ENVIROTECH

ENGINEERING

STATIONARY COMMERCIAL FLUID RECYCLING FACILITY APPLICATION

TWIN WELLS RECYCLE FACILITY

WATERBRIDGE

SECTION 20, TOWNSHIP 20S, RANGE 30E

EDDY COUNTY, NEW MEXICO

TYLER JOE WILLIAMS
NEW MEXICO
26432
PROFESSIONAL ENGINEER
5/2/2023

APRIL 2023

CA 26432
Expires 12/31/2024
023026-00

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

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

Form C-147
Revised April 3, 2017

Recycling Facility and/or Recycling Containment

Type of Facility: ☐ Recycling Facility ☒ Recycling Containment*

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

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

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

1.
Operator: WaterBridge Stateline, LLC (For multiple operators attach page with information) OGRID #: 330129
Address: 5555 San Felipe Suite 1200 Houston, TX 77056
Facility or well name (include API# if associated with a well): Twin Wells Recycle Pit
OCD Permit Number: 2RF-191 (For new facilities the permit number will be assigned by the district office)
U/L or Qtr/Qtr SW/4 of NW/4 Section 20 Township 20 S Range 30E County: Eddy County
Surface Owner: ☐ Federal ☐ State ☒ Private ☐ Tribal Trust or Indian Allotment

2.
☐ **Recycling Facility:**
Location of recycling facility (if applicable): Latitude 32.561434° Longitude -104.001228° 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:**
☐ Annual Extension after initial 5 years (attach summary of monthly leak detection inspections for previous year)
Center of Recycling Containment (if applicable): Latitude 32.561434° Longitude -104.001228° NAD83
☐ For multiple or additional recycling containments, attach design and location information of each containment
☒ Lined ☐ Liner type: Thickness 60/40 mil ☐ LLDPE ☒ HDPE ☐ PVC ☐ Other _____
☐ String-Reinforced
Liner Seams: ☒ Welded ☐ Factory ☐ Other _____ Volume: 776,815 bbl Dimensions: L 790 x W 600 x D 17
☐ 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 $ 1,075,575.50 **(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 8-ft tall 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.

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.

- [X] Design Plan - based upon the appropriate requirements.
- [X] Operating and Maintenance Plan - based upon the appropriate requirements.
- [X] Closure Plan - based upon the appropriate requirements.
- [X] Site Specific Groundwater Data -
- [X] Siting Criteria Compliance Demonstrations –
- [X] **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): MICHAEL REITZ Title: EVP

Signature: Date: 5-2-23

e-mail address: Michael.Reitz@H2OBridge.com Telephone: 2254131273

11.
OCD Representative Signature: Victoria Venegas **Approval Date:** 05/11/2023

Title: Environmental Specialist **OCD Permit Number:** 2RF-191

- [X] OCD Conditions
- [X] Additional OCD Conditions on Attachment

District I
1625 N. French Dr., Hobbs, NM 88240
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Type of action: ☒ Permit ☐ Registration ☐ Modification ☐ Extension ☐ Closure ☐ Other (explain) _____

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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: WaterBridge Stateline, LLC (For multiple operators attach page with information) OGRID #: 330129
Address: 5555 San Felipe Suite 1200 Houston, TX 77056
Facility or well name (include API# if associated with a well): Twin Wells Recycle AST
OCD Permit Number: 2RF-191 (For new facilities the permit number will be assigned by the district office)
U/L or Qtr/Qtr SW/4 of NW/4 Section 20 Township 20 S Range 30E County: Eddy County
Surface Owner: ☐ Federal ☐ State ☒ Private ☐ Tribal Trust or Indian Allotment

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☐ **Recycling Facility:**
Location of recycling facility (if applicable): Latitude 32.561434° Longitude -104.001228° 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*
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☐ Above ground tanks ☒ Recycling containment ☐ Activity permitted under 19.15.17 NMAC explain type_____
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☐ For multiple or additional recycling containments, attach design and location information of each containment
☐ **Closure Report (required within 60 days of closure completion):** ☐ Recycling Facility Closure Completion Date:_____

3.
☐ **Recycling Containment:**
☐ Annual Extension after initial 5 years (attach summary of monthly leak detection inspections for previous year)
Center of Recycling Containment (if applicable): Latitude 32.559590° Longitude -104.001955° NAD83
☐ For multiple or additional recycling containments, attach design and location information of each containment
☒ Lined ☐ Liner type: Thickness 40/40 mil ☒ LLDPE ☐ HDPE ☐ PVC ☐ Other _____
☐ String-Reinforced
Liner Seams: ☒ Welded ☐ Factory ☐ Other _____ Volume: 40,000 bbl Dimensions: L_____ x W 155 x D 12
☐ Recycling Containment Closure Completion Date:_____
155-ft Diameter AST

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 $ 1,075,575.50 **(work on these facilities cannot commence until bonding amounts are approved)**

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

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Fencing:

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

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

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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.
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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.

- [X] Design Plan - based upon the appropriate requirements.
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- [X] Closure Plan - based upon the appropriate requirements.
- [X] Site Specific Groundwater Data -
- [X] Siting Criteria Compliance Demonstrations –
- [X] **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): MICHAEL REITZ Title: EVP

Signature: [signature] Date: 5/2/23

e-mail address: Michael.Reitz@H2OBridge.com Telephone: 225 413 1273

11.
OCD Representative Signature: Victoria Venegas **Approval Date:** 05/11/2023

Title: Environmental Specialist **OCD Permit Number:** 2RF-191

- [X] OCD Conditions
- [X] Additional OCD Conditions on Attachment

ENVIROTECH
ENGINEERING

May 10, 2023

Ms. Victoria Venegas
New Mexico EMNRD
Oil conservation Division
811 S. First St.
Artesia, New Mexico 88210

RE: Rule 34 Variance Request –Produced Water Impoundment Construction on Unstable Area

Ms. Venegas:

WaterBridge Stateline, LLC (WaterBridge) is requesting a variance to Rule 34-Part 12(A)(8) construction on an unstable area (Twin Wells Recycle). According to Bureau of Land Management guidelines and maps, this area is classified as a "Area of High Karst Potential" a site-specific karsting evaluation was conducted by Southwest Geophysical Consulting at this location. During this investigation, it was concluded that there are no areas of "high likelihood of karsting features." A copy of the full report is attached. Even though risk of karsting in this area is low, WaterBridge will still use best engineering practices and best management practices to ensure no undo risk is posed to the preservation of fresh water, public health, and the natural environment.

Should you have any questions or require additional information, please contact me by phone at 580-234-8780 or by email at twilliams@envirotechconsulting.com at your convenience.

Thank you for your consideration.
Best regards,

ENVIROTECH ENGINEERING & CONSULTING, INC.

Tyler Williams, P.E.
President and Principal Engineer

TYLER JOE WILLIAMS
NEW MEXICO
26432
PROFESSIONAL ENGINEER
5/10/2023

ENVIROTECH
ENGINEERING

April 27, 2023

Ms. Victoria Venegas
New Mexico EMNRD
Oil conservation Division

RE: Rule 34 Variance Request –Produced Water Impoundment Bird Netting

Ms. Venegas:

WaterBridge Stateline, LLC (WaterBridge) is requesting a variance to Rule 34-Part 12(E) Netting to ensure the recycling facility is protected from wildlife. Based on our experience from previous projects, we believe audible bird deterrents provide equal or better protection when compared to netting. In addition, they require less inspection, maintenance, and repair over the life of the facility.

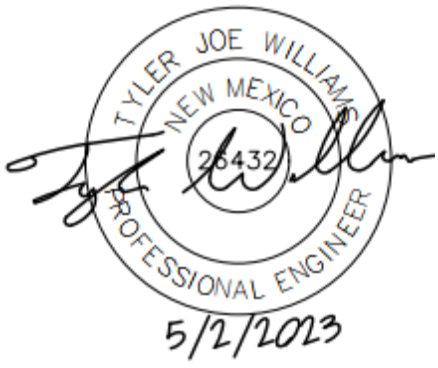
WaterBridge is proposing to use the "Bird-X Mega Blaster Pro" system. This system will replace the netting required by the current rule and submitted with the original permit application. It should be noted that this variance has been granted on previous sites.

Should you have any questions or require additional information, please contact me by phone at 580-234-8780 or by email at twilliams@envirotechconsulting.com at your convenience.

Thank you for your consideration.
Best regards,

ENVIROTECH ENGINEERING & CONSULTING, INC.

Tyler Williams, P.E.
President and Principal Engineer



ENVIROTECH
ENGINEERING

April 27, 2023

Ms. Victoria Venegas
New Mexico EMNRD
Oil conservation Division

RE: Rule 34 Variance Request –Produced Water Impoundment Fencing

Ms. Venegas:

WaterBridge Stateline, LLC (WaterBridge) is requesting a variance to C-147 Fencing requirement for requiring a fence four foot in height, with four strands of barbed wire evenly spaced between one and four feet. WaterBridge is requesting approval to a wire mesh, game fence, eight (8) feet in height. Based on our experience, we feel that the requested fencing will provide greater security to the facility for excluding animals and unauthorized individual access. Details for this type of fence can be found on Sheet 11 of 12 in Appendix D Engineering Drawings.

The proposed fencing has been approved for other C-147 facilities and used extensively on similar projects in New Mexico and Texas with outstanding success in deterring unauthorized entry by both humans and wildlife. It should be noted that this variance request has been approved on previous sites.

Should you have any questions or require additional information, please contact me by phone at 580-234-8780 or by email at twilliams@envirotechconsulting.com at your convenience.

Thank you for your consideration.
Best regards,

ENVIROTECH ENGINEERING & CONSULTING, INC.

Tyler Williams, P.E.
President and Principal Engineer

TYLER JOE WILLIAMS
NEW MEXICO
26432
PROFESSIONAL ENGINEER
5/2/2023

ENVIROTECH
ENGINEERING

April 27, 2023

Ms. Victoria Venegas
New Mexico EMNRD
Oil conservation Division

RE: Rule 34 Variance Request –Produced Water Recycling Containment Primary Liner

Ms. Venegas:

WaterBridge Stateline, LLC (WaterBridge) is requesting a variance to Rule 34 Part 12(A)(4) requiring primary liners to be 45-mil string reinforced LLDPE. WaterBridge is requesting approval to use 40-mil LLDPE in place of the specified material in an above ground storage tank (AST). Based on our experience, we feel that the requested material will allow us to provide equal environmental protection in our impoundments.

Due to the construction of the 45-mil reinforced LLDPE material, nondestructive QA/QC testing cannot be performed. The proposed 40-mil LLDPE will be seamed in a manner that will allow nondestructive pressure testing of the seams to ensure proper sealing.

The proposed LLDPE is appropriate material for the proposed use in the impoundment and is compatible with the material that will be stored. This material will provide equal or better environmental protection as the specified 45-mil reinforced LLDPE.

The proposed new liner system cross-section is as follows: prepare subgrade, 10 oz. geotextile, 40-mil LLDPE, 200 mil geonet, 40-mil LLDPE. This will replace the cross-section required by the current rule and submitted with the original permit application. It should also be noted that this variance has been granted on past sites.

Should you have any questions or require additional information, please contact me by phone at 580-234-8780 or by email at twilliams@envirotechconsulting.com at your convenience.

Thank you for your consideration.
Best regards,

ENVIROTECH ENGINEERING & CONSULTING, INC.

Tyler Williams, P.E.
President and Principal Engineer

2500 N. Eleventh Street Enid, OK 73701 envirotechconsulting.com info@envirotechconsulting.com 580.234.8780

ENVIROTECH
ENGINEERING

April 27, 2023

Ms. Victoria Venegas
New Mexico EMNRD
Oil conservation Division

RE: Rule 34 Variance Request –Produced Water Recycling Containment Liner

Ms. Venegas:

WaterBridge Stateline, LLC (WaterBridge) is requesting a variance to Rule 34 Part 12(A)(4) requiring secondary liners to be 30-mil string reinforced LLDPE. WaterBridge is requesting approval to use 40-mil HDPE in place of the specified material for a earthen containment and 40-mil LLDPE for an above ground storage tank (AST). Based on our experience, we feel that the requested material will allow us to provide greater environmental protection in our impoundments.

Due to the construction of the 30-mil reinforced LLDPE material, nondestructive QA/QC testing cannot be performed. The proposed 40-mil HDPE and 40-mil LLDPE will be seamed in a manner that will allow nondestructive pressure testing of the seams to ensure proper sealing.

The proposed HDPE and LLDPE are appropriate material for the proposed use in the impoundment and is compatible with the material that will be stored. This material will provide equal or better environmental protection as the specified 30-mil reinforced LLDPE.

The proposed new liner system cross-section for the earthen containment is as follows: prepare subgrade, 10 oz. geotextile, 40-mil HDDPE, 200-mil geonet, 60-mil HDPE. This will replace the cross-section required by the current rule and submitted with the original permit application. It should also be noted that this variance has been granted on past sites.

The proposed new liner system cross-section for the AST is as follows: prepare subgrade, 10 oz. geotextile, 40-mil LLDPE, 200-mil geonet, 40-mil LLDPE. This will replace the cross-section required by the current rule and submitted with the original permit application. It should also be noted that this variance has been granted on past sites.

Should you have any questions or require additional information, please contact me by phone at 580-234-8780 or by email at twilliams@envirotechconsulting.com at your convenience

Thank you for your consideration.
Best regards,
ENVIROTECH ENGINEERING & CONSULTING, INC.

TYLER JOE WILLIAMS
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5/2/2023

Tyler Williams, P.E.
President and Principal Engineer

2500 N. Eleventh Street Enid, OK 73701 envirotechconsulting.com info@envirotechconsulting.com 580.234.8780

ENVIROTECH
ENGINEERING

April 27, 2023

Ms. Victoria Venegas
New Mexico EMNRD
Oil conservation Division

RE: Rule 34 Variance Request –Produced Water Recycling Containment

Ms. Venegas:

WaterBridge Stateline, LLC (WaterBridge) is requesting a variance to Rule 34 Part 12(A)(3) requiring "The edges of all liners shall be anchored in the bottom of a compacted earth-filled trench.."

WaterBridge is requesting approval to use an Above Ground Storage Tank (AST) as a containment structure at the WaterBridge Twin Wells Recycle Facility. Based on our experience AST's work well for this purpose, they are structurally sound and easy to maintain. Clips will be used at the top of the steel walls to secure the liner. These clips are specifically designed to hold the AST liner in place and provide the same type of liner security as an anchor trench. It should also be noted that this variance has been granted on past sites.

Should you have any questions or require additional information, please contact me by phone at 580-234-8780 or by email at twilliams@envirotechconsulting.com at your convenience.

Thank you for your consideration.
Best regards,

ENVIROTECH ENGINEERING & CONSULTING, INC.

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TYLER JOE WILLIAMS
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26432
PROFESSIONAL ENGINEER
5/2/2023

ENVIROTECH
ENGINEERING

April 27, 2023

Ms. Victoria Venegas
New Mexico EMNRD
Oil conservation Division

RE: Rule 34 Variance Request –Produced Water Recycling Containment

Ms. Venegas:

WaterBridge Stateline, LLC (WaterBridge) is requesting a variance to Rule 34 Part 12(A)(2) requiring *"… 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)."*

WaterBridge is requesting approval to use an Above Ground Storage Tank (AST) as a containment structure at the WaterBridge Twin Wells Recycle Facility. Based on our experience AST's work well for this purpose, they are structurally sound and easy to maintain. This AST will have vertical walls on both interior and exterior sides and thus requires a variance for use. The AST will, however be double lined like other containments to limit the risk of leakage. It should also be noted that this variance has been granted on past sites.

Should you have any questions or require additional information, please contact me by phone at 580-234-8780 or by email at twilliams@envirotechconsulting.com at your convenience.

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ENVIROTECH
ENGINEERING

April 27, 2023

Ms. Victoria Venegas
New Mexico EMNRD
Oil conservation Division

RE: Rule 34 Variance Request –Produced Water Recycling Containment

Ms. Venegas:

WaterBridge Stateline, LLC (WaterBridge) is requesting a variance to Rule 34 Part 12(A)(2) requiring "*…The levee shall have an outside grade no steeper than three horizontal feet to one vertical foot (3H:1V)*."

WaterBridge is requesting approval to use an Above Ground Storage Tank (AST) as a containment structure at the WaterBridge Twin Wells Recycle Facility. Based on our experience AST's work well for this purpose, they are structurally sound and easy to maintain. This AST will have vertical walls on both interior and exterior sides and thus requires a variance for use. The AST will, however be double lined like other containments to limit the risk of leakage. It should also be noted that this variance has been granted on past sites.

Should you have any questions or require additional information, please contact me by phone at 580-234-8780 or by email at twilliams@envirotechconsulting.com at your convenience.

Thank you for your consideration.
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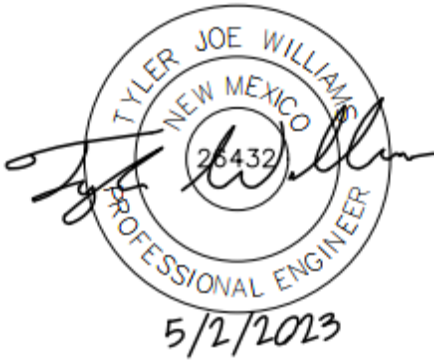


TABLE OF CONTENTS

APPENDICES:

SITE CRITERIA FOR RECYCLING CONTAINMENT

1.0 LOCATION

WaterBridge Stateline, LLC is proposing to construct a recycle facility, Twin Wells Recycle Facility, located in Section 20, Township 20 South, Range 30 East in Eddy County, New Mexico. An aerial photographic map, *Figure 1*, shows the location of the proposed facility. This study was performed on the proposed location to evaluate that the proposed facility location would be in accordance with the 19.15.34.11 NMAC Siting Requirements for Recycling Containments.

2.0 DISTANCE TO GROUNDWATER

2.1 GROUNDWATER WELLS

Banks Environmental Data (Banks) was contracted to search the New Mexico Office of State Engineers (OSE) records for water wells within a 1.0-mi. radius of the proposed facility location. According to Banks, six (6) water wells were identified within a 1.0-mi radius of the proposed facility. No water wells were identified to be located within the proposed facility boundaries. The Banks Water Well Report is included as *Appendix A*, and *Figure 2.1* illustrates the location of the six (6) water wells located within a 1.0-mi. radius of the proposed facility.

Of the six (6) total water wells, three (3) water wells are owned by the United States Geological Society (USGS), however the well type was not reported. Two (2) water wells are owned by Twin Wells Ranch LLC, one (1) well is labelled as a "livestock watering" well and one (1) well type was not reported. One (1) well is owned by Intrepid Potash New Mexico, LLC and is labelled as a "monitoring well." The six (6) water wells have an average total depth of 79.5-ft. below ground surface (bgs.) and the average approximate depth to water was 56-ft. bgs.

The New Mexico Oil and Gas Division (NMOCD) requires that groundwater (freshwater as defined by NMOCD rules) at the location be greater than 50-ft below the containment bottom. *Figure 2.1* demonstrates the following to meet these criteria:

1. The location of the proposed facility shown on the United States Geologic Survey (USGS) Angel Draw, NM 7.5 Minute Series Topographic Map.
2. A 1.0-mile radius from the site, and location of water wells in comparison to that radius. It should be noted, OSE wells can be mis-located as older wells are plotted in the center of the quarter, quarter, quarter section, township, and range.
3. The Banks search of the OSE records show there were no water wells located within the boundary of the proposed facility.

During onsite investigation, conducted by COZ Engineering, LLC on January 25, 2023, five (5) total borings were advanced on the proposed facility location. Four (4) borings were drilled to a total depth of approximately 20-ft. bgs. and one (1) boring was drilled to a total depth of approximately 75-ft. bgs. The groundwater table was not encountered during the onsite field investigation. The geotechnical engineering report prepared by COZ Engineering, LLC is included in *Appendix C*.

2.2 AQUIFERS

Information reviewed from the Bureau of Land Management (BLM) Carlsbad Field Office shows the proposed facility is located within the Capitan Reef Aquifer system. The Capitan Reef is a fossil limestone reef of the middle Permian age. Recharge of the Capitan Reef Aquifer occurs by direct infiltration into outcropping cavernous zones formed in the Capitan limestone and equivalent backreef units of the Artesia Group. *Figure 2.2* shows the site location in reference to Bureau of Land Management Declared Aquifers in the State of New Mexico.

2.3 GEOLOGY

A geological map of New Mexico was obtained from the New Mexico Bureau of Geology and Mineral Resources (NMBGMR) Interactive Resources Map to review the geologic setting for the proposed containment location. Based on the review of the geologic map, the containment location lies within Middle to Lower Pleistocene older alluvial deposits. These are unconsolidated older alluvial deposits of upland plains and piedmont areas, and calcic soils and eolian cover sediments of High Plains Region.

Figure 2.3 is reproduction of the NMBGMR Interactive Resources Map. *Figure 2.3* shows the following:

1. Location of the proposed Containment
2. Geologic setting of the Containment

Area stratigraphy to a depth of 75-ft. bgs. was obtained from five (5) geotechnical borings conducted on the site by COZ Engineering, LLC on January 25, 2023. The onsite investigation determined that the soils and geology at the site were generally composed of clayey sand and silty sand with varying amounts of gypsum and carbonate indurations from the surface to the total drilled depths. However, it is noted that a layer of fat clay with sand was encountered in Boring B-4 at an approximate depth of 15-ft. bgs.

3.0 DISTANCE TO MUNICIPALITIES AND FRESHWATER FIELDS

Figure 3 demonstrates that the location is not located within incorporated municipal boundaries or within a defined municipal freshwater field covered under a municipal ordinance adopted pursuant to NMSA 1978, Section 3-27-3. *Figure 3* illustrates the following:

1. The closest municipality to the proposed facility is Carlsbad, New Mexico, located approximately 15.75-mi. to the southwest.
2. The closest freshwater field to the proposed facility is the Carlsbad Municipal Water System, located approximately 256-mi. to the southwest.

4.0 DISTANCE TO SUBSURFACE MINES

According to the New Mexico Mining and Minerals Division there are no subsurface mines near the proposed facility. The proposed facility location is not within an area overlying a subsurface mine. *Figure 4* illustrates the following:

1. The nearest registered subsurface mine is the Eddy Potash Mill, actively mining potash. The subsurface potash mine is located approximately 0.95-mi. to the north of the proposed facility location.

5.0 DISTANCE TO HIGH OR CRITICAL KARST AREAS (UNSTABLE AREAS)

The Bureau of Land Management Carlsbad Field Office Cave Potential map was reviewed for the proposed facility. *Figure 5* illustrates the following:

1. The proposed facility is located in a "high" karst potential area.
2. Voids or other evidence of karsting was not observed during an aerial karst survey conducted by Southwest Geophysical Consulting, LLC.

Southwest Geophysical Consulting, LLC conducted an aerial karst survey for the location of the proposed facility. No surface karst features were located during the aerial survey. It is noted that the lack of surface karst features does not indicate there are not karstified areas. However, mitigation is not necessary. Caution should be used during all phases of construction and that any dikes, buffers, or liners installed should be checked regularly for integrity, with repairs made immediately upon discovery. A copy of the "Cave and Karst Resource Inventory Report" prepared by Southwest Geophysical Consulting, LLC is included in *Appendix B*.

6.0 DISTANCE TO 100-YEAR FLOOD PLAIN

The Federal Emergency Management Agency (FEMA) Flood Map Service Center was utilized to review the flood map for the proposed facility location. The proposed facility is located on FEMA flood map panel number 35015C0850D, "Zone X" was effective on 6/4/2010. *Figure 6* demonstrates the area of the site is not located within a 100-year Floodplain.

1. The proposed facility is located within "Zone X." Zone X for the proposed facility is an area of "area of minimal flood hazard."

7.0 DISTANCE TO SURFACE WATER

After review of the Illinois Camp SE, NM, USGS 7.5-Minute Series Topographic map, *Figure 7*, there is no continuously flowing surface waters located on or near the proposed facility. *Figure 7* illustrates the following:

1. No continuously flowing surface waters or other water bodies defined by NMOCD are located on the proposed facility.
2. The closest surface waterbody is Fenton Draw located approximately 6.80-mi. to the southwest.

8.0 DISTANCE TO PERMANENT RESIDENCE OR STRUCTURES

The United States Geological Survey (USGS) Illinois Camp SE, NM, USGS 7.5-Minute Series Topographic Map, *Figure 8*, demonstrates:

1. The proposed facility is not within 1,000-ft. of an occupied permanent residence, school, hospital, institution, church, or other permanent structure.
2. *Figure 8* and *Figure 1 (Site Map*) show that the nearest structure to the proposed facility is an oil tank battery located to the northeast.

9.0 DISTANCE TO NON-PUBLIC WATER SUPPLY

The proposed facility must not be within 500-ft. horizontally of a spring or freshwater well used for domestic or stock watering purposes, in existence at the time of initial application. *Figure 9* demonstrates the following:

1. The proposed facility is not located within 500-ft. horizontally of a spring or freshwater well.
2. The nearest freshwater well or spring used for stock watering purposes is located approximately 0.19-mi. to the northeast of the proposed facility location.
3. No springs were identified within the proposed facility location.

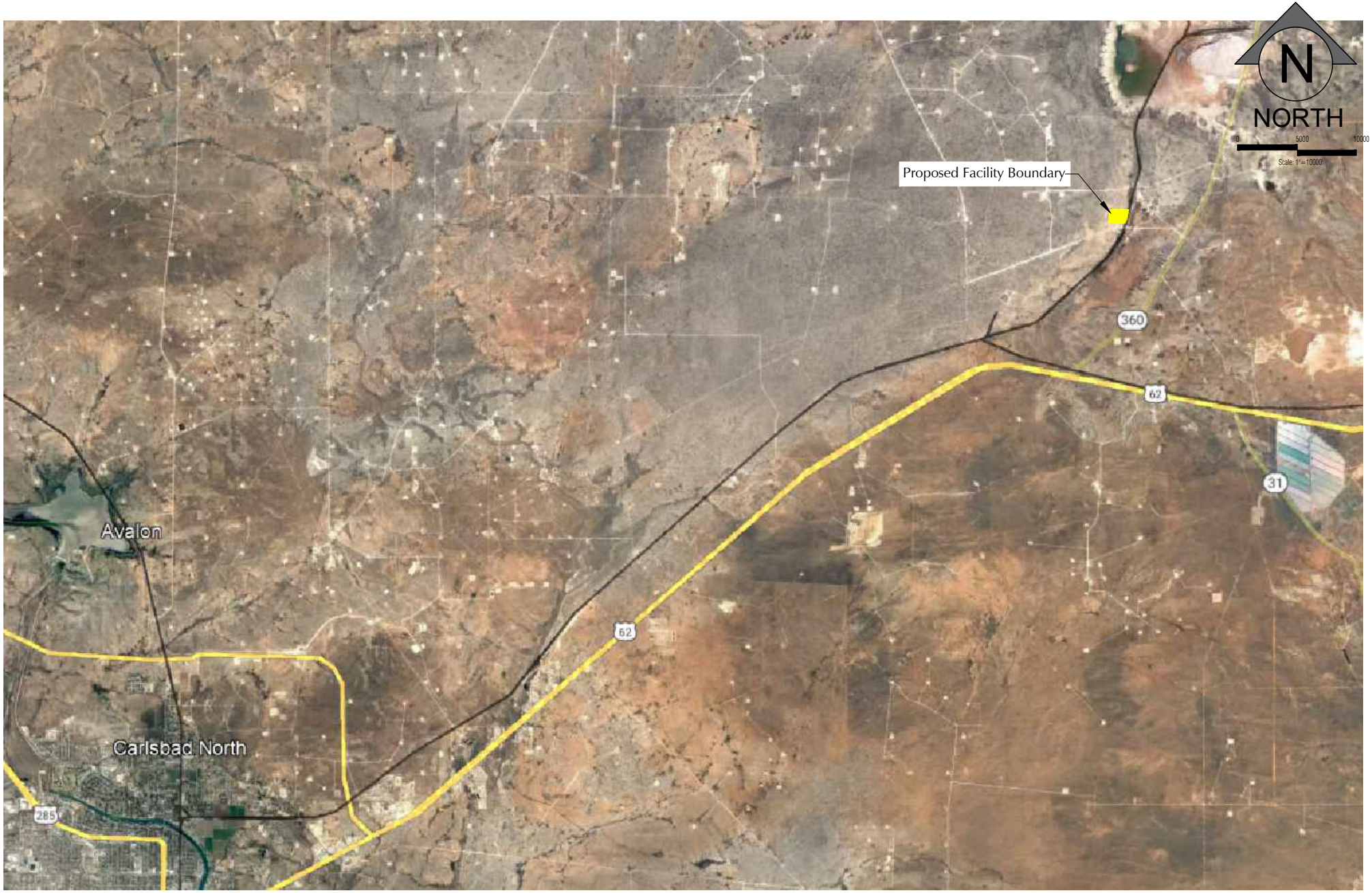
In addition, *Figure 2.1 (Groundwater Wells Map)* illustrates that the proposed facility location is not located within 1,000-ft. of known domestic water wells. There are no identified domestic water wells within a 1.0-mi. radius of the proposed facility location.

10.0 DISTANCE TO WETLANDS

The United States Fish and Wildlife National Wetlands Inventory Maps were reviewed for the area of the proposed facility. *Figure 10* confirms the proposed facility is not located within an area of a potential wetland. In addition, *Figure 10* illustrates the following:

1. The nearest potential wetland is located approximately 0.30-mi. to the east-northeast of the proposed facility location. The potential wetland closest to the proposed facility is labeled as a "freshwater pond" with a wetland code "PUSJ."
2. The National Wetlands Inventory Maps do not show a potential wetland located within 500-ft. of the proposed facility location.

It should be noted the United States Fish and Wildlife Service generates the NWI maps through infrared aerial imagery and aerial photograph interpretation; no actual field reconnaissance was conducted in the making of the maps. As such, the NWI maps do not always accurately identify wetlands or the extent of those wetlands; therefore, the maps are used for preliminary analysis only.



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ENGINEERING
2500 N. Eleventh Street Enid, OK 73701 ● 580.234.8780 ● envirotechconsulting.com
C.A. #1960 - Expiration Date: 6-30-2024

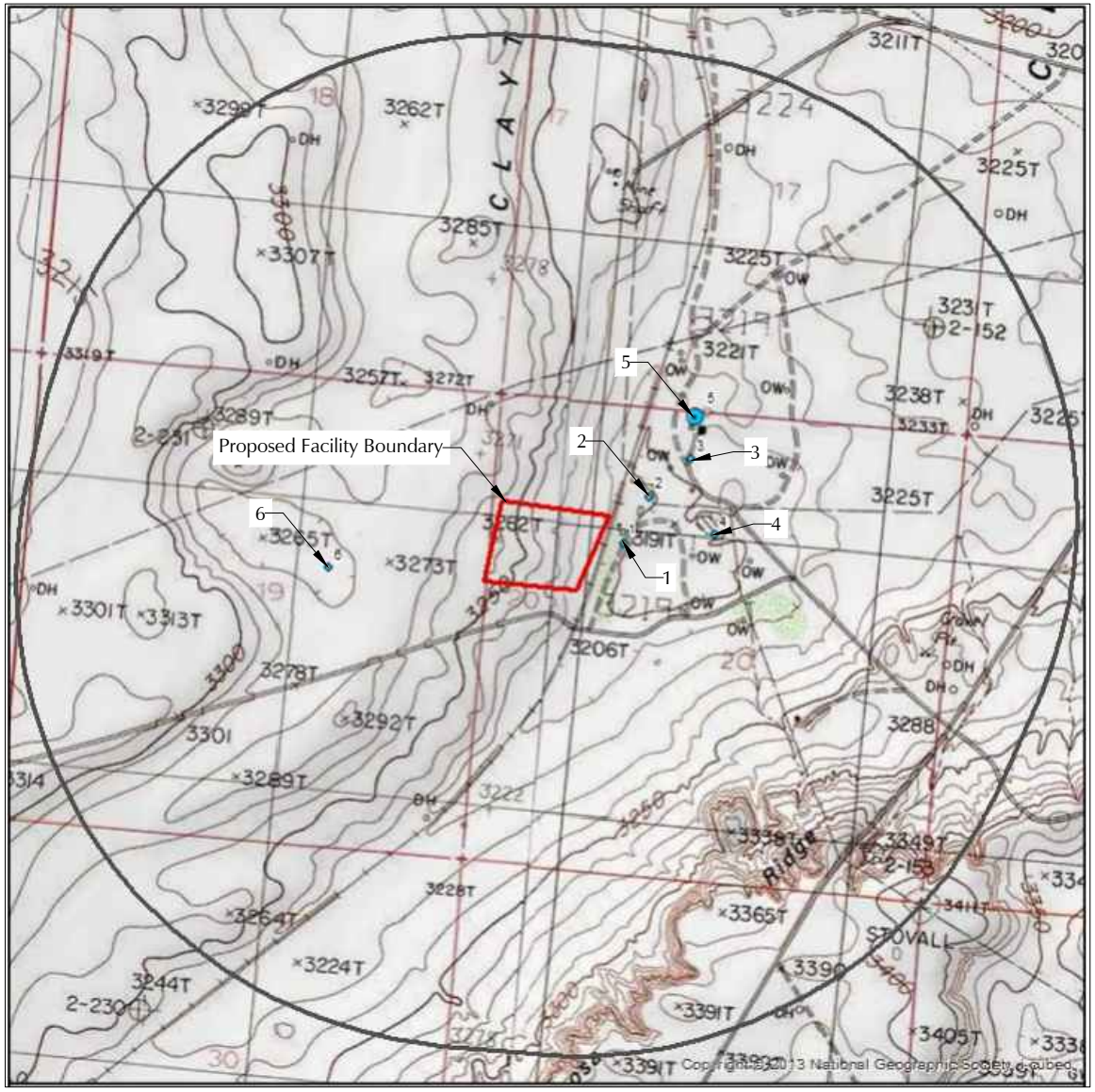
Site Map

Twin Wells Recycle Facility
Section 20, Township 20 South, Range 30 East
Eddy County, New Mexico

WATERBRIDGE

Project No.
23.026-00

Figure 1



Groundwater Well Information

(1) OSE POD id: USGS32334210359501
Well Type: Not Reported
Total Depth: 60-ft.
Depth to Water: N/A
(2) OSE POD id: CP-01910-POD1
Well Type: 72-12-1 Livestock Watering
Total Depth: 80-ft.
Depth to Water: 15-ft.
(3) OSE POD id: USGS323352103594301
Well Type: Not Reported
Total Depth: 90-ft.
Depth to Water: N/A
(4) OSE POD id: USGS323344103593901
Well Type: Not Reported
Total Depth: 50-ft.
Depth to Water: N/A
(5) OSE POD id: C-04592-POD1
Well Type: Not Reported
Total Depth: 56-ft.
Depth to Water: N/A
(5) OSE POD id: CP-01900-POD1
Well Type: Not Reported
Total Depth: 0
Depth to Water: N/A
(6) OSE POD id: CP-01629-POD1
Well Type: Monitoring Well
Total Depth: 141-ft.
Depth to Water: 102-ft.

N
NORTH
0 3750 7500
Scale: 1" = 7500'

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Groundwater Wells Map

Twin Wells Recycle Facility
Section 20, Township 20 South, Range 30 East
Eddy County, New Mexico

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Figure 2.1

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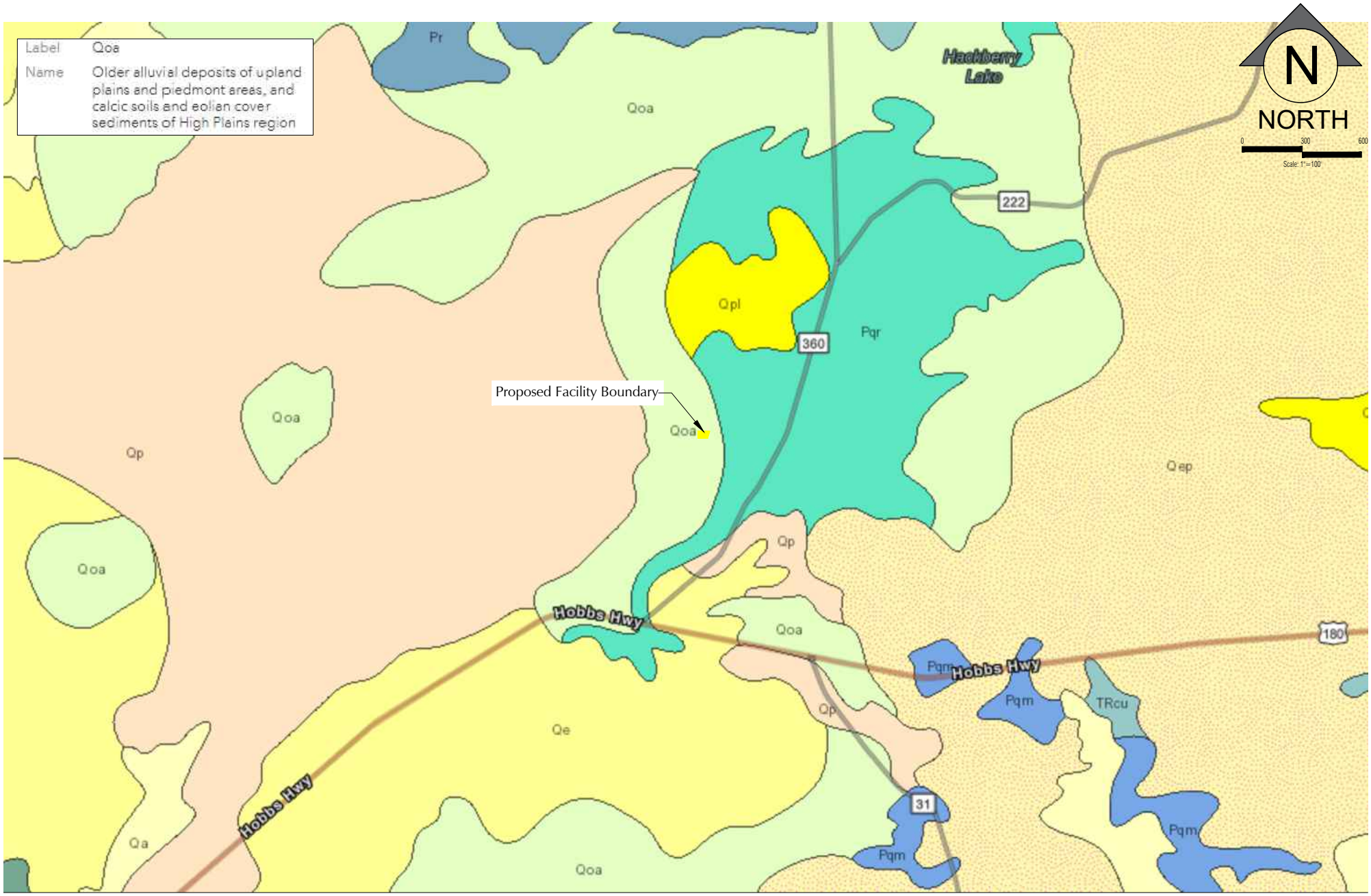
New Mexico Aquifers Map

Twin Wells Recycle Facility
Section 20, Township 20 South, Range 30 East
Eddy County, New Mexico

WATERBRIDGE

Project No.
23.026-00

Figure 2.2



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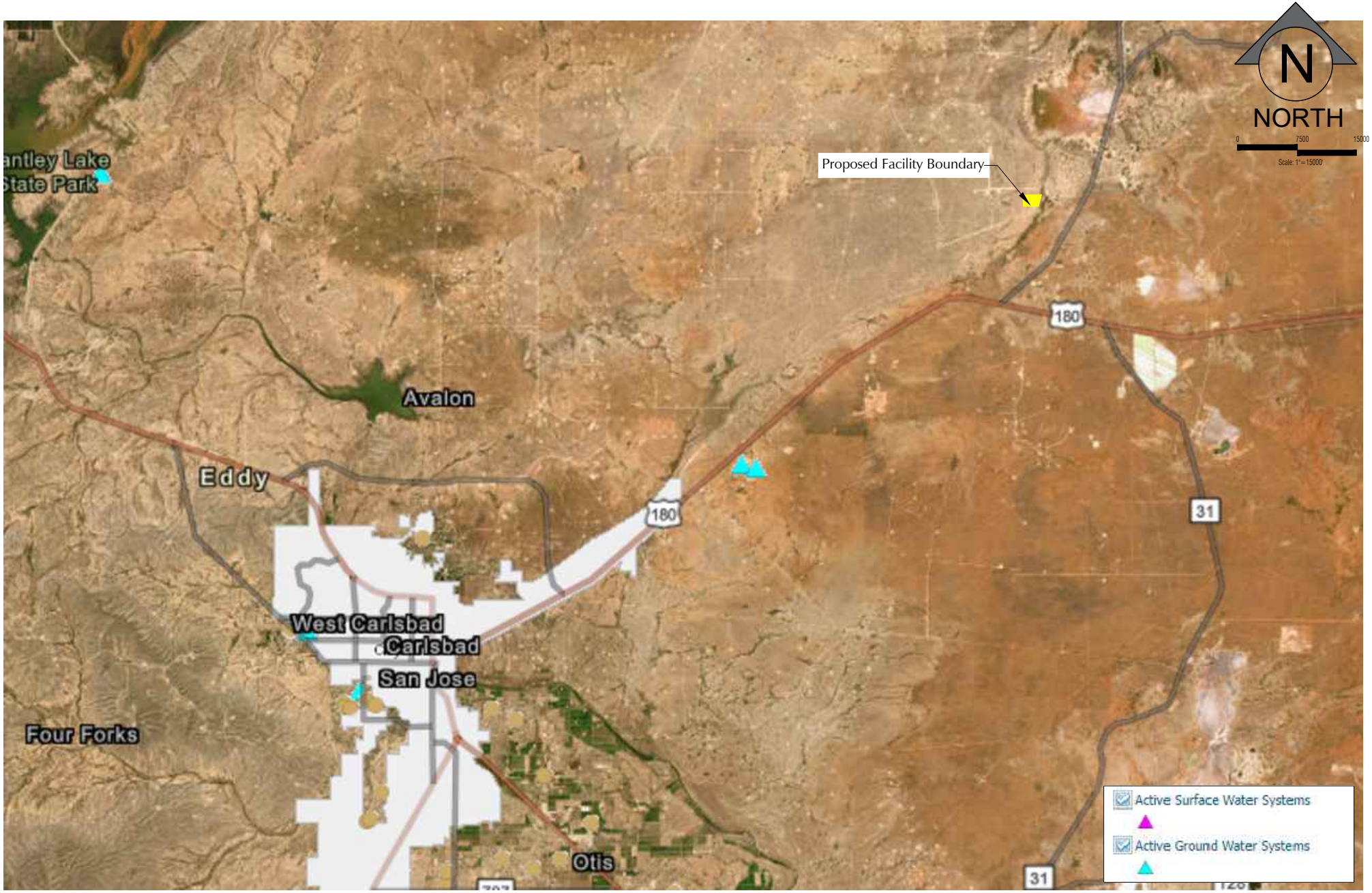
New Mexico Geologic Map

