NM2 - ___24____

PART 36 PERMIT APPLICATION

Dated

Dec. 21, 2012

WWC ENGINEERING
1275 Maple Street, Suite F - Helena, MT 59601 - (406) 443-3962
Fax (406) 449-0056 - Email: infohln@wwcengineering.com

January 11, 2013

Mr. Brad Jones
New Mexico Energy, Minerals and Natural Resources Department
Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, NM 87505

RE: East Blanco Field Produced Water Reuse Facility Permit Application Attachment

Dear Mr. Jones:

Please attach the accompanying survey plat to the revised C-137 application for the East Blanco Produced Water Reuse Facility that was submitted to the Oil Conservation Division on December 21, 2012. This survey plat should be placed at the end of the Land Ownership Information section of Appendix E of the permit application. Please do not hesitate to contact us should you have any further questions or require additional clarification.

Sincerely,

Shawn Higley, P.E.
Helena Branch Manager

cc: Black Hills Exploration and Production

Enc.: Survey Plat to be included in Appendix E of revised C-137 application

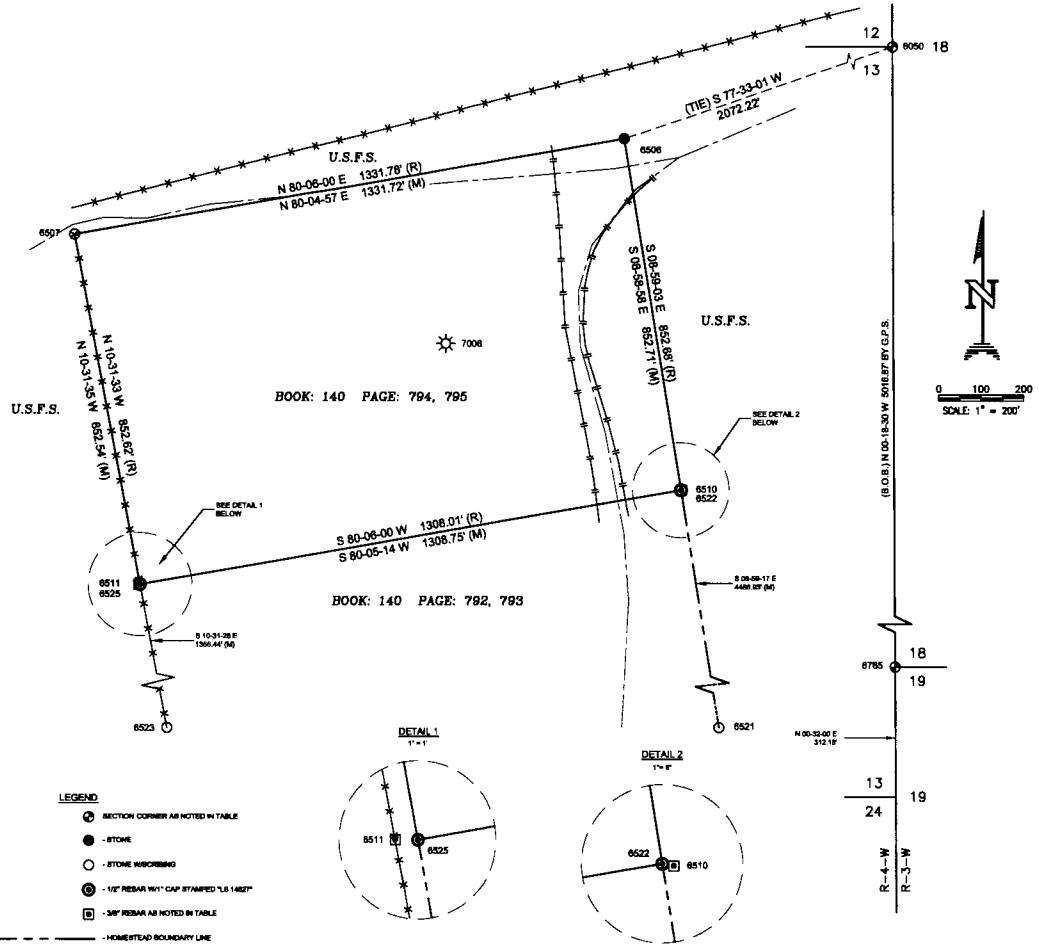
SH/mh

K:\BLACK HILLS\11063 - E. BLANCO FIELD\CORRE\Survey Plat Addition Letter 1-11-13.doc

AN BOUNDARY RETRACEMENT FOR

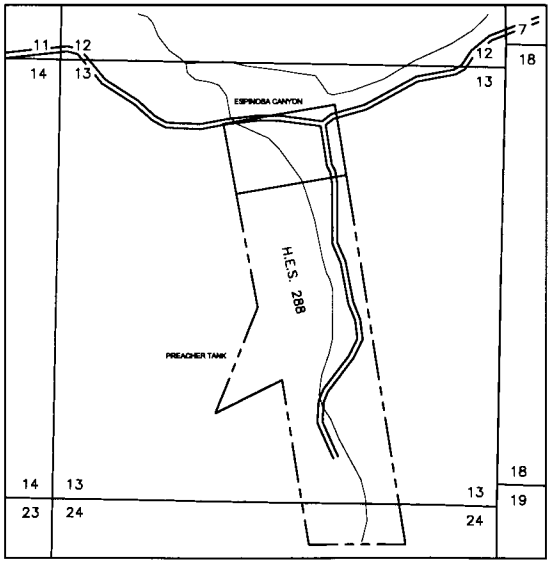
MALLON OIL COMPANY
OF
NANCY VIGIL PROPERTY

SEC. 13, T-30-N, R-4-W, N.M.P.M.
RIO ARRIBA COUNTY, NEW MEXICO



POINT #	DESCRIPTION	ACCEPTED
6050	NE CORNER SEC 13 FOUND BLM 3.25" B.C. 1953	YES
8765	CORNER S/W SEC 18, FOUND GLO 2.5" B.C. 1917	YES
6506	COR. 7, H.E.S. #288 FOUND STONE	YES
6507	COR. 6, H.E.S. #288 FOUND SCRIBED STONE	YES
6510	ORIGINAL COR. PARCEL 1 FOUND 3/8" REBAR WITH CAP	YES
6511	ORIGINAL COR. PARCEL 1 FOUND 3/8" REBAR WITH CAP	YES
6521	COR 1, H.E.S. #288 FOUND SCRIBED STONE. W/ BEARING TREES	YES
6523	COR. 5, H.E.S. #288 FOUND STONE W/ BEARING TREES	YES
6522	SE CORNER OF PARCEL SET 1/2" X 24" REBAR WITH 1" PLASTIC CAP MARKED "NM 14827"	
6525	SW CORNER OF PARCEL SET 1/2" X 24" REBAR WITH 1" PLASTIC CAP MARKED "NM 14827"	
7006	WATER WELL	

VICINITY MAP
1" = 1000'



LEGEND

- SECTION CORNER AS NOTED IN TABLE
- STONE
- STONE W/SCRIBING
- 1/2" REBAR W/1" CAP STAMPED "LS 14827"
- 3/8" REBAR AS NOTED IN TABLE
- HOMESTEAD BOUNDARY LINE
- FENCE

NOTES:

1.) BASIS OF BEARING: BETWEEN FOUND MONUMENTS AT THE SOUTHWEST CORNER OF SECTION 18, TOWNSHIP 30 NORTH, RANGE 3 WEST AND THE NORTHEAST CORNER OF SECTION 13, TOWNSHIP 30 NORTH, RANGE 4 WEST, N.M.P.M. RIO ARRIBA COUNTY, NEW MEXICO
LINE BEARS: N 00-18-30 W A DISTANCE OF 5016.87 FEET AS MEASURED BY G.P.S.

2.) DATE OF FIELD SURVEY: 9/16/03

DETAIL 1
1" = 1'

DETAIL 2
1" = 1'

REFERENCES

1.) DEED DOCUMENT BOOK 140, PAGES 792 THROUGH 795, FILED FOR RECORD APRIL 22, 1991, WITH RIO ARRIBA COUNTY CLERK.

2.) PATENT No. 724676 FROM U.S.A. TO TORIBIO Z. SALAZAR DECEMBER 19, 1919.

3.) PLAT AND FIELD NOTES OF HOMESTEAD ENTRY SURVEY No. 288, APPROVED MAY 31, 1918.

4.) PLAT OF SURVEY AND DIVISION OF 135.85 ACRES OF LAND IN SECTION 13, T-30-N, R-4-W, N.M.P.M. FOR NANCY VIGIL, AUGUST 4, 1978, BY RICHARD P. CHERREY, PELS No. 3834

APPROVALS

RIO ARRIBA COUNTY PLANNING DEPARTMENT

INDEXING INFORMATION FOR COUNTY CLERK

OWNER:_____

LOCATION:_____

NAME OF SUBDIVISION:_____

_____ DATE: _____

I, DAVID A. JOHNSON, A NEW MEXICO REGISTERED PROFESSIONAL SURVEYOR CERTIFY THAT I CONDUCTED AND AM RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, AND THAT THIS SURVEY AND PLAT MEET THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO.

I FURTHER CERTIFY THAT THIS IS NOT A LAND DIVISION OR SUBDIVISION AS DEFINED IN THE NEW MEXICO SUBDIVISION ACT AND THAT THIS IS A BOUNDARY SURVEY PLAT OF AN EXISTING TRACT.

AN BOUNDARY RETRACEMENT FOR

MALLON OIL COMPANY
OF
NANCY VIGIL PROPERTY

SEC. 13, T-30-N, R-4-W, N.M.P.M.
RIO ARRIBA COUNTY, NEW MEXICO

REVISION	REV. BY	DATE

Daggett Enterprises, Inc.
Surveying and Oil Field Services
P. O. Box 15068 Farmington, NM 87401
Phone (505) 326-1772 Fax (505) 326-6019
REGISTERED LAND SURVEYOR
NEW MEXICO LS No.14827

DRAWN BY: BB | SCALE: 1"=200' | CHECKED: DAJ | DATE: 9/12/03

WWC ENGINEERING
(406) 443-3962
THE UPS STORE #4489
NOT CUSTOMERS RETURN ADDRESS
2047 N LAST CHANCE GULCH
HELENA MT 59601-0774

8 LBS 1 OF 1
SHP WT: 8 LBS
DATE: 21 DEC 2012

SHIP BRAD JONES
TO: NEW MEXICO OCD
1220 S ST FRANCIS DR

SANTA FE NM 87505-4225

NM 875 0-03

UPS 2ND DAY AIR 2
TRACKING #: 1Z 8V2 065 02 8530 8130

BILLING: P/P

REF #1. ORDER / ITEM #
REF #2: REFERENCE #

ISH 13.00N E2844 33.5V 10/2012

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Front Desk

Signed By:
LOPEZ

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Type:	Package
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Tracking Number:	1Z8V20650285308130
Service:	UPS 2nd Day AirÂ®
Weight:	7.10 lbs
Shipped/Billed On:	12/21/2012
Delivered On:	12/26/2012 10:40 A.M.
Delivered To:	SANTA FE, NM, US
Signed By:	LOPEZ
Left At:	Front Desk

Thank you for giving us this opportunity to serve you.

Sincerely,

UPS

Tracking results provided by UPS: 01/02/2013 3:27 P.M. ET

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For State Use Only: DEC 26 2012

Per ...

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

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-137
Revised August 1, 2011

Submit 1 Copy to Santa Fe Office

APPLICATION FOR SURFACE WASTE MANAGEMENT FACILITY

A meeting should be scheduled with the Division's Santa Fe office Environmental Bureau prior to pursuing an application for a surface waste management facility in order to determine if the proposed location is capable of satisfying the siting requirements of Subsections A and B of 19.15.36.13 NMAC for consideration of an application submittal.

1 Application: ■ New ☐ Modification ☐ Renewal

2. Type: ☐ Evaporation ☐ Injection ☐ Treating Plant ☐ Landfill ☐ Landfarm ■ Other

3. Facility Status: ☐ Commercial ■ Centralized

4. Operator: Black Hills Gas Resources

Address: 3200 N 1st Street, Bloomfield, NM 87413

Contact Person: Daniel Manus Phone: (505) 634-5104

5. Location: SE /4 NW /4 Section 13 Township 30 N Range 4 W

6. Is this an existing facility? ☐ Yes ■ No If yes, provide permit number _____

7. Attach the names and addresses of the applicant and principal officers and owners of 25 percent or more of the applicant. Specify the office held by each officer and identify the individual(s) primary responsible for overseeing management of the facility.

8. Attach a plat and topographic map showing the surface waste management facility's location in relation to governmental surveys (quarter-quarter section, township and range); highways or roads giving access to the surface waste management facility site; watercourses; fresh water sources, including wells and springs; and inhabited buildings within one mile of the site's perimeter.

9. Attach the names and addresses of the surface owners of the real property on which the surface waste management facility is sited and surface owners of the real property within one mile of the site's perimeter.

10. Attach a description of the surface waste management facility with a diagram indicating the location of fences and cattle guards, and detailed construction/installation diagrams of pits, liners, dikes, piping, sprayers, tanks, roads, fences, gates, berms, pipelines crossing the surface waste management facility, buildings and chemical storage areas.

11. Attach engineering designs, certified by a registered professional engineer, including technical data on the design elements of each applicable treatment, remediation and disposal method and detailed designs of surface impoundments.

12. Attach a plan for management of approved oil field wastes that complies with the applicable requirements contained in 19.15.36.13, 19.15.36.14, 19.15.36.15 and 19.15.36.17 NMAC.

13. Attach an inspection and maintenance plan that complies with the requirements contained in Subsection L of 19.15.36.13 NMAC.

14. Attach a hydrogen sulfide prevention and contingency plan that complies with those provisions of 19.15.3.118 NMAC that apply to surface waste management facilities.

15. Attach a closure and post closure plan, including a responsible third party contractor's cost estimate, sufficient to close the surface waste management facility in a manner that will protect fresh water, public health, safety and the environment (the closure and post closure plan shall comply with the requirements contained in Subsection D of 19.15.36.18 NMAC).

16 Attach a contingency plan that complies with the requirements of Subsection N of 19.15.36.13 NMAC and with NMSA 1978, Sections 12-12-1 through 12-12-30, as amended (the Emergency Management Act).

17. Attach a plan to control run-on water onto the site and run-off water from the site that complies with the requirements of Subsection M of 19.15.36.13 NMAC.

18. In the case of an application to permit a new or expanded landfill, attach a leachate management plan that describes the anticipated amount of leachate that will be generated and the leachate's handling, storage, treatment and disposal, including final post closure options.

19. In the case of an application to permit a new or expanded landfill, attach a gas safety management plan that complies with the requirements of Subsection O of 19.15.36.13 NMAC

20. Attach a best management practice plan to ensure protection of fresh water, public health, safety and the environment.

21. Attach a demonstration of compliance with the siting requirements of Subsections A and B of 19.15.36.13 NMAC.

22. Attach geological/hydrological data including:

(a) a map showing names and location of streams, springs or other watercourses, and water wells within one mile of the site;

(b) laboratory analyses, performed by an independent commercial laboratory, for major cations and anions; benzene, toluene, ethyl benzene and xylenes (BTEX); RCRA metals; and total dissolved solids (TDS) of ground water samples of the shallowest fresh water aquifer beneath the proposed site;

(c) depth to, formation name, type and thickness of the shallowest fresh water aquifer;

(d) soil types beneath the proposed surface waste management facility, including a lithologic description of soil and rock members from ground surface down to the top of the shallowest fresh water aquifer;

(e) geologic cross-sections;

(f) potentiometric maps for the shallowest fresh water aquifer; and

(g) porosity, permeability, conductivity, compaction ratios and swelling characteristics for the sediments on which the contaminated soils will be placed.

23. In the case of an existing surface waste management facility applying for a minor modification, describe the proposed change and identify information that has changed from the last C-137 filing.

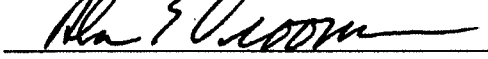
24. The division may require additional information to demonstrate that the surface waste management facility's operation will not adversely impact fresh water, public health, safety or the environment and that the surface waste management facility will comply with division rules and orders

25. CERTIFICATION

I hereby certify that the information submitted with this application is true, accurate and complete to the best of my knowledge and belief.

Name: Alan Vrooman

Title: Sr. Permitting Coordinator

Signature: 

Date: June 19, 2012

E-mail Address: alan.vrooman@blackhillscorp.com

WWC ENGINEERING
1275 Maple Street, Suite F - Helena, MT 59601 - (406) 443-3962
Fax (406) 449-0056 - Email: infohln@wwcengineering.com

December 21, 2012

RECEIVED
DEC 26 2012
Per

Mr. Brad Jones
New Mexico Energy, Minerals and Natural Resources Department
Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, NM 87505

RE: East Blanco Field Produced Water Reuse Facility Application Compliance Report

Dear Mr. Jones:

On behalf of Black Hills Exploration and Production, WWC is submitting a revised C-137 application for the East Blanco Produced Water Reuse Facility. The application has been revised per the Oil Conservation Division's request for additional information dated September 10, 2012. A response letter is included with this application that indicates additional information added to the permit application as requested. The facility consists of three independent storage ponds and is considered a centralized surface waste management facility that will be used exclusively by Black Hills Exploration and Production's surrounding oil and gas operations. A Permit Application is attached to this letter that describes the proposed facility's compliance to each application requirement.

It is our sincere hope that the stated conditions have been adequately addressed and that this application be approved as soon as possible. Please do not hesitate to contact us should you have any further questions or require additional clarification.

Sincerely,

Shawn Higley, P.E.
Helena Branch Manager

cc: Black Hills Exploration and Production

Enc.: Design Report for East Blanco Produced Water Reuse Facility

SH/mh

K:\BLACK HILLS\11063 - E. BLANCO FIELD\REPORT\Form C-137 Application\Application Letter.doc

WWC ENGINEERING
1275 Maple Street, Suite F - Helena, MT 59601 - (406) 443-3962
Fax (406) 449-0056 - Email: infohln@wwcengineering.com

December 21, 2012

Mr. Brad A. Jones, Environmental Engineer
State of New Mexico
Energy, Minerals and Natural Resources Department
Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, NM 87505

RE: Request for Additional Information - Permit Application Review for a Proposed Centralized Surface Waste Management Facility
Black Hills Gas Resources - East Blanco Produced Water Reuse Facility
Location: SE/4 NW/4 of Section 13, Township 30 North, Range 4 West, NMPM Rio Arriba County, New Mexico

Dear Mr. Jones:

In response to your letter dated September 10, 2012, we have prepared additional information for the above-referenced Permit Application for Black Hills Gas Resources East Blanco Produced Water Reuse Facility to address your comments and concerns. The following information reiterates your comments and our specific responses to each comment as follows:

General Review Comments:

1. Several of the written responses within the permit application to specific provisions of Part 36 do not recognize owner/operator's responsibility to comply with the actions identified within the provision. The responses focus on the inanimate objects rather than discussing how the owner/operator will complete specific actions on an inanimate object for compliance. If a provision begins with "the owner/operator shall. .. ," please respond in a manner that identifies and explains how Black Hills will complete the task for compliance.

Response:
The response has been updated to recognize Black Hills personnel's responsibility to comply with actions identified within Part 36. Actions taken by Black Hills personnel have been described in detail throughout the response.

Cover/Title Sheet:

2. The cover sheet is titled *"Design Report for East Blanco Produced Water Reuse Facility."* This is a *permit application* for a centralized surface waste management facility and not a report. Please properly identify the submittal.

Response:
The title on the cover sheet has been updated to "Permit Application for the East Blanco Produced Water Reuse Facility.

Page 2, Demonstration of Compliance Item 4:

3. Please clarify the corporate status (Inc. LLC, Corporation, Partnership, LP, etc. ...) of Black Hills Gas Resources and provide the complete name for the operating company.

Response:
Black Hills Gas Resources is the operating name of Black Hills Exploration & Production within the San Juan Basin of New Mexico. Black Hills Exploration & Production is a subsidiary of the Black Hills Corporation. This has been clarified in the response.

Page 2, Demonstration of Compliance Item 5:

4. The legal description provided represents a smaller area than depicted on Exhibit 5. Please establish a boundary for the proposed surface waste management facility and identify all of the quarter- quarter sections in which the facility occupies.

Response:
The legal description has been updated to include all quarter-quarter sections in which the facility is located and/or occupies.

Page 3, Demonstration of Compliance, Item 7:

5. Pursuant to Paragraph (1) of 19.15.36.8.C NMAC, the application shall include "the names and addresses of the applicant and principal officers and owners of 25 percent or more of the applicant." Black Hills Gas Resources is identified as the primary owner and Mr. John Benton, VP of Black Hills Exploration and Production, is the only officer identified. The relationship between the owner, Black Hills Gas Resources, and Black Hills Exploration and Production is not defined in the permit application. Please clarify. Also, please clarify if Mr. Benton is the only principal officer for the applicant or properly identify all principal officers for the applicant as required.

Response:
Black Hills Gas Resources is the principal owner of the proposed facility. Black Hills Gas Resources is the operating name of Black Hills Exploration & Production within the San Juan Basin of New Mexico. Black Hills Exploration & Production is a subsidiary of the Black Hills Corporation. Black Hills Corporation is a publicly traded company with a New York Stock Exchange ticker symbol of BKH. Therefore, the company is owned by various owners as with any publicly traded company. This information has been added to the response. In addition to John Benton, the contact information of the Facility Supervisor and Production Superintendent have been included in the response.

Facility Boundary Requirement:

6. A facility boundary was not properly identified or established within the permit application. Pursuant to Paragraph (2) of 19.15.36.8.C NMAC, the application shall include "a plat and topographic map showing the surface waste management facility's location in relation to governmental surveys (quarter-quarter section, township and range); highways or roads giving access to the surface waste management facility site; watercourses; fresh water sources, including wells and springs; and inhabited buildings *within one mile of the site's perimeter."* This lack of an identified facility boundary affects siting criteria setbacks and identification of the size of the proposed facility and the area requested to be considered for permitting. The boundary must be referenced in the following areas:

   a. **Page 3, Demonstration of Compliance, Item 8:**
   Exhibit 3 is a topographic map that illustrates the layout of the proposed facility, but does not represent an area larger for the one-mile assessment. Exhibit 5 is identified as the demonstration. Exhibit 5 is a satellite or aerial image which does not illustrate the required features such as watercourses and springs. Also, it is not a topographic map as required by this provision. This demonstration is an assessment "within one mile of the site's perimeter." Please establish a site perimeter (facility boundary) to properly demonstrate the one-mile assessment.

   Response:
   The proposed fence surrounding the facility will serve as the facility boundary. This has been updated on the corresponding exhibits. Exhibit 5 has been altered to include the topographic map instead of the aerial image. This extent of this exhibit includes all areas within 1-mile of the facility boundary. The text has been updated to reflect this change.

   b. Also, the response indicated that the one-mile assessment was completed for "continuously flowing watercourses." The term "watercourse" for the purpose of this application is defined in Paragraph (4) of 19.15.2.7.W NMAC. The survey plat provided in Appendix E represents only half of the area proposed for use. This is demonstrated by comparing it to Exhibit 6. Please provide the plat for the other parcel in which Black Hills Gas Resources is seeking to include as part of the surface waste management facility proposal.

   Response:
   The 1-mile assessment was updated to include watercourses as defined in Paragraph (4) of 19.15.27.7.W NMAC. The survey information in Appendix E has been updated to include all parcels in which the proposed facility will be located.

c. **Page 4, Demonstration of Compliance, Item 9; and Exhibit 6:**
Pursuant to Paragraph (3) of 19.15.36.8.C NMAC, the application shall include "the names and addresses of the surface owners of the real property on which the surface waste management facility is sited and surface owners of the real property *within one mile of the site's perimeter."* Exhibit 6 is identified as the demonstration. Exhibit 6 is a satellite or aerial image which seems to use the center of the middle impoundment as the basis of the one-mile assessment.

Response:
The proposed fence surrounding the facility will serve as the facility boundary. An updated 1-mile setback line from the facility boundary is shown on Exhibit 6.

d. **Page 19, Demonstration of Compliance, Item 21:**
The response provided for the second bulleted provision, *Section 19.15.36.13.B.1,* states that "the east side of the facility is located approximately 210 feet from the bank (ordinary high-water mark) of a small ephemeral drainage ...". The response also references Exhibit 2 as a demonstration of the "facility's location in relation to the ephemeral drainage." In order to properly assess and demonstrate setbacks to the facility, a facility perimeter or boundary must be established. If the white dotted line illustrated on Exhibit 2 is the eastern boundary of the facility, then several of the activities discussed in the permit application are proposed outside of the facility boundary. Such activities would include stockpiling of soil, stormwater run-off features, and the waste stockpile area that is illustrated on drawings but not discussed in the permit application.

Response:
The proposed fence surrounding the facility will serve as the facility boundary. The white dotted line on Exhibit 2 is a 210' setback line from the ephemeral drainage running through Espinosa Canyon. This setback line is included to illustrate that the facility boundary is located outside of this setback line.

e. **Page 20, Demonstration of Compliance, Item 21:**
The last sentence in the response provided for the third bulleted provision, *Section 19.15.36.13.B.5,* states "Exhibit 4 provides a 500 foot setback line from the proposed facility." In order to properly assess and demonstrate setbacks to the facility, a facility perimeter or boundary must be established.

Response:
The proposed fence surrounding the facility will serve as the facility boundary. An updated 500-foot setback line based on the facility boundary is shown on Exhibit 4.

f. Page 22, Demonstration of Compliance, Item 22a:
Pursuant to Subparagraph (a) of 19.15.36.8.C (15) NMAC, the application shall include "a map showing names and location of streams, springs or other watercourses, and water wells within one mile of the site." The last sentence in the response states that "Exhibit 5 shows there are no continuously flowing water courses, springs, fresh water sources, or water wells within one mile of the site." Exhibit 5 is a satellite or aerial image that does not properly illustrate most of the requested features. A topographic map would illustrate Mud Spring located on the north side of Cabresto Canyon, within a mile and just northwest of the proposed site. Please provide a topographic map for the demonstration.

Response:
Exhibit 5 has been updated to include a USGS topographic quad map that contains shows all streams, springs, watercourses, and water wells within 1-mile of the facility boundary.

g. Exhibit 4 is titled, *500 Foot Setback From Proposed Facility Boundaries.* The exhibit does not illustrate a facility boundary from which the 500 foot setback is measured and established.

Response:
The proposed fence surrounding the facility will serve as the facility boundary. Based on this boundary, an updated 500-foot setback line has been included in Exhibit 4.

h. Exhibits, Exhibit 5:
Exhibit 5 is titled, *1 Mile Setback From Proposed Facility Boundaries.* The 1 mile radius circle illustrated on Exhibit 5 does not coincide with the rectangular shaped facility. The exhibit does not illustrate a facility boundary from which the 1 mile setback is measured and established. The illustrated circle assessment would suggest that the setback was established from the center point of the facility, rather than an established facility boundary.

Response:
The proposed fence surrounding the facility will serve as the facility boundary. Based on this boundary, an updated 1-mile setback line has been included in Exhibit 5.

Page 4, Demonstration of Compliance, Item 10:

7. In the first paragraph, Exhibit 2 is referenced as showing the "proposed layout of the facility." The feature "waste stockpile area" illustrated on Exhibit 2 is not mentioned in the written description. Please provide the details and function of the proposed "waste stockpile area."

Response:
The waste stockpile area and topsoil stockpile area have been combined and relabeled as a "topsoil and excess excavation stockpile area." The purpose of the original waste stockpile area was to provide an area for the contractor to place excess excavated material. The response has been updated to include this explanation.

8. Please clarify in the third sentence of the fourth paragraph, if the projected inflow rate of 1,500 barrels per day is a per pond or total capacity rate.

Response:
The text has been updated to clarify that the 1,500 barrels per day is the total capacity rate.

Page 5, Demonstration of Compliance, Item 10:

9. Please reference the location of Table 1 and 2 mentioned in the last sentence of the first paragraph.

Response:
The location of Table 1 and 2 has been referenced in the response.

10. Pursuant to Paragraph (4) of 19.15.36.8.C NMAC, the application shall include "a description of the surface waste management facility with a diagram indicating the location of fences and cattle guards, and *detailed construction/installation diagrams of pits, liners, dikes, piping, sprayers, tanks, roads, fences, gates, berms, pipelines crossing the surface waste management facility, buildings and chemical storage areas."* Please reference the location of *"detailed construction/installation diagrams"* for the pond slopes, berms, and roads discussed in the third paragraph.

Response:
"Detailed construction/installation diagrams" for the pond slopes, levees, and roads are located in Appendix A, and this location has been referenced in the response.

11. The fifth sentence states that the "transmissivity of the 2-foot thick compacted soil transmission layer is mentioned in 19.15.36.17 NMAC is 6.1 x 10^4 cm/sec." Pursuant to Paragraph (9) of 19.15.36.17.B NMAC, the operator shall "place a leak detection system between the lower and upper geomembrane liners that consists of two feet of compacted soil with a saturated hydraulic conductivity of 1 x 10^{-5} cm/sec or greater to facilitate drainage." Please provide the correct regulatory saturated

hydraulic conductivity. Also, please reference the location of *"detailed construction/installation diagrams"* for the pond design discussed in the third paragraph and the manufacturer's specification sheets for the geomembrane liner material, the non-woven geotextile and 220-mil geonet.

Response:
The correct saturated hydraulic conductivity of the 220-mil geonet and 2-foot thick compacted soil layers have been included. "Detailed construction/installation diagrams" for the pond slopes, levees, and roads are located in Appendix A, and this location has been referenced in the response. Manufacturer's specifications for the liner material, geotextile, and geonet have been included in Sections 02206, 02208, and 02210 of the Technical Specifications located in Appendix B, and their location has been referenced in the response.

Page 6, Demonstration of Compliance, Item 10; and Page 9, Item 12:

12. The first sentence of the fourth paragraph on page 6 indicates that "no system will initially be included in the design" for a bird control. Pursuant to Paragraph (3) of 19.15.36.17.C NMAC, the operator shall "screen, net, cover or otherwise render non-hazardous to migratory birds tanks exceeding eight feet in diameter and exposed pits and ponds. Upon written application, the division may grant an exception to screening, netting or covering requirements *upon the operator's showing that an alternative method will adequately protect migratory birds or that the tank or pit is not hazardous to migratory birds."* Please clarify how the proposed alternative to monitor the ponds monthly and report bird deaths *"will adequately protect migratory birds or that the tank or pit is not hazardous to migratory)' birds."*

    The response provided for *Section* 19.15.36.13.1 relies on the quality of the produced water as justification for not implementing a bird control system. The response states "the produced water that will be stored in the proposed facility will have a water quality at or near 20.6.2.3103 NMAC standards for fresh water." Upon review of the laboratory summary report sheet in Attachment 2 of Appendix G the following discoveries were made: Only 12 of the 48 constituents identified in Subsections A, B, and C of 20.6.2.3103 NMAC were analyzed; the summary report sheet did not identify the unit of measurement for the results; and the laboratory analytical results, including the chain of custody and *QA/QC* report, was not provided in the permit application to support the data presented on the summary report sheet.

    An issue not addressed regarding the protection of migratory birds is the physical impact of hydrocarbon contact. The incomplete assessment and data do not support the statement "Therefore, the produced water stored at the facility will not pose a danger to wildlife." Pursuant to Subsection I of 19.15.36.13 NMAC, "To protect migratory birds, tanks exceeding eight feet in diameter, and exposed pits and ponds shall be screened, netted or covered.

Response:
The design of the facility has been updated to include bird netting with a 2" square mesh or smaller to prevent birds from landing on the pond surfaces. The response has been updated to reflect this change. No specification for bird netting has been added to the Technical Specifications located in Appendix B. All necessary product information is provided on Sheet D-10 of the Engineering Drawings located in Appendix A. Because bird netting has been included in the design, the water quality analysis results located in Attachment 2 of Appendix G has been removed from the application.

Page 6, Demonstration of Compliance, Item 11; and Appendix F, Page 3:

13. The response references Appendix A as the location of the engineering design plans, which include the liner specifications and compatibility. OCD was not able to locate any manufacturer's specification sheets or compatibility assessment for the geomembrane liner material, the non-woven geotextile and 220-mil geonet in Appendix A. Please verify the location of the information and provide the correct reference or provide the required information in Appendix A.

Response:
Manufacturer's specifications for the geomembrane liner, geotextile, and geonet leak detection layer are provided in Sections 02206, 02208, and 02210 of the Technical Specifications located in Appendix B. Their location has been referenced in the response.

14. The response also references Appendix A as the location of the engineering design plans, which includes freeboard and overtopping prevention. The only information provided on the design feature for freeboard and overtopping prevention is provided on page 3 of the Operation, Maintenance and Inspection Plan of Appendix F. The last sentence of the first paragraph, under the *General* section of *Normal Operations,* states "A minimum of three feet of freeboard will be maintained within each pond in the facility, and water level sensors connected to the supply pumps will help to ensure this limit is not surpassed." This is the first time in the permit application that the installation of "water level sensors" being "connected to the supply pumps" are part of the proposed design. This design feature is not identified or illustrated in any of the certified engineer drawings provided in Appendix A. Pursuant to Paragraph (5) of 19.15.36.8.C NMAC, the application shall include "engineering designs, certified by a registered professional engineer, including technical data on the design elements of each applicable treatment, remediation and disposal method *and detailed designs of surface impoundments."* Please update the appropriate drawings in Appendix A to reflect all the detail of the proposed design.

Response:
A pressure transducer will be used for freeboard and overtopping prevention within each pond. This pressure transducer will be installed on the concrete anchor blocks

located on each pond bottom to monitor the water level within each pond. Mounting the transducer to the concrete block will ensure that the pond liner's integrity will not be compromised. This transducer will communicate with a Programmable Logic Controller (PLC) system that will automatically shut off the pump supplying each pond to ensure that the water level does not encroach on the 3 foot freeboard requirement. The response has been updated to include a description of the pressure transducers, and their location within the facility is shown on Sheet D-1 of the Engineering Drawings located in Appendix A.

Page 8, Demonstration of Compliance, Item 12:

15. The response provided for *Section 19.15.36.13.F.3* discusses documenting and maintaining the C-138 form if non-hazardous, non-oil field waste is accepted by order by the department of public safety. The response references to Appendix F, the Operation, Inspection, and Maintenance Plan as the location in which the acceptance of such waste is addressed. Pursuant to Paragraph (6) of *19.15.36.8.C* NMAC, the application shall include "a plan for management of approved oil field wastes that complies with the applicable requirements contained in *19.15.36.13* NMAC, *19.15.36.14* NMAC, *19.15.36.15* NMAC and 19.15.36.17 NMAC." In the third paragraph under the General section of *Normal Operations* on page 3 of Appendix F, the manifesting of such waste is addressed. It also states that "In the event of an emergency, non-hazardous waste may be stored at the facility if ordered by the department of public safety." Beyond this statement there are no details of how or where such waste would be stored or what will happen to it after it is accepted. The current proposal is for the installation of three ponds to manage produced water. If Black Hills proposes to accept this waste stream, please provide the details of the management of the waste from acceptance, to storage, removal, transportation, and disposal. Appendix F indicates that it may be accepted, manifested, and stored. There are no more details beyond this point. Please clarify.

Response:
Black Hills will not accept any waste other than produced water. The proposed facility does not have the containment features to accept waste streams other than produced water, and transportation and other additional costs would be required to move the additional waste types from the East Blanco facility to a facility that is permitted to accept such waste types. The response has been updated to include this statement.

Page 10, Demonstration of Compliance, Item 12:

16. Please reference the location of the engineering drawings to demonstrate the design described in the response for provided for *Section 19.15.36.17.B.2.*

Response:
The location has been referenced in the response. The Engineering Drawings are located in Appendix A.

17. Please provide and/or reference the location of the liner manufacturer's specification sheet to demonstrate that the proposed liner for the design satisfies the requirements identified in the response provided for *Section* 19. 15.36.*17.B.3.*

Response:
Manufacturer's specification sheets for the geomembrane liner, geotextile, and geonet leak detection layer are provided in Sections 02206, 02208, and 02210 of the Technical Specifications located in Appendix B. The response has been updated to reference the location of these specification sheets.

Page 11, Demonstration of Compliance, Item 12:

18. The response provided for *Section 19.15.36.17.B.5* discusses items from interior and exterior slopes, subgrade preparation, anchor trench construction, and seaming and references Section 2206 of Appendix B for additional information. Section 2206 of Appendix B focus is geosynthetic fabrics, such as minimum specifications for the non-woven geotextile, geonet, and HDPE liner material. It also identifies the protocols for storage, installation, deployment, seam welding, and field quality assurance. Section 2206 of Appendix does not address interior and exterior slopes, subgrade preparation, and anchor trench construction. Please reference the appropriate certified engineer drawing that illustrates the specified design feature for a demonstration of compliance. Also, please provide and/or reference the location of the manufacturer's specification sheet for each of the proposed geosynthetic fabrics for the pond design and a proposed seam pattern that demonstrates compliance to the requirements of Paragraph (5) of 19.15.36.17.B NMAC.

Response:
Details on subgrade preparation have been included in Section 02201 of the Technical Specifications located in Appendix B. Interior and exterior pond slopes are shown on Sheet D-2 of the Engineering Drawings located in Appendix A. Anchor trenches are shown on Sheet D-2 of the Engineering Drawings located in Appendix A. Manufacturer's specifications for the geomembrane liner are provided in Section 02206 of the Technical Specifications located in Appendix B. These locations are referenced in the response.

Page 12 Demonstration of Compliance, Item 12:

19. The response provided for *Section 19.15.36.17.B.7* states "The primary geomembrane liner consists of GSE HD Geomembrane liner or equivalent." *OCD* has been unable to locate the manufacturer's specification sheet for the "GSE HD Geomembrane liner." Please provide and/or reference the location of the proposed "GSE HD Geomembrane liner" manufacturer's specification sheet to demonstrate that it satisfies all of the regulatory specifications for consideration of approval. Also, please reference the appropriate certified engineer drawing that illustrates the specified design feature for a demonstration of compliance.

Response:
Manufacturer's specifications for the geomembrane liner are provided in Section 02206 of the Technical Specifications located in Appendix B. Liner details are shown on Sheet D-2 of the Engineering Drawings located in Appendix A. The response has been updated to reference the locations of each.

20. The response provided for Section 19.15.36.17.B.8 states "The secondary geomembrane liner consists of GSE HD Geomembrane liner or equivalent." *OCD* has been unable to locate the manufacturer's specification sheet for the "GSE HD Geomembrane liner." Please provide and/or reference the location of the proposed "GSE HD Geomembrane liner" manufacturer's specification sheet to demonstrate that it satisfies all of the regulatory specifications for consideration of approval. Also, please reference the appropriate certified engineer drawing that illustrates the specified design feature for a demonstration of compliance.

Response:
Manufacturer's specifications for the geomembrane liner are provided in Section 02206 of the Technical Specifications located in Appendix B. Liner details are shown on Sheet D-2 of the Engineering Drawings located in Appendix A. The response has been updated to reference the locations of each. The response has been updated to include "GSE Geomembrane liner" instead of "GSE HD Geomembrane liner".

21. The response provided for *Section 19.15.36.17.B.9* states "The leak detection system consists of a GSE Hypernet Geonet or equivalent placed between the primary and secondary liners." OCD has been unable to locate the manufacturer's specification sheet for the "GSE Hypernet Geonet." Please provide and/or reference the location of the proposed "GSE Hypernet Geonet" manufacturer's specification sheet to demonstrate that it satisfies all of the regulatory specifications for consideration of approval. Also, please reference the appropriate certified engineer drawing that illustrates the specified design feature for a demonstration of compliance. The written response and certified engineer drawings do not recognize the minimum wall thickness, schedule 80, required for the piping collection system. Please modify the written response and drawings to demonstration of compliance regarding the specified design feature.

Response:
The response has been updated to include "GSE Geonet" instead of "GSE Hypernet Geonet". The GSE Geonet specifications are provided in Section 02210 of the Technical Specifications located in Appendix B. The leak detection pipes have been changed to 6" diameter schedule 80 PVC pipes. The leak detection pipes have also been updated so that each connects to its corresponding sump and continues up the interior slope of each pond in between the primary and secondary liners to provide a means for leak detection. The response and Engineering Drawings located in Appendix A have been updated to include these changes.

Page 13, Demonstration of Compliance, Item 12:

22. The response provided for Section 19.15.36.17.B.11 discusses the incorporation of an "automatic float" system to "ensure that the water level does not encroach on the 3 foot freeboard requirement." *OCD* has been unable to locate any other discussion or a design drawing that identifies this design feature. Please provide and/or reference the location of the details associated with the construction and installation of the proposed "automatic float" system. Also in the last sentence of the response, the letter designation of the Appendix for the Operation, Inspection and Maintenance Plan is not provided. Please provide.

Response:
A pressure transducer will be used instead of an automatic float system. This pressure transducer will be installed on the concrete anchor blocks located on each pond bottom to monitor the water level within each pond. Mounting the transducer to the concrete block will ensure that the pond liner's integrity will not be compromised. This transducer will communicate with a Programmable Logic Controller (PLC) system that will automatically shut off the pump supplying each pond to ensure that the water level does not encroach on the 3 foot freeboard requirement. The location of the pressure transducer is shown on Sheet D-1 of the Engineering Drawings located in Appendix A. The response and Engineering Drawings have been updated to reflect this change. The response has also been updated to reference Appendix F for the location of the Operation, Inspection and Maintenance Plan.

23. The response provided for Section 19.15.36.17.B.12 does not identify how the volume of the proposed ponds was determined. Please provide and/or reference the location of the calculations to support the volumes proposed in the response.

Response:
3D modeling software was used to determine each pond's total volume including 3 feet of freeboard. Volume reports generated for each pond are located in Appendix L. The response has been updated to include this information.

Page 14, Demonstration of Compliance, Item 12:

24. The response provided for Section 19.15.36.17.C.I does not clarify if Black Hills proposes a skimmer pit as part of the pond design or how a measurable or visible oil layer would be removed if discovered during the proposed inspections. Please clarify if Black Hills proposes a skimmer pit as part of the pond design and if so, please reference the appropriate certified engineer drawing that illustrates the specified design feature. Also, please provide the protocol for the removal of a measurable or visible oil layer would be removed if discovered during the proposed inspections.

Response:
The design does not include a skimmer pit for the proposed facility. The proposed ponds will be inspected on a daily basis by personnel for the presence of oil. If oil is observed the first step will be to immediately shut off the pumps supplying the facility

and to remove the oil from the surface of the ponds so that no accumulation occurs. Oil will be removed from the water surface via vacuum trucks and disposed of at an approved disposal facility. Additional in place remediation may include use of absorbent material to remove oil sheens from the ponds. Oil booms will be placed around discharge pipes in the ponds to contain oil discharges should they occur inside a smaller area. Once the oil has been removed from the ponds, necessary corrective measures will be taken to correct the source of the current oil presence and to prevent future instances from occurring. In the event of a major or unique event, additional equipment such as a floating pump may be employed to expedite oil removal. Details of these actions are given in the Operation, Inspection and Maintenance Plan located in Appendix F.

Page 14, Demonstration of Compliance, Item 13; Page 19, Item 21; Page 21, Item 22; Page 22, Item 22b; and Page 23, Item 22F:

25. These responses identify Borehole B-3 as the source in which a ground water sample was obtained and analyzed to demonstrate the quality of the shallowest fresh water aquifer beneath the proposed site. Upon review of the Hydrogeologic Investigation Report, provided in Appendix K, ground water was not discovered in Borehole B-3. Please properly identify which borehole the ground water sample was obtained.

Response:

The ground water sample was obtained in Borehole B-4. This sample represented the shallowest ground water encountered directly below the facility. The response has been updated to reflect this change.

Page 15, Demonstration of Compliance, Item 14:

26. The hydrogen sulfide regulatory reference, "19.15.3.18 NMAC," provided in the bold item text and in the response is incorrect and should be 19.15.11 NMAC. Please update.

Response:

"19.15.3.18 NMAC" has been updated to "19.15.11" in the response.

Page 16, Demonstration of Compliance, Item 15:

27. The fifth bullet of the written response proposed the closure standards for permanent pit pursuant to 19.15.17 NMAC (Part 17) which does not satisfy the closure requirements for a pond pursuant to Part 36, in which Black Hills is seeking a permit. Please modify the response to comply with the requirements of Part 36 in which Black Hills is seeking a permit.

Response:

The fourth bullet has been replaced with the correct language complying with the

requirements of Part 36. The fifth bullet was determined to be compliant with Part 36.

Page 16, Demonstration of Compliance, Item 16:

28. The first bullet in the response does not fully express all of the scenarios and considerations that are presented in the regulatory language that must be addressed in the contingency plan. Pursuant to Paragraph (1) of 19.15.36.13.N NMAC, the contingency plan for emergencies shall "describe the actions surface waste management facility personnel shall take in response to fires, explosions or releases *to air, soil, surface water or ground water of contaminants or oil field waste containing constituents that could threaten fresh water, public health, safety or the environment."* Please modify appropriately to properly reflect the intent of the provision.

Response:

The response has been updated to reflect the entire intent of the provision.

Page 17, Demonstration of Compliance, Item 17:

29. The first sentence in the introductory paragraph and the first bullet reference page P-2 of the Engineering Drawings provided in Appendix A as an illustration of the "berms ranging from approximately 5 to 22 feet high... located on the north, east, and south sides of the facility." Upon review of Sheet P-2 of Appendix A, OCD did not observe any features on the Facility Layout that were berms. Sheet P-2 does identify a "North Ditch" and a "South Ditch." The exterior slopes to the ponds are not considered berms since it is a construction standard for a pond pursuant to Paragraph (5) of 19.15.36.17.B NMAC. Since a key is not provided on the Facility Layout map of Sheet P-2 of Appendix A, please identify features considered to be berms or modify the response.

Response:

The response has been modified to remove the "berms" term. The pond surfaces are elevated approximately 5 to 22 feet above existing ground on the north, east, and south sides of the facility. Since the exterior slopes to the ponds are not considered berms, there are no berms included in the design of this facility, only engineered fills (levees) required for construction of the ponds.

Page 18, Demonstration of Compliance, Item 17:

30. The response provided for the bulleted provision, *Section* 19.15.36.*13.M.2*, indicates that the assessment for nearby "waters of the state" and "waters of the United States" is based upon the "nearest continuously flowing watercourse." The criterion of a "flowing watercourse" is only one of the considerations from US EPA for traditional navigable waters and traditional navigable waters are only one of the

considerations from US EPA for "waters of the United States." The assessment for "waters of the state or United States" is incomplete because both ground and surface water must be addressed. Surface waters of the state does not include private waters that do not combine with other surface or subsurface water or any water under tribal regulatory jurisdiction pursuant to Section 518 of the Clean Water Act. Waste treatment systems, including treatment ponds or lagoons designed and actively used to meet requirements of the Clean Water Act (other than cooling ponds as defined in 40 CFR Part 423.11(m) that also meet the criteria of this definition), are not surface waters of the state, unless they were originally created in surface waters of the state or resulted in the impoundment of surface waters of the state." Please complete the assessment for "waters of the state" as defined by Paragraph (5) of 20.6.4.7.S NMAC.

Response:

The response has been updated to describe design features that will prevent run-off within or up-gradient of the facility from discharging pollutants to the waters of the state or United States that violates state water quality standards. Groundwater will be protected by the double HDPE liner and leak detection system along with pressure transducers located in each pond that monitor water levels and ensure that 3 feet of freeboard is maintained at all times. The location of the pressure transducers in each pond is shown on Sheet D-1 of the Engineering Drawings located in Appendix A. Surface waters will be protected by maintaining the 3 feet of freeboard with the water level sensors within each pond. Additionally, best management practices listed in the Best Management Practice and Storm Water Management Plan located in Appendix J (excelsior logs, sediment traps, and silt fences) will be implemented during and after construction of the facility to prevent sediment from discharging into surface waters.

Page 19, Demonstration of Compliance, Item 21:

31. The response provided for the third bulleted provision, Section 19.15.36.13.B.2, states that the assessment of the wellhead protection area was accomplished by a "search of the New Mexico Office of the State Engineer's iWATERS database..." It goes on to discuss the proximity of the wells and the depth to ground water. Pursuant to (7) of 19.15.2.7.W NMAC, a wellhead protection area "" means the area within 200 horizontal feet of a private, domestic fresh water well or spring used by less than five households for domestic or stock watering purposes or within 1000 horizontal feet of any other fresh water well or spring. Wellhead protection areas do not include areas around water wells drilled after an existing oil or gas waste storage, treatment or disposal site was established." The response did not mention the presence or absence of any springs. Mud Spring is located on the north side of Cabresto Canyon just northwest of the proposed activities. Please establish a facility

boundary to determine the proper distances for the siting criteria. Also, please complete the assessment for a wellhead protection area. In regards to the 100-year floodplain assessment, since a FEMA FIRM map was not available, the distance from the nearest major watercourse and the site elevation were utilized for justification of the conclusion: "the flood risk for this area is minimal."

