapse sinkhole	Collapse of roof-spanning rock into a cave or void.
cave	Natural opening at the surface large enough for a person to enter.
cover-collapse sinkhole	Collapse of roof-spanning soil or clay ground cover into a subsurface void.
GPS	Global Positioning System
grike	A solutionally enlarged, vertical, or sub-vertical joint or fracture.
(H)	High confidence modifier for a PKF. This is typically reserved for a feature that is definitely karst but has not been confirmed in the field.
HKOZ	High Karst Occurrence Zone
karst	A landscape containing solutional features such as caves, sinkholes, swallets, and springs.
(L)	Low confidence modifier for a PKF. This is typically a feature that cannot be ruled out as karst but is most likely NOT karst related. This modifier may also be used for pseudokarst features.
LED	Locally enclosed depression. A natural depression on the surface that collects rainwater. Some contain swallets and/or caves, others do not.
LiDAR	Light Detection And Ranging
(M)	Medium confidence modifier for PKF. This is an ambiguous feature that can't be positively identified as karst without a field visit (e.g., burrows, abandoned unlined wells, solution tubes, pseudokarst).
MKOZ	Medium Karst Occurrence Zone
NCRC	National Cave Rescue Commission
NKF	Non-karst feature. Used for features originally identified as PKF that have been subsequently identified in the field as non-karst related. This term may also be used for pseudokarst features.
NMSLO	New Mexico State Land Office
Ohm-m	Ohm-meter, a unit of measurement for resistivity. Also sometimes abbreviated Ω-m.
paleokarst	Previously formed karst features that have been filled in by erosion and/or deposition of minerals.
Pat	Permian Artesia Group
Pc	Permian Capitan Formation

Pcs	Permian Castile Formation
Pdl	Permian Dewey Lake Formation
PKF	Possible karst feature. This term is reserved for features identified in satellite or aerial imagery that have NOT been visited in the field. Further modifiers include (H) for high confidence, (M) for medium confidence, and (L) for low confidence. These confidence levels are based on field experience.
PLSS	Public Land Survey System
Pqg	Permian Queen/Greyburg Formation
Pru	Permian Rustler Formation
pseudokarst	Karst-like features (sinkholes, conduits, voids etc.) that are not formed by dissolution. These types of features include soil piping, lava tubes, and some cover-collapse and suffosion sinkholes.
Psl	Permian Salado Formation
Psr	Permian Seven Rivers Formation
Pt	Permian Tansill Formation
Py	Permian Yates Formation
Qal	Quaternary alluvium
Qe	Quaternary eolian deposits
Qg	Quaternary Gatuna Formation
Qp	Quaternary piedmont deposits
Qpl	Quaternary playa lake deposits
RKF	Recognized karst feature. This term is reserved for karst features that have been physically verified in the field.
SKF	Surface Karst Feature
SPAR	Small Party Assisted Rescue
suffosion sinkhole	Raveling of soil into a pre-existing void or fracture.
swallet	A natural opening in the surface, too small for a person, that drains water to an aquifer. Some are "open," meaning a void can be seen below; some are "closed, "meaning they are full of sediment.
SWG	Southwest Geophysical Consulting, LLC
UTM	Universal Transverse Mercator (projected coordinates)
(V)	Field verified modifier for a PKF. This indicates that the feature has been visited by a qualified karst professional in the field and fully identified
WGS	World Geodetic System (geographic coordinates)

6.0 ATTESTATION

David D. Decker, PhD, PG, CPG
Chief Executive Officer, Principal Geologist
Southwest Geophysical Consulting, LLC
5117 Fairfax Dr. NW
Albuquerque, NM 87114
dave@swgeophys.com
(505) 585-2550

CERTIFICATE OF AUTHOR

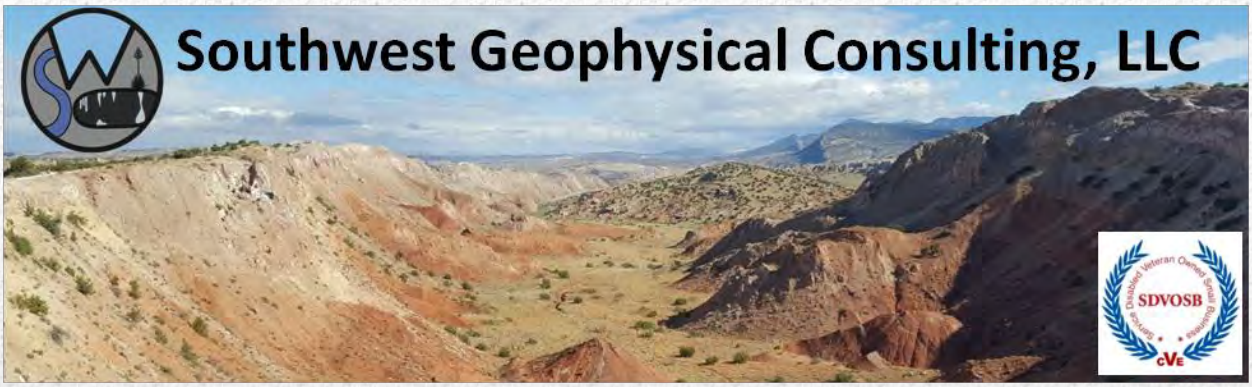
I, David D. Decker, a Licensed Professional Geologist and a Certified Professional Geologist, do certify that:

- I am currently employed as a consulting geologist in the specialty of caves and karst with an office address of 5117 Fairfax Dr. NW, Albuquerque, NM, USA, 87114.
- I graduated with a Master of Science in Applied Physics with a specialization in Sensor Systems from the Naval Post Graduate School in Monterey, California, in 2003, and a Doctor of Philosophy in Earth and Planetary Sciences from the University of New Mexico, Albuquerque, New Mexico, in 2018.
- I am a Licensed Professional Geologist in the State of Texas, USA (PG-15242) and have been since 2021. I am a Certified Professional Geologist through the American Institute of Professional Geologists (CPG-12123) and have been since 2021.
- I have been employed as a geologist continuously since 2016. I was previously employed as a Fire Controlman, Naval Flight Officer, and Aerospace Engineering Duty Officer in the U.S. Navy and operated, maintained, and installed various sensor systems including magnetic, electromagnetic, radar, communications, and acoustic systems in various capacities from 1986 through 2010.
- I have been involved in various aspects of cave and karst studies continuously since 1985, including exploration, mapping, and scientific studies.
- I have read the definition of “qualified karst professional” set out in the ASTM Standard Practice for Preliminary Karst Terrain Assessment for Site Development (ASTM E-1527). I meet the definition of “qualified professional” for the purposes of this standard.
- I am responsible for the content, compilation, and editing of all sections of report number CASC-009-20250122 entitled, “Cave and Karst Resource Inventory Report, BTS Management Angel Pond Eddy County, New Mexico.” I or a duly authorized representative of Southwest Geophysical Consulting, LLC, have personally visited or reviewed the aerial imagery for this site on the date or dates mentioned in section ***2.3 Description of Survey***.

- I have no prior involvement nor monetary interest in the described property or project, save for my fee for conducting this investigation and providing the report.

Dated in Albuquerque, New Mexico, March 19, 2025.

David D. Decker
PhD, CPG-12123



2D Electrical Resistivity Imaging Report

TPW Angel Pond Phase 1

Eddy County, New Mexico

Prepared For:

Cascade Services, LLC

4400 North Big Spring Street, Suite 114

Midland, TX 79705

☐ **Positive**

- ☐ **Avoidance Recommended**
- ☐ **Realignment Not Required**

☑ **Negative**

☐ **Karst Monitor Recommended**

January 29, 2025

CASC-008-20241021

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(505) 585-2550
www.swgeophys.com

Prepared by:
David D. Decker, PhD, PG, CPG
Principal, Chief Executive Officer
dave@swgeophys.com

Reviewed by:
David D. Decker, PhD, PG, CPG
Principal, Chief Executive Officer
dave@swgeophys.com

Prepared for:
Cascade Services, LLC
4400 North Big Spring Street, Suite 114
Midland, TX 79705

Point of Contact:
Ms. Bobbi Jo Crain
(210)-632.8670
Bobbijo@CascadeServicesLLC.com

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1.0 INTRODUCTION

This report was commissioned by Cascade Services, LLC (hereinafter referred to as "the client"), on October 21, 2024, for the purpose of determining the existence of any voids within the boundaries of the TPW Angel Pond Phase 1 project site (hereinafter termed “TPWAP”) centered at N 32.532654° W 104.202358° using electrical resistivity imaging.

1.1 Goals of this Study

To provide the client with the location and depth of any anomalies that can be interpreted as voids located within the survey boundary agreed to during the October 21, 2024 online meeting between Cascade Services, LLR Consults, and Southwest Geophysical Consulting, and within the parameters of the designed study using electrical resistivity imaging for the purpose of determining the feasibility of placing a pad at this location.

1.2 Summary of Findings

No shallow anomalies interpreted as possible voids or related karst features were found within the TPWAP survey area. See section **3.0 RESULTS** and **4.0 DISCUSSION** for more information.

1.3 Affected Environment

The TPWAP project is located in evaporite karst terrain, a landform that is characterized by underground drainage through solutionally enlarged conduits. Evaporite karst terrain may contain sinkholes, sinking streams, caves, and springs. Sinkholes leading to underground drainages and voids are common. These karst features, as well as occasional fissures and discontinuities in the bedrock, provide the primary sources for rapid recharge of the groundwater aquifers of the region. Additionally, karst may develop by hypogene processes involving dissolution by upwelling fluids from depth independent of recharge from the overlying or immediately adjacent surface. Hypogene karst systems may not be connected to the surface and can remain undiscovered unless encountered during drilling or excavation.

Karst features are delicate resources that are often of geological, hydrological, biological, and archeological importance, and should be protected. The four primary concerns that need to be considered in these types of terrain are environmental issues, worker safety, equipment damage, and infrastructure integrity.

The Bureau of Land Management (BLM) categorizes all areas within the Carlsbad Field Office (CFO) zone of responsibility as having either low, medium, high, or critical cave potential based on geology, occurrence of known caves, density of karst features, and potential impacts to freshwater aquifers[1]. The New Mexico State Land office also recognizes these categories. This project occurs within a **HIGH** karst occurrence zone [2] (HKOZ) (**Figure 1**).

A high karst occurrence zone is defined as an area in known soluble rock types that contains a high frequency of significant caves and karst features such as sinkholes, bedrock fractures that provide rapid recharge of karst aquifers, and springs that provide riparian habitat[1].

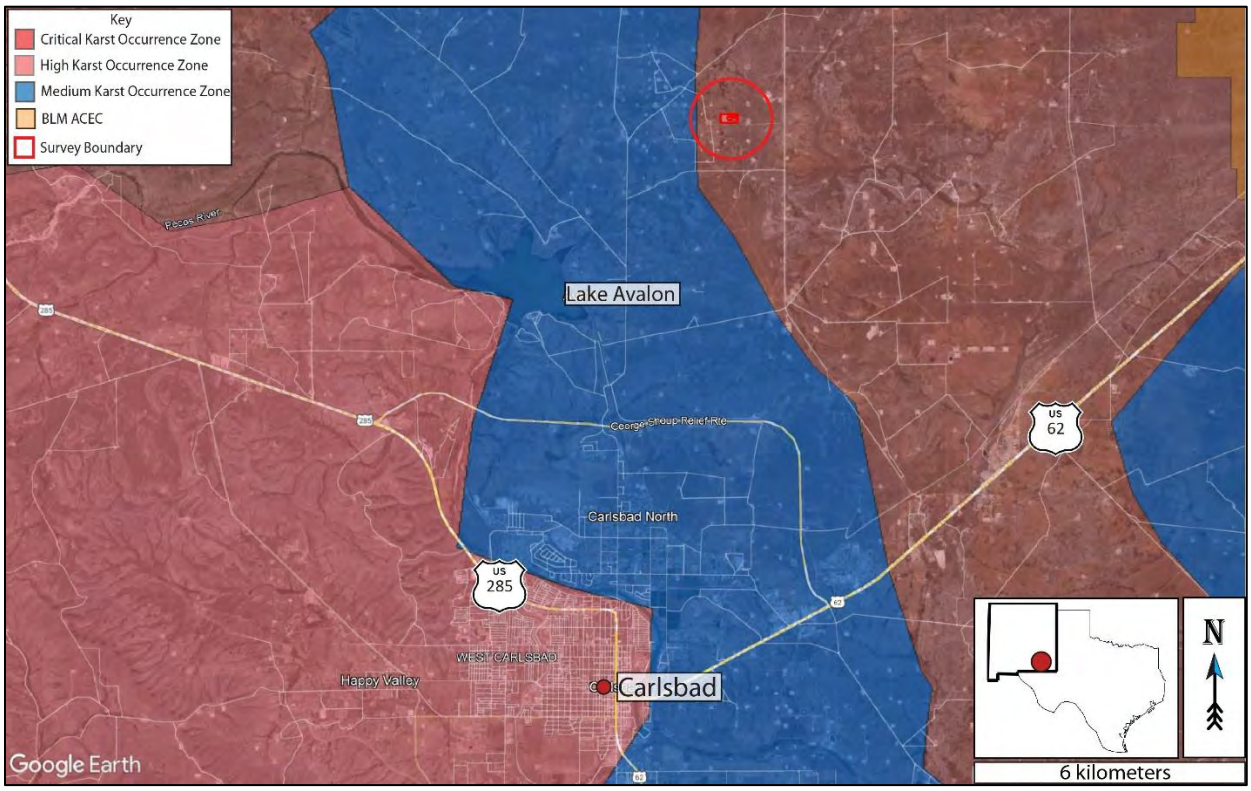

Figure 1: Karst occurrence zone overview. Background image credit: Google Earth. Image date: July 13, 2024. Image datum: WGS-84.