Twin Wells Recycle Facility
Section 20, Township 20 South, Range 30 East
Eddy County, New Mexico

WATERBRIDGE

Project No. 23.026-00

Figure 2.3



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Municipalities & Freshwater Fields Map

Twin Wells Recycle Facility
Section 20, Township 20 South, Range 30 East
Eddy County, New Mexico

WATERBRIDGE

Project No.
23.026-00

Figure 3

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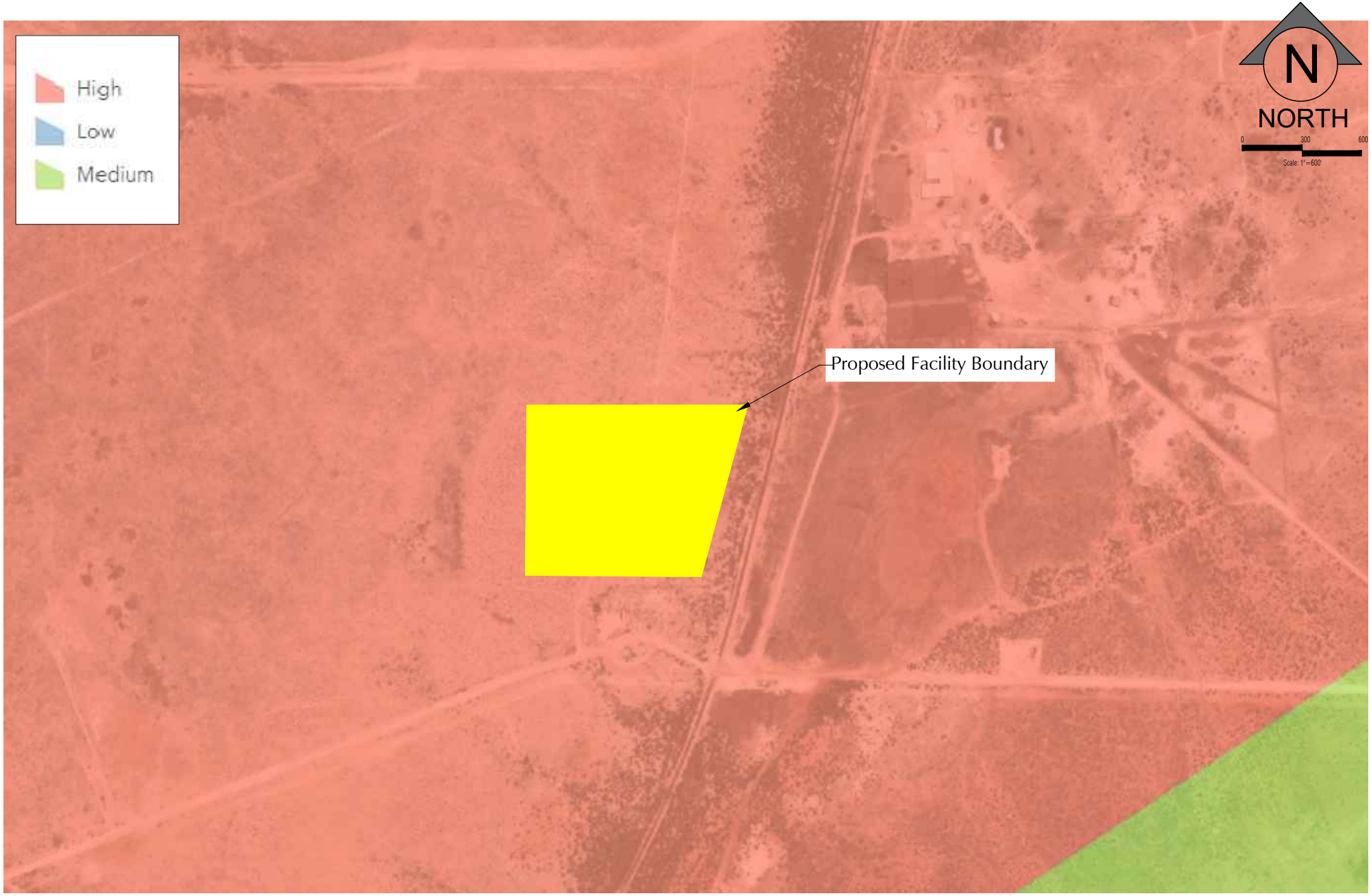
New Mexico Registered Mines Map

Twin Wells Recycle Facility
Section 20, Township 20 South, Range 30 East
Eddy County, New Mexico

WATERBRIDGE

Project No. 23.026-00

Figure 4



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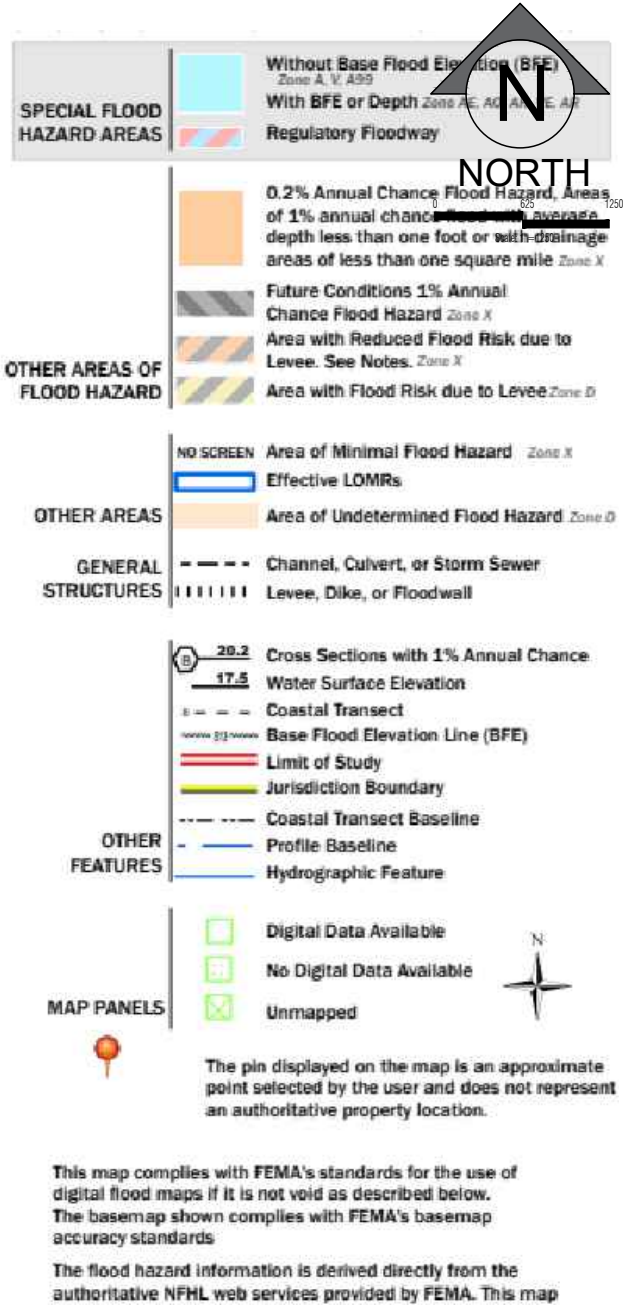
Karst & Cave Potential Map

Twin Wells Recycle Facility
Section 20, Township 20 South, Range 30 East
Eddy County, New Mexico

WATERBRIDGE

Project No.
23.026-00

Figure 5



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FEMA Flood Map

Twin Wells Recycle Facility
Section 20, Township 20 South, Range 30 East
Eddy County, New Mexico

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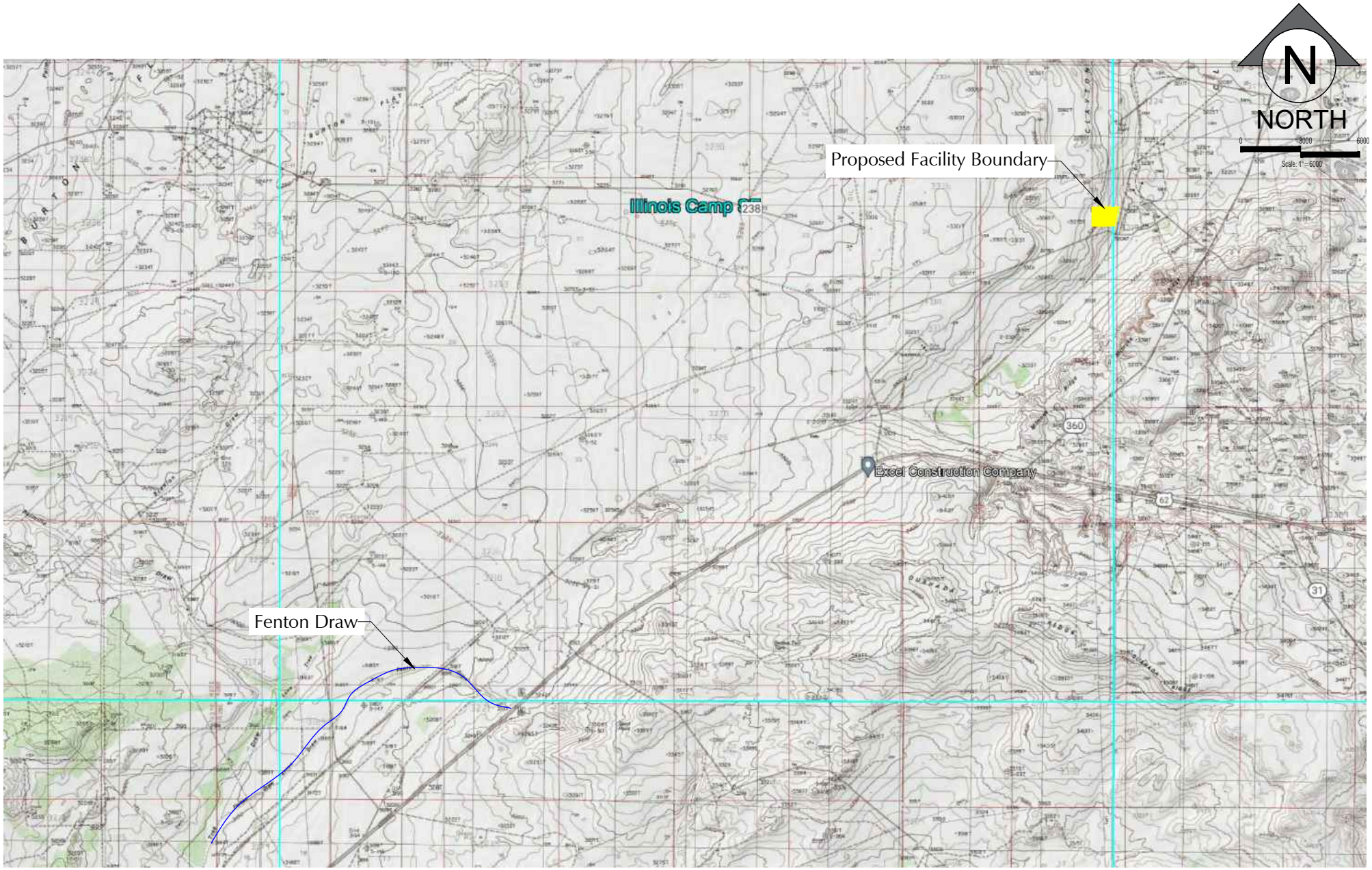
Figure 6



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Surface Water Map

Twin Wells Recycle Facility
Section 20, Township 20 South, Range 30 East
Eddy County, New Mexico

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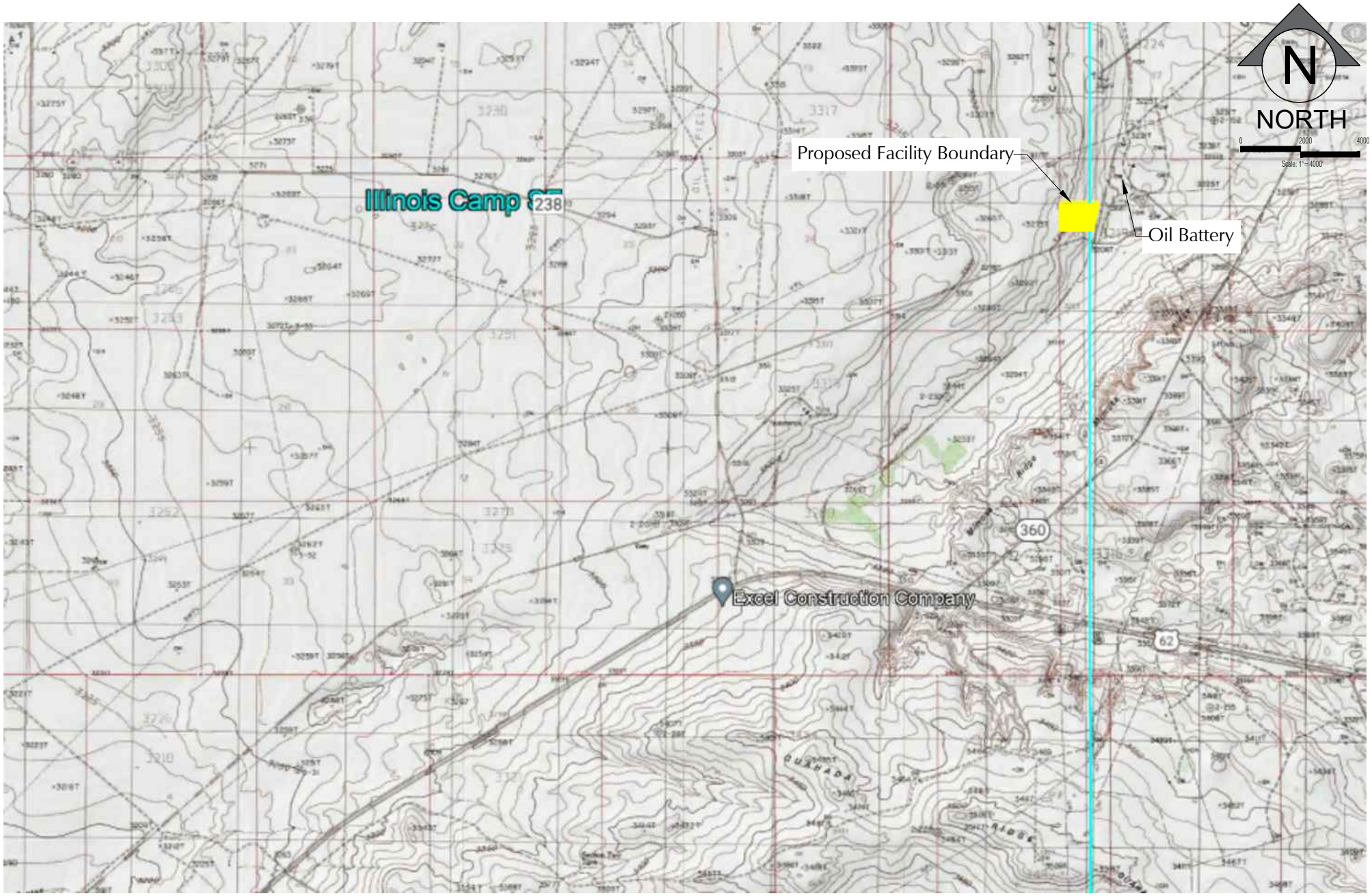
Project No.
23.026-00

Figure 7



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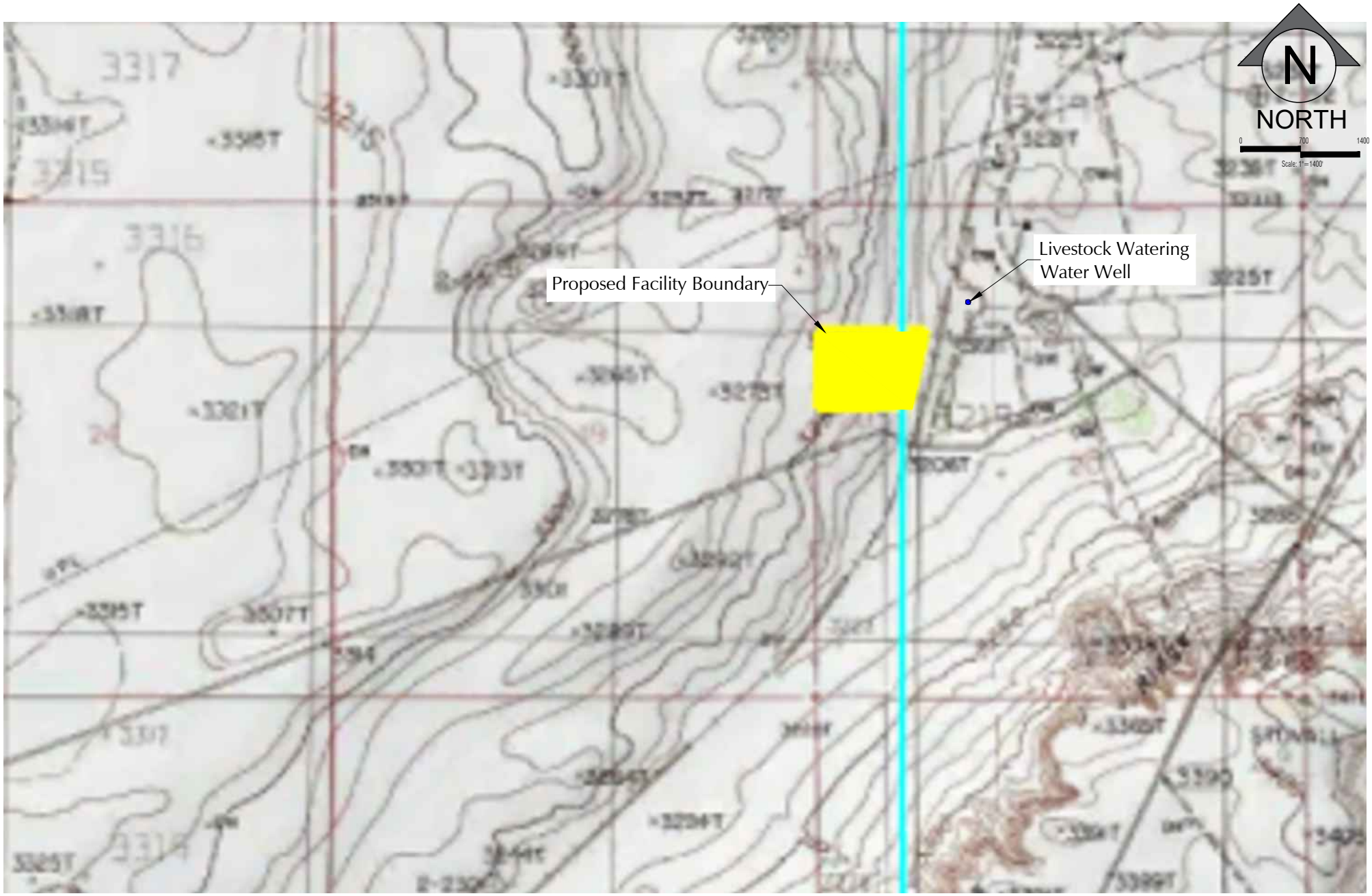
Permanent Residence & Structures Map

Twin Wells Recycle Facility
Section 20, Township 20 South, Range 30 East
Eddy County, New Mexico

WATERBRIDGE

Project No.
23.026-00

Figure 8



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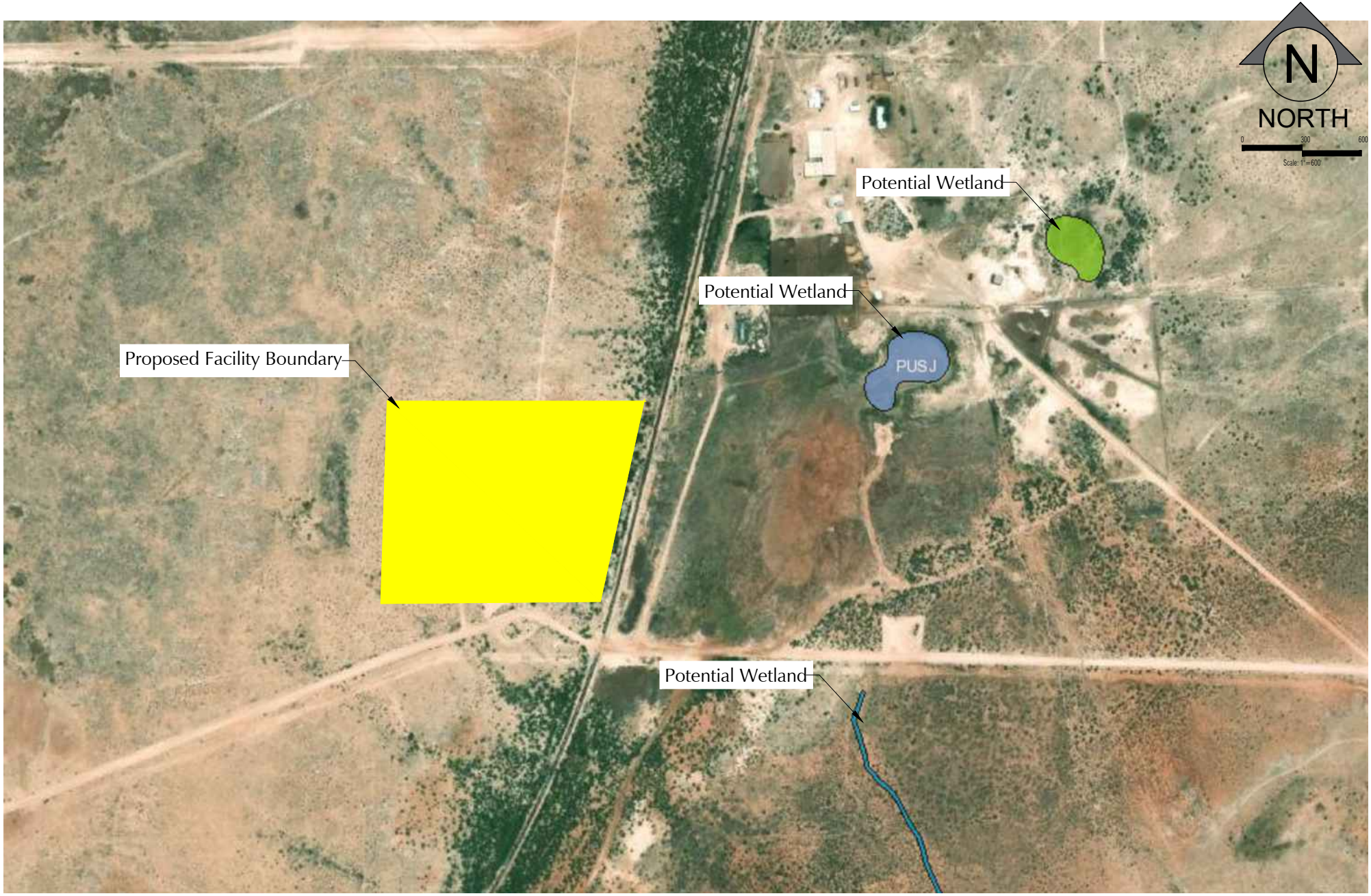
Non-Public Water Supply Map

Twin Wells Recycle Facility
Section 20, Township 20 South, Range 30 East
Eddy County, New Mexico

WATERBRIDGE

Project No.
23.026-00

Figure 9



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NWI Wetlands Map

Twin Wells Recycle Facility
Section 20, Township 20 South, Range 30 East
Eddy County, New Mexico

WATERBRIDGE

Project No.
23.026-00

Figure 10

APPENDIX A

BANKS WATER WELL REPORT

Prepared for:

ENVIROTECH ENGINEERING and CONSULTING, INC
2500 North 11th
Enid, OK 73703

BANKS ENVIRONMENTAL DATA
A DIVISION OF THE BANKS GROUP

Water Well Report

Twin Wells Facility

NM

PO #: 023026

ES-141534

Monday, February 6, 2023

Table of Contents

Banks Environmental Data, Inc. - PO Box 12851 - Austin, TX 78711 - 800.531.5255 P - 512.478.1433 F
www.banksenvdata.com

Geographic Summary

Location
NM
Target location is 0.037 square miles and has a 0.79 mile perimeter

Coordinates	
Longitude & Latitude in Degrees Minutes Seconds	NA
Longitude & Latitude in Decimal Degrees	NA
X and Y in UTM	NA

Elevation
NA

Zip Codes Searched	
Search Distance	**Zip Codes (historical zip codes included)**
Target Property	88210, 88211, 88254, 88255
1 mile	88210, 88211, 88254, 88255

Topos Searched	
Search Distance	**Topo Name**
Target Property	Illinois Camp SE (1985), Tower Hill North (1985)
1 mile	Tower Hill North (1985), Illinois Camp SE (1985)

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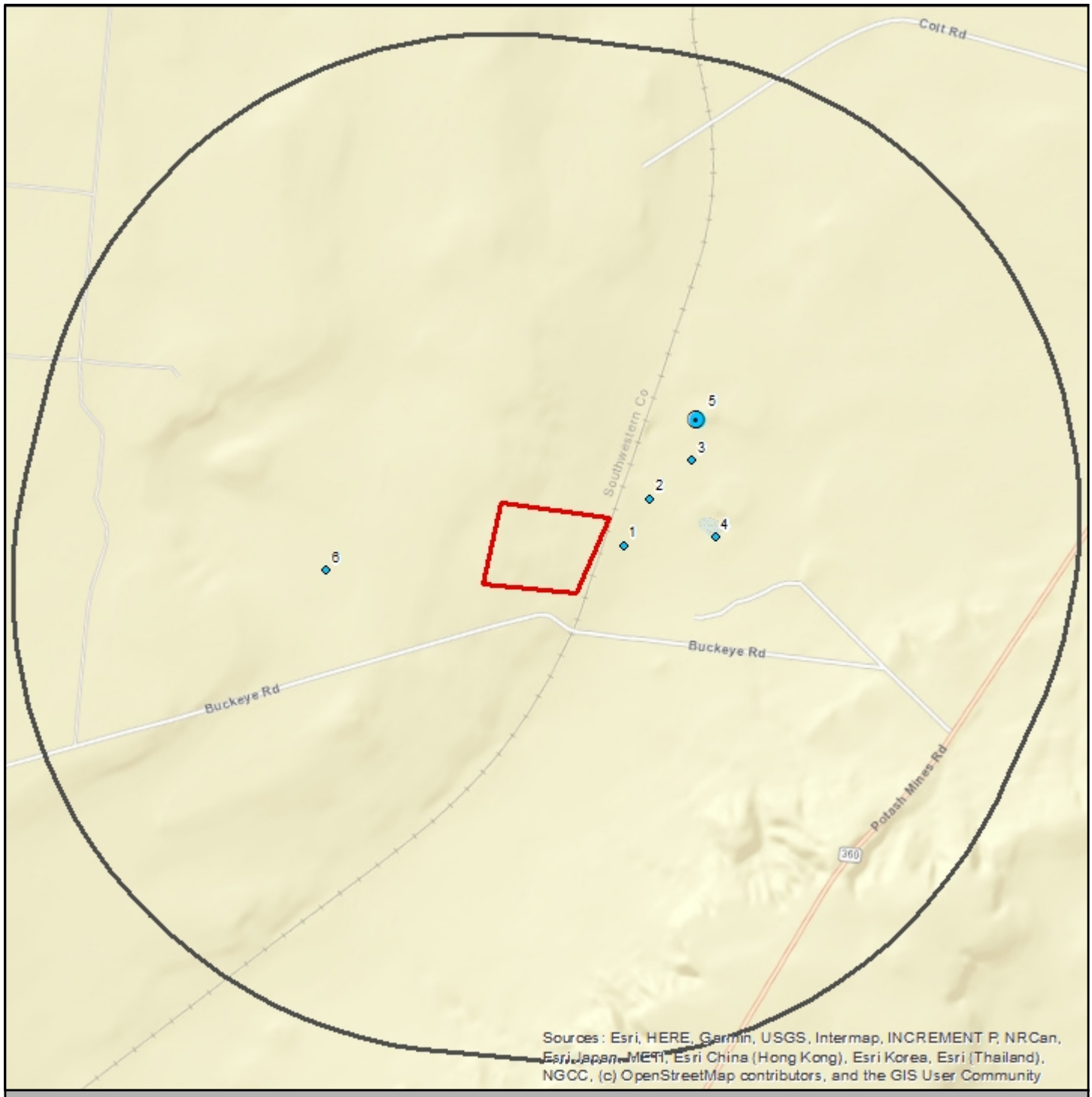
Summary Map - 1 Mile Buffer



Twin Wells Facility

Well
Well Cluster
Target Property
Search Buffer

1 : 19,500
1 inch = 0.308 miles
1 inch = 1625 feet
1 centimeter = 0.195 kilometers
1 centimeter = 195 meters

N

Lambert Conformal Conic Projection
1983 North American Datum
First Standard Parallel: 33 0' 00" North
Second Standard Parallel: 45 0' 00" North
Central Meridian: 96 0' 00" West
Latitude of Origin: 39 0' 00" North

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Topographic Overlay Map - 1 Mile Buffer

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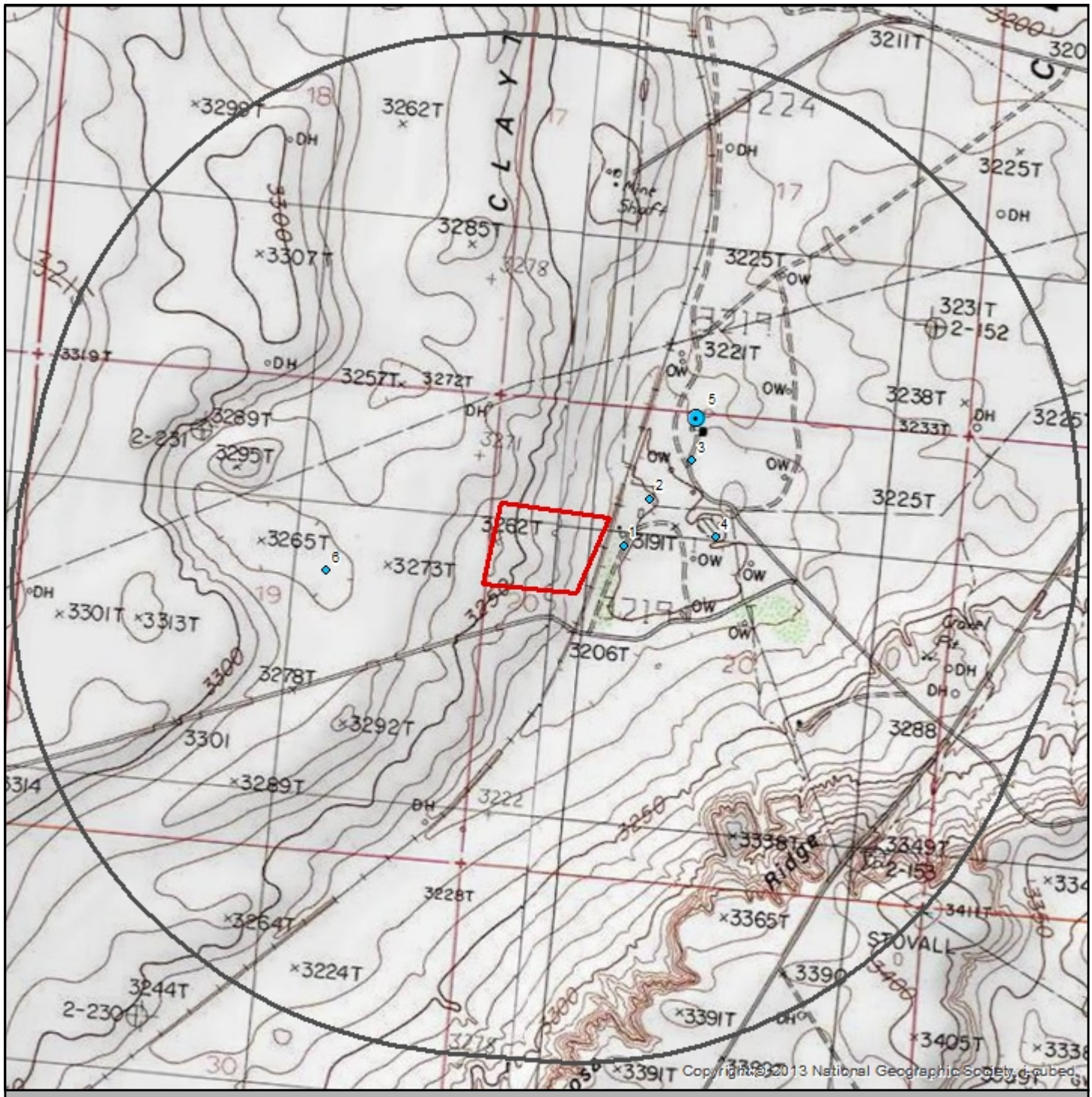

Twin Wells Facility

- Well
- Well Cluster
- Target Property
- Search Buffer

Target Property Quad Name(s)
See Geographic Summary page for list

1 : 19,500
1 inch = 0.308 miles
1 inch = 1625 feet

Lambert Conformal Conic Projection
1983 North American Datum
First Standard Parallel: 33 0' 00" North
Second Standard Parallel: 45 0' 00" North
Central Meridian: 96 0' 00" West
Latitude of Origin: 39 0' 00" North

N

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Current Imagery Overlay Map - 1 Mile Buffer

BANKS ENVIRONMENTAL DATA
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Twin Wells Facility

Well
Well Cluster
Target Property
Search Buffer

1 : 21,000
1 inch = 0.331 miles
1 inch = 1750 feet
1 centimeter = 0.210 kilometers
1 centimeter = 210 meters

N

Lambert Conformal Conic Projection
1983 North American Datum
First Standard Parallel: 33 0' 00" North
Second Standard Parallel: 45 0' 00" North
Central Meridian: 96 0' 00" West
Latitude of Origin: 39 0' 00" North

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Water Well Details

BANKS ENVIRONMENTAL DATA
A DIVISION OF THE BANKS GROUP

Map ID	Source ID	Dataset	Owner of Well	Type of Well	Depth Drilled	Completion Date	Longitude	Latitude	Elevation	Driller's Logs
1	USGS3233 421035951 01	USGS WW	USGS	Not Reported	60	N/A	-103.998	32.5618	3205 ft	N/A
2	CP-01910-POD1	NM WW	TWIN WELLS RANCH	72-12-1 LIVESTOCK WATERING	80	8/16/2022	-103.9972	32.5633	3203 ft	Log
3	USGS3233 521035943 01	USGS WW	USGS	Not Reported	90	N/A	-103.9958	32.5646	3205 ft	N/A
4	USGS3233 441035939 01	USGS WW	USGS	Not Reported	50	N/A	-103.9947	32.5623	3201 ft	N/A
5	C-04592-POD1	NM WW	TWIN WELLS RANCH LLC	Not Reported	56	00000000	-103.9957	32.5659	3215 ft	N/A
5	CP-01900-POD1	NM WW	TWIN WELLS RANCH LLC	Not Reported	0	00000000	-103.9957	32.5659	3215 ft	Application
6	CP-01629-POD1	NM WW	INTREPID POTASH NEW MEXICO LLC	MONITORIN G WELL	141	10/31/2016	-104.008731	32.560227	3271 ft	Log

Well Summary

Water Well Dataset	# of Wells
NM WW	4
USGS WW	3
Total Count	**7**

Dataset Descriptions and Sources

BANKS ENVIRONMENTAL DATA
A DIVISION OF THE BANKS GROUP

Dataset	Source	Dataset Description	Update Schedule	Data Requested	Data Obtained	Data Updated	Source Updated
NM WW - New Mexico Water Wells	New Mexico Office of the State Engineer	This WATERS dataset contains all groundwater records and water rights applications compiled by New Mexico Office of the State Engineer (OSE). OSE is in the process of digitizing all records, all wells have not yet been plotted.	Quarterly	01/14/2023	01/14/2023	02/03/2023	10/26/2022
NM WW HIST - New Mexico Historical Water Wells	New Mexico Office of the State Engineer	This dataset contains all groundwater records found at the New Mexico Office of the State Engineer Water Rights Division district office. Groundwater rights are administered and filed at the district level: Albuquerque (District I), Roswell (District II),		N/A	N/A	N/A	N/A
USGS WW - USGS Water Wells	U.S. Geological Survey	This dataset contains groundwater well records from the U.S. Geological Survey.	Semi-annually	10/11/2022	10/11/2022	10/18/2022	10/11/2022

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).
POD 1	21111	CP-01910

WELL OWNER NAME(S)	PHONE (OPTIONAL)
Twin Wells Ranch-Steve McCutcheon	

WELL OWNER MAILING ADDRESS	CITY	STATE	ZIP
PO Box 3175	Carlsbad	NM	88221

WELL LOCATION (FROM GPS)		DEGREES	MINUTES	SECONDS	
	LATITUDE	32	33	47.93	N
	LONGITUDE	103	59	49.94	W

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

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

2. DRILLING & CASING INFORMATION

LICENSE NO.	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD1058	GARY KEY	KEY'S DRILLING & PUMP SERVICE, INC

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
08/09/22	08/16/22	80	80	15

COMPLETED WELL IS: ☐ ARTESIAN ☐ DRY HOLE ☑ SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT): 15

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)
-2	20	16"	STEEL		10"	.375	
-2	80	9-7/8"	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	16"	CEMENT		TREMIE
15	80	9-7/8"	PEA GRAVEL		HAND
				OSE DIT SEP 14 2022 AM 11:54	

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

FILE NO. CP-1910-POD 1	POD NO. 1	TRN NO. 729527
LOCATION STK 20.30.20.321	WELL TAG ID NO. 21111	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	TOP SOIL-ENCOUNTERED OIL (DRY)	Y ✔ N	
5	30	25	BROWN CLAY & SAND/H20 AT 15fT	✔ Y N	150.00
30	37	7	GRAVEL - LOTS OF OIL (WET)	✔ Y N	100.00
37	80	43	MULTI COLORED SANDSTONE	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	
				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): 250.00

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:

CASEY KEY

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:

GARY KEY — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

9/13/2022 — DATE

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

FILE NO. CP-1910-POD 1	POD NO. 1	TRN NO. 729527	
LOCATION STK 20.30.20.321		WELL TAG ID NO. 21111	PAGE 2 OF 2

File No. CP-1900

NEW MEXICO OFFICE OF THE STATE ENGINEER

APPLICATION FOR PERMIT TO USE UNDERGROUND WATERS IN ACCORDANCE WITH SECTIONS 72-12-1.1, 72-12-1.2, OR 72-12-1.3 NEW MEXICO STATUTES

For fees, see State Engineer website: http://www.ose.state.nm.us/

1. APPLICANT(S)

Name: Twin Wells Ranch LLC.	Name:
Contact or Agent: check here if Agent ☐ Steve McCutcheon	Contact or Agent: check here if Agent ☐
Mailing Address: P. O. Box 3175	Mailing Address:
City: Carlsbad	City:
State: NM Zip Code: 88220	State: Zip Code:
Phone: ☐ Home ■ Cell Phone (Work): 575 706 7068	Phone: ☐ Home ☐ Cell Phone (Work):
E-mail (optional): daggerdrawranchnm@gmail.com	E-mail (optional):

■ Check here if existing well. Enter OSE File No. _____

2. WELL LOCATION **Required: Coordinate location must be New Mexico State Plane (NAD 83), UTM (NAD 83), or Lat/Long (WGS84). District II (Roswell) and District VII (Cimarron) customers, provide a PLSS location in addition to above.**

NM State Plane (NAD83) - In feet	NM West Zone ☐ NM Central Zone ☐ NM East Zone ☐	X (in feet): Y (in feet):					
UTM (NAD83) - In meters	UTM Zone 13N ☐ UTM Zone 12N ☐	Easting (in meters): Northing (in meters):					
Lat/Long (WGS84) - To 1/10th of second ☐ Check if seconds are decimal format	Lat:	32	deg	33	min	57.24	sec
	Long:	103	deg	59	min	44.60	sec

Other Location Information (complete the below, if applicable):
PLSS Quarters or Halves: NE-NE-NW Section: 20 Township: 20S Range: 30E

County: Eddy

Land Grant Name (if applicable):

Lot No: Block No: Unit/Tract: Subdivision:

Hydrographic Survey: Map: Tract:

Other description relating well to common landmarks, streets, or other:
Twin Wells Ranch head quarters off of Buck Eye road.