Response:
The response has been updated to include Mud Spring into the assessment. Mud Spring is located approximately 0.45 mile (approximately 2,400 feet) from the proposed facility boundary. The facility is located more than 200 horizontal feet from any private, domestic fresh water well or spring used by less than five households for domestic or stock watering purposes. Additionally, the facility is located more than 1,000 horizontal feet from any other fresh water well or spring. Therefore, the facility does not lie within an existing wellhead protection area. The response has been updated to include this assessment. Additionally, a flood hazard analysis has been performed due to the absence of a FEMA FIRM map for the area. This flood analysis indicates that the peak discharge from a 100-year storm will result in a water level surface below the top of bank elevations of the ephemeral drainage located within Espinosa Canyon. Therefore, the 100-year flood will be contained within the banks of the ephemeral drainage, and the East Blanco Facility is not located within a 100-year floodplain and will not be impacted by runoff events equal to or less than a 100-year recurrence interval frequency. The results of this analysis are provided in Appendix M.

Page 20, Demonstration of Compliance, Item 21:

32. Please provide and/or reference the source of the Appendix E subsurface mines map mentioned in the response for the second bulleted provision on page 20, Section 19.15.36.13.B.4

Response:
The map provided in Appendix E was obtained from the New Mexico Mines, Mills and Quarries Web Map provided by the New Mexico Mining and Minerals Division. This reference has been included in the response.

33. The response provided for the fourth bulleted provision, Section 19. 15.36.13.B.6, did not include any comments regarding karst formations in the assessment for unstable areas. Please determine the presence or absence of karst formations and provide comments in the response.

Response:
The response has been updated to address the absence of karst formations. Based on the subsurface investigations, no karst formations are present within the area.

The material encountered consisted generally of various clays, shale, and sandstone. These materials are not typically encountered in karst formations. Additionally, a review of the New Mexico Bureau of Geology and Mineral Resources' Geologic Map of New Mexico shows that the area lies within the San Jose Formation. This formation generally consists of sandstones and mudstones and does not typically contain karst formations.

Page 22, Demonstration of Compliance, Item 22b:

34. The response comments on the water quality from the sample obtained from the monitoring well. The argument presented on page 2, Aquifer Description Section, of the Hydrogeologic Investigation Report in Appendix K is that the ground water encountered in Borehole B-4 is the shallowest. Borehole B-4 is used for the basis of the ground water elevation beneath the proposed site, but was not the location in which the ground water sample was obtained. The ground water results are from a sample obtained from Borehole B-1. Pursuant to Subparagraph (b) of 19.15.36.8.C (15) NMAC, the application shall include "laboratory analyses, performed by an independent commercial laboratory, for major cations and anions; BTEX; RCRA metals; and TDS of *ground water samples of the shallowest fresh "water aquifer beneath the proposed site."* The Hydrogeologic Investigation Report did not indicate that Borehole B-4 was constructed into a monitoring well, as required in the OCD approved boring plan. Please provide the results from *"ground water samples of the shallowest fresh water aquifer beneath the proposed site."*

Response:

A ground water monitoring well was installed at the Borehole B-1 location. This borehole is located approximately 85 feet west and uphill of the western limits of the proposed ponds. In addition, a temporary monitoring well was installed at the B-4 location. The groundwater at this location represented the shallowest fresh water aquifer beneath the proposed site. A temporary well was installed at B-4 due to its location within the construction limits of the proposed facility. After construction of the proposed facility is complete, a permanent well will be installed at this location. A laboratory analysis was performed on samples from B-1 and B-4 that focused on major cations and anions; benzene, toluene, ethyl benzene and xylenes (BTEX); RCRA metals; and total dissolved solids (TDS).Table 1 of the Hydrogeologic Investigation Report in Appendix K shows the results of this analysis. Detailed laboratory data is provided in Attachment 2 of the Hydrogeologic Investigation Report in Appendix K.

35. The second paragraph is a discussion of how the results from B-3 compare with the discharge limits specified in the Water Quality Control Commission Regulations of 20.6.2.3103 NMAC. OCD is unsure why the comparison was completed and which provision required the comparison. The purpose of the results is to demonstrate

background quality of the ground water *"of the shallowest fresh water aquifer beneath the proposed site"* prior to operations. Please either omit the comparison paragraph or explain the purpose of the comparison and reference the provision in which it is provided as demonstration of compliance.

Response:
The response has been updated to include a water quality analysis of the ground water encountered at the B-4 location because this represents the shallowest fresh water aquifer beneath the proposed site. The second paragraph containing the comparison of this ground water with 20.6.2.3103 is not needed and has therefore been omitted.

Page 22, Demonstration of Compliance, Item 22c; Appendix H, Hydrogeologic Investigation Report; and Page 23, Item 22F:

36. As clarified in the first comment above to Item 22b, ground water was not encountered in Borehole B-3, but in B-1 instead. Please modify the first paragraph to reflect the information provided in the Hydrogeologic Investigation Report of Appendix K. The third sentence of the first paragraph states the reason for "the drastic change in ground water elevation between these two boreholes is that the bedrock shelf and corresponding groundwater elevation dive deeply from B-3 to B-4." Please keep in mind that B-3 should be B-1, as identified properly identified on Figure 1 of the Hydrogeologic Investigation Report in Appendix K. The proposed reasoning is not supported by the geologic cross-sections and lithologic logs. Borehole B-1 is approximately 85 feet west of B-4. Figure 2, a geologic cross-section in Appendix K, illustrates a "shale" formation, with a thickness of approximately 10 to 15 feet, which separates the water bearing zones. Also, Figure 2 illustrates that the ground water was encountered above the "shale" formation in B-1. Ground water was not discovered above the "shale" formation in B-4, but was encountered approximately 25 feet below the bottom of the "shale" formation. A comparison of ground water quality results from B-1 and B-4 would either confirm that the ground water beneath the proposed site is hydraulically connected or separate water bearing zones. Please provide the comparison and modify the response appropriately, if necessary.

Response:
The response has been updated to include the groundwater elevation at the Borehole B-1 and B-4 locations. The groundwater encountered at Boreholes B-1 and B-4 is most likely hydraulically connected. This assumption is supported by similarities in water chemistry at each location as shown in Table 1 as well as the close proximity between the two locations. If it is assumed that the groundwater encountered at Borehole B-1 was a perched aquifer located above the confining

shale layer shown on the attached geologic cross sections, it is expected that this perched aquifer would also be encountered at Borehole B-4. However, no groundwater was encountered above the shale layer at Borehole B-4. Therefore, the groundwater encountered above the shale layer at Borehole B-1 is most likely hydraulically connected with the groundwater encountered below the shale layer at Borehole B-4. The change in groundwater elevation between both locations occurs because the shale layer is most likely a fractured bedrock layer and does not act as a continuous confining layer.

37. The first sentence of the second paragraph indicates that "USGS has labeled the shallow aquifer formations at this location as Colorado Plateaus aquifers." The response also states "no information is available to determine whether the ground water encountered at this location is considered part of the Colorado Plateaus aquifers as specified by the USGS." OCD recommends that local publications and resources be utilized for this assessment. OCD recommends Hydrologic Report 6 Hydrogeology and water resources of San Juan Basin, New Mexico, Stone, W. J.; Lyford, F. P.; Frenzel, P. F.; Mizell, N.H.; Padgett, E. T., 1983 published by the New Mexico Bureau of Mines and Mineral Resources. The publication addresses the proposed area. Also, please provide references of the resource material mentioned in the responses. In this case the response mentioned USGS but did not identify which USGS publication and page number(s) in which USGS "labeled the shallowest aquifer formations at this location as Colorado Plateaus aquifers." Please identify and provide proper references to the resource material used for the basis of proposed conclusions.

Response:
The Hydrologic Report 6 Hydrogeology and water resources of the San Juan Basin, New Mexico has been assessed to determine the depth to, formation name, type and thickness of the shallowest fresh water aquifer. According to this report, the facility is located within the San Jose Formation which is a Tertiary bedrock unit. This formation begins at the ground surface and has a thickness of approximately 2,000 to 3,000 feet at the proposed facility location.

Exhibits, Exhibit 2:

38. Exhibit 2 illustrates a feature identified as "waste stockpile area." The permit application does not provide information regarding the purpose and function of this feature, except for the illustration on the exhibits. Please provide the details and purpose of this proposed feature within the permit application. Exhibit 2 provides a detailed overlay of the existing surface contours of the proposed site over a satellite or aerial image. Elevations (amsl) are not provided on Exhibit 2, therefore the contour intervals cannot be determined. Please provide the above mean sea level (amsl) elevations for the existing surface contours of the proposed site.

Response:
The waste stockpile area and topsoil stockpile area have been combined and relabeled as a "topsoil and excess excavation stockpile area." The purpose of the original waste stockpile area was to provide an area for the contractor to place excess excavated material. Exhibit 2 has been updated to include this change. The existing ground contours on Exhibit 2 have been provided with contour elevation labels.

Appendix A, Engineering Drawings:

Sheet P-1, Location Overview; and Sheet P-2, Facility Layout:

39. The satellite or aerial image provides a detailed overlay of the proposed layout of the facility and illustrates the proposed fencing for the surface waste management facility. Exhibit 2 is the same satellite or aerial image with the same proposed layout of the facility (minus the fencing), but illustrates a "210' setback line from the drainage." Pursuant to Paragraph (1) of 19.15.36.I3 .B NMAC, *"No surface waste management facility shall be located within* 200 *feet of a watercourse,* lakebed, sinkhole or playa lake." This would suggest that only a portion of the fenced area illustrated on Sheet P-1 can be considered for permitting as a surface waste management facility. Please establish a facility boundary based upon the required setbacks of 19.15.36 NMAC. If the fencing is proposed to extend beyond the surface waste management facility boundary, please present a solution to prevent Black Hills personnel from performing waste management operations within the fenced area but outside the permitted facility boundary.

Response:
The proposed fence shown on the updated Exhibit 2 will serve as the facility boundary. As seen on Exhibit 2, the entire facility lies outside the 210-foot setback line.

Sheet D-1, Pipe System Detail, Detail O/D-1:

40. Pursuant to Paragraph (9) of 19.15.36.17.B NMAC, in regards to the leak detection system *"Piping used shall be designed* to withstand chemical attack from oil field waste or leachate; structural loading from stresses and disturbances from overlying oil field waste, cover materials, equipment operation or expansion or contraction; and *to facilitate clean-out maintenance."* Based upon the proposed design, the leak detection pipe extends approximately 100 feet from the leak detection sump, through the secondary liner, and beneath and past the interior and exterior slopes of the pond to a detection riser pipe that extends upward 7 feet to the ground surface. The 100 foot six-inch leak detection pipe and 7 plus foot six-inch detection riser pipe are connected with a ninety degree elbow. If an obstruction occurred, it would be difficult to clean-out the line. OCD recommends modifying the design so that the leak detection pipe is installed between the primary and secondary liner along the interior slope to the top edge of the pond. This would allow easy access for cleaning out and

maintenance. Please contact OCD if you have questions regarding this design.

Response:
The design has been updated to incorporate OCD's recommended design. The leak detection pipe will be installed between the primary and secondary liner along the interior slope to the top edge of the pond. All details within the Engineering Plans located in Appendix A have been updated to reflect this change.

41. The detection riser pipe is identified as having a "water level monitor." The note on the design drawing is the first and only mention of the "water level monitor." The water level monitor is part of the proposed design of the leak detection system. Please provide the details regarding what it is and how it operates.

Response:
The water level monitor has been removed from the design due to the leak detection piping now being installed between the primary and secondary liner along the interior slope to the top edge of the pond. All references to a water level monitor have been removed from the Engineering Drawings located in Appendix A.

42. The proposed 12-inch collection and supply lines that extend beneath the pond perimeter road and the exterior slope has gate valves to and from each pond that are proposed to be installed at a minimum of seven feet below the existing grade. How will Black Hills personnel gain access to the gate values to manually close them when they will be buried, at a minimum, seven feet beneath the surface?

Response:
Within the Engineering Drawings located in Appendix A, the "collection" lines have been renamed as "outlet" lines, and the "supply" lines have been renamed as "inlet" lines. As shown in on Sheet D-1 of the Engineering Drawings, a 6-foot diameter steel culvert has been included in the design to act as a manhole for access to the valves.

Sheet D-2, Pipe Trench & Liner Details, Sump Detail 5/D-1; Page 2 of 6, Section 02203, Part 2 and Part 3, Subpart 3.02:

43. This detail indicates that the leak detection pipe (the portion within the sump and the portion that extends outside of the secondary liner to the riser pipe) will be "slotted." The arrow points to the exterior pipe with this description and not the pipe within the leak detection sump. Please modify the drawing to identify the type of pipe proposed within the leak detection sump and the type of pipe proposed for use outside the lined pond. Also, pursuant to Paragraph (9) of 19.15.36.17.B NMAC, "The piping collection system shall be comprised of solid and perforated pipe having a minimum diameter of four inches and *a minimum wall thickness of schedule* 80." This design specification is not recognized in any of the proposed design drawing. Please modify

the design drawings appropriately to identify and include the required regulatory design specifications.

Response:
The sump detail has been updated to reflect the new design of the leak detection piping. The piping has also been specified as 6-inch diameter schedule 80 PVC pipe to correspond with the required regulatory design specifications.

Appendix B. Technical Specifications:

Page 5 of 12, Section 01000 Administrative Instructions, Part 3 Execution, Subpart 3.06 Environmental:

44. The response provided for A.1 of Subpart 3.06 indicates that the New Mexico Environment Department would be the primary contact to "remediate and correct all environmental damage resulting from any such release, discharge, spill or leak occurring during the course of the Work ... " Please modify the response to reflect that the Oil Conservation Division is the primary contact for such activities.

Response:
A.1 of Subpart 3.06 has been updated to reflect that the Oil Conservation Division is the primary contact instead of the New Mexico Environment Department.

45. The response provided for E of Subpart 3.06 properly identifies the New Mexico Environment Department as the primary agency for oversight of handling and storage of materials during the construction phase of the facility. But if material and waste are "released, discharged, spilled or leaked in, on or near the property" then the Oil Conservation Division is the primary contact for release notifications, corrective actions, and remediation. Please modify the response appropriately.

Response:
E of Subpart 3.06 has been updated to include the statement "The New Mexico Oil Conservation Division shall be the primary contact for release notifications, corrective actions, and remediation."

Page 2 of 3, Section 02200 Topsoil Removal and Replacement, Part 3 Execution, Subpart 3.02 Removal of Topsoil:

46. The response provided for A.1 of Subpart 3.02 discusses how the topsoil piles will be managed. Please identify the features that will be installed or the protocols implemented to contain erosional run-off from the stockpile of topsoil.

Response:
The following statement was added to Subpart 3.02 of Section 02200 of the

Technical Specifications located in Appendix B: "Silt Fences, straw waddles, or other ENGINEER approved BMP shall be installed around the entire perimeter of the topsoil stockpile and will be maintained until sufficient vegetation is established to prevent or minimize erosion."

Page 2 of 10, Section 02201 Earthwork, Part 2 Products; Subpart 2,02; and Page 4 of 10; Section 02201 Earthwork, Part 3 Execution, Subpart 3.04 Placing Compacted Earth Fill:

47. Pursuant to Paragraph (5) of 19.15.36.17.B NMAC, "Each pit or pond shall have a properly constructed foundation or firm, unyielding base, smooth and free of rocks, debris, sharp edges or irregularities, in order to prevent rupture or tear of the liner..." The response provided for C of Subpart 2.02 indicates that the "maximum rock size" is "5 inches in any direction." The response provided for C of Subpart 3.04 indicates that prior to compaction, rock larger than "five inches" will be removed from the fill material. This does not satisfy the requirements for subgrade soils as stated in the provision above. The subgrade soils should *be free of rocks.* Please modify the response to comply with the requirements of the provision.

Response:

Subpart 2.02 pertains to the placement of excess material in stockpile areas. The material referenced in this subpart will not be used as compacted fill or subgrade soils for the construction of the ponds. Subpart 2.01 address the placement of compacted fill for the construction of the ponds. A statement has been added in Subpart 2.01 and Subpart 3.04 that states "Suitable compacted fill will be placed to construct a firm, unyielding base that is smooth and free of rocks, debris, sharp edges or irregularities in order to prevent rupture or tear of the liner."

Page 6 of 10, Section 02201 Earthwork, Part 3 Execution, Subpart 3.04 Placing Compacted Earth Fill:

48. The response provided for H of Subpart 3.04 indicates the types of soil tests and the proposed frequency of testing for compacted fill. The response provided for H.2 of Subpart 3.04 indicates that the field density and moisture testing will occur once every 2000 cubic yards or once every lift. The response provided for H.4 of Subpart 3.04 indicates that the Standard Proctor compaction testing will occur "one time for every four foot of fill." Is the field density testing frequency proposed as a substitute for the compaction testing? If so, please clarify and provide the field density equivalent conversion for "ninety- five (95%) of the Standard Proctor Maximum Dry Density as determined by ASTM D689" standard as specified on page 5 of 10 of G of Subpart 3.04.

Response:

The Standard Proctor compaction test as specified in ASTM D698 is a laboratory test that provides the maximum density value and optimum compaction moisture

content for a specific material. The field density and moisture testing is used to determine whether the material placed and compacted during construction has an in-situ dry density exceeding 95% of the maximum dry density obtained from the Standard Proctor test specified in ASTM D698. Therefore, the field density and moisture testing provides a direct determination of whether the in-place material meets the requirement of 95% of the Standard Proctor test per ASTM D698.

49. The response provided for H.4 of Subpart 3.04 indicates that the Standard Proctor compaction testing will occur "one time for every four foot of fill or a minimum of two per berm." On page 4 of 10, the response provided for D of Subpart 3.04 instructs to "place compacted fill in horizontal lifts not exceeding eight inches (8") before compaction or six inches (6") in thickness after compaction." Based upon the two proposed technical specifications, only one lift out of 8 lifts of compacted fill (when compacted to four feet or more) will be tested for Standard Proctor; if less than four feet of fill, this would mean testing is not required. Please clarify. Regarding the proposed minimum Standard Proctor compaction testing frequency of "two per berm," the length and/or size of the berm is not a consideration. The interior and exterior slopes are commonly referred to as berms throughout the permit application. The illustration, of the proposed facility layout on Sheet P-2 of Appendix A, demonstrates that the largest berm would be the eastern exterior slope that runs along the southern quarter of the northern pond and along the other two ponds. Based upon the proposed Standard Proctor compaction testing of berms, this area which is approximately 600 feet in length and ranges from 25 to 50 feet in width will require the same frequency of testing as the smallest berm of an area of approximately 10 feet in length and five feet in width. Please clarify and justify the frequency of the proposed testing.

Response:
H.4 of Subpart 3.04 has been removed from the specification. In its place, G of Subpart 3.04 has been included that specifies that quality assurance tests will be performed for each material used for construction to determine the laboratory maximum density values and optimum compaction moisture content under ASTM D698. H and I of Subpart 3.04 have been modified to require that compacted fill shall be placed at a minimum of 95% of the Standard Proctor Maximum Dry Density under ASTM D698, and the moisture content of compacted fill shall be maintained within ± 3 percent of optimum moisture content as determined by ASTM D698. J of Subpart 3.04 provides the typical field density and moisture density testing frequency required.

Page 6 of 10, Section 02201 Earthwork, Part 3 Execution, Subpart 3.05 Waste Excavation Placement:

50. This is the first place that the term "waste excavation" is utilized within the permit application. OCD is unsure of what the term is referring to, but the provided technical

specifications are similar to, but less stringent than, those of Subpart 3.04, *Placing Compacted Earth Fill.* This suggests that the "waste excavation" material will be used for construction purposes. Please provide an introductory paragraph or statement that describes the source of "waste excavation·' material and explains how it will be used.

Response:
All references to "waste excavation" have been updated to "excess excavation". The term "waste excavation" was used to identify excess cut material that was not needed for placement as compacted fill.

51. The response provided for A of Subpart 3.05 states "provide waste excavation placement as shown on the Drawings and as specified herein." OCD was unable to locate any drawings in Appendix B or any drawings within the permit application that illustrated areas for "waste excavation" placement. Please reference the location of the drawings referred to in the response.

Response:
All references to "waste excavation" have been updated to "excess excavation". The term "waste excavation" was used to identify excess cut material that was not needed for placement as compacted fill. Any excess excavated material will be placed in the designated topsoil and excess excavation stockpile area as shown on Sheet P-2 of the Engineering Drawings located in Appendix A.

Page 7 of 10, Section 02201 Earthwork, Part 3 Execution, Subpart 3.05 Waste Excavation Placement:

52. The response provided for F of Subpart 3.05 proposes a less stringent compaction standard of "ninety (90%) of the Standard Proctor Maximum Dry Density as determined by ASTM D698" for the "waste excavation" material rather than minimum earth fill compaction standard of 95%. Please clarify and justify the different standard for construction. Also the response provided G.1 of Subpart 3.05 states "field density and moisture testing will be performed at a frequency determined by the ENGINEER" and does not recommend the testing frequency for earth fill of once every 2000 cubic yards or once every lift. Please clarify and justify the different standard for construction.

Response:
The lower standard for the placement of excess excavated material is due to the materials placement in the designated topsoil and excess excavation stockpile area shown on Sheet P-2 of the Engineering Drawings located in Appendix A. This material will not be used in the construction of the facility and will not be used in any structural capacity. Less stringent compaction is required of this material to reduce

possible erosion of the stockpile area.

Page 9 of 10, Section 02201 Earthwork, Part 4 Method of Measurement and Basis of Payment, Subpart 4.01 Method of Measurement:

53. The response provided for C of Subpart 4.01 supports OCD's conclusion that the "waste excavation" material is proposed for construction by stating "Measurement of Water Excavation Placement will be in cubic yards of compacted fill including hauling cut material to the point of use, placing, moistening, and compacting Waste Excavation to the lines and grades shown on the Drawings ..." OCD was unable to locate any drawings in Appendix B or any drawings within the permit application that illustrated areas for "waste excavation" placement. Please reference the location of the drawings referred to in the response.

Response:

All references to "waste excavation" have been updated to "excess excavation". The term "waste excavation" was used to identify excess cut material that was not needed for placement as compacted fill. Any excess excavated material will be placed in the designated topsoil and excess excavation stockpile area as shown on Sheet P-2 of the Engineering Drawings located in Appendix A.

54. The second sentence of the response provided for F of Subpart 4.01 identifies the nature of the water proposed for "dust control and/or compaction of earthwork" as "wastewater." Please identify the source and quality of the "wastewater." A separate permit issued under the Water Quality Control Commission Regulations 20.6.2 NMAC may be required for proposals to discharge wastewater to the surface, such as for dust control and construction.

Response:

The term "wastewater" has been removed and replaced with "water". This was an error in the specifications. No type of wastewater will be used in the construction of this project. Subpart 4.01 has been updated to reference subpart 3.04 of Section 01000. Subpart 3.04 of Section 01000 requires the ENGINEER to be notified 24 hours prior to application of any water for embankment compaction or dust control in order to verify that the water meets or exceeds the background water quality of the existing groundwater at the location.

Page 5 of 6, Section 02203, Pipes, Pumps, Fittings, and Appurtenances, Part 4 Method of Measurement and Basis of Payment, Subpart 4.01 Method of Measurement:

55. The response provided for F of Subpart 4.02 states "no measurement will be made for pea gravel required for the leak detection system pipe installation. Installation of

all pea gravel will be considered subsidiary to other items of work." Pursuant to Paragraph (9) of 19.15.36.I7.B NMAC, "The operator shall place a leak detection system between the lower and upper geomembrane liners that consists of two feet of compacted soil with a *saturated hydraulic conductivity of* 1 x 10^{-5} *cm/sec or greater to facilitate drainage."* The proposed pea gravel is soil component of the leak detection system that has a regulatory specification that is not identified in the permit application. Please include pea gravel in the product list of Part 2 of Section 02203 that identifies the regulatory specification of "a *saturated hydraulic conductivity of* 1 x *10-^{5} cm/sec or greater"* to facilitate drainage.

Response:
Pea gravel has been added as Subpart 2.06 of Section 02203. The specification includes the requirement that the pea gravel have a saturated hydraulic conductivity of 1 x 10^{-5} cm/sec or greater.

Page 3 of 11, Section 02206 Geosynthetic Fabrics, Part 2 Products, Subparts 2.01 and 2.02 GSE Non-Woven Geotextile:

56. The response provided for A of Subpart 2.01 states "provide 8 oz. GSE non-woven geotextile filter fabric or approved equivalent as shown on Drawings and as specified herein." GSE Environmental is a manufacturer of geosynthetic materials. Please provide the manufacturer's specification sheet on the GSE non-woven geotextile filter fabric product to demonstrate that it satisfies the specifications presented in the Table of B of Subpart 2.01.

Response
Section 02206 has been split into three separate sections: Section 02206 Geomembranes, Section 02208 Geotextiles, and 02210 Geonets. Table 2.01B and Table 2.01C contain GSE standards. They are provided in these specifications so that a contractor has the opportunity to use a product from another manufacturer other than GSE as long as it meets or exceeds the GSE properties listed in each table.

57. Pursuant to Paragraph (9) of 19.15.36.17.B NMAC, "The operator shall place a leak detection system between the lower and upper geomembrane liners that consists of two feet of compacted soil with a saturated hydraulic conductivity of 1 x 10^{-5} cm/sec or greater to facilitate drainage." The GSE HyperNet Geonet is a geosynthetic that is proposed in lieu of the two feet of compacted soil for the leak detection system. The Table provided in B of Subpart 2.02 proposes a minimum average transmissivity rate standard of 2 x 10^{-3} m^2/sec. Please demonstrate that the proposed transmissivity rate standard of 2 x 10^{-3} m^2/sec is equivalent to the required regulatory standard for

saturated hydraulic conductivity of 1 x 10^{-5} cm/sec or greater.

Response:
The Geonet specifications are now provided in Section 02210 Geonets of the Technical Specifications located in Appendix B. Transmissivity provides a better representation of a materials ability to transmit fluid than saturated hydraulic conductivity because transmissivity takes into account the thickness of the transmission layer. As stated in Section 10 of the Permit Application, a 200-mil geonet with a transmissivity rate of 2 x 10^{-3} m^2/sec (20 cm^2/sec) has a saturated hydraulic conductivity of 35.8 cm/sec. This is larger than the required saturated hydraulic conductivity of 1 x 10^{-5} cm/sec for a 2-foot thick compacted soil transmission layer. The transmissivity of the specified 2-foot thick compacted soil transmission layer is 6.1 x 10^{-4} cm^2/sec. Therefore, the 200-mil geonet with a transmissivity rate of 2 x 10^{-3} m^2/sec provides a quicker and more efficient means of leak detection than the compacted soil layer.

Page 4 of 11, Section 02206 Geosynthetic Fabrics, Part 2 Products, Subpart 2.03 GSE 60 mil HDPE Liner:

58. The response provided for A of Subpart 2.03 states "provide GSE HD Smooth Geomembrane or approved equivalent installed as shown on Drawings and as specified herein." GSE Environmental is a manufacturer of geosynthetic materials. Please provide the manufacturer's specification sheet on the GSE HD Smooth Geomembrane product.

Response:
Section 02206 has been split into three separate sections: Section 02206 Geomembranes, Section 02208 Geotextiles, and 02210 Geonets. Table 2.01B, Table 2.01D, Table 2.01E, and Table 3.03E contain GSE standards. They are provided in these specifications so that a contractor has the opportunity to use a product from another manufacturer other than GSE as long as it meets or exceeds the GSE properties listed in each table.

59. The response provided for B of Subpart 2.03 states "provide conductive textured geomembrane that conforms to the specifications." Based upon information provided in this section, it is OCD's understanding that the proposed ponds will be constructed utilizing a smooth and a textured 60-mil HDPE geomembrane material for the primary and secondary liners. The engineering drawings, provided in Appendix A, only identifies the liner material as "60 MIL HDPE Liner" and do not illustrate or identify where the smooth or textured will be installed. Please provide the manufacturer's specification sheet on the proposed "conductive textured geomembrane" to demonstrate that it satisfies the specifications presented in the

Table of B of Subpart 2.03. Also, please modify the engineering drawings in Appendix A to properly illustrate the design that is proposed.

Response:
Notes have been added to Sheet D-1 and Sheet D-2 of the Engineering Drawings located in Appendix A. The notes clarify that the primary liner may be either smooth or textured, while the secondary liner shall be smooth. Specifications have been provided for both smooth and textured liners in Section 02206 of the Technical Specifications located in Appendix B. All references to a conductive geomembrane have been removed from the Technical Specifications as a conductive liner is not specified for this project.

Page 6 of 11, Section 02206, Geosynthetic Fabrics, Part 3 Execution, Subpart 3.05 Field Seaming:

60. The response provided for A.3 of Subpart 3.05 instructs the operator to "use a sequential seam numbering system compatible with panel numbering system that is agreeable to the ENGINEER and INSTALLER." Please provide a seam pattern based upon the pond design and size that demonstrates the seaming requirements of Paragraph (5) of 19.15.36.17.B NMAC.

Response:
A proposed seam pattern is shown on Exhibit 7 of the response. This seam pattern demonstrates the seaming requirements of Paragraph (5) of 19.15.36.17.B NMAC.

61. Pursuant to Paragraph (5) of 19.15.36.17.B NMAC, "The operator shall ensure field seams in geosynthetic material are thermally seamed (hot wedge) with a double track weld to create an air pocket for non-destructive air channel testing." This requirement is not recognized within Subpart 3.05: *Field Seaming.* Please modify response provided for A of Subpart 3.05 to include and recognize the regulatory requirement.

Response:
The geomembrane specifications are now provided in Section 02206 of the Technical Specifications located in Appendix B. Subpart 3.03 and Subpart 3.04 of Section 02206 includes the requirements of 19.15.36.17B.

Page 8 of 11, Section 02206 Geosynthetic Fabrics, Part 3 Execution, Subpart 3.06 Ventilation:

62. The response provided for A of Subpart 3.06 instructs the operator to "install ventilation through both layers of HDPE liner along pond slopes according to installer's recommendation." OCD is confused by the instruction. The proposal to

install vents through the liner system is not supported or proposed in the Certified Engineer drawings of the pond design provided in Appendix A. Nor is it a design requirement for a pond considered under 19.15.36 NMAC. Please explain the purpose of the proposed design feature and update all sections and drawings in the permit application to address the design and installation, as well as the materials required for the installation, if necessary.

Response:
No ventilation is required for the liner due to the depth to groundwater at the proposed facility. Ventilation is normally used to vent water pressures out from beneath the liner in locations where groundwater is close to the pond surfaces. All references to ventilation have been removed from Section 02206 of the Technical Specifications located in Appendix B.

Page 1 of 2, Section 02500 Wire Fence, Part 2 Product, Subpart 2.01 Wire Fence Materials; and Page 1 of 2, Section 02500 Wire Fence, Part 3 Fence Installation, Subpart 3.01 Wire Fence Installation:

63. Pursuant to Paragraph (3) of 19.15.36.17.C NMAC, the operator "shall fence or enclose pits or ponds to prevent unauthorized access and maintain fences in good repair. Fences are not required if there is an adequate perimeter fence surrounding the surface waste management facility." The response provided for A of Subpart 2.01 instructs the operator to "provide all necessary materials to install a 48" 4-stand Barb Wire Fence according to the New Mexico Oil Conservation Division Rule 19.15.17 NMAC." This permit application is based upon the requirements of the Surface Waste Management Facilities regulation 19.15.36 NMAC. The proposed fencing is based upon a regulatory design in the Pits, Closed-Loop Systems, Below-grade Tanks and Sumps regulation 19.15.17 NMAC. The requirements of 19.15.17 NMAC are not identified or addressed within the permit application. Please identify the wire fence materials in the response based upon the requirements of 19.15.17 NMAC.

Response:
The fence surrounding the entire facility has been updated to include a 6-foot high, 6-strand barb wire fence instead of the 48", 4-strand barb wire fence that was previously described. The entire Section 02500 of the Technical Specifications located in Appendix B has been updated to include this change and to better describe the specifications of the 6-foot, 6-strand barb wire fence. The updated fence is pursuant to Paragraph (3) of 19.51.36.17.C NMAC in that it will prevent unauthorized access to the facility. All references to 19.15.17 NMAC have been removed. Sheet D-9 of the Engineering Drawings located in Appendix A provides details for fence construction.

64. The response provided for A of Subpart 3.01 instructs the operator to "install a 48" 4-stand Barb Wire Fence as described in the New Mexico Oil Conservation Division Rule 19.15.17 NMAC ." The requirements of 19.15.I7 NMAC are not identified or addressed within the permit application. Please identify the wire fence installation in the response based upon the requirements of 19.15.17 NMAC.

Response:
The fence surrounding the entire facility has been updated to include a 6-foot high, 6-strand barb wire fence instead of the 48", 4-strand barb wire fence that was previously described. The entire Section 02500 of the Technical Specifications located in Appendix B has been updated to include this change and to better describe the specifications of the 6-foot, 6-strand barb wire fence. The updated fence is pursuant to Paragraph (3) of 19.51.36.17.C NMAC in that it will prevent unauthorized access to the facility. All references to 19.15.17 NMAC have been removed. Sheet D-9 of the Engineering Drawings located in Appendix A provides details for fence construction.

Page 1 of 4, Section 02900 Revegetation, Part 1 General, Subpart 1.01 Description:

65. The response provided for A-C of Subpart 1.01 identifies areas based upon proposed activities that would require re-vegetation. The only scenario that is not identified is closure. Pursuant to Paragraph (6) of 19.15.36.18.A NMAC, the operator "Upon completion of closure, the operator shall re-vegetate the site unless the division has approved an alternative site use plan as provided in Subsection G of 19.15.36.18 NMAC. Re-vegetation, except for landfill cells, shall consist of establishment of a vegetative cover equal to 70 percent of the native perennial vegetative cover (un-impacted by overgrazing, fire or other intrusion damaging to native vegetation) or scientifically documented ecological description consisting of at least three native plant species, including at least one grass, but not including noxious weeds, and maintenance of that cover through two successive growing seasons." Please modify the information provided in Section 02900, *Revegetation,* to demonstrate compliance to the re-vegetation requirements of Part 36.

Response:
The Technical Specifications provided in Appendix B are only for construction of the proposed facility. Therefore, any aspect of closure of the facility will not be addressed within the Technical Specifications. The Closure Plan provided in Appendix H addresses revegetation during closure of the facility pursuant to Paragraph (6) of 19.15.36.18.A NMAC.

Page 3 of 4, Section 02900 Revegetation, Part 2 Products, Subpart 2.01 Seed Mixture:

66. Pursuant to Paragraph (6) of 19.15.36.18.A NMAC, the regulatory seed mixture should consist "of at least three native plant species, including at least one grass, but not including noxious weeds ... " Please modify the response to demonstrate compliance.

Response:

Subpart 2.01 of Section 02900 has been updated to include the requirements of Paragraph (6) of 19.15.36.18.A NMAC.

Page 4 of 4, Section 02900 Revegetation, Part 3 Execution, Subpart 3.03 Preserving Revegetated Areas:

67. Pursuant to Paragraph (6) of 19.15.36.18.A NMAC, the re-vegetated cover must be maintained "through two successive growing seasons." Please modify the response to demonstrate compliance.

Response:

The Technical Specifications only contain information regarding construction of the proposed facility. Therefore, the Technical Specifications will not include information on closure requirements of the facility. The Closure Plan provided in Appendix H addresses revegetation during closure of the facility pursuant to Paragraph (6) of 19.15.36.18.A NMAC.

Appendix E, Wetlands Map, Mining Map, FEMA Map:

Land Ownership Information:

68. Pursuant to Paragraph (2) of 19.15.36.8.C NMAC, the application shall include "a *plat* and topographic map showing the surface waste management facility's location in relation to governmental surveys (quarter-quarter section, township and range); highways or roads giving access to the surface waste management facility site; watercourses; fresh water sources, including wells and springs; and inhabited buildings within one mile of the site's perimeter." The survey plat provided in Appendix E represents only half of the area proposed for use. This is demonstrated by comparing it to Exhibit 6. Please provide the plat for the other parcel in which Black Hills Gas Resources is seeking to include as part of the surface waste management facility proposal.

Response:

The survey information in Appendix E has been updated to include all parcels in which the proposed facility will be located.

FEMA Map:

69. The map provided for this demonstration included a note which stated "No map is available, area is located in Zone D." Please provide a definition for the FEMA flood zone designation Zone D to explain the assessment.

Response:

FEMA flood zone designation Zone D describes areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted within Zone D areas. This description is included under the heading Section 19.15.36.13.B.2 of Item 21 of the response.

Appendix F, Operation, Maintenance and Inspection Plan:

Page 4, Normal Operations, Record Keeping:

70. The response provided for this section addresses the record keeping requirements associated with manifesting of accepted waste pursuant to Subsection F of 19.15.36.13 NMAC and documentation of annual employee training pursuant to Subsection P of 19.15.36.13 NMAC. It did not address all of the applicable record keeping requirements of Part 36. Pursuant to Subsection L of 19.15.36.13 NMAC, "Each operator shall have an inspection and maintenance plan that includes the following: (1) monthly inspection of leak detection sumps including sampling if fluids are present with analyses of fluid samples furnished to the division; and *maintenance of records of inspection dates, the inspector and the leak detection system's status;* (2) semi-annual inspection and sampling of monitoring wells as required, with analyses of ground water furnished to the division; and *maintenance of records of inspection dates, the inspector and ground water monitoring wells' status;* and (3) inspections of the berms and the outside walls of pond levees quarterly and after a major rainfall or windstorm, and maintenance of berms in such a manner as to prevent erosion." Also pursuant to Paragraph (2) of 19.15.36.17.C NMAC, the operator "shall monitor leak detection systems pursuant to the approved surface waste management facility permit conditions, *maintain monitoring records in a form readily accessible for division inspection* and report discovery of liquids in the leak detection system to the division within 24 hours." Please modify the response to address all of the applicable record keeping requirements of Part 36.

Response:

The Record Keeping section within Appendix F, Operation, Maintenance and Inspection Plan has been moved from Page 4 to Page 5 of Appendix F. The Record Keeping Section has been updated to include all record keeping requirements listed in 19.15.36.13 NMAC and Paragraph (2) of 19.15.36.17.C NMAC.

Page 4, Normal Operations, Signs:

71. The second sentence in the response states "the sign will be at least 12 inches by 24 inches with lettering not less than two inches in height." This is one of the regulatory sign requirements for a pit, closed-loop system or below-grade tank permitted pursuant to Subsection C of 10.15.17.11 NMAC. Pursuant to Subsection J of 19.15.36.13 NMAC, *"Surface waste management facilities shall have a sign, readable from a distance of* 50 *feet* and containing the operator's name; surface waste management facility permit or order number; surface waste management facility location by unit letter, section, township and range; and emergency telephone numbers." The requirements of Part 36 do not specify the minimum size for the sign or the lettering. It is based upon being legible from a distance of 50 feet.

Response:

The language containing lettering size requirements has been removed from the Signs section of the Operation, Maintenance and Inspection Plan located within Appendix F. The Signs section contains the requirements listed in Subsection J of 19.15.36.13 NMAC.

Page 4, Monitoring and Inspection, Leak Detection System:

72. The actions proposed in the response for the discovery of moisture within the leak detection system are based upon the requirements of Part 17. The response does not recognize the pre-repair assessment requirements of Part 36 in which the permit will be considered. Pursuant to Paragraph (1) of 19.15.36.13.L NMAC, "Each operator shall have an inspection and maintenance plan that includes the following: monthly inspection of leak detection sumps *including sampling if fluids are present with analyses of fluid samples furnished to the division;* and maintenance of records of inspection dates, the inspector and the leak detection system's status; ... " If moisture and/or fluids are discovered are discovered in the leak detection system, the first step would be to obtain a sample and compare the water quality and chemistry to the water in the pond. This demonstration will assist the operator to determine if the moisture was generated from condensation or if it is an indication of a leak. Please modify the response to allow ample time for the sampling and laboratory analysis and incorporate the requirements of Paragraph (1) of 19.15.36.13.L NMAC.

Response:

The Leak Detection System section of the Operation, Maintenance and Inspection Plan has been updated to include the requirement that if any fluids are present in the leak detection sumps, they shall be immediately sampled and analyzed. The analysis of these samples will be provided to the Oil Conservation Division within two (2) days of discovery. If the fluid is determined to be from a leak and not from

condensation, the pond in question shall be emptied and the liner inspected and repaired.

Page 5, Monitoring and Inspection, Pond Surfaces:

73. The first sentence of the response proposes to inspect the surfaces of the ponds "on a monthly basis for the presence of oil on the water surface ..." This proposal contradicts the operational requirements specified for ponds. Pursuant to Paragraph (1) of 19.15.36.17.C NMAC, the "operator shall ensure that only produced fluids or non-hazardous waste are discharged into or stored in a pit or pond; and *that no measurable or visible oil layer is allowed to accumulate or remain anywhere on a pit's surface* except an approved skimmer pit." Since a skimmer pit is not proposed in this submittal the proposed frequency would allow for a month's potential accumulation and would not address the daily operational requirement. Please modify the response to demonstrate compliance with the operational requirements specifically for ponds pursuant to Part 36.

Response:
The Pond Surfaces Section of the Operation, Maintenance and Inspection Plan has been updated so that the ponds will be inspected on a daily basis. Daily monitoring will ensure that no oil will accumulate on the pond surfaces. As described in the Oil on the Surface of the Ponds section of the Operation, Inspection and Maintenance Plan, If oil is discovered, the first step will be to immediately shut off the pumps supplying the facility and to remove the oil from the surface of the ponds so that no accumulation occurs.

74. The second sentence of the response proposes to report "dead migratory birds or other wildlife" on a monthly basis "to the appropriate wildlife agency and to the Oil Conservation Division within 30 days of discovery to determine whether measures need to be implemented to prevent deaths from reoccurring." Black Hills proposes to allow deaths to occur prior to determining the appropriate level of protection. This does not coincide with the requirements of Part 36.

Response:
Bird netting has been included in the design of the facility as shown on Sheet D-10 of the Engineering Drawings located in Appendix A. The Pond Surfaces section of the Operation, Inspection and Maintenance Plan has been updated to remove any proposal to allow bird deaths from occurring. This plan requires the bird netting to be inspected on a quarterly basis.

Page 6, Maintenance and Repairs, Spills:

75. The response provided for this section proposes clean-up procedures and in-place remediation of contaminated soils. Pursuant to Subsection K of 19.15.36.13 NMAC, the "operator shall comply with the spill reporting and corrective action provisions of 19.15.30 NMAC or 19.15.29 NMAC." Also, the contingency plan, required as part of the permit application pursuant to Subsection N of 19.15.36.13 NMAC, is more comprehensive and is "designed to minimize hazards to fresh water, public health, safety or the environment from fires, explosions or an unplanned sudden or non-sudden release of contaminants or oil field waste to air, soil, surface water or ground water." Please modify the response in a manner to demonstrate compliance to the requirements of Part 36.

Response:

The Spills section of the Operation, Inspection and Maintenance Plan has been updated to require that Black Hills personnel will comply with the spill reporting and corrective action provisions of 19.15.30 NMAC or 19.15.29 NMAC in the event that spills occur. The Contingency Plan for Emergencies located in Appendix I is a comprehensive plan and is designed to minimize hazards to fresh water, public health, safety or the environment from fires, explosions or an unplanned sudden or non-sudden release of contaminants or oil field waste to air, soil, surface water or ground water.

Page 7, Maintenance and Repairs, Oil on the Surface of the Pond:

76. The first sentence, of the first complete paragraph on page 7, proposes to inspect the surfaces of the ponds "on a monthly basis for the presence of oil." The second sentence states "If oil is observed the first step will be to determine the oil source and reason for discharge." This proposal contradicts the operational requirements specified for ponds. Pursuant to Paragraph (1) of 19.15.36.17.C NMAC, the "operator shall ensure that only produced fluids or non-hazardous waste are discharged into or stored in a pit or pond; and *that no measurable or visible oil layer is allowed to accumulate or remain anywhere on a pit's surface* except an approved skimmer pit. Pursuant to Paragraph (5) of 19.15.36.17.C NMAC, the "operator shall use skimmer pits or tanks to separate oil from produced water prior to water discharge into a pond. The operator shall install a trap device in connected ponds to prevent solids and oils from transferring from one pond to another unless approved in the surface waste management facility permit." The last sentence of the paragraph proposes the use of oil booms to contain oil discharges. The provisions above are clear that a skimmer pit is required to prevent oil from entering the pond. Proposals should not suggest actions that will result in the planned accumulation of oil on the surface of the pond for the purposes of collection and removal. Since a skimmer pit is not proposed in this submittal the proposed frequency would allow for

a month's potential accumulation and would not address the daily operational requirement. Please modify the response to demonstrate compliance with the operational requirements specifically for ponds pursuant to Part 36.

Response:
The Oil on the Surface of the Ponds section of the Operation, Inspection and Maintenance Plan has been updated to state that the ponds shall be monitored daily for the presence of oil. If oil is observed the first step will be to immediately shut off the pumps supplying the facility and to remove the oil from the surface of the ponds so that no accumulation occurs. Oil will be removed from the water surface via vacuum trucks and disposed of at an approved waste disposal facility. Additional in place remediation may include use of absorbent material to remove oil sheens from the ponds. Oil booms will be placed around discharge pipes in the ponds to contain oil discharges should they occur inside a smaller area. Once the oil has been removed from the ponds, necessary corrective measures will be taken to correct the source of the current oil presence and to prevent future instances from occurring.

Pages 7 and 8, Emergency Procedures:

77. The information provided in this section identifies governmental emergency response parties and their contact information that would be notified during certain conditions or scenarios. In the event of a "fire" or "operational emergencies including large amounts of spoiled fluids or complete embankment failure," the operator/owner is required to notify the regulatory and permitting agency, the Oil Conservation Division. Pursuant to Subsection K of 19.15.36.13 NMAC, the "operator shall comply with the *spill reporting and corrective action* provisions of 19.15.30 NMAC or 19.15.29 NMAC." Please identify the Oil Conservation Division as a required party for notification regarding fires and unauthorized releases .

Response:
The Emergency Procedures section of the Operation, Inspection and Maintenance Plan has been updated to require the Oil Conservation Division be included as a required party for notification regarding fires and unauthorized releases.

Appendix G, Hydrogen Sulfide Prevention and Contingency Plan:

78. Pursuant to Section 2 of 19.15.11 NMAC "19.15.11 NMAC does not exempt or otherwise excuse surface waste management facilities the division permits pursuant to 19.15.36 NMAC from more stringent conditions on the handling of hydrogen sulfide required of such facilities by 19.15.36 NMAC or more stringent conditions in permits issued pursuant to 19.15.36 NMAC, nor shall the facilities be exempt or otherwise excused from the requirements set forth in 19.I5.11 NMAC by virtue of permitting under 19.15.36 NMAC." Pursuant to Paragraph (1) of 19.I5.11.9.B NMAC

"The person shall develop the hydrogen sulfide contingency plan with due consideration of paragraph 7.6 of the guidelines in the API publication Recommended Practices for Oil and Gas Producing and Gas Processing Plant Operations Involving Hydrogen Sulfide, RP-55 , most recent edition, or with due consideration to another division-approved standard." Based upon the information provided in Appendix G, OCD has determined that "due consideration of paragraph 7.6" of the API guidelines was not considered in the development of the proposed Hydrogen Sulfide Prevention and Contingency Plan. Also, the review has demonstrated that all of the appropriate provisions were not considered or addressed within the proposed Hydrogen Sulfide Prevention and Contingency Plan. Please comply with the requirements of Part 11 in the development of the Hydrogen Sulfide Prevention and Contingency Plan. The unaddressed requirements of 19.15.11.9 NMAC for a hydrogen sulfide contingency plan are underlined in the following copy of the rule and must be addressed in the permit application.

Response:
The Hydrogen Sulfide Prevention and Contingency Plan has been revised based on the recommendations of paragraph 7.6 of API RP-55. The unaddressed requirements underlined in the response letter have been addressed.

Page 2, Emergency Contacts:

79. Pursuant to Paragraph (8) of 19.15.36.8 .C NMAC, the application shall include "a hydrogen sulfide prevention and contingency plan that complies with those provisions of 19.15.11 NMAC that apply to surface waste management facilities ." Pursuant to Section 16 of 19.15.11 NMAC, "The person shall *notify the division upon a release of hydrogen sulfide requiring activation of the hydrogen sulfide contingency plan as soon as possible, but no more than four hours after plan activation,* recognizing that a prompt response should supersede notification. The person shall submit a full report of the incident to the division on form C-141 no later than 15 days following the release." Please include the OCD in the emergency contact information.