1.4 Limitations of Report

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

This report has been prepared for the use of Cascade Services, LLC, in accordance with generally accepted consulting practices. Every effort has been made to ensure the information in this report is accurate as of the time of its writing. This report has not been prepared for use by parties other than the client, their contracting party, and their respective consulting advisors. It may not contain sufficient information for the purposes of other parties or for other uses.

This report was prepared upon completion of the associated fieldwork using a standard template prepared by Southwest Geophysical Consulting and is based on relevant information collected prior to fieldwork, conditions encountered on-site, and data collected during the fieldwork, all of which was reviewed at the time of preparation. Southwest Geophysical Consulting disclaims responsibility for any changes that might have occurred at the site after this time. The interpreted results, locations, and depths noted in this report (if applicable) should be taken as an interpretation only and no decision should be based solely on this information. Physical verification of geophysical results using geotechnical methods should be considered.

To the best of our knowledge, information contained in this report is accurate at the date of issue; however, conditions on the site can change in a limited time and, therefore, the information in this report shall not be used beyond three years past the date of the data collection (see section ***2.3 Description of Survey***).

2.0 LOCATION AND DESCRIPTION OF STUDY AREA

2.1 Description of Site

The site is located 24.0 kilometers (14.0 miles) northeast of Carlsbad, New Mexico, between Illinois Camp Road and Angel Ranch Road, North of Rains Road, and within the NW ¼ section of section 32, NM T20S R28E[3] (**Figure 1** and **Figure 2**). This area is locally known as Burton Flats. The region has flat terrain with heavy karstification occurring in the gypsite soils and underlying gypsum bedrock [4] (see section ***2.2 Local Geology Summary*** for further information). The region is semi-arid with an average annual precipitation of approximately 13 inches, of which about two-thirds falls as rain during summer thunderstorms from June to October. Summers are hot and sunny while winters are generally mild, with an average maximum temperature of 96°F in July and an average minimum temperature of 28°F in January[5]. There are over twenty-five documented *surface* karst features located within 2.0 kilometers (1.2 miles) of the site[6]. This area is within the Chihuahuan Desert Thornscrub as defined by the Southwestern Regional ReGAP Vegetation map[7] and the vegetation consists mostly of areas of blue grama, nine-awned pappus grass, burro grass and low scrub including yucca. The entire survey site is located within an HKOZ[2] (**Figure 1**) and within privately managed land[8] (**Figure 2**).

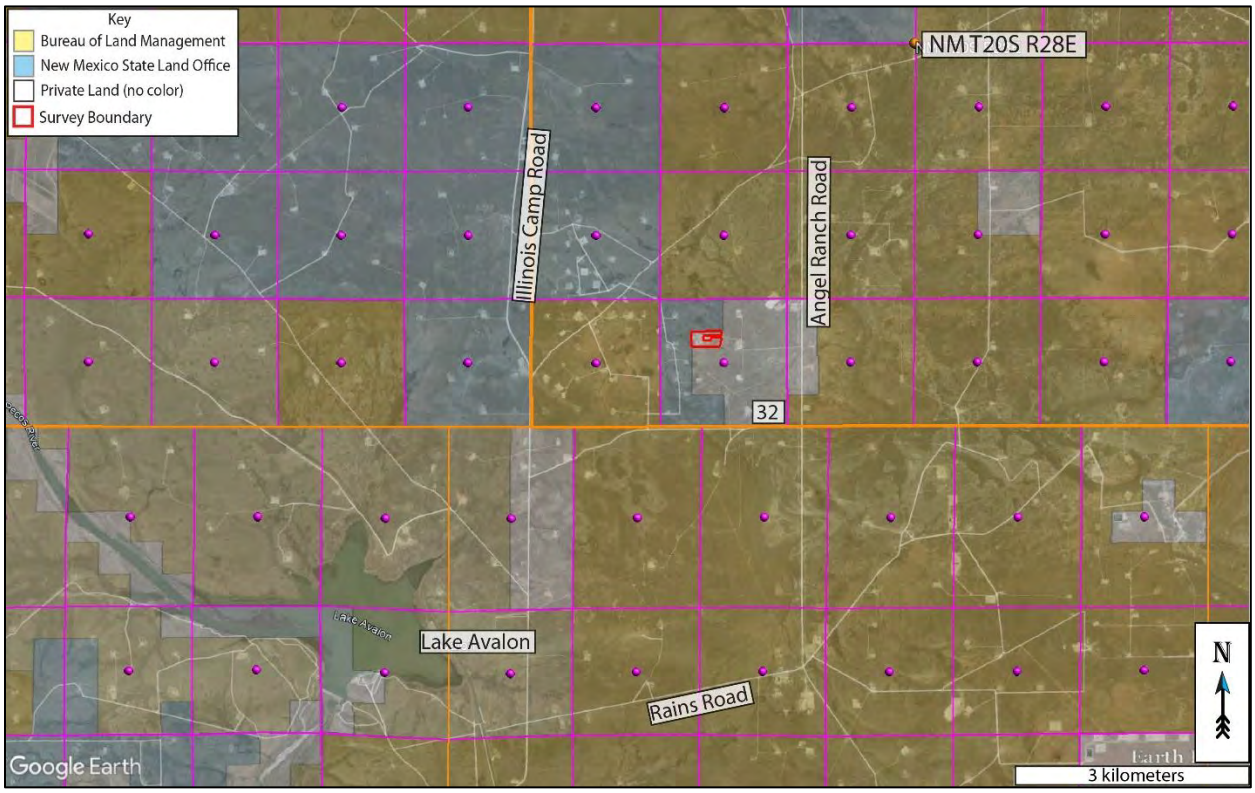

Figure 2: Land ownership and PLSS overview. Background image credit: Google Earth. Image date: July 13, 2024. Image datum: WGS-84.

2.2 Local Geology Summary

The survey site for the TPWAP project is located at an elevation of 981 meters (3,218 feet), ± 2 meters (6.5 feet), and is located within a region underlain by the Permian Rustler Formation (Pru). The area is mantled by thin gypsiferous soils (gypsite), Quaternary alluvium (Qal), eolian sands (Qe), and piedmont alluvial gravels (Qp)[9] up to 5 meters in depth (**Figure 3**).

The Rustler Formation is an evaporite facies and is composed mainly of thin siltstones and sandstones interbedded with claystones, dolomite and gypsum[10], and contains both karst-forming strata (the Forty-niner and Tamarisk members) and two shallow aquifers (the Magenta and Culebra Dolomite members)[11]. At this location, it is most likely the Los Medaños member underlying the surface Quaternary units.

The Pru overlies the Permian Salado Formation (Psl – not shown), a layer of extremely soluble halite which can readily dissolve to create caves, sinkholes, and other karst features; however, due to its extremely soluble nature, only non-soluble silt and sand remain from the dissolution of this layer at the surface. The Rustler Formation may be subject to collapse if a void has developed beneath it in the Salado Formation[10].

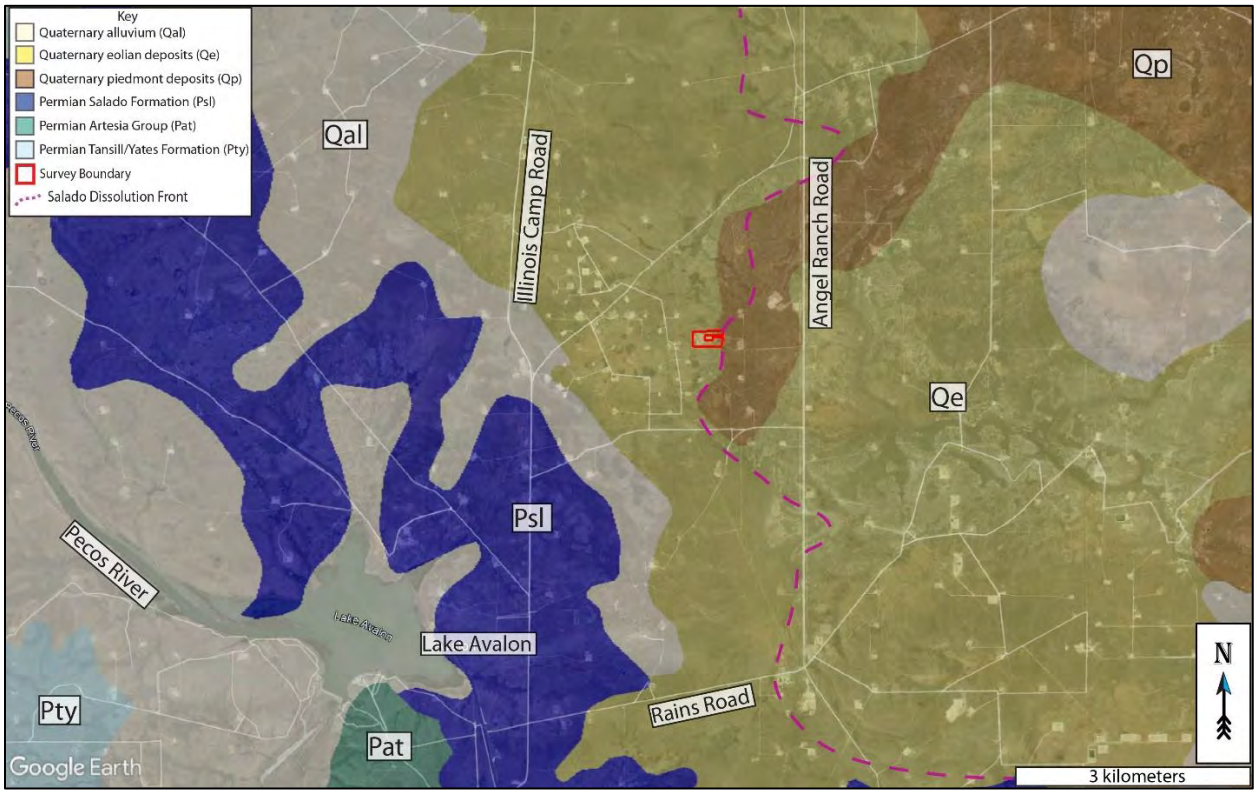

Figure 3: Geology overview. Map credit: The Digital Geologic Map of New Mexico in ARC/INFO Format, and Google Earth. Image date: July 13, 2024. Datum: WGS-84.

In areas around the contact between the upper Salado and lower Rustler Formations, the Salado dissolution front may be present. As the halite in the Salado Formation is dissolved by fresh meteoric waters and groundwater travelling along the Pecos River corridor, the Rustler Formation subsides, forming jumbled blocks of bedrock, crevices, and fractures. The edges of these blocks, crevices, and fractures are prone to further dissolution, forming small subsurface voids that may be encountered during trenching or construction operations[12].

The survey area is covered by the easily accessible Geologic Map of New Mexico (2003) at 1:500,000 scale[9] and the Digital Geologic Map of New Mexico in ARC/INFO Format[13].

2.3 Description of Survey

For this survey, an Advanced Geosciences Inc. (AGI) SuperSting™ Wifi R8 with an 8-channel switchbox, a 56-electrode array of 40-centimeter-long (1.3 feet) stainless-steel electrodes, and a tablet controller were used to image the subsurface. The survey boundary and survey lines were determined via a virtual meeting between the client and Southwest Geophysical Consulting staff. The TPWAP survey consisted of three resistivity lines of 56 electrodes each in a dipole-dipole configuration laid out in a west-east array at 5-meter electrode spacing, and six resistivity lines of 42 electrodes each in a dipole-dipole configuration laid out in a south-north array at 5-meter electrode spacing. The total number of electrodes placed was 420. The total combined length of this survey was 2.06 kilometers (1.27 miles) (**Figure 4**, **Table 1**).

A preconfigured command file was used to run the data collection (DiDi56 and DiDi42) which consisted of a dipole-dipole survey. This electrode configuration provided a depth of investigation of up to 55 meters (180 feet) in this location at a resolution of 2.5 to 3.0 meters (8.3 to 9.8 feet) near the surface. A Leica GS18 GPS was used to record electrode locations and elevations. On this survey, the estimated horizontal error mean was 7 cm (2.75 inches) and the estimated vertical error mean was 12 cm (4.7 inches).

Please see accompanying data files in **TPWAP_ERI_Points.kmz** within file **CASC-008-20241021_TPWAP_Data_Files.kmz** for detailed information on each electrode location. EarthImager™ 2D software was used to download and process the data and to provide the model used to make our interpretations (**Table 2**). A typical starting model was used for the data processing due to the two-layer model of the geology in the area; specifically, generally high-resistivity gypsum and dolomite at the surface and low-resistivity saturated gypsum and dolomite bedrock at depth. The starting model used was “average apparent resistivity” and a default inversion setting of “surface,” with a minimum apparent resistivity set to 0.1 Ohm-meters (Ohm-m or Ω-m) and a max apparent resistivity set to 100,000 Ω-m (**Table 2**).

The field work for the TPWAP survey was completed over a three-day period by Steven Kesler, Britt Bommer, and Michael Jones on December 9 to 11, 2024, with Monday, December 9, as a travel, set up, and survey day and Wednesday, December 11, as a survey, stow, and travel day.

Raw data files (.stg files for EarthImager™ 2D and EarthImager™ 3D) and processed data (.trn files, terrain files for surface correction in EarthImager™ 2D and EarthImager™ 3D and .out files, the processed .stg files) are available upon request.

Table 1: Survey Lines Data Table. Each .kml file contains all the points for the survey lines listed in the file name. These data are available in the accompanying file PW-305-20241204_TPWAP_Data_Files.kmz.