OSE DII FEB 1 2022 PM3:16

Well is on Land Owned by (Required): Twin Wells Ranch LLC

FOR OSE INTERNAL USE Application for Permit, Form wr-01, Rev 10/29/2020

File No.: CP-1900	Trn. No.: 718298	Receipt No.: Z-44487
Well Tag ID No. (if applicable): —	Sub-Basin: CP	Log Due Date: —

3. PURPOSE OF USE

- [x] Domestic use for one household
- [x] Livestock watering
- [ ] Domestic use for more than one household. Number of households _____ Complete and attach form WR-01m "MULTIPLE home-owner info"
- [ ] Drinking and sanitary uses that are incidental to the operations of a governmental, commercial, or non-profit facility
- [ ] Prospecting, mining or drilling operations to discover or develop natural resources
- [ ] Construction of public works, highways and roads
- [ ] Domestic use for one household and livestock watering
- [ ] Domestic use for multiple households and livestock watering _____ Complete and attach form WR-01m "MULTIPLE home-owner info"
- [ ] Domestic well to accompany a house or other dwelling unit constructed for sale
- [ ] New well (with new purpose)
- [ ] Amend purpose of use on existing well
- [ ] No change in purpose

4. WELL INFORMATION: CHECK THOSE THAT APPLY [x] Existing Well [ ] Known Artesian

File Information: (If existing well, provide OSE no. & indicate below if well is to be replacement, repaired or deepened, or supplemental. If new well, leave blank, as OSE must assign no.)

OSE Well No.(If Existing)	New Well No. (provided by OSE)
Well Driller Name:	**Well Driller License Number:**
Approximate Depth of Well (feet):	Outside Diameter of Well Casing (inches):

[ ] Replacement well (List all existing wells if more than one):	[ ] Repair or Deepen: [ ] Clean out well to original depth [ ] Deepen well from _____ to _____ ft. [ ] Other (Explain):	[ ] Supplemental well (List OSE No. for all wells this will supplement):

5. ADDITIONAL STATEMENTS OR EXPLANATIONS (Use additional sheets if necessary)

Existing well drilled in the early fifties. Well never registered. Ranch would like to register the well. Static depth 32.5 Total depth 55.5.

ACKNOWLEDGEMENT

I, We (name of applicant(s)), Twin Wells Ranch LLC
Print Name(s)

affirm that the foregoing statements are true to the best of (my, our) knowledge and belief.

Applicant Signature

Applicant Signature

OSE DII FEB 1 2022 PM3:15

ACTION OF THE OFFICE OF THE STATE ENGINEER (FOR OSE USE ONLY)

This application is approved subject to the attached general and specific conditions of approval.

Witness my hand and seal this 8th day of Feb 20 22, for the New Mexico State Engineer,

By: _____ Claudia K. Guillen
Signature Print

FOR OSE INTERNAL USE

Well Tag ID Issued? [ ] Yes [x] No

Application for Permit, Form wr-01, Rev 10/29/2020

File No.: CP-1900 No.: 718298 Well ID Tag No.: —

NEW MEXICO STATE ENGINEER OFFICE
APPLICATION FOR PERMIT TO USE UNDERGROUND WATERS
IN ACCORDANCE WITH SECTION 72-12-1 NEW MEXICO STATUTES

GENERAL CONDITIONS OF APPROVAL (A thru S)

17-A The maximum combined diversion of all wells that may be appropriated under this permit is 3.000 acre-feet in any year (One acre-foot equals 325,851 gallons).

17-B The well shall be drilled by a driller licensed in the State of New Mexico in accordance with 72-12-12 NMSA 1978. A licensed driller shall not be required for the construction of a well driven without the use of a drill rig; provided that the casing shall not exceed two and three-eighths (2 3/8) inches outside diameter.

17-C The well driller must file the well record with the State Engineer and the applicant within 30 days after the well is drilled or driven. It is the well owner's responsibility to ensure that the well driller files the well record. The well driller may obtain the well record form from any District Office or the Office of the State Engineer website.

17-D The production casing shall not exceed 7 inches outside diameter except under specific conditions in which reasons satisfactory to the State Engineer are shown.

17-E To request a change to the purpose of use of water authorized under this permit, the permittee shall file an application with the State Engineer.

17-F An application for a new 72-12-1.1 NMSA 2003 domestic well permit where the proposed point of diversion is to be located on the same legal lot of record as an operational 72-12-1.1 NMSA domestic well shall be treated as an application for a supplemental well and the combined diversion may not exceed the maximum annual diversion permitted.

17-G If artesian water is encountered, the well driller shall comply with all rules and regulations pertaining to the drilling and casing of artesian wells.

17-H The drilling of the well and amount and uses of water permitted are subject to such limitations as may be imposed by a court or by lawful municipal or county ordinance which are more restrictive than the conditions of this permit and applicable State Engineer regulations.

Trn Desc: CP 01900 POD1 File Number: CP 01900
Log Due Date: Trn Number: 718298
Form: wr-01

NEW MEXICO STATE ENGINEER OFFICE
APPLICATION FOR PERMIT TO USE UNDERGROUND WATERS
IN ACCORDANCE WITH SECTION 72-12-1 NEW MEXICO STATUTES

GENERAL CONDITIONS OF APPROVAL (Continued)

17-I The permittee shall utilize the highest and best technology available to ensure conservation of water to the maximum extent practical.

17-J The well shall be set back a minimum of 50 ft. from an existing well of other ownership unless a variance has been granted by the State Engineer. The State Engineer may grant a variance for a replacement well or to allow for maximum spacing of the well from a source of groundwater contamination. The well shall be set back from potential sources of contamination in accordance with federal, state, and local requirements.

17-K Pursuant to section 72-8-1 NMSA 1978, the permittee shall allow the State Engineer and OSE representatives entry upon private property for the performance of their respective duties, including access to the ditch or acequia to measure flow and also to the well for meter reading and water level measurement.

17-L The permit is subject to cancellation for non-compliance with the conditions of approval or if otherwise not exercised in accordance with the terms of the permit.

17-M The right to divert water under this permit is subject to curtailment by priority administration as implemented by the State Engineer or a court.

17-N In the event of any change of ownership to this permit the new owner shall file a change of ownership form with the State Engineer in accordance with Section 72-1-2.1 NMSA 1978.

17-O This well permit shall automatically expire unless the well is completed and the well record is filed with the State Engineer within one year of the date of issuance of the permit.

17-P The well shall be constructed, maintained, and operated to prevent inter-aquifer exchange of water and to prevent loss of hydraulic head between hydrogeologic zones.

17-Q The State Engineer retains jurisdiction over this permit.

Trn Desc: CP 01900 POD1 File Number: CP 01900
Log Due Date: Trn Number: 718298
Form: wr-01 page: 2

NEW MEXICO STATE ENGINEER OFFICE
APPLICATION FOR PERMIT TO USE UNDERGROUND WATERS
IN ACCORDANCE WITH SECTION 72-12-1 NEW MEXICO STATUTES

GENERAL CONDITIONS OF APPROVAL (Continued)

17-R The State Engineer shall supply a well identification tag for the well driller to firmly affix to the well casing or cap with a steel band upon completion in accordance with Subsection M of 19.27.4.29 NMAC.
The permit holder is responsible for maintaining the well identification tag.

Well Tag(s) associated with this permit:

GENERAL CONDITIONS OF APPROVAL (A thru S)

17-S Construction of a water well by anyone without a valid New Mexico Well Driller License is illegal, and the landowner shall bear the cost of plugging the well by a licensed New Mexico well driller. This does not apply to driven wells, the casing of which does not exceed two and three-eighths inches outside diameter.

SPECIFIC CONDITIONS OF APPROVAL

17-S Construction of a water well by anyone without a valid New Mexico Well Driller License is illegal, and the landowner shall bear the cost of plugging the well by a licensed New Mexico well driller. This does not apply to driven wells, the casing of which does not exceed two and three-eighths inches outside diameter.

17-10 Total diversion from all wells under this permit number shall not exceed 3.000 acre-feet per annum.

17-19 This permit authorizes the diversion of water for domestic use to serve a single household and livestock. The maximum combined total diversion of water under this permit shall not exceed 3.000 acre-feet per year.

Trn Desc: CP 01900 POD1 File Number: CP 01900
Log Due Date: Trn Number: 718298
Form: wr-01 page: 3

NEW MEXICO STATE ENGINEER OFFICE
APPLICATION FOR PERMIT TO USE UNDERGROUND WATERS
IN ACCORDANCE WITH SECTION 72-12-1 NEW MEXICO STATUTES

ACTION OF STATE ENGINEER

This application is approved for the use indicated, subject to all general conditions and to specific conditions listed above.

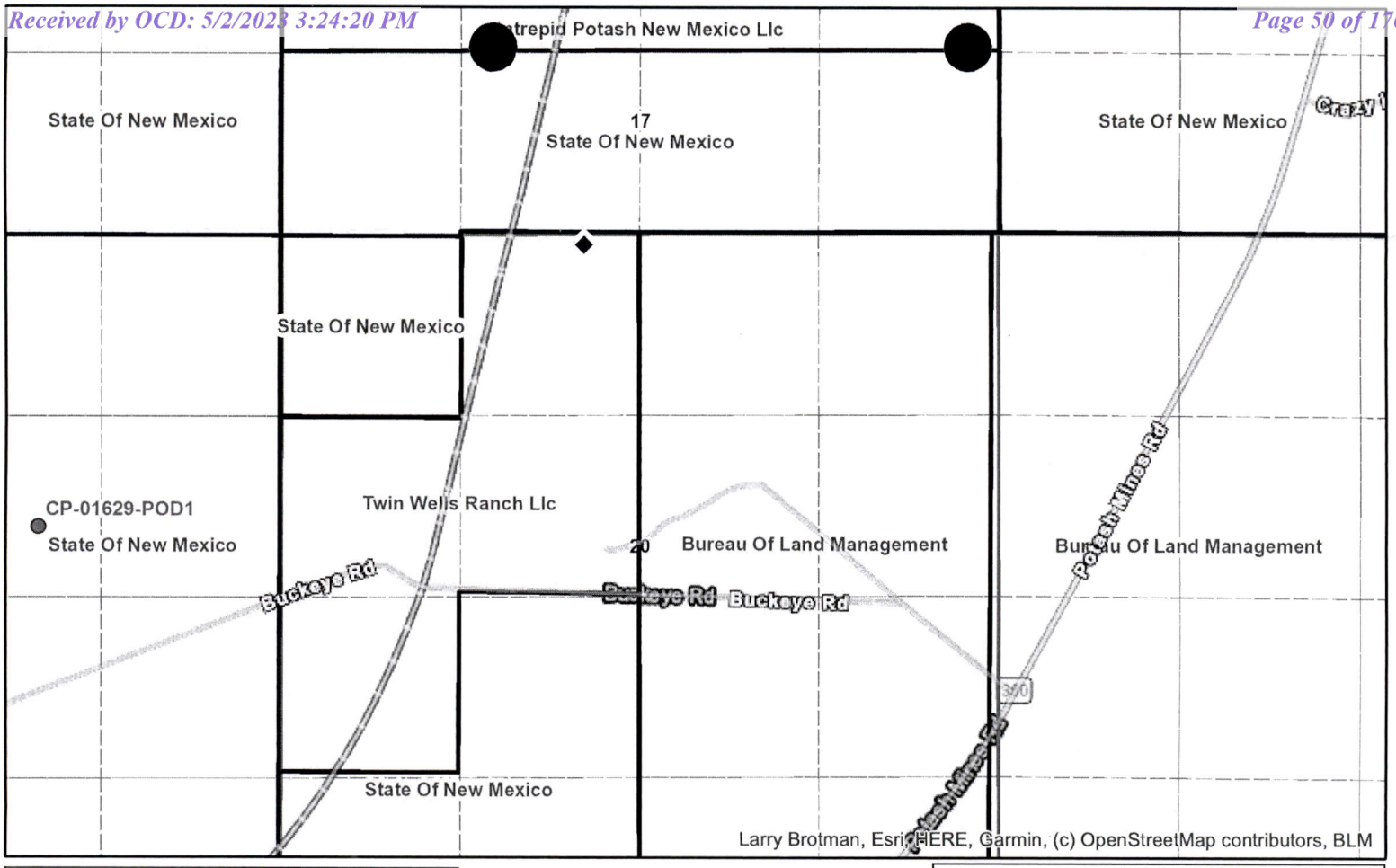
Witness my hand and seal this 08 day of Feb A.D., 2022

Mike A. Hamman, P.E., State Engineer

By: CLAUDIA GUILLEN

Trn Desc: CP 01900 POD1
Log Due Date:
Form: wr-01

File Number: CP 01900
Trn Number: 718298



Coordinates

UTM - NAD 83 (m) - Zone 13

Easting 594275.080

Northing 3603608.415

State Plane - NAD 83 (f) - Zone E

Easting 645348.138

Northing 569768.098

Degrees Minutes Seconds

Latitude 32 : 33 : 57.240000

Longitude -103 : 59 : 44.600000

Location pulled from Coordinate Search

NEW MEXICO OFFICE OF THE STATE ENGINEER

1:18,056

mi

0 0.05 0.1 0.2

N

GUILLEN 2/8/2022

Office of the State Engineer

Interstate Stream Commission

Spatial Information

County: Eddy

Groundwater Basin: Capitan

Abstract Area: Capitan

Land Grant:
Not in Land Grant

Restrictions:

NA

PLSS Description

NWNENENW Qtr of Sec 20 of 020S 030E

Derived from CADNSDI- Qtr Sec. locations are calculated and are only approximations

Parcel Information

UPC/DocNum: 4176118132199

Parcel Owner: Twin Wells Ranch Llc

Address: 294-1 Buckeye Road Carlsbad 88220

Legal: Quarter: Nw S: 20 T: 20S R: 30E E2Nw4, Swnw4
Quarter: Sw S: 20 T: 20S R: 30E Nwsw4

POD Information

Owner: TWIN WELLS RANCH LLC

File Number: CP-1900 POD 1

POD Status: NoData

Permit Status: NoData

Permit Use: NoData

Purpose: DOM-STK

◆ Coord Search Location

GIS WATERS PODs

● Active

Eddy County Parcels 2021

Lea County Parcels 2021

Lincoln County Parcels 2021

BLM Land Grant

PLSSTownship

PLSSFirstDiv...

PLSSSecond...

Mike A. Hamman, P.E.
State Engineer

Roswell Office
1900 WEST SECOND STREET
ROSWELL, NM 88201

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER

Trn Nbr: 718298
File Nbr: CP 01900

Feb. 08, 2022

STEVE MCCUTCHEON
TWIN WELLS RANCH LLC
PO BOX 3175
CARLSBAD, NM 88220

Greetings:

Enclosed is your copy of the above numbered permit that has been approved in accordance with NM Statute Section 72-12-1 subject to the conditions set forth on the approval page.

Carefully review the attached conditions of approval for these specific permit requirements:

* The applicant is responsible for providing the contracted driller with the permit Conditions of Approval and the enclosed well identification tag (if applicable), which must be firmly affixed to the well casing or cap.
* If metering is required, a meter report form must be properly completed and submitted to this office upon installation.
* The well record and log must be submitted within 30 days of the completion of the well or if the attempt was a dry hole. When conditions require a replaced well be plugged, a plugging record must be properly completed and submitted to this office within 30 days of plugging.
* This permit expires and will be cancelled if no well is drilled and/or a well log is not received by the date set forth in the conditions of approval.

Appropriate forms can be downloaded from the OSE website www.ose.state.nm.us or will be mailed upon request.

Sincerely,

Claudia Guillen
(575)622-6521

Enclosure

wr_01app

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER)	OSE FILE NUMBER(S)
EXPL-POD 1-Monitor	CP-1629
WELL OWNER NAME(S)	PHONE (OPTIONAL)
Intrepid Potash - New Mexico LLC	
WELL OWNER MAILING ADDRESS	CITY / STATE / ZIP
707 17th Street, Suite 4200	Denver / CO / 80202

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	33	36.8	N
LONGITUDE	104	00	31.4	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

SW4NEA, Sec19, T205, R30E Eddy County, NM

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1210	Bryan Nydoske	

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
10-4-16	10-31-16	141	146	97

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

STATIC WATER LEVEL IN COMPLETED WELL (FT): 102

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

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

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	105	7 5/8	PVC Casing	PVC Flush Thread	2.864	0.3	
105	125	7 5/8	PVC Screen	PVC Flush Thread	2.864	0.3	.020
125	135	7 5/8	PVC Casing	PVC Flush Thread	2.864	0.3	

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	23	7 5/8	Portland Cement	47.5 Gal	triemed
23	84.3	7 5/8	High solids bentonite grout	132 Gal	Triemed
84.3	89.6	7 5/8	Bentonite Chips	2	Triemed
89.6	94.6	7 5/8	20/40 Sand	4	Triemed
94.6	141	7 5/8	8/12 Sand	25	Triemed
141	146	7 5/8	Bentonite Chips	2.5	Triemed

STATE ENGINEER OFFICE ROSWELL, NEW MEXICO 2016 DEC 1 PM 2 31

FOR OSE INTERNAL USE

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

FILE NUMBER	CP-1629	POD NUMBER	1	TRN NUMBER	593112
LOCATION	20S.30E.19.2.3.4			monitoring	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	19	19	See Attached	○ Y ◉ N	
19	93	74	See Attached	○ Y ◉ N	
93	96	3	See Attached	○ Y ◉ N	
96	110	14	See Attached	◉ Y ○ N	1-2
110	120	10	See Attached	◉ Y ○ N	3
120	128	8	See Attached	◉ Y ○ N	50
128	146	18	See Attached	◉ 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): 50

STATE ENGINEER OFFICE ROSWELL, NEW MEXICO 2016 DEC 12 PM 3 03

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:

NA

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

Mark Green

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:

Bryan Nydoske — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

11/30/16 — DATE

FOR OSE INTERNAL USE

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

FILE NUMBER	CP-1629	POD NUMBER	1	TRN NUMBER	593112
LOCATION	20S.30E.19.2.3.4			monitoring	PAGE 2 OF 2

Feet BGS	**LITHOLOGY**
0-19	Weathered Caliche, pink to tan. Strong effervescence with 10% HCl.
19-93	Dark Red siltstones with interbedded claystones of varying thickness. Clay percentage varies in matrix. Interbedded claystones highly indurated and waxy. Selenite crystals at top, decreasing with depth.
93-96	Dark Claystone. Well-Indurated. Damp at base. No flow.
96-110	Siliceous gravel, poorly sorted from coarse sandstone to 1.5 inch gravel. Very fine sandstone and claystone in matrix. Clasts of dark red shale with green reduction spots also present.Water starting to come in very slow at 97 (1-2 gpm at most).
110-115	Water estimated up to ~3 gpm max at 110. Clean fine grained brick red sandstone with minimal to zero gravel
115-120	Well indurated light red mudstone and anhydrite. Limey. Water still estimated max ~3 gpm
120-128	Vuggy dark red dolomite. Water estimated at up to ~50 gpm
128-146	White anhydrite. Massive.
	Original TD listed as 140. Subs added after tripping out. Depths subject to 6 foot shift beginning after last joint of driven casing.

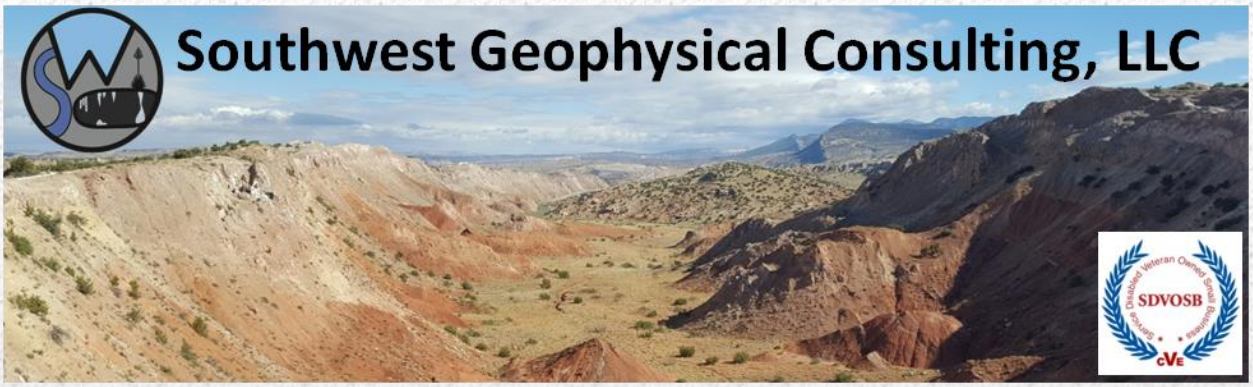
	WELL CONSTRUCTION (from bottom up)
146-141	146 below ground surface (bgs) backfilled with 3 sacks bentonite chips
141-94.6	8x12 Silica Sand in Annulus
135-125	10 foot x 3 inch Sch80 PVC, flush thread blank set at 135 bgs (sounded by pump installer at 139 below top of casing). Cap screwed on bottom.
125-105	20 foot x 3 inch Sch80 PVC, 0.020 machine slot screen with flush threads
94.6-89.6	20x40 Silica Sand in Annulus
89.6-84.3	Bentonite Chips
84.3-23	Bentonite Grout
23-0	Portland Cement
105 bgs to ~2.5 ags	3 inch Sch80 PVC, flush thread solid casing
	Concrete pad 4 feet x 4 feet x 6 inches set at leveled surface, and pitched away from wellhead.
	Steel slip casing with locking aluminum cap set in concrete pad to 6 inches above top of PVC casing. Painted safety yellow.
	Pea gravel installed between slip casing and PVC well casing. Locking J-plug installed into PVC casing

Disclaimer

The Banks Environmental Data Water Well Report was prepared from existing state water well databases and/or additional file data/records research conducted at the state agency and the U.S. Geological Survey. Banks Environmental Data has performed a thorough and diligent search of all groundwater well information provided and recorded. All mapped locations are based on information obtained from the source. Although Banks performs quality assurance and quality control on all research projects, we recognize that any inaccuracies of the records and mapped well locations could possibly be traced to the appropriate regulatory authority or the actual driller. It may be possible that some water well schedules and logs have never been submitted to the regulatory authority by the water driller and, thus, may explain the possible unaccountability of privately drilled wells. It is uncertain if the above listing provides 100% of the existing wells within the area of review. Therefore, Banks Environmental Data cannot fully guarantee the accuracy of the data or well location(s) of those maps and records maintained by the regulatory authorities.

APPENDIX B

CAVE AND KARST RESOURCE INVENTORY REPORT



Cave and Karst Resource Inventory Report
Waterbridge Twin Wells
Eddy County, New Mexico

Prepared for:

Permits West, Inc.
37 Verano Loop
Santa Fe, NM 87508

☐ Positive
- ☐ Relocation/Realignment Recommended
- ☐ Construction Monitor Recommended
- ☐ Relocation/Realignment Not Required

☑ Negative

March 11, 2023

PW-131-20230207

Published by:
Southwest Geophysical Consulting, LLC
5117 Fairfax Dr. NW
Albuquerque, NM 87114
(505) 585-2550
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dave@swgeophys.com

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Permits West, Inc.
37 Verano Loop
Santa Fe, NM 87508

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(505) 466-8120
mike@permitswest.com

MMXXIII

TABLE OF CONTENTS

LIST OF FIGURES

1.0 INTRODUCTION

An aerial karst survey was commissioned by Permits West, Inc. (hereinafter referred to as "the client"), on February 7, 2023, for the purpose of determining the presence of karst-related surface features within the Waterbridge Twin Wells project site (hereinafter termed “TWNO”).

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, LLC, 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 an approximately 350-meter by 280-meter rectangular survey boundary as provided by the client via e-mail (**22.6-Acre NW Option 01.10.23.kmz**) on February 7, 2023.

1.2 Summary of Findings

No surface karst features are located within the karst survey area for the TWNO project. The lack of surface karst features does not mean the area is not karstified and the survey area may still contain 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 on site during these operations should be considered.

1.3 Affected Environment

The proposed TWNO 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.

Karst features are delicate resources that are often of geological, hydrological, biological, and archeological importance, and should be protected. The three primary concerns in these types of terrain are environmental issues, worker safety, 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, or high 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[2] (**HKOZ**, **Figure 1**).

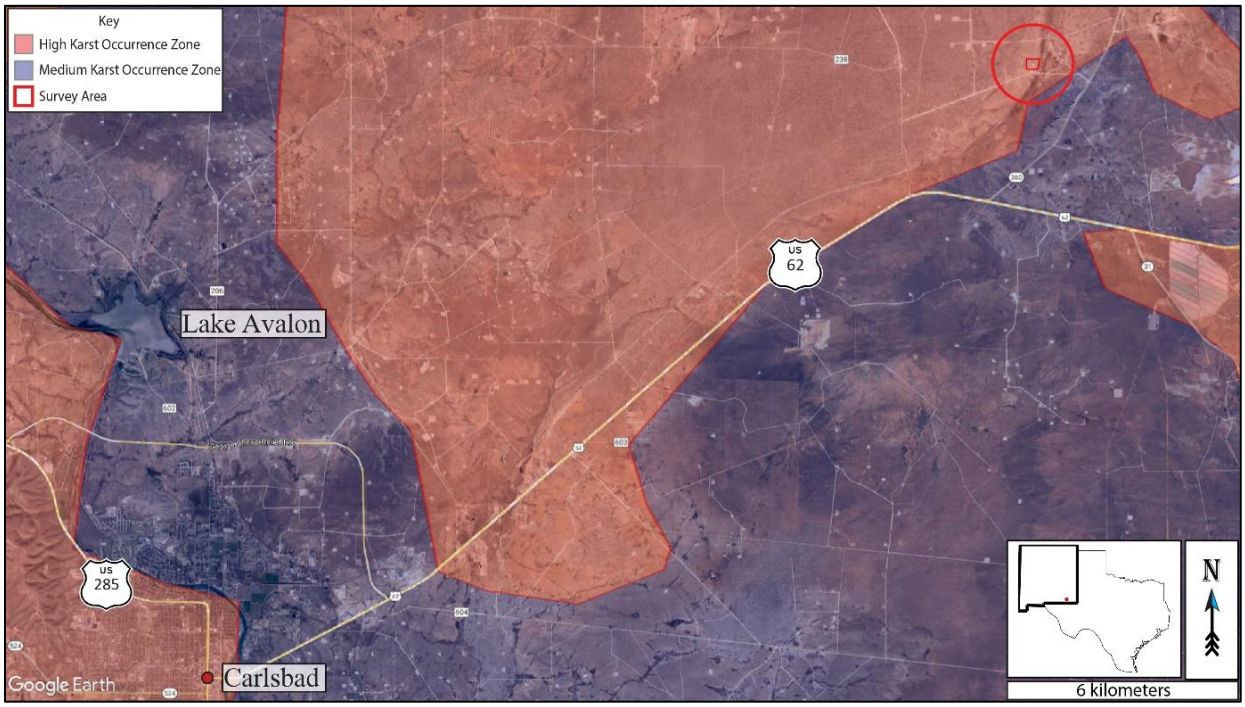


Figure 1: Karst occurrence overview. Background image: Google Earth. Image date: December 29, 2019. Datum: WGS-84.

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 Permits West, 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.

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 on the cover page.

2.0 LOCATION AND DESCRIPTION OF STUDY AREA

2.1 Description of Site

The TWNO project site is located in Eddy County, New Mexico, 26.5 kilometers (16.5 miles) northeast of Carlsbad, New Mexico, west of Potash Mines Road and north of Buckeye Road (**Figure 1** and **Figure 2**). The survey area is located within the SW ¼ of the NW ¼ of section 20 of NM T20S R30E[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*** for the geology of the area. The project site is located entirely within an HKOZ[2] (**Figure 1**) and privately managed land[6] (**Figure 2**).

The site has an active caliche quarry located on the west half of the project area.

Figure 2: Land ownership[6] and PLSS[3] overview. Background image credit: Google Earth. Image date: December 29, 2019. Datum: WGS-84.

2.2 Local Geology

The survey site for the TWNO project is located in the Burton Flats at an elevation of 988 meters (3,241 feet), ± 7 meter (23.0 feet), within an area underlain by the Permian Rustler Formation (Pru, covered by Quaternary deposits in the below image). The area is mantled by thin gypsiferous soils and Quaternary aeolian sands (Qal) and alluvial gravels (Qp)[7] between 0 and 6 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[8], and contains both karst-forming strata (the Forty-niner and Tamarisk Members) and two shallow aquifers (the Magenta and Culebra Dolomite Members).

The Pru overlies the Permian Salado Formation (Psl, not shown), a layer of extremely soluble halite which can easily be dissolved to create caves, sinkholes, and other karst features[9]. The Rustler Formation may be subject to collapse if a void has developed beneath it in the Salado Formation[9].

This area is karstified and has nearby sinkholes, swallets, caves, and other karst features within the survey area. Extreme caution is recommended during any surface activities including surface inspection, brush clearing, and trenching. The survey area is covered by the easily accessible Geologic Map of New Mexico (2003) at 1:500,000 scale[7].

Figure 3: Geology overview. Map credit: The Digital Geologic Map of New Mexico in ARC/INFO Format[10], and Google Earth. Image date: December 29, 2019. Datum: WGS-84.

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). 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].

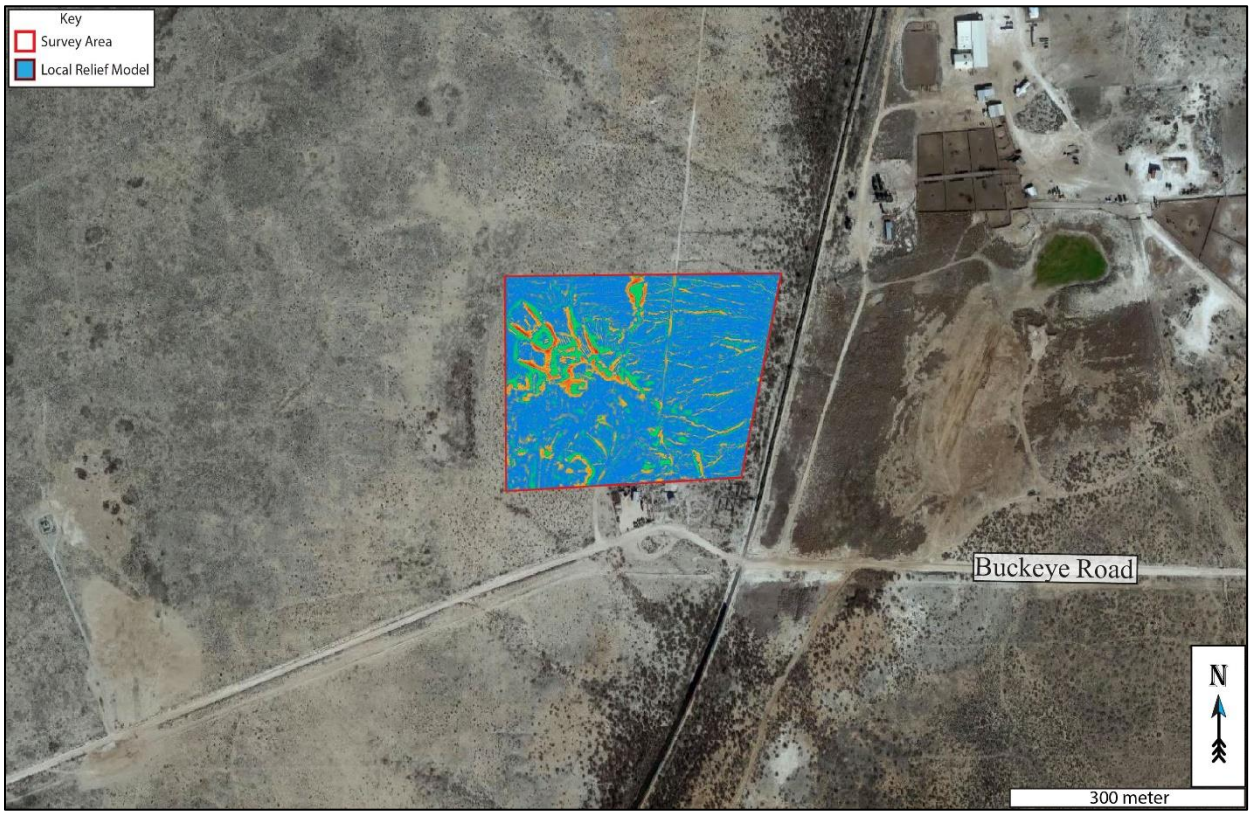


Figure 4: Survey overview. Background image credit: Google Earth. Image date: December 29, 2019. Datum: WGS-84.

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[12]. These features are marked with yellow dots in **Figure 4**. If a feature is subsequently verified in the field prior to publication of the report, the dot color will be changed to red 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 February 16, 2023. Surface karst features may have developed after this date and will not be noted in this report. Imagery analysis was completed by Garrett Jorgensen Olague of Southwest Geophysical Consulting on March 1, 2023.

2.4 Description of Karst Features

No features identified as surface karst features were located in the aerial survey area (**Figure 4**). However, the lack of surface karst features does not mean the area is not karstified. Please be aware that the area may contain buried karst features. Caution is advised while clearing brush and during trenching and excavation activities. Employing a BLM-CFO approved karst monitor on site during these activities should be considered.

3.0 RECOMMENDATIONS

3.1 Summary

- No surface karst features are located within the aerial survey area (**Figure 4**).
- This area may contain subsurface 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 in this area 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).

2 Rybacki, K. (Bureau of Land Management - Carlsbad Field Office, 2020).

3 Earthpoint. *Earthpoint Tools for Google Earth*, <https://www.earthpoint.us/Townships.aspx> (2022).

4 W.R.C.C. *National Climate Data Center 1981-2010 Normal Climate Summary for Carlsbad, New Mexico (291469)*, 2010).

5 Whitehead, W. & Flynn, C. *Plant Utilization in Southeastern New Mexico: Botany, Ethnobotany, and Archaeology*. (Bureau of Land Management, Carlsbad Field Office, 2017).

6 NMSLO. Digital overlay (KML) of the surface land ownership in New Mexico (New Mexico State Land Office, Santa Fe, NM, 2016).

7 Scholle, P. A. Geologic Map of New Mexico. (2003).

8 Johnson, K. S. Evaporite Karst in the United States. *Carbonates and Evaporites* **12**, 2-14 (1997).

9 Martinez, J. D., Johnson, K. S. & Neal, J. T. Sinkholes in Evaporite Rocks. *American Scientist* **86**, 38-51 (1998).

10 Green, G. N. & Jones, G. E. *The Digital Geologic Map of New Mexico in ARC/INFO Format*, <https://mrdata.usgs.gov/geology/state/state.php?state=NM> (1997).

11 Whitehead, W., Bandy, M. & Decker, D. Protocol for Using UAV Photography for Rapid Assessment of Karst Features in Southeast New Mexico. *Proceedings of the 2022 Cave and Karst Management Symposium* (2022).

12 Decker, D. D. & Jorgensen, G. L. (ed LLC Southwest Geophysical Consulting) (Private Correspondence, 2020).

5.0 GLOSSARY OF TERMS AND ABBREVIATIONS

BLM-CFO	Bureau of Land Management - Carlsbad Field Office
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
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.
(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.
LKOZ	Low Karst Occurrence Zone
(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
Pat	Permian Artesia Group
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
Pr	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
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 (currently in review). I meet the definition of “qualified professional” for the purposes of ASTM E-1527.
- I am responsible for the content, compilation, and editing of all sections of the report entitled “PW-131-20230207 Cave and Karst Resource Inventory Report, Waterbridge Twin Wells 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 11, 2022.

David D. Decker
PhD, CPG-12123

APPENDIX C

GEOTECHNICAL ENGINEERING REPORT

COZ Engineering, LLC

GEOTECHNICAL ENGINEERING REPORT

TWIN WELLS RANCH RECYCLING FACILITY
FINAL LOCATION

EDDY COUNTY, NEW MEXICO
Project No. 4223012
February 4, 2023

Prepared for:

ENVIROTECH ENGINEERING & CONSULTING, INC.
Enid, Oklahoma

Prepared by:

COZ ENGINEERING, LLC
Las Cruces, New Mexico

COZ Engineering, LLC

PO Box 13331
Las Cruces, New Mexico 88013
Cell: 575.642.7671
Email: thecoz42@gmail.com

February 4, 2023

Envirotech Engineering & Consulting, Inc.
2500 North Eleventh Street
Enid, OK 73701

Attn. Mitchell Ratke, EIT
P: 580.234.8780
E: mratke@envirotechconsulting.com

Re: Geotechnical Engineering Report
Twin Wells Ranch Recycling Facility
Final Location: Lat.: 32.561596° Long.: -104.002716°
Eddy County, New Mexico
COZ Report No. 4223012

Dear Mr. Ratke:

The following is a geotechnical engineering report for the proposed Twin Wells Ranch Recycling Facility in Eddy County, New Mexico. Recommendations for earthwork, embankments and other geotechnical considerations are presented in the report.

Thank you for the opportunity to provide this geotechnical engineering report. If you have any questions or concerns, please contact me at (575)-642-7671.

Sincerely,
COZ Engineering, LLC

Dan Cosper, P.E.

Appendix:

Twin Wells Recycling Facility Final Location
February 4, 2023
COZ Report No. 4223012

Site Investigation:

A subsurface investigation was performed for the proposed Twin Wells Ranch Recycling Facility to be located at Lat.: 32.561596° Long.: -104.002716° about 19 miles northeast of Carlsbad, New Mexico. Five (5) test borings were advanced within the proposed facility near client requested locations. The borings were advanced to depths of 20 and 75 feet below ground surface (bgs).

Site Conditions:

The ground surface consisted of exposed subgrade with areas of dense vegetation. Soils investigated at this site were generally comprised of clayey sand and silty sand with varying amounts of gypsum and carbonate indurations from the surface to the total explored depths of about 20 and 75 feet bgs. However, it should be noted that a layer of fat clay with sand was encountered in Boring B-4 at a depth of about 15 feet bgs.

The groundwater table was not encountered during the field investigation.

Planned Construction:

Based on the information provided, the project will include the construction of a recycling facility.

Site Grading:

Areas for planned construction should be clear of debris, vegetation and any oversized or deleterious material prior to grading operations. Fill construction shall not be allowed on surfaces that contain vegetation or rocks larger than four inches in greatest dimension. No fill shall be placed that contains vegetative material as decomposition of that material can cause voids and possibly result in surface settlement. Voids in the soil matrix created or encountered during grading operations shall be backfilled with compacted fill material.

Positive drainage away from embankments should be provided throughout the life of the project. Areas adjacent to embankments that could retain water should be sealed or eliminated.

Soil Improvements:

Subgrade preparation (beneath embankments and engineered fills) should consist of scarifying the native soil surface a minimum thickness of 10 inches, moisture conditioning (+/- 2% of optimum moisture content per ASTM D-698) and compaction to a minimum of 95% of standard Proctor density (per ASTM D-698). Engineered fill materials should be placed in 10-inch maximum lifts, moisture conditioned to within 2% of optimum moisture content (per ASTM D-698) and compacted to a minimum of 95% of standard Proctor density (per ASTM D-698).

Fill Material:

Engineered fill material for this project should meet the following gradation criteria:

Sieve	% Passing
4″	100
¾	70-100
#4	50-100
#200	50 max.

The plasticity index of the minus #40 sieve portion should not exceed twenty (20). On-site soils meet the above specifications with the exception of the fat clay with sand encountered in Boring B-4 below a depth of about 15 feet bgs.

Excavation of Embankment Areas:

The soils below the new embankments should be scarified ten inches, moisture conditioned and compacted. The interior/exterior width of subgrade preparation should extend to the intersection of the slopes of the embankment fill. Once the subgrade preparation has been observed and approved by the geotechnical engineer, embankment fill operations can initiate.

Embankment Placement:

Once the subgrade has been prepared, on-site embankment material stockpiles should be moisture conditioned in preparation for lift placement. The embankments should be constructed as a unit from the bottom elevation to the rim elevation.

The distal slopes of the embankments should be overbuilt and cut to final grade to provide compaction to these edges of the embankments. The embankments should be constructed in strict accordance with the project plans and specifications.

Seismic Site Classification:

The seismic site classification is based upon the soil profile in the upper 100 feet as defined by the weighted average of standard penetration blow-counts or shear wave velocity in accordance with Section 20.4 of the ASCE 7 and the International Building Code (IBC). Based upon my field investigation, it is my opinion that the Seismic Site Classification is **D ("Stiff Soil")**. The maximum depth of the borings advanced at the site was 75 feet. Therefore, soil properties below the maximum boring depth to 100 feet were estimated based on my experience with the general area. Deeper borings or geophysical testing would be required to confirm the conditions below the current boring depth.

Testing and Inspection:

It is recommended that all site grading operations be inspected by a geotechnical engineer. The inspecting engineer should be responsible for immediately reporting any site or soil conditions that vary significantly from this report.

The testing of materials should be made at the following:

1) One (1) soil density every 5,000 square feet of prepared subgrade and embankment fill areas (ASTM D-1556, ASTM D-2167, or ASTM D-2922, ASTM D-3017).

2) One (1) sieve analysis and plasticity index per material used according to ASTM D-422 and ASTM D-4318.

3) One (1) proctor per each type of material used according to ASTM D-698.