Response:
The emergency contacts have been updated to include OCD. Additionally, the Hydrogen Sulfide Prevention and Contingency Plan has been updated to require the operator to notify OCD within 4 hours of plan activation.

Page 3, Determination of Hydrogen Sulfide Concentration:

80. The first sentence in the response states "A permanent hydrogen sulfide monitor is currently in place and in service at the existing tank battery." The monitor at the existing tank battery is approximately 500 feet east of the closest pond. Since the

plan did not indicate the direction of the prevailing wind for the proposed site, OCD is unable determine if the monitor will detect hydrogen sulfide from the ponds. Also, will any of Black Hills employees be wearing personal monitors? Please identify all of the methods of detection and in the case of the monitor at the existing tank battery, please demonstrate and justify that it is capable of detecting hydrogen sulfide from the ponds approximately 500 west of the tank battery.

Response:
The Hydrogen Sulfide Prevention and Contingency Plan identifies all methods of detection. A stationary hydrogen sulfide sensor is located at the produced water inlet to the tank battery facility. This sensor will provide a means of early detection prior to storage within the tanks or at the East Blanco Produced Water Reuse Facility. This sensor is calibrated on a quarterly basis, and documentation is maintained for each calibration. Individual hydrogen sulfide sensors are required to be maintained and worn at all times by any personnel within the tank battery facility or East Blanco Produced Water Reuse Facility. Individual hydrogen sulfide sensors are calibrated on a monthly basis, and documentation is maintained for each calibration.

81. The third sentence in the response states "This monitor will alert workers at the facility if a hydrogen sulfide concentration is greater than 100 ppm is present." OSHA and NIOSH identify the PEL or Time Weighted Average (TWA) for H2S as 10 ppm, the Short Term Exposure Limit (STEL) as 15 ppm and the Immediate Danger to Life and Health limit (IDLH) as 100 ppm. The current proposal would lead to workers being overexposed. Please modify the response to reflect the implementation of the proposed H2S contingency plan and the appropriate regulatory exposure limits as designated by the proper regulatory authority and agency.

Response:
The Hydrogen Sulfide Prevention and Contingency Plan has been updated to include two (2) levels of hydrogen sulfide concentration in which immediate action is taken. Level 1 occurs when a hydrogen sulfide concentration of 4 ppm is detected. Level 2 occurs when a hydrogen sulfide concentration of 10 ppm is detected. The details of each action taken for each level are provided in the plan.

Page 4, Emergency Procedures:

82. The first emergency procedure indicates that when the monitor at the existing tank battery detects hydrogen sulfide, on-site workers will ensure all personnel are alerted and moved to higher elevations and upwind from the affected area. Please clarify how Black Hills personnel will know that the monitor at the existing tank battery has detected hydrogen sulfide. Also, please identify the method in which all other personnel will be "alerted". Please identify the designated Black Hills staff (by

title) that will be responsible for this task. Please explain how the upwind direction will be determined. Please identify how will one determine who is present to alert. Pursuant to Subparagraph (a) of 19.15.11.9.B (2) NMAC, the hydrogen sulfide contingency plan "shall contain information on emergency procedures the person will follow in the event of a release and shall include, *at a minimum,* information concerning the *responsibilities and duties of personnel* during the emergency ..." Please identify which personnel are assigned to specific responsibilities and duties to ensure implementation of the contingency plan during an emergency.

Response:
A description of the alarms in place and responsibilities of specific personnel in the case of an emergency have been included in various locations within the Hydrogen Sulfide Prevention and Contingency Plan.

83. The second emergency procedure indicates that equipment and potential sources of explosion will be shut down. Based upon the recommended sequence for an immediate action plan as described in the API document, this would be the seventh step or procedure. Pursuant to Subparagraph (a) of 19.15.11.9.B (2) NMAC, the hydrogen sulfide contingency plan "shall contain information on emergency procedures the person will follow in the event of a release and shall include, *at a minimum,* information concerning the *responsibilities and duties of personnel* during the emergency, *an immediate action plan as described in the API document* referenced in Paragraph (1) of Subsection B of 19.15.11.9 NMAC ... " Based upon the information provided in this section, OCD has determined that "due consideration of paragraph 7.6" of the API guidelines was not considered in the development of the proposed Hydrogen Sulfide Prevention and Contingency Plan. Please comply with the requirements of Part 11 in the development of the Hydrogen Sulfide Prevention and Contingency Plan.

Response:
The Hydrogen Sulfide Prevention and Contingency Plan has been revised based on the recommendations of paragraph 7.6 of API RP-55.

84. The fourth emergency procedure indicates that "on-site personnel will evacuate to a safe distance from the affected area." Based upon the information provided in the permit application, the only hydrogen sulfide monitors/sensors are located approximately 500 east of the closest proposed pond. The proposed evacuation routes on Figures 1 and 2 illustrate the access roads back to US Highway 64. The hydrogen sulfide contingency plan does not propose evacuation routes or assembly points at and within the proposed facility. Please modify the plan to include facility evacuation routes and assembly points within and outside of the proposed facility

perimeter and provide protocols to will ensure personnel are at a "safe distance from the affected area." The plan shall describe the steps to ensure safety, such as explain how one determines that they are no longer in the "affected area."

Response:
Updated evacuation routes, roadblock locations, and designated assembly areas are shown on Figure 2 and Figure 3 of the Hydrogen Sulfide Prevention and Contingency Plan. Steps to ensure safety of all personnel have been included at various locations within the plan.

85. The fifth emergency procedure states that "The facility's emergency coordinator will determine whether the 100 ppm concentration has a radius of exposure greater than 3000 feet." The only hydrogen sulfide monitors/sensors are located approximately 500 east of the closest proposed pond. OSHA and NIOSH identify the PEL or Time Weighted Average (TWA) for H2S as 10 ppm, the Short Term Exposure Limit (STEL) as 15 ppm and the Immediate Danger to Life and Health limit (IDLH) as 100 ppm. Please explain how the "facility's emergency coordinator" will determine the hydrogen sulfide concentration when the only monitor proposed in the plan is stationary and located on the east side of the tank battery which is not located within the proposed facility. Please identify how "facility emergency coordinator" will complete this task without becoming overexposed while monitoring. Also, please identify how the monitoring will occur. Also, please justify the proposed overexposure to on-site personnel.

Response:
The Hydrogen Sulfide Prevention and Contingency Plan has been revised based on the recommendations of paragraph 7.6 of API RP-55. The plan specifies that facility operators will wear self-contained breathing apparatus (SCBA) respirators during the emergency situation, and will monitor hydrogen sulfide concentrations using personal sensors. The maximum level of response now occurs at a hydrogen sulfide concentration of 10 ppm.

86. The sixth emergency procedure indicates that "state police and county sheriff's office" will be contacted "so that the public can be notified via media outlets and evacuated from affected areas." Pursuant to Subparagraph (a) of 19.15.11.9.B (2) NMAC, the plan shall also include "procedures for notifying the public, *either through direct telephone notification using telephone number lists or by means of mass notification and reaction plans."* Please identify the procedures and arrangements that have been established with "state police and county sheriff's office" and "media outlets" that ensure that the "public" within the proximity of the proposed facility will receive notification regarding the time of the release. Please consider that the

proposed "media outlets" notification may not provide a timely notice to parties if the release occurred after midnight when the general public is asleep. Please identify the "public" that requires notification. Please identify how it will be determined that the "100 ppm radius of exposure exceeds 3000 feet."

Response:
The Hydrogen Sulfide Prevention and Contingency Plan has been updated to require the notification of anyone within the radius of exposure to leave the area until further notice or shelter in place. Notification will take place via telephone. However, at the time of this application, there are no residences, businesses, schools, churches, or medical facilities located within the radius of exposure. Black Hills personnel will make a visual inspection of the ROE area to ensure that no individuals are present within the ROE. If individuals are present, they will be instructed to immediately evacuate the area and not return until further notice.

87. The seventh emergency procedure indicates "facility personnel" will assist in "evacuating the public from the area and blocking access roads... " Please identify the "public" that would require evacuation. Also pursuant to Subparagraph (a) of 19.15.11.9.B (2) NMAC, the plan shall include *"locations of potentially affected public areas and public roads* and shall describe proposed evacuation routes, *locations of road blocks..."* The *"locations of potentially affected public areas and public roads " and "locations of road blocks"* are not provided in Appendix G. Please provide the required information.

Response:
There are no public areas or public roads near the 100 ppm radius of exposure. Only unnamed gravel roads access the area within the radius of exposure as shown on Figure 2 of the Hydrogen Sulfide Prevention and Contingency Plan. At the time of this application however, there are no residences, businesses, schools, churches, or medical facilities located within the radius of exposure. An updated 3,000-foot radius of exposure, based on the facility boundary, has been included on Figure 2 of the Hydrogen Sulfide Prevention and Contingency Plan. Figure 2 contains roadblock locations outside of the radius of exposure.

88. The eighth emergency procedure states that "facility personnel will monitor the air in the exposure areas to determine when safe re-entry <u>to</u> affected areas is possible." Please correct the sentence structure. Please identify how "facility personnel" will complete this task without becoming overexposed while monitoring. Also, please identify how the monitoring will occur and what concentration is safe for re-entry.

Response:
The Hydrogen Sulfide Prevention and Contingency Plan has been revised based on the recommendations of paragraph 7.6 of API RP-55. The plan specifies that facility operators will wear self-contained breathing apparatus (SCBA) respirators during the emergency situation, and will monitor hydrogen sulfide concentrations using personal sensors. The maximum level of response now occurs at a hydrogen sulfide concentration of 10 ppm.

Page 5, Evacuation Routes:

89. The proposed evacuation routes on Figures 1 and 2 illustrate the access roads back to US Highway 64. The hydrogen sulfide contingency plan does not propose evacuation routes or assembly points within and outside of the proposed facility perimeter. Please modify the plan to include facility evacuation routes and assembly points within and outside of the proposed facility perimeter.

Response:
Figure 3 of the Hydrogen Sulfide Prevention and Contingency Plan has been updated to include evacuation routes and assembly points within and outside of the proposed facility perimeter.

Page 5, Analysis Results:

90. The first sentence of the response states "Produced water samples have been taken from existing gas wells from which produced water will be supplied to the facility." Only one water analysis summary report on one water sample is provided in Appendix G. The results of "produced water samples" are not provided. Please provide all of the analytical results from all the wells sampled including the associated chain of custody and QA/QC. A proper assessment would be to monitor the hydrogen sulfide gas venting from the tank battery that will be the source of the produced water for the proposed ponds. The current demonstration of water chemistry is not appropriate. Please provide an appropriate assessment and modify the response accordingly.

Response:
The produced water quality results have been removed from the application. Per 9.15.11 NMAC, a water quality analysis of the produced water that will be stored at the facility is not a requirement for the Hydrogen Sulfide Prevention and Contingency Plan.

Figures 1 and 2:

91. The maps illustrate the access road to US Highway 64 as the only proposed evacuation route. There is not a facility layout map that proposes evacuation routes

within the proposed facility to the facility boundary or established assembly points/areas to account for personnel and/or visitors. Please provide. Figures 1 and 2 are satellite or aerial images which seem to use the center of the middle impoundment as the basis of the 3000-foot assessment. Please establish a site perimeter (facility boundary) to properly demonstrate the 3000-foot assessment. Also, update maps to include proposed road blocks.

Response:
An updated 3,000-foot radius of exposure, based on the facility boundary, has been included on Figure 2 of the Hydrogen Sulfide Prevention and Contingency Plan. Figure 2 contains roadblock locations outside of the radius of exposure.

Attachment 1, H2S Monitoring System Schematics:

92. OCD is unable to read the text beneath anything colored green and purple. Please use lighter colors on the illustration in order to make the text legible.

Response:
Attachment 1 of the Hydrogen Sulfide Prevention and Contingency Plan has been updated to identify the text beneath the colors green and purple.

Attachment 2, Results from Produced Water Analysis:

93. Please provide all of the analytical results from all the wells sampled including the associated chain of custody and QA/QC. A proper assessment would be to monitor the hydrogen sulfide gas venting from the tank battery that will be the source of the produced water for the proposed ponds. The current demonstration of water chemistry is not appropriate. Please provide an appropriate assessment and modify accordingly.

Response:
The produced water quality results have been removed from the application. Per 9.15.11 NMAC, a water quality analysis of the produced water that will be stored at the facility is not a requirement for the Hydrogen Sulfide Prevention and Contingency Plan.

<u>Appendix H, Closure Plan:</u>

Page 1, Closure, Protocols and Procedures:

94. Pursuant to Paragraph (1) of 19.15.36.18.A NMAC, "The operator shall notify the division's environmental bureau at least 60 days prior to cessation of operations at the surface waste management facility and provide a proposed schedule for closure." The closure notice and schedule submittal is not addressed in the

proposed closure plan. Please modify the plan to include the requirement as the first protocol or procedure.

Response:
The Protocols and Procedures section of the Closure Plan has been updated to include the requirement that the operator shall notify the division's environmental bureau at least 60 days prior to cessation of operations and will provide a proposed schedule for closure.

95. The first sentence of the response indicates that produced water in the ponds will be removed using suction pumps and pipeline connected to the existing tank battery. Please clarify if this will result in the produced water from the ponds being moved to the tank battery for storage or will the produced water be moved elsewhere for closure. Clarification is needed since the proposal includes using the suction pumps and pipeline connected to the existing tank battery to transfer liquids from the ponds to well locations for reuse.

Response:
The Protocols and Procedures section of the Closure Plan has been updated to include the statement that the produced water will be moved to the existing tank battery facility for storage.

96. The proposed closure sampling protocol is not based upon the requirements of Part 36, but is based upon the requirements of Part 17 for a below-grade tank or permanent pit. Pursuant Paragraph (4) of 19.15.36.18.E NMAC, the operator shall ensure "the site is sampled, in accordance with the procedures specified in chapter nine of EPA publication SW-846, test methods for evaluating solid waste, physical/chemical methods for *TPH, BTEX, metals and other inorganics listed in Subsections A and B of 20.6.2.3103 NMAC,* in accordance with a *gridded plat of the site containing at least four equal sections that the division has approved."* Please provide the required sampling grid and base the closure on the requirements in which the permit is being requested: Part 36.

Response:
The Protocols and Procedures section of the Closure Plan has been updated to include the sampling requirements of 19.15.36.18.E NMAC including sampling the site in accordance with a gridded plat of the site containing at least four equal sections OCD has approved. This plat is provided on Figure 1 of the Closure Plan located in Appendix H. Testing will be performed for TPH, BTEX, metals and other inorganics listed in Subsections A and B of 20.6.2.3103 NMAC. Test methods for evaluating solid waste were not mentioned because no solid waste will be stored at

the facility.

Page 2, Post-Closure, Monitoring:

97. Pursuant to Subsection F of 19.15.36.18 NMAC, *"If there has been a release to the vadose zone or to ground water, then the operator shall comply with the applicable requirements of 19.15.30 NMAC and 19.15.29 NMAC."* The last sentence of the response states "If there has been a release, the operator shall comply with the reporting and remediation requirements of listed in the Contingency Plan given in Appendix I of the Design Report." Upon review of the Contingency Plan for Emergencies in Appendix I, OCD discovered that the requirements of 19.15.29 NMAC and 19.15.30 NMAC were not addressed in the plan and should not be addressed in the proposed contingency plan. The contingency plan, provided in Appendix I, is a demonstration of compliance to the provision Subsection N of 19.15.36.13 NMAC, as stated on page 16 for Item 16 of the permit application. Pursuant to Subsection N of 19.15.36.13 NMAC, "The contingency plan shall be designed to minimize hazards to fresh water, public health, safety or the environment from fires, explosions or an unplanned sudden or non-sudden release of contaminants or oil field waste to air, soil, surface water or ground water." The provision does not request that the requirements of 19.15.29 NMAC and 19.15.30 NMAC to be addressed in the plan since it must be addressed under Subsection K of 19.15.36.13 NMAC. Please modify the response to reflect compliance to the requirements of Subsection F of 19.15.36.18 NMAC and address releases to the vadose zone and ground water in the response.

Response:

The Post-Closure, Monitoring section of the Closure Plan has been updated to reflect compliance to the requirements of Subsection F of 19.15.36.18. This section states that if there has been a release to the vadose zone or to ground water, the operator shall comply with the reporting and remediation requirements listed in the Contingency Plan for Emergencies given in Appendix I of the Permit Application. The Contingency Plan for Emergencies states that Black Hills personnel shall comply with the applicable requirements of 19.15.30 NMAC and 19.15.29 NMAC.

Attachment: Closure and Post Closure Cost Estimates:

98. Please comply with the centralized surface waste management facility financial assurance requirements of Subsection A of 19.15.36.11 NMAC.

Response:

The proposed facility is a centralized facility. Therefore, a closure cost estimate is not required. The closure and post closure cost estimate has been removed from the Closure Plan.

Appendix I. Contingency Plan for Emergencies:

Page I, Description of the Facility:

99. The first sentence of the second paragraph identifies the parties in which Black Hills proposes to maintain a copy of the proposed contingency plan. A copy of the contingency plan should also be maintained with the permitting and regulatory agency. Please include the Oil Conservation Division in the list. If changes are made to the plan as described in the response, please clarify that a copy of the revised contingency plan will be provided to the listed parties and agencies.

Response:
The response has been updated to include the Oil Conservation Division as maintaining a copy of the Contingency Plan. A statement has been included that states that if any changes are made to the plan, a copy of the revised contingency plan will be provided to the listed parties and agencies.

Page 1, Types of Waste:

100. The first sentence of the response states "Produced water from the surrounding oil and gas operations will be the primary type of waste received at this facility." Please clarify if produced water is the only type of waste received or identify the other waste.

Response:
The response has been updated to clarify that produced water will be the only type of waste received at the proposed facility.

101. The last sentence of the response states "Drilling mud and drilling fluids will not be disposed of within the facility. Please modify the response to clarify if "drilling mud and drilling fluids" will be accepted at the proposed facility.

Response:
The response has been updated to clarify that drilling mud and drilling fluids will not be accepted at the proposed facility.

102. Pursuant to Paragraph (6) of 19.15.36.13.N NMAC, the contingency plan for emergencies shall "include an *evaluation of expected contaminants, expected media contaminated and procedures for investigation, containment and correction or remediation."* Please identify the *"procedures for investigation, containment and correction or remediation"* as required by this provision.

Response:
The procedures for investigation, containment and correction or remediation are provided in the Surface Release and Subsurface Release sections of the Contingency Plan for Emergencies.

Page 2, Emergency Contacts:

103. Pursuant to Paragraph (2) of 19.15.36.13.N NMAC, the contingency plan for emergencies shall *"describe arrangements* with local police departments, fire departments, hospitals, contractors and *state* and local emergency response teams *to coordinate emergency services."* The Oil Conservation Division, the permitting and regulatory agency, was not identified as an emergency contact. Please modify the list to include the Oil Conservation Division and provide the associated contact information.

Response:
The Contingency Plan for Emergencies has been updated to include the Oil Conservation Division as an emergency contact.

Page 2, Emergency Contacts, Police Department:

104. Pursuant to Paragraph (2) of 19.15.36.13.N NMAC, the contingency plan for emergencies shall "describe arrangements with local police departments, fire departments, hospitals, contractors and state and local emergency response teams to coordinate emergency services." The New Mexico State Police and the Rio Arriba County Sheriff's Office are both identified in the Hydrogen Sulfide Contingency Plan, Appendix G, as contacts responsible for public notice and assisting in establishing and maintaining roadblocks. The response provided in this section states "In the event that law enforcement officials may be contacted... contact information is given below." Please identify in the response the *"arrangements with local police departments,* fire departments, hospitals, contractors and state and local emergency response teams *to coordinate emergency services."*

Response:
The Contingency Plan for Emergencies has been updated to identify arrangements with various emergency response agencies. The plan describes the responsibilities of the Incident Commander (IC). Coordinating with emergency responders is one of the responsibilities of the IC. Additionally, all emergency response agencies listed within the plan will be invited to attend annual training meetings regarding the contents of the plan and will be notified of the contents of this plan.

Page 3, Emergency Procedures, Fire or Explosion:

105. The last sentence of the first paragraph states "no fire alarm system will be implemented in this facility." Please clarify if the facility has an audible alarm system. The sentence does indicate that on-site personnel will be notified by cell phone or handheld radio. Pursuant to Paragraph (4) of 19.15.36.13.N NMAC, the contingency plan for emergencies shall "include a list, which shall be kept current, of emergency equipment at the surface waste management facility, such as fire extinguishing systems, spill control equipment *communications and alarm systems* and decontamination equipment, containing a physical description of each item on the list and a brief outline of its capabilities." Cell phones and handheld radios were not identified on page 5 of the contingency plan under the section titled, *Emergency Equipment,* or any other portion of the plan. Of the equipment listed, none include the required "physical description of each item on the list and a brief outline of its capabilities." Please ensure that all of the required information is provided.

Response:

The Contingency Plan for Emergencies has been updated to include physical descriptions and capabilities of each item of emergency equipment. This list clarifies that no fire alarm system will be implemented at the East Blanco Produced Water Reuse Facility.

Page 4, Emergency Procedures, Fire or Explosion:

106. The first sentence of the first paragraph indicates that facility personnel may use fire extinguishers if the emergency coordinator determines that a fire can be easily extinguished. Fire extinguishers are identified on page 5 under *Emergency Equipment,* but the type *(A,* B, or C) is not provided. Please modify the list under the *Emergency Equipment* section of the contingency plan to provide a "physical description of each item on the list and a brief outline of its capabilities." In this case, please identify the limitation/capabilities of the type of the extinguisher(s).

Response:

The Safety Equipment and Supplies Available section of the Contingency Plan for Emergencies contains a list of emergency equipment available along with a brief description and capabilities of each. The fire extinguisher is rated 2-A:10-B:C and can fight wood, fabric, paper, flammable liquid, and electrical fires.

107. The second to last sentence of the third paragraph states "Any releases shall be reported to the New Mexico Oil Conservation Division and appropriate State and Federal authorities." The Oil Conservation Division was not identified as an emergency contact nor was the contact information provided in the contingency plan. Please modify the emergency contact list to include the Oil Conservation

Division and provide the associated contact information.

Response:
The Contingency Plan for Emergencies has been updated to include the Oil Conservation Division to the emergency contact list.

Page 4, Emergency Procedures, Releases:

108. Pursuant to Paragraph (1) of 19.15.36.13.N NMAC, the contingency plan for emergencies shall *"describe the actions* surface waste management facility *personnel shall take in response to* fires, explosions or *releases to air, soil, surface water or ground water* of contaminants or oil field waste containing constituents that could threaten fresh water, public health, safety or the environment." Pursuant to Subsection N of 19.15.36.13 NMAC, the "contingency plan shall be designed to minimize hazards to fresh water, public health, safety or the environment from fires, explosions or *an unplanned sudden or non-sudden release* of contaminants or oil field waste to air, soil, surface water or ground water."

Response:
The Contingency Plan for Emergencies has been updated to describe reactions to unplanned sudden or non-sudden releases of contaminants or oilfield waste to air, soil, surface water or ground water. These reactions are described in the Air Release, Surface Release, and Subsurface Release sections.

109. The first sentence of the protocol presented in the first paragraph is to notify the emergency coordinator and perform a visual inspection "to identify the character, source, amount, and extent of the released material." A visual inspection of a release on the ground surface would be appropriate to determine the surface area impact, but releases that impact or are to the vadose zone and ground water are subsurface and cannot be assessed through a visual inspection of the ground surface. In a release to surface water, a visual inspection may assist in determining where the release entered and possibility the migration of the release, but not impact of the of contaminants or oil field waste. A universal approach or protocol is not appropriate for the assessment of different type of releases, as identified above. Please address each scenario individually and consider the difference between surface and subsurface assessments.

Response:
The Contingency Plan for Emergencies has been updated to address identification and reaction to air releases, surface releases, and subsurface releases. These procedures are described in the Air Release, Surface Release, and Subsurface release sections.

110. The proposed pond designs and facility layout, Sheet P-2 of Appendix A, illustrate that the ponds will be constructed primary above the existing contours (steep slopes) above a watercourse, as defined by Paragraph (4) of 19.15.2.7.W NMAC. A surface release of produced water from one of the ponds would most likely result in the water flowing downhill toward the watercourse. The proposed "actions" should address and consider the site specific conditions of the proposed facility. Please provide the required information for each type of scenario and the detailed instruction to assist facility personnel with due consideration of the site specific conditions and surrounding topographical features of the proposed facility location.

Response:
The Surface Release section of the Contingency Plan for Emergencies includes a consideration of the site specific conditions and surrounding topographical features of the facility's location. This section states that if feasible, grading and diversion channels will be constructed on the north and east sides of the facility (downhill from the facility) to isolate the release and prevent waste from reaching the ephemeral drainages within the area.

Page 5, Emergency Procedures, Releases:

111. In the continuance of the second paragraph of this section from page 4, the first complete sentence states "Any release shall be reported to the New Mexico Oil Conservation Division and appropriate State or Federal authorities." Pursuant to Subsection K of 19.15.17.13 NMAC, the operator "shall comply with the spill reporting and corrective action provisions of 19.15.30 NMAC or 19.15.29 NMAC." Please recognize the responsibility of the operator/owner to comply with the applicable provisions of 19.15.29 NMAC regarding notice.

Response:
The Surface Release and Subsurface Release sections of the Contingency Plan for Emergencies include the requirement that facility operators shall comply with the spill reporting and corrective action provisions of 19.15.30 NMAC or 19.15.29 NMAC.

112. The second sentence proposes to treat "oil stained soils" on-site or in-place by biodegradation. During the review of the permit application packet, OCD was unable to locate a proposal for a landfarm. Landfarming is a method of surface waste management permitted under Part 36, the same provision in which Black Hills is seeking to permit the proposed ponds. If Black Hills wishes to address a release without having to pursue landfarming through this permit, then please recognize the responsibility of the operator/owner to comply with the applicable provisions of 19.15.29 NMAC and 19.15.30 NMAC regarding notice and the submittal and

approval of remediation plans and/or abatement plans.

Response:
The Surface Release and Subsurface Release sections of the Contingency Plan for Emergencies include the requirement that the Incident Commander will ensure compliance with the applicable provisions of 19.15.29 NMAC and 19.15.30 NMAC regarding notice and the submittal and approval of remediation plans and/or abatement plans.

113. The last sentence of the paragraph states "The emergency coordinator shall be on site to monitor the cleanup efforts and ensure that no oil field waste, which may be incompatible with the release material, is treated, stored, or disposed of until cleanup procedures are complete." Pursuant to Paragraph (12) of 19.15.36.13.N NMAC, the contingency plan for emergencies shall *"describe how* the emergency coordinator, immediately after an emergency, *will provide for treating, storing or disposing of recovered oil field waste, or other material that results from a release, fire or explosion* at a surface waste management facility ." Also pursuant to Paragraph (13) of 19.15.36.13.N NMAC, the contingency plan for emergencies shall *"describe how* the emergency coordinator *will ensure that no oilfield waste, which may be incompatible with the released material, is treated, stored or disposed of until cleanup procedures are complete."* As demonstrated above, the last sentences states that the required task will be completed but does not "describe how" the emergency coordinator will complete each task, as required by the provisions. Please "describe how" the emergency coordinator will complete the required tasks. Site maps should be provided or referenced to illustrate where the proposed described activities will take place.

Response:
The Fire or Explosion, Surface Release, and Subsurface Release sections of the Contingency Plan for Emergencies contain the actions the Incident Commander will follow in order to treat, store, and dispose of recovered oil field waste, or other materials that result from a release, fire or explosion at a surface waste management facility. Because this is a centralized facility that will only accept produced water generated from Black Hills operations, there is no risk of other types of oilfield wastes mixing with any released materials.

Page 5, Notification:

114. The first sentence of the paragraph identifies "greater than 25 barrels" as the only consideration for reporting a major release. This is one of the considerations identified under the definition of a "major release" pursuant to Subsection A of 19.15.29.7 NMAC. All of the considerations, except for Paragraph (3) regarding gas,

identified under Subsection A of 19.15.29.7 NMAC apply and should be recognized in the response. Please provide.

Response:
The Notification section of the Contingency Plan for Emergencies contains the criteria that differentiate between a major release and a minor release.

Page 5, Emergency Equipment:

115. Pursuant to Paragraph (4) of 19.15.36.13.N NMAC, the contingency plan for emergencies shall *"include a list,* which shall be kept current, *of emergency equipment at the surface waste management facility,* such as fire extinguishing systems, spill control equipment, communications and alarm systems and decontamination equipment, *containing a physical description of each item on the list and a brief outline of its capabilities."* The response provided for this section identified some equipment in the written text and others in a list. A *"physical description of each item on the list and a brief outline of its capabilities"* was not provided in the plan. The equipment that would be needed to construct the proposed "diversion channels" during a release to retain fluid is not identified. Equipment such as "oil absorbent pads" are identified in a list, but the scenario in which and how they will be utilized during a release is not presented in the contingency plan. Please provide the required information and present it in the manner the provision requires.

Response:
The Safety Equipment and Supplies Available section of the Contingency Plan for Emergencies contains a list of emergency equipment available along with a brief description and capabilities of each.

Page 5, Evacuation Plan:

116. Pursuant to Paragraph (5) of 19.15.36.13.N NMAC, the contingency plan for emergencies shall "include an evacuation plan for surface waste management facility personnel *that describes signals to be used to begin evacuation,* evacuation routes and *alternate evacuation routes in cases <u>where fire</u> or releases of wastes could block the primary routes."* The response proposes only one evacuation route and does not describe the *"signals to be used to begin evacuation."* Please provide the required information.

Response:
Figure 2 of the Contingency Plan for Emergencies contains various evacuation routes and the locations of designated assembly areas.

Figures 1 and 2:

117. The figures provided in the contingency plan only propose one evacuation route from the facility. *"Alternate evacuation routes in cases where fire or releases of wastes could block the primary routes"* are not proposed, as required. Please provide.

Response:

Figure 2 of the Contingency Plan for Emergencies contains various evacuation routes and the locations of designated assembly areas.

Additional provisions of 19.15.36.13.N NMAC not addressed in contingency plan:

118. Pursuant to Paragraph (6) of 19.15.36.13.N NMAC, the contingency plan for emergencies shall "include an *evaluation of expected contaminants, expected media contaminated and procedures for investigation, containment and correction or remediation."* Please identify the *"procedures for investigation, containment and correction or remediation"* as required by this provision.

Response:

The Surface Release and Subsurface Release sections of the Contingency Plan for Emergencies include the procedures facility personnel will follow for the investigation, containment, correction, or remediation of releases.

Appendix J, Best Management Practices Plan:

Page 3, Controls, Stabilization Practices, During-Construction Stabilization:

119. The first sentence of the response states" Topsoil and fill stockpiles will be located away from drainages to prevent storm water contamination during construction." Sheet P-2 of Appendix A illustrates that the proposed topsoil stockpile area will be located on a slope approximately 100 feet from and above a watercourse. No additional BMPs, such as berming the stockpile, are proposed other than the location which will most likely result in erosional run-off into the watercourse. Please provide BMPs that address the erosional run-off issues regarding the proposal to stockpile soils.

Response:

The topsoil and excess excavated material stockpile area has been moved to the north of the facility as shown on Sheet P-2 of Appendix A. Sheet ER-1 of Appendix A indicates the location of BMPs throughout the site. As shown, BMPs will be installed around the entire perimeter of the topsoil and excess excavation stockpile area to prevent erosion and off-site sediment migration.

Page 6, Storm Water Management:

120. Pursuant to Paragraph (11) of 19.15.36.8.C NMAC, the application shall include "a plan to control run-on water onto the site and run-off water from the site that complies with the requirements of Subsection M of 19.15.36.13 NMAC. Pursuant to Subsection M of 19.15.36.13 NMAC, "Each operator shall have a plan to control run-on water onto the site and run-off water from the site, such that: (1) the run-on and run-off control system shall prevent flow onto the surface waste management facility's active portion during the peak discharge from a 25-year storm; and (2) run-off from the surface waste management facility's active portion shall not be allowed to discharge a pollutant to the waters of the state or United States that violates state water quality standards." OCD has been unable to locate a consolidated storm water management plan. Some of the information is provided on page 17-18 and 27 of the written text, drawings are provided in Appendix A, drainage ditch hydraulic analysis results are provided in Appendix C and additional erosional controls regarding construction are suggested here in the Best Management Plan of Appendix J. Please provide a storm water management plan that complies with the requirements of Paragraph (11) of 19.15.36.8.C NMAC.

Response:

All information regarding a plan to control run-on and run-off at the site that complies with the requirements of Subsection M of 19.15.36.13 NMAC has been consolidated within the Best Management Practice and Storm Water Management Plan located in Appendix J.

Appendix H, Hydrogeologic Investigation Report:

Page 1, Introduction:

121. In the second to last sentence of the first paragraph, the proposed ponds start beginning referred to as "pits." This is the only section of the permit application in which the term "pit" is used to describe the proposed ponds. Please perform a universal search to replace "pit" with "pond" throughout Appendix K.

Response:

All references to "pits" have been changed to "ponds" within the response.

Page 1, Introduction, Problem Statement:

122. The first sentence of the second paragraph states "It is important to realize that only a portion of the project area will be utilized for the storage of produced water in pits below ground." Please clarify if the "pits below ground" are the proposed ponds. The second sentence of the second paragraph states "The existing facility pad located in the northeast corner of the project area east of the drainage contains only

above-ground facilities." Please clarify if the "above-ground facilities" are above-grade tanks or other features. Please properly identify or describe the nature of the referenced "above-ground facilities."

Response:
The second paragraph of the Problem Statement section has been removed for clarification. There are no above-ground facilities. The fence surrounding the facility will serve as the facility boundary. The adjacent tank battery supplies the proposed containment ponds but is a separate facility.

Page 2, Scope of Work:

123. The second sentence of the first paragraph states "Although these two boreholes were not initially approved by the OCD, they were drilled and logged by Geomat, Inc. in accordance with OCD rules and requirements." Please present the information based upon the facts. The initial investigation, which resulted in WB4 #1 and WB4 #2, was completed without OCD knowledge or input. A boring plan was not submitted to OCD, therefore it was never considered for approval by OCD. The boreholes were not continuously cored, the boreholes were not left to sit open when damp zones were encountered, and the proposed depths were not based upon a proposed design depth for the ponds. If the work was completed pursuant to OCD requirements, it would have been completed based upon an OCD approved boring plan. Please modify appropriately and present the information based upon the facts.

Response:
The response has been updated to clarify that boreholes WB4 #1 and WB4 #2 were not considered for approval by OCD. The response states that four boreholes were drilled in February 2012 and March 2012 pursuant to the Hydrogeologic Investigation Work Plan approved by OCD. Although boreholes WB4 #1 and WB4 #2 were not drilled with OCD approval, they were utilized in the analysis for the purpose of expanding our knowledge of subsurface conditions at the site.

124. The first sentence of the second paragraph states "Groundwater was encountered at two borehole locations, B-3 and B-4." Figure 1 and Borehole log for B-3 in Appendix K, demonstrates that ground water was not encountered in Borehole B-3, but in Borehole B-1 instead. Figure 1 illustrates that B-3 is located approximately 600 feet east of the nearest proposed pond, east of the tank battery. Please modify the written text in this section to reflect the information provided in the supporting documentation. Borehole B-1, not B-3, is located approximately 85 feet west of the proposed pond as stated in the second sentence. Please modify appropriately. The third sentence states "Due to ground water being encountered, a monitoring well was installed at the Borehole B-3 location." Please provide the correct borehole, B-1,

reference. The information provided in this section did not indicate or suggest that a monitoring well was installed at Borehole B-4 due to ground water being discovered. The OCD approved boring plan for Borehole B-4 required the installation of a monitoring well if ground water was encountered. Please provide a clarifying statement regarding this issue.

Response:
All references to groundwater being encountered at B-3 have been removed from the response. The response now states that groundwater was encountered at B-1 and B-4. A water quality analysis was performed on water samples taken from B-1 and B-4. The results of this analysis are provided in Attachment 2 of the Hydrogeologic Investigation Report.

Page 2, Discussion of Results, Water Quality Analysis:

125. The first sentence of the first paragraph identifies Borehole B-3 as the location in which a monitoring well was installed. Please modify the written text in permit application to reflect the information provided in the supporting documentation of Appendix K, which demonstrates that Borehole B-1, not B-3, as the location in which a monitoring well was installed. OCD is unsure why a ground water sample from B-1 was obtained and analyzed when the supporting documentation does not demonstrate that it is the shallowest fresh water aquifer beneath the proposed site. None of the ponds are proposed in the location of Borehole B-1 in which the aquifer was sampled. Ground water was discovered in Borehole B-4 which is approximately 15 to 20 feet west of the nearest proposed pond, within the proposed exterior slope of the pond. OCD is unsure if a monitoring well was installed in the Borehole B-4 location, as required by the OCD approved boring plan since ground water was encountered, but it was not sampled for this demonstration. The section titled *Aquifer Description* argues that the ground water discovered in B-4 is the basis for siting the ponds. Pursuant to Paragraph (5) of 19.15.36.13.A NMAC, "No other surface waste management facility shall be located where ground water is less than 50 feet *below the lowest elevation at which the operator will place oil field waste."* Borehole B-4 is within 20 feet or less of the nearest pond in which *"the operator will place oilfield waste."* Also, please see comments below on the review of the *Aquifer Description* section. Please make the appropriate modifications based upon the comments provide in this section and the section titled *Aquifer Description.* The third sentence of the first paragraph states "A laboratory analysis that focused on major cations and anions; benzene, toluene, ethyl benzene and xylenes (BTEX); RCRA metals; and total dissolved solids (TDS) was performed on a ground water sample taken from this location." The analytical results provided in Attachment 2 of Appendix K only provided results for BTEX, GRO - Gas Range Organics, and DRO - Diesel Range Organics. No other results are provided. Please obtain a sample from the B-4

monitoring well and provide all of the required analytical results for the permit application.

Response:
All references to groundwater being encountered at B-3 have been removed from the response. The response now states that groundwater was encountered at B-1 and B-4. A water quality analysis was performed on water samples taken from B-1 and B-4. A permanent groundwater monitoring well was not installed at B-4 due to its location within the limits of construction of the proposed ponds. However, a monitoring well will be installed at this location following construction and prior to operation of the facility. Table 1 located within the Hydrogeologic Investigation Report provides a summary of the results of the water quality analysis that includes all of the required analytical results for the permit application. Attachment 2 of the Hydrogeologic Investigation Report contains the actual results from the groundwater quality analysis.

126. The first sentence of the second paragraph states "As evidenced in the water quality analysis results, the ground water at the B-3 location satisfies all fresh water requirements in 20.6.2.3103 NMAC with the exception of Chromium limit. The requirements of 20.6.2.3103 NMAC identify human health standards, other standards for domestic water supply, and standards for irrigation use that used to determine if a proposed direct or indirect discharge into ground water requires a permit pursuant to the New Mexico Water Quality Control Commission Regulations 20.6.2 NMAC. Table I in Appendix K demonstrates that only 12 of the 48 constituents identified in Subsections A, B, and C of 20.6.2.3103 NMAC were analyzed. Pursuant to Subparagraph *(b)* of 19.15.36.8.C (15) NMAC, the application shall include "laboratory analyses, performed by an independent commercial laboratory, for *major cations and anions; BTEX; RCRA metals; and TDS of ground water samples of the shallowest fresh water aquifer beneath the proposed site."* Please only provide the information required in the permit application in accordance with 19.15.36 NMAC.

Response:
The response has been updated to remove the groundwater comparison to the constituents identified in Subsections A, B, and C of 20.6.2.3103 NMAC. Table 1 located within the Hydrogeologic Investigation Report provides a summary of the results of the water quality analysis that includes all of the required analytical results for the permit application in accordance with 19.15.36 NMAC. Attachment 2 of the Hydrogeologic Investigation Report contains the actual results from the groundwater quality analysis.

Page 2, Discussion of Results, Aquifer Description:

127. The first sentence of the first paragraph describes the shallow ground water discovered in Borehole B-1 (incorrectly identified as B-3) at 49.7 feet below the ground surface (bgs) or at a mean sea level (msl) of the 6,948.3 feet. The second sentence identifies ground water discovered in Borehole B-4 at 77.7 feet bgs or at a mean sea level of the 6,912.3 feet. The wells or boreholes are approximately 65 feet apart from each other. As proposed in this section of the permit application, the ground water elevation of B-1 drops approximately 36 feet in elevation over a surface distance of 65 feet to B-4. The proposed hypothesis and conclusion of the ground water assessment states "The reason for this drastic change in ground water elevation between these two boreholes is that the bedrock shelf and corresponding groundwater elevation dive deeply from B-3 to B-4. The shallow aquifer at this location appears to be unconfined and follows a rock shelf formation to a deeper shallow aquifer surface that was not encountered." This is not supported by the information provided in Appendix K. Figure 2 illustrates the geologic cross-section and the relationships between B-1, B-4, WB4 #2 and B-3. Starting from the left side of the geologic cross-section on Figure 2, B-1 illustrates that ground water was encountered above or on top of the shale formation at a msl elevation of 6945 feet. The shale formation, which would most likely be a claystone or siltstone, extends west-east toward the ephemeral drainage/watercourse. Figure 2 illustrates that the top of the shale does not" dive deeply" from B-1 to B-4 nor does "shallow aquifer" follow "a rock shelf formation to a deeper shallow aquifer." The geologic cross-section of Figure 2 and the lithologic log for Borehole B-4 both illustrate that ground water was encountered approximately 37 feet below the top of the 12 foot thick shale formation, not on top of the shale formation where the ground water was encountered in B-1. All of the boreholes on the west side of the ephemeral drainage/watercourse were drilled through the shale formation except Borehole B-1, which was the only location in which ground water was encountered on top or above the shale formation. This contradicts the proposed assessment that the "shallow aquifer at this location ... follows a rock shelf formation to a deeper shallow aquifer surface that was not encountered." The information provided in Appendix K does not support the hypothesis and conclusion of the aquifer description. The subsurface geology does not support that B-1 and B-4 are hydraulically connected. A comparison of ground water quality results from B-1 and B-4 would either confirm that the ground water beneath the proposed site is hydraulically connected or separate water bearing zones. Please provide the comparison and modify the response appropriately, if necessary.

Response:

The response has been updated to include groundwater quality analysis for samples taken from B-1 and B-4. Table 1 located within the Hydrogeologic Investigation

Report provides a summary of the results of the water quality analysis that includes all of the required analytical results for the permit application. Attachment 2 of the Hydrogeologic Investigation Report contains the actual results from the groundwater quality analysis. Additionally, the response has been updated to include an explanation for the difference in groundwater elevation between the B-1 and B-4 locations.

Page 3, Discussion of Results, Geologic Cross-Section; and Discussion of Results, Potentiometric Map:

128. The last sentence of this paragraph states "These geologic cross sections include subsurface soil stratigraphy along with the projected ground water surface elevation and are shown on Figure 2 and 3." The projected ground water surface elevation illustrated on Figures 2 and 3 is not supported by the information provided in Appendix K. Both Figure 2 and Figure 3 illustrate that the ground water bearing zones encountered in B-1 and B-4 are separated by a 10 to 12 foot shale formation but are identified as hydraulically connected. Borehole B-1 is approximately 65 feet west of B-4 and the geologic cross-sections indicate the presence of two separate aquifers, with the shallow aquifer of B-1 as being a perched aquifer on top of the shale formation and the deeper aquifer of B-4 being located beneath the shale formation in a sandstone formation. The projected ground water surface elevation between B-4 and WB4 #2 on Figure 2 is not supported by any real data. Borehole WB4 #2 was drilled to a total depth of 68.2 feet or a msl elevation of 6929.8. The projected ground water surface elevation of WB4 #2 on Figure 2 has a msl elevation of 6813 feet, which is 116.8 feet deeper than the borehole was drilled. Borehole B-3 was drilled to a total depth of 75 feet or a msl elevation of 6905 feet. The projected ground water surface elevation of B-3 on Figure 2 has a msl elevation of 6815 feet or 90 feet deeper than the borehole was drilled. On Figure 3, the projected ground water surface elevation of WB4 #1 has a msl elevation of 6830 feet, which is approximately 100 feet deeper than the borehole was drilled. Borehole B-2 was drilled to a total depth of 55 feet or a msl elevation of 6902 feet. The projected ground water surface elevation of B-2 on Figure 3 has a msl elevation of 6810 feet or 92 feet deeper than the borehole was drilled. On average, the proposed projected ground water surface elevations illustrated on Figures 2 and 3 are at least 90 feet deeper than the subsurface investigation was performed. There is no data to support that ground water will be encountered at the proposed elevations As stated above in the *Aquifer Description* comments, all of the boreholes on the west side of the ephemeral drainage/watercourse were drilled through the shale formation except Borehole B-1 which was the only location in which ground water was encountered on top or above the shale formation. This contradicts the proposed assessment that the "shallow aquifer at this location...follows a rock shelf formation to a deeper shallow aquifer surface that was not encountered." The information provided in

Appendix K does not support the proposed projected ground water surface elevations. The subsurface geology does not support that B-1 and B-4 are hydraulically connected. Please address the issues regarding the proposed projected ground water surface elevations.

Response:

The Potentiometric Map section of the Hydrogeologic Investigation Report has been updated to include an explanation regarding the known and estimated groundwater elevations within the project area. It is OCD's opinion that the groundwater at B-1 and B-4 is not hydraulically connected. However, the groundwater encountered at Boreholes B-1 and B-4 is most likely hydraulically connected. This assumption is supported by similarities in water chemistry at each location as shown in Table 1 of the Hydrogeologic Investigation Report as well as the close proximity between the two locations. If it is assumed that the groundwater encountered at Borehole B-1 was a perched aquifer located above the confining shale layer, it is expected that this perched aquifer would also be encountered at Borehole B-4. However, no groundwater was encountered above the shale layer at Borehole B-4. Therefore, the groundwater encountered above the shale layer at Borehole B-1 is most likely hydraulically connected with the groundwater encountered below the shale layer at Borehole B-4. The change in groundwater elevation between both locations occurs because the shale layer is most likely a fractured bedrock layer and does not act as a continuous confining layer. The absence of groundwater at the Borehole B-2, B-3, WB4 #1, and WB4 #2 locations indicates that the groundwater surface continues deeper to the east of the B-4 location. The groundwater surface is then expected to flatten in a fashion similar to the topography of the ground surface. It should be noted that the groundwater surface at these locations is not known, and therefore, an estimated groundwater surface elevation was assumed at these locations. A shallow aquifer potentiometric surface map was developed for the proposed location based on the known and expected groundwater surface elevations. This map is located on Figure 4 of the Hydrogeologic Investigation Report and includes both the known groundwater surface between the Borehole B-1 and B-4 locations as well as the estimated groundwater surface at the Borehole B-2, B-3, WB4 #1, and WB4 #2 locations.

Page 5, Table 1:

129. The summary of the results provided on Table 1 do not coincide with the laboratory results provided in Attachment 2 of Appendix K. The analytical results provided in Attachment 2 of Appendix K only provided results for BTEX, GRO - Gas Range Organics, and DRO - Diesel Range Organics. The laboratory results for other constituents identified on Table 1 are not provided in the permit application. Also, the water sample that was analyzed was obtained from B-1 which is approximately 85

feet west of the nearest proposed pond. The sample should have been taken and should be taken from B-4. Borehole B-4 is 20 feet west of the nearest pond. The ground water encountered at B-4 is used to demonstrate the 50 foot plus separation from the lowest elevation at which the operator will place oil field waste. Pursuant to Subparagraph (b) of 19.15.36.8.C (15) NMAC, the application shall include "laboratory analyses, performed by an independent commercial laboratory, for *major cations and anions; BTEX; RCRA metals; and TDS of ground water samples of the shallowest fresh water aquifer beneath the proposed site."* Please provide laboratory results from B-4, including the associated QA/QC reports and chain-of-custody. Also, a comparison of ground water quality results from B-1 and B-4 would either confirm that the ground water beneath the proposed site is hydraulically connected or separate water bearing zones. Please provide the comparison and modify the response appropriately, if necessary.

Response:
Table 1 of the Hydrogeologic Investigation Report has been updated to include a summary of the laboratory analyses for major cations and anions; BTEX; RCRA metals; and TDS of the groundwater that was encountered. Groundwater from B-4 has been sampled, and the results are summarized in Table 1 along with the results from B-1. The results of these tests have been included in Attachment 2 of the Hydrogeologic Investigation Report.

Figures, Figure 1, Hydrogeologic Investigation, Borehole Locations:

130. As identified by the title of Figure I, the satellite or aerial image provides a detailed overlay of the proposed layout of the facility and identifies the boreholes, the borehole depth, ground water depth, and ground water elevation. The reason this figure is discussed is due to Borehole B-1 is consistently referred to as Borehole B-3 throughout the permit. As illustrated on Figure 1, ground water was encountered in B-1 and B-4. Borehole B-3 is located on the east side of the ephemeral drainage/watercourse and the note on the figure indicates that ground water was "not encountered." Please perform a universal search for "B-3" throughout the permit application (including tables) and verify if the discussion is appropriate or if it is referring to the ground water encountered in Borehole B-1. Please make the appropriate modifications.