File Name:	Completed By:	Date:
TPWAP01.kmz	Steven Kesler – Field Geologist Britt Bommer – Field Geologist Michael Jones – Field Geologist	12/9/2025
TPWAP02.kmz		12/10/2025
TPWAP03.kmz		12/10/2025
TPWAP04.kmz		12/10/2025
TPWAP05.kmz		12/10/2025
TPWAP06.kmz		12/10/2025
TPWAP07.kmz		12/11/2025
TPWAP08.kmz		12/11/2025
TPWAP09.kmz		12/11/2025

Table 2: Software Information and Settings

Software Name:	EarthImager™ 2D/ EarthImager™ 3D
Version:	2.4.4.649/ 1.5.5.377
Starting Model:	Average Apparent Resistivity
Default Inversion Settings:	Surface
Changes to Default Inversion Settings:	Max Apparent Resistivity = 100 kΩ-m Min Apparent Resistivity = 0.1 Ω-m

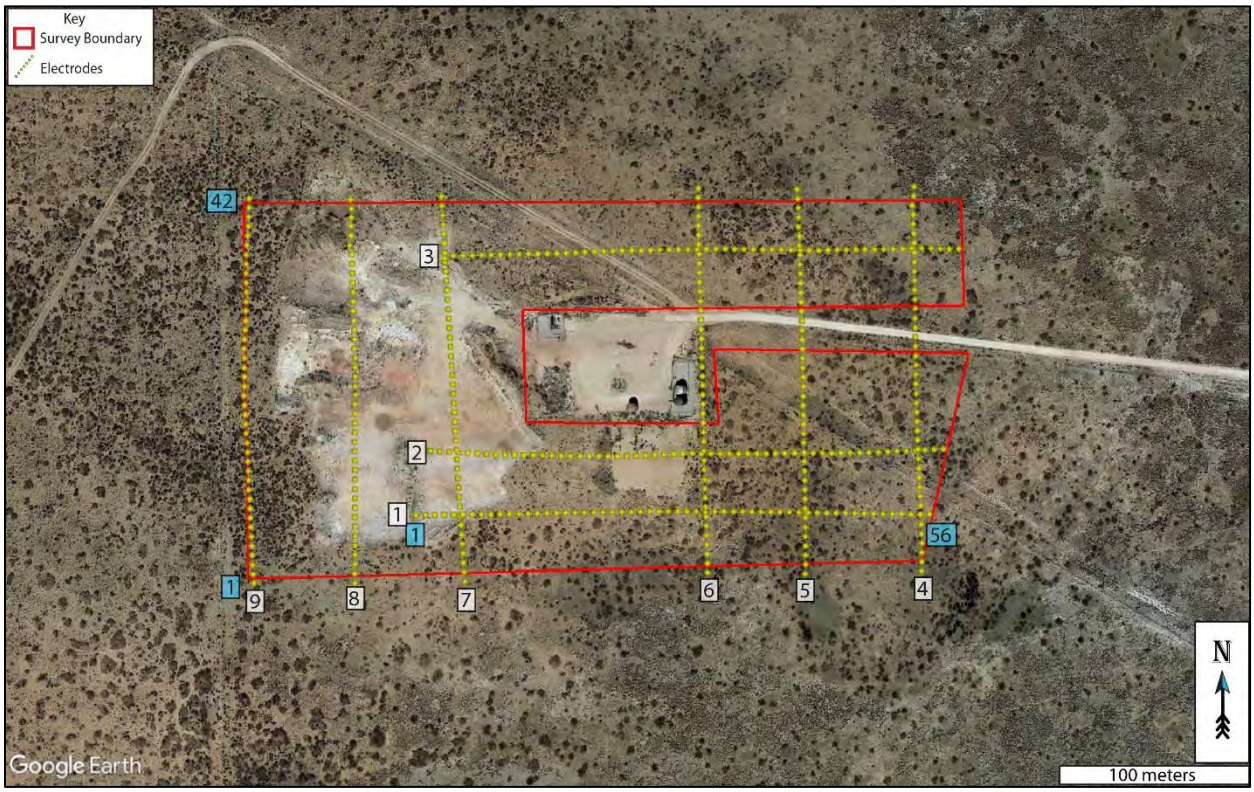

Figure 4: Survey overview. Nine survey lines were conducted at preplanned locations. The three west-east survey lines (numbered in white from south to north) had 56 electrodes at 5-meter electrode spacing (yellow dots numbered from west to east in a blue background). The six south-north survey lines (numbered in white from east to west) had 42 electrodes at 5-meter spacing (yellow dots numbered from south to north in a blue background). Background image credit: Google Earth. Image date: July 13, 2024. Image datum: WGS-84.

3.0 RESULTS

Electrical resistivity tomography forms images of the subsurface by causing a current to flow through the rock and soil and then measuring the resistance of these materials as the current flows through them. This measurement is taken many times and the resulting data, once processed, is used to produce a model of the subsurface (**Figure 5** and **Figure 6**). This model is produced using "non-unique" solutions, which means that there are many models and interpretations which will satisfy the data. Using experience and knowledge of the local geology, a high-confidence model can be established and used to develop an accurate understanding of what lies below the surface. This survey was conducted with the express purpose of locating subsurface voids and does not purport to find paleokarst (old, non-active karst features that have been filled in with sand and sediment) or nascent karst features below the resolution limit of the survey.

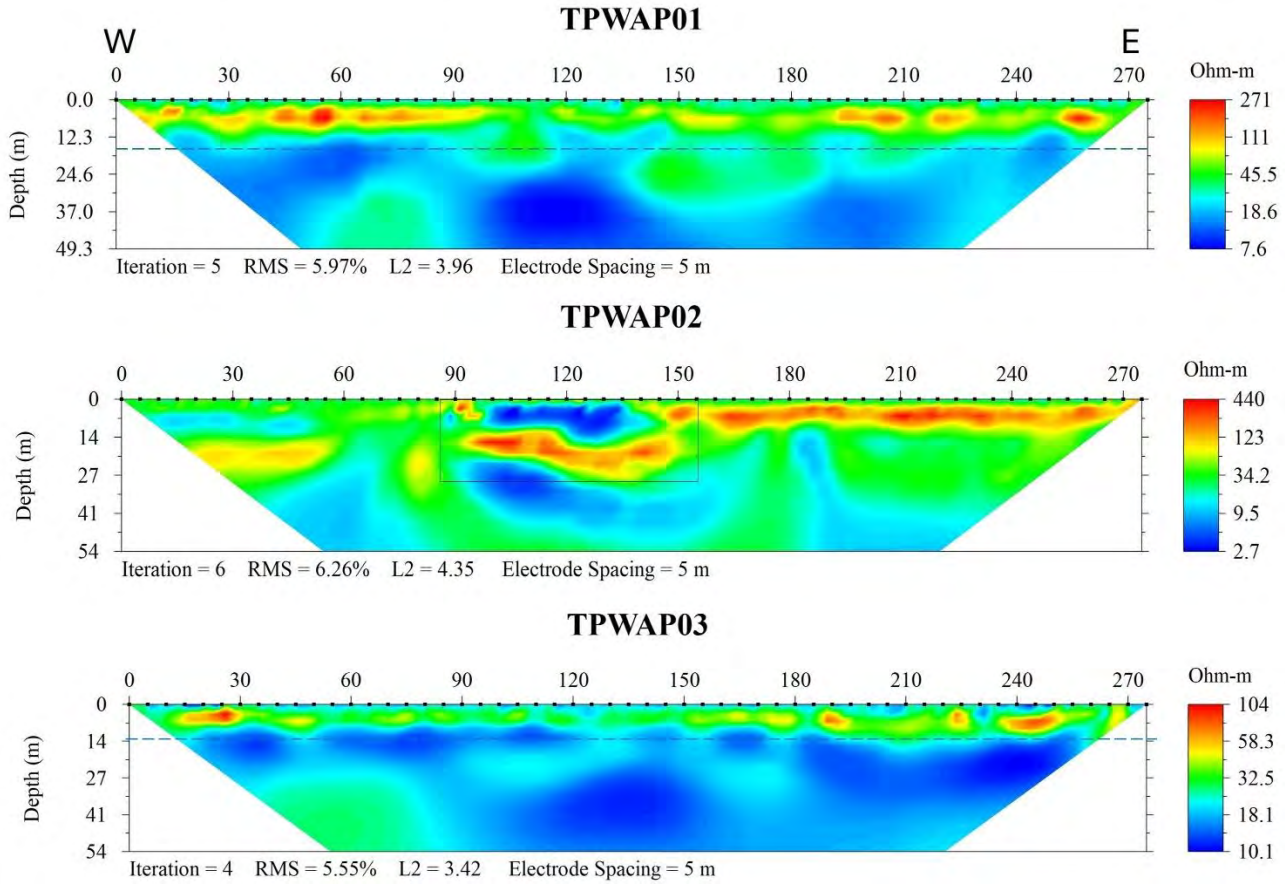

Figure 5: TPWAP lines 1 through 3 2D inverted resistivity sections showing highest and lowest resistivities. Reds and oranges: higher resistivity. Blues: lower resistivity. Black dots are electrode locations. Blue dashed line indicates change from medium to low resistivity values. Black polygon is interpreted as a previously reclaimed pad.

The results of this study (**Figure 5** and **Figure 6**) indicate a well-layered geologic system with moderate resistivities between 3 and 800 Ohm-m.

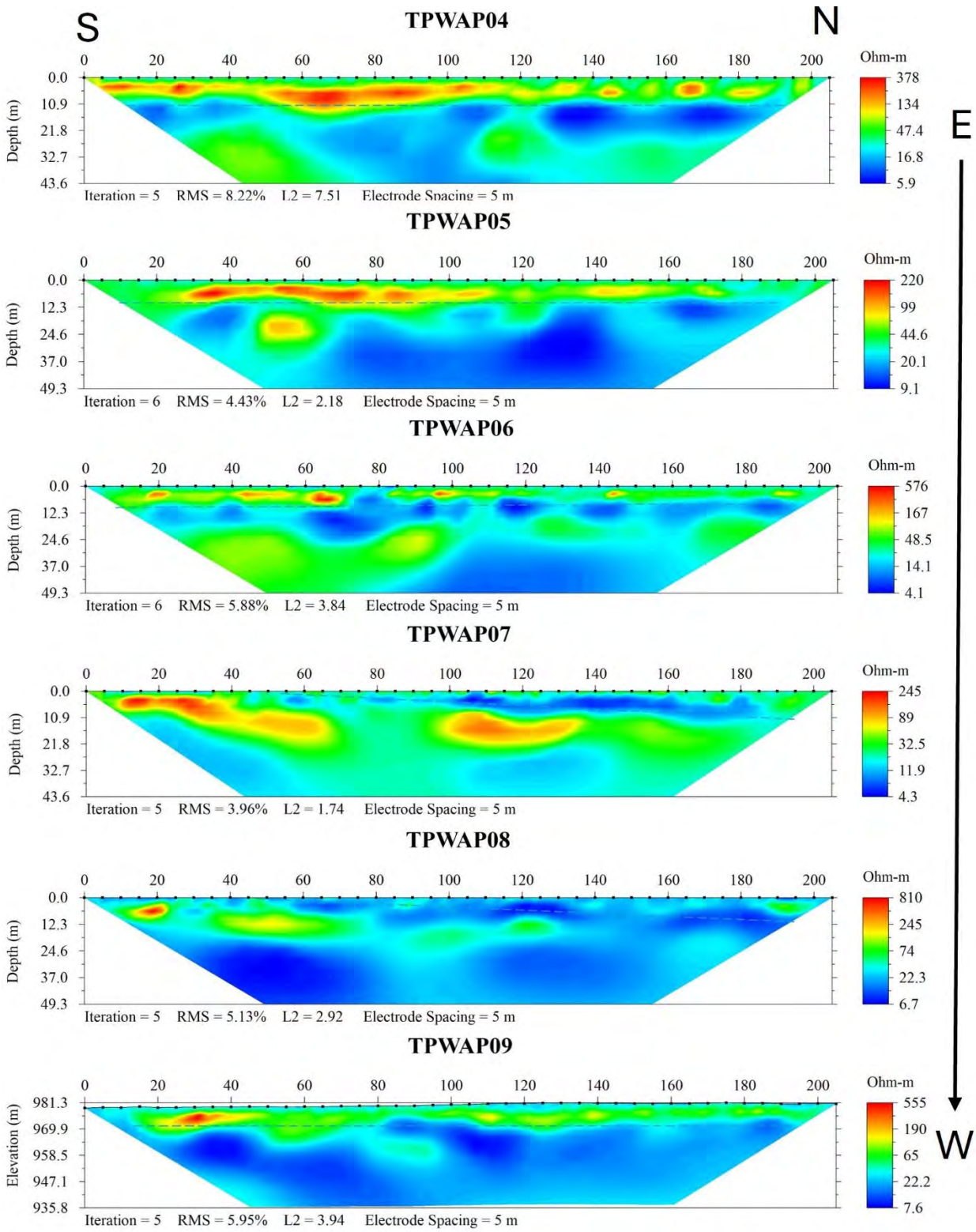

Figure 6: TPWAP lines 4 through 9 2D inverted resistivity sections. Reds and oranges indicate higher resistivity values. Yellows and greens are medium resistivity values. Blues are low resistivity values. The upper reds and yellows are most likely caliche and gypsite soils or dolomite. Deeper reds and oranges are likely dolomite or sandstone lenses. Blues are likely to represent clays or halite lenses, or saturated layers, in the Rustler Formation. Blue dashed lines indicate the transition between moderate to low resistivities.

Please keep in mind when viewing the 2D inverted resistivity sections that color maps can be widely different for each view. Always check the color map located on the right side of the image when viewing the 2D images to ensure you understand the range of resistivities presented. Distances along the top and depths along the left side are in meters. The color map along the right side is in Ohm-m. Due to the nature of the survey, shallower zones have higher resolution between electrodes than deeper zones; therefore, small features at depth will not be visible.