Report Limitations:

The conclusions, recommendations and opinions presented herein are:

1) Based upon evaluation and interpretation of the findings of the field and laboratory program.

2) Based upon an interpolation of soil conditions between and beyond the explorations.

3) Subject to confirmation of the conditions encountered during construction.

4) Based upon the assumption that sufficient observation and testing will be provided during construction.

There is no other warranty, either express or implied. Any person using this report for bidding or construction purposes should perform such independent investigation as he deems necessary to satisfy himself as to the surface and subsurface conditions to be encountered and the procedures to be used in the performance of work on this project. If conditions are encountered during construction that appear to differ from those indicated in this report, I should be notified immediately.

N

⊗ Approximate Boring Location

Project Manager: DC	Project No. 4223012	COZ Engineering, LLC PO Box 13331 Las Cruces, NM 88013	BORING LOCATION PLAN Twin Wells Ranch Recycling Facility Lat.: 32.561596° Long.: -104.002716° Eddy County, New Mexico	Exhibit 1
Drawn by: DC	Scale: AS SHOWN			
Checked by: DC	File Name: Figures			
Approved by: DC	Date: 2-4-23			

Project: **Twin Wells Ranch Recycling Facility Final Location** Project Location: **Buckeye Road, Eddy County, NM** Project Number: **4223012**	Log of Boring B-1 **Sheet 1 of 1**

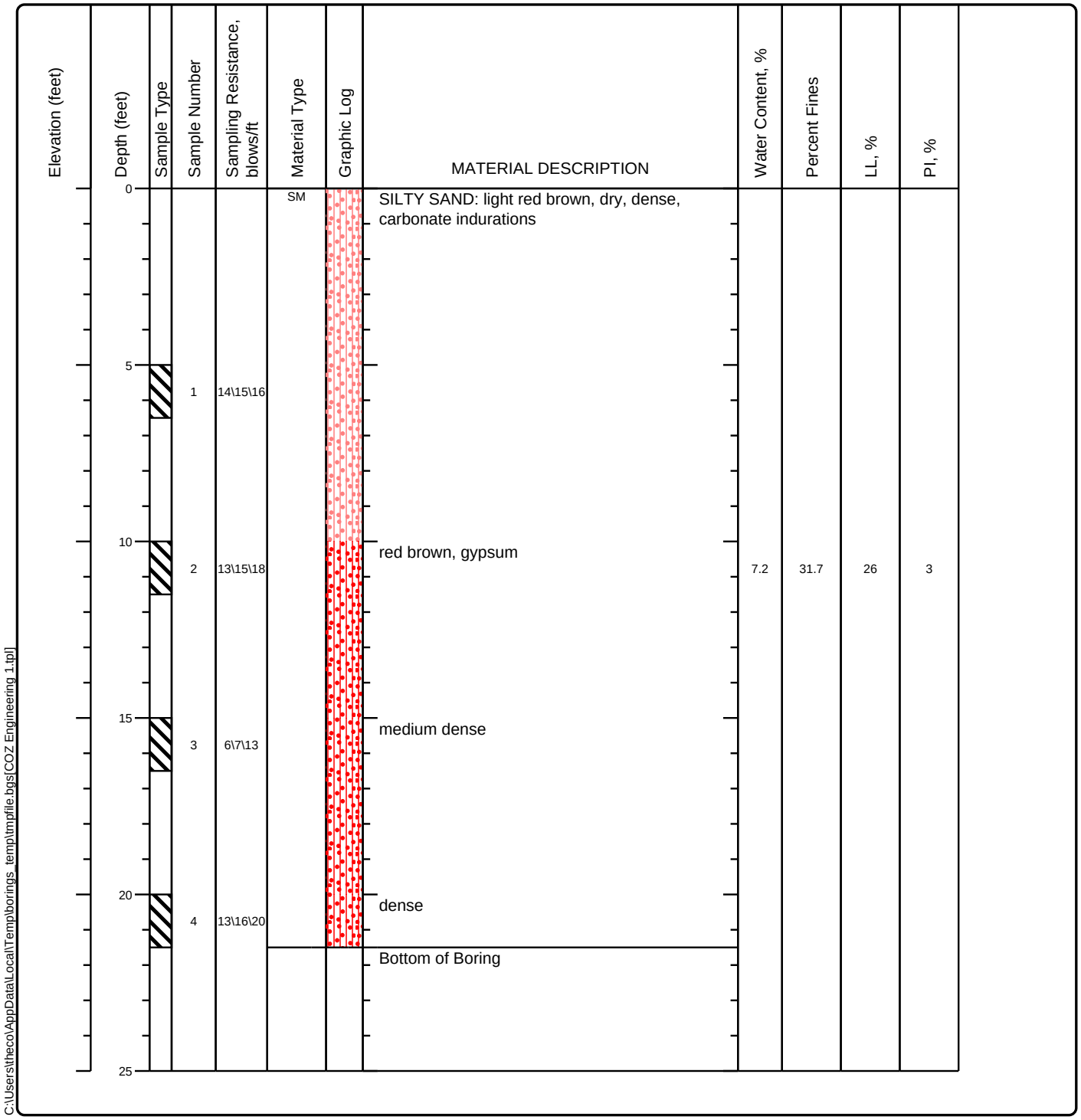
Date(s) Drilled **1-25-23**	Logged By **COZ**	Checked By **COZ**
Drilling Method **hollow-stem auger**	Drill Bit Size/Type	Total Depth of Borehole **21.5 feet bgs**
Drill Rig Type **CME-75**	Drilling Contractor **Southlands**	Approximate Surface Elevation
Groundwater Level and Date Measured **not encountered**	Sampling Method(s) **SPT**	Hammer Data
Borehole Backfill **cuttings**	Location **see boring plan**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Percent Fines	LL, %	PI, %
	0				SM		SILTY SAND: red brown, moist, medium dense, gypsum				
	5		1	7\11\13				10.3	16.4		NP
	10		2	6\12\13			brown, dry				
	15		3	5\9\9			red brown				
	20		4	10\13\15							
	25						Bottom of Boring				

C:\Users\theco\AppData\Local\Temp\borings_temp\tmpfile.bgs[COZ Engineering 1.tpl]

Project: **Twin Wells Ranch Recycling Facility Final Location** Project Location: **Buckeye Road, Eddy County, NM** Project Number: **4223012**	Log of Boring B-2 **Sheet 1 of 1**

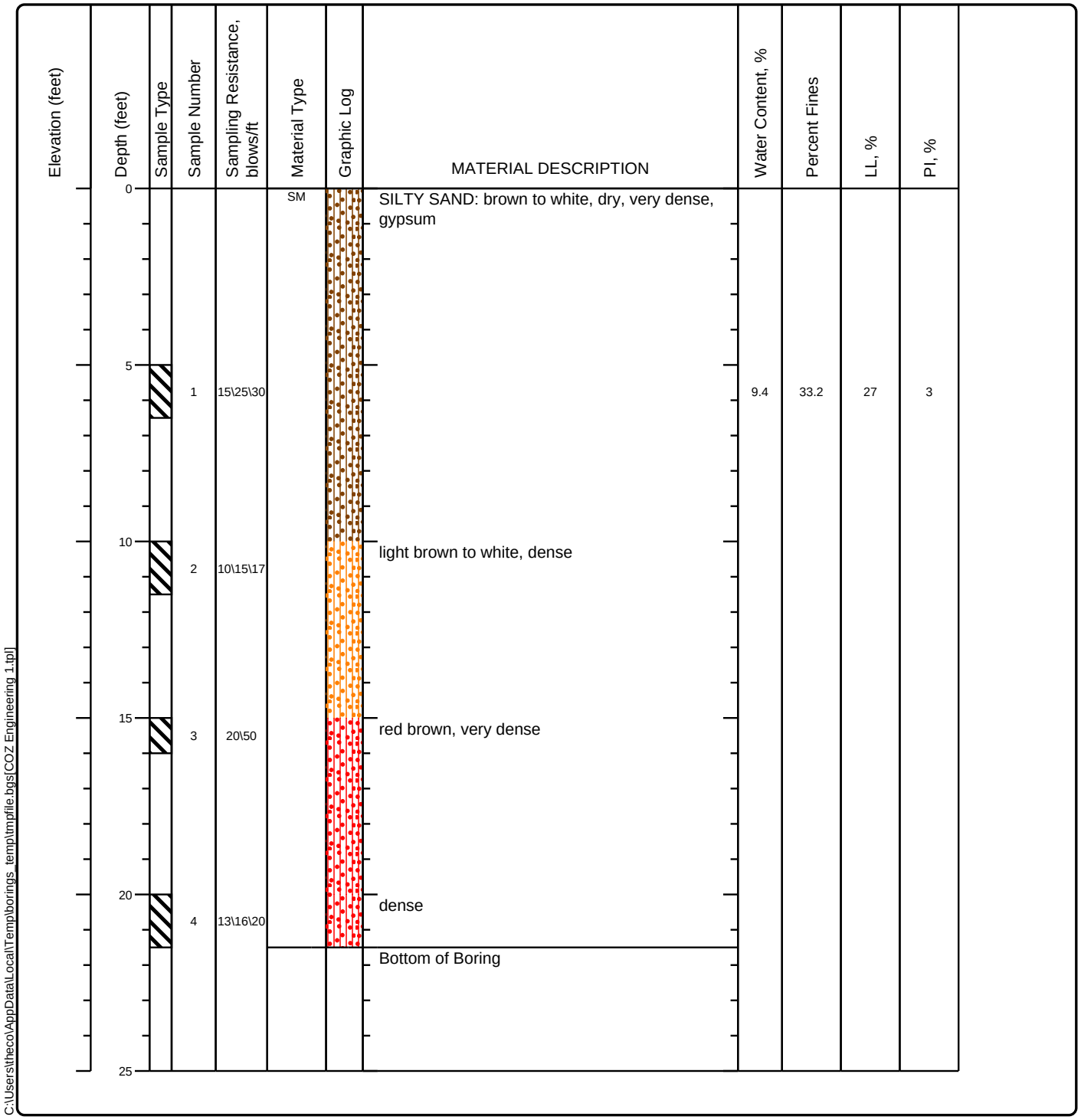
Date(s) Drilled **1-25-23**	Logged By **COZ**	Checked By **COZ**
Drilling Method **hollow-stem auger**	Drill Bit Size/Type	Total Depth of Borehole **21.5 feet bgs**
Drill Rig Type **CME-75**	Drilling Contractor **Southlands**	Approximate Surface Elevation
Groundwater Level and Date Measured **not encountered**	Sampling Method(s) **SPT**	Hammer Data
Borehole Backfill **cuttings**	Location **see boring plan**	



C:\Users\theco\AppData\Local\Temp\borings_temp\tmpfile.bgs[COZ Engineering 1.tpl]

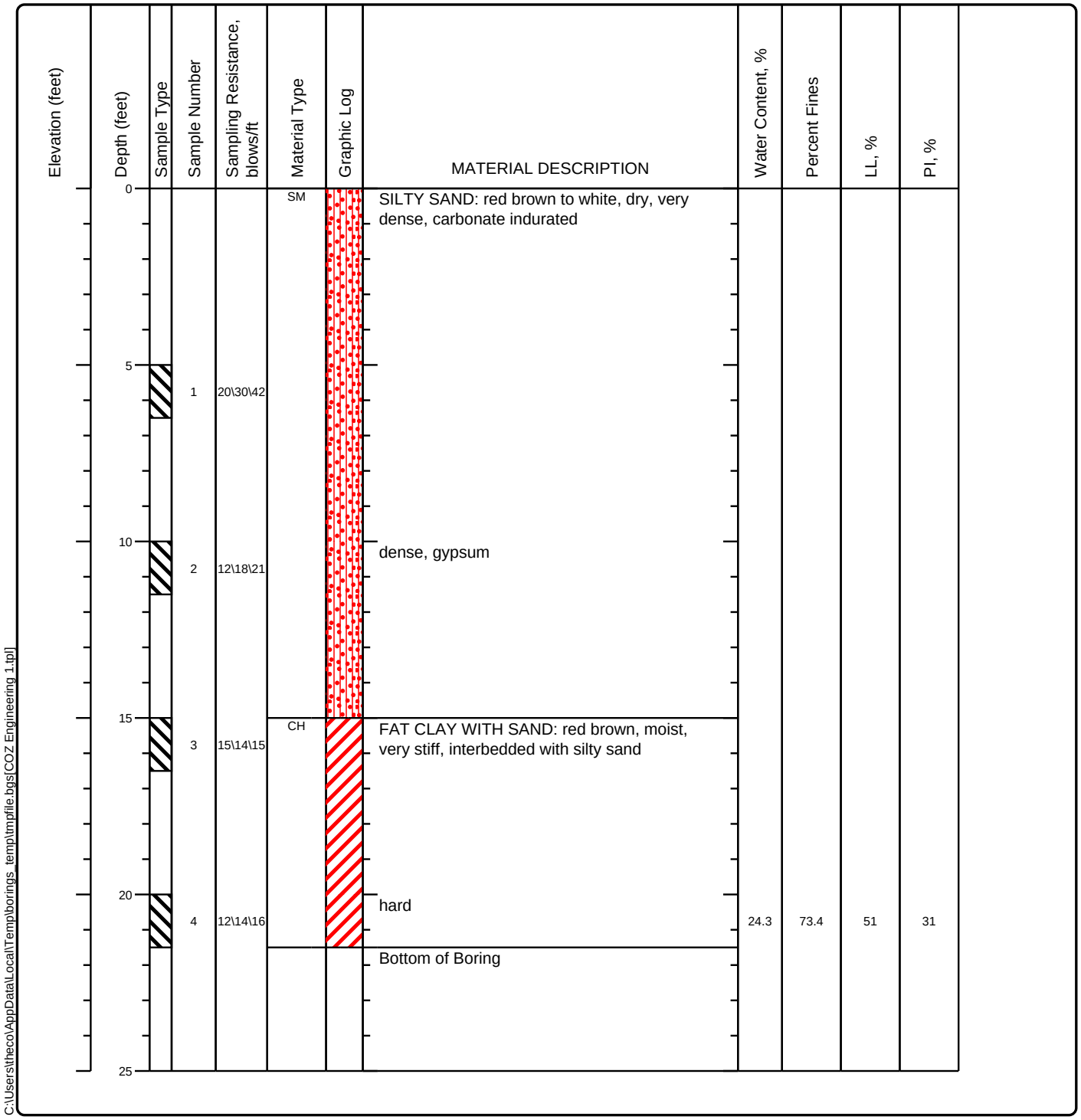
Project: **Twin Wells Ranch Recycling Facility Final Location** Project Location: **Buckeye Road, Eddy County, NM** Project Number: **4223012**	Log of Boring B-3 **Sheet 1 of 1**

Date(s) Drilled **1-25-23**	Logged By **COZ**	Checked By **COZ**
Drilling Method **hollow-stem auger**	Drill Bit Size/Type	Total Depth of Borehole **21.5 feet bgs**
Drill Rig Type **CME-75**	Drilling Contractor **Southlands**	Approximate Surface Elevation
Groundwater Level and Date Measured **not encountered**	Sampling Method(s) **SPT**	Hammer Data
Borehole Backfill **cuttings**	Location **see boring plan**	



Project: **Twin Wells Ranch Recycling Facility Final Location** Project Location: **Buckeye Road, Eddy County, NM** Project Number: **4223012**	Log of Boring B-4 **Sheet 1 of 1**

Date(s) Drilled **1-25-23**	Logged By **COZ**	Checked By **COZ**
Drilling Method **hollow-stem auger**	Drill Bit Size/Type	Total Depth of Borehole **21.5 feet bgs**
Drill Rig Type **CME-75**	Drilling Contractor **Southlands**	Approximate Surface Elevation
Groundwater Level and Date Measured **not encountered**	Sampling Method(s) **SPT**	Hammer Data
Borehole Backfill **cuttings**	Location **see boring plan**	



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Project: **Twin Wells Ranch Recycling Facility** Project Location: **Buckeye Road, Eddy County, NM** Project Number: **4222140**	Log of Boring B-5 **Sheet 1 of 2**

Date(s) Drilled **11-30-22**	Logged By **COZ**	Checked By **COZ**
Drilling Method **hollow-stem auger**	Drill Bit Size/Type	Total Depth of Borehole **75 feet bgs**
Drill Rig Type **CME-75**	Drilling Contractor **Southlands**	Approximate Surface Elevation
Groundwater Level and Date Measured **not encountered**	Sampling Method(s)	Hammer Data
Borehole Backfill **cuttings**	Location **Lat.: 32.561596, Long.: -104.002716**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Percent Fines	LL, %	PI, %
	0				SC		CLAYEY SAND: light brown, dry, trace gravel				
	5						white, carbonate indurated				
	10						light red brown				
	15										
	20				SM		SILTY SAND: red brown, dry				
	25										
	30										
	35										
	40										
	45										
	50										

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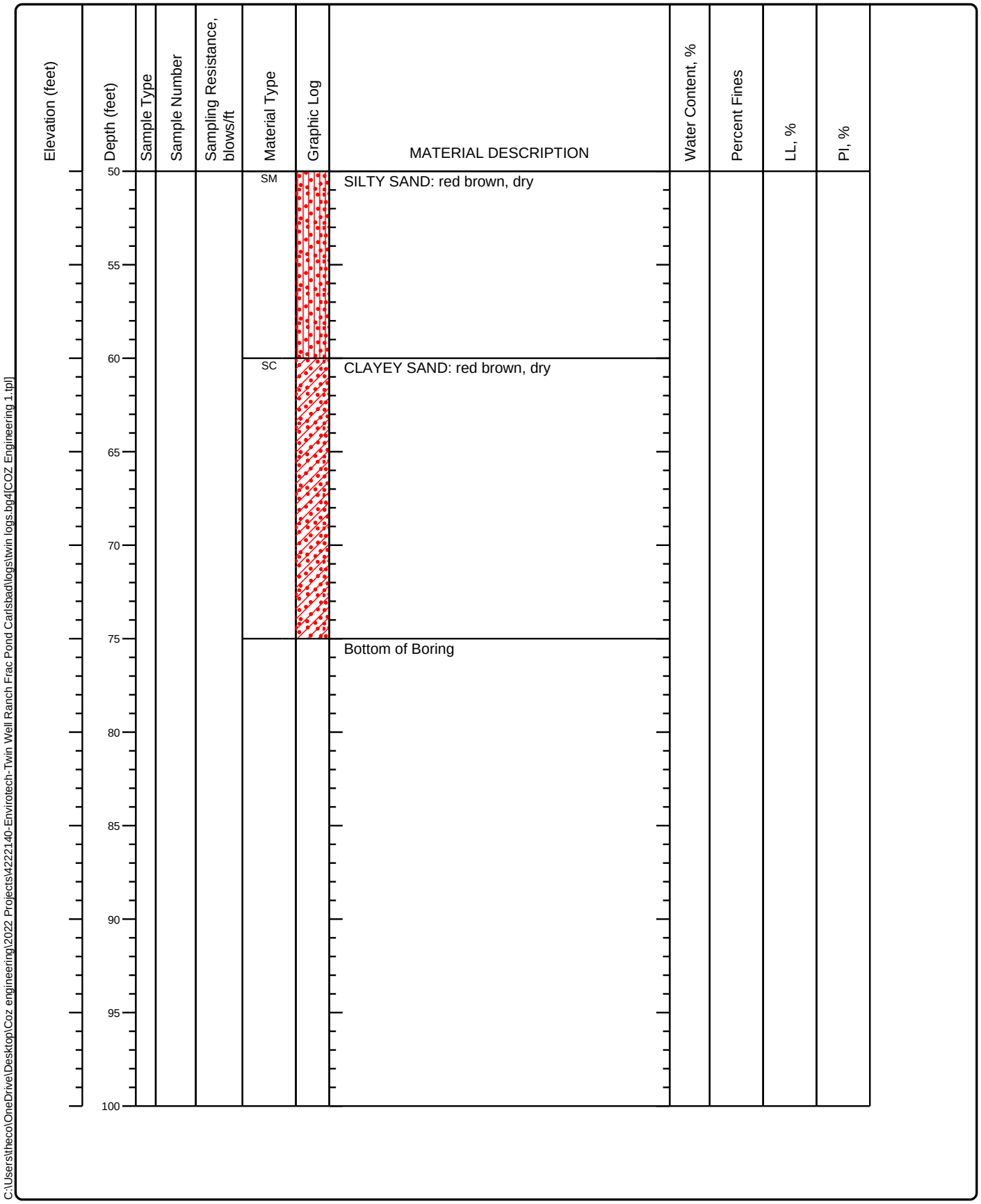
Project: **Twin Wells Ranch Recycling Facility**
Project Location: **Buckeye Road, Eddy County, NM**
Project Number: **4222140**

Log of Boring B-5
Sheet 2 of 2



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Project: **Twin Wells Ranch Recycling Facility Final Location**
Project Location: **Buckeye Road, Eddy County, NM**
Project Number: **4223012**

Key to Log of Boring
Sheet 1 of 1

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Percent Fines	LL, %	PI, %
1	2	3	4	5	6	7	8	9	10	11	12

COLUMN DESCRIPTIONS

1 Elevation (feet): Elevation (MSL, feet).
2 Depth (feet): Depth in feet below the ground surface.
3 Sample Type: Type of soil sample collected at the depth interval shown.
4 Sample Number: Sample identification number.
5 Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.
6 Material Type: Type of material encountered.
7 Graphic Log: Graphic depiction of the subsurface material encountered.
8 MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
9 Water Content, %: Water content of the soil sample, expressed as percentage of dry weight of sample.
10 Percent Fines: The percent fines (soil passing the No. 200 Sieve) in the sample. WA indicates a Wash Sieve, SA indicates a Sieve Analysis.
11 LL, %: Liquid Limit, expressed as a water content.
12 PI, %: Plasticity Index, expressed as a water content.

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

MATERIAL GRAPHIC SYMBOLS

Fat CLAY, CLAY w/SAND, SANDY CLAY (CH)
Silty SAND (SM)

TYPICAL SAMPLER GRAPHIC SYMBOLS

Auger sampler
Bulk Sample
3-inch-OD California w/ brass rings
CME Sampler
Grab Sample
2.5-inch-OD Modified California w/ brass liners
Pitcher Sample
2-inch-OD unlined split spoon (SPT)
Shelby Tube (Thin-walled, fixed head)

OTHER GRAPHIC SYMBOLS

Water level (at time of drilling, ATD)
Water level (after waiting)
Minor change in material properties within a stratum
Inferred/gradational contact between strata
Queried contact between strata

GENERAL NOTES

1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

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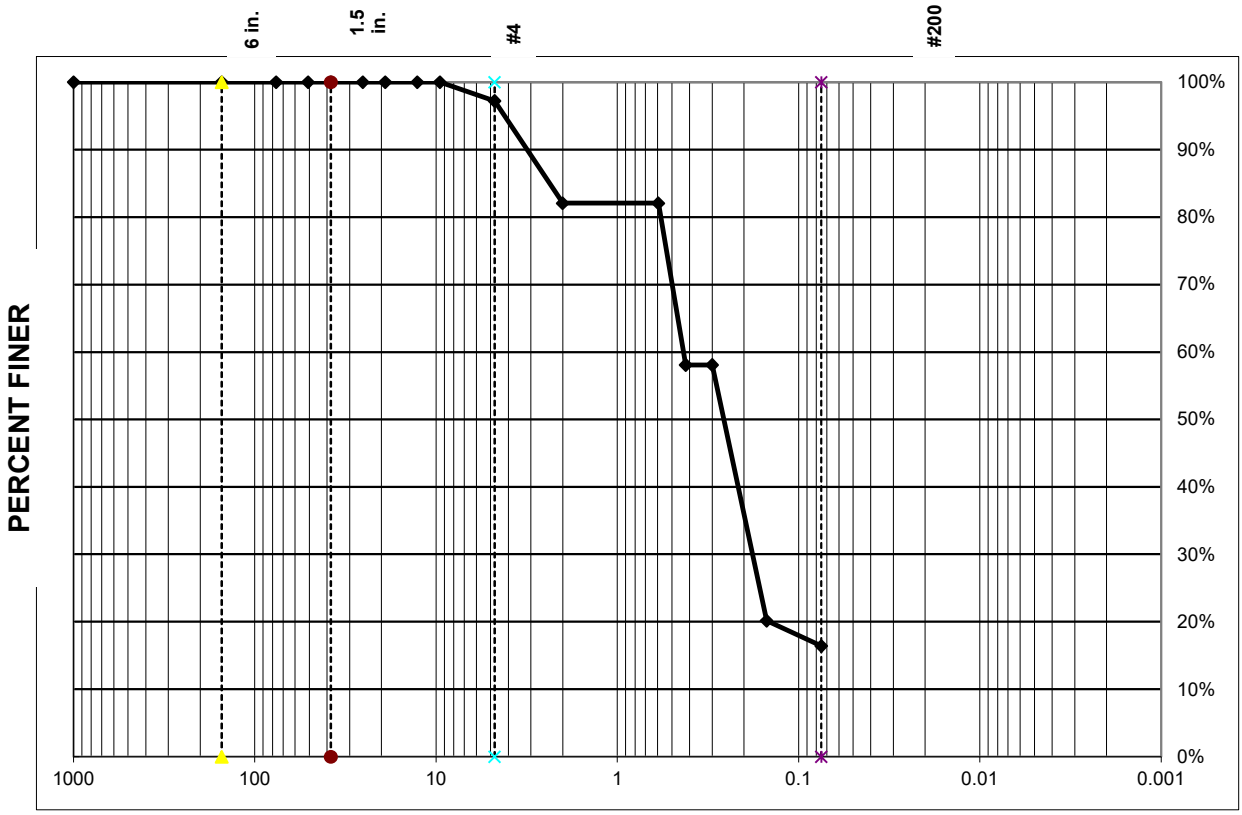
Figure B-1

GRAIN SIZE DISTRIBUTION GRAPH



TEST SUMMARY (ASTM C136)

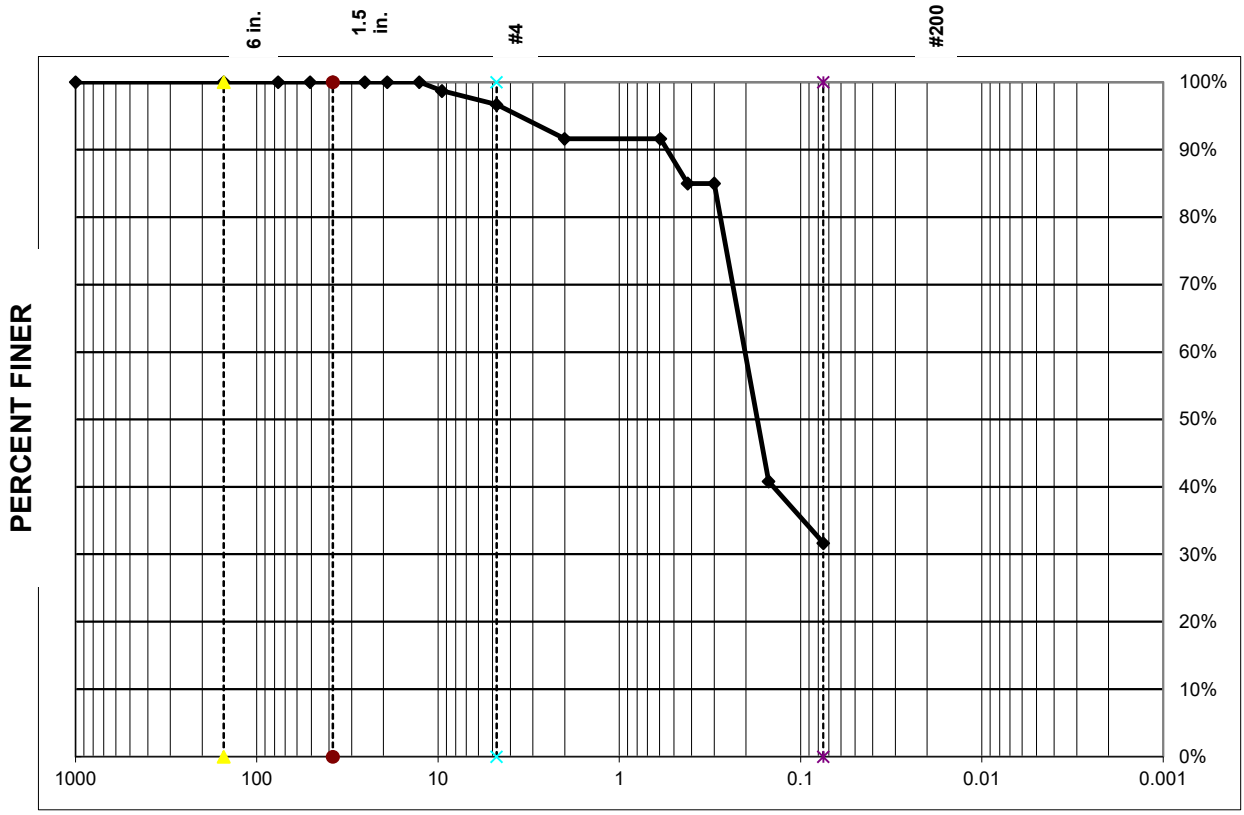
Sieve Size	1 1/2"	3/4"	3/8"	#4	#10	#40	#100	#200
% Passing (Cumulative)	100%	100%	100%	97%	82%	58%	20%	16.4%
Specification								

% GRAVEL =	3%	**D_{85} =** 2.4	**D_{15} =**
% SAND =	81%	**D_{60} =** 0.4	**D_{10} =**
% SILT & CLAY =	16%	**D_{50} =** 0.3	**C_U =**
		D_{30} = 0.2	**C_C =**

Sample Date: 1/25/23
Project No.: 4223012
Project Name: Twin Wells Recycling Facility
Report Date: 2/4/23
Sample Location: B-1 at 5'
Liquid Limit: **Plasticity Index:** NP
USCS Classification: SM
Material Description: Silty Sand
Moisture Content: 10.3%

COZ Engineering, LLC
PO Box 13331
Las Cruces, NM 88013
(575) 642-7671

GRAIN SIZE DISTRIBUTION GRAPH



TEST SUMMARY (ASTM C136)

Sieve Size	1 1/2"	3/4"	3/8"	#4	#10	#40	#100	#200
% Passing (Cumulative)	100%	100%	99%	97%	92%	85%	41%	31.7%
Specification								

% GRAVEL =	3%		**D_{85} =** 0.4	**D_{15} =**	
% SAND =	65%		**D_{60} =** 0.2	**D_{10} =**	
% SILT & CLAY =	32%		**D_{50} =** 0.2	**C_U =**	
			D_{30} =	**C_C =**	

Sample Date: 1/25/23
Project No.: 4223012
Project Name: Twin Wells Recycling Facility
Report Date: 2/4/23
Sample Location: B-2 at 10'
Liquid Limit: 26 **Plasticity Index:** 3
USCS Classification: SM
Material Description: Silty Sand
Moisture Content: 7.2%

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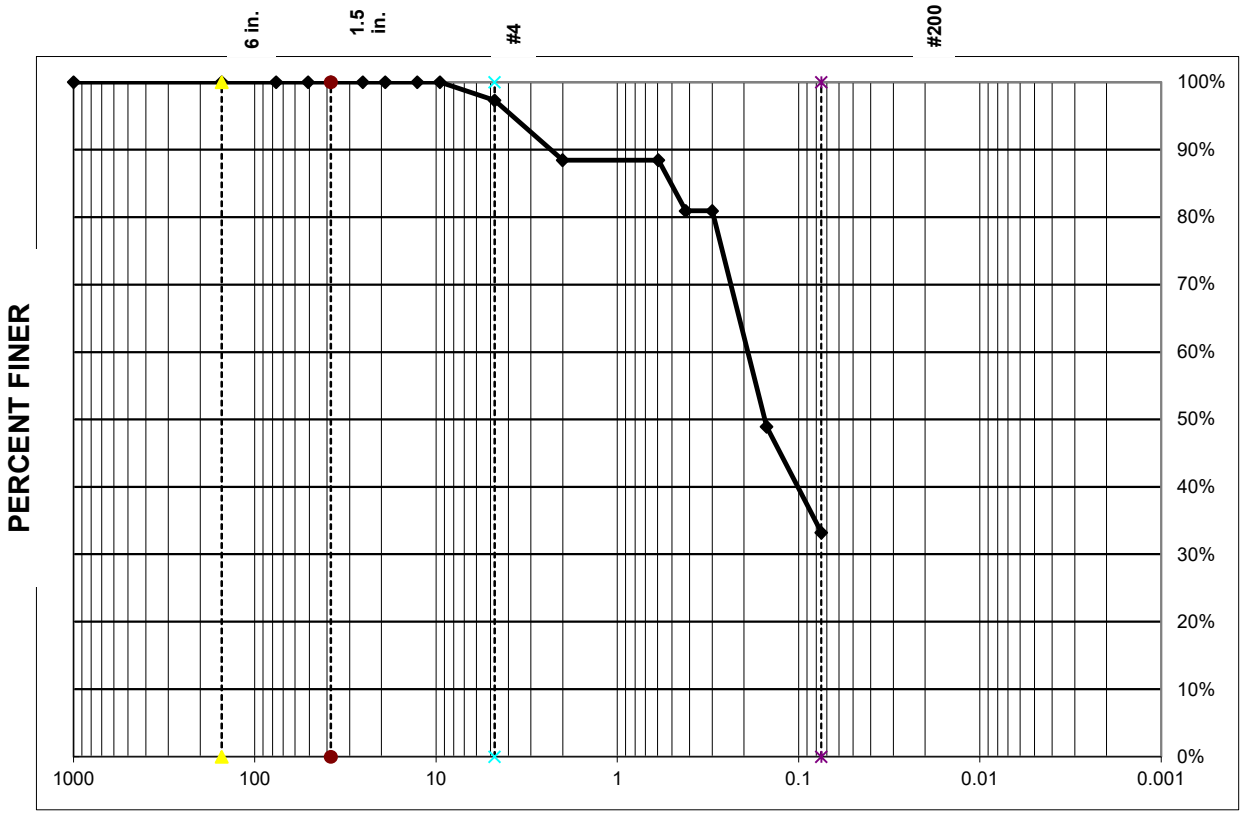
GRAIN SIZE DISTRIBUTION GRAPH



TEST SUMMARY (ASTM C136)

Sieve Size	1 1/2"	3/4"	3/8"	#4	#10	#40	#100	#200
% Passing (Cumulative)	100%	100%	100%	97%	88%	81%	49%	33.2%
Specification								

% GRAVEL =	3%		**D_{85} =** 0.5	**D_{15} =**	
% SAND =	64%		**D_{60} =** 0.2	**D_{10} =**	
% SILT & CLAY =	33%		**D_{50} =** 0.2	**C_U =**	
			D_{30} =	**C_C =**	

Sample Date: 1/25/23
Project No.: 4223012
Project Name: Twin Wells Recycling Facility
Report Date: 2/4/23
Sample Location: B-3 at 5'
Liquid Limit: 27 **Plasticity Index:** 3
USCS Classification: SM
Material Description: Silty Sand
Moisture Content: 9.4%

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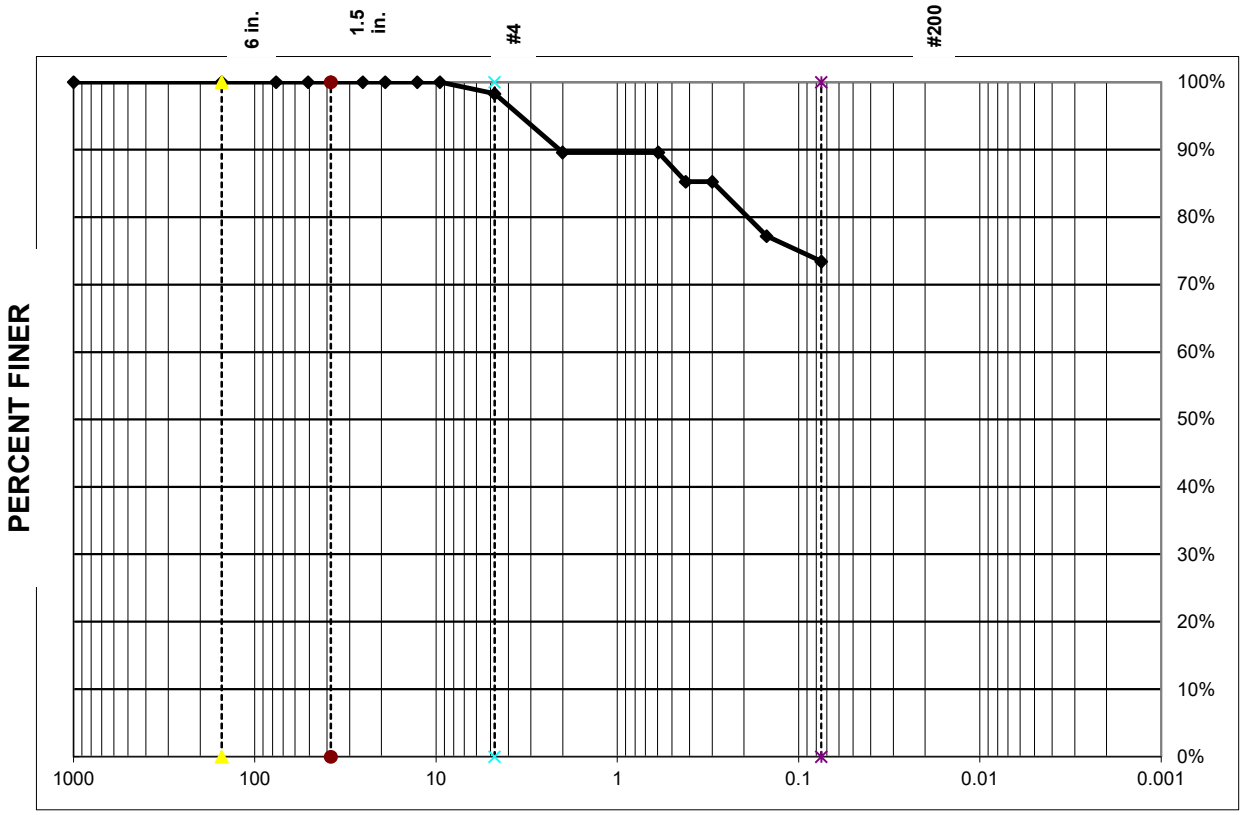
GRAIN SIZE DISTRIBUTION GRAPH



TEST SUMMARY (ASTM C136)

Sieve Size	1 1/2"	3/4"	3/8"	#4	#10	#40	#100	#200
% Passing (Cumulative)	100%	100%	100%	98%	90%	85%	77%	73.4%
Specification								

% GRAVEL =	2%		**D_{85} =** 0.3	**D_{15} =**	
% SAND =	25%		**D_{60} =**	**D_{10} =**	
% SILT & CLAY =	73%		**D_{50} =**	**C_U =**	
			D_{30} =	**C_C =**	

Sample Date: 1/25/23
Project No.: 4223012
Project Name: Twin Wells Recycling Facility
Report Date: 2/4/23
Sample Location: B-4 at 20'
Liquid Limit: 51 **Plasticity Index:** 31
USCS Classification: CH
Material Description: Fat Clay with Sand
Moisture Content: 24.3%

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Laboratory Compaction Characteristics of Soil

COZ Engineering, LLC
P. O. Box 13331
Las Cruces, NM 88013
575-642-7671

Client Name: Envirotech
Project Name: Twin Wells Ranch Recycling Facility
Location: Lat.: 32.561596° Long.: -104.002716°
Eddy County, New Mexico

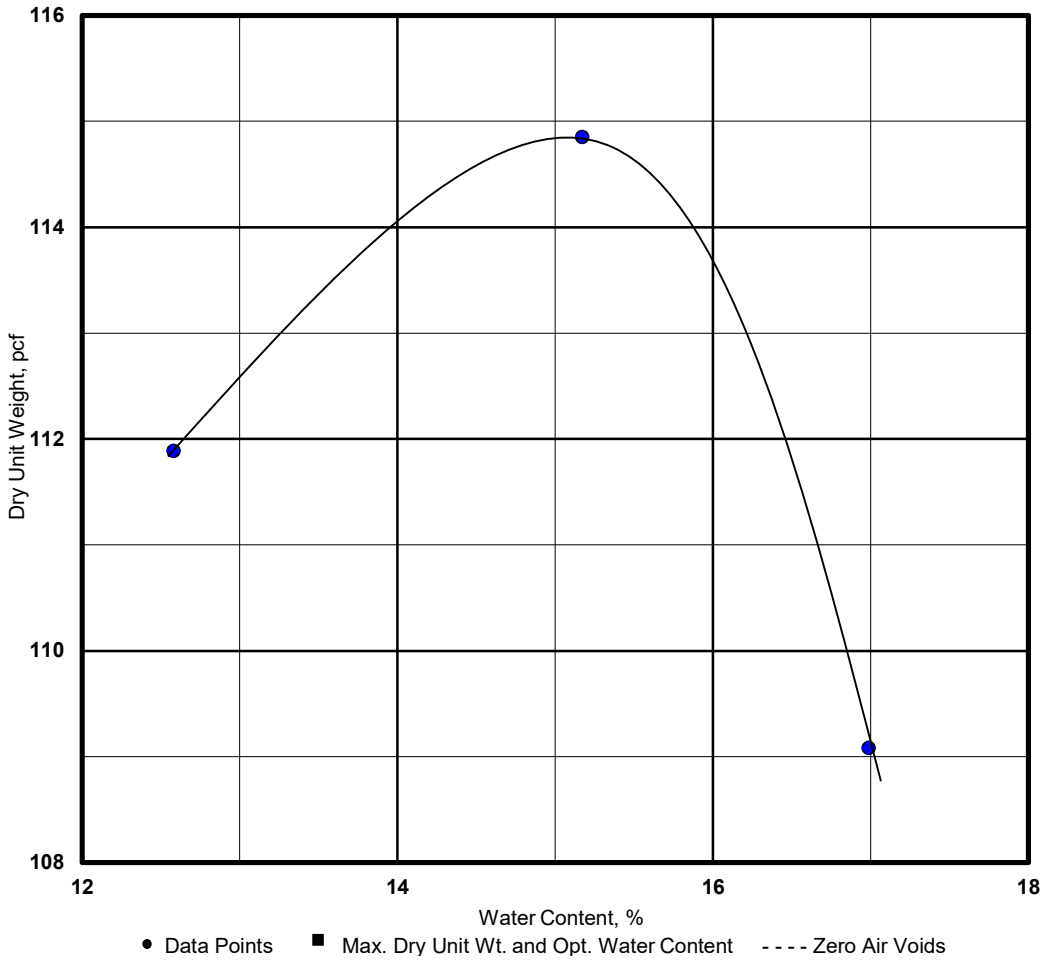
Source Material: B-1 at 0-5'
Sample Description: Silty Sand
Proctor #1
Material Designation: SM Sample date: 1/25/2023
Test Method: ASTM-698
Test Procedure: A
Sample Preparation: D. Parrack
Rammer: ___ Mechanical X Manual

Project No.: 4223012 Date: 2/4/2023

TEST RESULTS
Maximum Dry Unit Wt.: 114.9 pcf
Optimum Water Content: 15.2 %

Liquid Limit: ___ Plastic Limit: ___
Plasticity Index: NP
% passing # 200 sieve: 16

Reviewed by: Dan Cosper, P. E.