Response:
All references to groundwater being encountered at B-3 have been removed from the response. The response now states that groundwater was encountered at B-1 and B-4.

Figures, Figure 2 and 3, Hydrogeologic Investigation, Geologic Cross Sections 1 and 2:

131. The hypothesis, provided in the *Aquifer Description* section of Appendix K, that the shallow ground water encountered in B-1 is hydraulically connected to the ground water encountered in B-4 based upon a proposal that the "shallow aquifer at this location...follows a rock shelf formation to a deeper shallow aquifer surface that was not encountered". Both Figure 2 and Figure 3 illustrate that the ground water bearing zones encountered in B-1 and B-4 are separated by a 10 to 12 foot shale formation. Borehole B-1 is approximately 65 feet west of B-4 and the geologic cross-sections indicate the presence of two separate aquifers, with the shallow aquifer of B-1 as being a perched aquifer on top of the shale formation and the deeper aquifer of B-4 being located beneath the shale formation in a sandstone formation. All of the boreholes on the west side of the ephemeral drainage/watercourse were drilled through the shale formation except Borehole B-1 which was the only location in which ground water was encountered on top or above the shale formation. The information provided in Appendix K does not support the proposed projected ground water surface elevations as illustrated on Figures 2 and 3. The subsurface geology does not support that B-1 and B-4 are hydraulically connected. Please address the issues regarding the proposed projected ground water surface elevations.

Response:

The groundwater encountered at Boreholes B-1 and B-4 is most likely hydraulically connected. This assumption is supported by similarities in water chemistry at each location as shown in Table 1 of the Hydrogeologic Investigation Report as well as the close proximity between the two locations. If it is assumed that the groundwater encountered at Borehole B-1 was a perched aquifer located above the confining shale layer, it is expected that this perched aquifer would also be encountered at Borehole B-4. However, no groundwater was encountered above the shale layer at Borehole B-4. Therefore, the groundwater encountered above the shale layer at Borehole B-1 is most likely hydraulically connected with the groundwater encountered below the shale layer at Borehole B-4. The change in groundwater elevation between both locations occurs because the shale layer is most likely a fractured bedrock layer and does not act as a continuous confining layer. As a result, the shale layer allows the groundwater surface elevation to dive between the two locations. The absence of groundwater at the Borehole B-2, B-3, WB4 #1, and WB4 #2 locations indicates that the groundwater surface dives to the east of the B-4 location. The groundwater surface is then expected to flatten in a fashion similar to the topography of the ground surface. It should be noted that the groundwater surface at these locations is not known, and therefore, an estimated groundwater surface elevation was assumed at these locations.

Figures, Figure 4, Hydrogeologic Investigation, Potentiometric Map:

132. Please see the comments above for Figures 2 and 3. The information provided in Appendix K does not support the proposed projected ground water surface elevations as illustrated on the potentiometric map, Figure 4. Please address the issues regarding the proposed projected ground water surface elevations and the development of a potentiometric map.

Response:

The Potentiometric Map located on Figure 4 of the Hydrogeologic Investigation Report has remained the same. It is OCD's opinion that the groundwater at B-1 and B-4 is not hydraulically connected. However, the groundwater encountered at Boreholes B-1 and B-4 is most likely hydraulically connected. This assumption is supported by similarities in water chemistry at each location as shown in Table 1 of the Hydrogeologic Investigation Report as well as the close proximity between the two locations. If it is assumed that the groundwater encountered at Borehole B-1 was a perched aquifer located above the confining shale layer, it is expected that this perched aquifer would also be encountered at Borehole B-4. However, no groundwater was encountered above the shale layer at Borehole B-4. Therefore, the groundwater encountered above the shale layer at Borehole B-1 is most likely hydraulically connected with the groundwater encountered below the shale layer at Borehole B-4. The change in groundwater elevation between both locations occurs because the shale layer is most likely a fractured bedrock layer and does not act as a continuous confining layer. As a result, the shale layer allows the groundwater surface elevation to dive between the two locations. The absence of groundwater at the Borehole B-2, B-3, WB4 #1, and WB4 #2 locations indicates that the groundwater surface dives to the east of the B-4 location. The groundwater surface is then expected to flatten in a fashion similar to the topography of the ground surface. It should be noted that the groundwater surface at these locations is not known, and therefore, an estimated groundwater surface elevation was assumed at these locations. The potentiometric surface map was developed for the proposed location based on the known and expected groundwater surface elevations. This map includes both the known groundwater surface between the Borehole B-1 and B-4 locations as well as the estimated groundwater surface at the Borehole B-2, B-3, WB4 #1, and WB4 #2 locations.

Attachment 2; Ground Water Quality Analysis Results:

133. OCD is unsure why a ground water sample from B-1 was obtained and analyzed when the supporting documentation does not demonstrate that it is the shallowest fresh water aquifer beneath the proposed site. None of the ponds are proposed in the location of Borehole B-1 in which the aquifer was sampled. Ground water was discovered in Borehole B-4 which is approximately 15 to 20 feet west of the nearest

proposed pond, within the proposed exterior slope of the pond. OCD is unsure if a monitoring well was installed in the Borehole B-4 location, as required by the OCD approved boring plan since ground water was encountered, but it was not sampled for this demonstration. The section titled *Aquifer Description* argues that the ground water discovered in B-4 is the basis for siting the ponds. Pursuant to Paragraph (5) of 19.15.36.13.A NMAC, "No other surface waste management facility shall be located where ground water is less than 50 feet *below the lowest elevation at which the operator will place oil field waste."* Borehole B-4 is within 20 feet or less of the nearest pond in which *"the operator will place oilfield waste."* Also, the analytical results provided in Attachment 2 of Appendix K only provided results for BTEX, GRO - Gas Range Organics, and DRO - Diesel Range Organics. No other results are provided. Please obtain a sample from the B-4 monitoring well and provide all of the required analytical results including the associated *QA/QC* reports and chain-of-custody for the permit application.

Response:

The response has been updated to include groundwater quality analysis for samples taken from B-1 and B-4. Table 1 located within the Hydrogeologic Investigation Report provides a summary of the results of the water quality analysis that includes all of the required analytical results for the permit application. Attachment 2 of the Hydrogeologic Investigation Report contains the actual results from the groundwater quality analysis along with QA/QC reports and chain-of-custody.

It is our sincere hope that these comments have been adequately addressed and that the application for a centralized surface waste facility permit for East Blanco Produced Water Reuse Facility be approved as soon as possible. Please do not hesitate to contact us should you have any further questions or require additional clarification.

Sincerely,

Shawn Higley, P.E.
Project Manager

cc: Black Hills

Encl.: As Noted

SH/mh

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PERMIT APPLICATION FOR
The East Blanco Produced Water Reuse Facility

Prepared for:

New Mexico Energy, Minerals, & Natural Resources Department
Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, NM 87505

Black Hills Exploration & Production
A Black Hills Corporation Enterprise

Black Hills Gas Resources
3200 N. 1st Street
Bloomfield, NM 87413

Prepared By:

WWC ENGINEERING

1275 Maple Street, Suite F
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INTRODUCTION

This report provides information on the proposed East Blanco Produced Water Reuse Facility in Rio Arriba County, NM. Information presented herein demonstrates compliance with the Form C-137 Application for Surface Waste Management Facility. The proposed facility consists of three independent storage ponds and is considered a centralized surface waste management facility that will be used exclusively by Black Hills Gas Resources' surrounding oil and gas operations. The proposed facility is designed for the storage and reuse of produced water. The following provides a list and description of the proposed facility's compliance to each application requirement.

DEMONSTRATION OF COMPLIANCE

1. **Application:** New
   This application is for permitting a new facility.

2. **Type:** Other
   This facility is a produced water reuse facility consisting of three independent lined ponds. Produced water from the surrounding oil and gas operations will be the primary type of waste received at this facility.

3. **Facility Status:** Centralized
   This facility is considered a centralized facility and will be used exclusively by one waste generator. The generator or operator will not receive compensation for oil field waste management at the facility, and the facility will only receive oil field wastes that are generated from oil and gas production.

4. **Operator:** Black Hills Gas Resources
   Address: 3200 N. 1st Street, Bloomfield, NM 87413
   Contact Person: Gary Stripling
   Phone: (505) 634-5101

   Black Hills Gas Resources is the operating name of Black Hills Exploration & Production within the San Juan Basin of New Mexico. Black Hills Exploration & Production is a subsidiary of Black Hills Corporation.

5. **Location:** NE/4 NW/4, SE/4 NW/4, NW/4 NE/4, SW/4 NE/4 Section 13, Township 30 North, Range 4 West

6. **Is this an existing facility?**
   This is not an existing facility. This application is for permitting a new facility.

7. **Attach the names and addresses of the applicant and principal officers and owners of 25 percent or more of the applicant. Specify the office held by each officer and identify the individual(s) primarily responsible for overseeing management of the facility.**

Principal Owner:

Black Hills Gas Resources
3200 N. 1st Street
Bloomfield, NM 87413

Black Hills Gas Resources is the operating name of Black Hills Exploration & Production within the San Juan Basin of New Mexico. Black Hills Exploration & Production is a subsidiary of Black Hills Corporation. Black Hills Gas Resources is a publicly traded company with a New York Stock Exchange ticker symbol of BKH. Therefore, the company is owned by various owners as with any publicly traded company.

Vice President of Black Hills Exploration and Production:

John Benton
1515 Wynkoop Street
Suite 500
Denver, CO 80202

Facility Supervisor:

Gary Stripling
3200 N. 1st Street
Bloomfield, NM 87413

Production Superintendent:

Bruce Voiles
3200 N. 1st Street
Bloomfield, NM 87413

8. **Attach a plat and topographic map showing the surface waste management facility's location in relation to governmental surveys (quarter-quarter section, township and range); highways or roads giving access to the surface waste management facility site; watercourses; fresh water sources, including wells and springs; and inhabited buildings within one mile of the site's perimeter.**

The proposed facility's location is shown in relation to Dulce, NM on Exhibit 1. Exhibit 2 provides the proposed facility layout and includes contours generated from a topographic survey of the area. Exhibit 3 shows the facility layout on a USGS topographic quad map. Exhibit 5 includes a USGS topographic quad map that contains all areas within 1-mile of the proposed facility. The proposed fence surrounding the facility will serve as the facility boundary. Exhibit 5 also includes the road used to access the facility as well as the proposed facility location in

relation to the quarter-quarter, section, township, and range. The locations of Mud Spring as well as the ephemeral drainages within Cabresto Canyon, Espinosa Canyon, Maestas Canyon, and Augustine Canyon are all included within this exhibit. A survey plat of the proposed location is included in Appendix E.

9. **Attach the names and addresses of the surface owners of the real property on which the surface waste management facility is sited and surface owners of the real property within one mile of the site's perimeter.**

Exhibit 6 provides a map showing the names and addresses of all surface owners within one mile of the proposed facility.

10. **Attach a description of the surface waste management facility with a diagram indicating the location of fences and cattle guards, and detailed construction/installation diagrams of pits, liners, dikes, piping, sprayers, tanks, roads, fences, gates, berms, pipelines crossing the surface waste management facility, buildings and chemical storage areas.**

The proposed produced water reuse facility consists of three independent ponds that are designed to function as three separate ponds. A fence surrounding the proposed facility will serve as the facility boundary. This boundary will encompass the three separate ponds as well as a topsoil and excess excavation stockpile area. The proposed facility is located approximately 11.6 miles southwest of Dulce, New Mexico in Section 13, T30N R4W as shown on Exhibit 1. Exhibit 2 shows the proposed site layout of the facility. As shown, the proposed facility is located approximately 450 feet west of an existing tank battery facility owned by Black Hills Gas Resources. The site is accessed via a 450-foot proposed access road connecting to the existing tank battery facility.

Produced water from the surrounding oil and gas operations will be the primary type of waste received at this facility. A pipeline connected to the existing tank battery facility located approximately 450 feet east of the proposed facility will transport the produced water to the ponds. Prior to storage, the produced water will be treated with an oil skimmer and particulate filter at the existing tank battery facility. Drilling mud and drilling fluids will not be disposed of within the proposed facility.

The East Blanco Produced Water Reuse Facility is designed for the storage and reuse of produced water from surrounding oil and gas operations. A pipeline connected to the existing tank battery facility located approximately 450 feet east of the proposed facility will transport the produced water to the ponds. Prior to storage, the produced water will be treated with an oil skimmer and particulate filter at the existing tank battery facility. After storage, the water will be evacuated via suction pump and pipeline to an existing header pipeline system at the tank battery facility. The header pipeline system will connect to new oil and gas well locations via surface casing. The individual ponds within the proposed facility will be constructed using a dual layer HDPE geomembrane liner system to prevent

exfiltration, and a geonet transmission layer is included in the liner system to provide a means for leak detection.

Each individual pond has a total volume of 9.99 acre-feet including 3 feet of freeboard (7.46 acre-feet excluding freeboard). The total capacity of the 3 ponds within the facility is 22.38 acre-feet. Projected inflows are 1,500 barrels (bbl) per day for the entire facility. Water balances were performed based on estimated produced water and precipitation inflows, calculated evaporation rates, and the assumption that all 3 ponds were to be evacuated at the end of a three month period. These water balances were performed for the three-month period with the lowest evaporation rates, November through January, and for the three-month period with the highest evaporation rates, April through June. These water balances are presented in Table 1 and Table 2 located immediately after the References section of this permit application.

Evaporation rates used in the water balance were obtained by averaging pan evaporation rates from Abiquiu Dam (56 miles southwest of the facility, 6200 ft elevation), El Vado Dam (30 miles west southwest of the facility, 6900 ft elevation), and Navajo Dam (24 miles west of the facility, 6100 ft elevation). Two of these sights lie to the west of mountain ranges, similar to the facility. A conservative pan evaporation rate was obtained by multiplying this average value by a pan factor of 0.7, and the rate is expected to be higher than those used in the water balance. Precipitation values were obtained from the Western Regional Climate Center (WRCC) Dulce, NM meteorological site located approximately 11.6 miles northeast of the proposed facility. The monthly average data period of record for this site is 6/1/1906 to 12/31/2005.

The earthwork and grading design of the facility has been performed to ensure compliance with 19.15.36 NMAC guidelines and general engineering practices. All interior pond levee slopes are designed at 2H:1V, and all exterior levee slopes are designed at 3H:1V. 24-foot wide levees with 12-foot wide access roads surround each pond and provide a means for maintenance and inspection of the facility. Detailed construction/installation diagrams for the pond slopes, levees, and roads are provided in Appendix A.

To comply with Surface Waste Management Facility storage pond guidelines, the liner system consists of 60-mil HDPE primary (upper) and secondary (lower) geomembrane liners with maximum hydraulic conductivities no greater than 1×10^{-9} cm/sec. Prior to placement of the secondary liner, a non-woven geotextile will be installed directly on the subgrade to prevent liner damage from rocks or sharp edges. A 200-mil geonet, with a saturated hydraulic conductivity of 35.8 cm/sec, will be placed between the primary and secondary liners and will act as a transmission layer for the leak detection system. The transmissivity, or the rate at which water flows through this layer, is 20 cm^2/sec. The transmissivity of a 2-foot thick compacted soil transmission layer, with a minimum saturated hydraulic conductivity of 1×10^{-5} cm/sec as required in 19.15.36.17 NMAC, is 6.1×10^{-4} cm^2/sec. A comparison of these two drainage layer alternatives indicates that the

geonet provides a quicker means of leak detection than the compacted soil layer. The interior sub-grade slope of each pond is sloped 2.46% toward one corner containing an 8'x8' leak detection sump placed between the two geomembrane liners. A 6" diameter, Schedule 80 PVC pipe with a slotted and capped end connects to the sump. This leak detection pipe then runs up the interior slope of each pond in between the primary and secondary liners to provide a means for leak detection.

To comply with the 19.15.36 NMAC requirement that external discharge or suction lines shall not penetrate the liner, a pump house containing an 7.5 horsepower self priming pump will be placed on the levee of each individual pond with a 12" diameter HDPE suction pipe running down the interior slope of the pond above the primary liner. The suction pipe will be anchored to the pond bottom via a 2 foot concrete block to prevent the bottom end of the pipe from floating to the water surface. A 12" diameter HDPE supply line will run approximately 2 feet down (horizontally) the interior slope of each pond above the primary liner. Both pipes will be restrained at the pump house to restrict movement and eliminate wear on the liner. HDPE is specified for these pipes due to their possible exposure to sunlight. Once underground, both pipes will connect to pipelines located at the existing tank battery facility adjacent to the proposed facility.

The facility layout, fence locations, pond levees, and drainage ditch locations are shown on Sheet P-2 of the Engineering Drawings included in Appendix A. Piping and pump house locations are shown on Sheet P-2 of the Engineering Drawings. Piping, liner system, pump, and sump details are provided in Sheets D-1, D-2, and D-3 of the Engineering Drawings.

Technical Specifications for the major components to be constructed are included in Appendix B. No specification has been included for the work required to provide electrical service to the pumps and pump houses. It is anticipated that Black Hills Gas Resources will hire an electrical contractor to install required electrical facilities prior to the start of construction on the ponds. All electrical services and wiring will be installed according to applicable NEC and local codes.

Black Hills Gas Resources will install bird netting with a 2" square mesh or smaller to prevent birds from landing on the pond surfaces. No specification for bird netting has been added to the Technical Specifications located in Appendix B. All necessary product information is provided on Sheet D-10 of the Engineering Drawings located in Appendix A.

11. Attach engineering designs, certified by a registered professional engineer, including technical data on the design elements of each applicable treatment, remediation and disposal method and detailed designs of surface impoundments.

Engineering design plans certified by a professional engineer are included in Appendix A. The design plans address dike protection and structural integrity; leak detection, including an adequate fluid collection and removal system; liner specifications and compatibility; and freeboard and overtopping prevention. Manufacturer's specification sheets for the geomembrane liner, geotextile, and geonet leak detection layer are provided in Sections 02206, 02208, and 02210 in the Technical Specifications located in Appendix B.

12. Attach a plan for management of approved oil field wastes that complies with the applicable requirements contained in 19.15.36.13, 19.15.36.14, 19.15.36.15 and 19.15.36.17 NMAC.

An Operation, Inspection and Maintenance Plan is attached in Appendix F for the proposed facility. This plan addresses the management of approved oil field wastes. The following list describes compliance with the applicable requirements contained in 19.15.36.13, 19.15.36.14, 19.15.36.15 and 19.15.36.17 NMAC.

- *Section 19.15.36.13.D – The operator shall not accept oil field wastes transported by motor vehicle at the surface waste management facility unless the transporter has a form C-133, authorization to move liquid waste, approved by the division.*

  Motor vehicles will not be used to transport waste to and from the proposed facility. Produced water will be transported to and from the proposed facility via pipelines connected to the existing tank battery facility located approximately 450 feet east of the proposed facility. The location of these pipelines is shown on Page P-2 of the Engineering Drawings located in Appendix A.

- *Section 19.15.36.13.E – The operator shall not place oil field waste containing free liquids in a landfill or landfarm cell. The operator shall use the paint filter test, as prescribed by the EPA (EPA SW-846, method 9095) to determine conformance of the oil field waste to this criterion.*

  The proposed facility is comprised of 3 separate lined ponds and is not considered a landfill or landfarm. The facility consists of storage ponds, and only produced water from surrounding oil and gas operations will be stored at the facility.

- *Section 19.15.36.13.F – Surface waste management facilities shall accept only exempt or non-hazardous waste, except as provided in Paragraph (3) of Subsection F of 19.15.36.13 NMAC. The operator shall not accept*

hazardous waste at a surface waste management facility. The operator shall not accept wastes containing NORM at a surface waste management facility except as provided in 19.15.35 NMAC. The operator shall require the following documentation for accepting oil field wastes, and both the operator and the generator shall maintain and make the documentation available for division inspection.

The proposed facility will accept and/or contain only produced water that will be recycled in future oil and gas operations. This produced water is considered an exempt oil field waste and will originate from Black Hills Gas Resources operations. Wastes containing NORM will not be placed in this facility. As specified in the Operation, Inspection and Maintenance Plan provided in Appendix F, a certification on form C-138, signed by Black Hills Gas Resources operators, will be maintained and made available for the Oil Conservation Division's inspection.

- *Section 19.15.36.13.F.1 - Exempt oil field wastes. The operator shall require a certification on form C-138, signed by the generator or the generator's authorized agent, that represents and warrants that the oil field wastes are generated from oil and gas exploration and production operations, are exempt waste and are not mixed with non-exempt waste. The operator shall have the option to accept such certifications on a monthly, weekly or per load basis. The operator shall maintain and shall make the certificates available for the division's inspection.*

  As specified in the Operation, Inspection and Maintenance Plan provided in Appendix F, a certification signed by Black Hills Gas Resources on form C-138 will be maintained stating that the oil field wastes are generated from oil and gas exploration and production operations, are exempt waste and are not mixed with non-exempt waste. The exempt waste stored at this facility will be generated by Black Hills Gas Resources, and therefore, certification will be accepted on a monthly basis. These certificates will be maintained and made available for the Oil Conservation Division's inspection.

- *Section 19.15.36.13.F.2 - Non-exempt, non-hazardous, oil field wastes. The operator shall require a form C-138, oil field waste document, signed by the generator or its authorized agent. This form shall be accompanied by acceptable documentation to determine that the oil field waste is non-hazardous.*

  No non-exempt oil field wastes will be stored at the proposed facility. The produced water that will be stored at this facility is considered an exempt oil field waste and will originate from Black Hills Gas Resources operations.

- *Section 19.15.36.13.F.3 - Emergency non-oil field wastes. The operator may accept non-hazardous, non-oil field wastes in an emergency if ordered by the department of public safety. The operator shall complete a form C-138, oil field waste document, describing the waste, and maintain the same, accompanied by the department of public safety order, subject to division inspection.*

  Black Hills will not accept any other waste other than produced water. The proposed facility does not have the containment features to accept waste streams other than produced water, and transportation and other additional costs would be required to move the additional waste types from the East Blanco facility to a facility that is permitted to accept such waste types.

- *Section 19.15.36.13.I – To protect migratory birds, tanks exceeding eight feet in diameter, and exposed pits and ponds shall be screened, netted or covered. Upon the operator's written application, the division may grant an exception to screening, netting or covering upon the operator's showing that an alternative method will protect migratory birds or that the surface waste management facility is not hazardous to migratory birds. Surface waste management facilities shall be fenced in a manner approved by the division.*

  Each pond within the facility will be covered with bird netting consisting of a 2" square mesh or smaller to prevent birds from landing on the pond surfaces. Sheet D-10 of the Engineering Drawings located in Appendix A provides the details of this netting system. The entire facility will be surrounded with a 6-foot, 6-wire fence to exclude livestock or wild animals. Sheet D-9 of the Engineering Drawings located in Appendix A provides fence details.

- *Section 19.15.36.13.J – Surface waste management facilities shall have a sign, readable from a distance of 50 feet and containing the operator's name; surface waste management facility permit or order number; surface waste management facility location by unit letter, section, township and range; and emergency telephone numbers.*

  Signs matching NMAC Section 19.15.36.13.J requirements will be placed in obvious locations on the fence surrounding the proposed facility. Requirements for sign locations and contents are provided in the Operation, Inspection and Maintenance Plan located in Appendix F.

- *Section 19.15.36.13.K – The operators shall comply with the spill reporting and corrective action provisions of 19.15.30 NMAC or 19.15.29 NMAC.*

  Spill reporting and corrective action provisions of 19.15.30 NMAC or 19.15.29 NMAC will be followed in the case of a spill. These requirements

are addressed on pages 4 and 5 in the Contingency Plan for Emergencies located provided in Appendix I.

- *Section 19.15.36.13.L – Each operator shall have an inspection and maintenance plan.*

  Inspection and maintenance requirements are provided in the Operation, Inspection and Maintenance Plan given in Appendix F.
- *Section 19.15.36.13.P – Training program. Each operator shall conduct an annual training program for key personnel that includes general operations, permit conditions, emergencies, proper sampling methods and identification of exempt and non-exempt waste and hazardous waste. The operator shall maintain records of such training, subject to division inspection, for five years.*

  An annual training program will be implemented by Black Hills Gas Resources. Details of this training program are provided on page 3 of the Operation, Inspection and Maintenance Plan located in Appendix F.

- *Section 19.15.36.17.B.1 – In general. The operator shall ensure each pit, pond and below-grade tank is designed, constructed and operated so as to contain liquids and solids in a manner that will protect fresh water, public health, safety and the environment.*

  Each pond within the proposed facility is designed with a double HDPE liner and leak detection system. These systems ensure that the facility poses no threat to fresh water, public health, safety or the environment.

- *Section 19.15.36.17.B.2 – Liners required. Each pit or pond shall contain, at a minimum, a primary (upper) liner and a secondary (lower) liner with a leak detection system appropriate to the site's conditions.*

  The liner system consists of a 60-mil HDPE primary (upper) liner, a 200-mil geonet leak detection layer, a 60-mil HDPE secondary (lower) liner, and a non-woven geotextile fabric to prevent liner damage from rocks or sharp edges. All layers will be anchored in a compacted earth-filled trench that is 24 inches deep. Manufacturer's specification sheets for the geomembrane liner, geotextile, and geonet leak detection layer are provided in Sections 02206, 02208, and 02210 in the Technical Specifications located in Appendix B. Each layer is shown on the Engineering Drawings located in Appendix A.

- *Section 19.15.36.17.B.3 – Liner specifications. Liners shall consist of a 30-mil flexible PVC or 60-mil HDPE liner, or an equivalent liner approved by the division. Synthetic (geomembrane) liners shall have a hydraulic conductivity no greater than 1 x 10^{-9} cm/sec. Geomembrane liners shall be composed of an impervious, synthetic material that is resistant to*

petroleum hydrocarbons, salts and acidic and alkaline solutions. Liner materials shall be resistant to ultraviolet light, or the operator shall make provisions to protect the material from sunlight. Liner compatibility shall comply with EPA SW-846 method 9090A.

The primary and secondary geomembrane liners consist of GSE Geomembrane liners or equivalent. These geomembranes are 60-mil HDPE liners with maximum hydraulic conductivities of 1 x 10^{-9} cm/sec. The liner materials are resistant to petroleum hydrocarbons, salts, UV light, and acidic and alkaline solutions. See Section 02206 of the Technical Specifications located in Appendix B for additional information. Liner details are shown on Sheet D-2 of the Engineering Drawings located in Appendix A.

- *Section 19.15.36.17.B.5 – Each pit or pond shall have a properly constructed foundation or firm, unyielding base, smooth and free of rocks, debris, sharp edges or irregularities, in order to prevent rupture or tear of the liner and an adequate anchor trench; and shall be constructed so that the inside grade of the levee is no steeper than 2H:1V. Levees shall have an outside grade no steeper than 3H:1V. The levees' tops shall be wide enough to install an anchor trench and provide adequate room for inspection and maintenance. The operator shall minimize liner seams and orient them up and down, not across a slope. The operator shall use factory seams where possible. The operator shall ensure field seams in geosynthetic material are thermally seamed (hot wedge) with a double track weld to create an air pocket for non-destructive air channel testing. A stabilized air pressure of 35 psi, plus or minus one percent, shall be maintained for at least five minutes. The operator shall overlap liners four to six inches before seaming, and orient seams parallel to the line of maximum slope, i.e., oriented along, not across, the slope. The operator shall minimize the number of field seams in corners and irregularly shaped areas. There shall be no horizontal seams within five feet of the slope's toe. Qualified personnel shall perform field seaming.*

  Section 02201 of the Technical Specifications located in Appendix B includes details on subgrade preparation. All interior levees are sloped at 2H:1V. All exterior levees are sloped at 3H:1V. These slopes are shown on Sheet XS-1 of the Engineering Drawings located in Appendix A. The interior surface of each pond will be inspected prior to liner installation to ensure the prepped ground surface is unyielding, smooth and free of rocks, debris, sharp edges, or irregularities. A non-woven geotextile fabric is to be placed directly over the finished ground prior to liner installation to prevent liner damage from rocks or sharp edges. 24 foot wide levees surround each pond to allow for anchor trenches and maintenance roads to be installed. All levee fills will be compacted to 95% Standard Proctor compaction in accordance with ASTM D698. Qualified personnel will perform the liner installation and field seaming. A construction inspector will ensure that

contractors will adhere to all 19.15.36 NMAC requirements. Anchor trenches will be constructed as shown on Sheet D-2 of the Engineering Drawings located in Appendix A. A proposed liner seam pattern is provided in Exhibit 7. Additional information along with the manufacturer's specifications for the geomembrane liner are provided in Section 02206 of the Technical Specifications located in Appendix B.

- *Section 19.15.36.17.B.6 – At a point of discharge into or suction from the lined pit, the liner shall be protected from excessive hydrostatic force or mechanical damage, and external discharge lines shall not penetrate the liner.*

  A pump house with a 7.5 horsepower self priming pump will be placed on the levee of each individual pond with a 12" diameter HDPE suction pipe running down the slope above the primary liner. A 12" diameter HDPE supply line will run partially down the slope of each pond above the primary liner. The pipes will be restrained at the pump house to restrict movement and eliminate wear on the liner. The Engineering Drawings located in Appendix A provide additional information.

- *Section 19.15.36.17.B.7 – Primary liners shall be constructed of a synthetic material.*

  The primary geomembrane liner consists of GSE Geomembrane liner or equivalent. This geomembrane is a 60-mil HDPE synthetic liner with a maximum hydraulic conductivity of 1×10^{-9} cm/sec. See Section 02206 of the Technical Specifications located in Appendix B for the manufacturer's specifications for the liner. Liner details are shown on Sheet D-2 of the Engineering Drawings located in Appendix A.

- *Section 19.15.36.17.B.8 – A secondary liner may be a synthetic liner or an alternative liner approved by the division. Secondary liners constructed with compacted soil membranes, i.e., natural or processed clay and other soils, shall be at least three feet thick, placed in six-inch lifts, and compacted to 95 percent of the material's standard proctor density, or equivalent. Compacted soil membranes used in a liner shall undergo permeability testing in conformity with ASTM standards and methods approved by the division before and after construction. Compacted soil membranes shall have a hydraulic conductivity of no greater than 1×10^{-8} cm/sec. The operator shall submit results of pre-construction testing to the division for approval prior to construction.*

  The secondary geomembrane liner consists of GSE Geomembrane liner or equivalent. This geomembrane is a 60-mil HDPE synthetic liner with a maximum hydraulic conductivity of 1×10^{-9} cm/sec. See Section 02206 of the Technical Specifications located in Appendix B for the manufacturer's

specifications for the liner. Liner details are shown on Sheet D-2 of the Engineering Drawings located in Appendix A.

- Section 19.15.36.17.B.9 – *The operator shall place a leak detection system between the lower and upper geomembrane liners that consists of two feet of compacted soil with a saturated hydraulic conductivity of 1 x 10^{-5} cm/sec or greater to facilitate drainage. The leak detection system shall consist of a properly designed drainage and collection and removal system placed above the lower geomembrane liner in depressions and sloped so as to facilitate the earliest possible leak detection. Piping used shall be designed to withstand chemical attack from oil field waste or leachate; structural loading from stresses and disturbances from overlying oil field waste, cover materials, equipment operation or expansion or contraction; and to facilitate clean-out maintenance. The material placed between the pipes and laterals shall be sufficiently permeable to allow the transport of fluids to the drainage pipe. The slope of the interior sub-grade and of drainage lines and laterals shall be at least a two percent grade, i.e., two feet vertical drop per 100 horizontal feet. The piping collection system shall be comprised of solid and perforated pipe having a minimum diameter of four inches and a minimum wall thickness of schedule 80. The operator shall seal a solid sidewall riser pipe to convey collected fluids to a collection, observation and disposal system located outside the perimeter of the pit or pond. The operator may install alternative methods as approved by the division.*

  The leak detection system consists of a GSE Geonet or equivalent placed between primary and secondary liners. This geonet is a 200-mil geonet with a saturated hydraulic conductivity of 35.8 cm/sec. The transmissivity, or the rate at which water flows through this layer, is 20 cm^2/sec. The transmissivity of a 2-foot thick compacted soil transmission layer, with a minimum saturated hydraulic conductivity of 1 x 10^{-5} cm/sec as required in 19.15.36.17 NMAC, is 6.1 x 10^{-4} cm^2/sec. A comparison of these two drainage layer alternatives indicates that the geonet provides a quicker means of leak detection than the compacted soil layer. Manufacturer's specifications are shown in Section 02210 of the Technical Specifications located in Appendix B. The interior sub-grade slope of each pond is 2.46% toward one corner with an 8' x 8' sump. A 6" diameter, Schedule 80 PVC pipe with a slotted and capped end connects to the sump. This leak detection pipe then runs up the interior slope of each pond in between the primary and secondary liners to provide a means for leak detection. The geonet specifications are provided in Section 02210 of the Technical Specifications located in Appendix B. The geonet, leak detection sumps, and leak detection pipes are shown on Sheet D-2 of the Engineering Drawings located in Appendix A.

- *Section 19.15.36.17.B.10 – The operator shall notify the division at least 72 hours prior to the primary liner's installation so that a division representative may inspect the leak detection system before it is covered.*

  Section 02206 of the Technical Specifications located in Appendix requires that the Oil Conservation Division be notified a minimum of 72 hours prior to installation of the leak detection system.

- *Section 19.15.36.17.B.11 – The operator shall construct pits and ponds in a manner that prevents overtopping due to wave action or rainfall, and maintain a three foot freeboard at all times.*

  Each pond will maintain 3 feet of freeboard throughout operation. A pressure transducer will be installed on the concrete anchor blocks located on each pond bottom to monitor the water level within each pond. Mounting the transducer to the concrete block will ensure that the pond liner's integrity will not be compromised. This transducer will communicate with a Programmable Logic Controller (PLC) system that will automatically shut off the pump supplying each pond to ensure that the water level does not encroach on the 3 foot freeboard requirement. The location of the pressure transducer is shown on Sheet D-1 of the Engineering Drawings located in Appendix A. The ponds will also be inspected on a regular basis by field personnel to ensure freeboard is being maintained. The Operation, Inspection and Maintenance Plan located in Appendix F provides inspection details.

- *Section 19.15.36.17.B.12 – The maximum size of an evaporation or storage pond shall not exceed 10 acre-feet.*

  Each individual pond has a volume of 9.97 acre-feet total volume including 3 feet of freeboard. Excluding freeboard, each pond has a volume of 7.46 acre-feet. 3D modeling software was used to determine each pond's total volume including 3 feet of freeboard. Volume reports generated for each pond are located in Appendix L.

- *Section 19.15.36.17.C.1 – The operator shall ensure that only produced fluids or non-hazardous waste are discharged into or stored in a pit or pond; and that no measurable or visible oil layer is allowed to accumulate or remain anywhere on a pit's surface except an approved skimmer pit.*

  Only produced water from surrounding Black Hills Gas Resources oil and gas operations will be stored at this facility. The produced water is considered an exempt oil field waste. A skimmer pit is not included as part of the design of this facility. The proposed ponds will be inspected on a daily basis by personnel for the presence of oil. If oil is observed the first step will be to immediately shut off the pumps supplying the facility and to remove the oil from the surface of the ponds so that no accumulation

occurs. Oil will be removed from the water surface via vacuum trucks and disposed of at an approved disposal facility. Additional in place remediation may include use of absorbent material to remove oil sheens from the ponds. Oil booms will be placed around discharge pipes in the ponds to contain oil discharges should they occur inside a smaller area. Once the oil has been removed from the ponds, necessary corrective measures will be taken to correct the source of the current oil presence and to prevent future instances from occurring. In the event of a major or unique event, additional equipment such as a floating pump may be employed to expedite oil removal. Details of these actions are given in the Operation, Inspection and Maintenance Plan located in Appendix F.

- *Section 19.15.36.17.C.4 – The division may approve spray systems to enhance natural evaporation. The operator shall submit engineering designs from spray systems to the division's environmental bureau for approval prior to installation. The operator shall ensure that spray evaporation systems are operated so that spray-borne suspended or dissolved solids remain within the perimeter of the pond's lined portion.*

  The facility consists of storage ponds (not evaporation ponds) for the purpose of storing produced water for reuse in oil and gas operations. Therefore, no spray system will be included in the facility's design.

- *Section 19.15.36.17.C.5 – The operator shall use skimmer pits or tanks to separate oil from produced water prior to water discharge into a pond. The operator shall install a trap device in connected ponds to prevent solids and oils from transferring from one pond to another unless approved in the surface waste management facility permit.*

  The gas/water separators at the gas well locations will serve as the primary treatment method for the produced water. Prior to storage at the facility, produced water will be treated with an oil skimmer and particulate filter at the adjacent tank battery facility. Oil is not expected to accumulate in the ponds, and therefore, skimmer pits and oil separators are not included in the facility's design.

13. Attach an inspection and maintenance plan that complies with the requirements contained in Subsection L of 19.15.36.13 NMAC.

The Operation, Inspection and Maintenance plan given in Appendix F complies with all requirements in Subsection L of 19.15.36.13. The plan specifies that the leak detection pipes will be inspected on a monthly basis. Records of the inspection dates, the inspector, and ground water monitoring wells' status will be kept. Any fluids present in the leak detection system will be sampled and sent to OCD. The current ground water quality was determined by analyzing samples from Borehole B-4, the location of which is shown on Figure 1 of the Hydrogeologic Investigation Report provided in Appendix K. The results from this

ground water quality analysis are provided in Appendix K. The pond levees and embankments will undergo a visual inspection on a quarterly basis and after major rainfall or windstorm events.

14. **Attach a hydrogen sulfide prevention and contingency plan that complies with those provisions of 19.15.11 NMAC that apply to surface waste management facilities.**

The Hydrogen Sulfide Prevention and Contingency Plan located in Appendix G satisfies the following provisions of 19.15.11 NMAC:

- A radius of exposure of 3000 feet is assumed.
- Due consideration of paragraph 7.6 was given of the guidelines in the API publication Recommended Practices for Oil and Gas Producing and Gas Processing Plant Operations Involving Hydrogen Sulfide, RP-55.
- Emergency procedures in case of the presence of hydrogen sulfide are included.
- Evacuation routes are provided.
- A list of emergency contacts is included.
- Characteristics of hydrogen sulfide are included.
- Training and drills for facility personnel are addressed.
- The activation level at which alarms will sound is included along with plans to implement emergency procedures.

15. **Attach a closure and post closure plan, including a responsible third party contractor's cost estimate, sufficient to close the surface waste management facility in a manner that will protect fresh water, public health, safety and the environment (the closure and post closure plan shall comply with the requirements contained in Subsection D of 19.15.36.18 NMAC).**

The Closure and Post Closure Plan provided in Appendix H includes a cost estimate provided by WWC Engineering. There are no requirements for storage ponds in Subsection D of 19.15.36.18. However, the plan specifies the following closure requirements contained in Subsections E and F of 19.15.36.18. NMAC:

- The operator will remove all remaining liquids and BS&W from the ponds prior to implementing a closure method and will dispose of the liquids and BS&W in a division-approved facility Liners will be disposed of in a division-approved surface waste management facility.

- The operator will remove the pond liner system and dispose of it in a division-approved facility. The site will be sampled in accordance with the division specified procedures.

- On-site equipment associated with the pond will be removed from the site.

- Upon removal of the pond liner, the site will be sampled in accordance with a gridded plat of the site containing four equal sections OCD has approved. Testing will be performed for TPH, BTEX, metals and other inorganics listed in Table 1 of the Closure and Post Closure Plan provided in Appendix H. The results will be compared to the natural background results obtained prior to construction of the facility to determine whether a release has occurred.

- If testing results do not indicate the presence of contamination, monitoring will continue on a yearly basis for the remaining two years of the three year post-closure care period. If there has been a release, the operator shall comply with the reporting and remediation requirements listed in the Contingency Plan for Emergencies given in Appendix I.

16. Attach a contingency plan that complies with the requirements of Subsection N of 19.15.36.13 NMAC and with NMSA 1978, Sections 12-12-1 through 12-12-30 as amended (the Emergency Management Act).

Refer to the Contingency Plan for Emergencies is provided in Appendix I for compliance with the requirements of Subsection N of 19.15.36.13 NMAC and with NMSA 1978, Sections 12-12-1 through 12-12-30. This plan includes the following information:

- The plan describes actions taken by facility personnel in response to fire, ›r releases to air, soil, surface water or ground water of or oil field waste containing constituents that could threaten ublic health, safety or the environment.

- Arrangements with local emergency response personnel and contact information are described.

- The emergency coordinator's name and contact information are provided.

- A list of emergency equipment maintained at the facility is provided.

- An evacuation plan and evacuation maps are included.

- The plan specifies where copies of the Contingency Plan for Emergencies will be located.

- The process for amendments to the plan is included.

- Immediate actions that will be taken by the facility workers and the emergency coordinator in case of an emergency are provided.

17. Attach a plan to control run-on water onto the site and run-off water from the site that complies with the requirements of Subsection M of 19.15.36.13 NMAC.

As shown on page P-2 of the Engineering Drawings provided in Appendix A, the pond surfaces are elevated approximately 5 to 22 feet above existing ground on the north, east, and south sides of the facility. Two 3-foot deep trapezoidal drainage ditches are located on the west side of the facility. The elevated pond surfaces and drainage ditches will protect all sides of the facility from run-on of surface water. For mitigation of storm water run-off, a Best Management Practice and Storm Water Management Plan is located in Appendix J. An erosion control plan is also provided on Sheet ER-1 of the Engineering Drawings located in Appendix A. The following list describes compliance with Subsection M of 19.15.36.13 NMAC.

- *Section 19.15.36.13.M.1 – The run-on and run-off control system shall prevent flow onto the surface waste management facility's active portion during the peak discharge from a 25-year storm.*

  The pond surfaces are elevated approximately 5 to 22 feet above existing ground on the north, east, and south sides of the facility. Additionally, 3-foot deep trapezoidal drainage ditches along the west side of the facility will prevent surface water run-on during the peak discharge from a 25-year storm. Each pond will maintain 3 feet of freeboard throughout operation and will prevent run-off from occurring from the facility's active portion from occurring. A hydraulic analysis was performed to ensure that the drainage ditches could adequately convey the peak discharge from a 25-year storm. The following provides information on how peak flows were obtained. Results from the hydraulic analysis are given in Appendix C.

  Using isopluvial maps from the National Oceanic and Atmospheric Administration (NOAA) Atlas 2 Volume 4 for New Mexico, the 25-year 24-hour and the 100-year 24-hour precipitation events are 2.2 inches and 2.8 inches respectively. The facility is protected from storm water run-on from the north, east, and south sides of the facility due to the pond surfaces being elevated approximately 5 to 22 feet above existing ground in those directions. The peak discharge from a 25 year storm was used to determine drainage ditch dimensions to protect the west side of the facility from storm water run-on. These ditches are labeled North Ditch and South Ditch on the Engineering Plans provided in Appendix A. With a drainage area of approximately 19 acres, a peak discharge of 125.7 cfs was used for the North Ditch. The South Ditch has a drainage area of approximately 17 acres and a peak discharge of 119.3 cfs. These peak discharges were obtained using the following regression equation:

$Q_{25} = 5.91*10^2*A^{0.44}$
Q_{25} = Peak discharge from a 25-year storm (cfs)
A = Drainage area (square miles).

The regression equation provides the peak discharge for small drainage basins in New Mexico with an area of 10 square miles or less and a mean basin elevation less than 7,500 feet. The regression equation was provided in a water-resources investigations report by Scott D. Waltemeyer and the U.S. Geological Survey in cooperation with the New Mexico State Highway and Transportation Department. Based on the attached hydraulic analysis results, a 3-foot deep trapezoidal drainage ditch with 2H:1V side slopes and a 3-foot bottom width adequately conveys both peak discharges and will protect the facility from the peak discharge resulting from a 25-year storm.

- *Section 19.15.36.13.M.2 – Run-off from the surface waste management facility's active portion shall not be allowed to discharge a pollutant to the waters of the state or United States that violates state water quality standards.*

  Maintaining 3 feet of freeboard will prevent the discharge of pollutants to the waters of the state or United States that violates state water quality standards. Groundwater will be protected by the double HDPE liner and leak detection system along with pressure transducers located in each pond that monitor water levels and ensure that 3 feet of freeboard is maintained at all times. The location of the pressure transducers in each pond is shown on Sheet D-1 of the Engineering Drawings located in Appendix A. Surface waters will be protected by maintaining the 3 feet of freeboard with the water level sensors within each pond. Additionally, best management practices listed in the Best Management Practice and Storm Water Management Plan located in Appendix J (excelsior logs, sediment traps, and silt fences) will be implemented during and after construction of the facility to prevent sediment from discharging to surface waters.

18. In the case of an application to permit a new or expanded landfill, attach a leachate management plan that describes the anticipated amount of leachate that will be generated and the leachate's handling, storage, treatment and disposal, including final post closure options.

The proposed facility is a produced water reuse facility and is not considered a landfill. Therefore, a leachate management plan is not required for this facility.

19. In the case of an application to permit a new or expanded landfill, attach a gas safety management plan that complies with the requirements of Subsection O of 19.15.36.13 NMAC.

The proposed facility is a produced water reuse facility and is not considered a landfill. Therefore, a gas safety management plan is not required for this facility.

20. Attach a best management practice plan to ensure protection of fresh water, public health, safety and the environment.

The Best Management Practice and Storm Water Management Plan provided in Appendix J describes procedures that will be taken during the construction and operation of the proposed facility to protect fresh water, public health, safety and the environment. The procedures in the Best Management Practice and Storm Water Management Plan address potential pollutants, stabilization practices, structural practices, non-structural practices, maintenance, inspections, and spill prevention.

21. Attach a demonstration of compliance with the siting requirements of Subsections A and B of 19.15.36.13 NMAC.

- *Section 19.15.36.13.A.5 – No other surface waste management facility shall be located where ground water is less than 50 feet below the lowest elevation at which the operator will place oil field waste.*

  Six boreholes were drilled at various locations within and surrounding the proposed pond limits shown on Figure 1 of the Hydrogeologic Investigation Report provided in Appendix K. Ground water was encountered at two borehole locations, B-1 and B-4. Borehole B-1 is located approximately 85' west of the proposed pond locations, and ground water was encountered at a depth of 49.7'. This placed the ground water elevation at 6,948.3' at this location. Borehole B-4 is located at the western limits of the proposed ponds, and ground water was located at a depth of 77.7'. This placed the ground water elevation at 6912.3' at the western edge of the ponds. Boreholes WB #1 and WB #2 were drilled at the north and south limits of the proposed ponds, and ground water was not encountered at either location. The lowest elevation of the proposed ponds is 6968' located at the sump within Pond 3 shown in Exhibit 2. Therefore, the lowest elevation of the proposed ponds is greater than 55' above the ground water surface. Borehole logs are provided in Appendix K.

- *Section 19.15.36.13.B.1 – No surface waste management facility shall be located within 200 feet of a watercourse, lakebed, sinkhole or playa lake.*

  The east side of the facility is located approximately 210 feet from the bank (ordinary high-water mark) of a small ephemeral drainage (Espinosa Canyon) that is a tributary to an ephemeral stream running through

Cabresto Canyon. The nearest continuously flowing watercourse is Navajo Reservoir, located approximately 11.6 miles west of the facility. Refer to Exhibit 2 for the facility's location in relation to the ephemeral drainage.

- *Section 19.15.36.13.B.2 – No surface waste management facility shall be located within an existing wellhead protection area or 100-year floodplain.*

  A search of the New Mexico Office of the State Engineer's iWATERS database indicates that the nearest fresh water well is located approximately 2.1 miles bearing S02°22'46"W from the proposed facility boundary. The results of this database search are given in Appendix D. The depth to ground water at this well is 250 feet. The next closest fresh water well is located approximately 2.7 miles bearing S12°15'19"W from the proposed facility boundary, and the depth to ground water at the well is 200 feet. The nearest spring is Mud Spring, located approximately 0.45 mile (approximately 2,400 feet) bearing N24°36'05"W from the proposed facility boundary. Therefore, the facility is not located within an existing wellhead protection area because it is located more than 200 horizontal feet from any private, domestic fresh water well or spring used by less than five households for domestic or stock watering purposes in addition to being located more than 1,000 horizontal feet from any other fresh water well or spring. The proposed facility is located in FEMA Flood Zone D as shown on the FEMA map located in Appendix M. This indicates that this area has possible but undetermined flood hazards, and no flood hazard analysis has been conducted for this area. Therefore, a flood hazard analysis was performed for the ephemeral drainage located within Espinosa Canyon. The results of this analysis indicate that the peak discharge from a 100-year storm will result in a water level surface below the top of bank elevations of the ephemeral drainage. Therefore, the 100-year flood will be contained within the banks of the ephemeral drainage, and the East Blanco facility is not located within a 100-year floodplain and will not be impacted by runoff events equal to or less than a 100-year recurrence interval frequency. The results of this analysis are provided in Appendix M.