4.0 DISCUSSION

No anomalies interpreted as large near-surface voids are located within the survey area (**Figure 7**). Higher-than-average resistivity areas located less than 10 meters beneath the surface are interpreted as dry caliche or dolomite bedrock; however, there may be small voids at or near the resolution limit of the survey (2.5 – 3.0 meters). Due to their low resistivity values when compared with significant subsurface voids, these features should not be a concern for construction of any well pad infrastructure. Areas of moderate resistivity (yellows and greens) near the surface are interpreted as dolomite bedrock of the Rustler Formation[4] (**Figure 5** and **Figure 6**).

The overall interpretation for this location indicates that intercepting a significant void in the area of the proposed pad between the surface and 3 meters (10 feet) depth during pad construction is unlikely (**Figure 7**). Due to the resolution limit of the survey, other small voids at or near the resolution limit (2.5 – 3.0 meters) cannot be ruled out and are quite common in this area.

Resistivity of the survey area drops below 15 Ω-m at approximately 11 to 15 meters (36 to 49 feet) depth throughout the survey area, indicating a change from dry caliche/gypsite soils or dolomites of the Rustler to a clay or halite layer or a saturated medium within the Rustler (**Figure 5** and **Figure 6**).

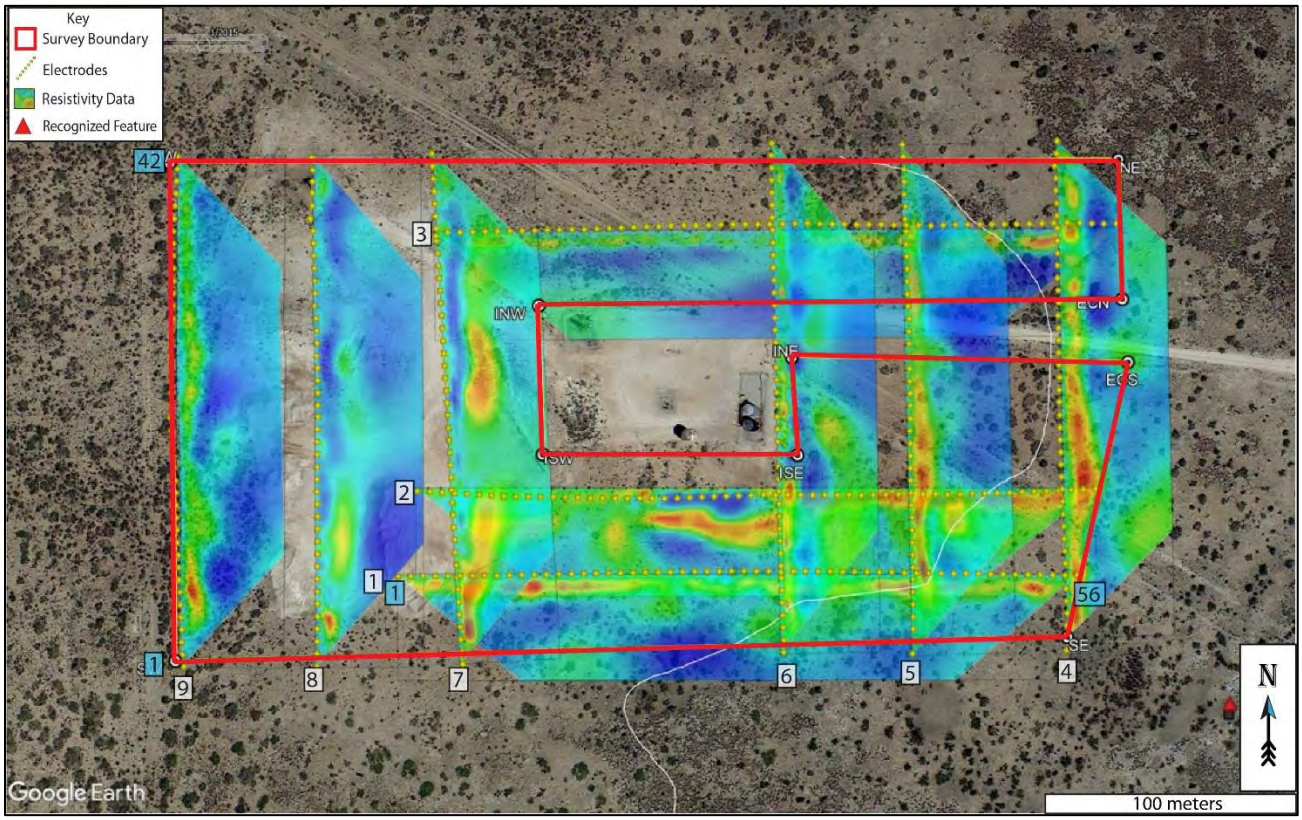

Figure 7: TPWAP map view. Background image credit: Google Earth. Image date: July 13, 2024. Image datum: WGS-84.

Within karst terrains like the project site, small air- or sediment-filled voids and/or brecciated zones and solutionally enlarged fractures that are below the resolution limit of the survey may exist; these may be encountered during excavation and if so, should be evaluated by a karst specialist prior to continuation of the excavation. Employing a BLM-CFO approved karst monitor on site during excavation in this area should be considered.

5.0 SUMMARY

5.1 Recommendations

- **The TPWAP survey area contains no shallow anomalies interpreted as large voids or related karst features.**
- Intercepting a small void or solutionally enlarged fracture below the resolution limit of the survey during pad construction is unlikely, but still possible.
- Employing a BLM-CFO approved karst monitor on site to evaluate any features encountered during brush clearing and grading should be considered. Construction activities may reactivate paleo-sinkholes and small voids may appear at the surface suddenly as settling occurs or after heavy rains.

5.2 Best Practices

This area is prone to rapid karst formation and warrants careful planning and engineering to mitigate karst-forming processes that could be accelerated by poor design considerations. Proper engineering of these facilities following karst guidelines should be implemented during both excavation and construction. Mitigation measures for any karst features revealed during excavation shall be approved by the BLM-CFO karst specialist and follow the Natural Resources Conservation Service Conservation Practice Standard for Karst Sinkhole Treatment, Code 527, or the Bureau of Land Management Cave and Karst Management Handbook, H-8380-1.

Keep in mind that any flow of gypsum-undersaturated waters into a small crack or crevice can rapidly dissolve the surrounding gypsum and cause catastrophic failure of any impoundment or infrastructure within a matter of months to a few years. It is imperative that any dikes, buffers, or liners installed are checked regularly for integrity, with repairs made immediately upon discovery of failure.

Vigilance during construction is paramount. If voids are encountered during excavation, contact the Bureau of Land Management Karst Division at (575) 234-5972, the New Mexico State Land Office Surface Resources Division at (505) 827-5768, or a BLM-CFO approved karst contractor and request an on-site investigation from a karst expert if one is not already on site. A karst consultant can generally be available in Eddy County within five hours. Monitoring services, as well as cave surveys and geophysical surveys, are available from Southwest Geophysical Consulting.

Approved karst monitors should have karst feature identification training, at least two years of supervised experience identifying karst features, wilderness first aid training, SRT training, confined space training, gas monitor training, and a minimum of SPAR cave rescue training through NCRC. They should have with them the proper gear and be prepared both physically and mentally to enter a collapse feature within minutes to perform a rescue if needed. Monitoring services with qualified karst monitors, as well as cave surveys and geophysical surveys, are available from Southwest Geophysical Consulting.

Under no circumstances should an untrained, inexperienced person enter a cave, pit, sinkhole, or collapse feature. All field employees of Southwest Geophysical Consulting have extensive caving experience and the ability to determine whether entry into a karst feature is safe or presents a hazard. In the event it is necessary to enter a karst feature, Southwest Geophysical Consulting can provide these services on request.

Cave and karst resource inventory reports, karst feature investigations, and geophysical reports commissioned at the request of the land manager should be submitted to:

BLM-CFO: blm_nm_karst@blm.gov

NMSLO: Project manager requesting the report.

6.0 REFERENCES

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7.0 APPENDICES

7.1 Glossary of Terms

ACEC	Area of Critical Environmental Concern
AGI	Advanced Geosciences Inc.
BLM-CFO	Bureau of Land Management - Carlsbad Field Office
brecciated	Fractured rock caused by faulting or collapse.
caprock-collapse sinkhole	Collapse of roof-spanning rock into a cave or void.
cave	Natural opening at the surface large enough for a person to enter.
cover-collapse sinkhole	Collapse of roof-spanning soil or clay ground cover into a subsurface void.
ERI	Electrical Resistivity Imaging
GPS	Global Positioning System
grike	A solutionally enlarged, vertical, or sub-vertical joint or fracture.
HKOZ	High Karst Occurrence Zone
InSAR	Interferometric Synthetic Aperture Radar. A method by which radar signals from satellites are processed to determine the amount and rate of subsidence of an area as well as whether the area is actively subsiding.
karst	A landscape containing solutional features such as caves, sinkholes, swallets, and springs.
LED	Locally enclosed depression. A natural depression on the surface that collects rainwater. Some contain swallets and/or caves, others do not.
LKOZ	Low Karst Occurrence Zone
MKOZ	Medium Karst Occurrence Zone
NCRC	National Cave Rescue Commission
NKF	Non-karst feature. Used for features originally identified as PKF that have been subsequently identified in the field as non-karst related. This term may also be used for pseudokarst features.
NMSLO	New Mexico State Land Office
Ohm-m	Ohm-meter, a unit of measurement for resistivity. Also sometimes abbreviated Ω-m.
paleokarst	Previously formed karst features that have been filled in by erosion and/or deposition of minerals.
Pat	Permian Artesia Group
Pc	Permian Capitan Formation
Pcs	Permian Castile Formation

Pdl	Permian Dewey Lake Formation
PKF	Possible karst feature. This term is reserved for features identified in satellite or aerial imagery that have NOT been visited in the field. Further modifiers include (H) for high confidence, (M) for medium confidence, and (L) for low confidence. These confidence levels are based on field experience.
PLSS	Public Land Survey System
Pqg	Permian Queen/Greyburg Formation
Pru	Permian Rustler Formation
Psl	Permian Salado Formation
Psr	Permian Seven Rivers Formation
Pt	Permian Tansill Formation
Py	Permian Yates Formation
pseudokarst	Karst-like features (sinkholes, conduits, voids etc.) that are not formed by dissolution. These types of features include soil piping, lava tubes, and some cover-collapse and suffosion sinkholes.
Py	Permian Yates Formation
Qal	Quaternary alluvium
Qe	Quaternary eolian deposits
Qp	Quaternary piedmont deposits
Qpl	Quaternary playa lake deposits
RKF	Recognized karst feature. This term is reserved for karst features that have been physically verified in the field.
SKF	Surface Karst Feature
SPAR	Small Party Assisted Rescue
suffosion sinkhole	Raveling of soil into a pre-existing void or fracture.
swallet	A natural opening in the surface, too small for a person, that drains water to an aquifer. Some are "open," meaning a void can be seen below; some are "closed, "meaning they are full of sediment.
SWG	Southwest Geophysical Consulting, LLC
UTM	Universal Transverse Mercator (projected coordinates)
WGS	World Geodetic System (geographic coordinates)

8.0 ATTESTATION

David D. Decker, PhD, PG, CPG
Chief Executive Officer, Principal Geologist
Southwest Geophysical Consulting, LLC
5117 Fairfax Dr. NW
Albuquerque, NM 87114
dave@swgeophys.com
(505) 585-2550

CERTIFICATE OF AUTHOR

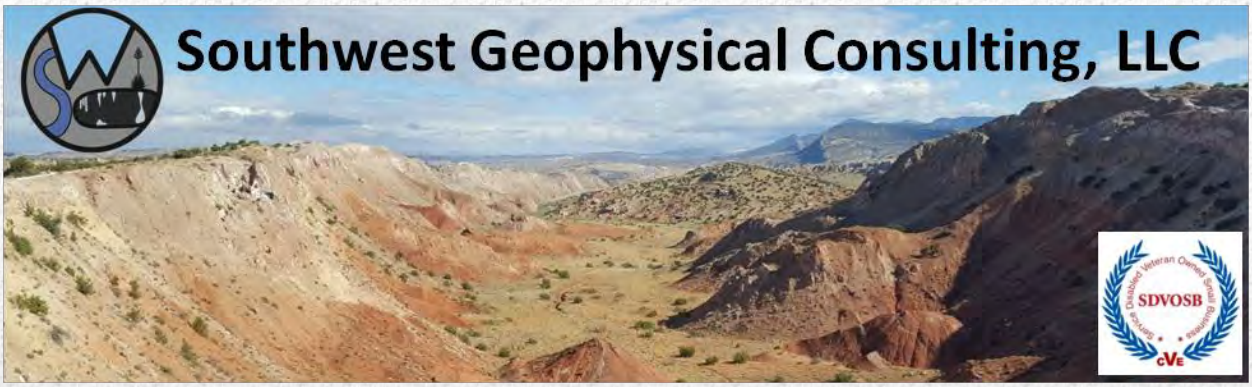
I, David D. Decker, a Licensed Professional Geologist and a Certified Professional Geologist, do certify that:

- I am currently employed as a consulting geologist in the specialty of caves and karst with an office address of 5117 Fairfax Dr. NW, Albuquerque, NM, USA, 87114.
- I graduated with a Master of Science in Applied Physics with a specialization in Sensor Systems from the Naval Post Graduate School in Monterey, California, in 2003, and a Doctor of Philosophy in Earth and Planetary Sciences from the University of New Mexico, Albuquerque, New Mexico, in 2018.
- I am a Licensed Professional Geologist in the State of Texas, USA (PG-15242) and have been since 2021. I am a Certified Professional Geologist through the American Institute of Professional Geologists (CPG-12123) and have been since 2021.
- I have been employed as a geologist continuously since 2016. I was previously employed as a Fire Controlman, Naval Flight Officer, and Aerospace Engineering Duty Officer in the U.S. Navy and operated, maintained, and installed various sensor systems including magnetic, electromagnetic, radar, communications, and acoustic systems in various capacities from 1986 through 2010.
- I have been involved in various aspects of cave and karst studies continuously since 1985, including exploration, mapping, and scientific studies.
- I have read the definition of “qualified karst professional” set out in the ASTM Standard Practice for Preliminary Karst Terrain Assessment for Site Development (ASTM E-1527). I meet the definition of “qualified professional” for the purposes of this standard.
- I am responsible for the content, compilation, and editing of all sections of report number CASC-008-20241021 entitled, “2D Electrical Resistivity Imaging Report, TPW Angel Pond Phase 1, Eddy County, New Mexico.” I or a duly authorized and qualified representative of Southwest Geophysical Consulting, LLC, have personally visited this site on the date or dates mentioned in section ***2.3 Description of Survey***.