Laboratory Compaction Characteristics of Soil

COZ Engineering, LLC
P. O. Box 13331
Las Cruces, NM 88013
575-642-7671

Client Name: Envirotech
Project Name: Twin Wells Ranch Recycling Facility
Location: Lat.: 32.561596° Long.: -104.002716°
Eddy County, New Mexico

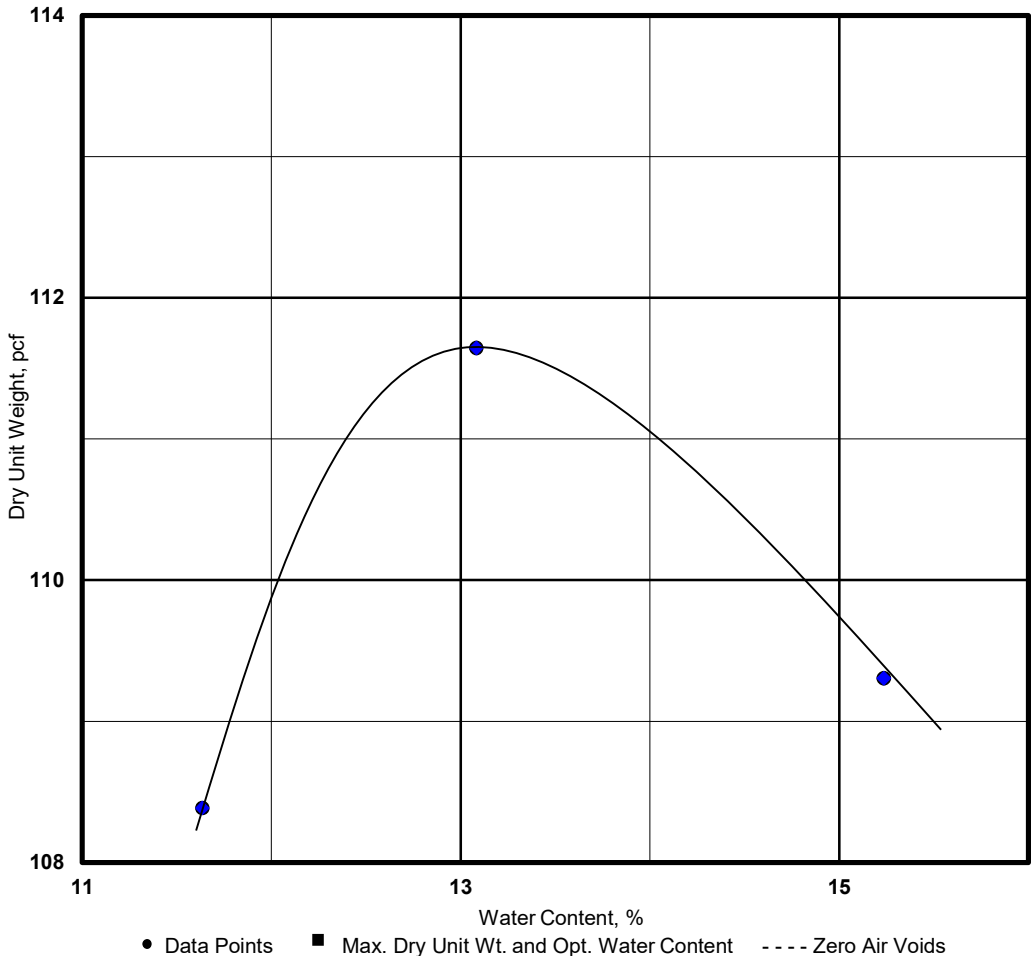
Source Material: B-3 at 0-5'
Sample Description: Silty Sand
Proctor #2
Material Designation: SM Sample date: 1/25/2023
Test Method: ASTM-698
Test Procedure: A
Sample Preparation: D. Parrack
Rammer: ___ Mechanical X Manual

Project No.: 4223012 Date: 2/4/2023

TEST RESULTS
Maximum Dry Unit Wt.: 111.7 pcf
Optimum Water Content: 13.1 %

Liquid Limit: 27 Plastic Limit: 24
Plasticity Index: 3
% passing # 200 sieve: 33

Reviewed by: Dan Cosper, P. E.



APPENDIX D

ENGINEERING DRAWINGS

TWIN WELLS RECYCLE
WATERBRIDGE OPERATING

Section 20, Township 20 South, Range 30 East

32° 33' 37.206", -104° 0' 5972"
32.560335°, -104.001277°

WATERBRIDGE

Index to Drawings
11X17

Sheet No.	Description
1.	Cover Sheet
2.	Project Location
3.	Existing Site Features
4.	Site Plan
5.	Staking Plan
6.	Pit Capacities
7.	Cross Sections
8.	Cross Sections
9.	Sump Details
10.	Liner Details
11.	Fence Details
12.	Stormwater Management

Contacts

Jake Ferenz - WaterBridge Operating - (214) 733-9919

Envirotech Engineering Consulting - Mitchell Ratke, EIT (580)-234-8780 (Design Engineer)

Envirotech Engineering Consulting - Tyler Williams, PE (580)-234-8780 (Supervising Engineer)

TYLER JOE WILLIAMS
NEW MEXICO
26432
PROFESSIONAL ENGINEER
5/2/2023

ENVIROTECH
ENGINEERING

2500 N. Eleventh Street Enid, OK 73701 • 580.234.8780 • envirotechconsulting.com
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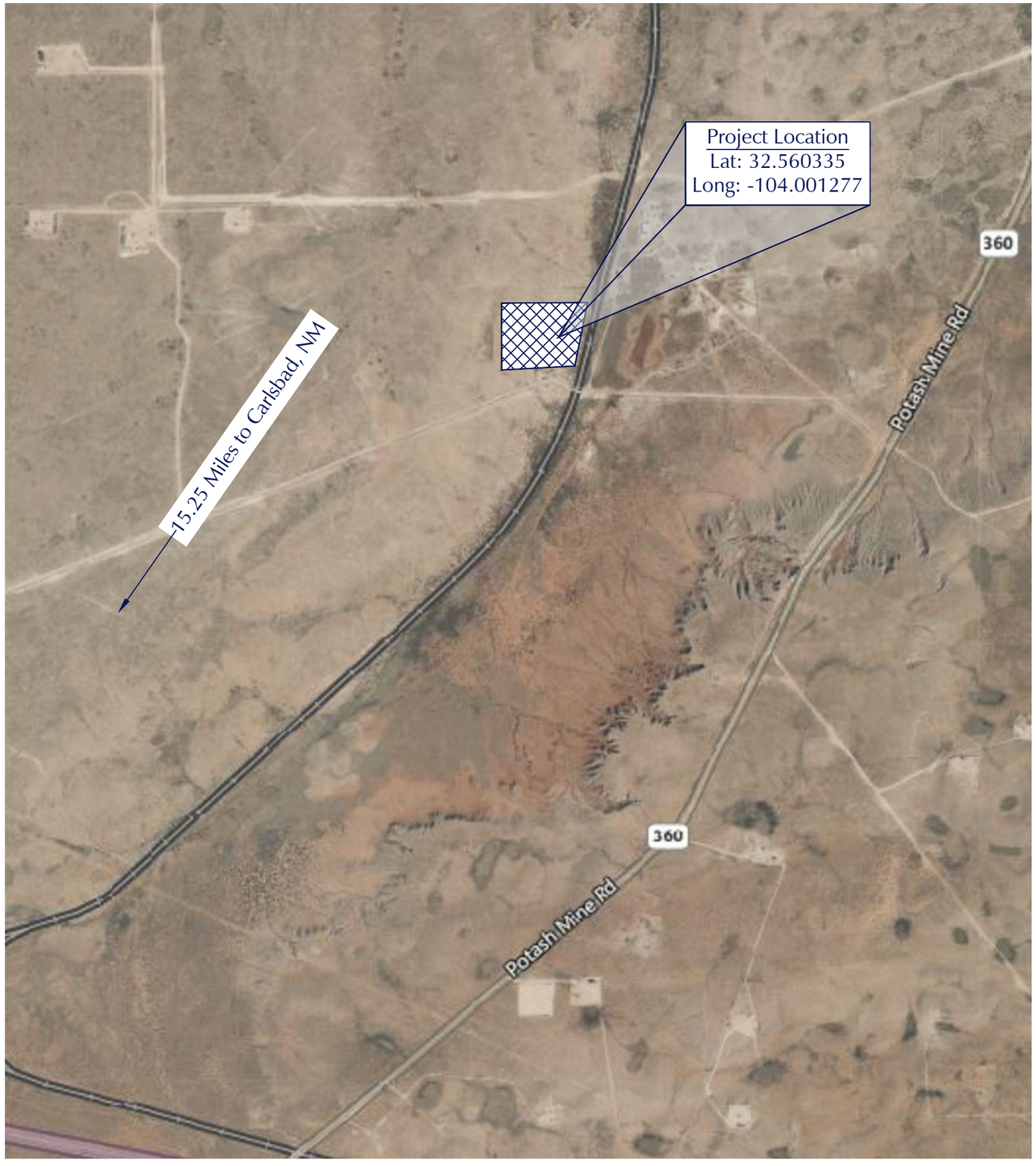
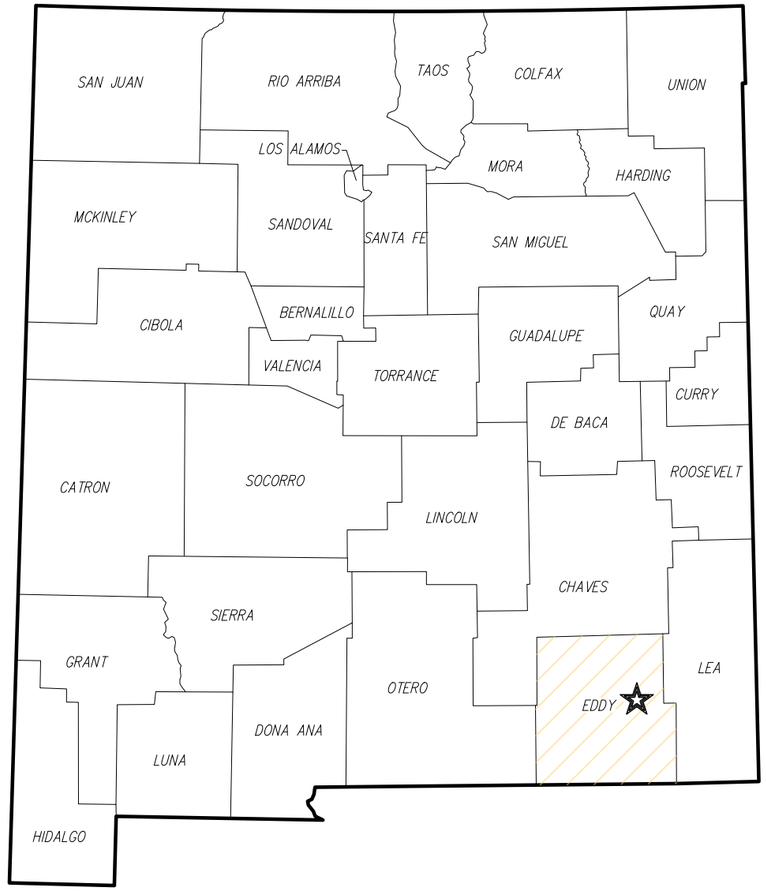
nm811 Professional Resources for Damage Prevention





NORTH

ENVIROTECH ENGINEERING
2500 North Eleventh Street
Enid, Oklahoma
580.234.8780
envirotechconsulting.com
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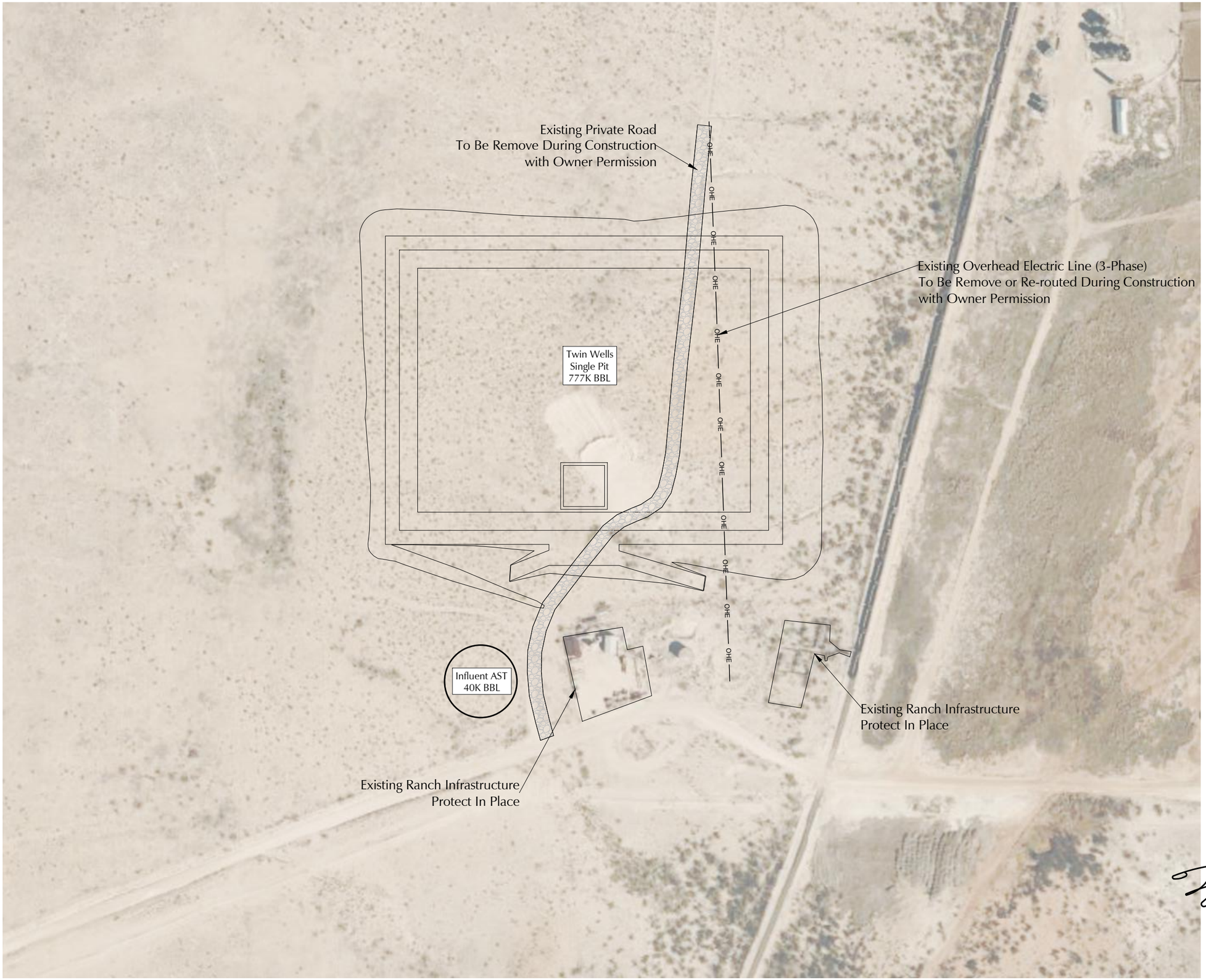
NO.	DATE	DESCRIPTION

WATERBRIDGE

PROJECT LOCATION
Twin Wells Recycle
WaterBridge Stateline LLC
Section 20, Township 20 South, Range 30 East,
Eddy County New Mexico

TYLER JOE WILLIAMS
NEW MEXICO
26432
PROFESSIONAL ENGINEER
5/2/2023

DATE:	April 2023
SCALE:	NTS
DESIGNED BY:	M. Ratke
DRAWN BY:	M. Ratke
CHECKED BY:	T. Williams
PROJECT NO.	023026-00
SHEET NO.	2 of 12



N

NORTH

0 100 200

Scale: 1" = 200'
Bar Scale is intended for 11" x 17" (Full Size)

NOTE*
All Existing Features shown at this location are base on survey received by M. Ratke of EEC via email on 1/17/2023 from J. Ferenz of WaterBridge. Survey conducted by COOSA Consulting

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Enid, Oklahoma
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envirotechconsulting.com
License #:26432 • Expiration Data: 12-31-2024

NO.	DATE	DESCRIPTION

WATERBRIDGE

EXISTING SITE FEATURES

Twin Wells Recycle

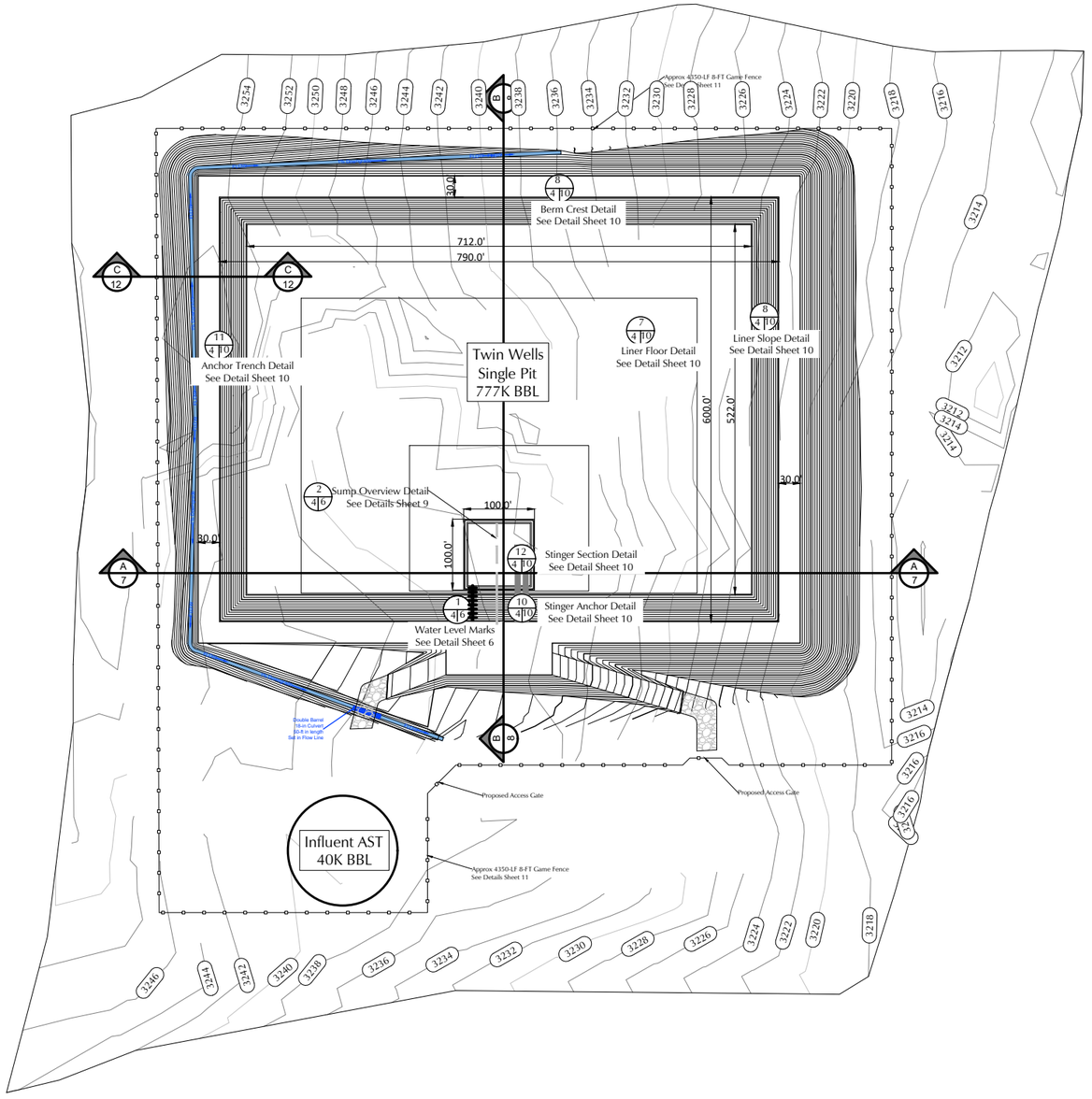
WaterBridge Stateline LLC
Section 20, Township 20 South, Range 30 East,
Eddy County New Mexico

TYLER JOE WILLIAMS
NEW MEXICO
26432
PROFESSIONAL ENGINEER
5/2/2023

DATE:	April 2023
SCALE:	1" = 200'
DESIGNED BY:	M. Ratke
DRAWN BY:	M. Ratke
CHECKED BY:	T. Williams
PROJECT NO.	023026-00
SHEET NO.	3 of 12

On Site Earthwork Quantities

					Cut	Fill	NET	
Site	Stratum	Surface 1	Surface 2	Fill Factor	cubic yard	cubic yard	cubic yard	Method
Twin Wells Single Pit	Facility EARTHWORK	Existing	Proposed	20%	132,585	126,661	5,924	AutoCAD



N

NORTH

0 100 200

Scale: 1" = 200'

Bar Scale is intended for 11" x 17" (Full Size)

NOTE*
All topographical data shown at this location are base on survey received by M. Ratke of EEC via email on 1/17/2023 from J. Ferenz of WaterBridge. Survey conducted by COOSA Consulting

Liner Bid Quantities

Type	Location	Square ft.
60 Mil HDPE	Storage Pits	496,600
200 Mil Geonet	Storage Pits	496,600
40 Mil HDPE	Storage Pits	496,600
Underlayment	Storage Pits	496,600

NOTE
Liner estimates account for pit AND anchor trench. Liner estimates do not account for waste or seam overlap

ENVIROTECH ENGINEERING
2500 North Eleventh Street
Enid, Oklahoma
580.234.8780
envirotechconsulting.com
License # 26432 • Expiration Data: 12-31-2024

NO.	DATE	DESCRIPTION

WATERBRIDGE

SITE PLAN

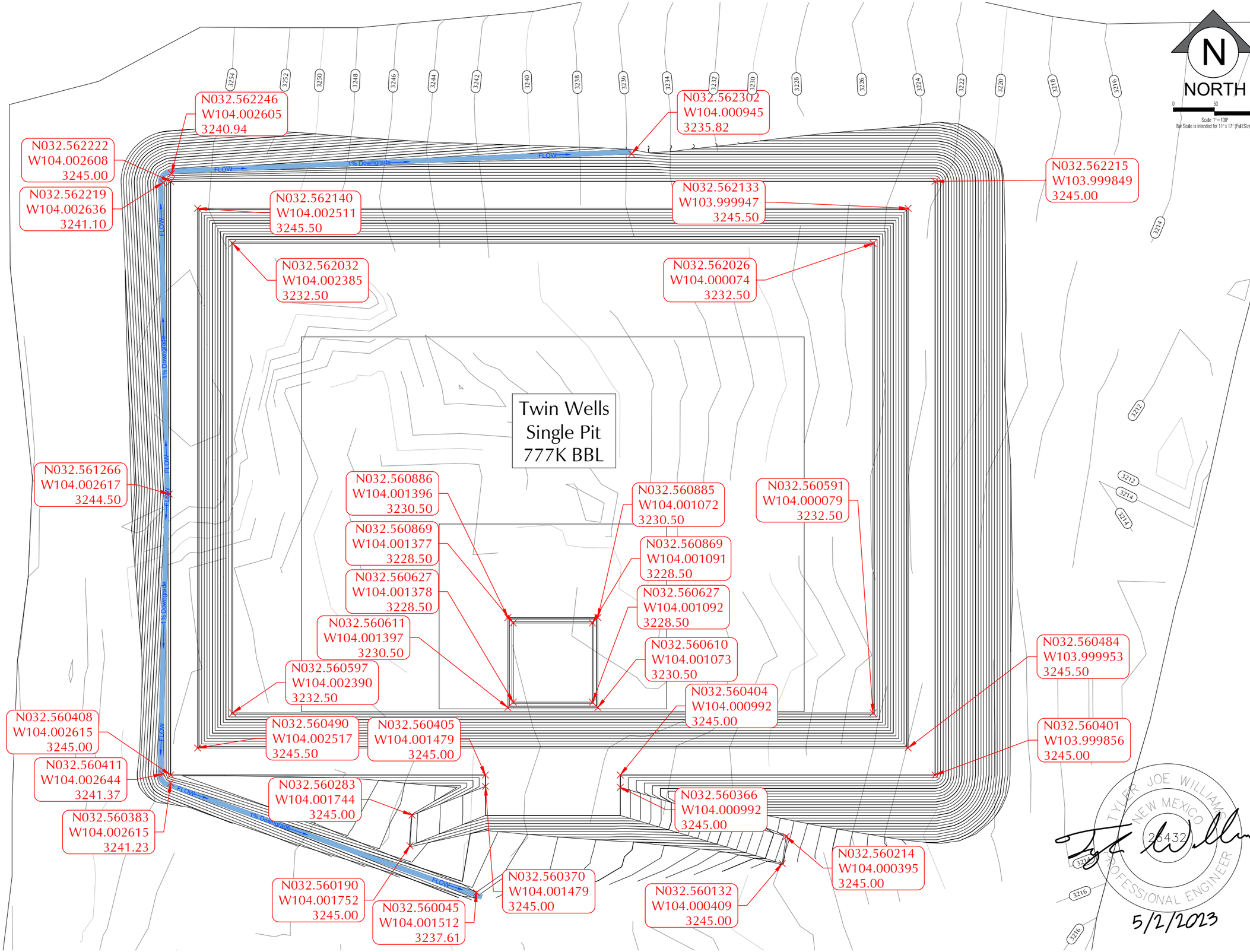
Twin Wells Recycle

WaterBridge Sateline LLC
Section 20, Township 20 South, Range 30 East,
Eddy County New Mexico

TYLER JOE WILLIAMS
NEW MEXICO
26432
PROFESSIONAL ENGINEER

5/2/2023

DATE:	April 2023
SCALE:	1" = 200'
DESIGNED BY:	M. Ratke
DRAWN BY:	M. Ratke
CHECKED BY:	T. Williams
PROJECT NO.	023026-00
SHEET NO.	4 of 12



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ENGINEERING
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Enid, Oklahoma
580.234.8780
envirotechconsulting.com
License #26432 • Expiration Data: 12-31-2024

NO.	DATE	DESCRIPTION

WATERBRIDGE

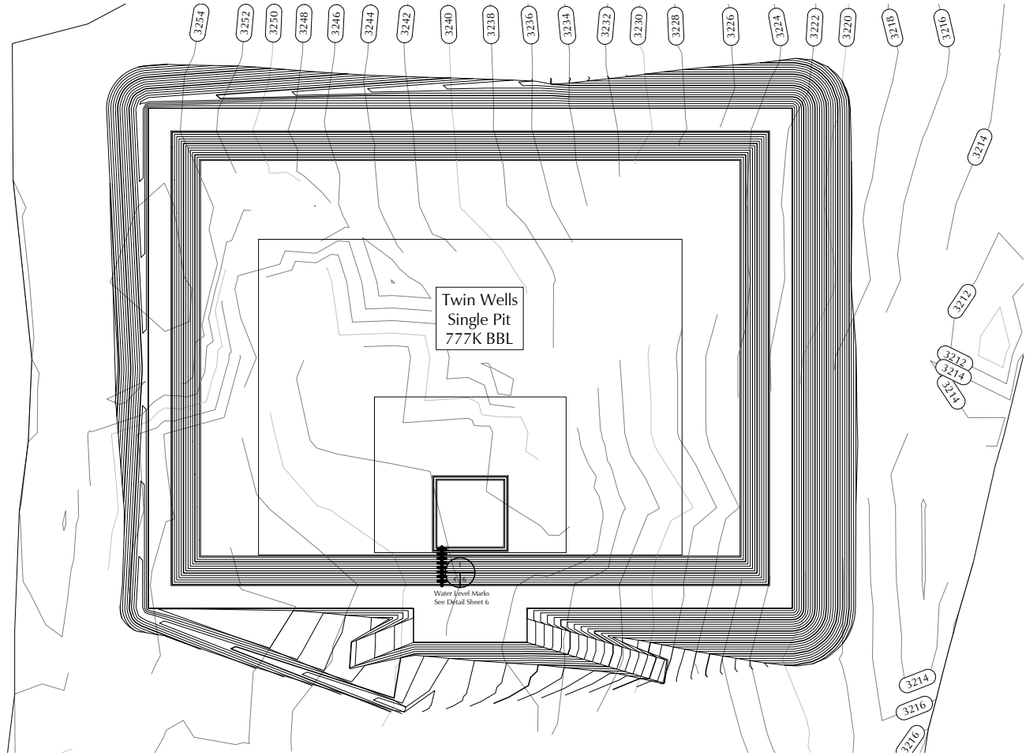
STAKING PLAN

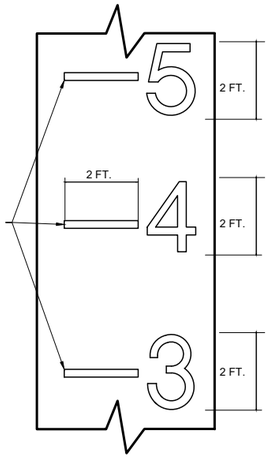
Twin Wells Recycle

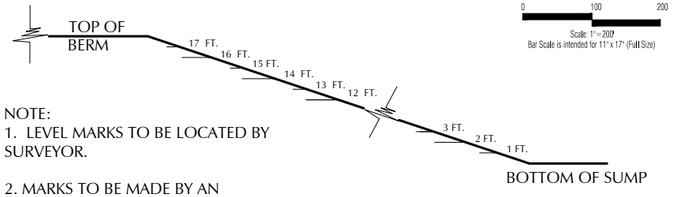
WaterBridge Sateline LLC
Section 20, Township 20 South, Range 30 East,
Eddy County New Mexico

TYLER JOE WILLIAMS
NEW MEXICO
26432
PROFESSIONAL ENGINEER
5/2/2023

DATE:	April 2023
SCALE:	1" = 100'
DESIGNED BY:	M. Ratke
DRAWN BY:	M. Ratke
CHECKED BY:	T. Williams
PROJECT NO.	023026-00
SHEET NO.	5 of 12







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 SHOULD BEGIN AT THE TOP OF BERM AND CONTINUE TO THE BOTTOM OF THE SUMP. (TOP OF BERM SHOULD READ 17-FT, BOTTOM OF SUMP +1-FT SHOULD READ 1-FT)

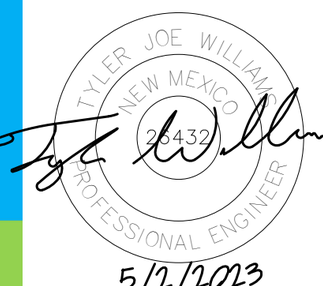
4. REFERENCE PIT CAPACITY TABLES FOR ACCURATE ELEVATIONS

WATER LEVEL MARKS
Not to Scale

1 | 3 4

Owner	WaterBridge Stateline LLC		
Site Name	Twin Wells Recycle Storage Pit		
	Top FB	Bottom	Max Liq. Level
Lagoon Features			
Side slope Ratio	3		2
Maximum Depth (ft)	17.0		15.0
Lagoon Top Width (ft)	600	511	588
Lagoon Top Length (ft)	600	515	588
Maximum Total Vol (ft^3)	5,745,823		4,814,532
Maximum Total Vol (bbls	1,023,304		857,560

Lagoon Liq Depth ft	Storage ft	Remaining Stor Vol ft3	Gallons Storage gal	BBLS Storage bbls	Percent of Total Volume %	Vol in lagoon ft^3	Gallons Storage gal	Vol in Lagoon bbls	Vol in Lagoon ac-ft	Percent Total Vol %	
17.0	0.0	-	-	-	0.0%	5,745,823	42,984,504	1,023,441	131.91	100%	
16.0	1.0	12,882	61,963	1,475	0.2%	5,276,044	39,470,085	939,764	121.12	92%	
15.0	2.0	27,519	132,367	3,152	0.5%	4,814,532	36,017,512	857,560	110.53	84%	Freeboard Maximum Capacity
14.0	**3.0**	**96,057**	**462,034**	**11,001**	**1.7%**	**4,361,214**	**32,626,244**	**776,815**	**100.12**	**76%**	
13.0	4.0	408,923	1,966,921	46,831	7.1%	3,916,020	29,295,744	697,518	89.90	68%	
12.0	5.0	992,671	4,774,748	113,684	17.3%	3,478,876	26,025,474	619,654	79.86	61%	
11.0	6.0	1,047,607	5,038,991	119,976	18.2%	3,049,712	22,814,892	543,212	70.01	53%	
10.0	7.0	2,195,157	10,558,703	251,398	38.2%	2,628,454	19,663,464	468,178	60.34	46%	
9.0	8.0	2,814,118	13,535,909	322,284	49.0%	2,215,031	16,570,648	394,539	50.85	39%	Freeboard
8.0	9.0	3,445,041	16,570,648	394,539	60.0%	1,809,372	13,535,909	322,284	41.54	31%	
7.0	10.0	4,088,038	19,663,464	468,178	71.1%	1,411,403	10,558,703	251,398	32.40	25%	
6.0	11.0	4,743,221	22,814,892	543,212	82.6%	673,572	5,038,991	119,976	15.46	12%	
5.0	12.0	5,410,702	26,025,474	619,654	94.2%	638,250	4,774,748	113,684	14.65	11%	
4.0	13.0	6,090,591	29,295,744	697,518	106.0%	262,922	1,966,921	46,831	6.04	5%	
3.0	14.0	6,783,003	32,626,244	776,815	118.1%	61,761	462,034	11,001	1.42	1%	
2.0	15.0	7,488,048	36,017,512	857,560	130.3%	17,694	132,367	3,152	0.41	0%	Freeboard
1.0	16.0	8,205,839	39,470,085	939,764	142.8%	8,283	61,963	1,475	0.19	0%	
0.0	17.0	8,936,487	42,984,504	1,023,441	155.5%	-	-	-	-	0%	



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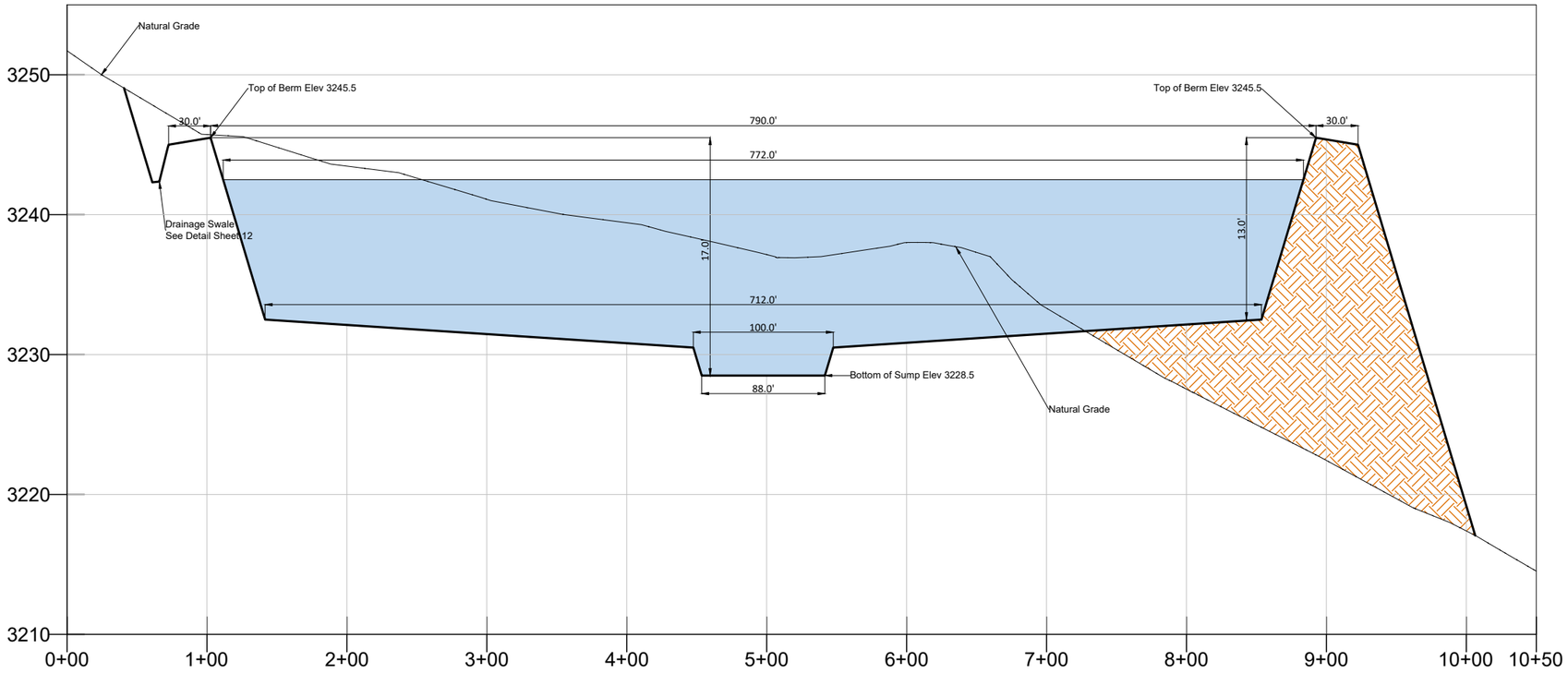
NO.	DATE	DESCRIPTION

WATERBRIDGE

PIT CAPACITIES
Twin Wells Recycle
WaterBridge Stateline LLC
Section 20, Township 20 South, Range 30 East,
Eddy County New Mexico

DATE:	April 2023
SCALE:	1" = 200'
DESIGNED BY:	M. Ratke
DRAWN BY:	M. Ratke
CHECKED BY:	T. Williams
PROJECT NO.	023026-00
SHEET NO.	6 of 12

Cross Section A-A



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NO.	DATE	DESCRIPTION

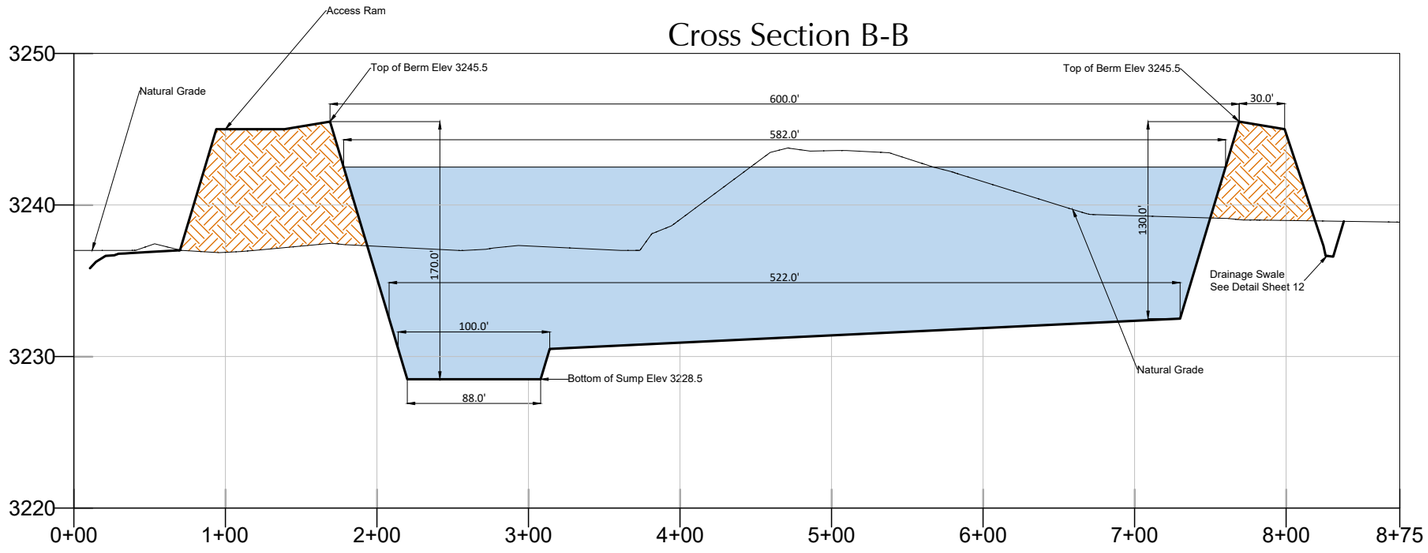
WATERBRIDGE

CROSS SECTIONS
Twin Wells Recycle
WaterBridge Stateline LLC
Section 20, Township 20 South, Range 30 East,
Eddy County New Mexico