- *Section 19.15.36.13.B.3 – No surface waste management facility shall be located within, or within 500 feet of, a wetland.*

  The nearest wetland is approximately 12 miles west of the proposed facility. This wetland is classified as Riverine (wetland code: R4USA). This indicates that this wetland includes channels with flowing water only part of the year, but may contain isolated pools when the flow stops. Surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface for most of the growing season. The U.S. Fish and Wildlife Service National Wetlands Inventory map for the area is given in Appendix E.

- *Section 19.15.36.13.B.4 – No surface waste management facility shall be located within the area overlying a subsurface mine.*

  The proposed facility is not located in an area overlying an active or historic subsurface mine. A New Mexico Mines, Mills and Quarries Web Map for the area provided by the New Mexico Mining and Minerals Division shows the proposed location in relation to subsurface mines. This map is provided in Appendix E.

- *Section 19.15.36.13.B.5 – No surface waste management facility shall be located within 500 feet from the nearest permanent residence, school, hospital, institution or church in existence at the time of initial application.*

  There are no permanent residences, schools, hospitals, institutions, or churches within 500 feet of the facility. The nearest town to the facility is Dulce, NM, located approximately 11.6 miles northeast of the proposed facility. Exhibit 4 provides a 500 foot setback line from the proposed facility.

- *Section 19.15.36.13.B.6 – No surface waste management facility shall be located within an unstable area, unless the operator demonstrates that engineering measures have been incorporated into the surface waste management facility design to ensure that the surface waste management facility's integrity will not be compromised.*

  The three boreholes that were drilled within the limits of the proposed ponds are WB4 #1, WB4 #2, and B-4. These boreholes indicate that the existing subgrade at the proposed pond locations consist primarily of clayey sand (USCS soil type SC) or sandy lean clay (USCS soil type CL) overlaying sandstone and shale rock layers. Borehole logs are provided in Appendix K. The clayey sand and sandy lean clay will provide an adequate and stable embankment material. No evidence of instability such as slumps or slides was identified within the area. Section 02201 of the Technical Specifications given in Appendix B requires that all embankments will be compacted to 95% Standard Proctor compaction pursuant to ASTM D698.

  Based on the material encountered at Boreholes B-1, B-2, B-3, B-4, WB4 #1, and WB4 #2, no karst formations are present within the area. The material encountered consisted generally of various clays, shale, and sandstone. These materials are not typically encountered in karst formations. Additionally, a review of the New Mexico Bureau of Geology and Mineral Resources' Geologic Map of New Mexico shows that the area lies within the San Jose Formation. This formation generally consists of sandstones and mudstones and does not typically contain karst formations.

22. Attach geological/hydrological data including:

An extensive hydrogeologic investigation of the proposed site was performed. A detailed description and results of this investigation are provided in the Hydrogeologic Investigation Report located in Appendix K. A total of 6 boreholes were drilled to determine subsurface conditions and depth to ground water at the location. The initial portion of this investigation included two boreholes located directly where the proposed ponds will be located. These boreholes were drilled in December 2011 and are labeled WB4 #1 and WB4 #2. Although these two boreholes were not initially approved by the OCD, they were drilled and logged by Geomat, Inc. in accordance with OCD rules and requirements. An additional four boreholes were drilled in February 2012 and March 2012. These boreholes were located in specific locations surrounding the proposed pond location in order to adequately determine a potentiometric map of the area. These boreholes are labeled B-1, B-2, B-3, and B-4. The location and depth to ground water of each borehole is shown in Figure 1 of the Hydrogeologic Investigation Report included in Appendix K.

Ground water was encountered at two borehole locations, B-1 and B-4. Borehole B-1 is located approximately 85' west of the proposed pond locations, and ground water was encountered at a depth of 49.7'. This placed the ground water elevation at 6,948.3' at this location. Borehole B-4 is located at the western limits of the proposed ponds, and ground water was located at a depth of 77.7'. This placed the ground water elevation at 6912.3' at the western edge of the ponds. The reason for the drastic change in ground water elevation between these two boreholes is that the bedrock shelf and corresponding ground water elevation dive deeply from B-1 to B-4. Borehole logs are provided in Attachment 1 of the Hydrogeologic Investigation Report included in Appendix K.

a) A map showing names and location of streams, springs or other watercourses, and water wells within one mile of the site;

Exhibit 5 includes a USGS topographic quad map that contains all areas within 1-mile of the proposed facility. The proposed fence surrounding the facility will serve as the facility boundary. The locations of Mud Spring as well as the ephemeral drainages within Cabresto Canyon, Espinosa Canyon, Maestas Canyon, and Augustine Canyon are all included within this exhibit.

b) Laboratory analyses, performed by an independent commercial laboratory, for major cations and anions; benzene, toluene, ethyl benzene and xylenes (BTEX); RCRA metals; and total dissolved solids (TDS) of ground water samples of the shallowest fresh water aquifer beneath the proposed site;

A ground water monitoring well was installed at the Borehole B-1 location. This borehole is located approximately 85 feet west and uphill of the

western limits of the proposed ponds. In addition, a temporary monitoring well was installed at the B-4 location. The groundwater at this location represented the shallowest fresh water aquifer beneath the proposed site. A temporary well was installed at B-4 due to its location within the construction limits of the proposed facility. After construction of the proposed facility is complete, a permanent well will be installed at this location. A laboratory analysis was performed on samples from B-1 and B-4 that focused on major cations and anions; benzene, toluene, ethyl benzene and xylenes (BTEX); RCRA metals; and total dissolved solids (TDS).Table 1 of the Hydrogeologic Investigation Report in Appendix K shows the results of this analysis. Detailed laboratory data is provided in Attachment 2 of the Hydrogeologic Investigation Report in Appendix K.

c) Depth to, formation name, type and thickness of the shallowest fresh water aquifer;

Groundwater was encountered at a depth of 49.7 feet below the ground surface at Borehole B-1, resulting in a groundwater elevation at this location of 6,948.3 feet. At Borehole B-4, groundwater was encountered at a depth of 77.7 feet below the ground surface, placing the groundwater location at 6,912.3 feet at this location.The groundwater encountered at Boreholes B-1 and B-4 is most likely hydraulically connected. This assumption is supported by similarities in water chemistry at each location as shown in Table 1 as well as the close proximity between the two locations. If it is assumed that the groundwater encountered at Borehole B-1 was a perched aquifer located above the confining shale layer shown on the attached geologic cross sections, it is expected that this perched aquifer would also be encountered at Borehole B-4. However, no groundwater was encountered above the shale layer at Borehole B-4. Therefore, the groundwater encountered above the shale layer at Borehole B-1 is most likely hydraulically connected with the groundwater encountered below the shale layer at Borehole B-4. The change in groundwater elevation between both locations occurs because the shale layer is most likely a fractured bedrock layer and does not act as a continuous confining layer. Borehole logs for each drilling location are provided in Attachment 1 of the Hydrogeologic Investigation Report located in Appendix K.

The facility is located within the San Jose Formation which is a Tertiary bedrock unit. This formation begins at the ground surface and has a thickness of approximately 2,000 to 3,000 feet at the proposed facility location (Stone, Lyford, Frenzel, Mizell, & Padgett, 1983).

d) Soil types beneath the proposed surface waste management facility, including a lithologic description of soil and rock members from ground surface down to the top of the shallowest fresh water aquifer;

The three boreholes that are located at or within the limits of the proposed ponds are WB4 #1, WB4 #2, and B-4. These boreholes indicate that the existing subgrade at the proposed pond locations consist primarily of clayey sand (USCS soil type SC) or sandy lean clay (USCS soil type CL) overlaying sandstone and shale rock layers. Detailed lithological descriptions of the soil and rock beneath the proposed facility are given in the borehole logs for WB4 #1, WB4 #2, and B-4 located in Appendix K.

The three boreholes that are located at or within the limits of the proposed ponds are WB4 #1, WB4 #2, and B-4. These boreholes indicate that the existing subgrade at the proposed pond locations consist primarily of clayey sand (USCS soil type SC) or sandy lean clay (USCS soil type CL) overlaying sandstone and shale rock layers. Detailed lithological descriptions of the soil and rock beneath the proposed facility are given in the borehole logs for WB4 #1, WB4 #2, and B-4 located in Attachment 1 of the Hydrogeologic Investigation Report in Appendix K. In addition, lithologic descriptions of the soil and rock members encountered in the other three boreholes are provided in the same attachment.

e) Geologic cross-sections;

Two geologic cross-sections were developed for the proposed location. These cross-sections were determined using the existing site topography in combination with the borehole logs from the six drilling locations. These geologic cross sections include subsurface soil stratigraphy along with the projected ground water surface elevation and are shown on Figure 2 and Figure 3 of the Hydrogeologic Investigation Report located in Appendix K.

f) Potentiometric maps for the shallowest fresh water aquifer; and

Groundwater was encountered at two borehole locations, B-1 and B-4. Borehole B-1 is located approximately 85 feet west of the proposed pond locations, and groundwater was encountered at a depth of 49.7 feet. This placed the groundwater elevation at 6,948.3 feet at this location. Borehole B-4 is located at the western limits of the proposed ponds, and groundwater was located at a depth of 77.7 feet. This placed the groundwater elevation at 6,912.3 feet at the western edge of the ponds.

The depth to ground water at the B-1 and B-4 locations along with ground water not being encountered at the other borehole locations indicates that the ground water surface deepens at the western edge of the proposed facility. The ground water surface then is expected to flatten in a similar fashion to the topography of the ground surface. A shallow aquifer

potentiometric surface map was developed for the proposed location based on the known and expected ground water surface elevations. This map is located on Figure 4 of the Hydrogeologic Investigation Report in Appendix K and includes both the known ground water surface between the B-1 and B-4 locations as well as the projected ground water surface surrounding the area where the surface is known.

g) Porosity, permeability, conductivity, compaction ratios and swelling characteristics for the sediments on which the contaminated soils will be placed.

A series of laboratory tests were performed on soil samples taken from Borehole B-4 to obtain various engineering parameters of the existing soils that will be used to construct the proposed facility. Samples were obtained using a continuous split spoon sampler from 0 to 10 feet below the ground surface. The results of this testing program are presented in Table 2 of the Hydrogeologic Investigation Report located in Appendix K. The laboratory testing report summarizing this testing program is provided in Attachment 3 of the Hydrogeologic Investigation Report located in Appendix K.

As evidenced in the laboratory testing results presented in Table 2 of the Hydrogeologic Investigation Report located in Appendix K, the existing soils are classified as Sandy Lean Clay and are suitable for construction of the proposed ponds. The in-situ soils have an average hydraulic conductivity of 3.1×10^{-5} cm/s, percent voids of 28.9% on a sample remolded to 95% of the maximum dry density, and slight to moderate swell potential of 6.9%. Additionally, these soils will be compacted to 95% Standard Proctor compaction pursuant to ASTM D698 as specified in Section 02201 of the Technical Specifications provided in Appendix B.

23. In the case of an existing surface waste management facility applying for a minor modification, describe the proposed change and identify information that has changed from the last C-137 filing.

This application is for a new facility. No modifications to an existing facility are included.

24. The division may require additional information to demonstrate that the surface waste management facility's operation will not adversely impact fresh water, public health, safety or the environment and that the surface waste management facility will comply with division rules and orders.

Additional information is available on request to demonstrate that the facility's operation will not adversely impact fresh water, public health, safety or the environment and that the surface waste management facility will comply with division rules and orders.

25. CERTIFICATION

Certification is provided on the actual application.

REFERENCES

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Western Regional Climate Center. (n.d.). *Monthly Climate Summary.* Retrieved from http://www.wrcc.dri.edu/Climsum.html

Table 1. Water Balance for East Blanco Produced Water Reuse Facility (Lowest Evaporation Rates).

Month	Pan Evap. (in)	Pan Evap. Per Day (bpd)	Total Water Evap. Per Day (bpd)	Days per Month	Total Water Evap. Per Month (bbl)	Monthly Precip.[1] (in)	Precip. Inflow per Month (bbl)	Produced Water Inflow per Month[2] (bbl)	Total Inflow per Month (bbl)	Cumulative Water Storage (bbl)	Available Pond Capacity (bbl)
Nov	1.13	41	41	30	1,225	1.31	2,366	45,000	47,366	46,141	127,459
Dec	0.52	18	18	31	564	1.31	2,366	46,500	48,866	94,443	79,157
Jan	0.00	0	0	31	0	1.37	2,474	46,500	48,974	143,417	30,183

[1] Monthly precipitation from WRCC, Dulce, NM Site.

[2] Assuming 1,500 bbl/day produced water inflow.

gpm = gallons per minute

gpd = gallons per day

bbl = barrels (42 gallons)

bpd = barrels per day

in = inch

Table 2. Water Balance for East Blanco Produced Water Reuse Facility (Highest Evaporation Rates).

Month	Pan Evap. (in)	Pan Evap. Per Day (bpd)	Total Water Evap. Per Day (bpd)	Days per Month	Total Water Evap. Per Month (bbl)	Monthly Precip.[1] (in)	Precip. Inflow per Month (bbl)	Produced Water Inflow per Month[2] (bbl)	Total Inflow per Month (bbl)	Cumulative Water Storage (bbl)	Available Pond Capacity (bbl)
Apr	4.54	163	163	30	4,902	1.13	2,041	45,000	47,041	42,139	131,461
May	6.19	217	217	31	6,724	1.08	1,951	46,500	48,451	83,866	89,734
Jun	7.30	256	256	31	7,922	0.80	1,445	46,500	47,945	123,889	49,711

[1] Monthly precipitation from WRCC, Dulce, NM Site.

[2] Assuming 1,500 bbl/day produced water inflow.

gpm = gallons per minute

gpd = gallons per day

bbl = barrels (42 gallons)

bpd = barrels per day

in = inch

Exhibits

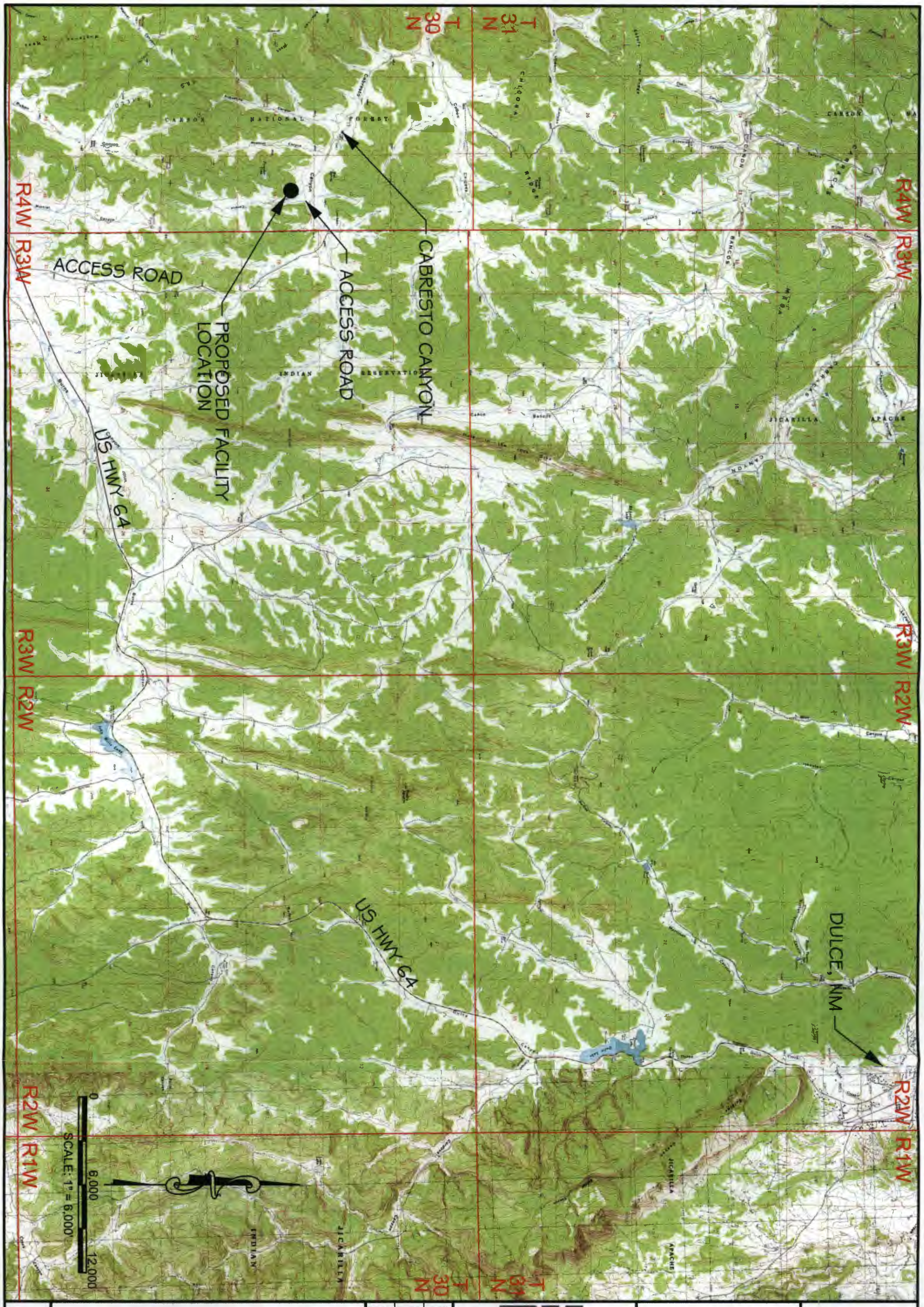

EXHIBIT 1

EAST BLANCO PRODUCED WATER REUSE FACILITY

PROPOSED FACILITY LOCATION

DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD

JOB # 2011-063

Black Hills Gas Resources
3200 N 1st Street
Bloomfield, NM 87413
(505) 634-5104

WWC ENGINEERING
1275 MAPLE STREET, SUITE F
HELENA, MT 59601
(406) 443-3962

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EXHIBIT 2

EAST BLANCO PRODUCED WATER REUSE FACILITY

PROPOSED FACILITY LAYOUT

DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD
JOB # 2011-063		

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(406) 443-3962

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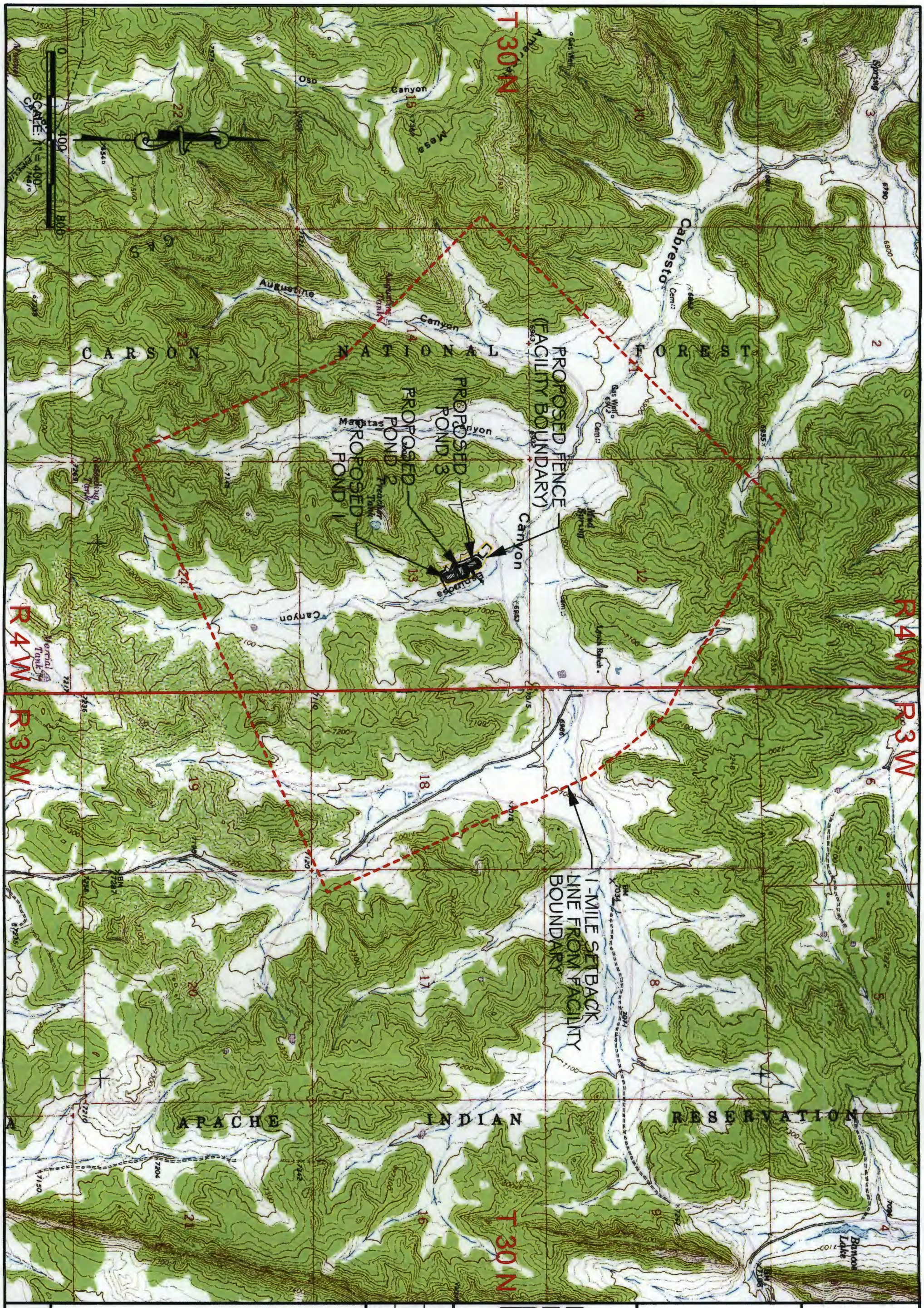

EXHIBIT 3

EAST BLANCO PRODUCED WATER REUSE FACILITY

USGS TOPOGRAPHIC MAP

DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD
JOB # 2011-063		

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Bloomfield, NM 87413
(505) 634-5104

WWC ENGINEERING
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HELENA, MT 59601
(406) 443-3962

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EXHIBIT 4

EAST BLANCO PRODUCED WATER REUSE FACILITY

500 FOOT SETBACK FROM PROPOSED FACILITY BOUNDARY

DSGN	DATE	CKD
MRS	6/12	STH

REV	DATE	CKD

JOB # 2011-063

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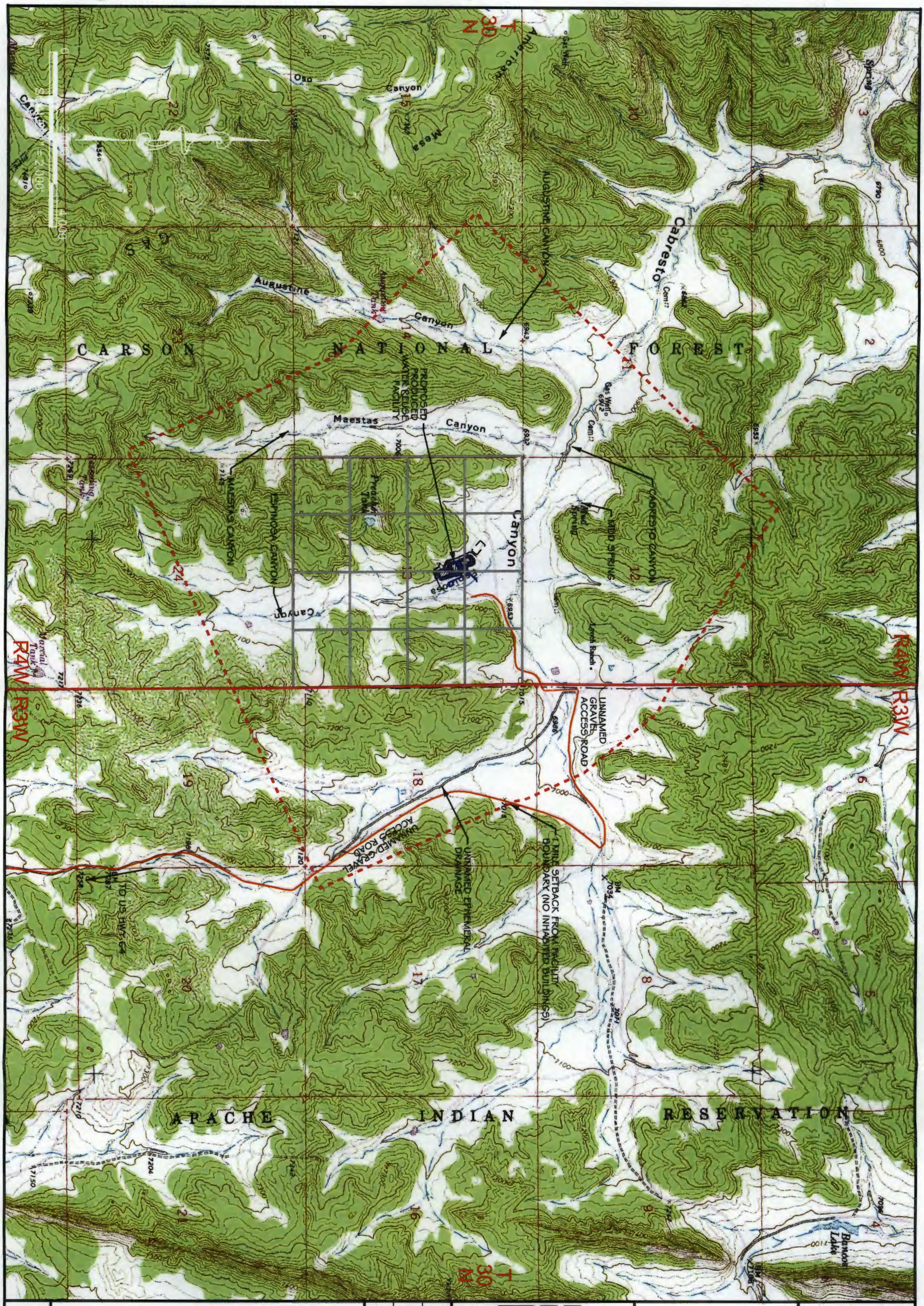

EXHIBIT 5

EAST BLANCO PRODUCED WATER REUSE FACILITY

1 MILE SETBACK FROM PROPOSED FACILITY BOUNDARIES

DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD

JOB # 2011-063

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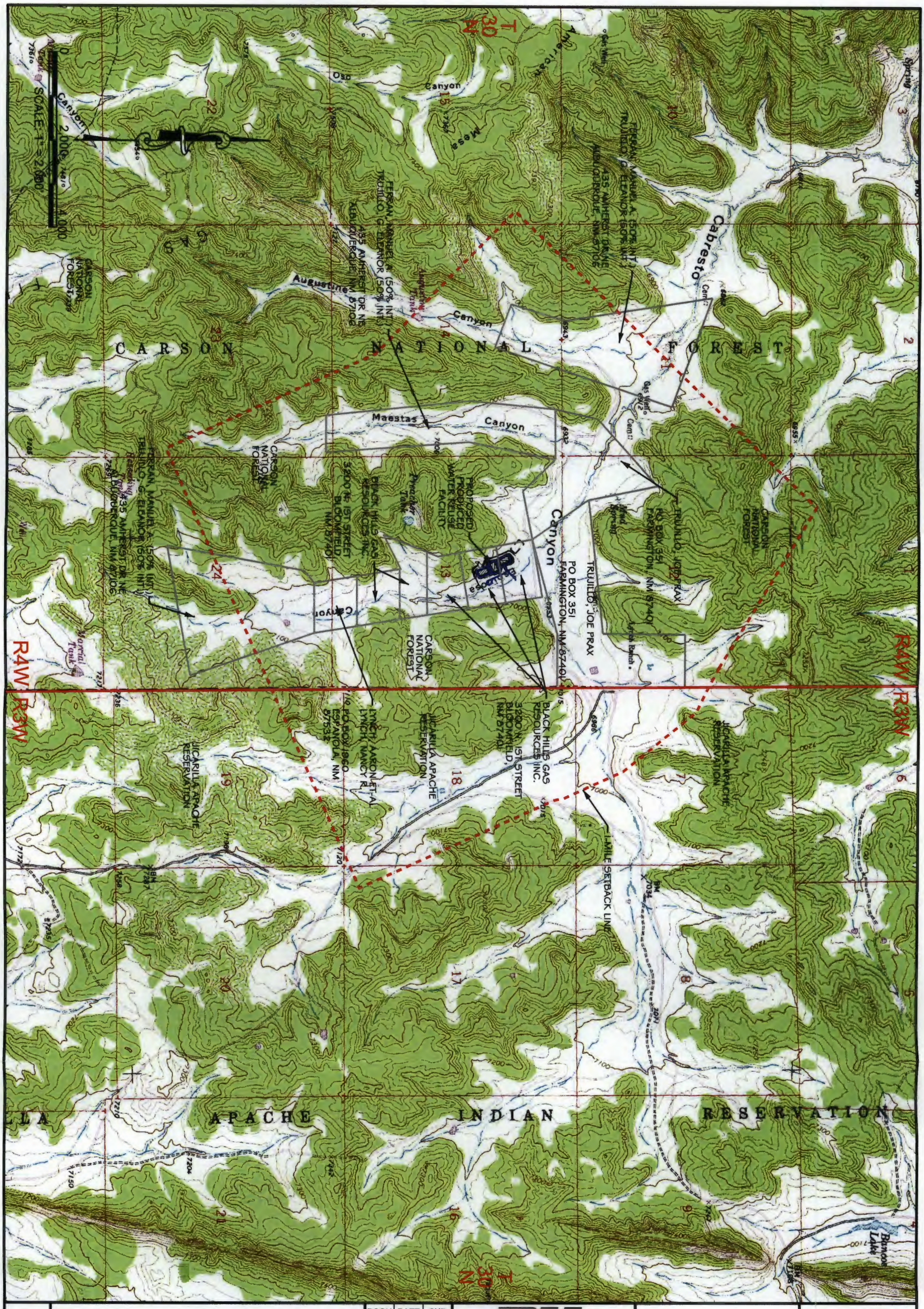

EXHIBIT 9

EAST BLANCO PRODUCED WATER REUSE FACILITY

PROPERTY OWNERSHIP MAP

DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD

JOB # 2011-063

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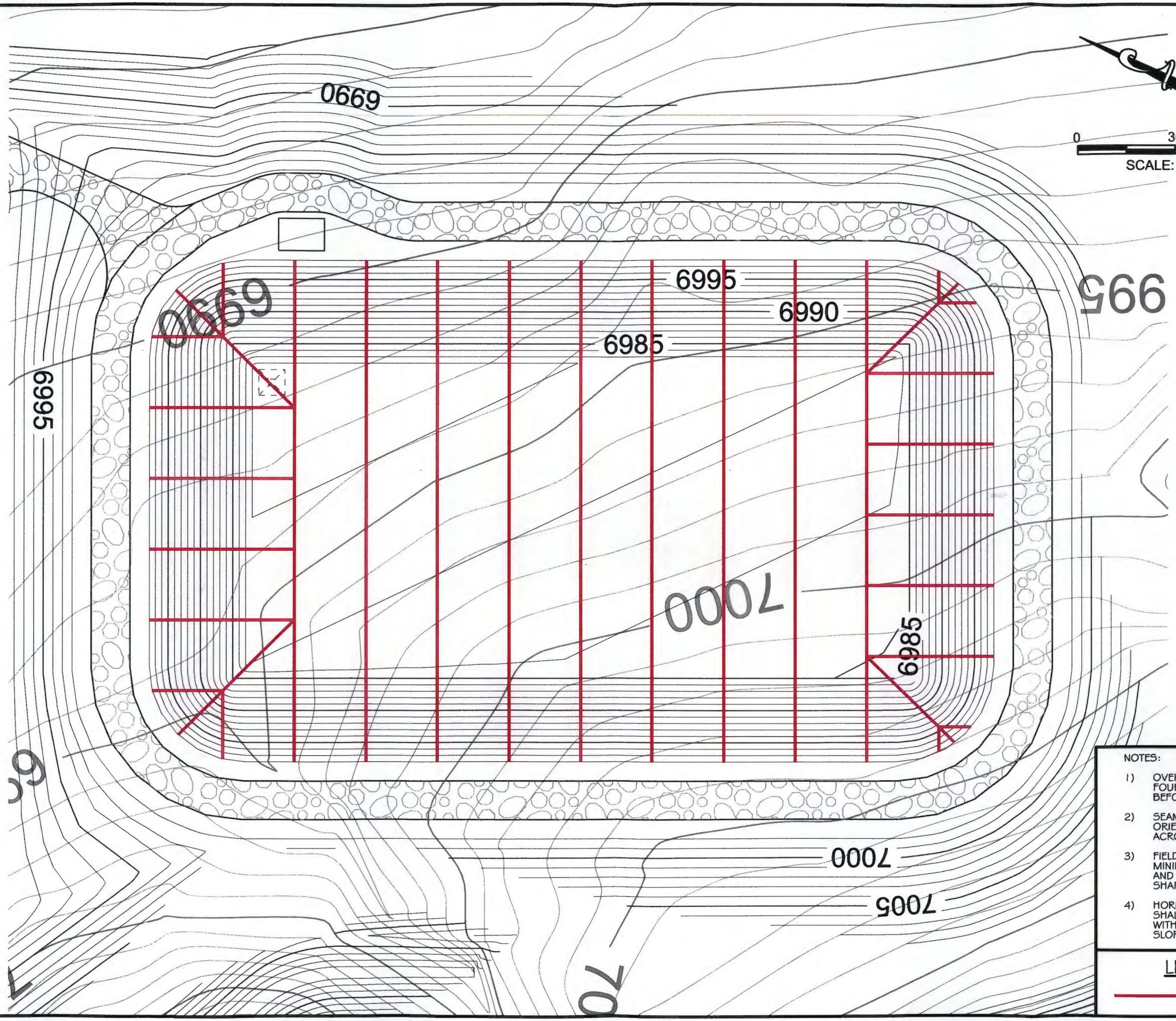

NOTES:

1) OVERLAPS SHALL BE FOUR TO SIX INCHES BEFORE SEAMING.
2) SEAMS SHALL BE ORIENTED ALONG, NOT ACROSS, THE SLOPE.
3) FIELD SEAMS SHALL BE MINIMIZED IN CORNERS AND IRREGULARLY SHAPED AREAS.
4) HORIZONTAL SEAMS SHALL NOT BE INSTALLED WITHIN 5 FEET OF THE SLOPE'S TOE.

LEGEND

LINER SEAM

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DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD

JOB # 2011-063

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EAST BLANCO PRODUCED WATER REUSE FACILITY

TYPICAL LINER SEAM PATTERN

EXHIBIT 7

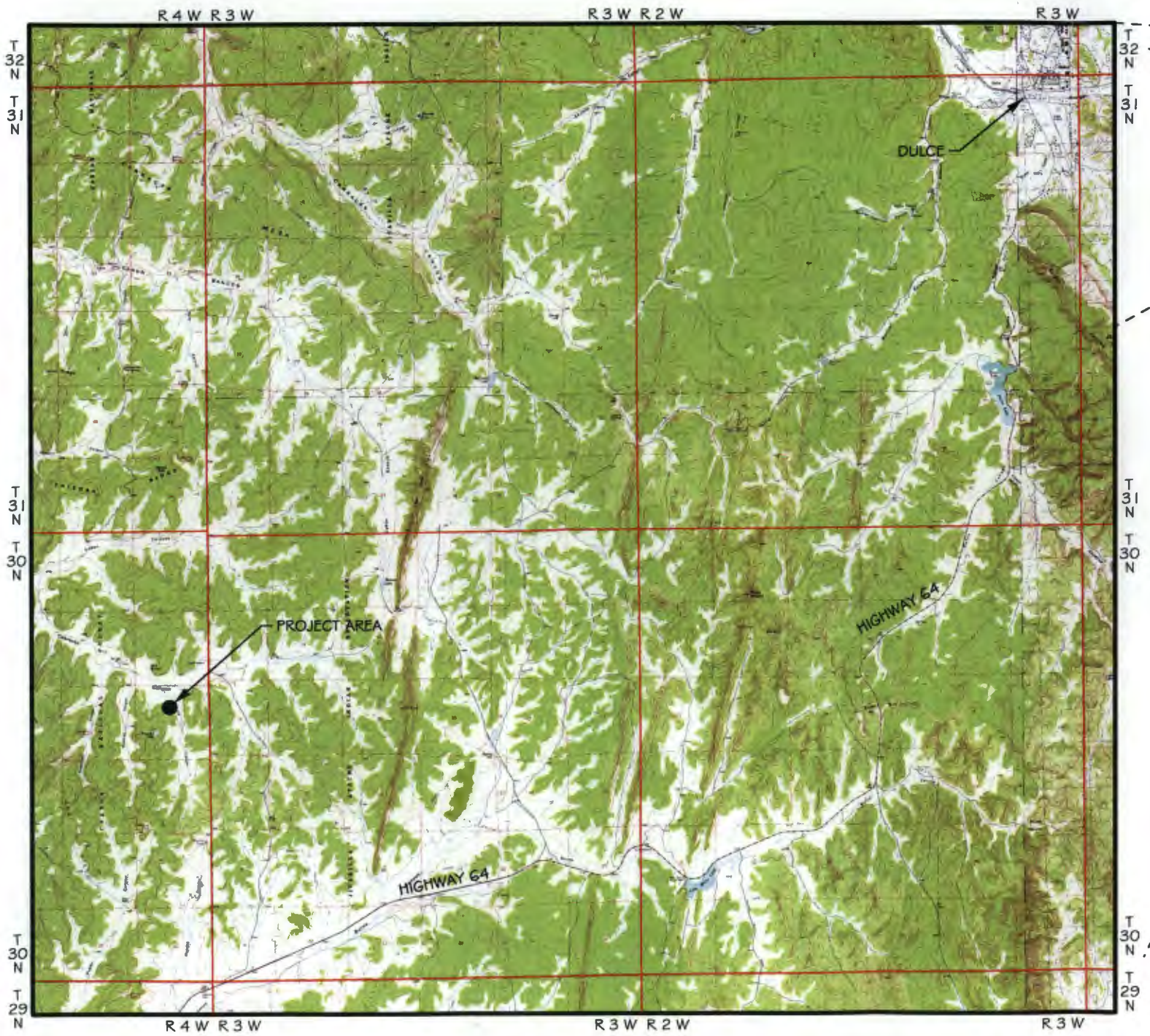
Appendix A

Engineering Drawings

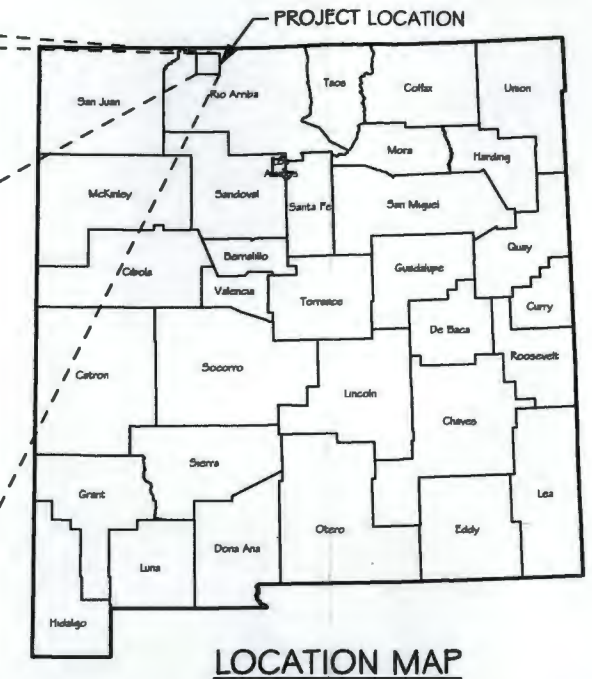
ENGINEERING DRAWINGS FOR
EAST BLANCO FIELD PRODUCED WATER REUSE FACILITY PROJECT

LOCATED IN RIO ARRIBA COUNTY, NEW MEXICO

DECEMBER 2012



VICINITY MAP
SCALE: 1"=10,000'



LOCATION MAP
NOT TO SCALE

INDEX OF SHEETS	
SHEET #	DESCRIPTION
T-1	TITLE SHEET AND TABLE OF CONTENTS
T-2	NOTES AND QUANTITIES
T-3	TYPICAL SECTIONS
P-1	LOCATION OVERVIEW
P-2	FACILITY LAYOUT
ER-1	EROSION CONTROL SHEET
R-1 TO R-2	ACCESS ROAD PLAN AND PROFILE SHEETS
DR-1 TO DR-2	DRAINAGE DITCH PLAN AND PROFILE SHEETS
XS-1 TO XS-3	CROSS SECTION SHEETS
D-1 TO D-11	DETAIL SHEETS

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(505) 634-5104

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DSGN	DATE	REV	DATE
MRS	6/12		

CKD	STH
CKD	

JOB # 2011-063

EAST BLANCO PRODUCED WATER REUSE FACILITY
Title Sheet and Table of Contents

SHEET
T-1

CONSTRUCTION NOTES:

1) UNLESS SPECIFICALLY SHOWN ON THE DRAWINGS OR REFERENCED IN THE SPECIFICATIONS, ALL WORK WILL CONFORM TO NEW MEXICO STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (NMSS).

2) THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL PERMITS REQUIRED FOR CONSTRUCTION ACTIVITES INCLUDING BUT NOT LIMITED TO A STORM WATER DISCHARGE PERMIT AS REQUIRED BY THE NEW MEXICO ENVIRONMENT DEPARTMENT.

3) THE CONTRACTOR SHALL NOTIFY A LOCATOR SERVICE FOR ONSITE UTILITY LOCATION. ALL EXISTING UTILITIES SHALL BE MARKED BEFORE DIGGING.

4) THE CONTRACTOR SHALL MAINTAIN SERVICE OF ALL EXISTING UTILITIES. IF SAID SERVICE IS DAMAGED, THE CONTRACTOR SHALL IMMEDIATELY REPAIR THE DAMAGE AT THE CONTRACTOR'S EXPENSE.

5) THE CONTRACTOR SHALL FIELD VERIFY THE EXISTENCE, LOCATION, DEPTH, SIZE, LINE, AND GRADE OF EXISTING UTILITIES PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE TO THE EXISTING FACILITIES DUE TO FAILURE TO LOCATE OR PROVIDE PROPER PROTECTION WHEN LOCATION IS KNOWN.

6) ALL QUANTITIES SHOWN IN THESE PLANS ARE FOR INFORMATIONAL PURPOSES ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DETERMINING ACTUAL QUANTITIES.

7) THE CONTRACTOR IS RESPONSIBLE FOR CONTROLLING DUST AND EROSION DURING CONSTRUCTION. AREAS SHALL BE WATERED TO CONTROL DUST WHEN ORDERED BY THE ENGINEER. EROSION SHALL BE CONTROLLED IN ACCORDANCE WITH NEW MEXICO ENVIRONMENT DEPARTMENT REGULATIONS.

8) ALL DISTURBED AREAS SHALL BE TOPSOILED AND SEEDED BY THE CONTRACTOR IN ACCORDANCE WITH NMSS SECTION 1000 AND THESE PLANS AND SPECIFICATIONS.

9) THE CONTRACTOR SHALL REFERENCE ALL SURVEY CONTROL, SECTION CORNERS, 1/4 CORNERS AND PROPERTY CORNERS PRIOR TO BEING DISTURBED BY CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPLACEMENT OF ANY STAKING POINTS, CONTROL, MONUMENTS, AND CORNERS THAT ARE DISTURBED DURING CONSTRUCTION.

10) EXCAVATION, BACKFILL, AND COMPACTION SHALL BE PERFORMED IN ACCORDANCE WITH NMSS SECTIONS 202 AND 204 AS WELL AS THESE PLANS AND SPECIFICATIONS.

11) THE CONTRACTOR SHALL PROVIDE AND INSTALL CORRUGATED STEEL CULVERTS (CMP) IN ACCORDANCE WITH NMSS SECTION 135.

12) ALL BURIED BENDS, TEES, AND VALVES LOCATED ON THE WATER SUPPLY AND COLLECTION LINES REQUIRE AN 18" X 18" X 18" CONCRETE THRUST BLOCK.

PROJECT LEGEND

PLAN FEATURES

- Edge of Road
- Road Centerline
- Fence
- Drainage Flow Line
- Gravel Road Surface
- Existing Ground Contour
- Proposed Ground Contour
- Culvert
- Leak Detection Pipe
- Water Collection Pipe
- Water Supply Pipe
- BMP Location

DRAWING NOTATION

A / X5-1 — Indicates cross section location. "A" refers to the cross section designation. "X5-1" refers to the drawing number where the section is cut or shown.

1 / D-1 — Indicates detail location. "1" refers to the detail designation. "D-1" refers to the drawing number where the detail is indicated or shown.

PIPES, PUMPS, FENCES, AND NETTING

ITEM	QUANTITY			REMARKS
	LINEAR FEET	SQUARE FEET	EACH	
6" Ø SCH 80 PVC LEAK DETECTION PIPE	120			
6" Ø SDR-17 HDPE PIPE	1160			
12" Ø SDR-17 HDPE PIPE	1160			
7.5-HP SELF-PRIMING SUCTION PUMP			3	
10' X 16' X 8' CMU PUMP HOUSE			3	
6' 6-STRAND BARB WIRE FENCE	3450			
2" SQUARE MESH BIRD NETTING		133,650		

GRADING

ITEM	VOLUME		REMARKS
	CUBIC YDS EXCAVATION	CUBIC YDS COMPACTED FILL	
POND GRADING	30000	29800	COMPACTED FILL INCLUDES 5% SHRINKAGE
ACCESS ROAD GRADING	0	2800	COMPACTED FILL INCLUDES 5% SHRINKAGE
DRAINAGE DITCH GRADING	5200	100	COMPACTED FILL INCLUDES 5% SHRINKAGE
WASTE EXCAVATION PLACEMENT	2500		

TOPSOIL AND REVEGETATION

ITEM	QUANTITY		REMARKS
	CUBIC YDS	ACRES	
TOPSOIL SALVAGING	6200		
SEEDING		3.5	
CLEARING AND GRUBBING		3.5	

CULVERTS

STATION	QUANTITY		REMARKS
	LENGTH (FT)	HEADWALL	
STA. 10+74.65	70	NONE	72" Ø CMP CULVERT
STA. 10+82.76	70	NONE	72" Ø CMP CULVERT
STA. 12+99.77	50	NONE	30" Ø CMP CULVERT

SURFACING

ITEM	QUANTITY		REMARKS
	CUBIC YDS	SY	
8 OZ. GSE NON-WOVEN GEOTEXTILE		14060	LOCATED ON POND INTERIOR
220-MIL GSE HYPERNET GEONET		14060	LOCATED ON POND INTERIOR
60-MIL GSE HD HDPE GEOMEMBRANE		28120	DOUBLE LAYER LOCATED ON POND INTERIOR
P-550 EROSION CONTROL BLANKET		3240	DRAINAGE DITCH LINER
1.5" MINUS CRUSHED BASE COURSE	900		6" THICKNESS FOR ALL ROADS
D_{50}= 12" RIPRAP	590		CULVERT AND DITCH DISCHARGES

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(505) 634-5104

DSGN	DATE	REV	DATE
MRS	8/12		

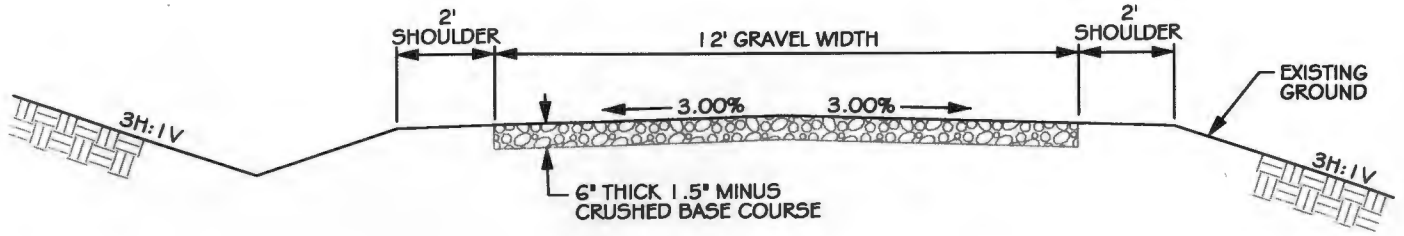
CKD STH CKD

JOB # 2011-083

EAST BLANCO PRODUCED WATER REUSE FACILITY

Notes and Quantities

SHEET
T - 2

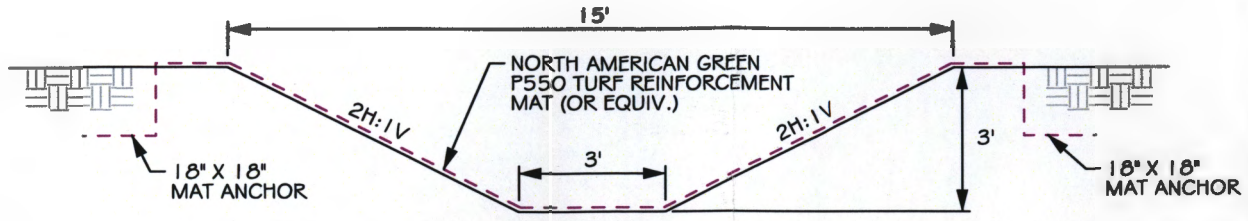


TYPICAL #1 ACCESS ROAD

NOT TO SCALE

NOTES:

1) TYPICAL SECTION #1 APPLIES TO ALL ACCESS ROADS EXCLUDING MAINTENANCE ROADS LOCATED ON TOP OF BERMS SURROUNDING PONDS.
2) COVER ALL DISTURBED AREAS WITH 6" TOPSOIL AND REVEGETATE WITH APPROVED GRASS SPECIES.
3) CUT AND FILL SLOPES OF 3H:1V OR FLATTER ARE TYPICAL SLOPES. SEE CROSS SECTION SHEETS FOR ACTUAL SLOPE GRADES.