- I have no prior involvement nor monetary interest in the described property or project, save for my fee for conducting this investigation and providing the report.

Dated in Albuquerque, New Mexico, January 29, 2025.

David D. Decker
PhD, CPG-12123



2D Electrical Resistivity Imaging Report

BTS Management Angel Pond Phase 2

Eddy County, New Mexico

Prepared For:

Cascade Services, LLC

4400 North Big Spring Street, Suite 114

Midland, TX 79705

☑ **Positive**

☑ **Avoidance Recommended**

☐ **Realignment Not Required**

☐ **Negative**

☑ **Karst Monitor Recommended**

March 19, 2025

CASC-011-20250122

Published by:
Southwest Geophysical Consulting, LLC
5117 Fairfax Dr. NW
Albuquerque, NM 87114
(505) 585-2550
www.swgeophys.com

Prepared by:
Garrett Jorgensen Olague
Senior Field Geologist
swgeogarrett@gmail.com

Reviewed by:
David D. Decker, PhD, PG, CPG
Principal, Chief Executive Officer
dave@swgeophys.com

Prepared for:
Cascade Services, LLC
4400 North Big Spring Street, Suite 114
Midland, TX 79705

Point of Contact:
Ms. Bobbi Jo Crain
(210)-632.8670
Bobbijo@CascadeServicesLLC.com

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1.0 INTRODUCTION

This report was commissioned by Cascade Services, LLC (hereinafter referred to as "the client"), on January 22, 2025, for the purpose of determining the existence of any voids within the boundaries of the BTS Management Angel Pond Phase 2 project site (hereinafter termed “TAPP2”) centered at N 32.531634° W 104.205028° using electrical resistivity imaging.

1.1 Goals of this Study

To provide the client with the location and depth of any anomalies that can be interpreted as voids located within the two survey boundaries provided by the client on January 22, 2025 (**Angel Pond Phase 2.kmz** and **Additional area (will likely still need resistivity to satisfy OCD).kmz**), and within the parameters of the designed study using electrical resistivity imaging for the purpose of determining the feasibility of placing a pad at this location.

1.2 Summary of Findings

Three shallow anomalies interpreted as possible voids or karst features are found within the TAPP2 survey area (Table 3). These anomalies exist within the southeast portion of the survey area. See section **3.0 RESULTS** and **4.0 DISCUSSION** for more information.

1.3 Affected Environment

The TAPP2 project is located in evaporite karst terrain, a landform that is characterized by underground drainage through solutionally enlarged conduits. Evaporite karst terrain may contain sinkholes, sinking streams, caves, and springs. Sinkholes leading to underground drainages and voids are common. These karst features, as well as occasional fissures and discontinuities in the bedrock, provide the primary sources for rapid recharge of the groundwater aquifers of the region. Additionally, karst may develop by hypogene processes involving dissolution by upwelling fluids from depth independent of recharge from the overlying or immediately adjacent surface. Hypogene karst systems may not be connected to the surface and can remain undiscovered unless encountered during drilling or excavation.

Karst features are delicate resources that are often of geological, hydrological, biological, and archeological importance, and should be protected. The four primary concerns that need to be considered in these types of terrain are environmental issues, worker safety, equipment damage, and infrastructure integrity.

The Bureau of Land Management (BLM) categorizes all areas within the Carlsbad Field Office (CFO) zone of responsibility as having either low, medium, high, or critical cave potential based on geology, occurrence of known caves, density of karst features, and potential impacts to freshwater aquifers[1]. The New Mexico State Land office also recognizes these categories. This project occurs within a **HIGH** karst occurrence zone[2] (HKOZ) (**Figure 1**).

A high karst occurrence zone is defined as an area in known soluble rock types that contains a high frequency of significant caves and karst features such as sinkholes, bedrock fractures that provide rapid recharge of karst aquifers, and springs that provide riparian habitat[1].

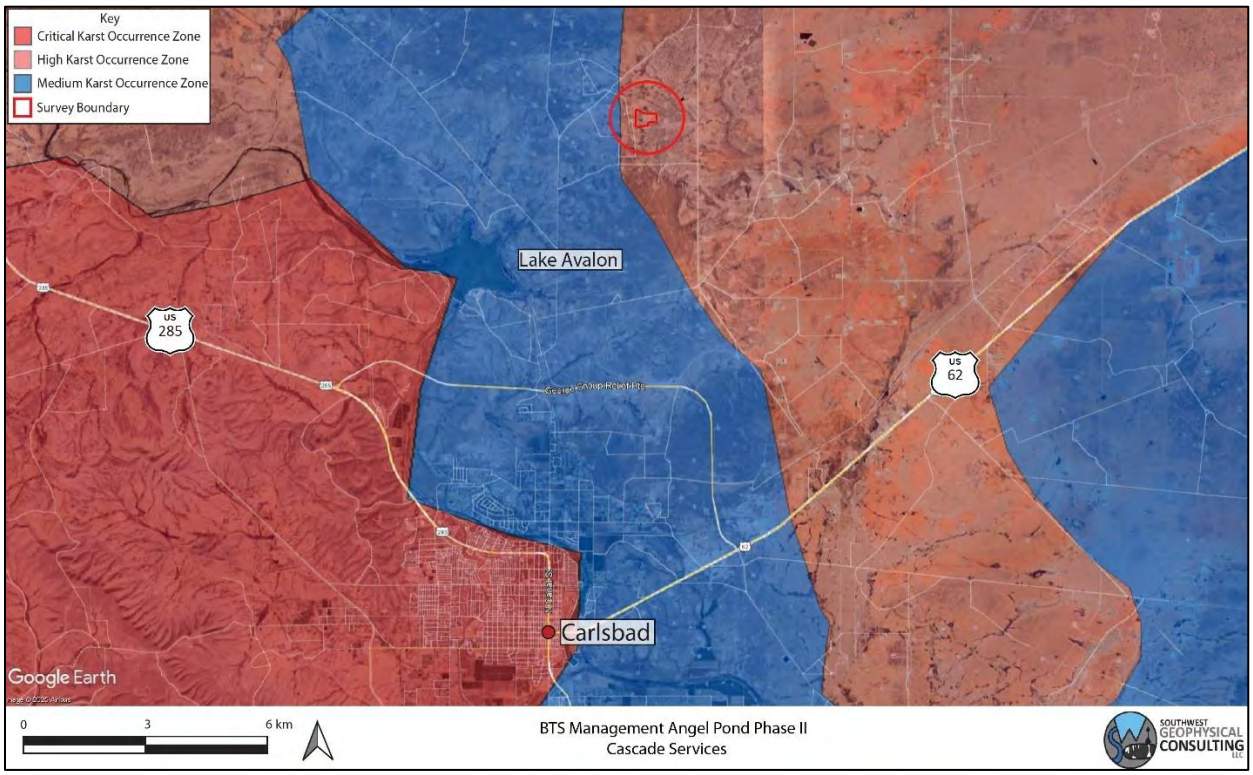

Figure 1: Karst occurrence zone overview. Background image credit: Google Earth. Image date: July 13, 2024. Image datum: WGS-84.

1.4 Limitations of Report

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

This report has been prepared for the use of Cascade Services, LLC, in accordance with generally accepted consulting practices. Every effort has been made to ensure the information in this report is accurate as of the time of its writing. This report has not been prepared for use by parties other than the client, their contracting party, and their respective consulting advisors. It may not contain sufficient information for the purposes of other parties or for other uses.

This report was prepared upon completion of the associated fieldwork using a standard template prepared by Southwest Geophysical Consulting and is based on relevant information collected prior to fieldwork, conditions encountered on-site, and data collected during the fieldwork, all of which was reviewed at the time of preparation. Southwest Geophysical Consulting disclaims responsibility for any changes that might have occurred at the site after this time. The interpreted results, locations, and depths noted in this report (if applicable) should be taken as an interpretation only and no decision should be based solely on this information. Physical verification of geophysical results using geotechnical methods should be considered.

To the best of our knowledge, information contained in this report is accurate at the date of issue; however, conditions on the site can change in a limited time and, therefore, the information in this report shall not be used beyond three years past the date of the data collection (see section ***2.3 Description of Survey***).

2.0 LOCATION AND DESCRIPTION OF STUDY AREA

2.1 Description of Site

The site is located 24.0 kilometers (14.0 miles) northeast of Carlsbad, New Mexico, between Illinois Camp Road and Angel Ranch Road, North of Alkali Road, and within the NW ¼ section of section 32, NM T20S R28E[3] (**Figure 1** and **Figure 2**). This area is locally known as Burton Flats. The region has flat terrain with heavy karstification occurring in the gypsite soils and underlying gypsum bedrock [4] (see section ***2.2 Local Geology Summary*** for further information). The region is semi-arid with an average annual precipitation of approximately 13 inches, of which about two-thirds falls as rain during summer thunderstorms from June to October. Summers are hot and sunny while winters are generally mild, with an average maximum temperature of 96°F in July and an average minimum temperature of 28°F in January[5]. There are over twenty-five documented *surface* karst features located within 2.0 kilometers (1.2 miles) of the site[6]. This area is within the Chihuahuan Desert Thornscrub as defined by the Southwestern Regional ReGAP Vegetation map[7] and the vegetation consists mostly of areas of blue grama, nine-awned pappus grass, burro grass and low scrub including yucca. The entire survey site is located within an HKOZ[2] (**Figure 1**) and within NMSLO and privately managed land[8] (**Figure 2**).

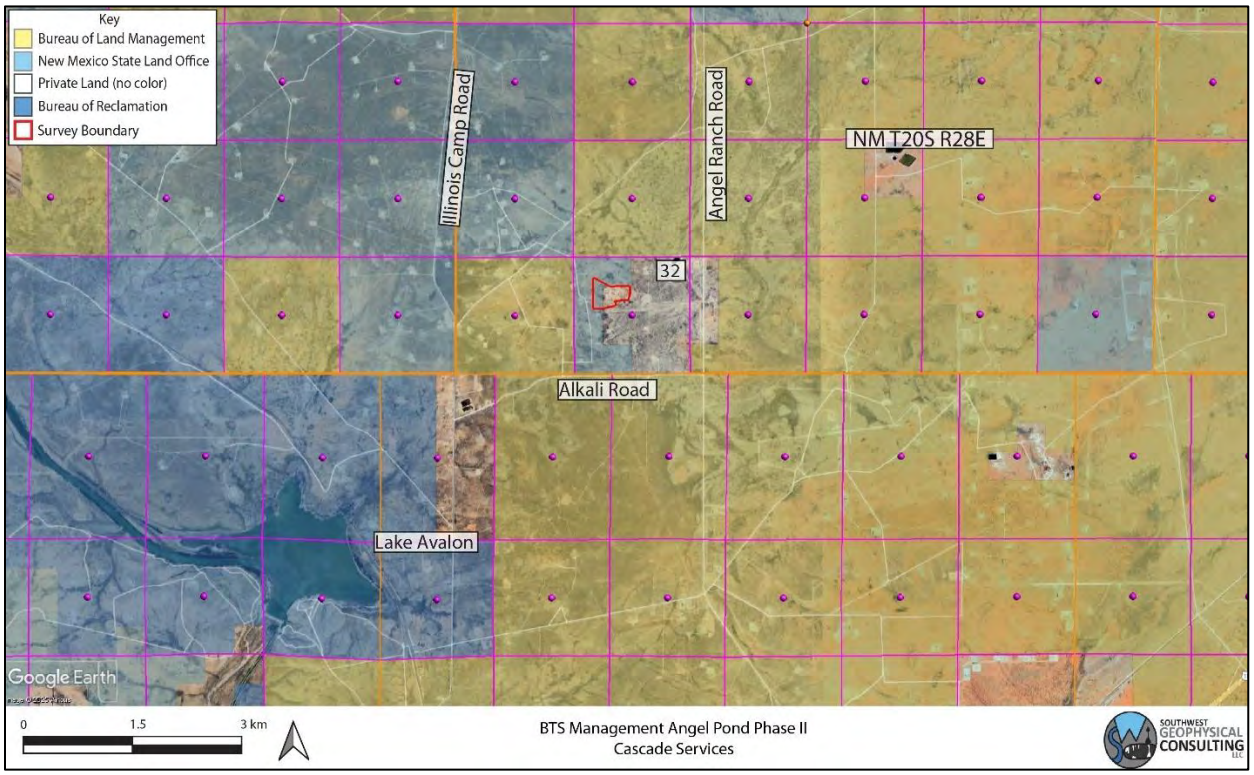

Figure 2: Land ownership and PLSS overview. Background image credit: Google Earth. Image date: July 13, 2024. Image datum: WGS-84.

2.2 Local Geology Summary

The survey site for the TAPP2 project is located at an elevation of 982 meters (3,222 feet), ± 2 meters (9.8 feet), and is located within a region underlain by the Permian Rustler Formation (Pru). The area is mantled by thin gypsiferous soils (gypsite), Quaternary alluvium (Qal), eolian sands (Qe), and piedmont alluvial gravels (Qp)[9] up to 5 meters in depth (**Figure 3**).