TYLER JOE WILLIAMS
NEW MEXICO
26432
PROFESSIONAL ENGINEER
5/2/2023

DATE:	April 2023
SCALE:	NTS
DESIGNED BY:	M. Ratke
DRAWN BY:	M. Ratke
CHECKED BY:	T. Williams
PROJECT NO.	023026-00
SHEET NO.	7 of 12

Cross Section B-B



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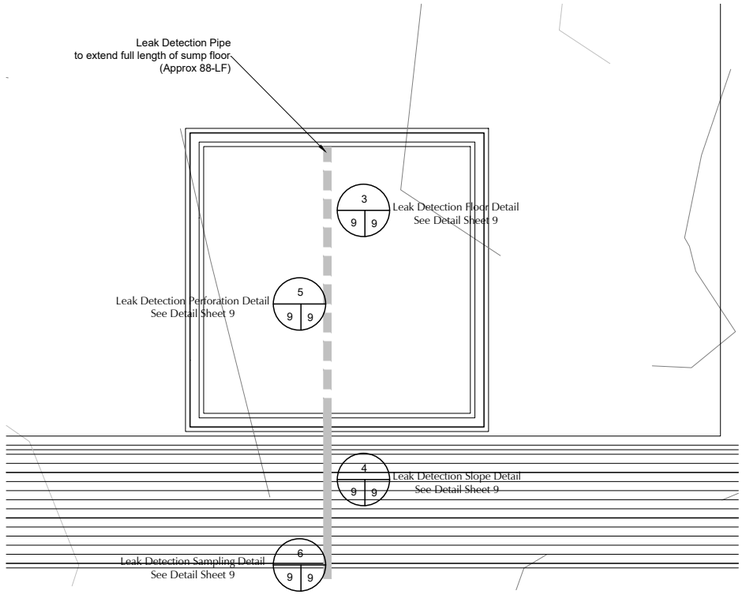
NO.	DATE	DESCRIPTION

WATERBRIDGE

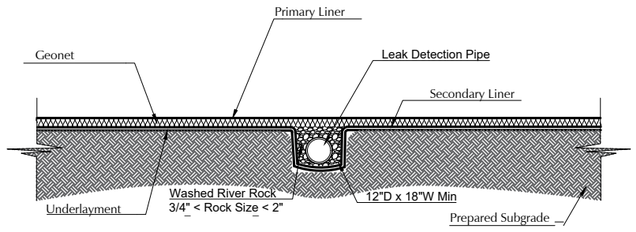
CROSS SECTIONS
Twin Wells Recycle
WaterBridge Stateline LLC
Section 20, Township 20 South, Range 30 East,
Eddy County New Mexico

TYLER JOE WILLIAMS
NEW MEXICO
26432
PROFESSIONAL ENGINEER
5/2/2023

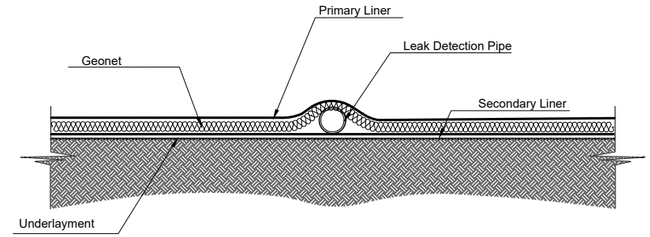
DATE:	April 2023
SCALE:	NTS
DESIGNED BY:	M. Ratke
DRAWN BY:	M. Ratke
CHECKED BY:	T. Williams
PROJECT NO.	023026-00
SHEET NO.	8 of 12



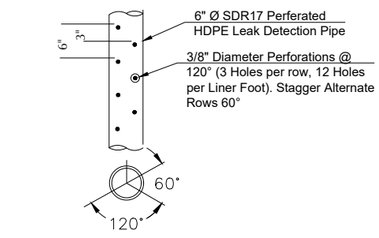
SUMP OVERVIEW DETAIL (2 / 4 9)
Not to Scale



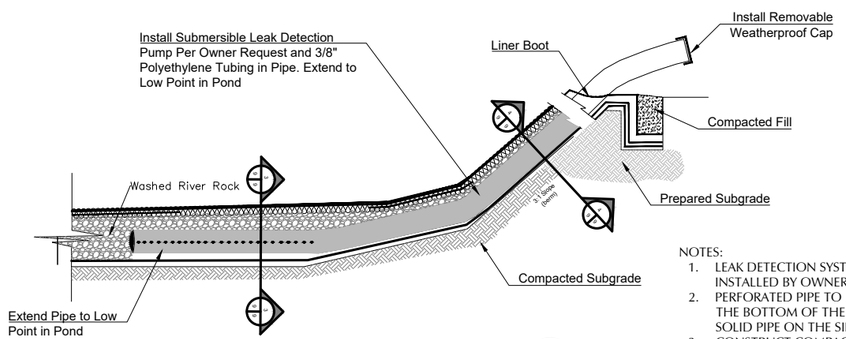
SUMP LEAK DETECTION PIPE DETAIL (3 / 9 9)
Not to Scale



SIDE SLOPE LEAK DETECTION PIPE DETAIL (4 / 9 9)
Not to Scale

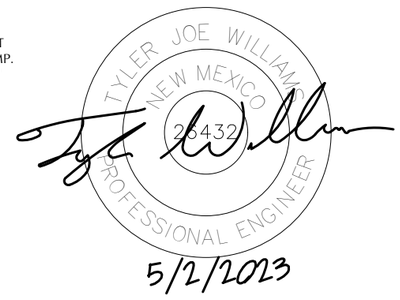


PERFORATED PIPE DETAIL (5 / 9 9)
Not to Scale



LEAK DETECTION/SAMPLING SYSTEM DETAIL (6 / 9 9)
Not to Scale

NOTES:
1. LEAK DETECTION SYSTEM TO BE INSTALLED BY OWNER.
2. PERFORATED PIPE TO BE ALONG THE BOTTOM OF THE POND. 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. WASH RIVER ROCK SHALL BE 3/4" MIN. & 2" MAX.



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NO.	DATE	DESCRIPTION

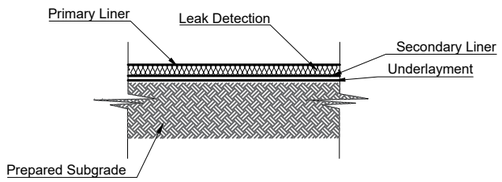
WATERBRIDGE

SUMP DETAILS

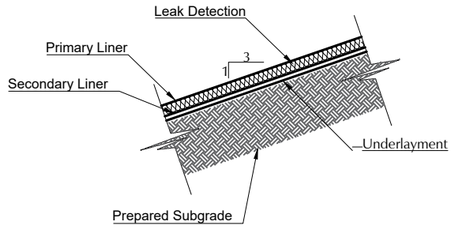
Twin Wells Recycle

WaterBridge Stateline LLC
Section 20, Township 20 South, Range 30 East,
Eddy County New Mexico

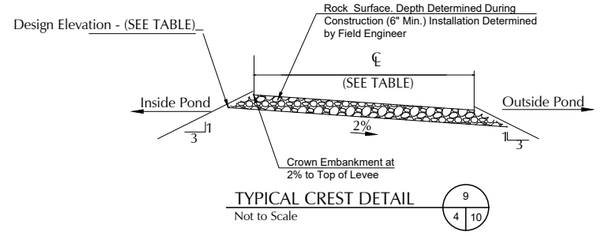
DATE:	April 2023
SCALE:	NTS
DESIGNED BY:	M. Ratke
DRAWN BY:	M. Ratke
CHECKED BY:	T. Williams
PROJECT NO.	023026-00
SHEET NO.	9 of 12



LINER SYSTEM FLOOR DETAIL (7 / 4 10)
Not to Scale



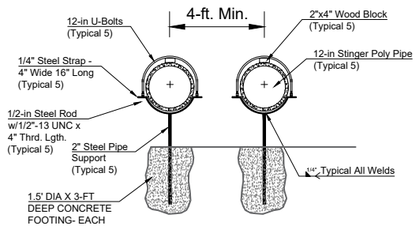
LINER SYSTEM SIDE SLOPE DETAIL (8 / 4 10)
Not to Scale



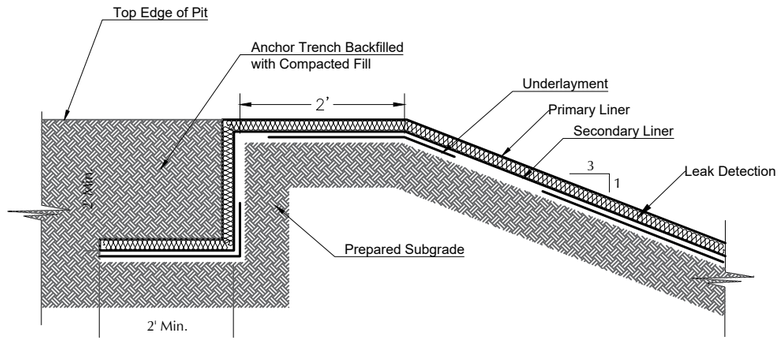
TYPICAL CREST DETAIL (9 / 4 10)
Not to Scale

GENERAL NOTES:

1. PREPARED SUBGRADE MEANS COMPACTED SMOOTH SUBGRADE FREE OF ROCK, ROOTS, WOOD DEBRIS, CONCRETE RUBBLE AND ANY SHARP OBJECTS THAT MIGHT PUNCTURE THE HDPE LINER.
2. ALL INTERIOR SLOPES AND TOP OF BERMS TO BE SMOOTH DRUM ROLLED.
3. ALL EMBANKMENT SLOPES SHALL HAVE A RATIO OF 3:1, COMPACTED EARTH EMBANKMENTS TO BE CONSTRUCTED WITH 12 INCH (MAXIMUM LOOSE LIFTS, COMPACTED TO 95% STANDARD PROCTOR DENSITY.
4. PERFORM GEOTECHNICAL ANALYSIS ON EXISTING SOIL TO CONFIRM SOIL IS SUITABLE FOR USE IN THE LEVEE.
5. ALL BOTTOM OF PITS SHALL SLOPE TO THE SUMP @ 1%.



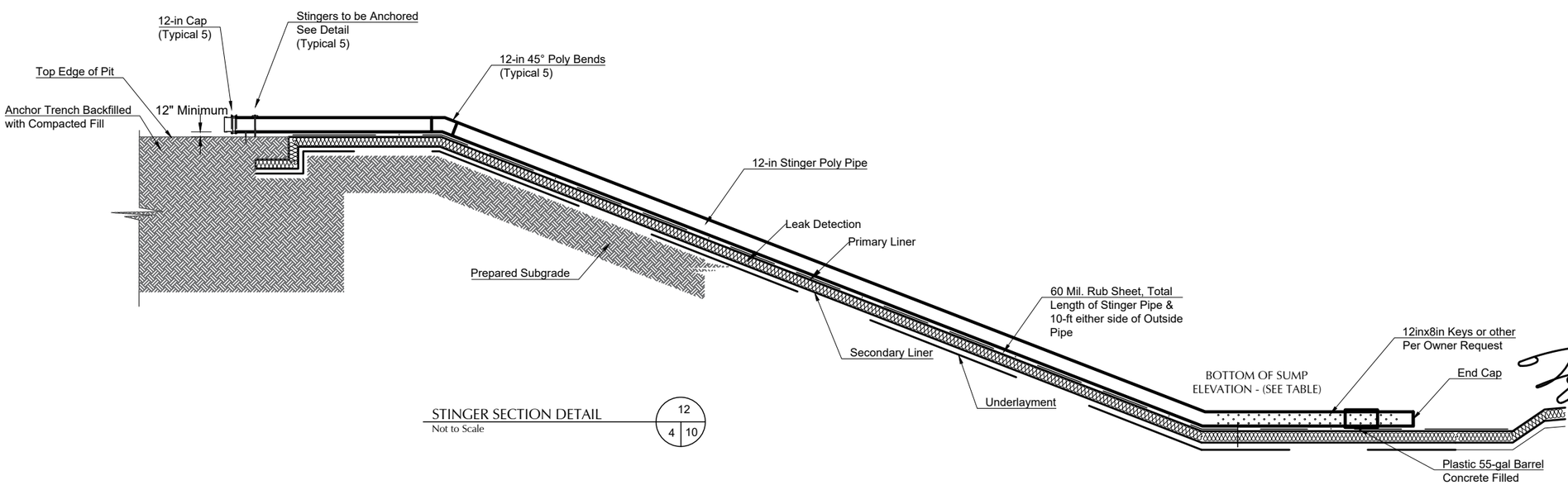
Stinger System Anchor Detail (10 / 4 10)
Not to Scale



ANCHOR TRENCH DETAIL (11 / 4 10)
Not to Scale

PROPOSED PIT REFERENCE TABLE

DETAIL	DESCRIPTION
PRIMARY LINER	60 mil HDPE LINER
LEAK DETECTION	200 mil Geonet
SECONDARY LINER	40 mil HDPE LINER
UNDERLAYMENT	10oz Geotextile
SUMP	3228.50 ft ELEVATION
BERM (ROAD CREST)	DESIGN ELEV. 3245.50-ft - ROAD CREST 30-ft
LEAK DETECTION PIPING	8-in DR11.X PERFORATED HDPE PIPE LEAK DETECTION PIPE



STINGER SECTION DETAIL (12 / 4 10)
Not to Scale

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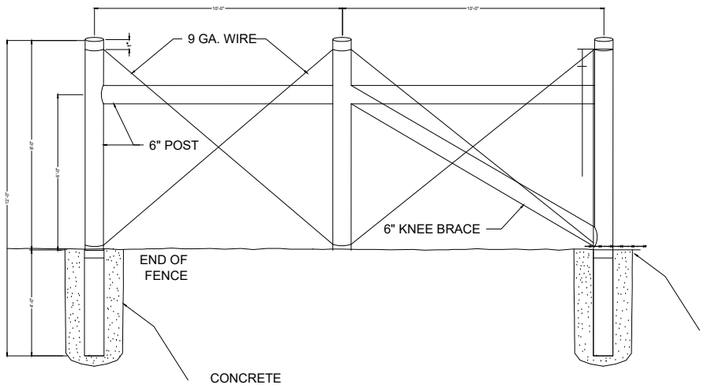
WATERBRIDGE

LINER DETAILS
Twin Wells Recycle
WaterBridge Stateline LLC
Section 20, Township 20 South, Range 30 East,
Eddy County New Mexico

TYLER JOE WILLIAMS
NEW MEXICO
26432
PROFESSIONAL ENGINEER
5/2/2023

DATE:	April 2023
SCALE:	NTS
DESIGNED BY:	M. Ratke
DRAWN BY:	M. Ratke
CHECKED BY:	T. Williams
PROJECT NO.	023026-00
SHEET NO.	10 of 12

END POST



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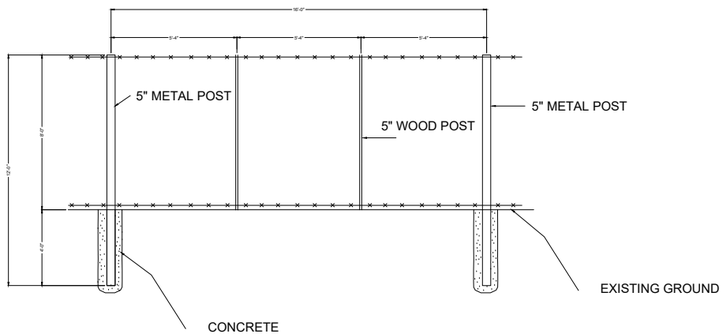

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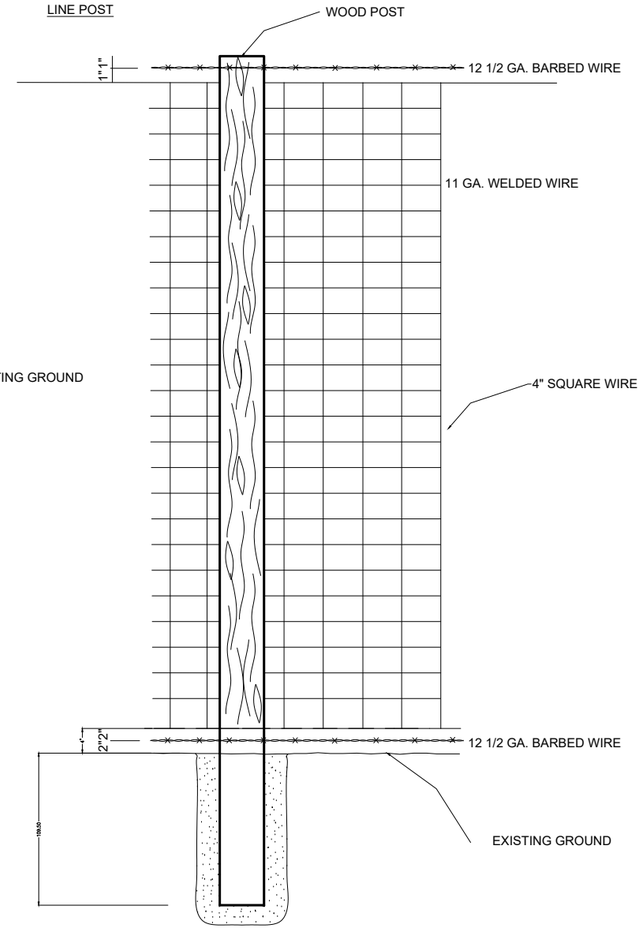

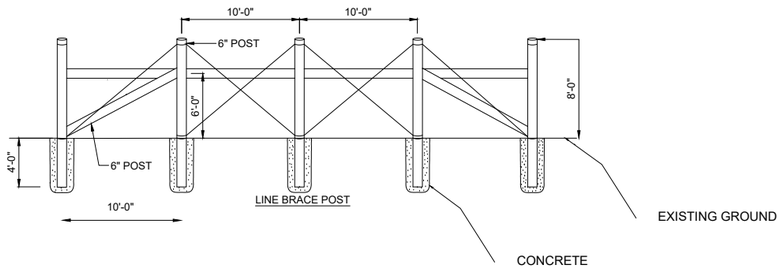

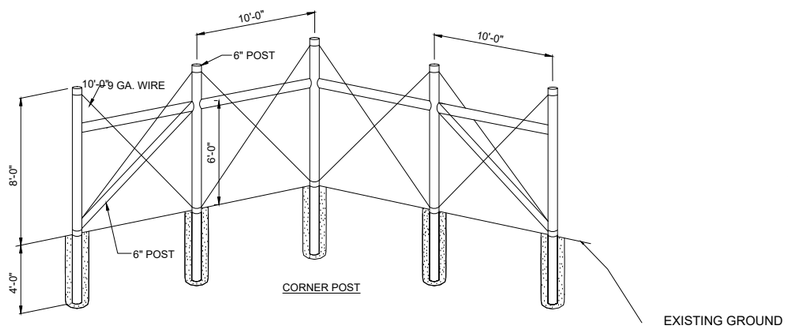

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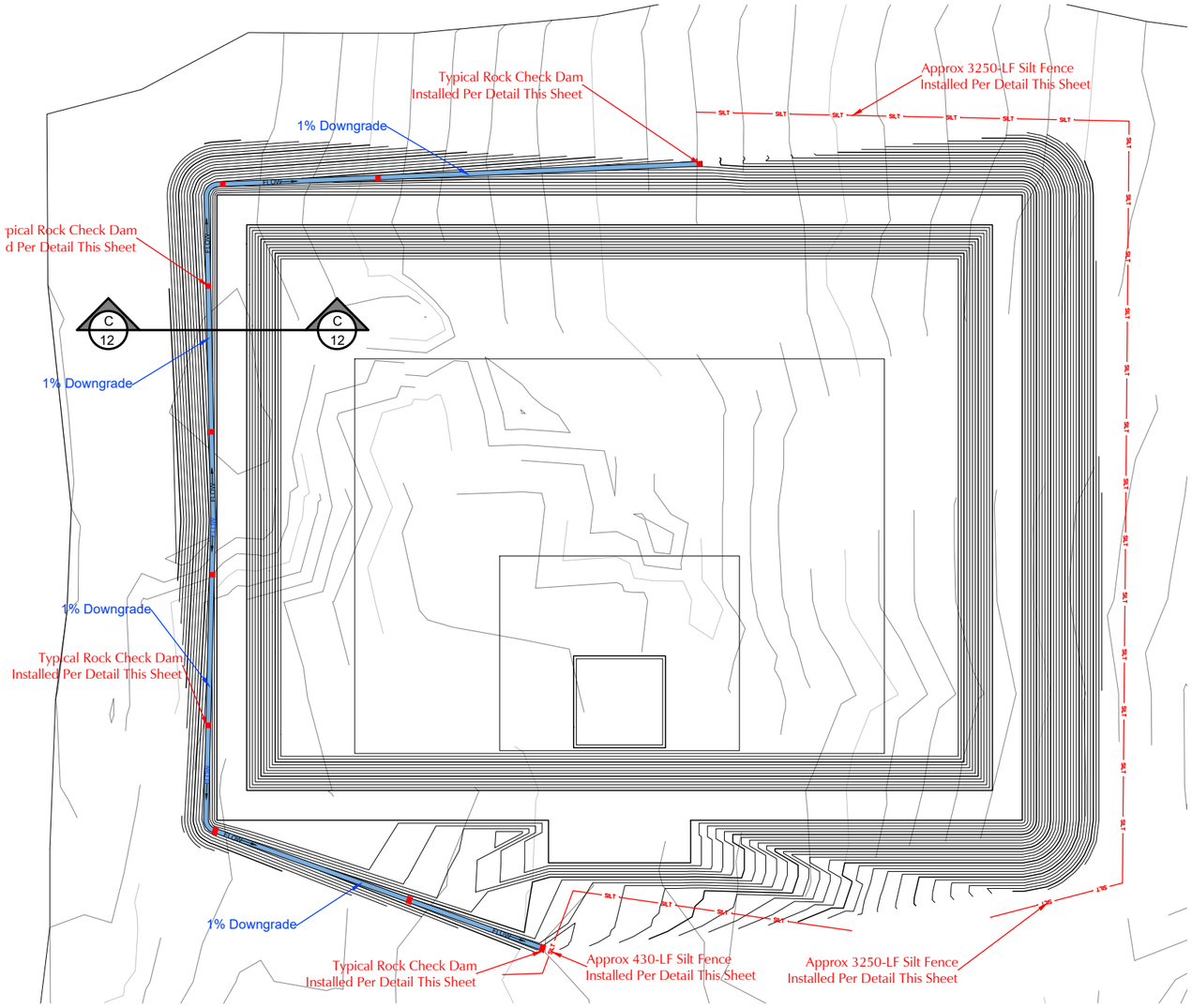
WATERBRIDGE

FENCE DETAILS

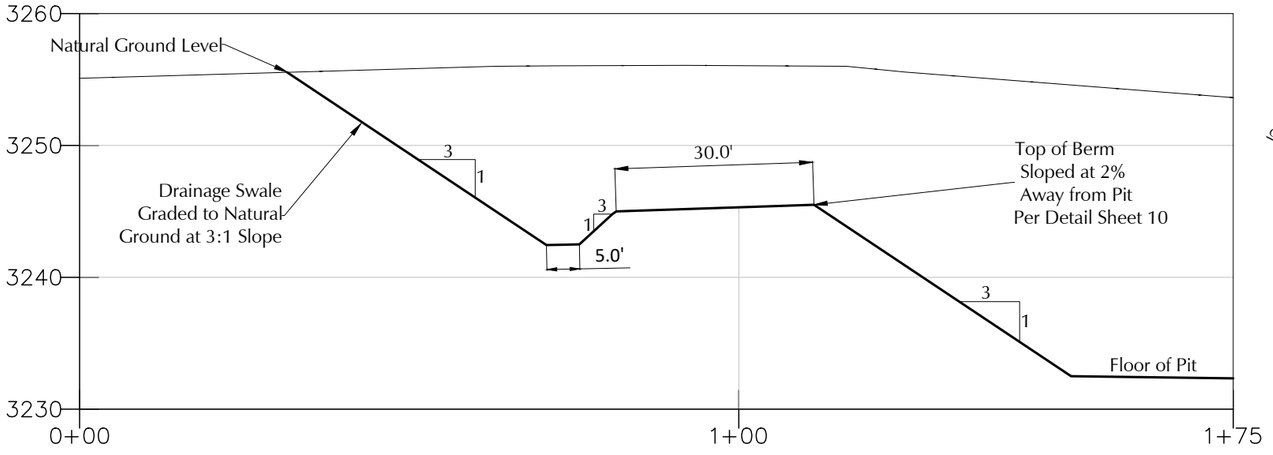
Twin Wells Recycle
WaterBridge Stateline LLC
Section 20, Township 20 South, Range 30 East,
Eddy County New Mexico

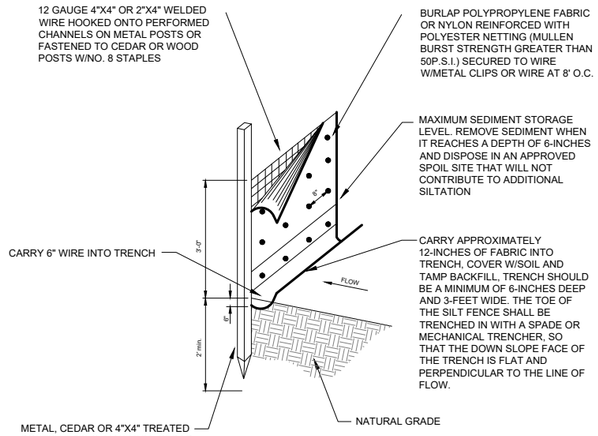
TYLER JOE WILLIAMS
NEW MEXICO
26432
PROFESSIONAL ENGINEER
5/2/2023

DATE:	April 2023
SCALE:	NTS
DESIGNED BY:	M. Ratke
DRAWN BY:	M. Ratke
CHECKED BY:	T. Williams
PROJECT NO.	023026-00
SHEET NO.	11 of 12

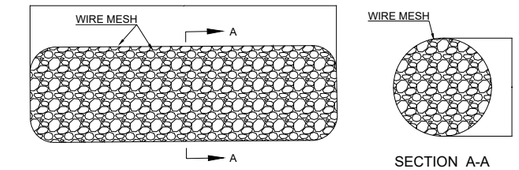


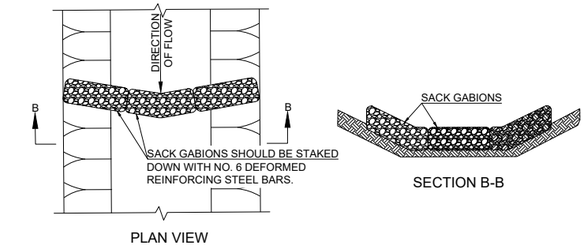
Cross Section C-C



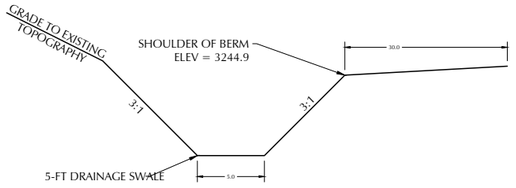


SILT FENCE DETAIL

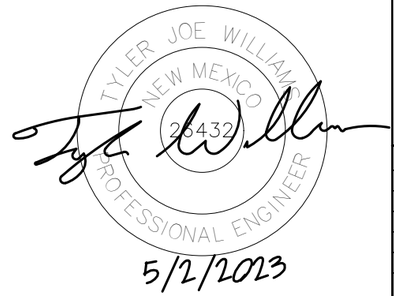




ROCK CHECK DAM DETAIL



Drainage Swale Detail
NOT TO SCALE



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NO.	DATE	DESCRIPTION

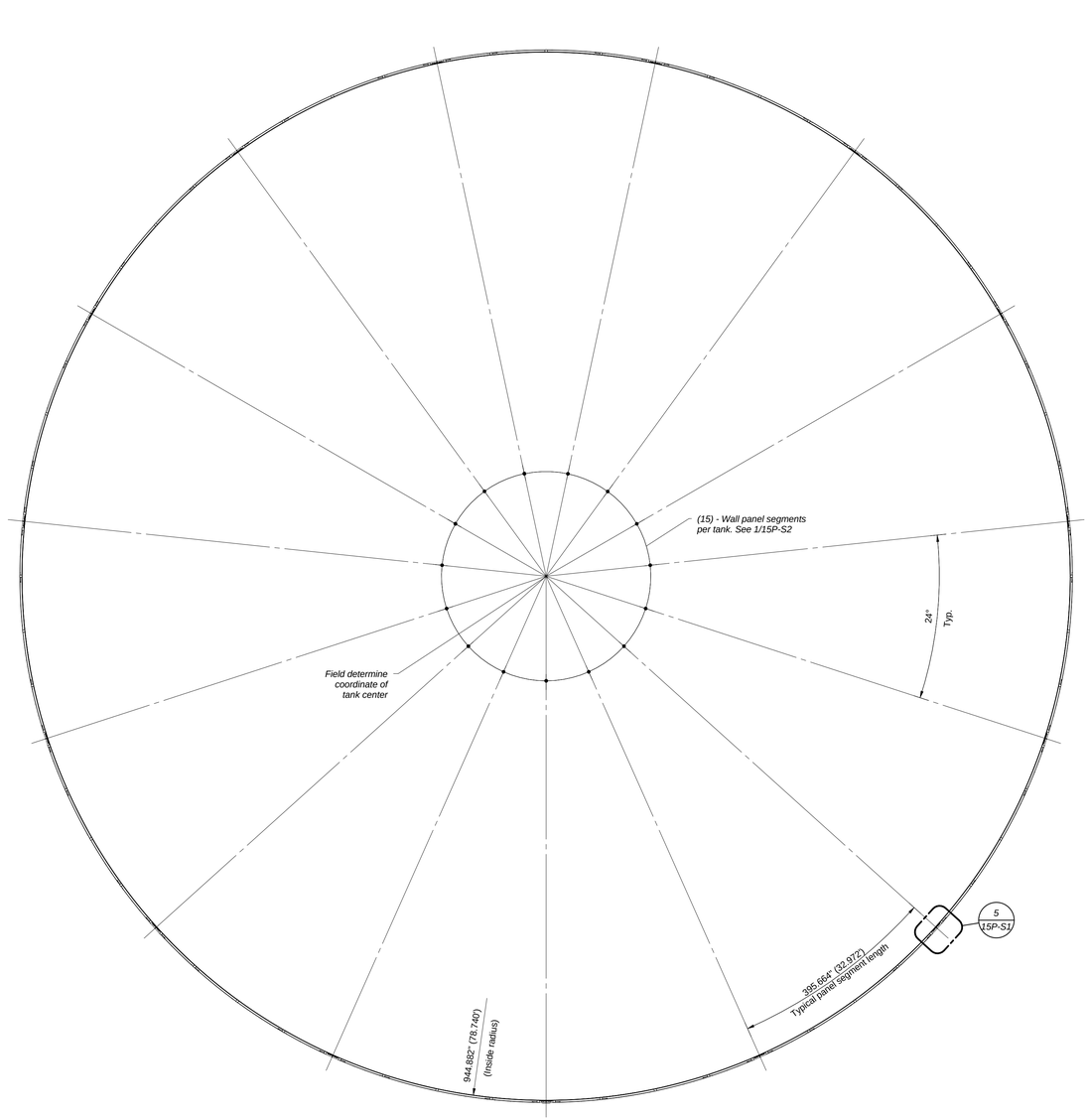
WATERBRIDGE

STORMWATER MANAGEMENT

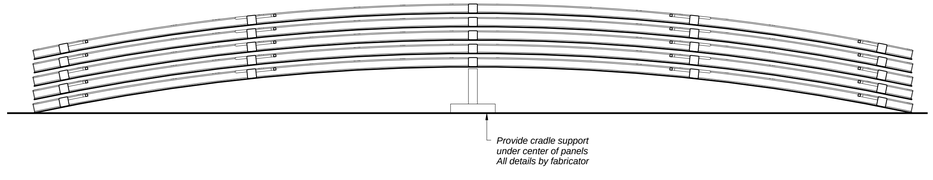
Twin Wells Recycle

WaterBridge Stateline LLC
Section 20, Township 20 South, Range 30 East,
Eddy County New Mexico

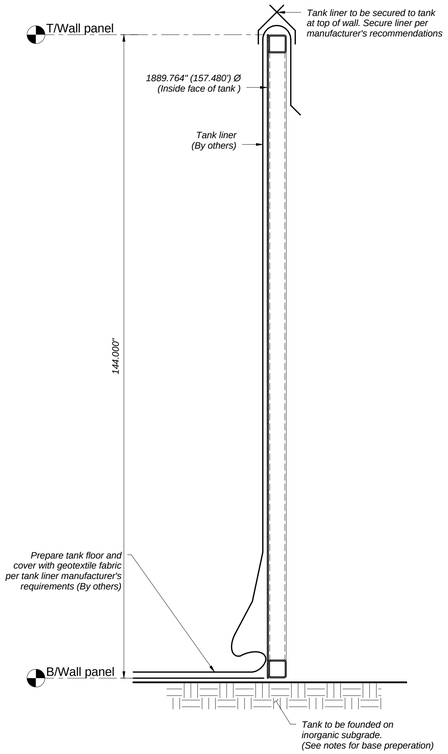
DATE:	April 2023
SCALE:	NTS
DESIGNED BY:	M. Ratke
DRAWN BY:	M. Ratke
CHECKED BY:	T. Williams
PROJECT NO.	023026-00
SHEET NO.	12 of 12



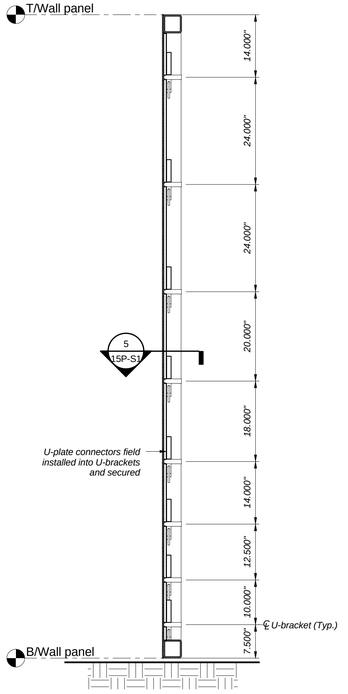
1 Tank Layout Plan
SCALE: 3/32" = 1'-0"



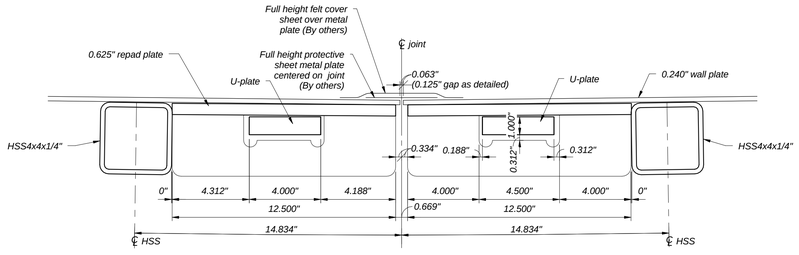
4 Transport and Storage Detail
SCALE: N.T.S.



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

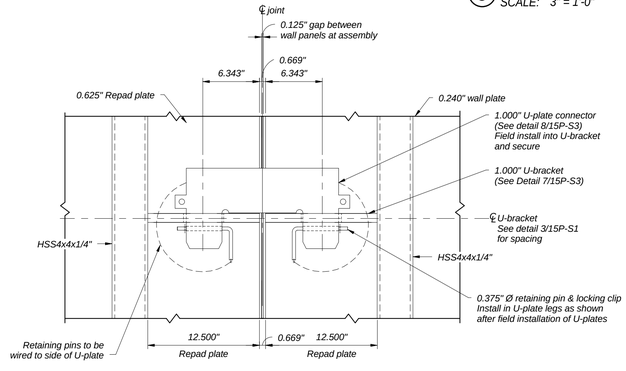


3 Wall Section at Panel Joint
SCALE: 3/4" = 1'-0"



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
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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:

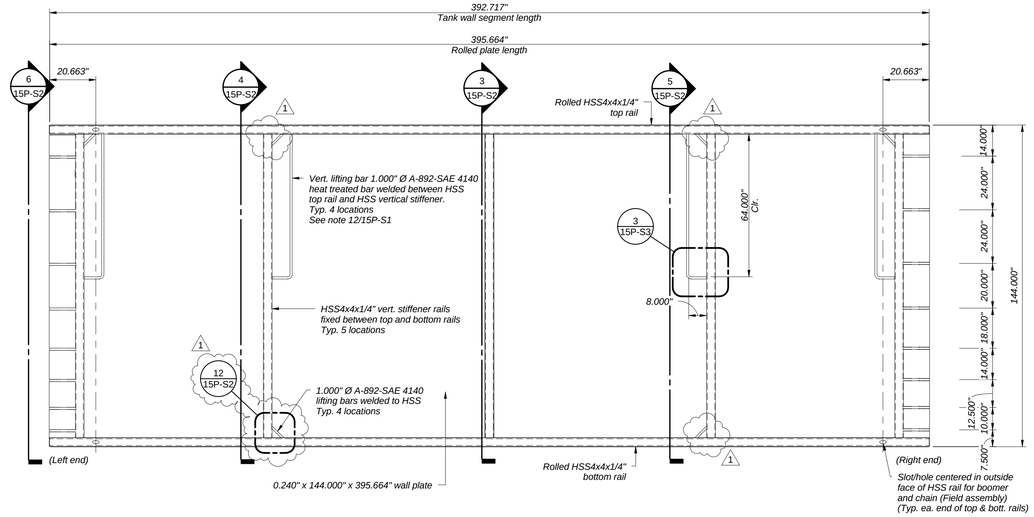
Project:
Designed: FEC
Drawn: TCM
Checked: TAM
Scale: As indicated
Issue Date: 06/24/13

Tank Installation & Assembly

15P-S1

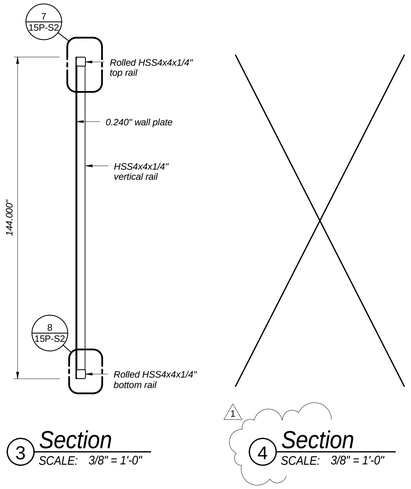
Highest level of Quality and Commitment for our Clients

P:\Hydrena Energy Services Corp\Modular Tanks\Dwg\15P Modular Water Tank.vt 7/30/2013 12:36:39 PM



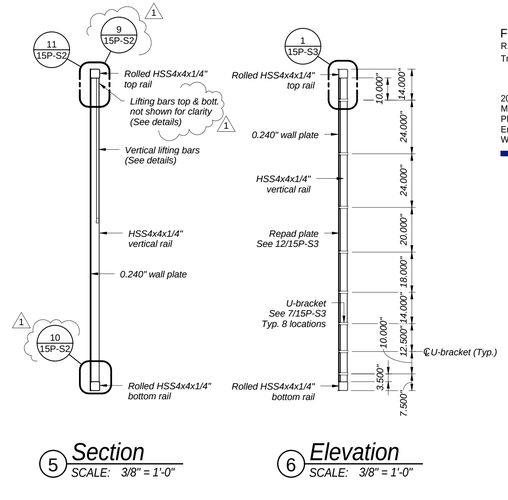
Note: Framing shown to outside face of panel.