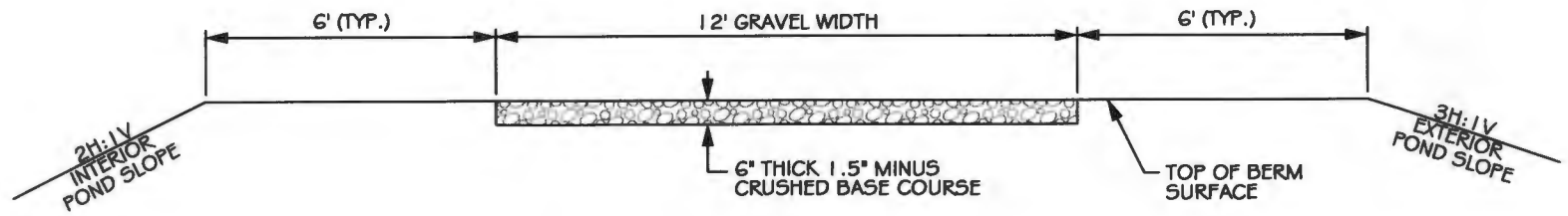


TYPICAL #3 DRAINAGE DITCH

NOT TO SCALE

NOTES:

1) TYPICAL SECTION #3 (DRAINAGE DITCH) APPLIES TO BOTH NORTH AND SOUTH DRAINAGE DITCHES.
2) DITCH BOTTOM AND SIDE SLOPES SHALL BE REVEGETATED WITH APPROVED GRASS SPECIES PRIOR TO APPLICATION OF TURF REINFORCEMENT MAT.
3) NORTH AMERICAN GREEN P550 TURF REINFORCEMENT MAT (OR EQUIV.) SHALL COVER DITCH BOTTOMS AND EXTEND UP THE SIDE SLOPES TO A HEIGHT OF 3 FEET ABOVE DITCH BOTTOM.
4) ALL DITCH CUT AND FILL SLOPES OF 2H:1V OR FLATTER ARE TYPICAL SLOPES. SEE CROSS SECTION SHEETS FOR ACTUAL SLOPE GRADES.



TYPICAL #2 MAINTENANCE ROAD

NOT TO SCALE

NOTES:

1) TYPICAL SECTION #2 (MAINTENANCE ROAD) APPLIES TO MAINTENANCE ROADS LOCATED ON TOP OF BERMS SURROUNDING PONDS.
2) CUT AND FILL SLOPES OF 3H:1V OR FLATTER ARE TYPICAL SLOPES. SEE CROSS SECTION SHEETS FOR ACTUAL SLOPE GRADES.
3) ALL INTERIOR POND SLOPES ARE 2H:1V.

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DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD

JOB # 2011-063

EAST BLANCO PRODUCED WATER REUSE FACILITY

Typical Sections

SHEET
T-3

SHEET P-1

EAST BLANCO PRODUCED WATER REUSE FACILITY

Location Overview

DSGN	DATE	CKD
MRS	6/12	STH

REV	DATE	CKD

JOB # 2011-063

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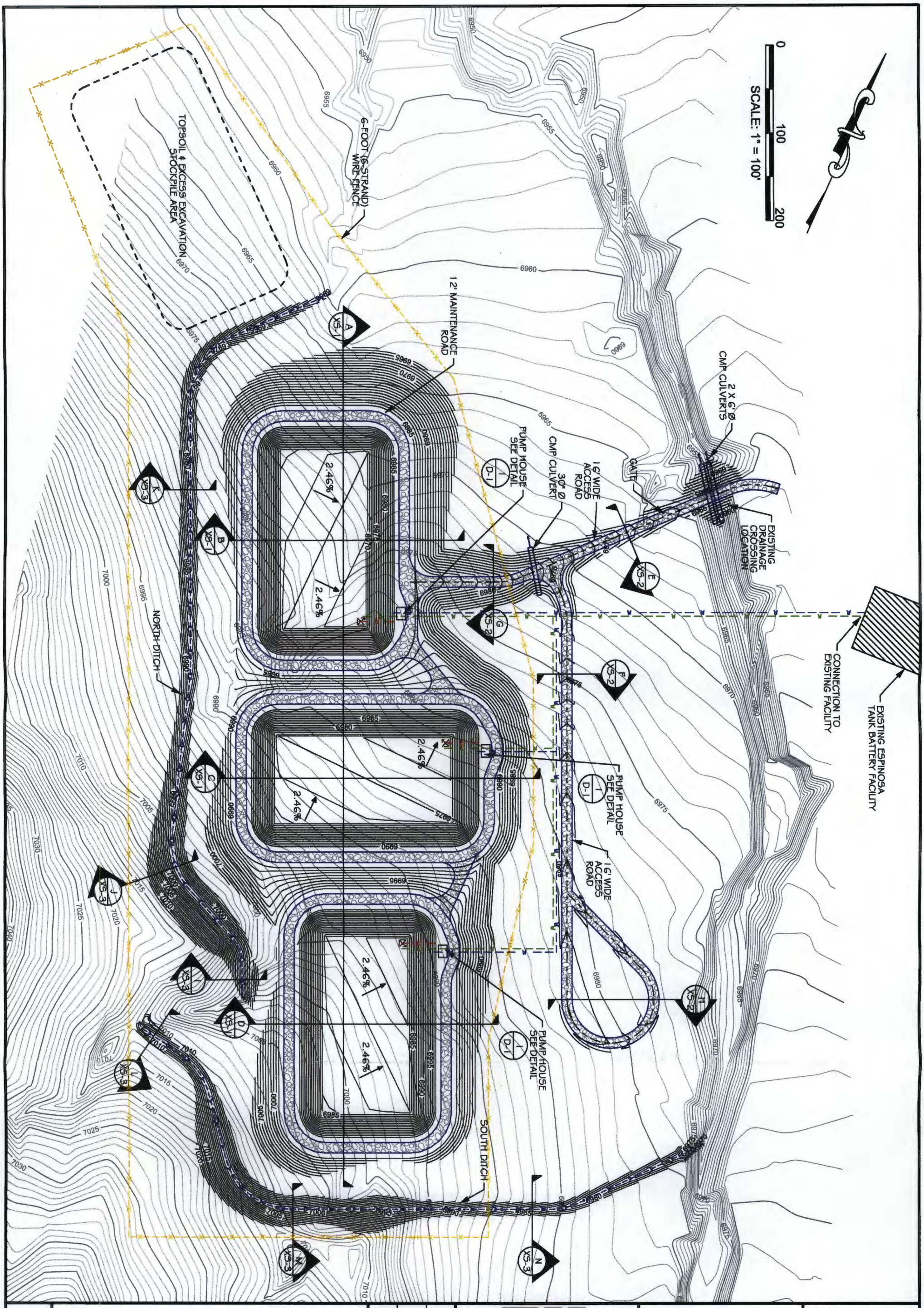

EAST BLANCO PRODUCED WATER REUSE FACILITY

Facility Layout

SHEET P-2

DSGN	DATE	CKD
MRS	6/12	STH

REV	DATE	CKD

JOB # 2011-063

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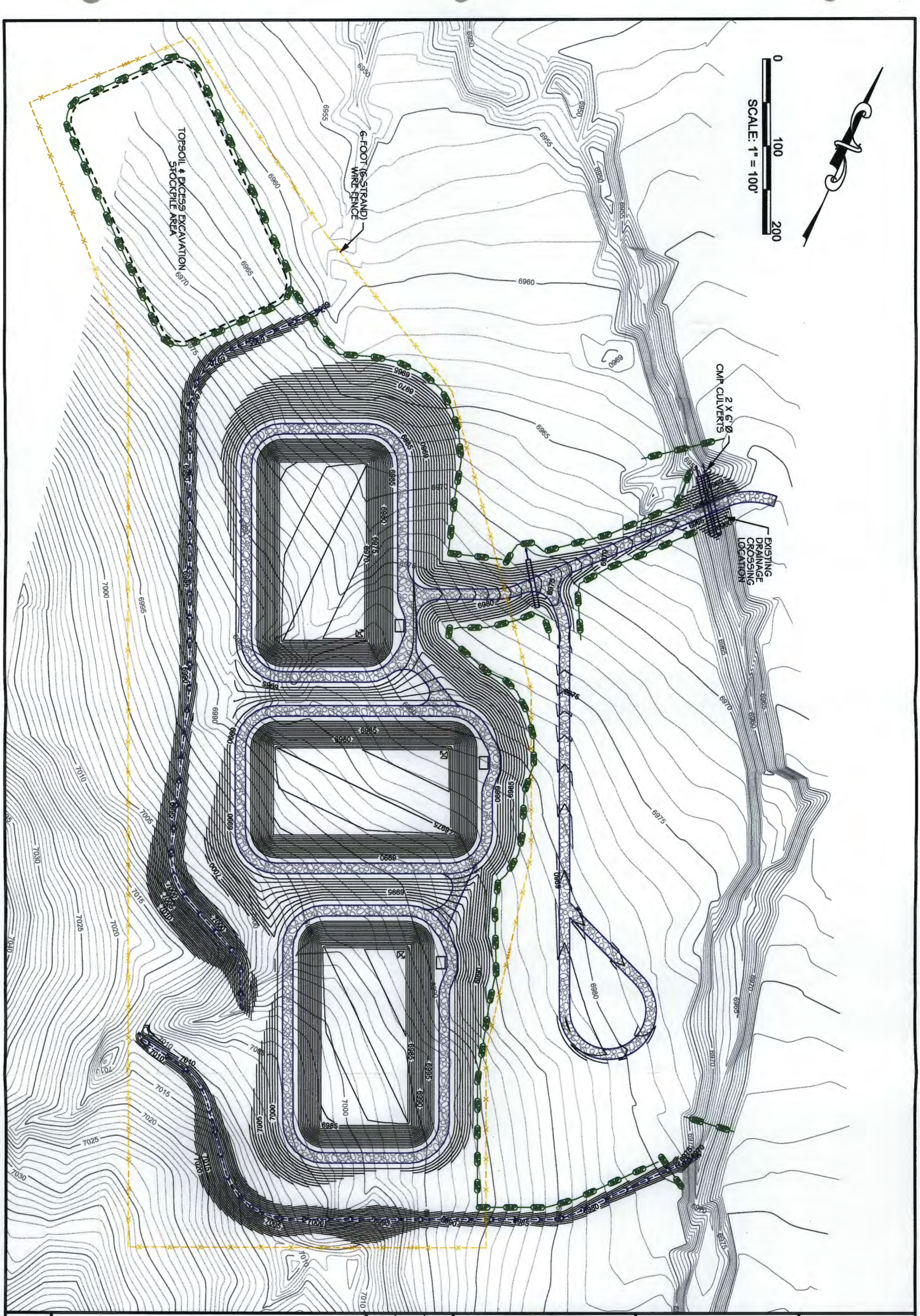


SHEET ER-1

EAST BLANCO PRODUCED WATER REUSE FACILITY

Erosion Control Sheet

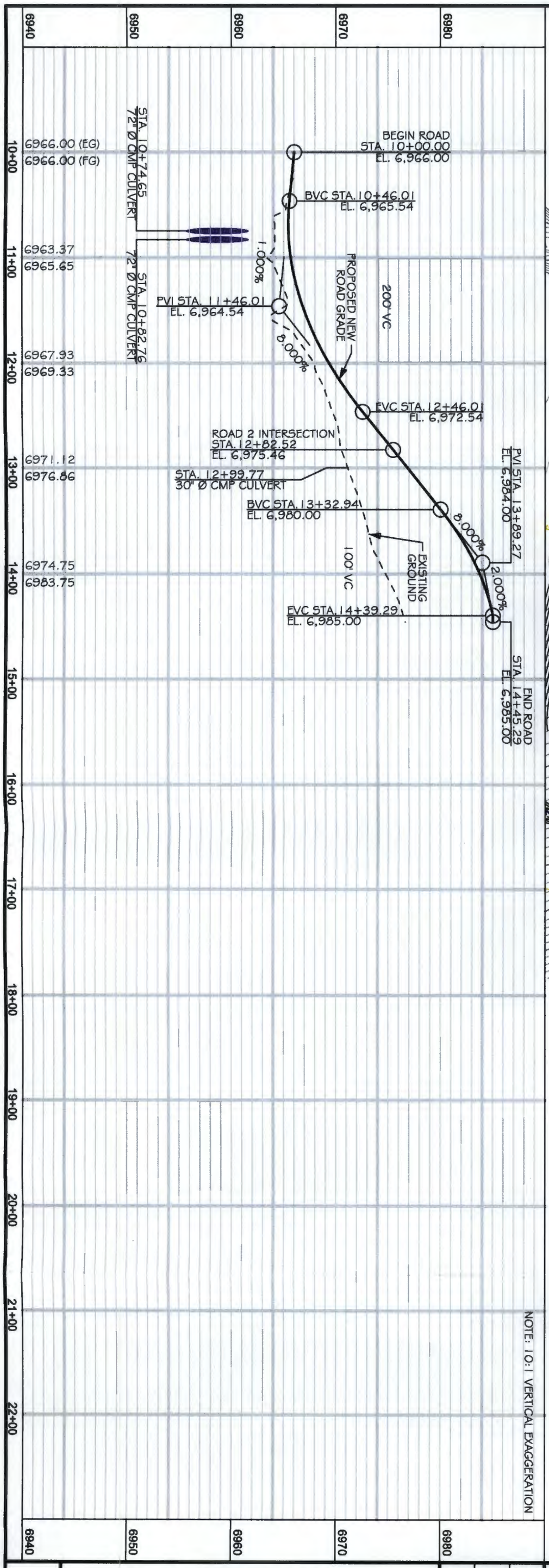
DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD

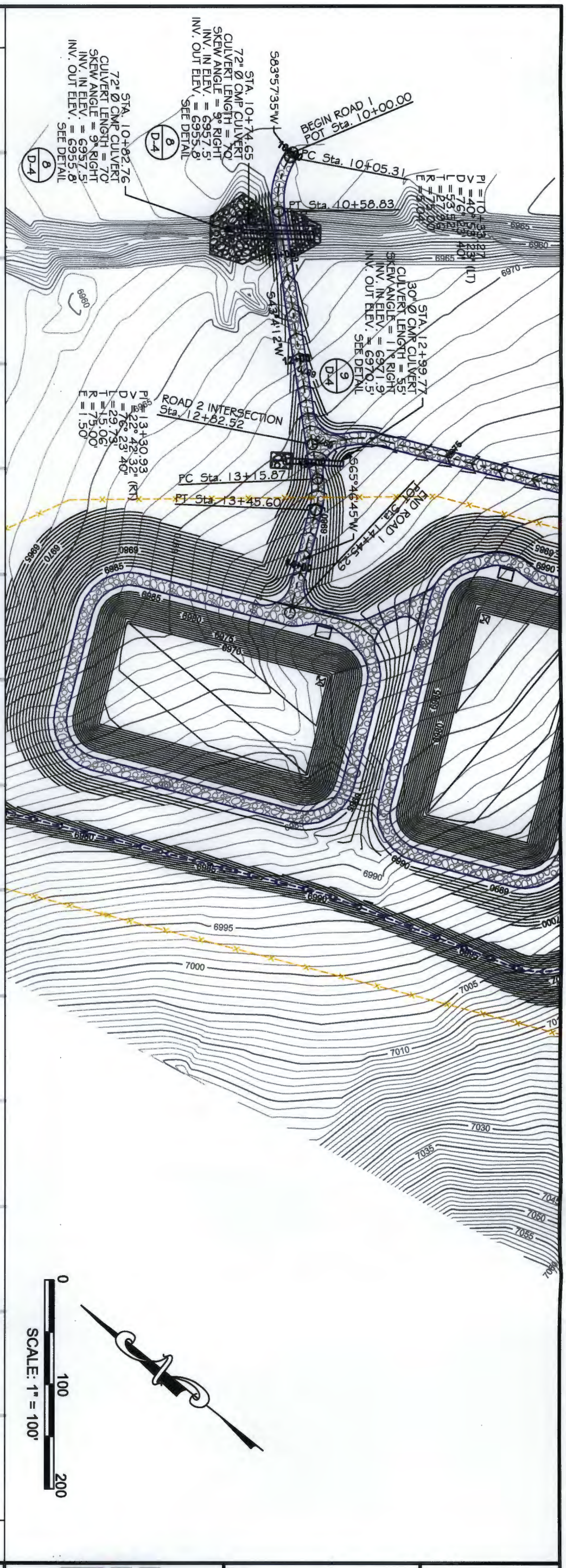
JOB # 2011-063

Black Hills Gas Resources
3200 N 1st Street
Bloomfield, NM 87413
(505) 634-5104

WWC ENGINEERING
1275 MAPLE STREET, SUITE F
HELENA, MT 59601
(406) 443-3962

PEN TABLE PATH: K:\BLACK HILLS\11063 - E. BLANCO FIELD\PDF\EAST BLANCO PLAN SET.tbl
12/20/2012 FILE PATH: K:\BLACK HILLS\11063 - E. BLANCO FIELD\DGN\East Blanco Field Planset.dgn





SHEET R-1

EAST BLANCO PRODUCED WATER REUSE FACILITY

Access Road 1 Plan and Profile Sheet

DSGN	DATE	CKD
MRS	6/12	STH

REV	DATE	CKD

JOB # 2011-063

Black Hills Gas Resources
3200 N 1st Street
Bloomfield, NM 87413
(505) 634-5104

WWC ENGINEERING
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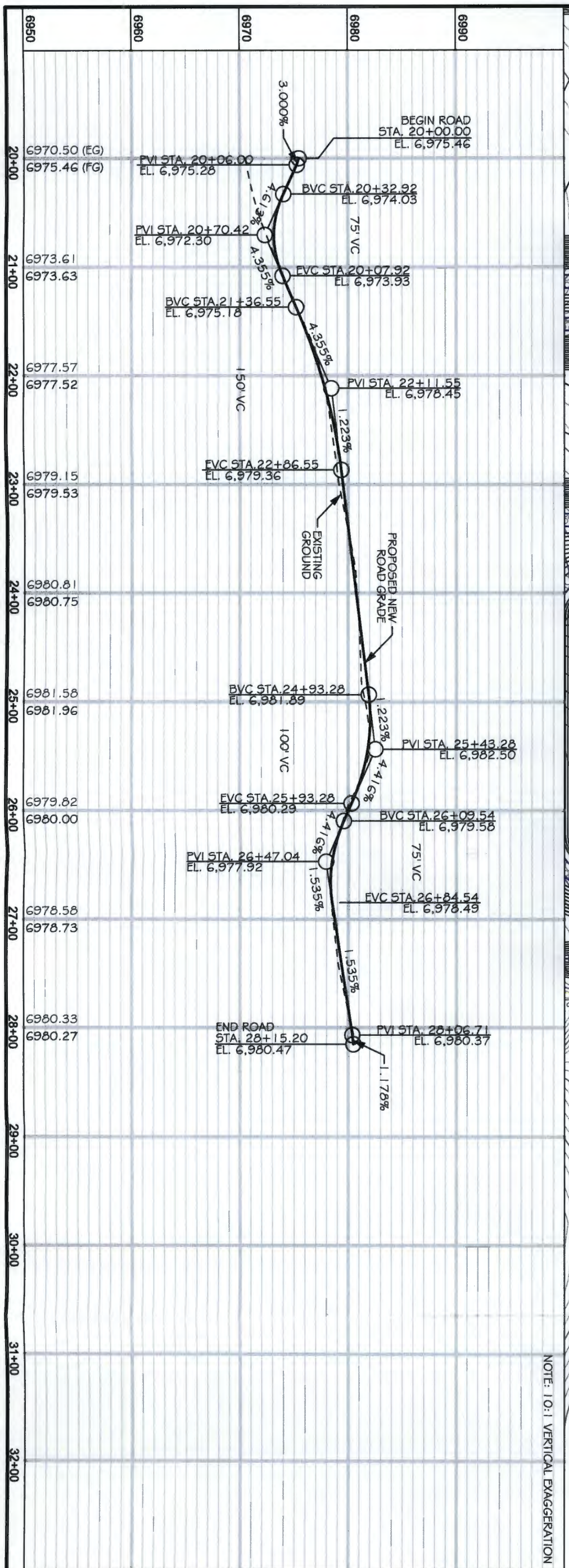
(406) 443-3962

PEN TABLE PATH: K:\BLACK HILLS\111083 - E. BLANCO FIELD\PDF\EAST BLANCO PLAN SET.tbl
12/20/2012 FILE PATH: K:\BLACK HILLS\111083 - E. BLANCO FIELD\DGN\East Blanco Field Planset.dgn



SHEET
R-2

EAST BLANCO PRODUCED WATER REUSE FACILITY

Access Road 2
Plan and Profile Sheet

DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD

JOB # 2011-063

Black Hills Gas Resources
3200 N 1st Street
Bloomfield, NM 87413
(505) 634-5104

WWC ENGINEERING
1275 MAPLE STREET, SUITE F
HELENA, MT 59601
(406) 443-3962

PEN TABLE PATH: K:\BLACK HILLS\11083 - E. BLANCO FIELD\PDF\EAST BLANCO PLAN SET.tbl
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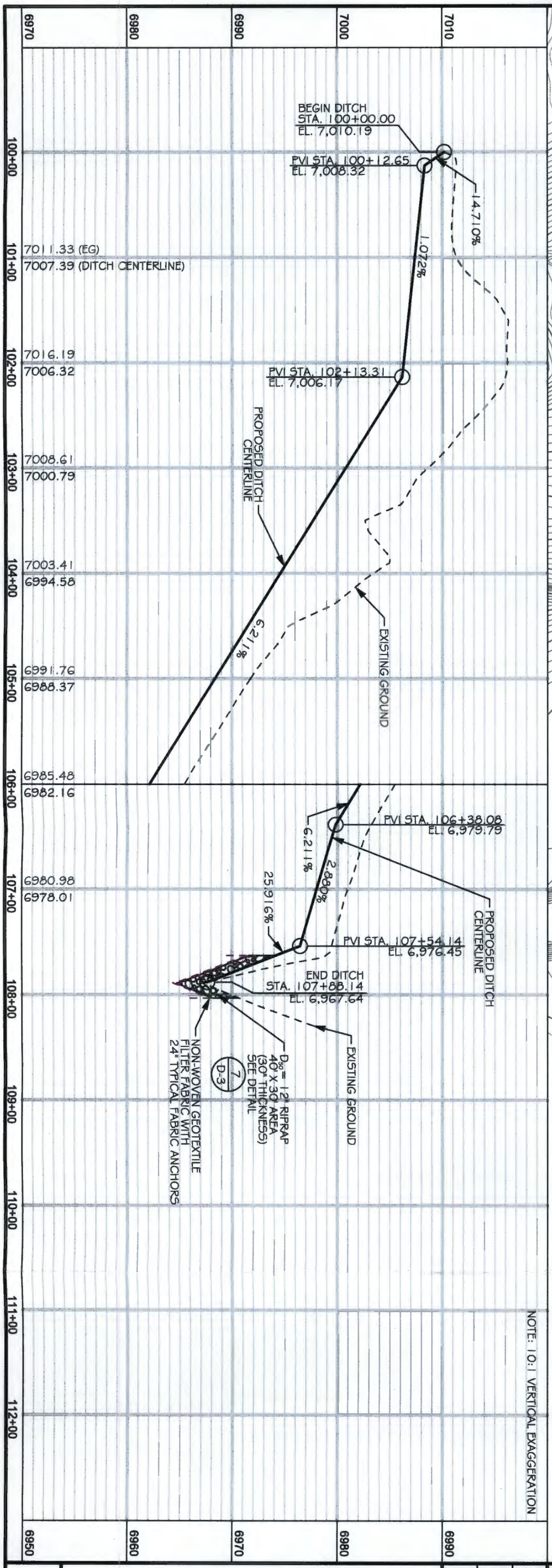

EAST BLANCO PRODUCED WATER REUSE FACILITY

South Ditch Plan and Profile Sheet

SHEET DR-1

DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD

JOB # 2011-063

Black Hills Gas Resources
3200 N 1st Street
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(505) 634-5104

WWC ENGINEERING
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HELENA, MT 59601
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PEN TABLE PATH: K:\BLACK HILLS\11063 - E. BLANCO FIELD\PD\PEAST BLANCO PLAN SET.tbl
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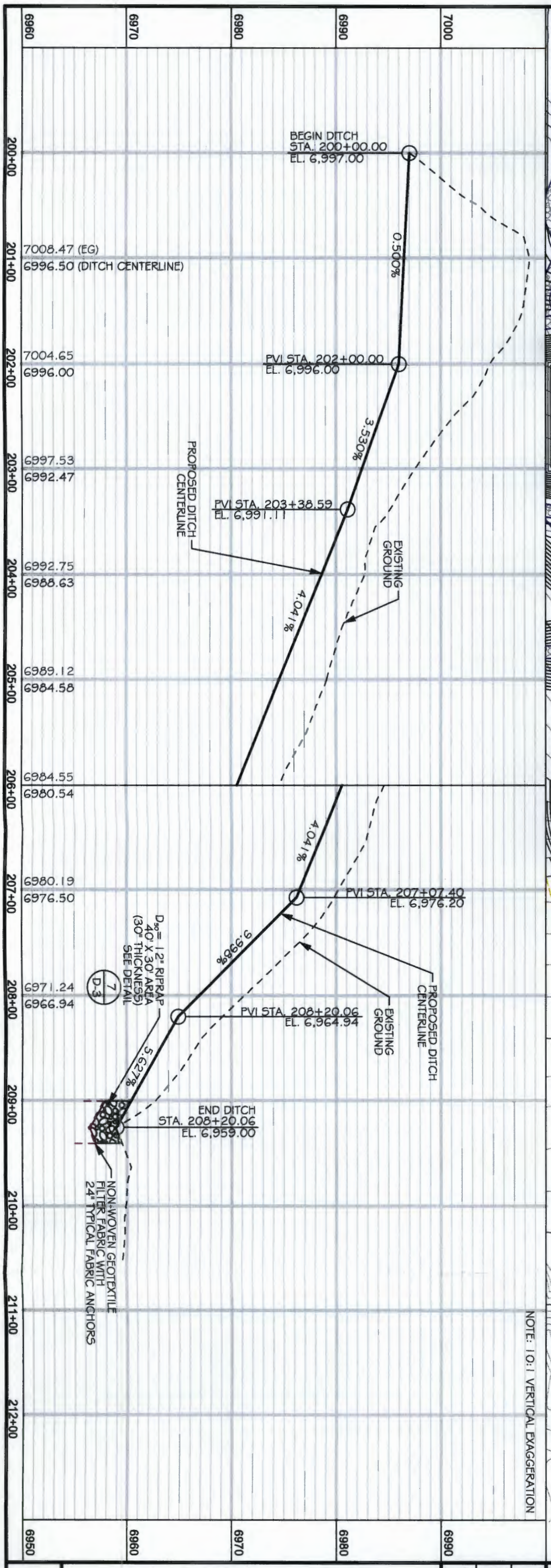

SHEET
DR-2

EAST BLANCO PRODUCED WATER REUSE FACILITY

North Ditch
Plan and Profile Sheet

DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD

JOB # 2011-063

Black Hills Gas Resources
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WWC ENGINEERING
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PEN TABLE PATH: K:\BLACK HILLS\11063 - E. BLANCO FIELD\PDF\EAST BLANCO PLAN SET.tbl
12/20/2012 FILE PATH: K:\BLACK HILLS\11063 - E. BLANCO FIELD\DGN\East Blanco Field Planset.dgn

SHEET
XS-1

EAST BLANCO PRODUCED WATER REUSE FACILITY

Pond Cross Sections

	DSGN	DATE	CKD
	MRS	6/12	STH
REV	DATE	CKD	

JOB # 2011-063

Black Hills Gas Resources
3200 N 1st Street
Bloomfield, NM 87413
(505) 634-5104

WWC ENGINEERING
1275 MAPLE STREET, SUITE F
HELENA, MT 59601
(406) 443-3982

PEN TABLE PATH: K:\MJACK HILLS\1065 - E. BLANCO FIELD\PP\EAST BLANCO PLAN SET.tbl
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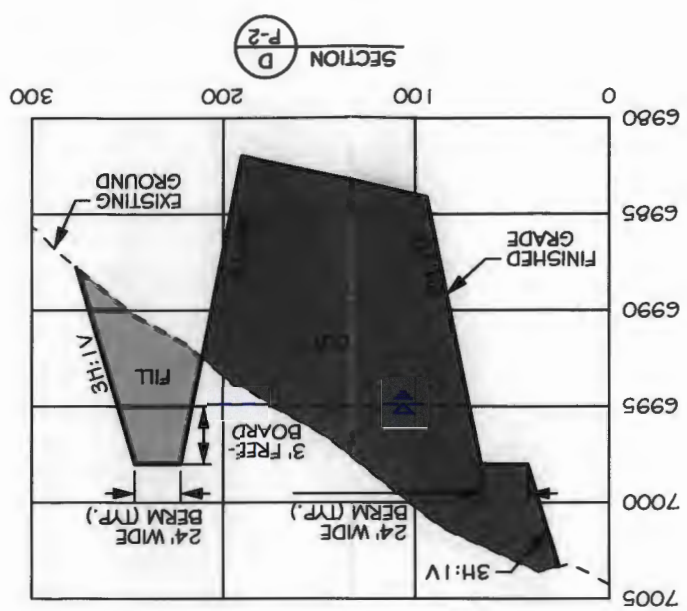
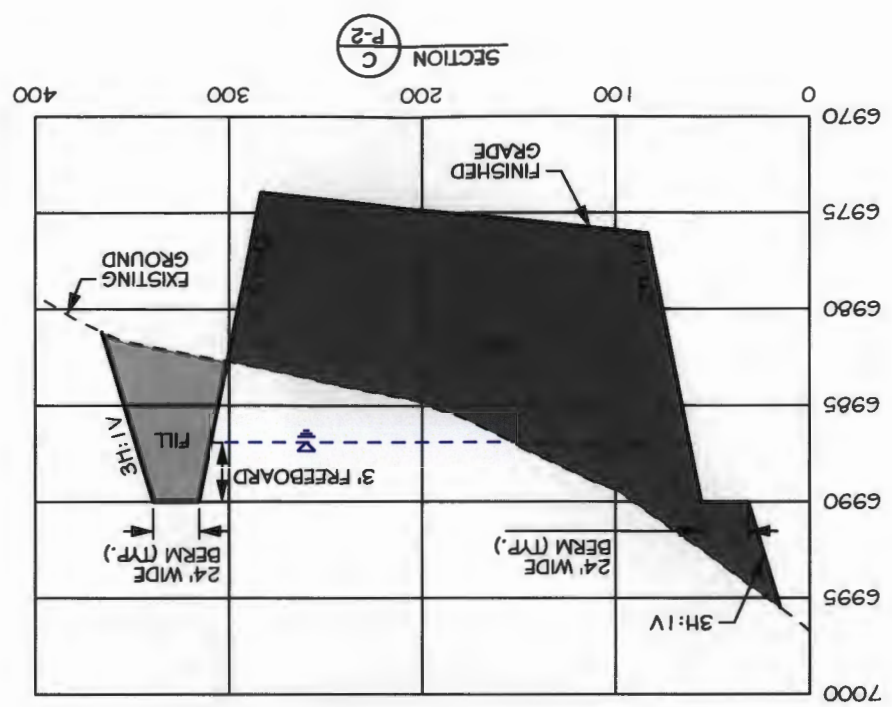
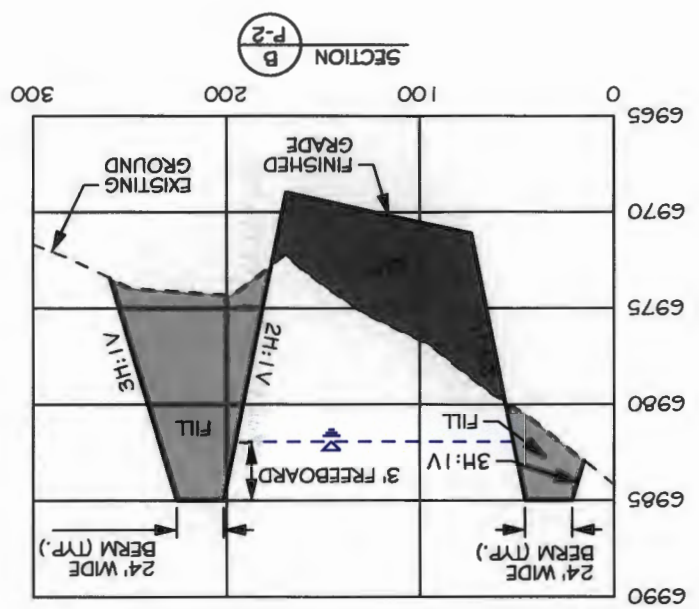
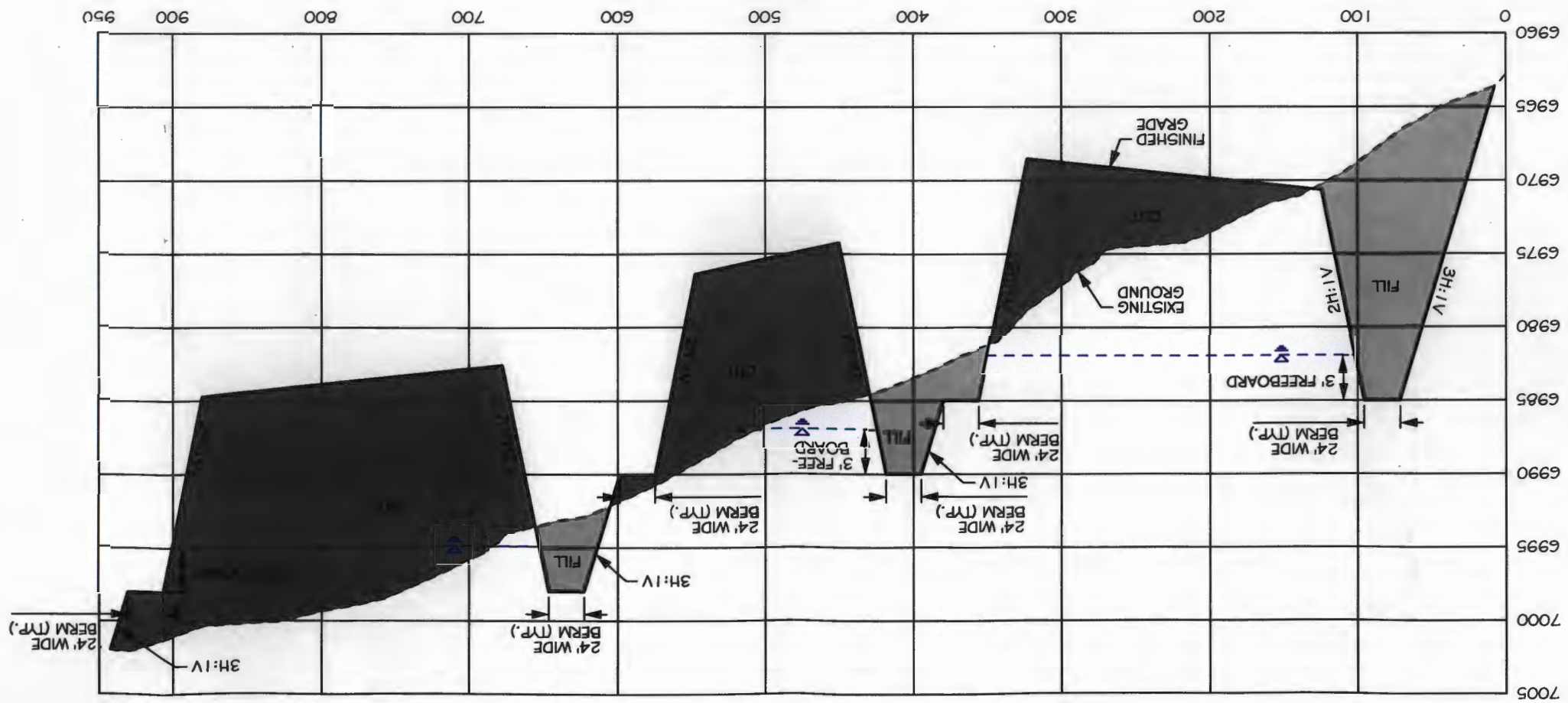




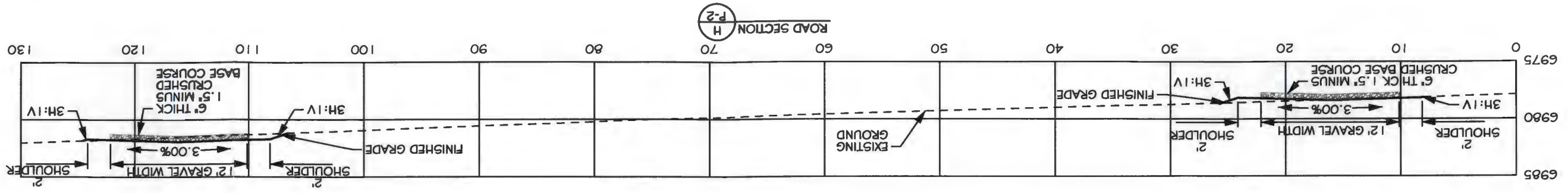


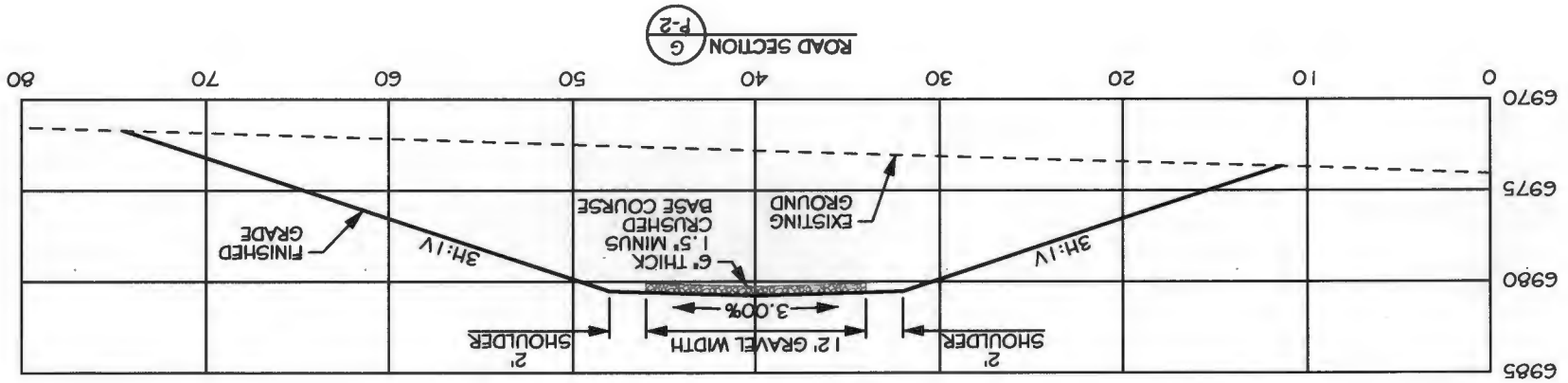


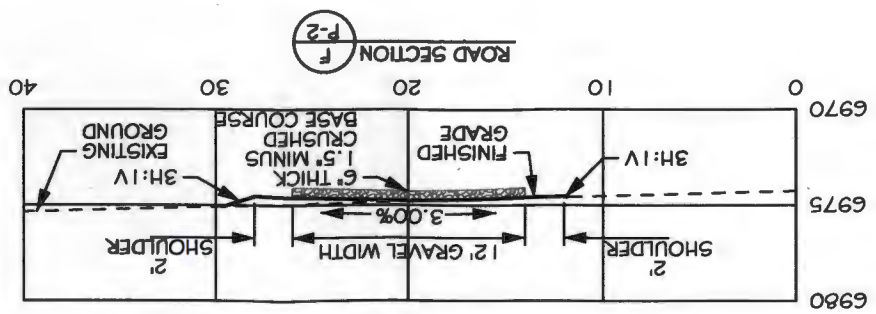
EAST BLANCO PRODUCED WATER REUSE FACILITY

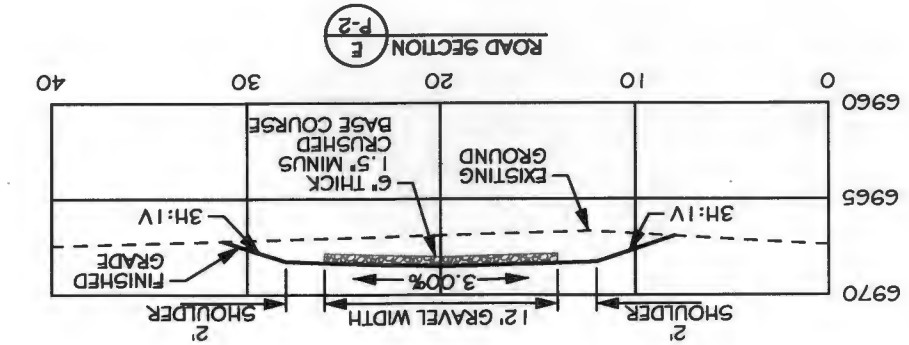
Drainage Ditch Cross Sections

SHEET XS-2









JOB # 2011-063	DSGN	DATE	CKD
	MRS	6/12	STH
REV	DATE	CKD	

Black Hills Gas Resources
3200 N 1st Street
Bloomfield, NM 87413
(505) 634-5104

WWC ENGINEERING
1275 MAPLE STREET, SUITE F
HELENA, MT 59601
(406) 443-3962

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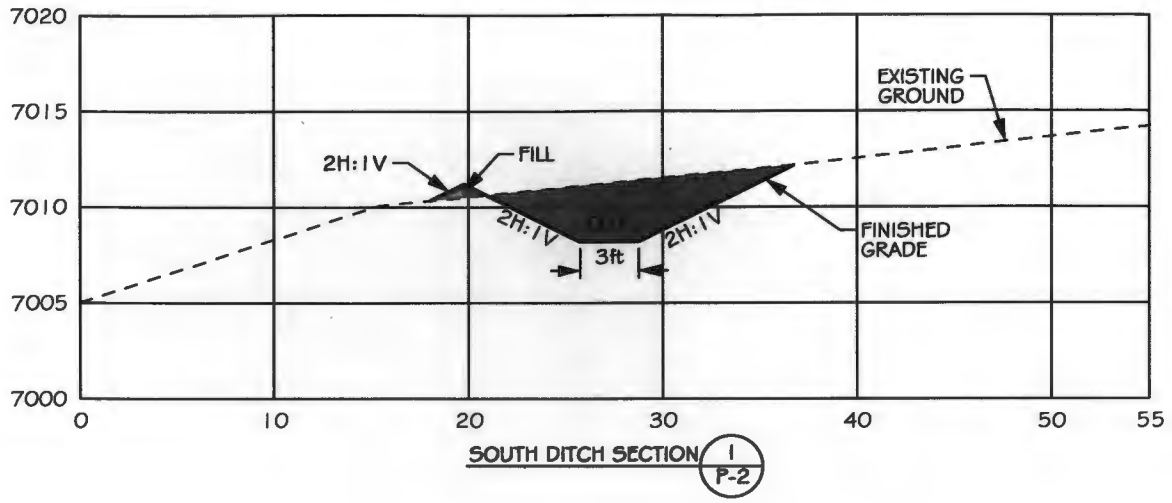
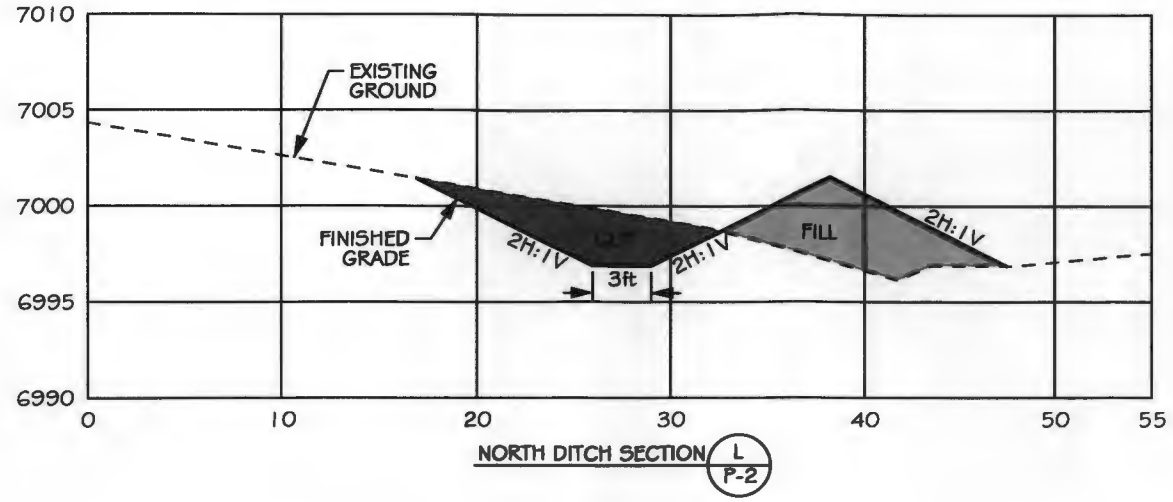
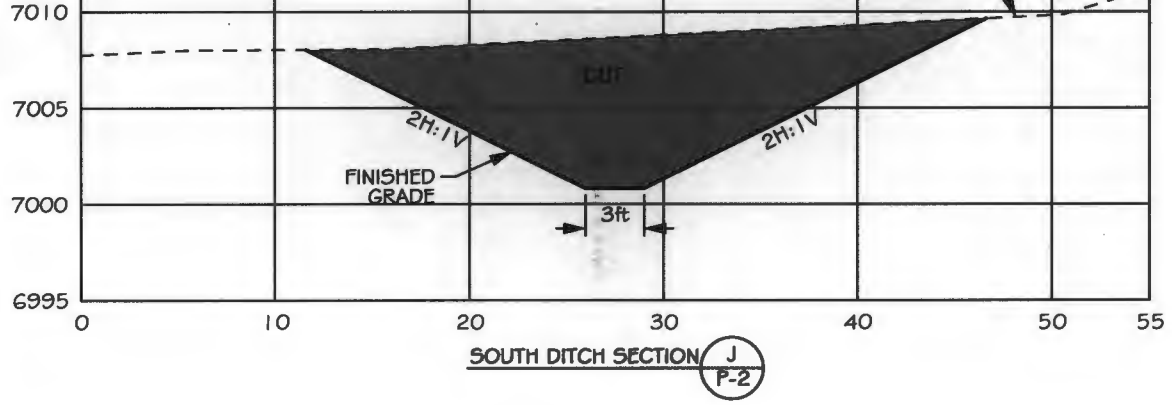