The Rustler Formation is an evaporite facies and is composed mainly of thin siltstones and sandstones interbedded with claystones, dolomite and gypsum[10], and contains both karst-forming strata (the Forty-niner and Tamarisk members) and two shallow aquifers (the Magenta and Culebra Dolomite members)[11]. At this location, it is most likely the Los Medaños member underlying the surface Quaternary units.

The Pru overlies the Permian Salado Formation (Psl – not shown), a layer of extremely soluble halite which can readily dissolve to create caves, sinkholes, and other karst features; however, due to its extremely soluble nature, only non-soluble silt and sand remain from the dissolution of this layer at the surface. The Rustler Formation may be subject to collapse if a void has developed beneath it in the Salado Formation[10].

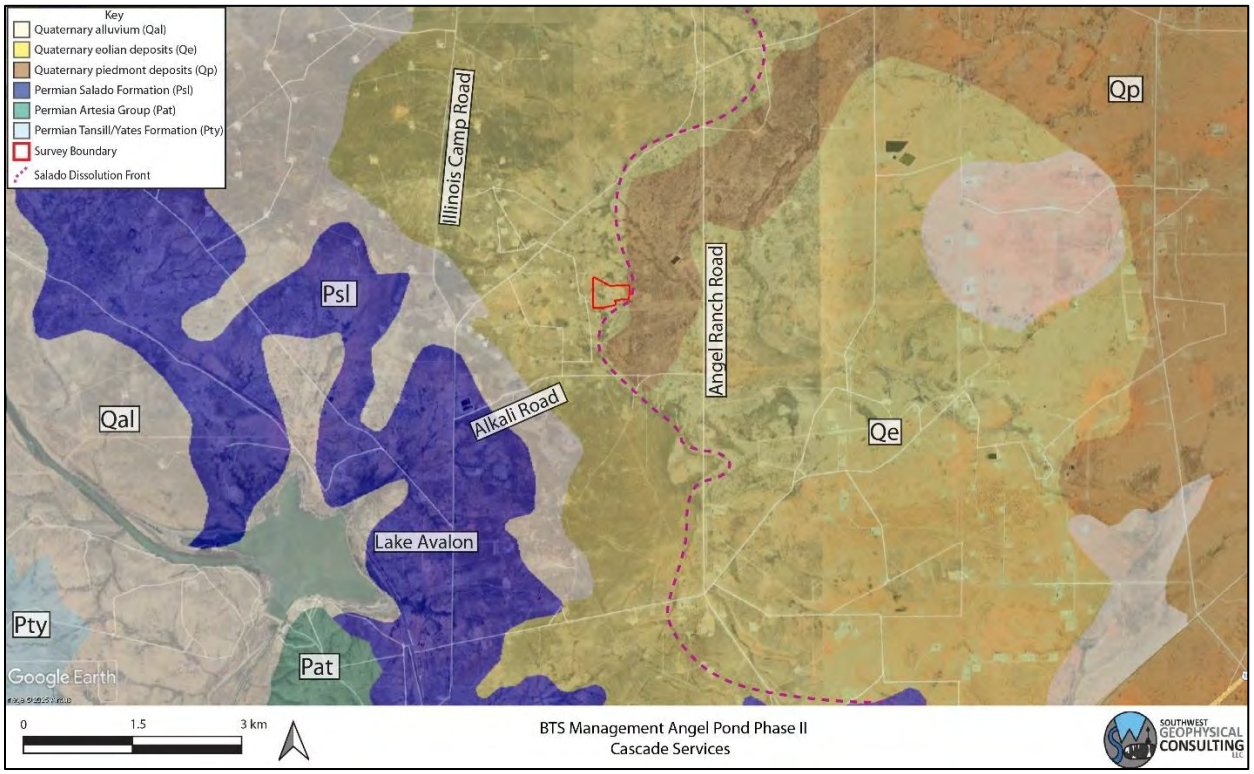

Figure 3: Geology overview. Map credit: The Digital Geologic Map of New Mexico in ARC/INFO Format, and Google Earth. Image date: July 13, 2024. Datum: WGS-84.

In areas around the contact between the upper Salado and lower Rustler Formations, the Salado dissolution front may be present. As the halite in the Salado Formation is dissolved by fresh meteoric waters and groundwater travelling along the Pecos River corridor, the Rustler Formation subsides, forming jumbled blocks of bedrock, crevices, and fractures. The edges of these blocks, crevices, and fractures are prone to further dissolution, forming small subsurface voids that may be encountered during trenching or construction operations[14].

The survey area is covered by the easily accessible Geologic Map of New Mexico (2003) at 1:500,000 scale[9] and the Digital Geologic Map of New Mexico in ARC/INFO Format[13].

2.3 Description of Survey

For this survey, an Advanced Geosciences Inc. (AGI) SuperSting™ Wifi R8 with an 8-channel switchbox, a 56-electrode array of 40-centimeter-long (1.3 feet) stainless-steel electrodes, and a tablet controller were used to image the subsurface. The pad boundaries provided by the client were used to plan the resistivity arrays and define the survey boundaries. The TAPP2 survey consisted of five resistivity lines of 56 electrodes in a dipole-dipole configuration, two of which were laid out in a south-north array and three of which were laid out in a west-east array; all at 5-meter electrode spacing. The total number of electrodes placed was 280. The total combined length of this survey was 1.40 kilometers (0.87 miles) (**Figure 4**, **Table 1**).

A preconfigured command file was used to run the data collection (DiDi56) which consisted of a dipole-dipole survey. This electrode configuration provided a depth of investigation of up to 55 meters (180 feet) in this location at a resolution of 2.5 to 3.0 meters (8.3 to 9.8 feet) near the surface. A Leica GS18 GPS was used to record electrode locations and elevations. On this survey, the estimated horizontal error mean was 7 cm (2.75 inches) and the estimated vertical error mean was 12 cm (4.7 inches).

EarthImager™ 2D software was used to download and process the data and to provide the model used to make our interpretations (**Table 2**). A typical starting model was used for the data processing due to the two-layer model of the geology in the area; specifically, generally high-resistivity gypsum and dolomite at the surface and low-resistivity saturated gypsum and dolomite bedrock at depth. The starting model used was “average apparent resistivity” and a default inversion setting of “surface,” with a minimum apparent resistivity set to 0.1 Ohm-meters (Ohm-m or Ω-m) and a max apparent resistivity set to 100,000 Ω-m (**Table 2**).

All field work for the TAPP2 survey including travel, set up, survey, and stow, was completed over a single day by Garrett Jorgensen Olague, Britt Bommer, and Steven Kesler on Tuesday, March 4, 2025.

Raw data files (.stg files for EarthImager™ 2D) and processed data (.trn files, terrain files for surface correction in EarthImager™ 2D and .out files, the processed .stg files) are available upon request.

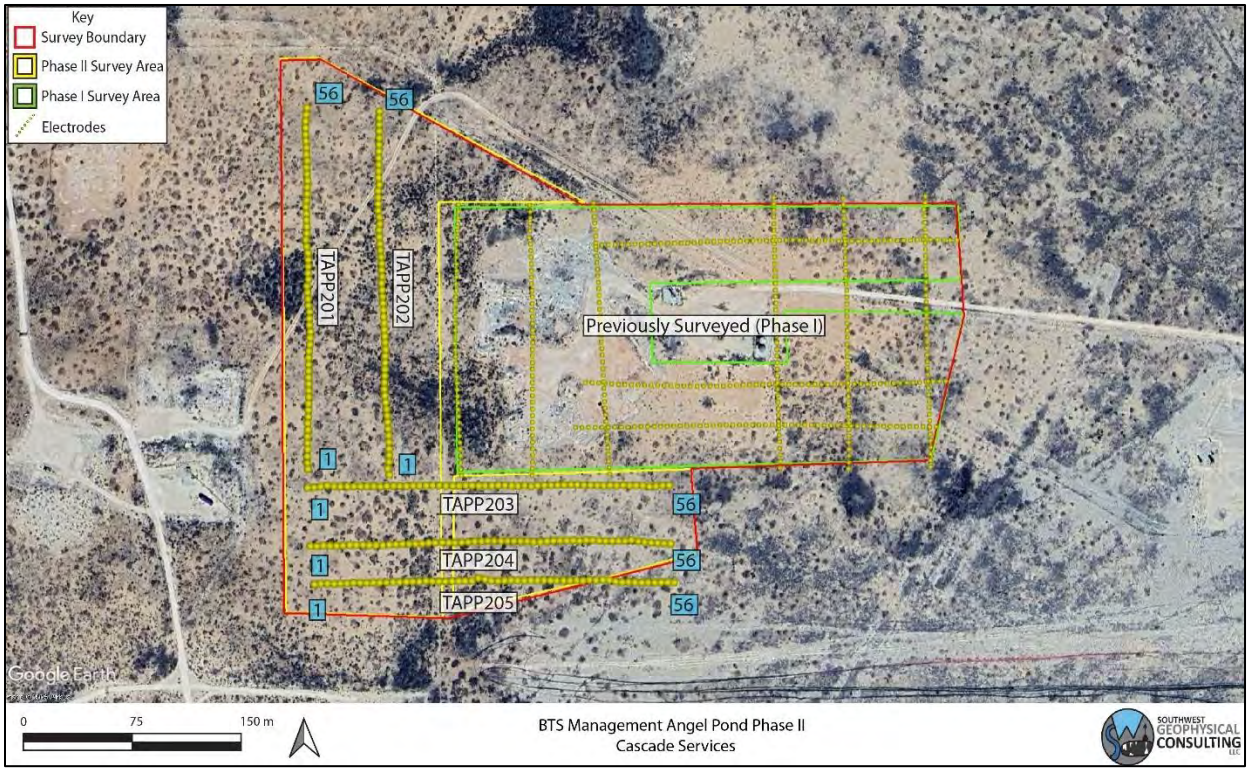

Figure 4: Survey overview. Five survey lines were conducted in the Phase II survey area (yellow polygon). The nine survey lines in the Phase I survey area (green polygon) were completed at an earlier date and detailed in the CASC-008-20241021 TPW Angel Pond Phase 1 (TPWAP) ERI Report. All survey lines (labeled in white) had 56 electrodes at 5-meter electrode spacing (yellow dots numbered in a blue background). Background image credit: Google Earth. Image date: July 13, 2024. Image datum: WGS-84.

Table 1: Survey Lines Data Table. Each .kml file contains all the points for the survey lines listed in the file name. These data are available in the accompanying file CASC-011-20250122_TAPP2_Data_Files.kmz.

File Name:	Completed By:	Date:
TAPP201.kmz	Garrett Jorgensen Olague – Senior Field Geologist Britt Bommer – Field Geologist Steven Kesler – Field Geologist	3/4/2025
TAPP202.kmz		3/4/2025
TAPP203.kmz		3/4/2025
TAPP204.kmz		3/4/2025
TAPP205.kmz		3/4/2025

Table 2: Software Information and Settings

Software Name:	EarthImager™ 2D
Version:	2.4.4.649
Starting Model:	Average Apparent Resistivity
Default Inversion Settings:	Surface
Changes to Default Inversion Settings:	Max Apparent Resistivity = 100 kΩ-m Min Apparent Resistivity = 0.1 Ω-m

3.0 RESULTS

Electrical resistivity tomography forms images of the subsurface by causing a current to flow through the rock and soil and then measuring the resistance of these materials as the current flows through them. This measurement is taken many times and the resulting data, once processed, is used to produce a model of the subsurface (**Figure 5**). This model is produced using "non-unique" solutions, which means that there are many models and interpretations which will satisfy the data. Using experience and knowledge of the local geology, a high-confidence model can be established and used to develop an accurate understanding of what lies below the surface. This survey was conducted with the express purpose of locating subsurface voids and does not purport to find paleokarst (old, non-active karst features that have been filled in with sand and sediment) or nascent karst features below the resolution limit of the survey.

The results of this study (**Figure 5, Table 3**) indicate a well-layered geologic system west of the Salado dissolution front and mildly chaotic terrain east of the Salado dissolution front (please keep in mind this is a general area over tens to hundreds of meters in width). Moderate resistivities between 1.5 and 230 Ohm-m with occasional areas of up to 315 Ohm-m are noted. Three high resistivity anomalies exist underneath electrodes 47 and 51-52 on line TAPP204 and electrodes 51 – 52 on line TAPP2 (east of the dissolution front). A layer of low resistivity exists approximately 12 meters (39 feet) below the surface. Please see section **4.0 DISCUSSION** for the interpretation of these anomalies.