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



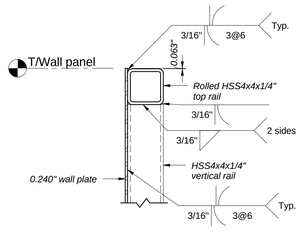
3 Section
SCALE: 3/8" = 1'-0"

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



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

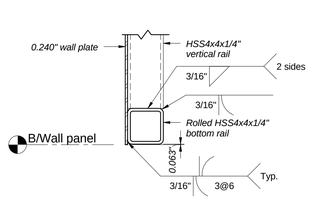
6 Elevation
SCALE: 3/8" = 1'-0"



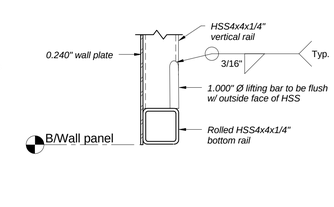
7 Enlarged Detail
SCALE: 1 1/2" = 1'-0"

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

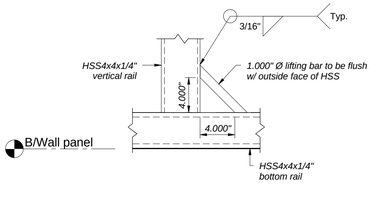
11 Enlarged Detail
SCALE: 1 1/2" = 1'-0"



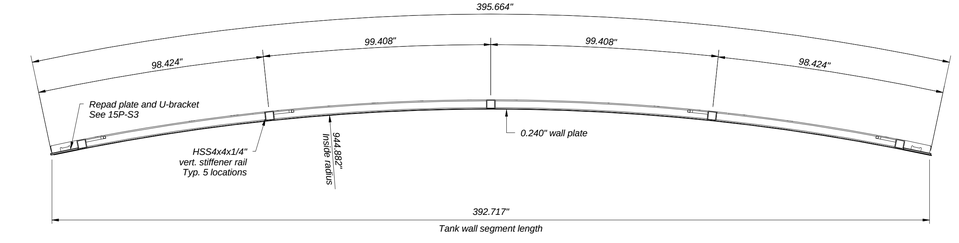
8 Enlarged Detail
SCALE: 1 1/2" = 1'-0"



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



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



2 Typical Plan Section
SCALE: 3/8" = 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

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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:

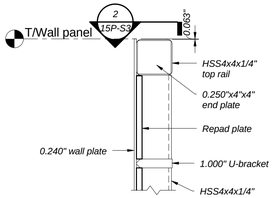
1	Revisions	07/30/13

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

Framing Plan, Elevation, Sections & details

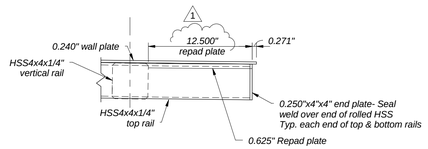
15P-S2

Highest level of Quality and Commitment for our Clients

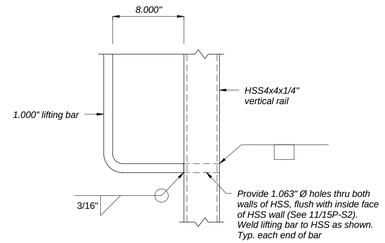


Note: Detail at bottom rail similar.

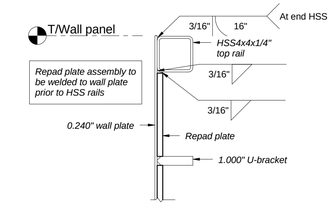
1 Enlarged Detail
SCALE: 1 1/2" = 1'-0"



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

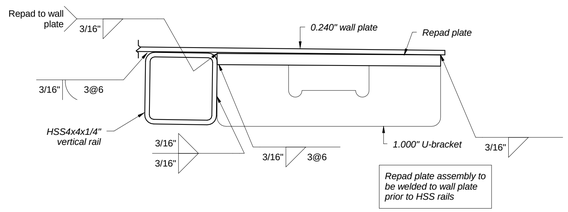


3 Enlarged Detail
SCALE: 1 1/2" = 1'-0"

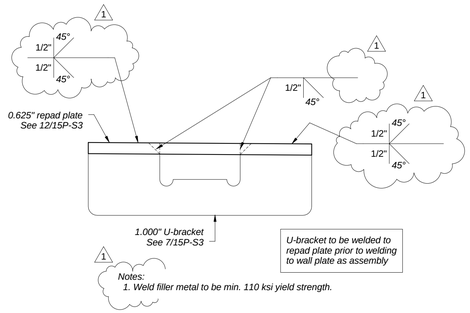


Note: Connection detail at bottom rail similar.

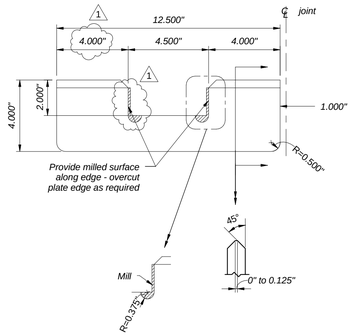
4 Panel Connection Welds - Section
SCALE: 1 1/2" = 1'-0"



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

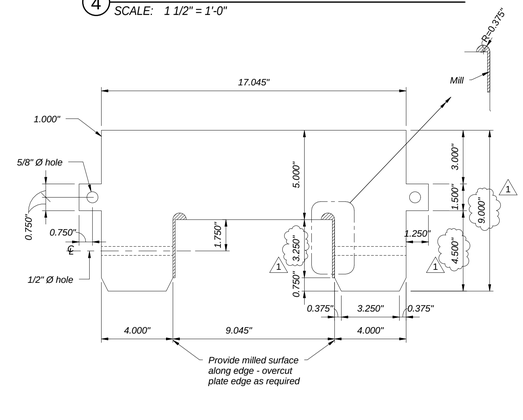


6 U-Bracket to Repad Connection
SCALE: 3" = 1'-0"



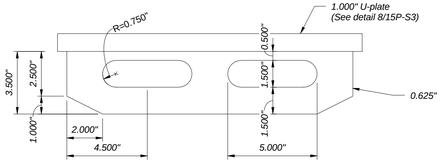
Note: U-bracket shall be ASTM A-514-B w/ min. Fy = 100 ksi.

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



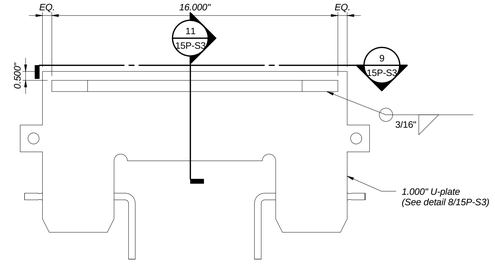
Note: U-plate shall be ASTM A-514-B w/ min. Fy = 100 ksi.

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

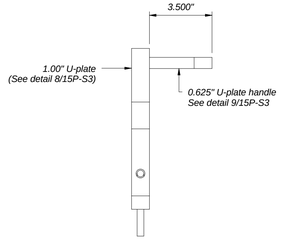


Note: U-plate handle shall be ASTM A-572, Gr. 50 w/ min Fy = 50 ksi.

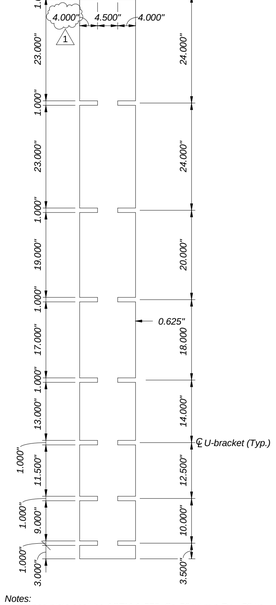
9 U-Plate Handle
SCALE: 3" = 1'-0"



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"

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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

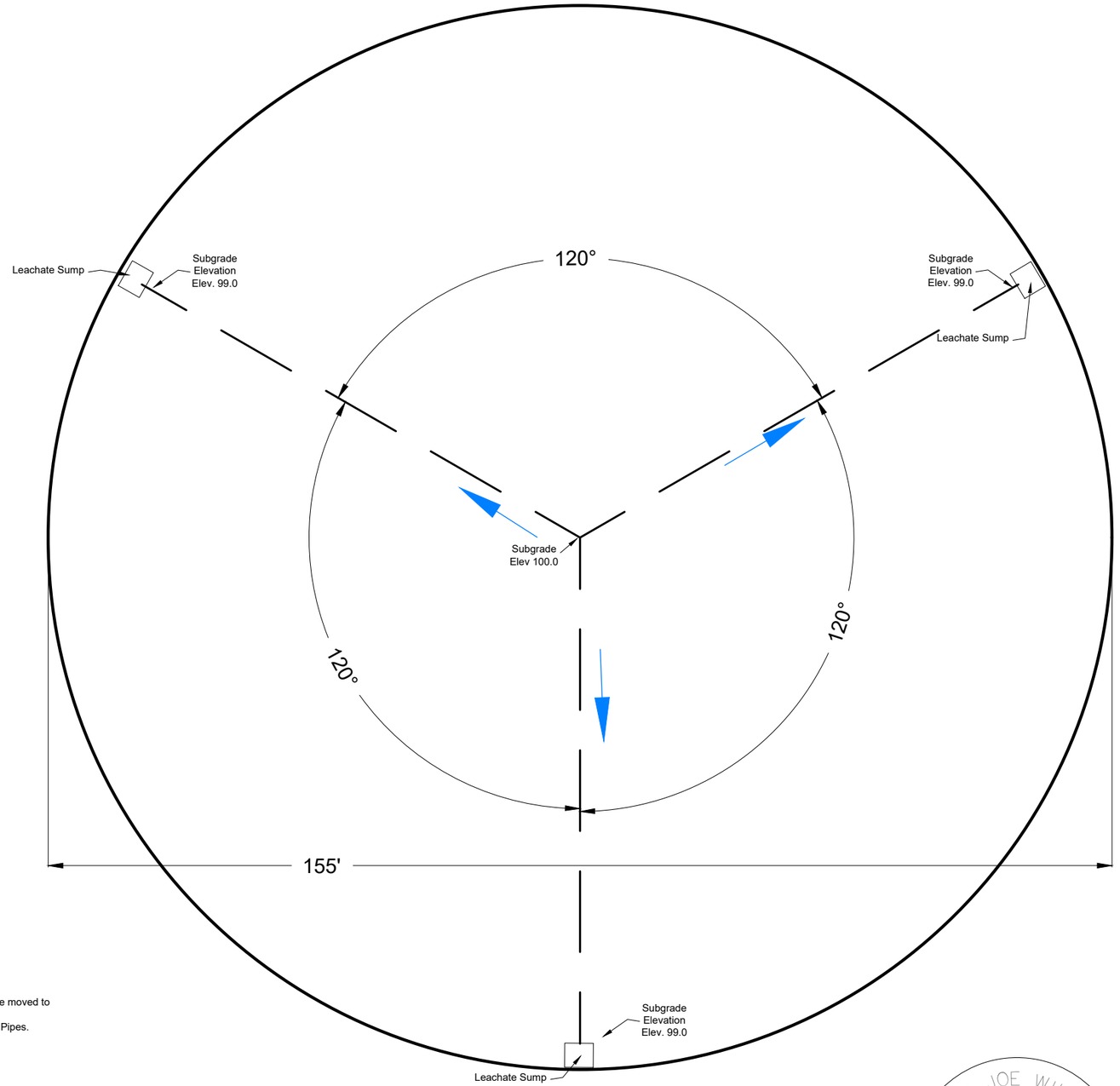
Framing Sections & Details

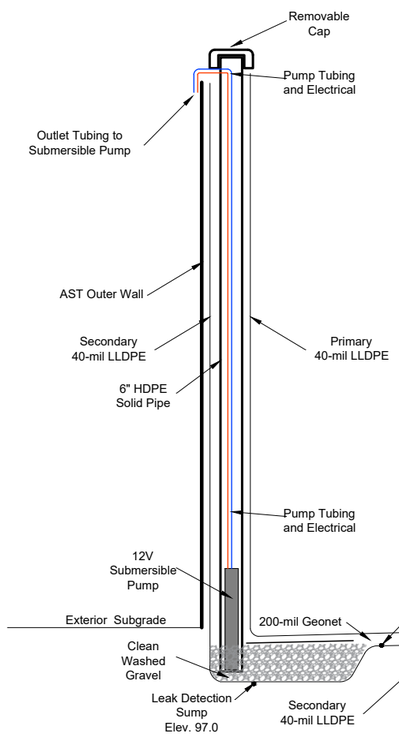
15P-S3

Highest level of Quality and Commitment for our Clients

P:\Hydrera Energy Services Corp\Modular Tanks\Dwg\15P Modular Water Tank.rvt 7/30/2013 12:36:43 PM

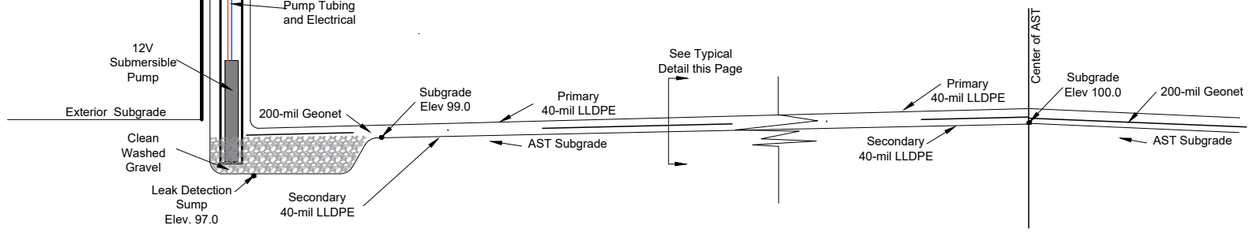
Utilize Leak Detection System below for Influent AST
Leachate Flow Direction

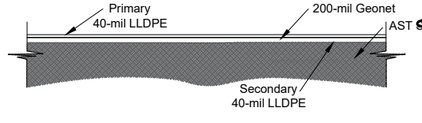


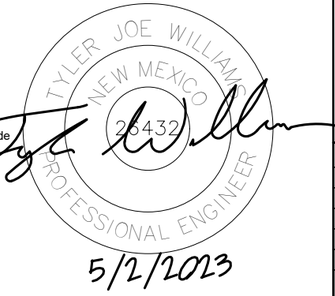


General Notes:

1. 12v Submersible Pump shall be mobile to be moved to each of the 3 standpipes as need.
2. Level Senor Probe in 1 of 3 Leak Detection Pipes.
3. All HDPE Piping to be SDR 17







ENVIROTECH ENGINEERING
2500 North Eleventh Street
Enid, Oklahoma
580.234.8780
envirotechconsulting.com
License #26432 • Expiration Data: 12-31-2024

NO.	DATE	DESCRIPTION

WATERBRIDGE

AST LEAK DETECTION PLAN

Twin Wells Recycle
WaterBridge Stateline LLC
Section 20, Township 20 South, Range 30 East,
Eddy County New Mexico

DATE:	April 2023
SCALE:	NTS
DESIGNED BY:	M. Ratke
DRAWN BY:	M. Ratke
CHECKED BY:	T. Williams
PROJECT NO.	023026-00
SHEET NO.	Figure 1

APPENDIX E

DESIGN AND CONSTRUCTION PLAN

WaterBridge Stateline, LLC (WaterBridge) is proposing to construct one (1) storage pit and one (1) Above Ground Storage Tank (AST) in Section 20, Township 20 South, Range 30 East, Eddy County, New Mexico. The Twin Wells Recycle shall consist of two containments with a total operational volume of approximately 817,000-bbl.

OPERATION AND MAINTENANCE PROCEDURES

Applicable mandates in Rule 34 are underlined. This plan addresses construction of lined earthen containments. *Appendix D* presents Engineering Design Plans. *Appendix F* provides liner and geotextile specifications.

Field conditions may create the need for minor modification of the containment design (e.g. changing the length, width, or depth.)

Dike Protection and Structural Integrity

Design elements are addressed in the section of this submission containing the foundation recommendations. The recommendations are based on site-specific data. The operator, engineer, and selected contractor will review the recommendations prior to beginning the earthwork and adhere to the specific recommendations.

The design and operation provide for the confinement of produced water to prevent releases and to prevent 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 (berm) and diversion ditch 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. The topsoil will be stockpiled adjacent to perimeter fence surrounding the containment or incorporated into the levee.

Signage

The design calls for an upright sign no less than 12-in by 24-in 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:

1. The operator's name,
2. The location of the site by quarter-quarter or unit letter, section, township and range, and
3. Emergency telephone numbers.

Fencing

The design provides for a fence to enclose the Recycling Containment in a manner that deters unauthorized wildlife and human access. The design calls for a 8-ft tall wire mesh game fence around the containment to exclude wildlife (see detail contained in engineering design drawings). This fence provides greater wildlife (and human) deterrence than the minimum required barbed wire fence with four strands evenly spaced in the interval between one foot and four feet above ground level. The fence will be gated to provide access for maintenance and placement of pumps and other necessary equipment. 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 game fence on the containment levee will be effective in excluding antelope, deer, coyotes, and most other terrestrial wildlife.

The Recycling Containment is otherwise protective of wildlife, including migratory birds. The containment will contain treated produced water that has not shown to be a material threat to birds due to hydrogen sulfide gas or floating, free-phase hydrocarbons. 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 ad to the division district office in order to facilitate assessment and implementation of measures to prevent incidents from reoccurring.

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 may be placed under the liner when needed to reduce localized stress-strain or protuberances that otherwise may compromise the liner's integrity.

Appendix D shows:

1. The levee has an inside grade no steeper than three horizontal feet to one vertical foot (3H:1V).
2. The levee outside grade is no steeper than three horizontal feet to one vertical foot (3H:1V).
3. The top of the levee is wide enough to install an anchor trench and provide adequate room for inspection and maintenance.
4. The caliche gravel placed on the outside levee provides additional erosion control.

Field conditions may create the need for changes to the design. Any changes to the construction or grade requirements due to unforeseen conditions will be reviewed and approved prior to initiating installation of the liner system. Any design change that does not conform to the NMOCD Rule will be the subject of a variance request and will be submitted **to the OCD for review and approval.**

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.

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 40-mil HDPE. Liner compatibility meets or exceeds a subsequent relevant publication to EPA SW-846 method 9090A.

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. This slope, combined with the highly transmissive geonet drainage layer, provides for the earliest possible leak detection.

The liners and drainage material will be installed consistent with the manufacture's specifications (See *Appendix F*). In addition to any specifications of the manufacturer, protocols for liner installation include measures to:

1. Minimize liner seams and orient them up and down, not across, a slope of the levee.
2. Use factory welded seams where possible.
3. Field seams in geosynthetic material are thermally seamed; prior to field seaming, overlap liner four to six inches.
4. Minimize the number of field seams and corners and irregularly shaped areas.
5. Provide for no horizontal seams within five feet of the slope's toe.
6. Use qualified personnel to perform field welding and testing.
7. Avoid excessive stress-strain on the liner.
8. The edges of all liners are anchored in the bottom of a compacted earth-filled trench that is at least 18-in deep.

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. 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.

Pumping from the containment to hydraulic fracturing operations is the responsibility of stimulation contractors. Typically, numerous 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 during operations, if the owner deems necessary. External discharge or suction lines do not penetrate the liner.

LEAK DETECTION AND FLUID REMOVAL SYSTEM INSTALLATION

The leak detection system, contains the following design elements:

1. The 200-mil geonet drainage material between the primary and secondary liner is sufficiently permeable to allow the transport of fluids to the observation ports (*Appendix D*).
2. The containment floor, sloped towards the monitoring riser pipe, facilitates the earliest possible leak detection of the containment bottom. A pump may be placed in an observation port to provide for fluid removal.
3. Piping will withstand chemical attack from any seepage, structural loading from stresses and disturbances from overlying water, cover materials, equipment operation, and expansion or contraction (see *Appendix D*).
4. The slope of the interior subgrade should be great enough to facility drainage.

APPENDIX F

MATERIAL SPECIFICATIONS

WaterBridge Stateline, LLC (WaterBridge) is proposing to construct one (1) storage pit and one (1) Above Ground Storage Tank (AST) in Section 20, Township 20 South, Range 30 East, Eddy County, New Mexico. The Twin Wells Recycle shall consist of two containments with a total operational volume of approximately 817,000-bbl.

GEOMEMBRANE SPECIFICATION

This specification covers the technical requirements for the Manufacturing and Installation of the geomembrane. All materials meet or exceed the requirements of this specification, and all work will be performed in accordance with the procedures provided in these project specifications

1.1 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
   2. D 1238 Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
   3. D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
   4. D 1603 Test Method for Carbon Black in Olefin Plastics
   5. D 3895 Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
   6. D 4218 Standard Test Method for Determination of Carbon Black in Polyethylene Compounds
   7. D 4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
   8. D 5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
   9. D 5397 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
   10. D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
   11. D 5994 Standard Test Method for Measuring Core Thickness of Textured Geomembranes
   12. D 6392 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
   13. D 6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
   14. D 7240 Standard Practice for Leak Location using Geomembranes with an Insulating Layer in Intimate Contact with a Conductive Layer via Electrical Capacitance Technique (Conductive Geomembrane Spark Test)

B. Geosynthetic Research Institute
   1. GRI GM 13 Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
   2. GRI GM 17 Test Properties, Testing Frequency and Recommended Warranty for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes

1.2 DEFINITIONS

A. Lot - A quantity of resin (usually the capacity of one rail car) used in the manufacture of geomembranes. Finished roll will be identified by a roll number traceable to the resin lot used.
B. Construction Quality Assurance Consultant (CONSULTANT) – The Party, independent from MANUFACTURER and INSTALLER, that is responsible for observing and documenting activities related to quality assurance during the lining system construction.
C. ENGINEER- The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.
D. Geomembrane Manufacturer (MANUFACTURER) - The party responsible for manufacturing the geomembrane rolls.
E. Geosynthetic Quality Assurance Laboratory (TESTING LABORATORY) – The Party, independent from the OWNER, MANUFACTURER, and INSTALLER, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the OWNER.
F. INSTALLER- The Party responsible for field handling, transporting, storing, deploying, seaming, and testing of the geomembrane seams.
G. Panel- Unit area of geomembrane that will be seamed in the field that is larger than 100-ft^2.
H. Patch - Unit area of geomembrane that will be seamed in the field that is less than 100-ft^2.
I. Subgrade Surface - Soil layer surface which immediately underlies the geosynthetic material(s).

1.3 SUBMITTALS POST-AWARD

A. Furnish the following product data, in writing, to ENGINEER prior to installation of the geomembrane material:
    1. Resin Data shall include the following:
    a. Certification stating that the resin meets the specification requirements (see *Table 1.9B*).
    2. Geomembrane Roll
    a. Statement certifying no recycled polymer and no more than 10% rework of the same type of material is added to the resin (product run may be recycled).
B. The INSTALLER shall furnish the following information to the ENGINEER and OWNER prior to installation:
    1. Installation layout drawings
    2. Must show proposed panel layout including field seams and details
    3. Must be approved prior to installing the geomembrane
    4. Approved drawings will be for concept only; actual panel placement will be determined by site conditions.
    5. Installer's Geosynthetic Field Installation Quality Assurance Plan

C. The INSTALLER will submit the following to the ENGINEER upon completion of installation:
    1. Certificate stating the geomembrane has been installed in accordance with the Contract Documents
    2. Material and installation warranties
    3. As-built drawings showing actual geomembrane placement and seams including typical anchor trench detail

1.4 QUALITY ASSURANCE

A. The OWNER will engage and pay for the services of a Geosynthetic Quality Assurance Consultant and Laboratory to monitor geomembrane installation.

1.5 QUALIFICATIONS

A. MANUFACTURER
    1. Geomembrane shall be manufactured by the following:
        a. GSE Lining Technology, LLC
        b. approved equal
    2. MANUFACTURER shall have manufactured a minimum of 10,000,000 square feet of polyethylene geomembrane during the last year.

B. INSTALLER
    1. Installation shall be performed by one of the following installation companies (or approved equal)
        a. GSE Lining Technology, LLC
        b. GSE Approved Installers
    2. INSTALLER shall have installed a minimum of 5,000,000-ft^2 of HDPE geomembrane during the last two years.
    3. INSTALLER shall have worked in a similar capacity on at least 5 projects similar in complexity to the project described in the contract documents, and with at least 500,000-ft^2 of HDPE geomembrane installation on each project.
    4. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.
    5. The INSTALLER shall provide a minimum of one Master Seamer for work on the project.
    6. Must have completed a minimum of 1,000,000-ft^2 of geomembrane seaming work using the type of seaming apparatus proposed for the use on this Project.

1.6 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

A. LABELING - Each roll of geomembrane delivered to the site shall be labeled by the MANUFACTURER. The label will identify:
    1. manufacturer's name
    2. product identification
    3. thickness
    4. length
    5. width
    6. roll number

B. DELIVERY - Rolls of liner will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.
C. STORAGE - The on-site storage location for geomembrane material, provided by the CONTRACTOR to protect the geomembrane from punctures, abrasions and excessive dirt and moisture, should have the following characteristics:
    1. level (no wooden pallets)
    2. smooth
    3. dry
    4. protected from theft and vandalism
    5. adjacent to the area being lined
D. Handling- Materials are to be handled so as to prevent damage.

1.7 WARRANTY

A. Material shall be warrantied, on a pro-rata basis, against Manufacturer's defects for a period of 5 years from the date of geomembrane installation.
B. Installation shall be warrantied against defects in workmanship for a period of 1 year from the date of geomembrane completion.

1.8 GEOMEMBRANE PROPERTIES

A. Material shall be smooth/textured polyethylene geomembrane as shown on the drawings.
B. Resin
    1. Resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane.
    2. Natural resin (without carbon black) shall meet the following requirements:

Table 1.9B RAW MATERIAL PROPERTIES			
Property	Test Method	HDPE	LLDPE
Density (g/cm3)	ASTM D 1505	$\geq$0.932	$\geq$0.915
Melt Flow Index (g/10 min)	ASTM D 1238 (190/2.16)	$\leq$1.0	$\leq$1.0
OIT (minutes)	ASTM D 3895 (1 atm/200^{0}C)	$\geq$100	$\geq$100

C. Geomembrane Rolls
    1. Do not exceed a combined maximum total of 1 percent by weight of additives other than carbon black.
    2. Geomembrane shall be free of holes, pinholes as verified by on-line electrical detection, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.
    3. Geomembrane material is to be supplied in roll form. Each roll is to be identified with labels indicating roll number, thickness, length, width, and MANUFACTURER.

4. All liner sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in section 1.09 D and be tested by an acceptable method of inspecting for pinholes. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected during installation.

D. Smooth surfaced geomembrane shall meet the requirements shown in the following data sheets below:

1. *Table 1.1* for Black HDPE
2. *Table 1.2* for Green HDPE
3. *Table 1.3* for White HDPE
    a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
    b. The white surface shall be installed upwards.
4. *Table 1.4* for Smooth Leak Location Liner HDPE
    a. The geomembrane shall have a coextruded, electrically conductive layer.
    b. The conductive layer is installed downward.
    c. Electrical testing shall be performed after liner installation by the INSTALLER.
5. *Table 1.5* for Smooth White Leak Location Liner HDPE
    a. The geomembrane shall have a coextruded, electrically conductive layer.
    b. The conductive layer is installed downward.
    c. The geomembrane shall be a white-surfaced, coextruded geomembrane.
    d. The white surface shall be installed upwards.
    e. Electrical testing shall be performed after liner installation by the INSTALLER.
6. *Table 1.6* for Black LLDPE
7. *Table 1.7* for White-surfaced LLDPE
    a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
    b. The white surface shall be installed upwards.
8. *Table 1.8* for Leak Location Liner LLDPE
    a. The geomembrane shall have a coextruded, electrically conductive layer.
    b. The conductive layer is installed downward.
    c. Electrical testing shall be performed after liner installation by the INSTALLER.
9. *Table 1.9* for White Leak Location Liner LLDPE
    a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
    b. The white surface shall be installed upwards.
    c. The geomembrane shall have a coextruded, electrically conductive layer.
    d. The conductive layer is installed downward.
    e. Electrical testing shall be performed after liner installation by the INSTALLER.

TABLE 1.1: GSE HD SMOOTH GEOMEMBRANE							
Tested Property	Test Method	Frequency	Minimum Average Values				
			30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	30 27	40 36	60 54	80 72	100 90
Density, g/cm^3, (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	 114 63 700 12	 152 84 700 12	 228 126 700 12	 304 168 700 12	 380 210 700 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	21	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	54	72	108	144	180
Carbon Black Content, % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note(1)	Note(1)	Note(1)	Note(1)	Note(1)
Notch Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lbs	>100	>100	>100	>100	>100
Typical Roll Dimensions							
Roll Length(2), ft			1,120	870	560	430	340
Roll Width(2), ft			22.5	22.5	22.5	22.5	22.5
Roll Area, ft^2			25,200	19,575	12,600	9,675	7,650

- NOTES:
  - (1)Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
  - (2)Roll lengths and widths have a tolerance of ± 1%.
  - GSE HD Smooth is available in rolls weighing approximately 4,000 lb.
  - All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D 746.
  - *Modified.

TABLE 1.2: GSE GREEN SMOOTH GEOMEMBRANE							
Tested Property	Test Method	Frequency	Minimum Average Values				
			30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	30 27	40 36	60 54	80 72	100 90
Density, g/cm^3 , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	 114 63 700 12	 152 84 700 12	 228 126 700 12	 304 168 700 12	 380 210 700 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	21	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	54	72	108	144	180
Carbon Black Content(1), % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note(2)	Note(2)	Note(2)	Note(2)	Note(2)
Notch Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lbs	>100	>100	>100	>100	>100
Typical Roll Dimensions							
Roll Length(3), ft			1,120	870	560	430	340
Roll Width(3), ft			22.5	22.5	22.5	22.5	22.5
Roll Area, ft^2			25,200	19,575	12,600	9,675	7,650

- NOTES:
  - (1)GSE Green Smooth may have an overall ash content of 3.0% due to the green layer. These values apply to the black layer only.
  - (2)Dispersion applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
  - (3)Roll lengths and widths have a tolerance of ± 1%.
  - GSE Green Smooth is available in rolls weighing approximately 4,000 lb.
  - All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D 746.
  - *Modified.

TABLE 1.3: GSE WHITE SMOOTH GEOMEMBRANE							
Tested Property	Test Method	Frequency	Minimum Average Values				
			30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	30 27	40 36	60 54	80 72	100 90
Density, g/cm^3 , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	 114 63 700 12	 152 84 700 12	 228 126 700 12	 304 168 700 12	 380 210 700 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	21	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	54	72	108	144	180
Carbon Black Content(1), % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note(2)	Note(2)	Note(2)	Note(2)	Note(2)
Notch Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lbs	>100	>100	>100	>100	>100
Typical Roll Dimensions							
Roll Length(3), ft			1,120	870	560	430	340
Roll Width(3), ft			22.5	22.5	22.5	22.5	22.5
Roll Area, ft^2			25,200	19,575	12,600	9,675	7,650

- NOTES:
  - (1)GSE White Smooth may have an overall ash content of 3.0% due to the white layer. These values apply to the black layer only.
  - (2)Dispersion applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
  - (3)Roll lengths and widths have a tolerance of ± 1%.
  - GSE White Smooth is available in rolls weighing approximately 4,000 lb.
  - All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D1204 and LTB of <-77° C when tested according to ASTM D 746.
  - *Modified.

TABLE 1.4: GSE LEAK LOCATION SMOOTH GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Values			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm^3 , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	 152 84 700 12	 228 126 700 12	 304 168 700 12	 380 210 700 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	72	108	144	180
Carbon Black Content(1), % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note(2)	Note(2)	Note(2)	Note(2)
Notch Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length(3), ft			870	560	430	340
Roll Width(3), ft			22.5	22.5	22.5	22.5
Roll Area, ft^2			19,575	12,600	9,675	7,650

- NOTES:
  - [1]GSE Leak Location Smooth may have an overall ash content of 3.0% due to the conductive layer. These values apply to the non-conductive black layer only.
  - [2]Dispersion applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
  - [3]Roll lengths and widths have a tolerance of ± 1%.
  - GSE Leak Location Smooth is available in rolls weighing approximately 4,000 lb.
  - All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D746.
  - *Modified.

TABLE 1.5: GSE LEAK LOCATION WHITE SMOOTH GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Values			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm^3, (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	 152 84 700 12	 228 126 700 12	 304 168 700 12	 380 210 700 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	72	108	144	180
Carbon Black Content[(1)], % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note[(2)]	Note[(2)]	Note[(2)]	Note[(2)]
Notch Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length[(3)], ft			870	560	430	340
Roll Width[(3)], ft			22.5	22.5	22.5	22.5
Roll Area, ft^2			19,575	12,600	9,675	7,650

- NOTES:
  - [(1)]GSE Leak Location White Smooth may have an overall ash content of 3.0% due to the white and conductive layers. These values apply to the black layer only.
  - [(2)]Dispersion applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
  - [(3)]Roll lengths and widths have a tolerance of ± 1%.
  - GSE Leak Location White Smooth is available in rolls weighing approximately 4,000 lb.
  - All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D 746.
  - *Modified.

TABLE 1.6: GSE ULTRAFLEX SMOOTH GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Value			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm^3 (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/in-width Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	152 800	228 800	304 800	380 800
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	56	84	112	140
Carbon Black Content, % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note[(1)]	Note[(1)]	Note[(1)]	Note[(1)]
Oxidative Induction Time, min	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length[(2)], ft			870	560	430	340
Roll Width[(2)], ft			22.5	22.5	22.5	22.5
Roll Area, ft^2			19,575	12,600	9,675	7,650

- NOTES:
  - [(1)]Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
  - [(2)]Roll lengths and widths have a tolerance of ±1 %.
  - GSE UltraFlex is available in rolls weighing approximately 4,000 lb.
  - All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
  - *Modified.

TALBE 1.7: GSE ULTRAFLEX WHITE SMOOTH GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Value			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm^3 (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/in-width Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	152 800	228 800	304 800	380 800
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	56	84	112	140
Carbon Black Content[(1)], % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note[(2)]	Note[(2)]	Note[(2)]	Note[(2)]
Oxidative Induction Time, min	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length[(3)], ft			870	560	430	340
Roll Width[(3)], ft			22.5	22.5	22.5	22.5
Roll Area, ft^2			19,575	12,600	9,675	7,650

- NOTES:
  - [(1)]GSE UltraFlex White Smooth may have an overall ash content greater than 3.0% due to the white layer. These values apply to the black layer only.
  - [(2)] Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
  - [(3)]Roll lengths and widths have a tolerance of ±1%.
  - GSE UltraFlex White Smooth is available in rolls weighing approximately 4,000 lb.
  - All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
  - *Modified.

TABLE 1.8: GSE ULTRAFLEX LEAK LOCATION LINER SMOOTH GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Value			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm^3 (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/in-width Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	152 800	228 800	304 800	380 800
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	56	84	112	140
Carbon Black Content[(1)], % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note[(2)]	Note[(2)]	Note[(2)]	Note[(2)]
Oxidative Induction Time, min	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length[(3)], ft			870	560	430	340
Roll Width[(3)], ft			22.5	22.5	22.5	22.5
Roll Area, ft^2			19,575	12,600	9,675	7,650

- NOTES:
  - [(1)]GSE UltraFlex Leak Location Smooth may have an overall ash content greater than 3.0% due to the conductive layer. These values apply to the non-conductive black layer only.
  - [(2)]Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
  - [(3)]Roll lengths and widths have a tolerance of ±1%.
  - GSE UltraFlex Leak Location Smooth is available in rolls weighing approximately 4,000 lb.
  - All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
  - *Modified.

TABLE 1.9: GSE ULTRAFLEX LEAK LOCATION LINER WHITE SMOOTH GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Value			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm^3 (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/in-width Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	152 800	228 800	304 800	380 800
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	56	84	112	140
Carbon Black Content[(1)], % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note[(2)]	Note[(2)]	Note[(2)]	Note[(2)]
Oxidative Induction Time, min	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length[(3)], ft			870	560	430	340
Roll Width[(3)], ft			22.5	22.5	22.5	22.5
Roll Area, ft^2			19,575	12,600	9,675	7,650

- NOTES:
  - [(1)]GSE UltraFlex Leak Location White Smooth may have an overall ash content greater than 3.0% due to the white and conductive layers. These values apply to the non-conductive black layer only.
  - [(2)]Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
  - [(3)]Roll lengths and widths have a tolerance of ±1%.
  - GSE UltraFlex Leak Location White Smooth is available in rolls weighing approximately 4,000 lb.
  - All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
  - *Modified.

E. Textured surfaced geomembrane shall meet the requirements shown in the following data sheets below.
   1. *Table 2.1* for Black coextruded textured HDPE
   2. *Table 2.2* for Green coextruded textured HDPE
   3. *Table 2.3* for White coextruded textured HDPE
      a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
      b. The white surface shall be installed upwards.
   4. *Table 2.4* for Leak Location Liner coextruded textured HDPE
      a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
      b. The white surface shall be installed upwards.
   5. *Table 2.5* for White Leak Location Liner coextruded textured HDPE
      a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
      b. The white surface shall be installed upwards.
   6. *Table 2.6* for Black coextruded textured LLDPE
   7. *Table 2.7* for White coextruded textured LLDPE
      a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
      b. The white surface shall be installed upwards.
   8. *Table 2.8* for Leak Location Liner coextruded textured LLDPE
      a. The geomembrane shall have a coextruded, electrically conductive layer.
      b. The conductive layer is installed downward.
      c. Electrical testing shall be performed after liner installation by the INSTALLER.
   9. *Table 2.9* for White Leak Location Liner coextruded textured LLDPE
      a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
      b. The white surface shall be installed upwards.
      c. The geomembrane shall have a coextruded, electrically conductive layer.
      d. The conductive layer is installed downward.
      e. Electrical testing shall be performed after liner installation by the INSTALLER.

TABLE 2.1: GSE HD TEXTURED GEOMEMBRANE							
Tested Property	Test Method	Frequency	Minimum Average Values				
			30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5994	every roll	30 27	40 36	60 54	80 72	100 90
Density, g/cm^3 , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	 45 63 100 12	 60 84 100 12	 90 126 100 12	 120 168 100 12	 150 210 100 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	21	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	45	60	90	120	150
Carbon Black Content, % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note(1)	Note(1)	Note(1)	Note(1)	Note(1)
Asperity Height, mil	ASTM D 7466	second roll	16	18	18	18	18
Notch Constant Tensile Load(2), hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lbs	>100	>100	>100	>100	>100
Typical Roll Dimensions							
Roll Length(3), ft	Double-Sided Textured Single-Sided Textured		830 1,010	700 780	520 540	400 410	330 330
Roll Width(3), ft			22.5	22.5	22.5	22.5	22.5
Roll Area, ft^2	Double-Sided Textured Single-Sided Textured		18,675 22,725	15,750 17,550	11,700 12,150	9,000 9,225	7,425 7,425

- NOTES:
  - (1)Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
  - (2)NCTL for GSE HD Textured is conducted on representative smooth geomembrane samples.
  - (3)Roll lengths and widths have a tolerance of ± 1%.
  - GSE HD Textured is available in rolls weighing approximately 4,000 lb.
  - All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D1204 and LTB of <-77° C when tested according to ASTM D 746.
  - *Modified.

TABLE 2.2 GSE GREEN TEXTURED GEOMEMBRANE							
Tested Property	Test Method	Frequency	Minimum Average Values				
			30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5994	every roll	30 27	40 36	60 54	80 72	100 90
Density, g/cm^3, (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	 45 63 100 12	 60 84 100 12	 90 126 100 12	 120 168 100 12	 150 210 100 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	21	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	45	60	90	120	150
Carbon Black Content(1), % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note(2)	Note(2)	Note(2)	Note(2)	Note(2)
Asperity Height, mil	ASTM D 7466	second roll	16	18	18	18	18
Notch Constant Tensile Load(3), hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lbs	>100	>100	>100	>100	>100
Typical Roll Dimensions							
Roll Length(4), ft	Double-Sided Textured Single-Sided Textured		830 1,010	700 780	520 540	400 410	330 330
Roll Width(4), ft			22.5	22.5	22.5	22.5	22.5
Roll Area, ft^2	Double-Sided Textured Single-Sided Textured		18,675 22,725	15,750 17,550	11,700 12,150	9,000 9,225	7,425 7,425

- NOTES:
  - [1]GSE Green may have an overall ash content greater than 3.0% due to the green layer. These values apply to the black layer only.
  - [2]Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
  - [3]NCTL for GSE Green Textured is conducted on representative smooth geomembrane samples.
  - [4]Roll lengths and widths have a tolerance of ±1%.
  - GSE Green Textured is available in rolls weighing approximately 4,000 lb.
  - All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D 746.
  - *Modified.

TABLE 2.3: GSE WHITE TEXTURED GEOMEMBRANE							
Tested Property	Test Method	Frequency	Minimum Average Values				
			30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5994	every roll	30 27	40 36	60 54	80 72	100 90
Density, g/cm3 , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	 45 63 100 12	 60 84 100 12	 90 126 100 12	 120 168 100 12	 150 210 100 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	21	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	45	60	90	120	150
Carbon Black Content[1], % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note[2]	Note[2]	Note[2]	Note[2]	Note[2]
Asperity Height, mil	ASTM D 7466	second roll	16	18	18	18	18
Notch Constant Tensile Load[3], hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lbs	>100	>100	>100	>100	>100
Typical Roll Dimensions							
Roll Length[4], ft	Double-Sided Textured Single-Sided Textured		830 1,010	700 780	520 540	400 410	330 330
Roll Width[4], ft			22.5	22.5	22.5	22.5	22.5
Roll Area, ft^2	Double-Sided Textured Single-Sided Textured		18,675 22,725	15,750 17,550	11,700 12,150	9,000 9,225	7,425 7,425

- NOTES:
  - [(1)]GSE White may have an overall ash content greater than 3.0% due to the white layer. These values apply to the black layer only.
  - [(2)]Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
  - [(3)]NCTL for GSE White Textured is conducted on representative smooth geomembrane samples.
  - [(4)]Roll lengths and widths have a tolerance of ±1%.
  - GSE White Textured is available in rolls weighing approximately 4,000 lb.
  - All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D 746.
  - *Modified.

TABLE 2.4: GSE LEAK LOCATION LINER TEXTURED GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Values			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5994	every roll	40 36	60 54	80 72	100 90
Density, g/cm^3, (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	 60 84 100 12	 90 126 100 12	 120 168 100 12	 150 210 100 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	60	90	120	150
Carbon Black Content[(1)], % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note[(2)]	Note[(2)]	Note[(2)]	Note[(2)]
Asperity Height, mil	ASTM D 7466	second roll	18	18	18	18
Notch Constant Tensile Load[(3)], hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length[(4)], ft	Double-Sided Textured Single-Sided Textured		700 780	520 540	400 410	330 330
Roll Width[(4)], ft			22.5	22.5	22.5	22.5
Roll Area, ft^2	Double-Sided Textured Single-Sided Textured		15,750 17,550	11,700 12,150	9,000 9,225	7,425 7,425

- NOTES:
  - [(1)]GSE Leak Location may have an overall ash content greater than 3.0% due to the conductive layer. These values apply to the non-conductive layer only.
  - [(2)]Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
  - [(3)]NCTL for GSE Leak Location Textured is conducted on representative smooth geomembrane samples.
  - [(4)]Roll lengths and widths have a tolerance of ±1%.
  - GSE Leak Location Textured is available in rolls weighing approximately 4,000 lb.
  - All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D 746.
  - *Modified.