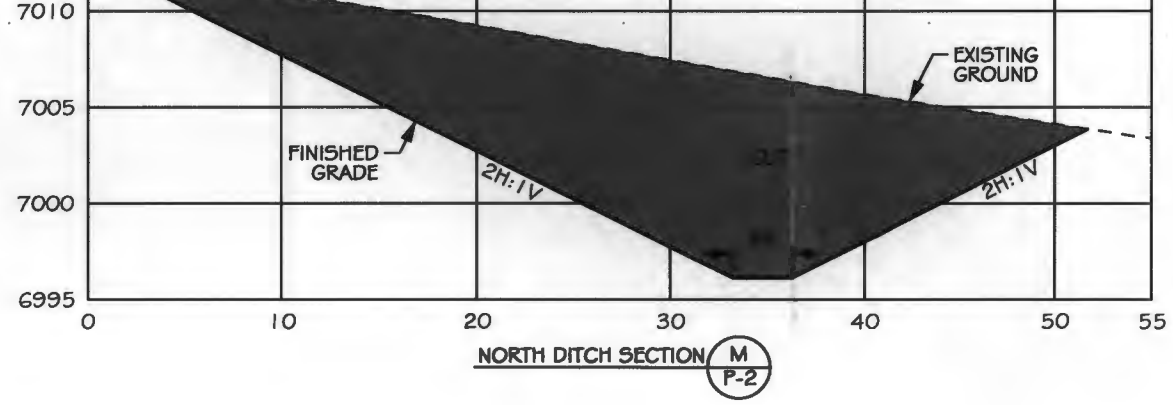
SOUTH DITCH SECTION I P-2



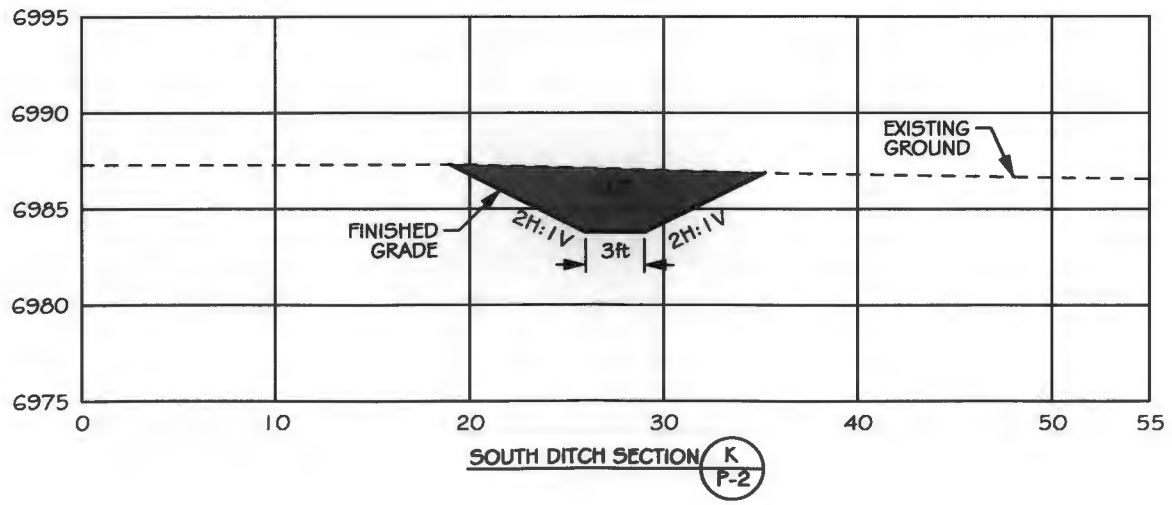
NORTH DITCH SECTION L P-2



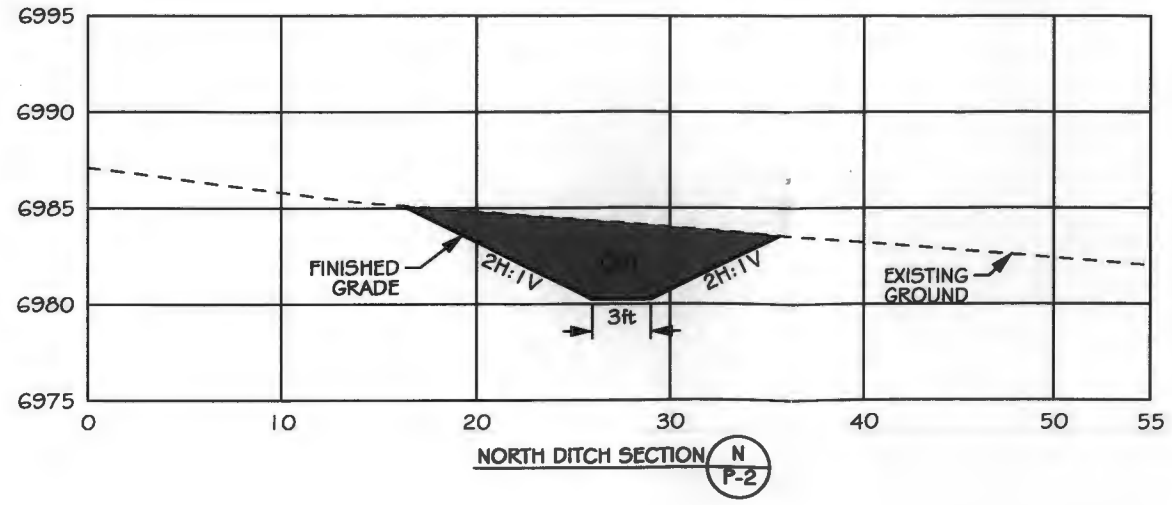
SOUTH DITCH SECTION J P-2



NORTH DITCH SECTION M P-2



SOUTH DITCH SECTION K P-2



NORTH DITCH SECTION N P-2

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(505) 634-5104

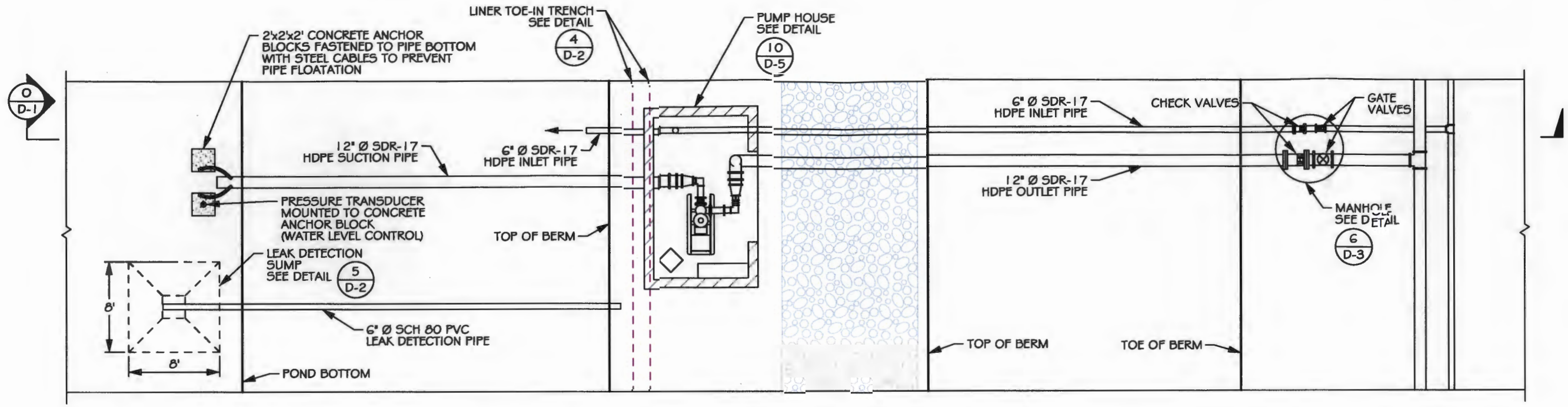
DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD

JOB # 2011-063

EAST BLANCO PRODUCED WATER REUSE FACILITY

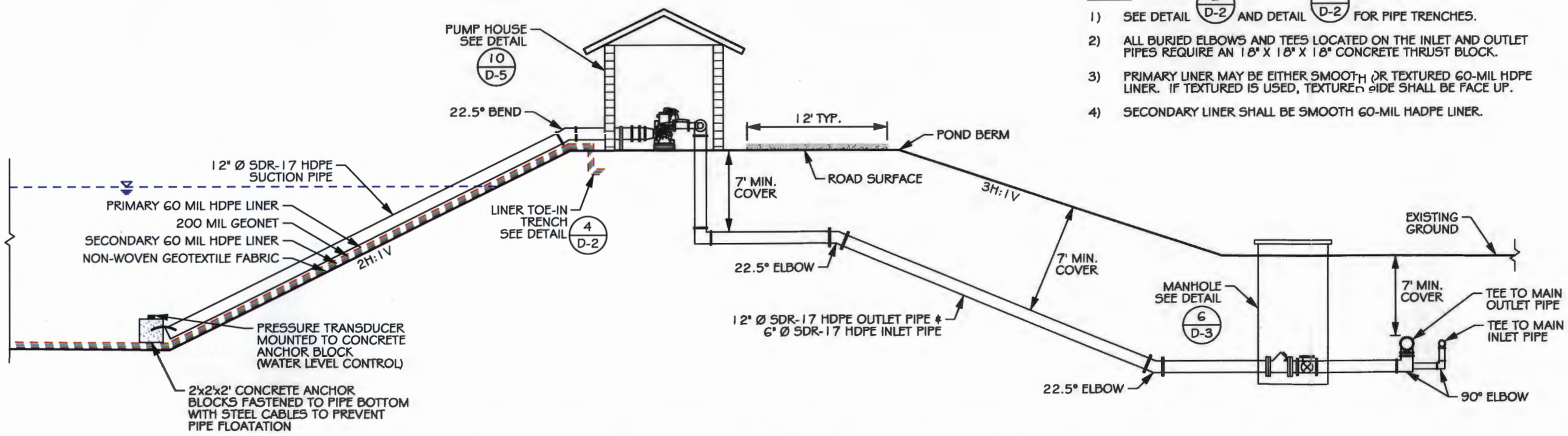
Drainage Ditch Cross Sections

SHEET
XS-3



PLAN VIEW - PIPE MAIN TO PUMPING STATION (1 / P-2)

SCALE: 1" = 10'



PROFILE VIEW - PIPE MAIN TO PUMPING STATION (0 / D-1)

SCALE: 1" = 10'

NOTES:

1) SEE DETAIL 2 D-2 AND DETAIL 3 D-2 FOR PIPE TRENCHES.
2) ALL BURIED ELBOWS AND TEES LOCATED ON THE INLET AND OUTLET PIPES REQUIRE AN 18" X 18" X 18" CONCRETE THRUST BLOCK.
3) PRIMARY LINER MAY BE EITHER SMOOTH OR TEXTURED 60-MIL HDPE LINER. IF TEXTURED IS USED, TEXTURED SIDE SHALL BE FACE UP.
4) SECONDARY LINER SHALL BE SMOOTH 60-MIL HADPE LINER.

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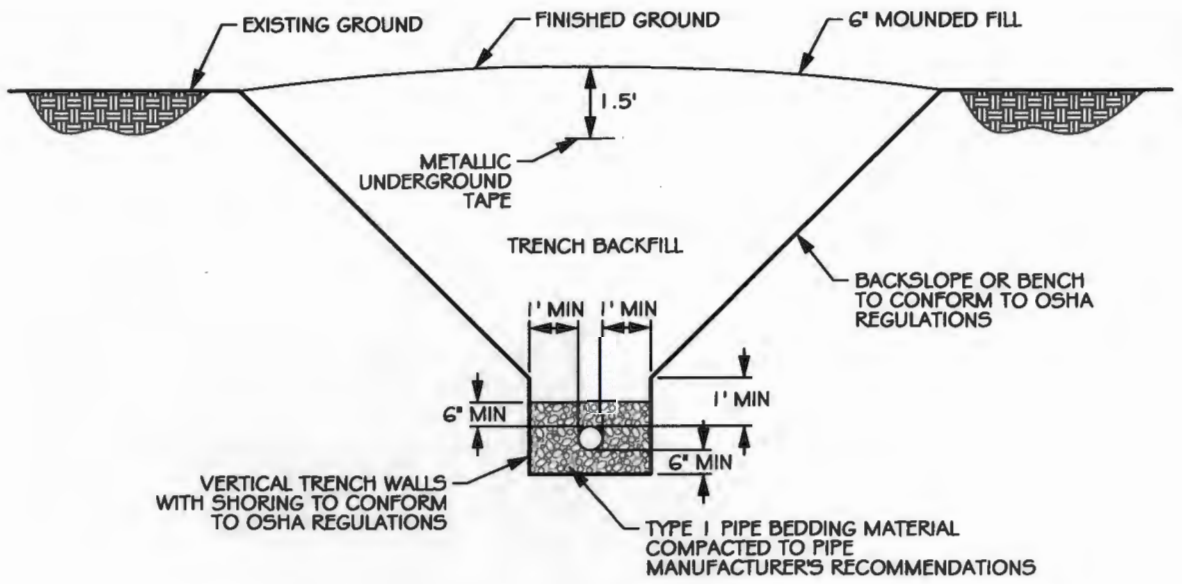
DSGN	DATE	CKD	DATE	CKD
MRS	8/12	STH		
REV				

JOB # 2011-063

EAST BLANCO PRODUCED WATER REUSE FACILITY

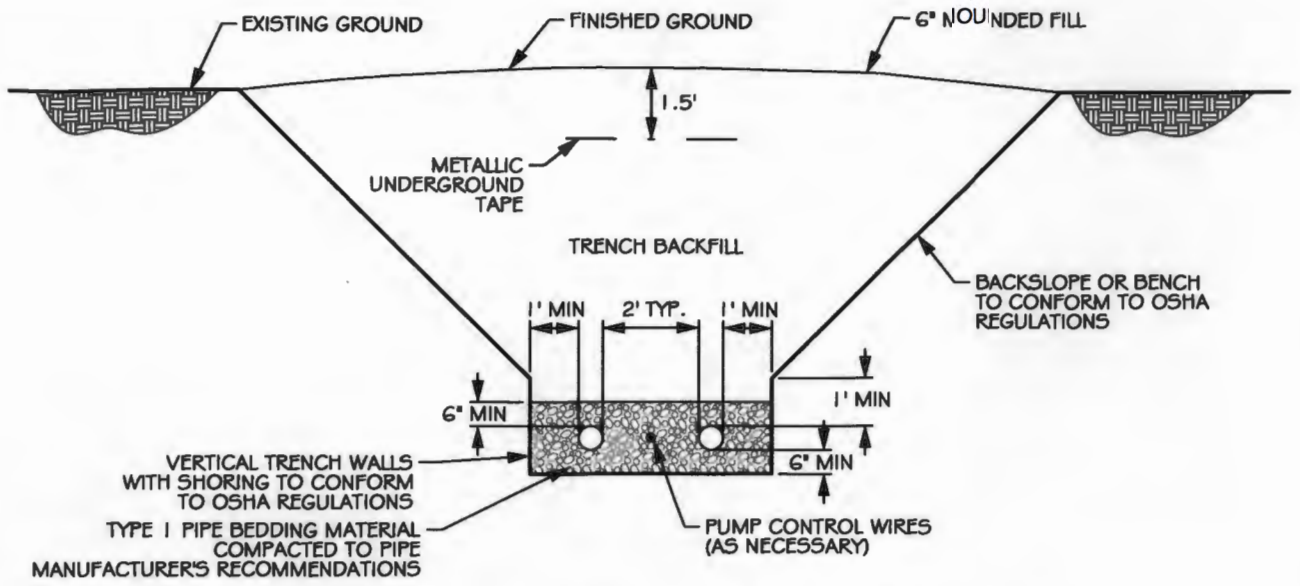
Pipe System Details

SHEET D-1



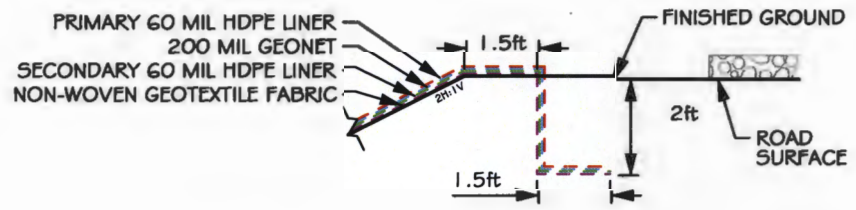
PIPE TRENCH DETAIL - SINGLE PIPE (2 / D-2)

SCALE: 1" = 4'



PIPE TRENCH DETAIL - MULTIPLE PIPES (3 / D-2)

SCALE: 1" = 4'

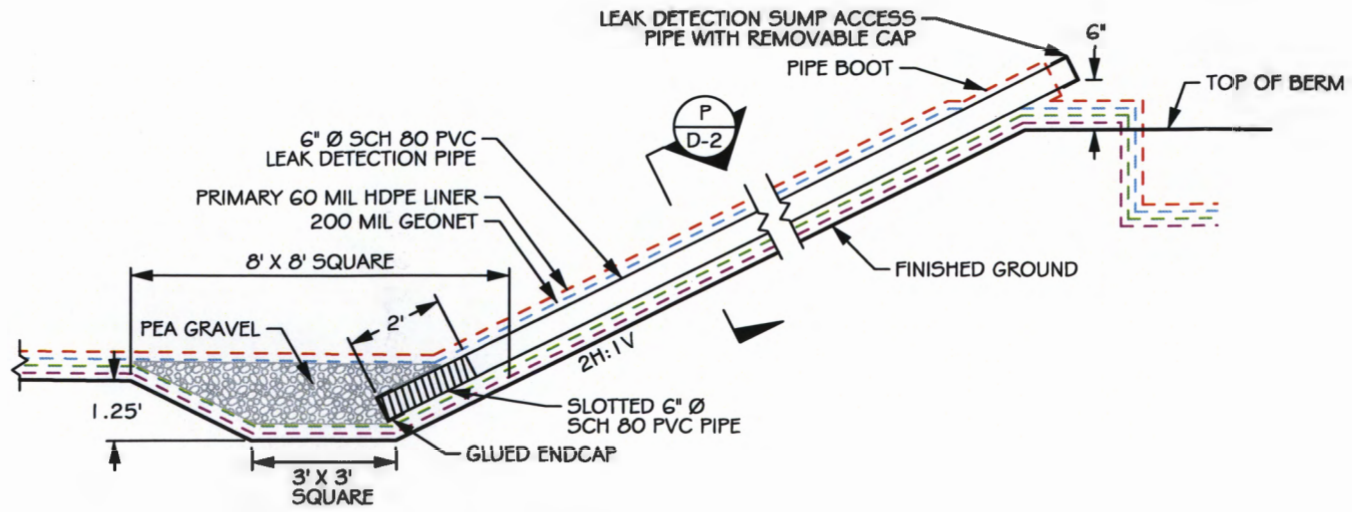


LINER TOE-IN DETAIL (4 / D-1)

NOT TO SCALE

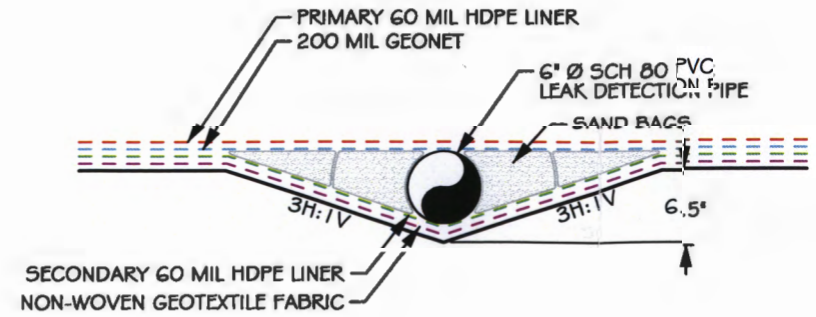
NOTES:

1) PRIMARY LINER MAY BE EITHER SMOOTH OR TEXTURED 60-MIL HDPE LINER. IF TEXTURED IS USED, TEXTURED SIDE SHALL BE FACE UP.
2) SECONDARY LINER SHALL BE SMOOTH 60-MIL HADPE LINER.



SUMP DETAIL (5 / D-1)

NOT TO SCALE



SUMP ACCESS PIPE DETAIL (P / D-2)

NOT TO SCALE

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(505) 634-5104

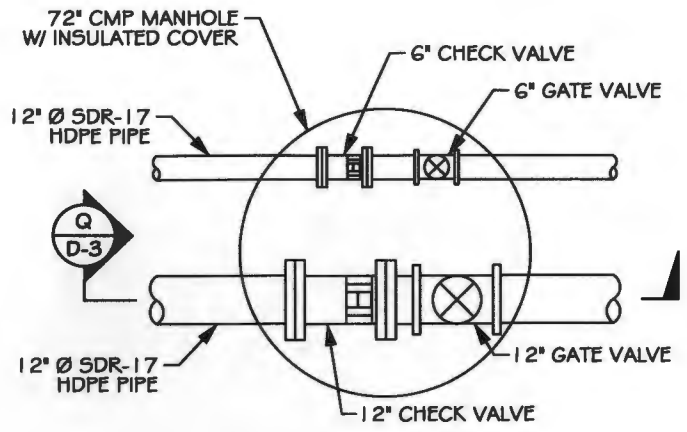
DSGN	DATE	CKD	REV	DATE	CKD
MRS	6/12	STH			

JOB # 2011-063

EAST BLANCO PRODUCED WATER REUSE FACILITY

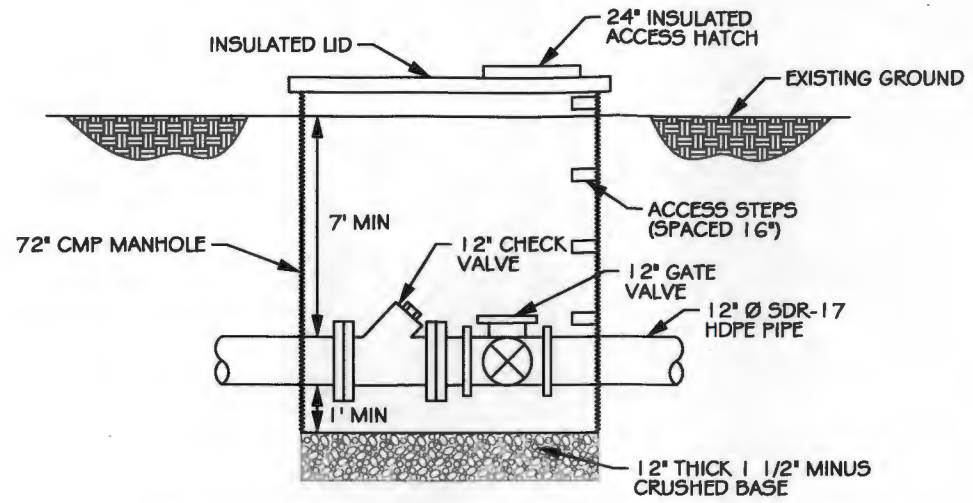
Pipe Trench & Liner Details

SHEET D-2



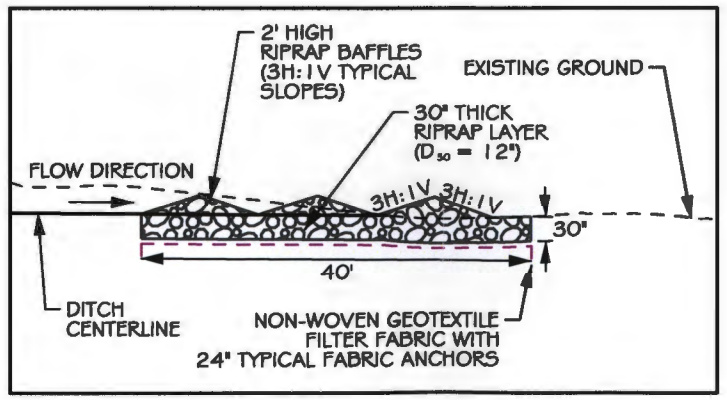
PROFILE VIEW - MANHOLE DETAIL (6 / D-1)

NOT TO SCALE



PLAN VIEW - MANHOLE DETAIL (Q / D-3)

NOT TO SCALE



DITCH RIPRAP BAFFLE DETAIL (7 / DR-1, DR-2)

SCALE: 1" = 20'

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DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD

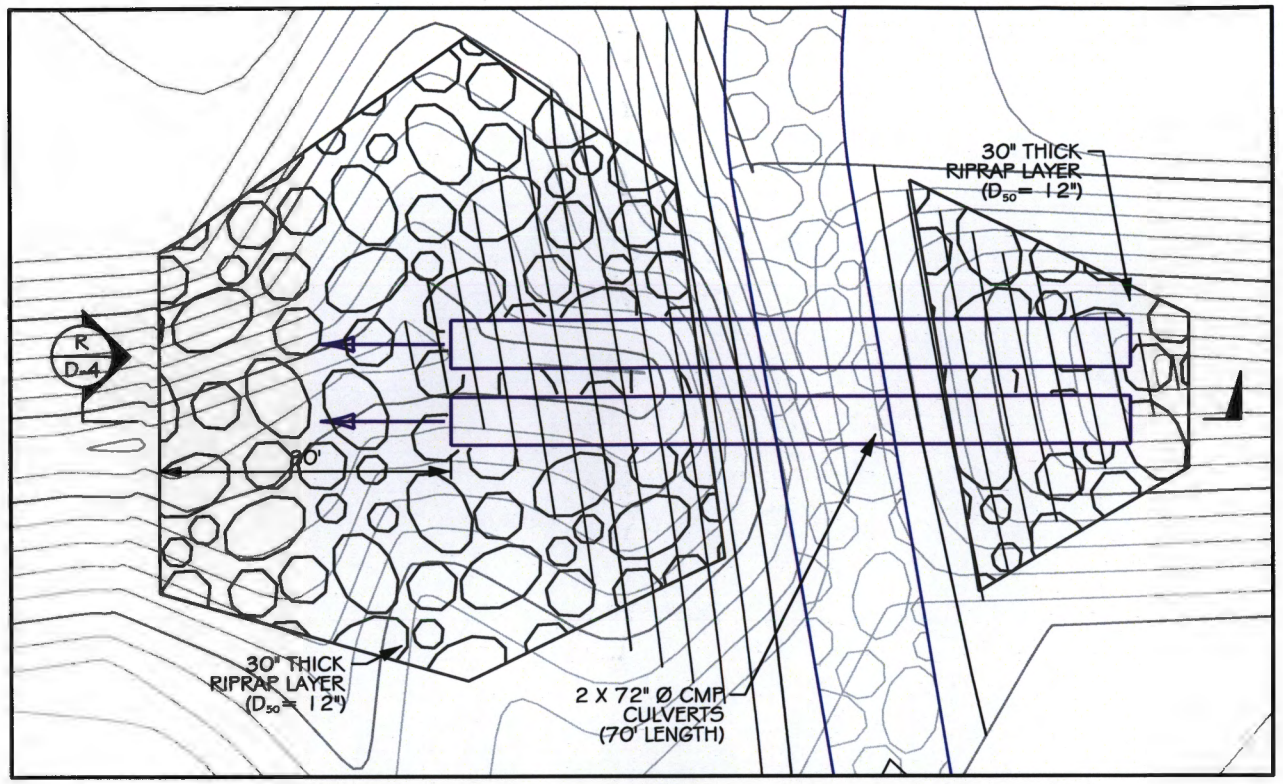
JOB # 2011-063

FILE PATH: K:\BLACK HILLS\1063 - E. BLANCO FIELD\DWG\EAST BLANCO PLAN SET.dwg
12/20/2012

EAST BLANCO PRODUCED WATER REUSE FACILITY

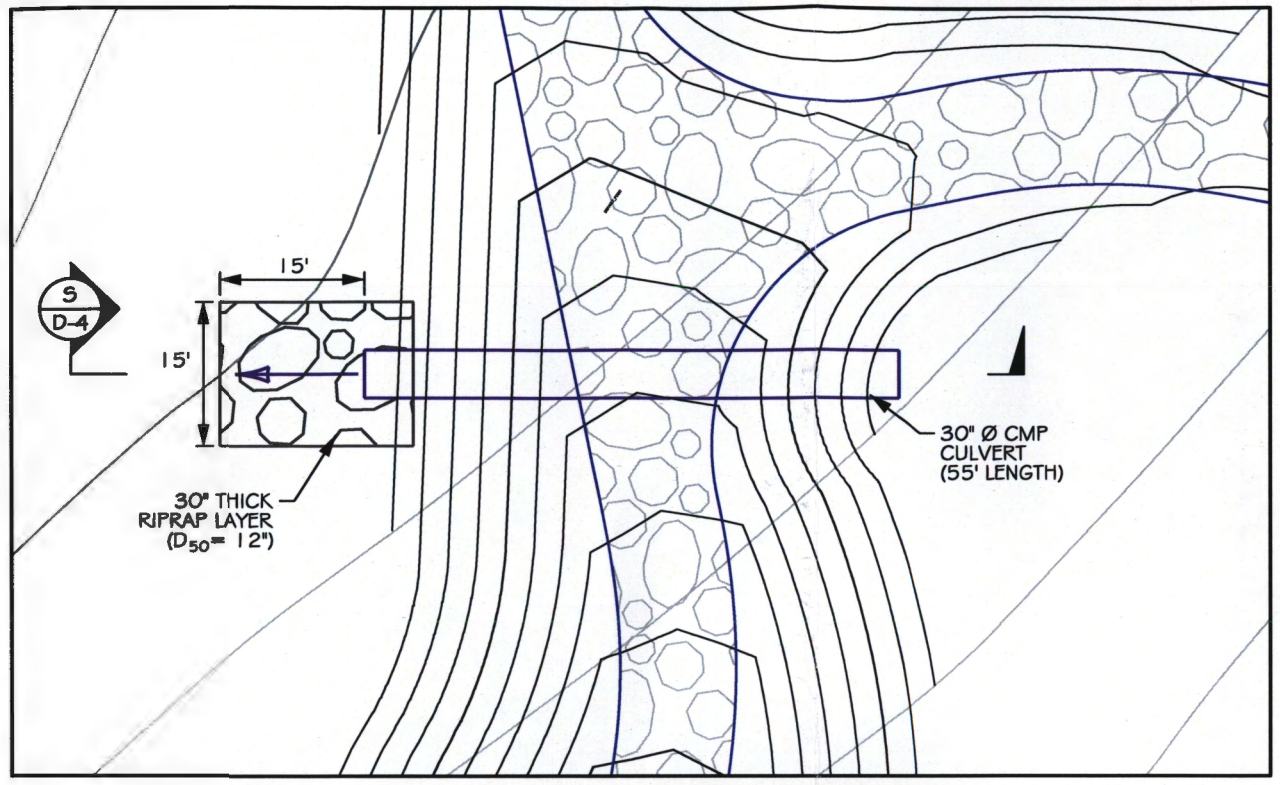
Pipe & Riprap Detail

SHEET
D-3



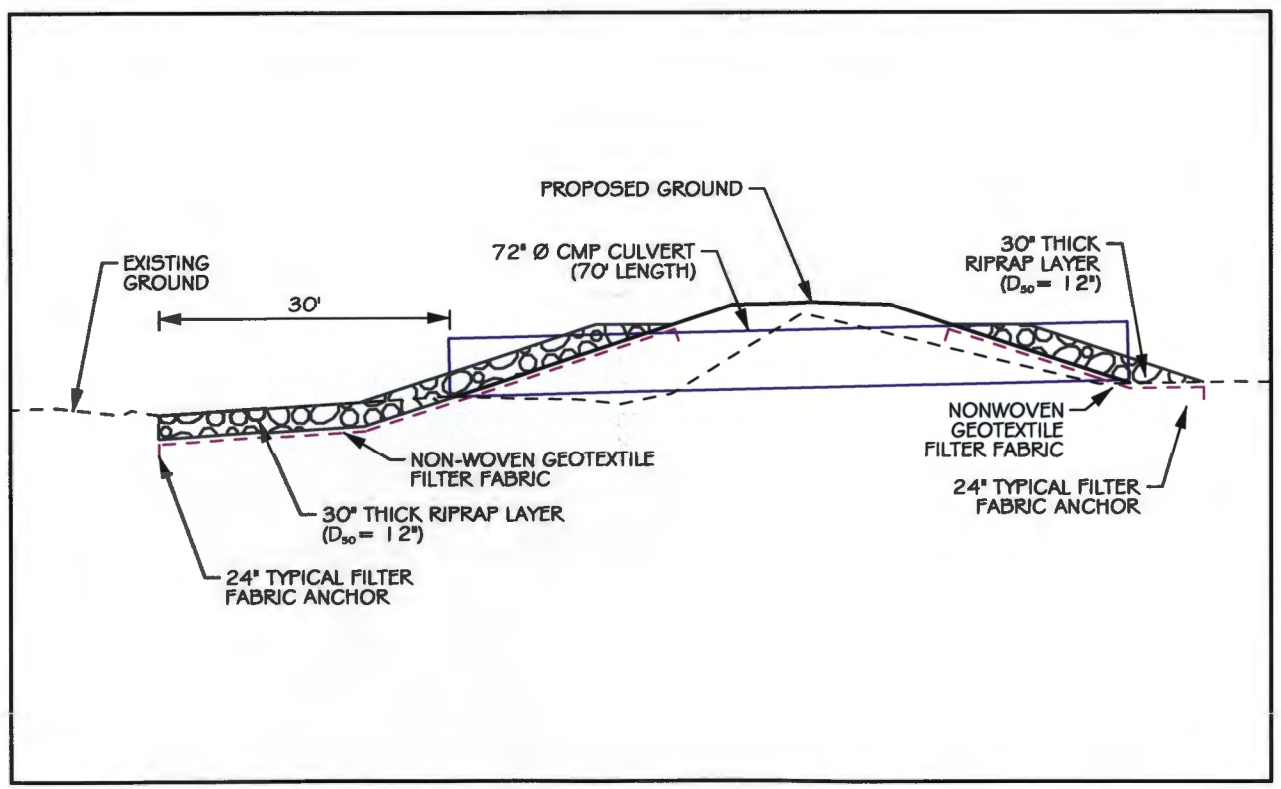
PLAN VIEW - 2 X 6' DIAMETER CULVERTS (8 / R-1)

SCALE: 1" = 20'



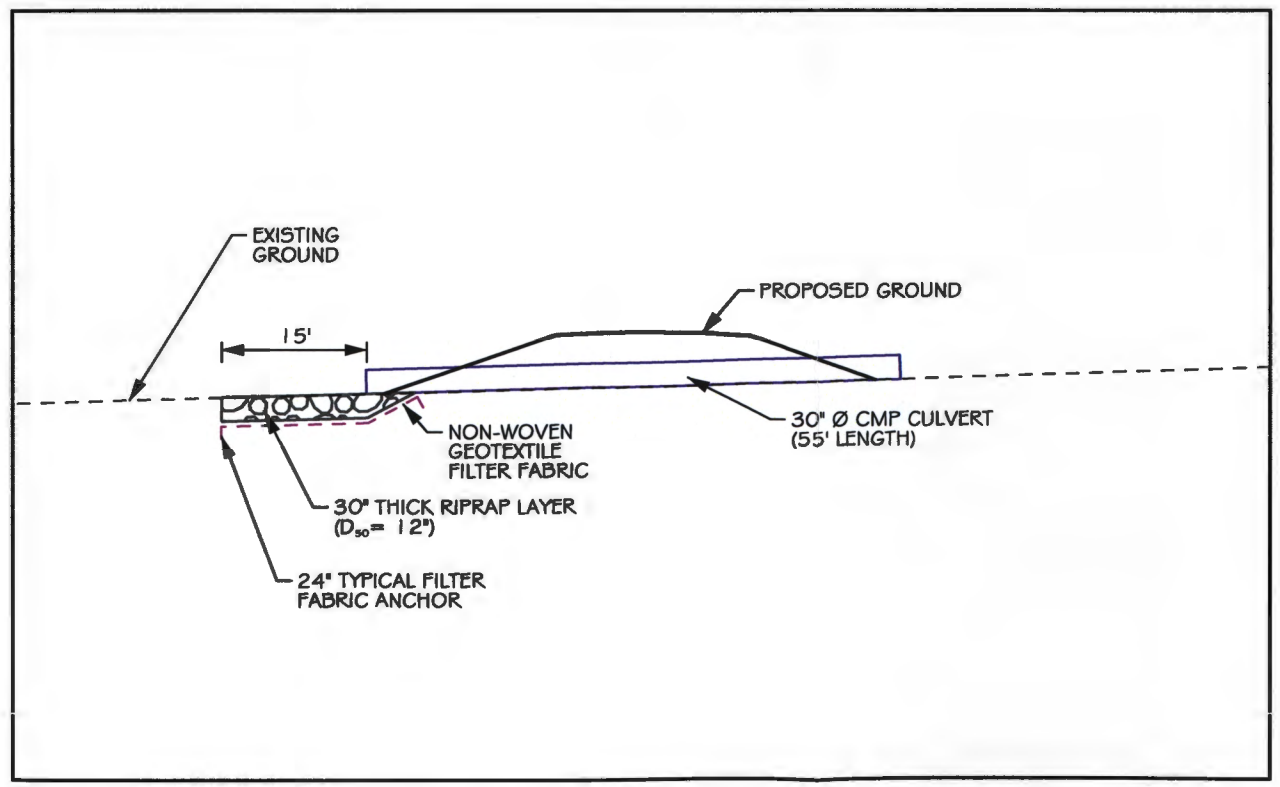
PLAN VIEW - 30" DIAMETER CULVERT (9 / R-1)

SCALE: 1" = 20'



PROFILE VIEW - 2 X 6' DIAMETER CULVERTS (R / D-4)

SCALE: 1" = 20'



PROFILE VIEW - 30" DIAMETER CULVERT (S / D-4)

SCALE: 1" = 20'

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PEN TABLE PATH: K:\BLACK HILLS\1063 - E. BLANCO FIELD\OFFICE\ BLANCO PLAN SET.tbl
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12/20/2012

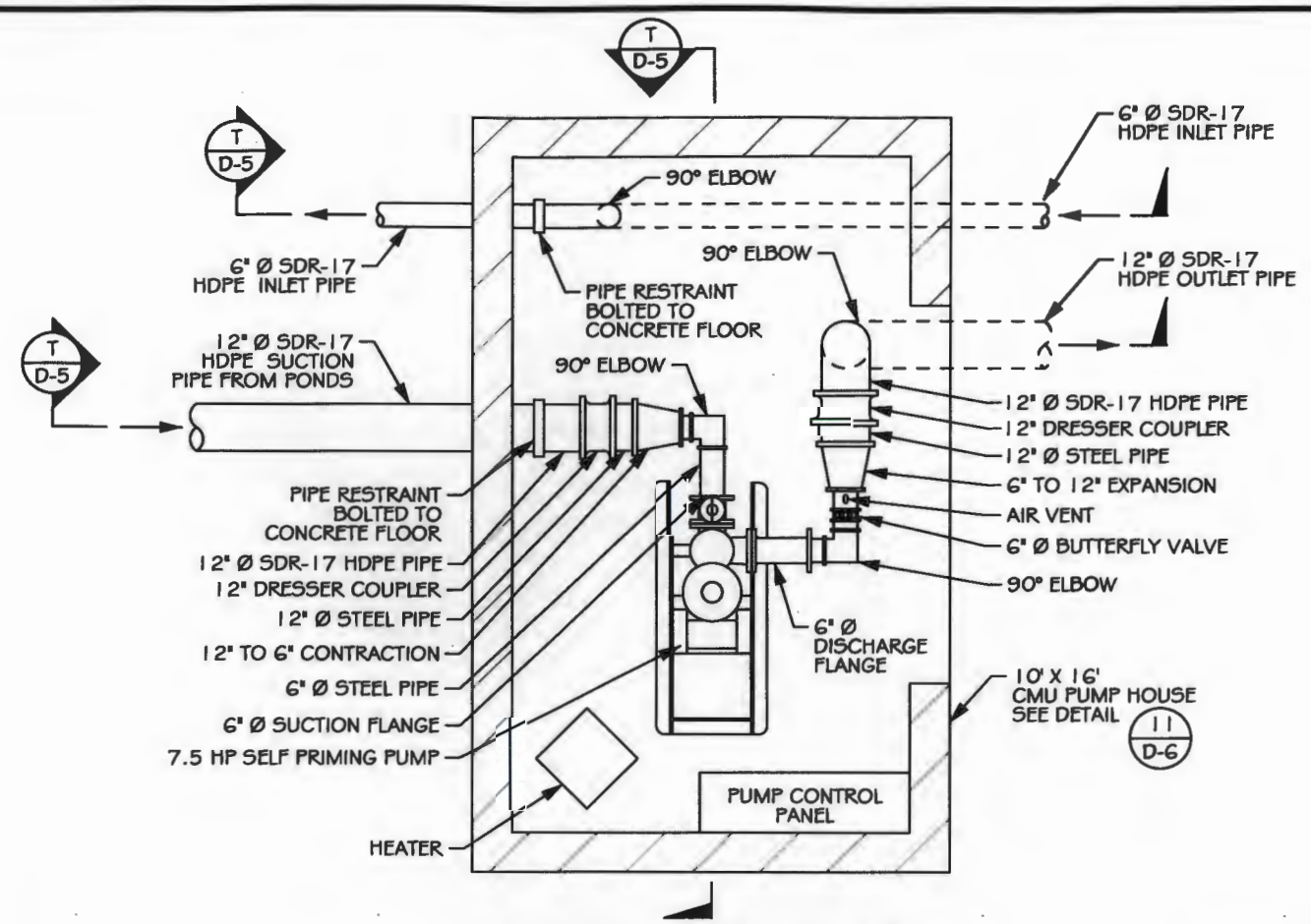
DSGN	MRS	REV	DATE	CKD
DATE	6/12			
CKD	STH			

JOB # 2011-063

EAST BLANCO PRODUCED WATER REUSE FACILITY

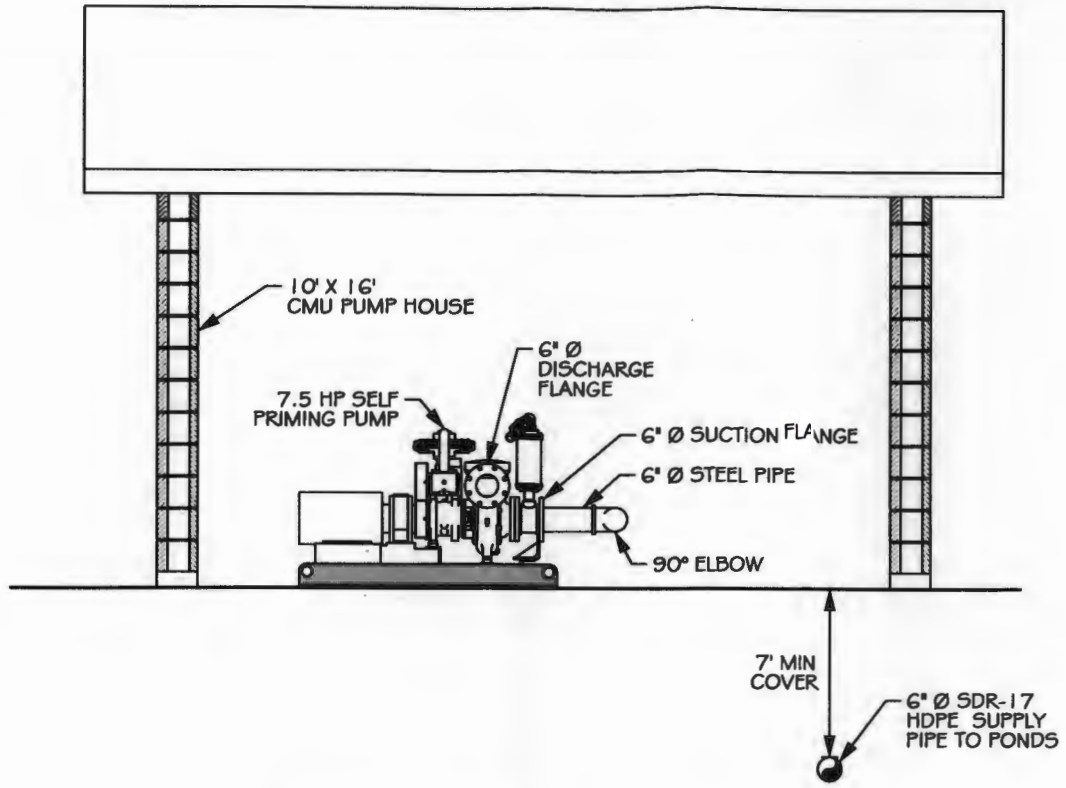
Culvert Details

SHEET
D-4



PLAN VIEW - PUMP HOUSE (10 / D-1)

NOT TO SCALE

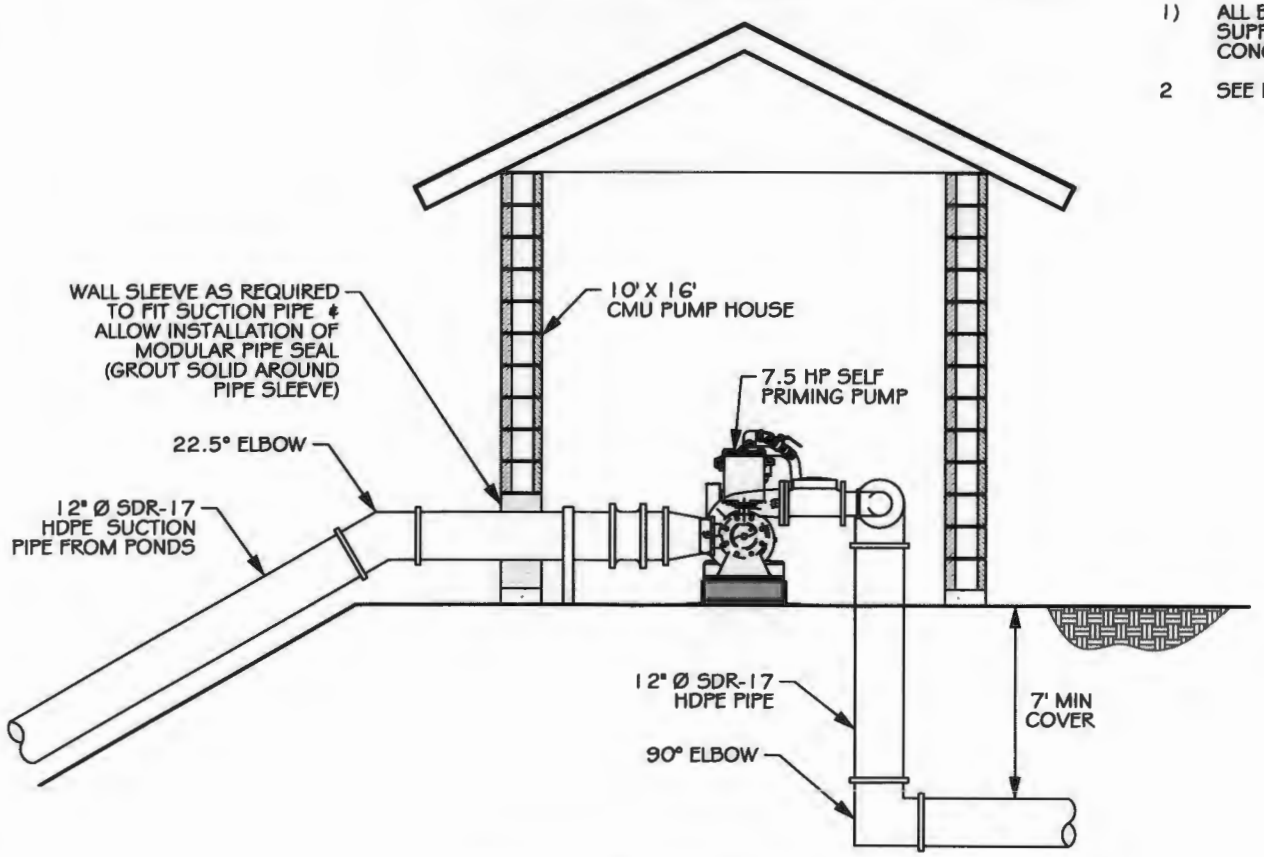


PROFILE VIEW - PUMP HOUSE (T / D-5)