Table 3: High Resistivity Anomaly Data Table

Anomaly	Line Number	Depth (m)	Description	Latitude	Longitude
A1	TAPP204	5	<2-meter diameter void	32.531260°	104.203208°
A2	TAPP204	5	<2-meter diameter void	32.531257°	104.202997°
A3	TAPP205	5	<2-meter diameter void	32.530977°	104.202916°

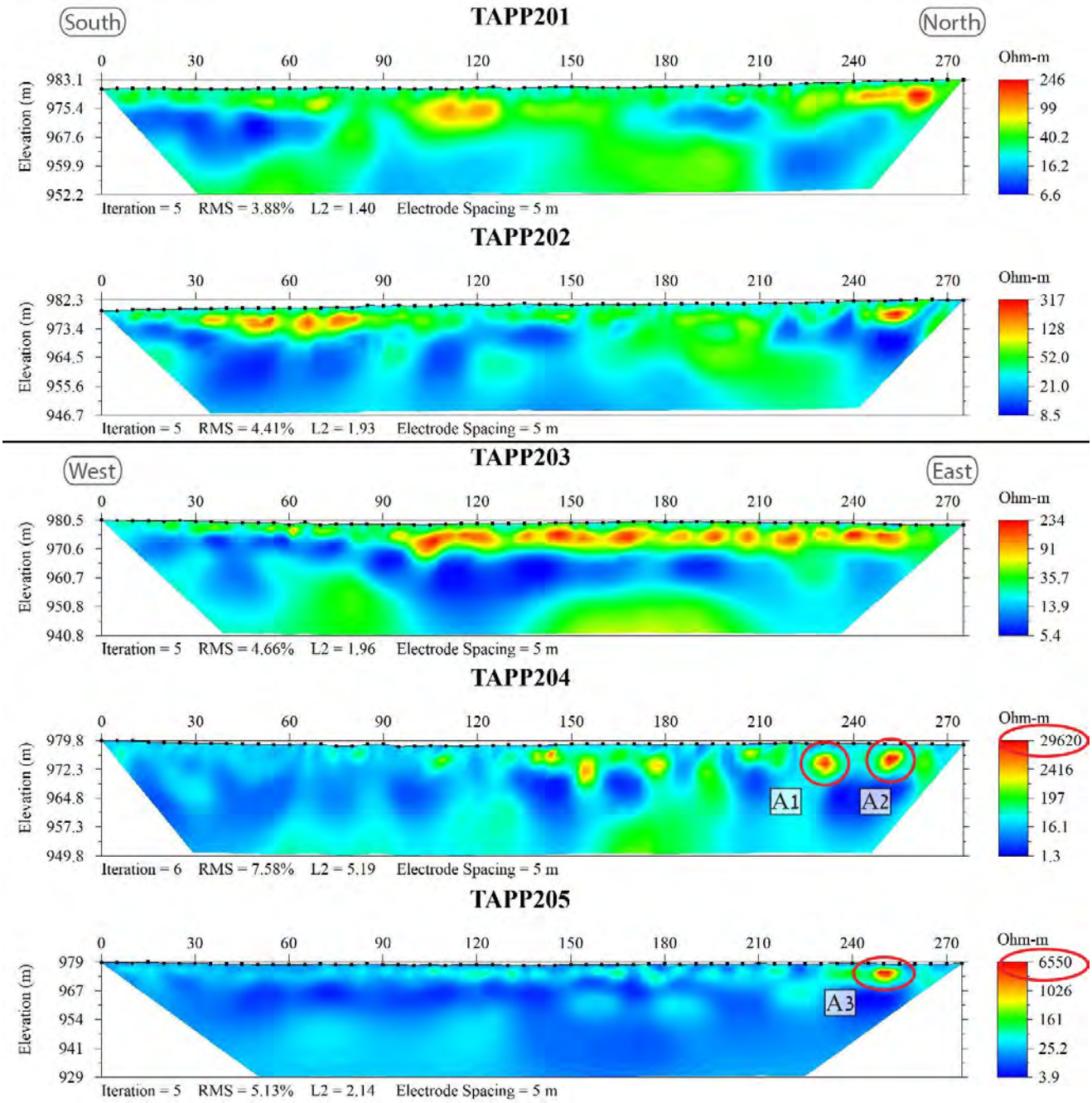

Figure 5: TAPP2 lines 1 through 5 2D inverted resistivity sections showing highest and lowest resistivities. Reds and oranges: higher resistivity. Blues: lower resistivity. Black dots are electrode locations. Red polygons highlight high-resistivity anomalies.

Please keep in mind when viewing the 2D inverted resistivity sections that color maps can be widely different for each view. Always check the color map located on the right side of the image when viewing the 2D images to ensure you understand the range of resistivities presented. Distances along the top and depths along the left side are in meters. The color map along the right side is in Ohm-m. Due to the nature of the survey, shallower zones have higher resolution between electrodes than deeper zones; therefore, small features at depth will not be visible.

4.0 DISCUSSION

The TAPP2 survey contains three high-resistivity anomalies (A1 – A3) at a depth of 5 meters that may be interpreted as near-surface voids or related karst features (**Figure 5**, **Figure 6**, and **Table 3**). The anomalies are located along the Salado Dissolution front and therefore are likely to represent isolated air-filled voids or related karst features greater than 2-meters in diameter within gypsite, caliche, or a gypsum or dolomite layer in the Rustler Formation. Such features could be associated with groundwater recharge and may also represent collapse hazards. It is also possible that these anomalies are associated with limestone or dolomite bedrock, but with the high resistivity values seen, it is unlikely. All three anomalies should be drilled to confirm their presence and resolve their interpretation or avoided by 30 meters during the construction of the pond.

No other anomalies interpreted as large near-surface voids are located within the study area. However, due to the resolution limit of the survey, other small voids at or below the resolution limit (2.5 – 3.0 meters) cannot be ruled out and are quite common in this area. Areas of moderate resistivity (yellows and greens) near the surface are interpreted as gypsite or dolomite bedrock of the Rustler Formation[4] (**Figure 5**).

Resistivity of the survey area drops below 15 Ω-m at approximately 12 meters (39 feet) depth throughout the survey area, indicating a change from dry caliche/gypsite soils or dolomites of the Rustler to a clay or halite layer or a saturated medium within the Rustler or the near-surface insoluble residue from the dissolution of the Salado Formation (**Figure 5**).

Within karst terrains like the project site, small air- or sediment-filled voids and/or brecciated zones and solutionally enlarged fractures that are below the resolution limit of the survey may exist; these may be encountered during excavation and if so, should be evaluated by a karst specialist prior to continuation of the excavation. If excavation is to occur within the southeast corner of the survey area near anomalies A1 and A2 (**Figure 6**), employing a BLM-CFO approved karst monitor on site during excavation is recommended.

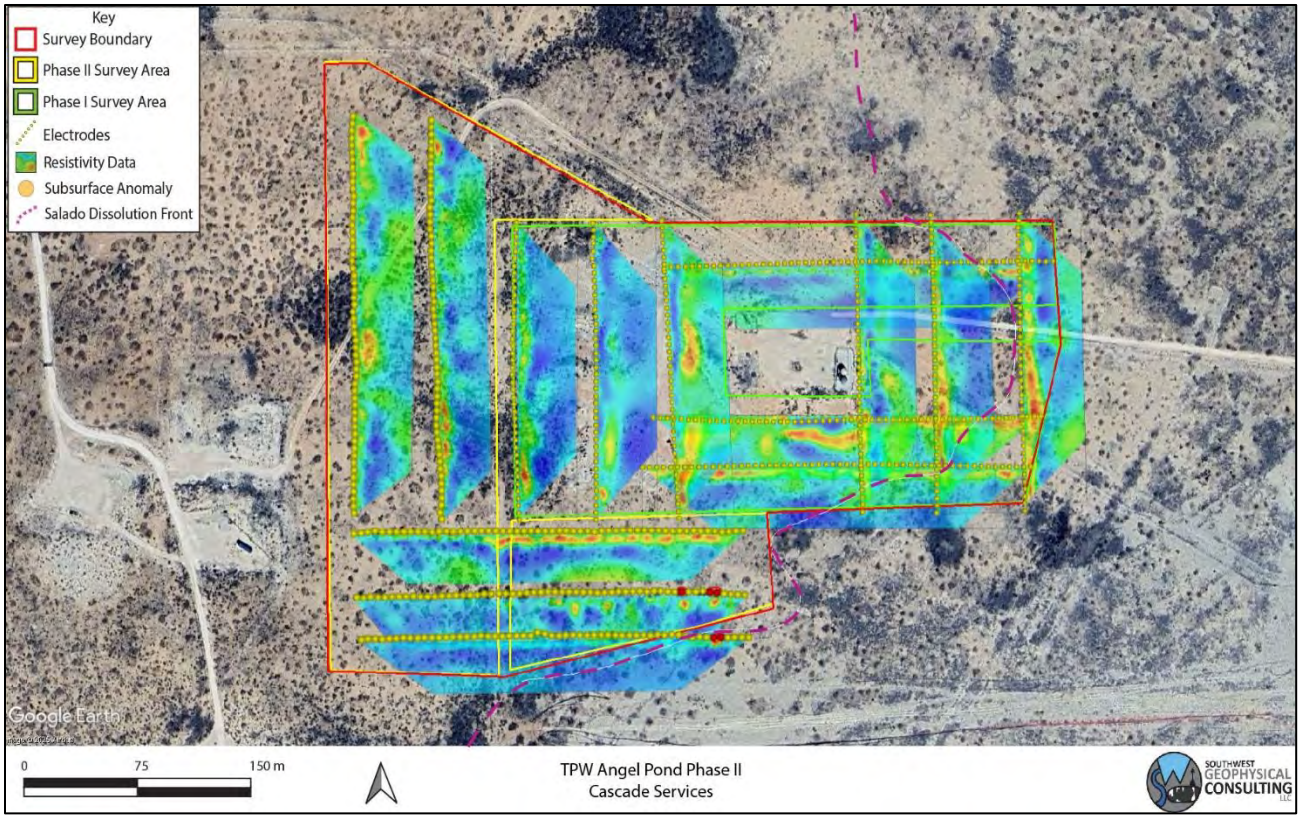

Figure 6: TAPP2 map view with the resistivity sections overlaid. The nine survey lines in the Phase I survey area (green polygon) were completed at an earlier date and detailed in the CASC-008-20241021 TPW Angel Pond Phase 1 (TPWAP) ERI Report. Background image credit: Google Earth. Image date: July 13, 2024. Image datum: WGS-84.

5.0 SUMMARY

5.1 Recommendations

- **The TAPP2 survey area contains three shallow anomalies interpreted as air-filled voids or related karst features.**
- All features should be drilled for verification or avoided by at least 30 meters during brush clearing and any construction activities (**Figure 7**).
- Additionally, small voids or solutionally enlarged fractures below the resolution limit of the survey may exist in this location, most likely on the east side near the dissolution front. Caution should be exercised during brush clearing, excavation, and construction activities.
- Employing a BLM-CFO approved karst monitor on site to evaluate any features encountered during brush clearing and grading should be considered. If excavation is to occur over or near the resistivity anomalies without prior geotechnical confirmation, employing a karst monitor is strongly recommended. Construction activities may reactivate paleo-sinkholes and small voids may appear at the surface suddenly as settling occurs or after heavy rains.

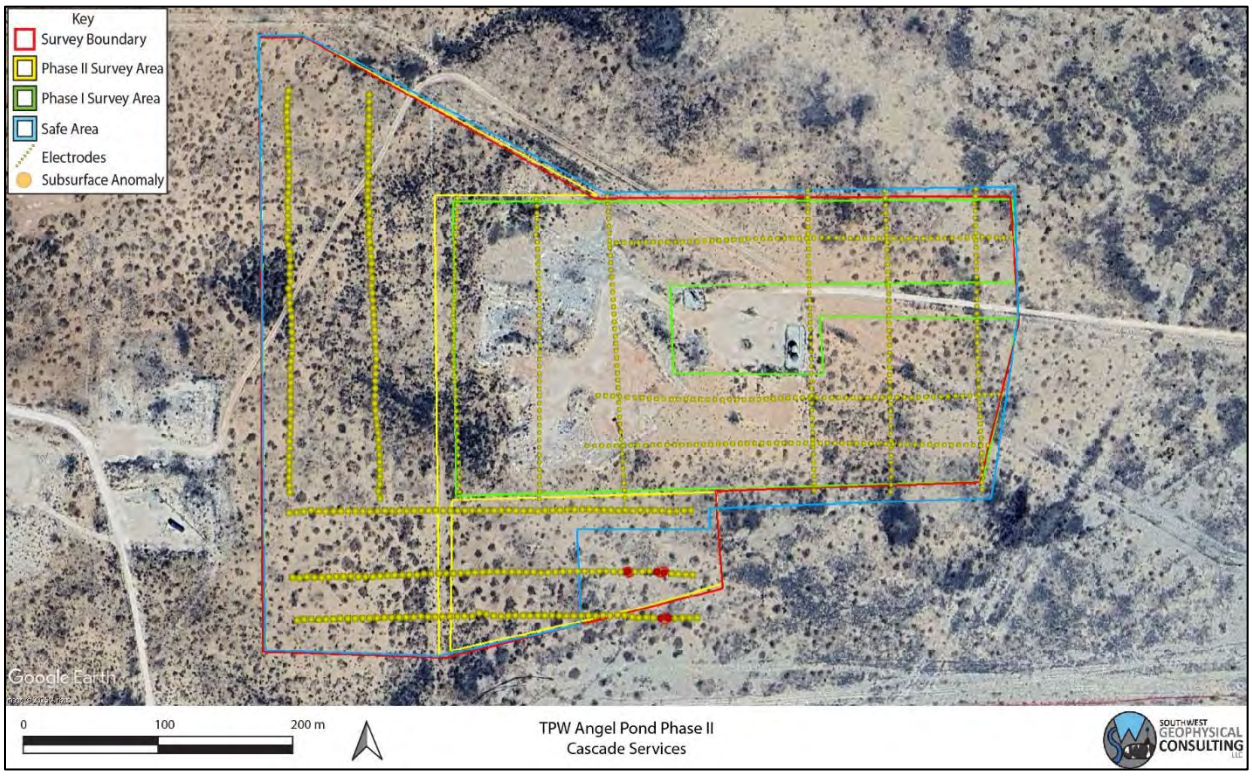

Figure 7: Recommended "safe" area. Background image credit: Google Earth. Image date: July 24, 2024. Image datum: WGS-84.

5.2 Best Practices

This area is prone to rapid karst formation and warrants careful planning and engineering to mitigate karst-forming processes that could be accelerated by poor design considerations. Proper engineering of these facilities following karst guidelines should be implemented during both excavation and construction. Mitigation measures for any karst features revealed during excavation shall be approved by the BLM-CFO karst specialist and follow the Natural Resources Conservation Service Conservation Practice Standard for Karst Sinkhole Treatment, Code 527, or the Bureau of Land Management Cave and Karst Management Handbook, H-8380-1.

Keep in mind that any flow of gypsum-undersaturated waters into a small crack or crevice can rapidly dissolve the surrounding gypsum and cause catastrophic failure of any impoundment or infrastructure within a matter of months to a few years. It is imperative that any dikes, buffers, or liners installed are checked regularly for integrity, with repairs made immediately upon discovery of failure.