TABLE 2.5: GSE LEAK LOCATION LINER WHITE TEXTURED GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Values			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5994	every roll	40 36	60 54	80 72	100 90
Density, g/cm3 , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	 60 84 100 12	 90 126 100 12	 120 168 100 12	 150 210 100 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	60	90	120	150
Carbon Black Content[(1)], % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note[(2)]	Note[(2)]	Note[(2)]	Note[(2)]
Asperity Height, mil	ASTM D 7466	second roll	18	18	18	18
Notch Constant Tensile Load[(2)], hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length[(4)], ft	Double-Sided Textured Single-Sided Textured		700 780	520 540	400 410	330 330
Roll Width[(4)], ft			22.5	22.5	22.5	22.5
Roll Area, ft^2	Double-Sided Textured Single-Sided Textured		15,750 17,550	11,700 12,150	9,000 9,225	7,425 7,425

- NOTES:
  - [(1)]GSE Leak Location White may have an overall ash content greater than 3.0% due to the conductive and white layers. These values apply to the non-conductive black layer only.
  - [(2)]Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
  - [(3)]NCTL for GSE Leak Location White Textured is conducted on representative smooth geomembrane samples.
  - [(4)]Roll lengths and widths have a tolerance of ±1%.
  - GSE Leak Location White Textured is available in rolls weighing approximately 4,000 lb.
  - All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D 746.
  - *Modified.

TABLE 2.6: GSE ULTRAFLEX TEXTURED GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Values			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm^3 (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/in-width Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	60 250	90 250	120 250	150 250
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	44	66	88	110
Carbon Black Content, % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note(1)	Note(1)	Note(1)	Note(1)
Asperity Height, mil	ASTM D 7466	second roll	18	18	18	18
Oxidative Induction Time, min	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length(2), ft	Double-Sided Textured Single-Sided Textured		700 650	520 420	400 320	330 250
Roll Width(2), ft			22.5	22.5	22.5	22.5
Roll Area, ft^2	Double-Sided Textured Single-Sided Textured		15,750 14,625	11,700 9,450	9,000 7,200	7,425 5,625

- NOTES:
  - (1)Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
  - (2)Roll lengths and widths have a tolerance of ±1%.
  - GSE UltraFlex Textured is available in rolls weighing approximately 4,000 lb.
  - All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
  - *Modified.

TABLE 2.7: GSE ULTRAFLEX WHITE TEXTURED GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Values			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm^3 (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/in-width Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	60 250	90 250	120 250	150 250
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	44	66	88	110
Carbon Black Content(1), % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note(2)	Note(2)	Note(2)	Note(2)
Asperity Height, mil	ASTM D 7466	second roll	18	18	18	18
Oxidative Induction Time, min	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length(3), ft	Double-Sided Textured Single-Sided Textured		700 650	520 420	400 320	330 250
Roll Width(3), ft			22.5	22.5	22.5	22.5
Roll Area, ft^2	Double-Sided Textured Single-Sided Textured		15,750 14,625	11,700 9,450	9,000 7,200	7,425 5,625

- NOTES:
  - (1)GSE UltraFlex White Textured may have an overall ash content greater than 3.0% due to the white layer. These values apply to the black layer only.
  - (2)Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
  - (3)Roll lengths and widths have a tolerance of ±1%.
  - GSE UltraFlex White Textured is available in rolls weighing approximately 4,000 lb.
  - All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
  - *Modified.

TABLE 2.8: GSE ULTRAFLEX LEAK LOCATION TEXTURED GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Values			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm^3 (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/in-width Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	60 250	90 250	120 250	150 250
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	44	66	88	110
Carbon Black Content[(1)], % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note[(2)]	Note[(2)]	Note[(2)]	Note[(2)]
Asperity Height, mil	ASTM D 7466	second roll	18	18	18	18
Oxidative Induction Time, min	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length[(3)], ft	Double-Sided Textured Single-Sided Textured		700 650	520 420	400 320	330 250
Roll Width[(3)], ft			22.5	22.5	22.5	22.5
Roll Area, ft^2	Double-Sided Textured Single-Sided Textured		15,750 14,625	11,700 9,450	9,000 7,200	7,425 5,625

- NOTES:
  - [(1)]GSE UltraFlex Leak Location Textured may have an overall ash content greater than 3.0% due to the conductive layer. These values apply to the non-conductive black layer only.
  - [(2)]Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
  - [(3)]Roll lengths and widths have a tolerance of ±1%.
  - GSE UltraFlex Leak Location Textured is available in rolls weighing approximately 4,000 lb.
  - All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
  - *Modified.

TABLE 2.9: GSE ULTRAFLEX LEAK LOCATION WHITE TEXTURED GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimum Average Values			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm^3 (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/in-width Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	60 250	90 250	120 250	150 250
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	44	66	88	110
Carbon Black Content[(1)], % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note[(2)]	Note[(2)]	Note[(2)]	Note[(2)]
Asperity Height, mil	ASTM D 7466	second roll	18	18	18	18
Oxidative Induction Time, min	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length[(3)], ft	Double-Sided Textured Single-Sided Textured		700 650	520 420	400 320	330 250
Roll Width[(3)], ft			22.5	22.5	22.5	22.5
Roll Area, ft^2	Double-Sided Textured Single-Sided Textured		15,750 14,625	11,700 9,450	9,000 7,200	7,425 5,625

- NOTES:
  - [(1)]GSE UltraFlex Leak Location White Textured may have an overall ash content greater than 3.0% due to the white and conductive layers. These values apply to the non-conductive black layer only.
  - [(2)]Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
  - [(3)]Roll lengths and widths have a tolerance of ±1%.
  - GSE UltraFlex Leak Location White Textured is available in rolls weighing approximately 4,000 lb.
  - All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
  - *Modified.

F. Extrudate Rod or Bead
    1. Extrudate material shall be made from same type resin as the geomembrane.
    2. Additives shall be thoroughly dispersed.
    3. Materials shall be free of contamination by moisture or foreign matter.

1.9 EQUIPMENT

A. Welding equipment and accessories shall meet the following requirements:
    1. Gauges showing temperatures in apparatus such as extrusion welder or fusion welder shall be present.
    2. An adequate number of welding apparatus shall be available to avoid delaying work.
    3. Power source must be capable of providing constant voltage under combined line load.

1.10 DEPLOYMENT

A. Assign each panel a simple and logical identifying code. The coding system shall be subject to approval and shall be determined at the job site.
B. Visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas.
C. Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines:
    1. Geomembranes shall be installed according to site-specific specifications, and GSE Conductive should be installed with the Conductive layer down.
        i. *Note: A spark tester or ohm meter can be used to determine Conductive layer.*
    2. Unroll geomembrane using methods that will not damage geomembrane and will protect underlying surface from damage (spreader bar, protected equipment bucket).
    3. Place ballast (commonly sandbags) on geomembrane which will not damage geomembrane to prevent wind uplift.
    4. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage it. Smoking will not be permitted on the geomembrane.
    5. Do not allow heavy vehicular traffic directly on geomembrane. Rubber-tired ATV's and trucks are acceptable if wheel contact is less than 8 psi.
    6. Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.
D. Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material.

1.11 FIELD SEAMING

A. Seams shall meet the following requirements:
    1. To the maximum extent possible, orient seams parallel to the line of the slope, i.e., down and not across slope.

2. Minimize number of field seams in corners, odd-shaped geometric locations and outside corners.
3. Slope seams (panels) shall extend a minimum of 5-ft beyond the grade break into the flat area.
4. Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the CONSULTANT and INSTALLER.
5. Align seam overlaps consistent with the requirements of the welding equipment being used. A 6-in overlap is commonly suggested.

B. During Welding Operations
1. Provide at least one Master Seamer who shall provide direct supervision over other welders as necessary.

C. Extrusion Welding
1. Hot-air tack adjacent pieces together using procedures that do not damage the geomembrane.
2. Clean geomembrane surfaces by disc grinder or equivalent.
3. Purge welding apparatus of heat-degraded extrudate before welding.

D. Hot Wedge Welding
1. Welding apparatus shall be a self-propelled device equipped with an electronic controller which displays applicable temperatures.
2. Clean seam area of dust, mud, moisture and debris immediately ahead of hot wedge welder.
3. Protect against moisture build-up between sheets.

E. Trial Welds
1. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.
2. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.
3. Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift.
4. Cut four, one-inch wide by six-inch long test strips from the trial weld.
5. Quantitatively test specimens for peel adhesion, and then for shear strength.
6. Trial weld specimens shall pass when the results shown in the following tables for HDPE and LLDPE are achieved in both peel and shear test.

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TABLE 1.12.6A: MINIMUM WELD VALUES FOR HDPE GEOMEMBRANES							
Property	Test Method	30	40	60	80	100	120
Peel Strength (fusion), ppi Peel Strength (extrusion), ppi	ASTM D 6392 ASTM D 6392	49 39	65 52	98 78	130 104	162 130	196 157
Shear Strength (fusion & ext.), ppi	ASTM D 6392	61	81	121	162	203	242

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TABLE 1.2.6B: MINIMUM WELD VALUES FOR LLDPE GEOMEMBRANES						
Property	Test Method	30	40	60	80	100
Peel Strength (extrusion), ppi Peel Strength (fusion), ppi	ASTM D 6392 ASTM D 6392	36 38	48 50	72 75	96 100	120 125
Shear Strength (fusion & ext.), ppi	ASTM D 6392	45	60	90	120	150

7. The break, when peel testing, occurs in the liner material itself, not through peel separation (FTB).
8. The break is ductile.
9. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.
10. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.

F. Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation. INSTALLER shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.

G. Defects and Repairs
1. Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.
2. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

1.12 FIELD QUALITY ASSURANCE

A. MANUFACTURER and INSTALLER shall participate in and conform to all terms and requirements of the Owner's quality assurance program. CONTRACTOR shall be responsible for assuring this participation.
B. Quality assurance requirements are as specified in this Section and in the Field Installation Quality Assurance Manual if it is included in the contract.
C. Field Testing
    1. Non-destructive testing may be carried out as the seaming progresses or at completion of all field seaming.
        b. Vacuum Testing
            1) Shall be performed in accordance with ASTM D 5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
        b. Air Pressure Testing
            1) Shall be performed in accordance with ASTM D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.
        c. Spark Testing
            1. Shall be performed accordance with ASTM D 7240 Standard Practice for Leak Location using Geomembranes with an Insulating Layer in Intimate Contact with a Conductive Layer via Electrical Capacitance Technique (Conductive Geomembrane Spark Test).
        d. Other approved methods.
    2. Destructive Testing (performed by CONSULTANT with assistance from INSTALLER)
        b. Location and Frequency of Testing
            1) Collect destructive test samples at a frequency of one per every 500 lineal feet of seam length.
            2) Test locations will be determined after seaming.
            3) Exercise Method of Attributes as described by GRI GM-14 (Geosynthetic Research Institute, http://www.geosynthetic-institute.org) to minimize test samples taken.

        c. Sampling Procedures are performed as follows:
            1) INSTALLER shall cut samples at locations designated by the CONSULTANT as the seaming progresses in order to obtain field laboratory test results before the geomembrane is covered.
            2) CONSULTANT will number each sample, and the location will be noted on the installation as-built.
                a) Samples shall be 12-in wide by minimal length with the seam centered lengthwise.
                b) Cut a 2-in wide strip from each end of the sample for field-testing.
                c) Cut the remaining sample into two parts for distribution as follows:
                d) One portion for INSTALLER, 12-in by 12-in
                e) One portion for the Third-Party laboratory, 12-in by 18-in

f) Additional samples may be archived if required.

3) Destructive testing shall be performed in accordance with ASTM D 6392, Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
   a) INSTALLER shall repair all holes in the geomembrane resulting from destructive sampling.

4) Repair and test the continuity of the repair in accordance with these Specifications.

3. Failed Seam Procedures
   a. If the seam fails, INSTALLER shall follow one of two options:
      1) Reconstruct the seam between any two passed test locations.
      2) Trace the weld to intermediate location at least 10-ft minimum or where the seam ends in both directions from the location of the failed test.
      b) The next seam welded using the same welding device is required to obtain an additional sample, i.e., if one side of the seam is less than 10-ft long.
      c) If sample passes, then the seam shall be reconstructed or capped between the test sample locations.
      d) If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed.

1.13 REPAIR PROCEDURES

A. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.
B. Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.
C. INSTALLER shall be responsible for repair of defective areas.
D. Agreement upon the appropriate repair method shall be decided between
   1. CONSULTANT and INSTALLER by using one of the following repair methods:
      a. Patching- Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.
      b. Abrading and Re-welding- Used to repair short section of a seam.
      c. Spot Welding- Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.
      d. Capping- Used to repair long lengths of failed seams.
      e. Flap Welding- Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap.
         1) Remove the unacceptable seam and replace with new material.
E. The following procedures shall be observed when a repair method is used:
   1. All geomembrane surfaces shall be clean and dry at the time of repair.
   2. Surfaces of the polyethylene which are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.
   3. Extend patches or caps at least 6 inches for extrusion welds and 4 inches for wedge welds beyond the edge of the defect, and around all corners of patch material.

F. Repair Verification
    1. Number and log each patch repair (performed by CONSULTANT).
    2. Non-destructively test each repair using methods specified in this Specification.

1.1 SCOPE

This specification covers the technical requirements for the Manufacturing and Installation of the nonwoven geotextile. All materials meet or exceed the requirements of this specification, and all work will be performed in accordance with the procedures provided in these project specifications.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)
1. ASTM D 5261, Standard Test Method for Measuring Mass per Unit Area of Geotextiles
2. ASTM D 4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
3. ASTM D 4533, Standard Test Method for Index Trapezoidal Tearing Strength of Geotextiles
4. ASTM D 4833, Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
5. ASTM D 4491, Standard Test Method for Water Permeability of Geotextiles by Permittivity
6. ASTM D 4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile
7. ASTM D 4354, Standard Practice for Sampling of Geosynthetics for Testing
8. ASTM D 4759, Standard Practice for Determining the Specifications Conformance of Geosynthetics

1.3 SUBMITTALS

A. Prior to material delivery to project site, the contractor shall provide the engineer with a written certification or manufacturers quality control data which displays that the geotextile meets or exceeds minimum average roll values (MARV) specified herein.
B. The contractor shall submit, if required by the engineer, manufacturer's quality control manual for the geotextile to be delivered to the site.

2. PRODUCT

2.1 GEOTEXTILE

A. The nonwoven needle-punched geotextile specified herein shall be made from staple fiber.
B. The geotextile shall be manufactured from prime quality virgin polymer.
C. The geotextile shall be able to withstand direct exposure to ultraviolet radiation from Sun for up to 30 days without any noticeable effect on index or performance properties.
D. Geotextile shall meet or exceed all material properties listed in *Table 1*.

TABLE 1: GEOTEXTILE PROPERTIES			
Property	**Test Method**	**Test Frequency**	**Value**
Mass per Unit Area, oz/yd^2	ASTM D 5261	90,000-ft^2	12
Grab Tensile Strength, lb	ASTM D 4632	90,000-ft^2	320
CBR Puncture Strength, lb	ASTM D 6241	540,000-ft^2	925
Grab Elongation, %	ASTM D 4632	90,000-ft^2	50
Trapezoidal Tear Strength, lb	ASTM D 4533	90,000-ft^2	125
UV Resistance, % retained after 500 hours	ASTM D 4355	per formulation	70

2.2 MANUFACTURE

A. All rolls of the geotextile shall be identified with permanent marking on the roll or packaging, with the manufacturers name, product identification, roll number, and roll dimensions.

2.3 TRANSPORT

A. Transportation of the geotextile shall be the responsibility of the contractor.
B. During shipment, the geotextile shall be protected from ultraviolet light exposure, precipitation, mud, dirt, dust, puncture, or other damaging or deleterious conditions.
C. Upon delivery at the job site, the contractor shall ensure that the geotextile rolls are handled and stored in accordance with the manufacturer's instructions as to prevent damage.

3. EXECUTION

3.1 QUALITY ASSURANCE

A. The engineer shall examine the geotextile rolls upon delivery to the site and report any deviations from project specifications to the contractor.

3.2 INSTALLATION

A. The geotextile shall be handled in such a manner as to ensure that it is not damaged in any way. Should the contractor damage the geotextile to the extent that it is no longer usable as determined by these specifications or by the engineer, the contractor shall replace the geotextile at his own cost.
B. The geotextile shall be installed to the lines and grades as shown on the contract drawings and as described herein.
C. The geotextile shall be rolled down the slope in such a manner as to continuously keep the geotextile in tension by self-weight. The geotextile shall be securely anchored in an anchor trench where applicable, or by other approved or specified methods.
D. In the presence of wind, all geotextiles shall be weighted by sandbags or approved equivalent. Such anchors shall be installed during placement and shall remain in place until replaced with cover material.
E. The contractor shall take necessary precautions to prevent damage to adjacent or underlying materials during placement of the geotextile. Should damage to such material occur due to the fault of the contractor, the latter shall repair the damaged materials at his own cost and to the satisfaction of the engineer.
F. During placement of the geotextile, care shall be taken not to entrap soil, stones or excessive moisture that could hamper subsequent seaming of the geotextile as judged by the engineer.
G. The geotextile shall not be exposed to precipitation prior to being installed and shall not be exposed to direct sunlight for more than 15 days after installation.
H. The geotextile shall be seamed using heat seaming or stitching methods as recommended by the manufacturer and approved by the engineer. Sewn seams shall be made using polymeric thread with chemical resistance equal to or exceeding that of the geotextile. All sewn seams shall be continuous. Seams shall be oriented down slopes perpendicular to grading contours unless otherwise specified. For heat-seaming, fusion welding techniques recommended by the manufacturer shall be used.
I. The contractor shall not use heavy equipment to traffic above the geotextile without approved protection.
J. The geotextile shall be covered as soon as possible after installation and approval. Installed geotextile shall not be left exposed for more than 15 days.
K. Material overlying the geotextile shall be carefully placed to avoid wrinkling or damage to the geotextile.

SINGLE SIDED GEOCOMPOSITE

1.1 SCOPE

This specification covers the technical requirements for the manufacturing and installation of the geocomposite drainage layer. All materials meet or exceed the requirements of this specification, and all work will be performed in accordance with the procedures provided in these project specifications.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM D 1238 Standard Test Method for Melt Flow Rates of Thermoplastics
2. by Extrusion Plastometer
3. D 1505-98 Standard Test Method for Density of Plastics by the Density-Gradient Technique
4. ASTM D 4218, Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle Furnace Technique D 1603-94 Standard Test Method for Carbon Black in Olefin Plastics
5. D 4355-02 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
6. D 4491-99 Standard Test Method for Water Permeability of Geotextiles by Permittivity
7. D4533 Standard Test Method for Trapezoid Tearing Strength of Geotextiles
8. D 4716-00 Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
9. D 4751-99 Standard Test Method for Determining Apparent Opening Size of a Geotextile
10. D 6241 Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile- Related Products Using a 50-mm Probe D 4833-88 (1996) Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
11. D 5261-92 (1996) Standard Test Method for Measuring the Mass Per Unit Area of Geotextiles
12. D7005-03 Determining The Bond Strength (Ply-Adhesion) of Geocomposites
13. D 7179 Standard Test Method for Determining Geonet Breaking Force

B. Relevant publications from the Environmental Protection Agency (EPA):
   1. Daniel, D.E. and R.M. Koerner, (1993), Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities, EPA/600/R-93/182.

1.3 DEFINITIONS

A. Construction Quality Assurance Consultant (CONSULTANT) – The Party, independent from MANUFACTURER and INSTALLER, that is responsible for observing and documenting activities related to quality assurance during the lining system construction.
B. ENGINEER - The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.
C. Geocomposite Manufacturer (MANUFACTURER) - The party responsible for manufacturing the geocomposite rolls.
D. Geosynthetic Quality Assurance Laboratory (TESTING LABORATORY) -The Party, independent from the MANUFACTURER and INSTALLER, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the OWNER.
E. INSTALLER- Party responsible for field handling, transporting, storing and deploying the geocomposite.
F. Lot- A quantity of resin (usually the capacity of one rail car) used to manufacture polyethylene geocomposite rolls. The finished rolls will be identified by a roll number traceable to the resin lot.

1.4 QUALIFICATIONS

A. MANUFACTURER
    1. Geocomposite shall be manufactured by the following:
    a. GSE Lining Technology, Inc.
    b. Approved Equal
    2. MANUFACTURER shall have manufactured a minimum of 10,000,000-ft^2 of polyethylene geocomposite material during the last year.
B. INSTALLER
    1. INSTALLER shall have installed a minimum of 500,000 square feet of geocomposite in the last 3 years.
    2. INSTALLER shall have worked in a similar capacity on at least 5 projects similar in complexity to the project described in the contract documents, and within at least 50,000 square feet of geonet installation on each project.
    3. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.

1.5 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

A. Labeling- Each roll delivered to the site shall be wrapped and labeled by the MANUFACTURER. The label will identify:
    1. Manufacturer's name
    2. Product identification
    3. Length
    4. Width
    5. Roll number

C. Delivery- Rolls will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.
D. Storage- The on-site storage location provided by the CONTRACTOR to protect the geonet from abrasions, excessive dirt and moisture, shall have the following characteristics:
    1. Level (no wooden pallets)
    2. Smooth
    3. Dry
    4. Protected from theft and vandalism
    5. Adjacent to the area being lined

E. Handling
    1. The CONTRACTOR and INSTALLER shall handle all rolls in such a manner to ensure they are not damaged in any way.
    2. The INSTALLER shall take any necessary precautions to prevent damage to underlying layers during placement of the drainage material.

1.6 WARRANTY

A. Material shall be warranted, on a pro-rata basis against defects for a period of 1-year from the date of the geocomposite installation.
B. Installation shall be warranted against defects in workmanship for a period of 1-year from the date of geocomposite completion.

2. PRODUCTS

2.1 GEOCOMPOSITE PROPERTIES

A. A geocomposite shall be manufactured by extruding two crossing strands to form a bi-planar drainage net structure with a non-woven geotextile bonded to one or both sides.
B. The geocomposite specified shall have properties that meet or exceed the values listed in the following data sheets below.

TABLE 1: GEOCOMPOSITE PROPERTIES			
Property	**Test Method**	**Frequency**	**Value**
Geocomposite			
Transmissivity (1), gal/min/ft (m2/sec) Single-Sided Composite	ASTM D 4716	1/540,000-ft^2	6.2 (1.3 x 10-3)
Ply Adhesion, lb/in	ASTM D 7005	1/50,000-ft^2	0.5
Geonet			
Geonet Core Thickness, mil (1)	ASTM D 5199	1/50,000-ft^2	270
Transmissivity (2), gal/min/ft (m2/sec)	ASTM D 4716	1/540,000-ft^2	19 (4 x 10-3)
Compressive Strength, lbs/ft	ASTM D 6364	1/540,000-ft^2	40,000
Density, g/cm3	ASTM D 1505	1/50,000-ft^2	0.94
Tensile Strength (MD), lb/in	ASTM D 7179	1/50,000-ft^2	100
Carbon Black Content, %	ASTM D 4218	1/50,000-ft^2	2.0
8 oz. Geotextile (prior to lamination)			
Mass per Unit Area, oz/yd2	ASTM D 5261	1/90,000-ft^2	8
Grab Tensile Strength, lb	ASTM D 4632	1/90,000-ft^2	220
Grab Elongation	ASTM D 4632	1/90,000-ft^2	50%
CBR Puncture Strength, lb	ASTM D 6241	1/540,000-ft^2	575
Trapezoidal Tear Strength, lb	ASTM D 4533	1/90,000-ft^2	90
AOS, US Sieve (mm)	ASTM D 4751	1/540,000-ft^2	80 (0.180)
Permittivity, sec-1	ASTM D 4491	1/540,000-ft^2	1.3
Water Flow Rate, gpm/ft2	ASTM D 4491	1/540,000-ft^2	95
UV Resistance, % Retained	ASTM D 4355 (after 500 hours)	per formulation	70

- *Note: The design engineer shall prepare the table above based on the GSE product data sheet and then delete this note*

C. Resin
   1. Resin shall be new first quality, compounded polyethylene resin.
   2. Natural resin (without carbon black) shall meet the following additional
   a. minimum requirements:

TABLE 2: RAW MATERIAL PROPERTIES		
Property	**Test Method[(1)]**	**Value**
Density (g/cm^3)	ASTM D 1505	>0.94
Melt Flow Index (g/10 min)	ASTM D 1238	$\leq$ 1.0

[1]GSE utilizes test equipment and procedures that enable effective and economical confirmation that the product will conform to specifications based on the noted procedures. Some test procedures have been modified for application to geosynthetics. All procedures and values are subject to change without prior notification.

2.2 MANUFACTURING QUALITY CONTROL

The geocomposite shall be manufactured in accordance with the Manufacturer's Quality Control Plan submitted to and approved by the ENGINEER.
The geocomposite shall be tested according to the test methods and frequencies listed on *Table 1* which has been prepared based on product data sheets.

3. EXECUTION

3.1 FAMILIARIZATION

A. Inspection
   1. Prior to implementing any of the work in the Section to be lined, the INSTALLER shall carefully inspect the installed work of all other Sections and verify that all Work is complete to the point where the installation of the Section may properly commence without adverse impact.
   2. If the INSTALLER has any concerns regarding the installed work of other Sections, he shall notify the Project ENGINEER.

3.2 MATERIAL PLACEMENT

A. The geocomposite roll should be installed in the direction of the slope and in the intended direction of flow unless otherwise specified by the ENGINEER.
   1. If the project contains long, steep slopes, special care should be taken so that only full length rolls are used at the top of the slope.
B. In the presence of wind, all geocomposites shall be weighted down with sandbags or the equivalent. Such sandbags shall be used during placement and remain until replaced with cover material.

C. If the project includes an anchor trench at the top of the slopes, the geocomposite shall be properly anchored to resist sliding. Anchor trench compacting equipment shall not come into direct contact with the geocomposite.
D. In applying fill material, no equipment can drive directly across the geocomposite. The specified fill material shall be placed and spread utilizing vehicles with a low ground pressure.
E. The cover soil shall be placed in the geocomposite in a manner that prevents damage to the geocomposite. Placement of the cover soil shall proceed immediately following the placement and inspection of the geocomposite.

3.3 SEAMS AND OVERLAPS

A. Each component of the geocomposite will be secured or seamed to the like component at overlaps.
B. Geonet Components
    1. Adjacent edges of the geonet along the length of the geocomposite roll shall be placed with the edges of each geonet butted against each other.
    2. The overlaps shall be joined by tying the geonet structure with cable ties. These ties shall be spaced every 5-ft along the roll length.
    3. Adjoining geocomposite rolls (end to end) across the roll width should be shingled down in the direction of the slope, with the geonet portion of the top overlapping the geonet portion of the bottom geocomposite a minimum of 12-in across the roll width.
    4. The geonet portion should be tied every 6-in in the anchor trench or as specified by the ENGINEER.

3.4 REPAIR

A. Prior to covering the deployed geocomposite, each roll shall be inspected for damage resulting from construction.
B. Any rips, tears or damaged areas on the deployed geocomposite shall be removed and patched. The patch shall be secured to the original geonet by tying every 6-in with the approved tying devices. If the area to be repaired is more than 50 percent of the width of the panel, the damaged area shall be cut out and the two portions of the geonet shall be cut out and the two portions of the geonet shall be joined in accordance with *Subsection 3.03*.

APPENDIX G

OPERATING AND MAINTENANCE PLAN

WaterBridge Stateline, LLC (WaterBridge) is proposing to construct one (1) storage pit and one (1) Above Ground Storage Tank (AST) in Section 20, Township 20 South, Range 30 East, Eddy County, New Mexico. The Twin Wells Recycle shall consist of two containments with a total operational volume of approximately 817,000-bbl.

OPERATION AND MAINTENANCE PROCEDURES

In this plan, underlined text represents the language of the Rule.

The operator will operate and maintain the lined earthen containment and AST to contain liquids and solids (blow sand and minimal precipitates from the treated 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 and AST is to facilitate recycling, reuse, and reclamation of produced water derived from nearby oil and gas wells. During periods when water for E&P operations is not needed, produced water will discharge to one of the injection wells in the operator's SWD system. The containment will not be used for the disposal of produced water or other oilfield waste.

The operation of the Recycling Containment is summarized below:

1. Via pipeline, produced water generated from nearby oil and gas wells is delivered to a treatment system located as indicated in the C-147.
2. After treatment, the produced water discharges into the containment.
3. When required, treated produced water is removed from the containment for E&P operations. At this time, treated produced water will be used for drilling beneath the fresh water zones (beneath surface casing), for well stimulation (e.g. hydraulic fracturing) and other E&P uses as approved by OCD.
4. Whenever the maximum fluid capacity of the containment is reached, treatment and discharge to the containment ceases (see Freeboard and Overtopping Plan, below).
5. 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.
6. 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.
7. 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.

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 discover, 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 Inspection and Monitoring Plan), 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 onsite, 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.
8. The operator will maintain the containment free of miscellaneous solid waste or debris.
9. The operator will maintain at least 3-ft of freeboard for the containment and will use a welded ladder gauge to allow easy determination of the required 3-ft 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.

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:

1. Reading and recording the fluid height of staff gauges,
2. Recording any evidence that the pond surface shows visible oil,
3. Visually inspecting the containment's exposed liners, and
4. Checking the leak detection system for any evidence of a loss of integrity of the primary liner.

As stated above, if a liner's integrity is compromised, or if any penetration of the liner occurs above the water surface, then the operator will notify the District office within 48 hours (phone or email).

Monthly, the operator will:

1. Inspect diversion ditches and berms around the containment to check for erosion and collection of surface water run-on.
2. Inspect the leak detection system for evidence of damage or malfunction and monitor for leakage.
3. Inspect the containment for 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.

4. 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.
5. Record sources and disposition of all recycled water.

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

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-ft of freeboard), the discharge of treated produced water ceases and the produced water generated by nearby oil and gas wells is managed by disposing of fluid at a local injection well.

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

1. Cease discharging treated produced water to the containment.
2. Accelerate re-use of the treated produced water for purposes approved by the Division.
3. Transfer treated produced water from the containment to a Division approved injection well.

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 D*, 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-in 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 treated produced water from the containment via field 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.

APPENDIX H

CLOSURE PLAN

WaterBridge Stateline, LLC (WaterBridge) is proposing to construct one (1) storage pit and one (1) Above Ground Storage Tank (AST) in Section 20, Township 20 South, Range 30 East, Eddy County, New Mexico. The Twin Wells Recycle shall consist of two containments with a total operational volume of approximately 817,000-bbl.

CLOSURE PLAN

In this plan, underlined text represents the language of the Rule.

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.

The operator shall substantially restore the impacted surface area to

1. The condition that existed prior to the construction of the recycling containment or
2. 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.

EXCAVATION AND REMOVAL CLOSURE PLAN - PROTOCOLS AND PROCEDURES

The storage pit and AST 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 remove all liquids from the pits and either:

a. Dispose of the liquids in a division-approved facility, or
b. Recycle, reuse, or reclaim the water for reuse in drilling and stimulation

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.

After the removal of the pit contents and liners, soils beneath the workover pit will be tested by collection of a five-point (minimum) composite sample, which includes stained or wet soils, if any. That sample shall be analyzed for the constituents listed in *Table 1* of *19.15.34.14*.

After review of the laboratory results:

a. If any contaminant concentration is higher than the parameters listed in *Table 1*, additional delineation may be required, 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 1*, 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.

The operator will 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.

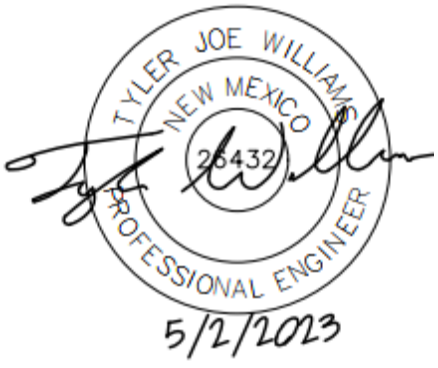
The operator shall notify the division when reclamation and re-vegetation are complete. Specifically, the notice will document that all ground surface disturbing activities at the site have been completed, and a uniform vegetative cover has been established that reflects a life-form ratio of plus or 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.

WaterBridge Stateline, LLC
Twin Wells Recycle Facility
Closure Cost Estimate

	Item	Units	Quanity	$/Unit	Estimate Cost
	Facility Closure				
1	Fluid removal				
	Twin Wells Recycle Pit (777K bbls)	bbls	776,815	$ 0.50	$ 388,407.50
	Twin Wells Recycle AST	bbls	40,000	$ 0.50	$ 20,000.00
2	Vac truck (final fluid removal)	hrs	16	$ 125.00	$ 2,000.00
3	Liner removal (fold-in-place)				
	Covers removal and disposal	SF	1,931,200	$ 0.18	$ 347,616.00
4	Equipment removal				
	Pit clean-out and residue haul-off	LS	1	$ 7,500.00	$ 7,500.00
	Equipment removal (tanks, gun barrel, FWKO)	LS	1	$ 5,000.00	$ 5,000.00
	Electrical decomissioning (pumps and panels)	LS	1	$ 1,500.00	$ 1,500.00
	Misc equipment clean-up and removal	hr	120	$ 125.00	$ 15,000.00
	Removal of AST	LS	1	$ 25,000.00	$ 25,000.00
5	Site Restoration				
	Dozer - push in berms (bid) and final grading of the site	CY	129,376	$ 2.00	$ 258,752.00
	Re-vegetation	ea	1	$ 4,800.00	$ 4,800.00
	Estimated Total				**$ 1,075,575.50**

Assumptions

No Remediation will be necessary
Pit is full at time of closure
Pit berms above natural grade will be used to fill voids below natural grade



Venegas, Victoria, EMNRD

From: Venegas, Victoria, EMNRD
Sent: Thursday, May 11, 2023 11:17 AM
To: Michael Reitz; Jake Ferenz; Heather Soto
Cc: twilliams@envirotechconsulting.com; Mitchell Ratke
Subject: 2RF-191 - TWIN WELLS RECYCLE PIT FACILITY ID [fVV2312854181]
Attachments: C-147 2RF-191 - TWIN WELLS RECYCLE PIT FACILITY ID [fVV2312854181] 05.11.2023.pdf

2RF-191 - TWIN WELLS RECYCLE PIT FACILITY ID [fVV2312854181] Conditions of Approval

Good morning Mr. Ferenz,
NMOCD has reviewed the recycling containment permit application and related documents, submitted by [330129] WaterBridge Stateline LLC on May 02, 2023, for 2RF-191 - TWIN WELLS RECYCLE PIT FACILITY ID [fVV2312854181] in Unit Letter E, Section 20, Township 20S, Range 30E, Eddy County, New Mexico. [330129] WaterBridge Stateline LLC requested variances from 19.15.34 NMAC for 2RF-191 - TWIN WELLS RECYCLE PIT FACILITY ID [fVV2312854181] related to 19.15.34. NMAC

The following variances have been approved:

- The variance from 19.15.34.13.D NMAC, for the installation of a wire mesh, game fence, eight (8) feet in height is approved.
- The variance from 19.15.34.13.E NMAC for the installation of an audible bird deterrence system, a Bird-X Mega-Blaster, is approved.
- The proposed new liner system cross-section for the inground containment is as follows: 10 oz. geotextile, 40-mil LLDPE, 200 mil geonet, 60-mil HDPE.
- The variance from 19.15.34.11.A.(8) to locate the containment within an unstable area is approved. The operator has demonstrated that it has incorporated engineering measures into the design to ensure that the containment integrity is not compromised as per 19.15.34.11.A.(8). A site-specific karst evaluation was conducted by Southwest Geophysical Consulting at this location. During this investigation, it was concluded that no surface karst features are located within the karst survey area for the TWNO project. Employing a BLM-CFO approved karst monitor on site during construction operations should be considered. Even though the risk of karst in this area is low, [330129] WaterBridge Stateline LLC will still use best engineering practices and best management practices to ensure no undo risk is posed to the preservation of fresh water, public health, and the natural environment.

The following variances, specific to the AST containment have been 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 40-mil non-reinforced LLDPE as the secondary liner is approved. The proposed new liner system cross-section is as follows: prepare subgrade, 10 oz. geotextile, 40-mil LLDPE, 200 mil geonet, 40-mil LLDPE.

The form C-147 and related documents for the 2RF-191 - TWIN WELLS RECYCLE PIT FACILITY ID [fVV2312854181] is approved with the following conditions of 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.

- [330129] WaterBridge Stateline LLC shall construct, operate, maintain, close, and reclaim 2RF-191 - TWIN WELLS RECYCLE PIT FACILITY ID [fVV2312854181] in compliance with 19.15.34 NMAC.
- 2RF-191 - TWIN WELLS RECYCLING FACILITY ID [fVV2312854181] approved to operate for five years from the permit application date. 2RF-191 - TWIN WELLS RECYCLE PIT FACILITY ID [fVV2312854181] permit expires on May 02, 2028. If [330129] WaterBridge Stateline LLC wishes to extend operations past five years, an annual permit extension request must be submitted using form C-147 through OCD Permitting by April 02, 2028
- [330129] WaterBridge Stateline LLC cannot receive produced water in the 2RF-191 - TWIN WELLS RECYCLE PIT FACILITY ID [fVV2312854181] until after the original copy of the financial assurance has been accepted by NMOCD.
- Per Rule 19.15.34.15.A.(1) operators without existing financial assurance pursuant to 19.15.8 NMAC shall furnish financial assurance acceptable to the division in the amount of the recycling containment's estimated closure cost. The total closure cost estimate 2RF-191 - TWIN WELLS RECYCLE PIT FACILITY ID [fVV2312854181] consisting of one (1) earthen impoundment of 777,000.00 BBL of capacity and one (1) AST containment of 40,000.00 BBL of capacity in the amount of $1,075,575.50, satisfies the requirements of NMAC 19.15.34.15.A.(1).
- The financial assurance should be mailed to the Oil Conservation Division; Bonding and Compliance; 1220 South St Frances Drive; Santa Fe, NM 87505.
- [330129] WaterBridge Stateline LLC shall notify NMOCD when construction of the 2RF-191 - TWIN WELLS RECYCLE PIT FACILITY ID [fVV2312854181] commences.
- [330129] WaterBridge Stateline LLC shall notify NMOCD when recycling operations commence and cease at 2RF-191 - TWIN WELLS RECYCLE PIT FACILITY ID [fVV2312854181].
- A minimum of 3-feet freeboard must be maintained in 2RF-191 - TWIN WELLS RECYCLE PIT FACILITY ID [fVV2312854181 recycling containment, at all times during operations.
- If less than 20% of the total fluid capacity is utilized every six months, beginning from the first withdrawal, operation of the facility is considered ceased and notification of cessation of operations should be sent electronically to OCD Online. An extension to extend the cessation of operation, not to exceed six months, may be submitted using a C-147 form through OCD Online.
- If after that 6-month extension period, the 2RF-191 - TWIN WELLS RECYCLE PIT FACILITY ID [fVV2312854181] 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.
- [330129] WaterBridge Stateline LLC shall submit monthly reports of recycling and reuse of produced water, drilling fluids, and liquid oil field waste on NMOCD form C-148 through OCD Online even if there is zero activity.
- [330129] WaterBridge Stateline LLC shall comply with 19.15.29 NMAC Releases in the event of any release of produced water or other oil field wastes at 2RF-191 - TWIN WELLS RECYCLE PIT FACILITY ID [fVV2312854181].
- [330129] WaterBridge Stateline 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 log available for review by the division upon request as per 19.15.34.13.A.

Please reference number 2RF-191 - TWIN WELLS RECYCLE PIT FACILITY ID [fVV2312854181] in all future communications.
Regards,

Victoria Venegas ● Environmental Specialist
Environmental Bureau
EMNRD - Oil Conservation Division
(575) 909-0269 | Victoria.Venegas@emnrd.nm.gov
https://www.emnrd.nm.gov/ocd/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OIL CONSERVATION DIVISION

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

CONDITIONS

Action 212774

CONDITIONS

Operator: WaterBridge Stateline LLC 5555 San Felipe Houston, TX 77056	OGRID: 330129
	Action Number: 212774
	Action Type: [C-147] Water Recycle Long (C-147L)

CONDITIONS

Created By	Condition	Condition Date
vvenegas	NMOCD has reviewed and approved the recycling containment permit application and related documents, submitted by [330129] WaterBridge Stateline LLC on May 02, 2023, for 2RF-191 - TWIN WELLS RECYCLE PIT FACILITY ID [fVV2312854181].. 2RF-191 - TWIN WELLS RECYCLE PIT FACILITY ID [fVV2312854181] permit expires on May 02, 2028. If [330129] WaterBridge Stateline LLC wishes to extend operations past five years, an annual permit extension request must be submitted using form C-147 through OCD Permitting by April 02, 2028. • If less than 20% of the total fluid capacity is utilized every six months, beginning from the first withdrawal, operation of the facility is considered ceased and notification of cessation of operations should be sent electronically to OCD Online. An extension to extend the cessation of operation, not to exceed six months, may be submitted using a C-147 form through OCD Online.	5/11/2023