Vigilance during construction is paramount. If voids are encountered during excavation, contact the Bureau of Land Management Karst Division at (575) 234-5972, the New Mexico State Land Office Surface Resources Division at (505) 827-5768, or a BLM-CFO approved karst contractor and request an on-site investigation from a karst expert if one is not already on site. A karst consultant can generally be available in Eddy County within five hours. Monitoring services, as well as cave surveys and geophysical surveys, are available from Southwest Geophysical Consulting.

Approved karst monitors should have karst feature identification training, at least two years of supervised experience identifying karst features, wilderness first aid training, SRT training, confined space training, gas monitor training, and a minimum of SPAR cave rescue training through NCRC. They should have with them the proper gear and be prepared both physically and mentally to enter a collapse feature within minutes to perform a rescue if needed. Monitoring services with qualified karst monitors, as well as cave surveys and geophysical surveys, are available from Southwest Geophysical Consulting.

Under no circumstances should an untrained, inexperienced person enter a cave, pit, sinkhole, or collapse feature. All field employees of Southwest Geophysical Consulting have extensive caving experience and the ability to determine whether entry into a karst feature is safe or presents a hazard. In the event it is necessary to enter a karst feature, Southwest Geophysical Consulting can provide these services on request.

Cave and karst resource inventory reports, karst feature investigations, and geophysical reports commissioned at the request of the land manager should be submitted to:

BLM-CFO: blm_nm_karst@blm.gov

NMSLO: Project manager requesting the report.

6.0 REFERENCES

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7.0 APPENDICES

7.1 Glossary of Terms

ACEC	Area of Critical Environmental Concern
AGI	Advanced Geosciences Inc.
BLM-CFO	Bureau of Land Management - Carlsbad Field Office
brecciated	Fractured rock caused by faulting or collapse.
caprock-collapse sinkhole	Collapse of roof-spanning rock into a cave or void.
cave	Natural opening at the surface large enough for a person to enter.
cover-collapse sinkhole	Collapse of roof-spanning soil or clay ground cover into a subsurface void.
ERI	Electrical Resistivity Imaging
GPS	Global Positioning System
grike	A solutionally enlarged, vertical, or sub-vertical joint or fracture.
HKOZ	High Karst Occurrence Zone
InSAR	Interferometric Synthetic Aperture Radar. A method by which radar signals from satellites are processed to determine the amount and rate of subsidence of an area as well as whether the area is actively subsiding.
karst	A landscape containing solutional features such as caves, sinkholes, swallets, and springs.
LED	Locally enclosed depression. A natural depression on the surface that collects rainwater. Some contain swallets and/or caves, others do not.
LKOZ	Low Karst Occurrence Zone
MKOZ	Medium Karst Occurrence Zone
NCRC	National Cave Rescue Commission
NKF	Non-karst feature. Used for features originally identified as PKF that have been subsequently identified in the field as non-karst related. This term may also be used for pseudokarst features.
NMSLO	New Mexico State Land Office
Ohm-m	Ohm-meter, a unit of measurement for resistivity. Also sometimes abbreviated Ω-m.
paleokarst	Previously formed karst features that have been filled in by erosion and/or deposition of minerals.
Pat	Permian Artesia Group
Pc	Permian Capitan Formation
Pcs	Permian Castile Formation

Pdl	Permian Dewey Lake Formation
PKF	Possible karst feature. This term is reserved for features identified in satellite or aerial imagery that have NOT been visited in the field. Further modifiers include (H) for high confidence, (M) for medium confidence, and (L) for low confidence. These confidence levels are based on field experience.
PLSS	Public Land Survey System
Pqg	Permian Queen/Greyburg Formation
Pru	Permian Rustler Formation
Psl	Permian Salado Formation
Psr	Permian Seven Rivers Formation
Pt	Permian Tansill Formation
Py	Permian Yates Formation
pseudokarst	Karst-like features (sinkholes, conduits, voids etc.) that are not formed by dissolution. These types of features include soil piping, lava tubes, and some cover-collapse and suffosion sinkholes.
Py	Permian Yates Formation
Qal	Quaternary alluvium
Qe	Quaternary eolian deposits
Qp	Quaternary piedmont deposits
Qpl	Quaternary playa lake deposits
RKF	Recognized karst feature. This term is reserved for karst features that have been physically verified in the field.
SKF	Surface Karst Feature
SPAR	Small Party Assisted Rescue
suffosion sinkhole	Raveling of soil into a pre-existing void or fracture.
swallet	A natural opening in the surface, too small for a person, that drains water to an aquifer. Some are "open," meaning a void can be seen below; some are "closed, "meaning they are full of sediment.
SWG	Southwest Geophysical Consulting, LLC
UTM	Universal Transverse Mercator (projected coordinates)
WGS	World Geodetic System (geographic coordinates)

8.0 ATTESTATION

David D. Decker, PhD, PG, CPG
Chief Executive Officer, Principal Geologist
Southwest Geophysical Consulting, LLC
5117 Fairfax Dr. NW
Albuquerque, NM 87114
dave@swgeophys.com
(505) 585-2550

CERTIFICATE OF AUTHOR

I, David D. Decker, a Licensed Professional Geologist and a Certified Professional Geologist, do certify that:

- I am currently employed as a consulting geologist in the specialty of caves and karst with an office address of 5117 Fairfax Dr. NW, Albuquerque, NM, USA, 87114.
- I graduated with a Master of Science in Applied Physics with a specialization in Sensor Systems from the Naval Post Graduate School in Monterey, California, in 2003, and a Doctor of Philosophy in Earth and Planetary Sciences from the University of New Mexico, Albuquerque, New Mexico, in 2018.
- I am a Licensed Professional Geologist in the State of Texas, USA (PG-15242) and have been since 2021. I am a Certified Professional Geologist through the American Institute of Professional Geologists (CPG-12123) and have been since 2021.
- I have been employed as a geologist continuously since 2016. I was previously employed as a Fire Controlman, Naval Flight Officer, and Aerospace Engineering Duty Officer in the U.S. Navy and operated, maintained, and installed various sensor systems including magnetic, electromagnetic, radar, communications, and acoustic systems in various capacities from 1986 through 2010.
- I have been involved in various aspects of cave and karst studies continuously since 1985, including exploration, mapping, and scientific studies.
- I have read the definition of “qualified karst professional” set out in the ASTM Standard Practice for Preliminary Karst Terrain Assessment for Site Development (ASTM E-1527). I meet the definition of “qualified professional” for the purposes of this standard.
- I am responsible for the content, compilation, and editing of all sections of report number CASC-011-20250122 entitled, “2D Electrical Resistivity Imaging Report, BTS Management Angel Pond Phase 2, Eddy County, New Mexico.” I or a duly authorized and qualified representative of Southwest Geophysical Consulting, LLC, have personally visited this site on the date or dates mentioned in section ***2.3 Description of Survey***.

- I have no prior involvement nor monetary interest in the described property or project, save for my fee for conducting this investigation and providing the report.

Dated in Albuquerque, New Mexico, March 19, 2025.

David D. Decker
PhD, CPG-12123

Venegas, Victoria, EMNRD

From: Venegas, Victoria, EMNRD
Sent: Tuesday, April 15, 2025 11:44 AM
To: dave@btsmanagementllc.com; 'BobbiJo Crain'
Subject: 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421]
Attachments: C-147 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421].pdf

2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421]

Good morning, Mr. Andersen.
NMOCD has reviewed the recycling containment permit application and related documents, submitted by [333139] BTS Management LLC on 04/10/2025, Application ID 450993, for 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421] in F-32-20S-28E, Eddy County, New Mexico. [333139] BTS Management LLC requested variances from 19.15.34 NMAC for 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421].

The following variances have been approved:

- The variance to 19.15.34.14 NMAC Table I for the use of alternate analytical method 8015/8015M for total petroleum hydrocarbons (TPH) is approved.
- The variance to 19.15.34.14 NMAC Table I for the use of alternate analytical method EPA 300.0 or SM4500 for the analysis of chloride is approved.
- The variance to 19.15.34.12.A.(2) NMAC for the no side-slope requirement for the AST containment with vertical walls is approved.
- The variance to 19.15.34.12.A.(3) NMAC for the liners to be anchored to the top of the AST steel walls and no anchor trenches is approved.
- The variance to 19.15.34.12.A.(4) NMAC for the installation on the AST containment of a 40-mil non-reinforced LLDPE primary liner and a 30-mil non-reinforced LLDPE secondary liner or a liner system consisting of a 40-mil non-reinforced LLDPE primary liner and a 40-mil non-reinforced LLDPE secondary liner is approved. [333139] BTS Management LLC will notify the OCD through OCD Permitting of the installation of the liner system and provide the specifications of the liner system that has been installed.
- The variance to NMAC 19.15.34.12.D to install a gate or chain across the stairway between the ground surface and the open-top of the AST containment is approved. The operator shall place an appropriate sign on the gate or chain to prevent unauthorized human access to the open top of the containment and will provide a mechanism to lock the gate when responsible personnel are not onsite.

The form C-147 and related documents for 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421] are approved with the following conditions of approval:

- The purpose of this permit is for oil and gas activities regulated under the NMAC 19.15.34.3 STATUTORY AUTHORITY: 19.15.34 NMAC is adopted pursuant to the Oil and Gas Act, Paragraph (15) of Section 70-2-12(B) NMSA 1978, which authorizes the division to regulate the disposition of water produced or used in connection with the drilling for or producing of oil and gas or both and Paragraph (21) of Section 70-2-12(B) NMSA 1978 which authorizes the regulation of the disposition of nondomestic wastes from the exploration, development, production or storage of crude oil or natural gas.
- 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421] is approved for five years of operation from the date of permit application of 04/10/2025. 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421] permit expires on 04/10/2030. If [333139] BTS

Management LLC wishes to extend operations past five years, an annual extension request must be submitted using Form C-147 through OCD Permitting by 03/10/2030.

- Per NMAC 19.15.34.15.A.(1) operators without existing financial assurance pursuant to NMAC 19.15.8 shall furnish financial assurance acceptable to the division in the amount of the recycling containment's estimated closure cost. The total closure cost estimate for 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421] in the amount of $432,600.20, meets the requirements of NMAC 19.15.34.15.A.(1).
- [333139] BTS Management LLC cannot receive produced water in the 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421] until the original copy of the financial assurance has been accepted by NMOCD.
- The financial assurance bond should be mailed to: **Oil Conservation Division, Administration and Compliance Bureau. 1220 S. St. Francis Drive, Santa Fe, NM 87505**.
- 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421] consists of one (1) AST of 40,000 bbls and one (1) inground containment of 663,961 bbls.
- [333139] BTS Management LLC shall construct, operate, maintain, close, and reclaim 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421] in compliance with NMAC 19.15.34 NMAC.
- **KARST Best Practices**:
  The operator must have a BLM-CFO approved karst monitor on site to assess any karst features encountered during brush clearing and grading or during the construction of 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421]. If voids are encountered during excavation, the operator must contact the Bureau of Land Management's Karst Division at (575) 234-5972 or a BLM-CFO-approved karst contractor and request an on-site investigation by a karst expert. The operator must also notify NMOCD through OCD Permitting.
- [333139] BTS Management LLC shall notify OCD, through OCD Permitting, when construction of 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421] commences.
- [333139] BTS Management LLC shall notify NMOCD through OCD Permitting when recycling operations commence and cease at 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421].
- A minimum of 3-feet freeboard must be maintained at 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421] at all times during operations.
- If less than 20% of the total fluid capacity is utilized every six months, beginning from the first withdrawal, operations of the 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421] are considered ceased and a notification of cessation of operations should be sent electronically to OCD Permitting. A request to extend the cessation of operations, not to exceed six months, may be submitted using a C-147 form through OCD Permitting. If after that 6-month extension period, the 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421] is not utilized at a minimum of 20% fluid capacity, no additional extensions would be granted, and the operator would be directed to remove all fluids and proceed with the closure requirements.
- [333139] BTS Management LLC shall submit monthly reports of recycling and reuse of produced water, drilling fluids, and liquid oil field waste on OCD form C-148 via OCD Permitting even if there is zero activity.
- [333139] BTS Management LLC shall inspect the recycling containment and associated leak detection systems weekly while it contains fluids. The operator shall maintain a current log of such inspections and make the logs available for review by the division upon request according to 19.15.34.13.A.
- [333139] BTS Management LLC shall comply with 19.15.29 NMAC Releases in the event of any release of produced water or other oil field waste at 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421].

Please reference number 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421] in all future communications.
Best regards,

Victoria Venegas ● Environmental Specialist Advanced
EMNRD - Oil Conservation Division
506 W. Texas Ave. Artesia, NM 88210
575.909.0269 | **Victoria.Venegas@emnrd.nm.gov**

Sante Fe Main Office
Phone: (505) 476-3441

General Information
Phone: (505) 629-6116

Online Phone Directory
https://www.emnrd.nm.gov/ocd/contact-us

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

CONDITIONS

Operator: BTS Management LLC 616 Queens Hwy Carlsbad, NM 88220	OGRID: 333139
	Action Number: 450993
	Action Type: [C-147] Water Recycle Long (C-147L)

CONDITIONS

Created By	Condition	Condition Date
vvenegas	2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421] permit expires on 04/10/2030. If [333139] BTS Management LLC wishes to extend operations past five years, an annual extension request must be submitted using Form C-147 through OCD Permitting by 03/10/2030. • [333139] BTS Management LLC shall construct, operate, maintain, close, and reclaim 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421] in compliance with NMAC 19.15.34 NMAC. • [333139] BTS Management LLC shall comply with 19.15.29 NMAC Releases in the event of any release of produced water or other oil field waste at 2RF-222 - ANGEL RECYCLING FACILITY EAST & AST CONTAINMENT [fVV2510451421].	4/15/2025