NOT TO SCALE

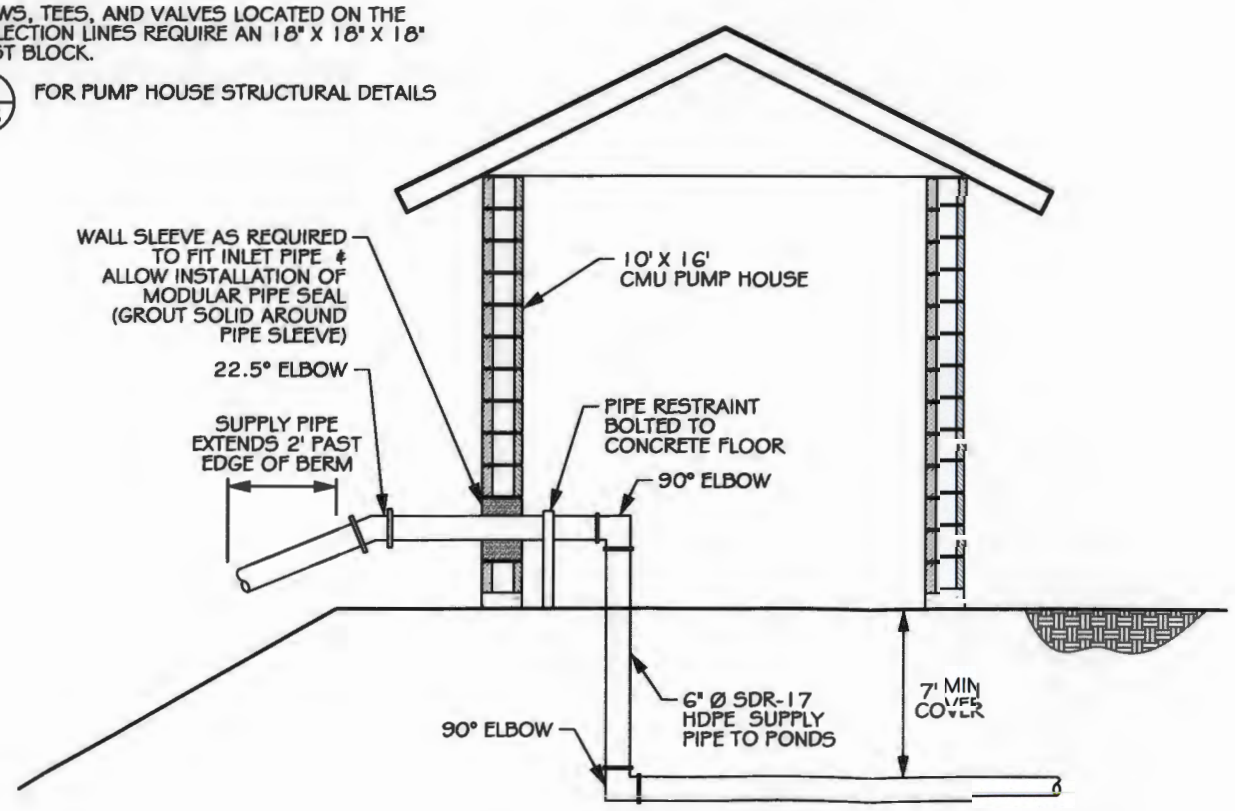
NOTES:

1) ALL BURIED ELBOWS, TEES, AND VALVES LOCATED ON THE SUPPLY AND COLLECTION LINES REQUIRE AN 18" X 18" X 18" CONCRETE THRUST BLOCK.
2) SEE DETAIL (11 / D-6) FOR PUMP HOUSE STRUCTURAL DETAILS



PROFILE VIEW - PUMP HOUSE (T / D-5)

NOT TO SCALE



PROFILE VIEW - PUMP HOUSE (T / D-5)

NOT TO SCALE

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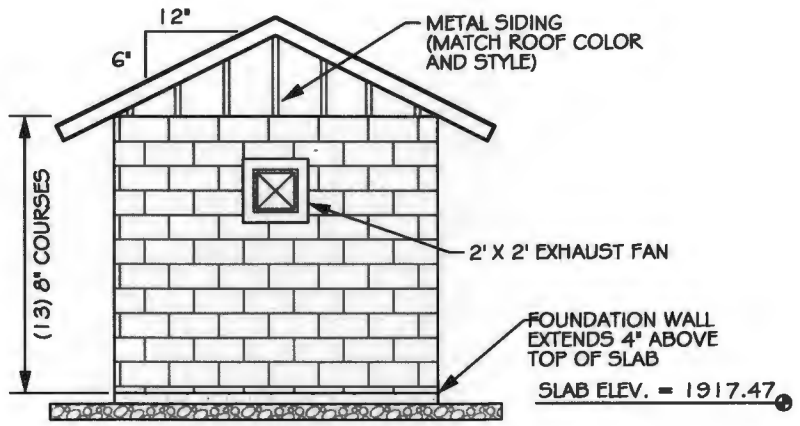
MRS	6/12	STH	
REV	DATE	CKD	

JOB # 2011-063

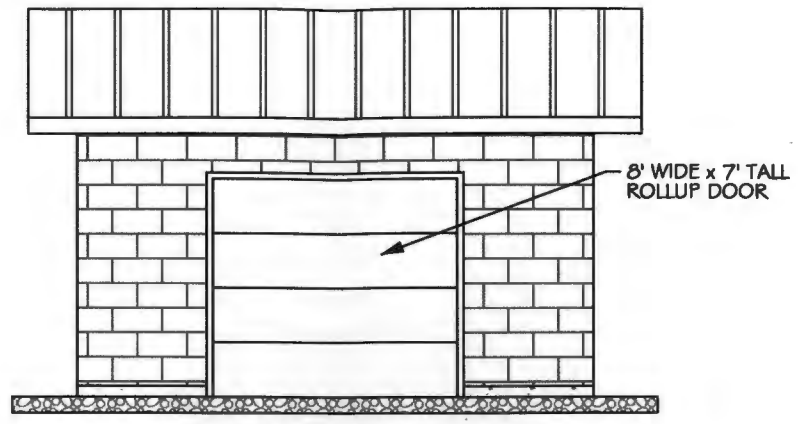
EAST BLANCO PRODUCED WATER REUSE FACILITY

Pump Details

SHEET D-5



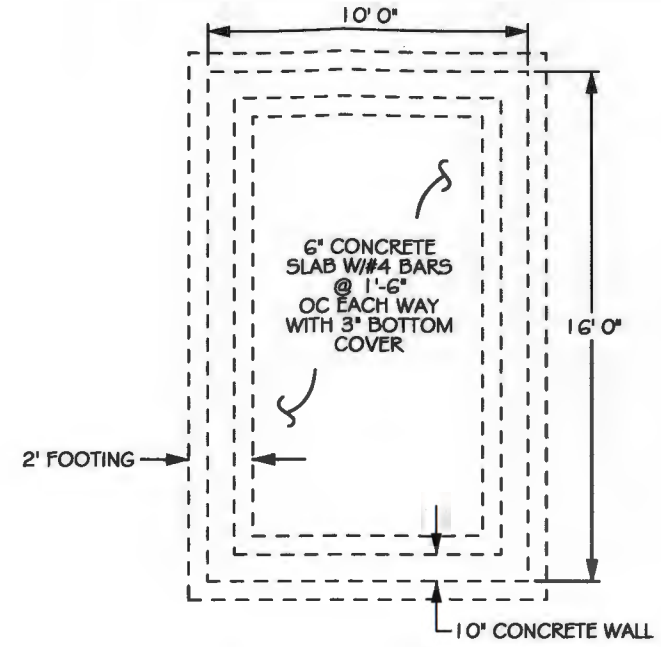
WEST ELEVATION
SCALE: 1" = 6'



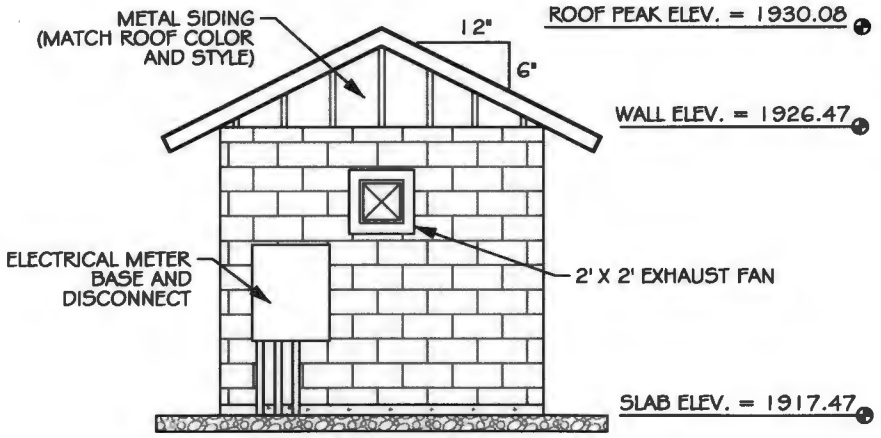
NORTH ELEVATION
SCALE: 1" = 6'

NOTES:

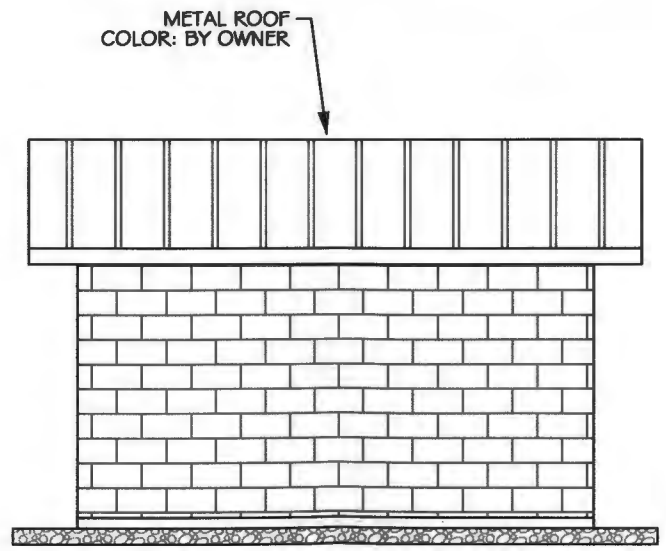
1) PRE-ENGINEERED ROOF TRUSSES WITH BRIDGING PER MANUFACTURER'S REQUIREMENTS. DESIGN LOADING ??.? PSF SNOW AND ?? MPH WIND WITH (2) GALE END TRUSSES SHEATED WITH 1/2" PLYWOOD AND METAL SIDING - MATCH ROOF COLOR AND STYLE.



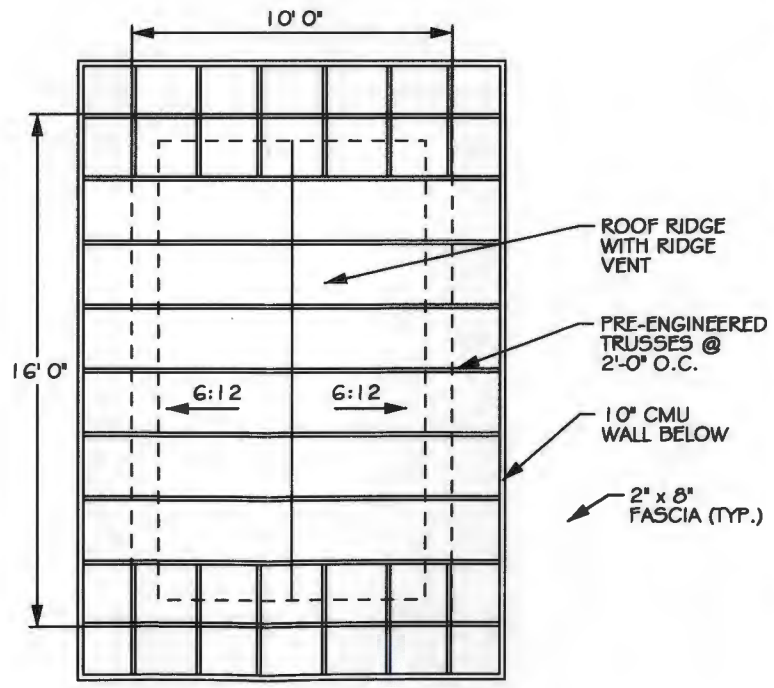
FOUNDATION PLAN
SCALE: 1" = 6'



EAST ELEVATION
SCALE: 1" = 6'



SOUTH ELEVATION
SCALE: 1" = 6'



ROOF FRAMING PLAN
SCALE: 1" = 6'

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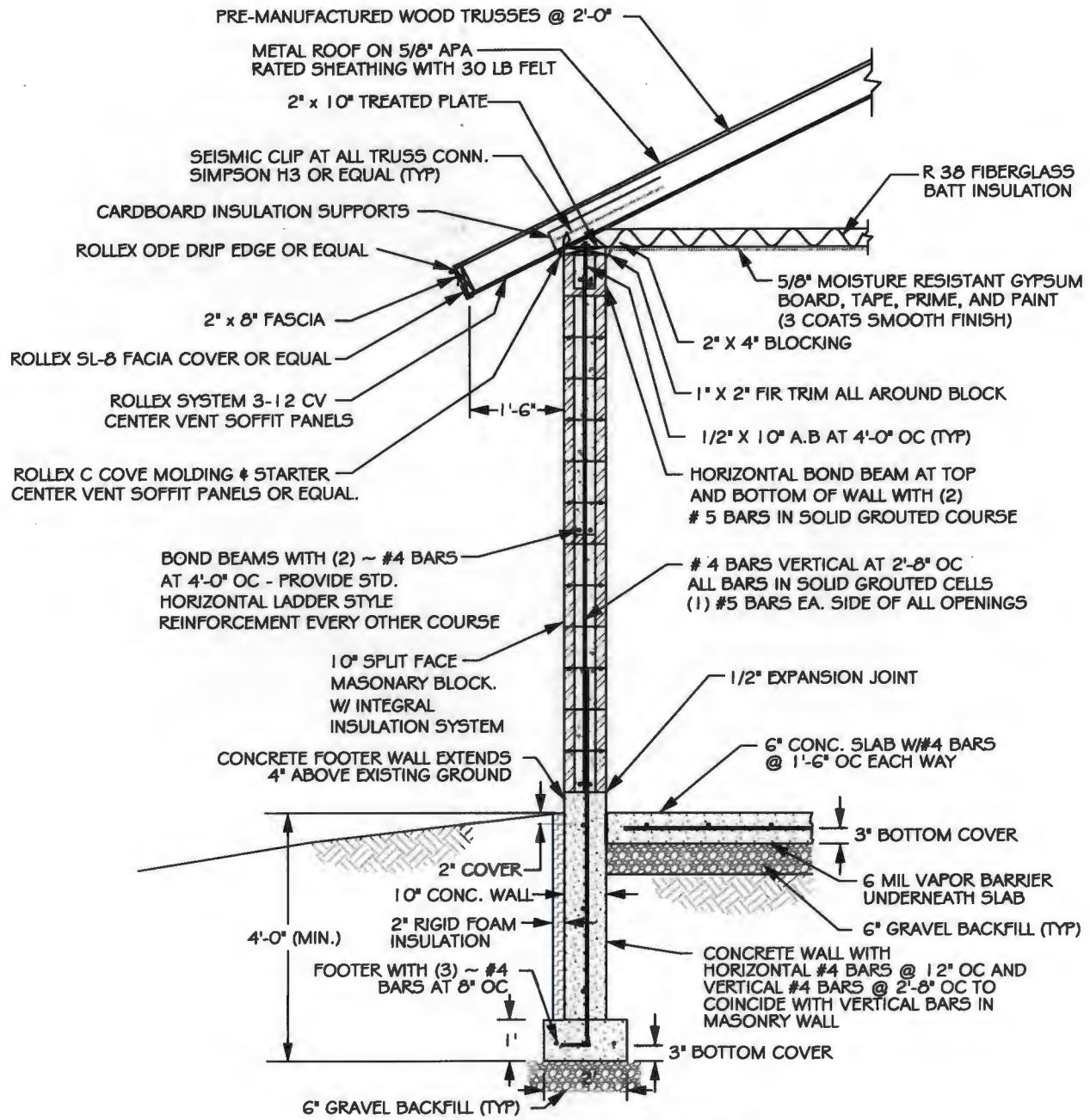
REV	DATE	CKD

JOB # 2011-083

EAST BLANCO PRODUCED WATER REUSE FACILITY

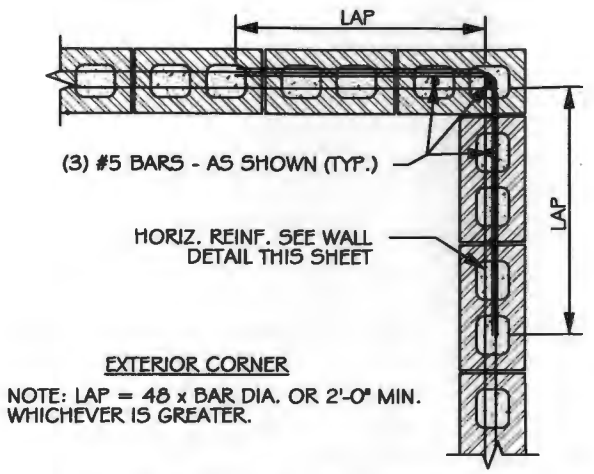
Pump House Details

SHEET
D-6



TYPICAL WALL DETAIL

NO SCALE

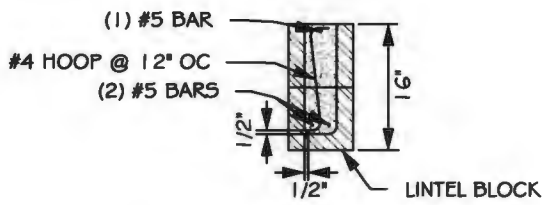


EXTERIOR CORNER

NOTE: LAP = 48 x BAR DIA. OR 2'-0" MIN. WHICHEVER IS GREATER.

CMU CORNER REINFORCEMENT

NO SCALE



NOTE: EXTEND 18" EACH SIDE OF OPENING OR EXTEND 10" WITH 8" HOOK (CORNERS).

TYPICAL LINTEL DETAIL (ALL HEADERS)

NO SCALE

NOTES:

1) MASONARY COLORS ARE OWNER SELECT.
2) ALL REINFORCEMENT SPLICE LENGTHS SHALL BE 24".

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MRS	8/12	STH
REV	DATE	CKD

JOB # 2011-063

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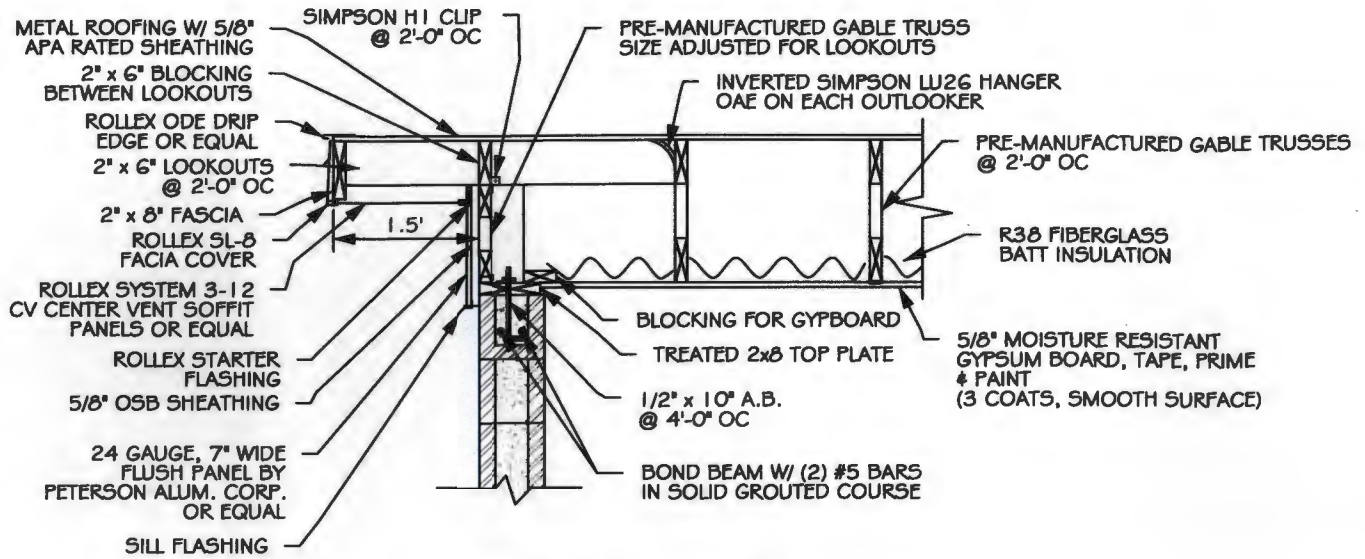
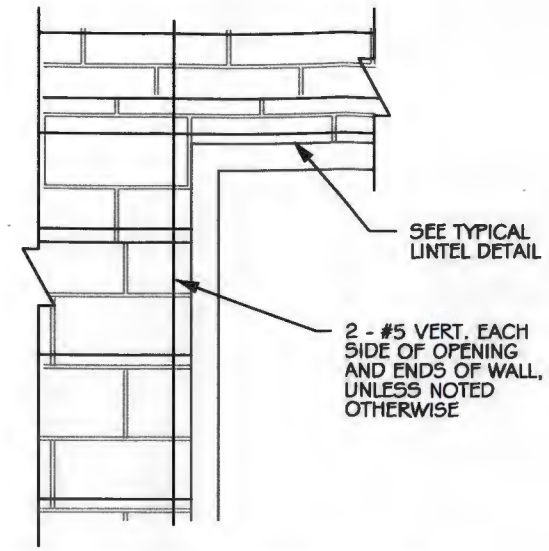
EAST BLANCO PRODUCED WATER REUSE FACILITY

Pump House Details

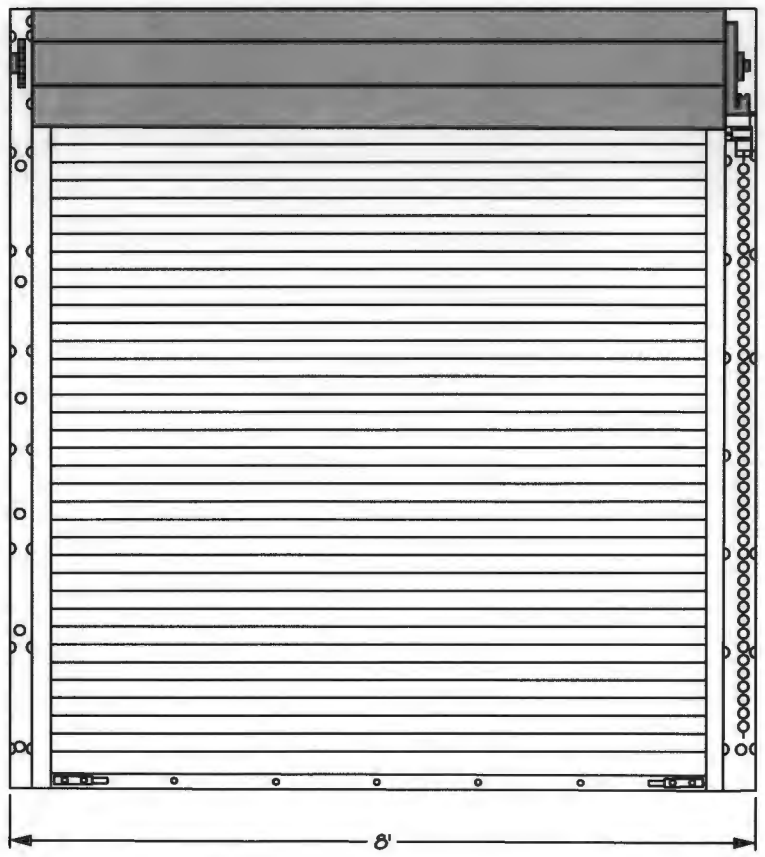
SHEET
D-7

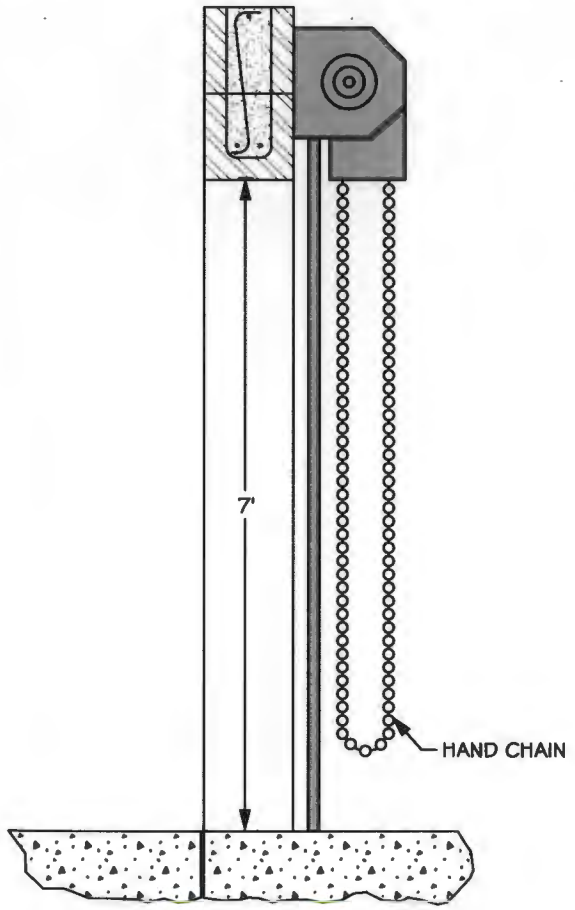


END WALL DETAIL
NO SCALE



CMU DOOR REINFORCEMENT
NO SCALE





ROLLUP DOOR CONNECTION DETAIL
NO SCALE

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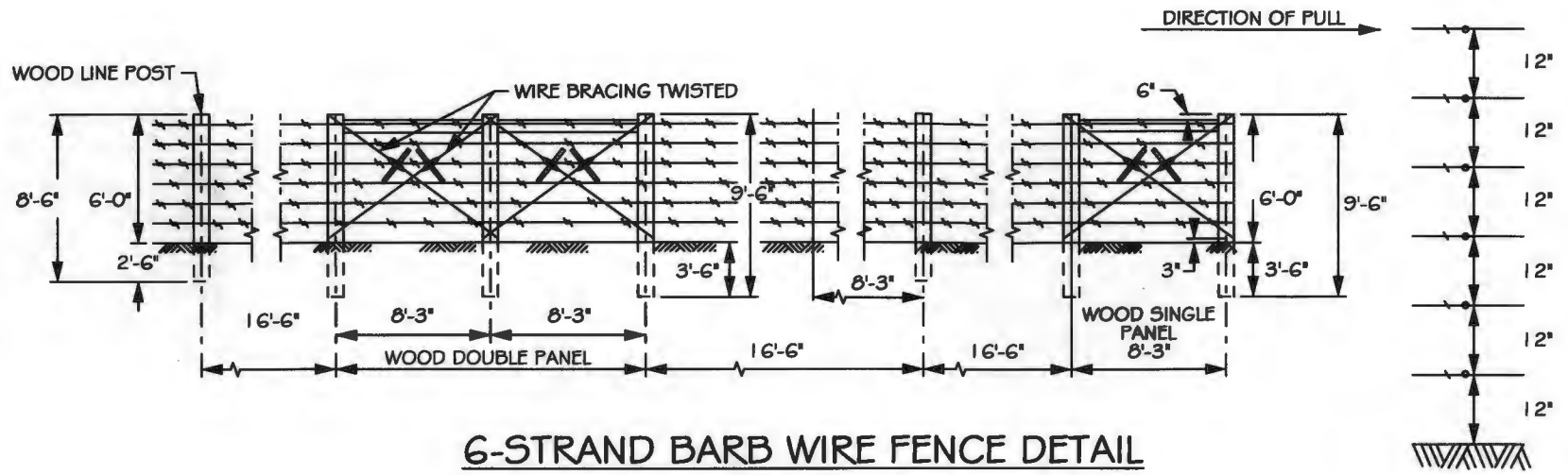
DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD

JOB # 2011-063

EAST BLANCO PRODUCED WATER REUSE FACILITY

Pump House Details

SHEET
D-8

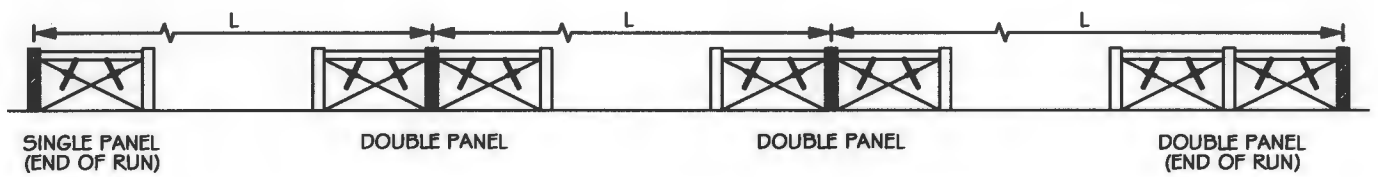


6-STRAND BARB WIRE FENCE DETAIL

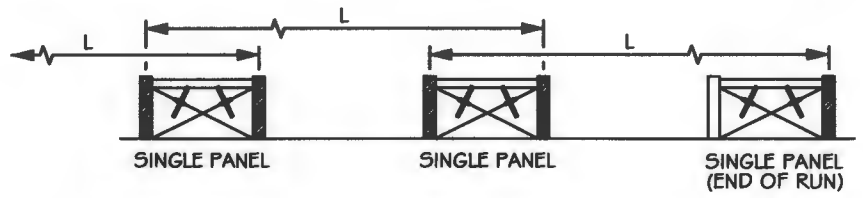
NOT TO SCALE

STAYS

1. USE WIRE STAYS ON ALL FENCES UNLESS WOOD STAYS ARE SPECIFIED.
2. LOCATE STAYS HALFWAY BETWEEN LINE POSTS.
3. WIRE STAYS FOR BARBED WIRE FENCING ARE 2" LONGER THAN THE DISTANCE BETWEEN THE TOP AND BOTTOM WIRES.



RUN = L	PANELS REQUIRED
LESS THAN 66'	NONE
66'-660'	SINGLE
OVER 660' TO 990' MAX	DOUBLE



DOUBLE PANEL AT FENCE CORNER OR ANGLE BREAK

NOTE:

ATTACH BARBED WIRES TO POSTS BY WRAPPING AROUND THE POST AT LEAST TWO TIMES, THEN WRAPPING AROUND ITSELF FIVE TIMES.

NOTES:

① LIMIT RUN LENGTHS IN POOR SOIL CONDITIONS TO REDUCE RESULTING TENSION AT CORNER OR ANGLE BREAK PANELS.

② TIE OFF ON ALL CROSS HATCHED OR SHADED POSTS.

FENCE PANEL DETAILS

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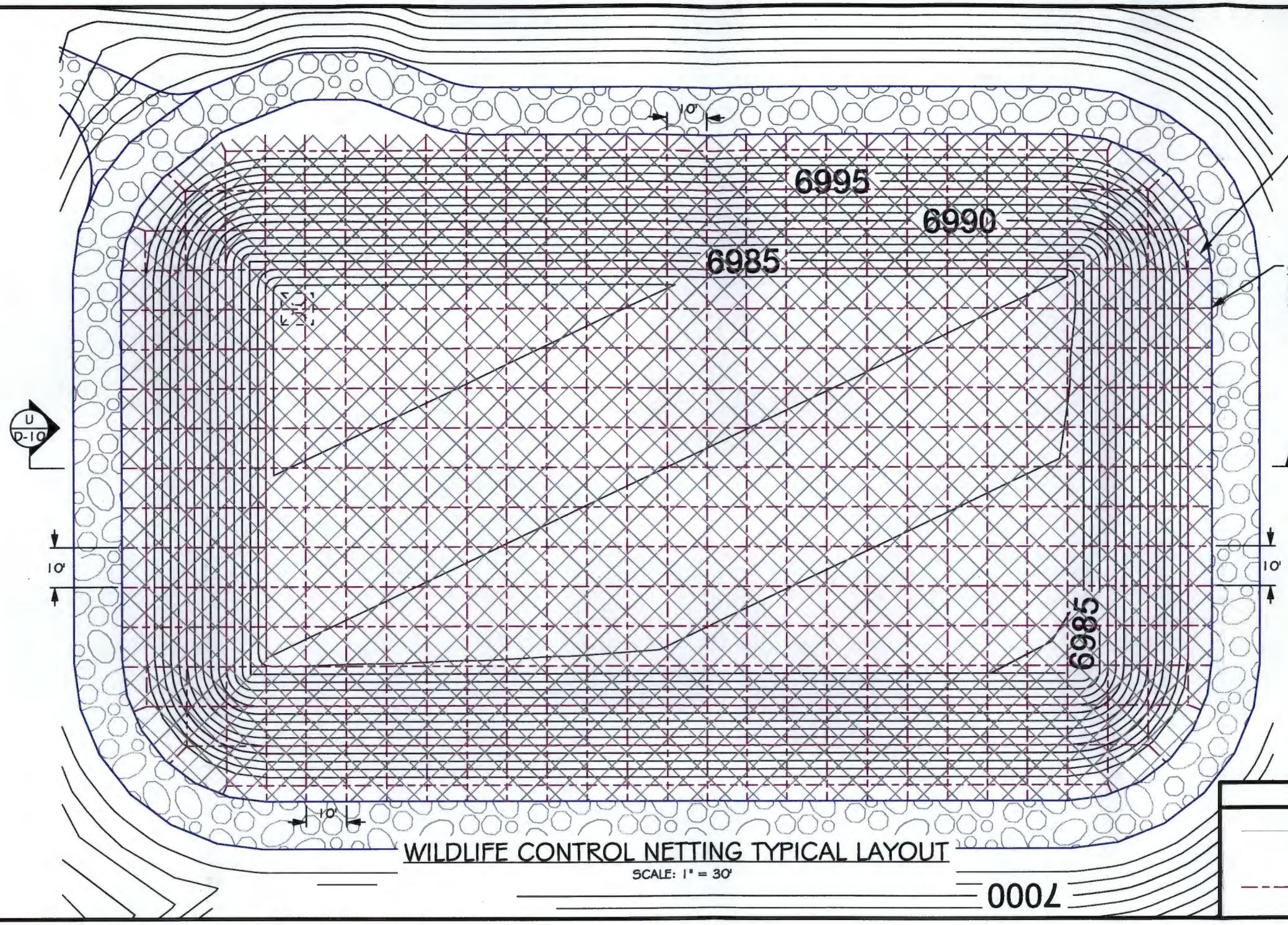
MRS	6/12	STH
REV	DATE	CKD

JOB # 2011-063

EAST BLANCO PRODUCED WATER REUSE FACILITY

Fence Details

SHEET D-9

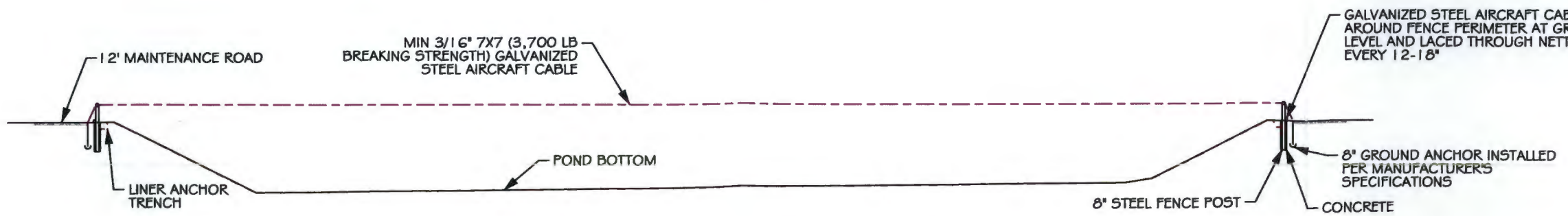


WILDLIFE CONTROL NETTING TYPICAL LAYOUT

SCALE: 1" = 30'

LEGEND

- HEAVY DUTY STRUCTURAL NETTING WITH 2" MESH SIZE OR SMALLER
- MIN 3/16" 7X7 (3,700 LB BREAKING STRENGTH) GALVANIZED STEEL AIRCRAFT CABLE



WILDLIFE CONTROL NETTING SECTION (U D-10)

NO SCALE

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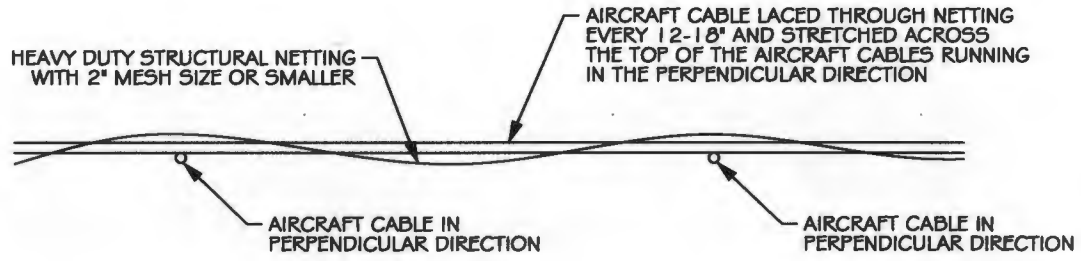
DSGN	DATE	CKD	CKD	DATE	STH
MRS	6/12	REV			

JOB # 2011-063

EAST BLANCO PRODUCED WATER REUSE FACILITY

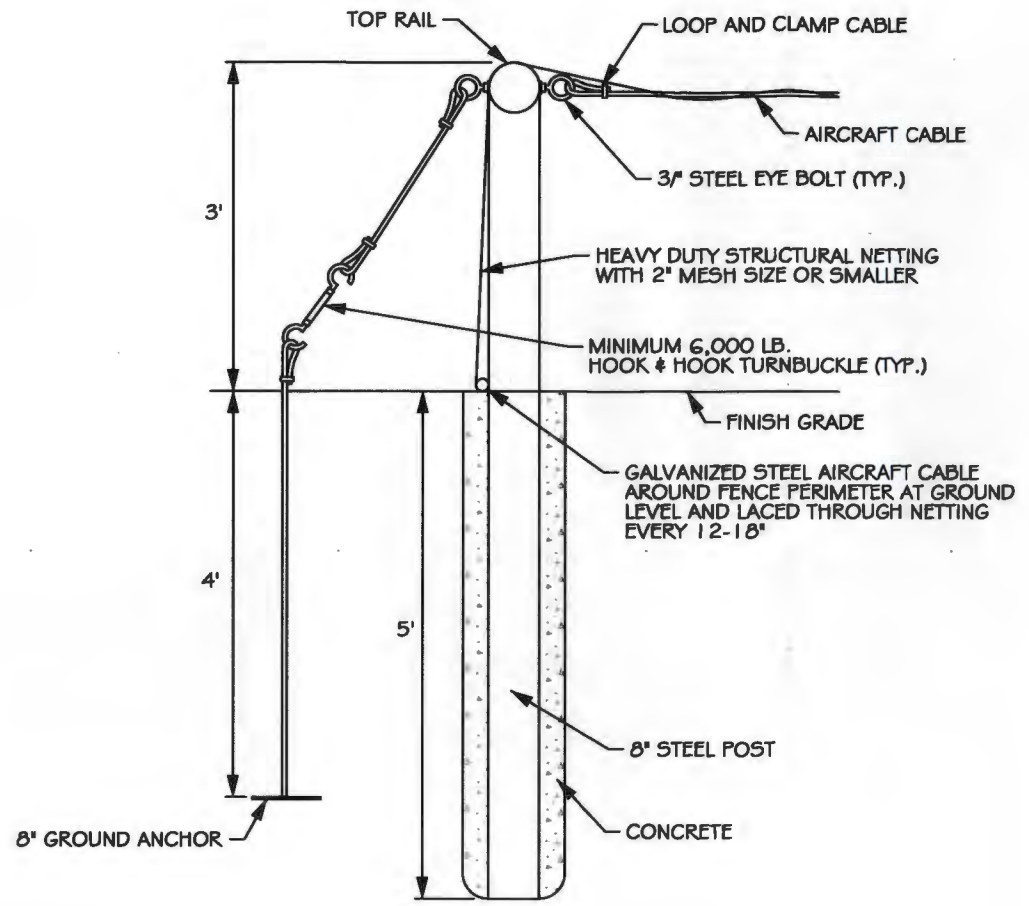
Wildlife Control Details

SHEET
D-10



NETTING DETAIL 11 D-10

NOT TO SCALE



NETTING SUPPORT DETAIL 12 D-10

NOT TO SCALE

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DSGN	MRS	REV	
DATE	6/12	DATE	
CKD	STH	CKD	

JOB # 2011-063

EAST BLANCO PRODUCED WATER REUSE FACILITY

Wildlife Control Details

SHEET
D-11

Appendix B

Technical Specifications

SECTION 01000

ADMINISTRATIVE INSTRUCTIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide all supervision, personnel, labor, materials, tools, equipment, maintenance and repairs, services, and all other facilities and incidentals required for the execution and completion of the Work as specified herein.

B. Provide all topsoil stripping and stockpiling, excavating, hauling, backfilling, grading, installation of pipes, pumps, geosynthetic materials, and associated work as shown on the Drawings, as specified herein, and as required to complete all components of the Work and all associated structures, complete, in place, and accepted by the ENGINEER.

1.02 CONSTRUCTION SCHEDULING

A. Provide a construction schedule within ten (10) calendar days of issuance of the Notice to Proceed.

B. Provide the ENGINEER for approval, a comprehensive construction schedule that includes but is not limited to:

1. A list of all construction operations,

2. A list of the types and numbers of equipment which will be mobilized to the site during construction, and

3. The anticipated length(s) of time during which each item of equipment will be used at the site.

C. Construction activities involving placement of compacted fill will only be allowed during normal daylight hours.

D. Revise the construction schedule as required by the ENGINEER.

1. Provide the ENGINEER a revised construction schedule if the ENGINEER determines that the Work is not progressing according to the approved schedule or if the ENGINEER determines that additional tasks must be added to accurately track the project progress.

2. Include in the revised construction schedule all revised operations, methods, overtime, and/or additional equipment and labor required to meet the revised schedule.

3. OWNER may withhold payment until a revised construction schedule has been submitted by the CONTRACTOR and approved by the ENGINEER.

1.03 CONSTRUCTION SITE RESTRICTIONS

A. Do not trespass on or in any way impact Black Hills Exploration and Production property or other property outside the construction area without written permission from the OWNER.

1.04 PRE-CONSTRUCTION CONFERENCE

A. At the award of the contract, a preconstruction conference with the CONTRACTOR, OWNER, and ENGINEER will be held.

1. The pre-construction conference will include consideration of all components of the upcoming phases of the Work and any possible safety concerns.

2. Ensure attendance by all of the CONTRACTOR'S assigned supervisory personnel.

3. Submit at this pre-construction conference a complete list of individual equipment and labor rates which will be used to perform miscellaneous projects as required during the course of the Work.

4. Submit at this pre-construction conference proposed locations for the staging/storage area.

5. The CONTRACTOR is responsible to develop a storm water pollution prevention plan according to the New Mexico Environment Department and all other related standards and regulations. The SWPPP and associated erosion control BMP's installed shall be deemed to be incidental and shall not be a pay item.

1.05 REFERENCES

A. All references to ASTM, ANSI, AASHTO, or other standardized designations or specifications in the contract documents are to the latest revisions at the time of the Notice of Award, except as noted in the contract documents.

1.06 ADDITIONAL PROVISIONS

A. Apply for, obtain, and pay for licenses and permits required to perform the Work.

B. Comply with applicable codes and regulations of authorities having jurisdiction, including but not limited to:

1. New Mexico Environment Department,

2. New Mexico Office of the State Engineer,

3. U.S. Army Corps of Engineers (COE), and

4. New Mexico Oil Conservation Division

C. Field verify dimensions shown on the Drawings before fabricating or ordering any materials.

1. Do not scale Drawings.

D. Notify the ENGINEER of existing conditions that differ from those shown on the Drawings.

E. Portions of the contract documents are written in the imperative mode.

1. Except where specifically intended otherwise, the subject of all imperative statements is the CONTRACTOR.

2. Examples of imperative statements include but are not limited to:

a. "Provide . . . " means "CONTRACTOR shall provide . . ." and

b. "Install . . . " means "CONTRACTOR shall install . . . ".

PART 2 - PRODUCTS

2.01 OWNER SUPPLIED PRODUCTS

A. OWNER will purchase and provide certain products to the CONTRACTOR for installation on the project. These products are noted in the drawings.

B. OWNER will contract directly with electrician to supply and install all electrical services as shown on the drawings.

PART 3 - EXECUTION

3.01 STANDARDS OF CONSTRUCTION

A. Complete all Work in a manner that meets the requirements of all applicable federal, state, and local laws, regulations, and ordinances.

B. Complete all Work in conformance with modern practices for this type of Work.

3.02 PERSONNEL SUPPORT AND SANITATION FACILITIES

A. Provide and maintain, in a neat and sanitary condition, such accommodations for use by the CONTRACTOR's and subcontractors' employees, the ENGINEER, and the OWNER as required by regulations of the General Safety and Health Regulations of the New Mexico Occupational Health and Safety Bureau and by State and locals Boards of Health as enforced by the Rio Arriba County Health Officer.

B. Provide personnel support facilities including but not limited to:

1. Drinking water,

2. First aid facilities,

3. Sanitary facilities,

4. Trash removal, and

5. Coordination with emergency medical services.

C. Prevent personnel support facilities and sanitation facilities from becoming a nuisance to the public or to the OWNER.

3.03 UTILITIES

A. The CONTRACTOR shall have full responsibility for locating all utilities before commencement of construction.

1. Omission of an existing utility location on the Drawings does not indicate or imply that a utility(ies) does not exist within the work site.

2. Inclusion of an existing utility(ies) location on the Drawings does not necessarily indicate the definite location(s) of the utility(ies).

B. Obtain written permission from the ENGINEER or OWNER before altering or removing any existing utility.

C. Protect all existing public or private utilities and improvements that are located on the work site.

1. Pay for any unplanned breakage or damage to existing utilities and improvements that may occur during construction and that is caused by the CONTRACTOR.

3.04 WATER

A. Water for embankment compaction and dust control will be provided by the OWNER. No separate measurement of payment will be made for water.

B. The ENGINEER shall be notified 24 hours prior to application of water for embankment compaction or dust control to verify that the water meets or exceeds the background water quality of the existing groundwater at the site.

3.05 ROADS

A. Use existing roads during construction as directed by the OWNER.

B. Modify or alter existing roads and construct additional temporary construction roads.

1. Obtain written approval from the OWNER before modifying or altering any existing road.

2. Obtain written approval from the OWNER before constructing any temporary construction road(s).

3.06 ENVIRONMENTAL

A. Guard against contamination of topsoil, any earthen material, groundwater, surface water, and air from oil, fuel and other fluid spills; from vehicle emissions; from garbage, waste and other debris; and from any other spills, leaks, discharges or releases of hazardous materials, hazardous wastes or other wastes.

1. Remediate and correct all environmental damage resulting from any such release, discharge, spill or leak occurring during the course of the Work, in accordance with applicable laws and with requirements of agencies having jurisdiction over such matters including, without limitations, New Mexico Oil Conservation Division.

B. Service all equipment in areas designated by the OWNER.

C. Maintain all equipment to prevent leakage of oil, fuel or other fluids and to prevent unacceptable levels of emissions.

D. Collect, remove and properly dispose of all trash, garbage, debris, used oil, contaminated soil, and other waste materials off site at an approved disposal area, in a manner which complies with all applicable state and federal regulations.

E. Comply with all applicable federal and state laws and regulations during the Work, including, but not limited to, New Mexico Environment Department rules and regulations, including, but not limited to, those pertaining to the handling and storage of fuel, oil, other liquids, and all other hazardous materials, hazardous wastes and other wastes used, stored, released, discharged, spilled or leaked in, on, or near the property of the OWNER. The New Mexico Oil Conservation Division shall be the primary contact for release notifications, corrective actions, and remediation.

1. This includes, but is not limited to, the acquisition of and compliance with any permits required by applicable law with respect to the Work, such as permits for releases under the Resource Recovery and Reclamation Act (RCRA) or the Clean Water Act or the Clean Air Act.

F. Establish and maintain dust control and erosion control during the contract time as directed by the ENGINEER, as specified herein, and as required by regulatory agencies.

1. Provide all equipment and personnel necessary to meet the requirements of this responsibility.

2. Provide the OWNER with name(s) and telephone number(s) of the person(s) designated to maintain dust and erosion control during construction.

G. Prior to bringing any potentially hazardous material onto the site, provide the Material Safety Data Sheet (MSDS) for that product to the OWNER and obtain approval for its use.

1. The CONTRACTOR is strongly encouraged to use only products that do not generate hazardous materials in their waste form, and may be precluded from using certain items at the discretion of the OWNER or ENGINEER.

2. Comply with all of the manufacturer's directions and all of the applicable rules and regulations pertaining to the handling and disposing of such material.

3. Maintain a file of MSDS information on site which shall be available to the OWNER and ENGINEER and available for inspection by proper authorities at any time.

4. At the completion of the project, provide the MSDS information, including quantities used, to the OWNER for record retention.

H. Be responsible for characterizing the wastes generated by the Work.

1. Do not dispose of any hazardous wastes, materials, or substances as defined by the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the Superfund Amendments and Reauthorization Act (SARA) or the Department of Transportation (DOT) on site.

2. Be responsible for the safe packaging, transportation, and disposal costs for hazardous materials.

3. Obtain a U.S. Environmental Protection Agency (EPA) identification number if generation of hazardous wastes will occur.

4. Keep records of waste volumes generated and comply with record keeping, training and reporting requirements specific to their assigned generator category.

I. Be responsible for providing training of those employees meeting the definition of a "hazmat employee" in 49 CFR Part 171.

J. Travel of CONTRACTOR'S vehicles on other than established roads shall be restricted as necessary to prevent erosion, air pollution and water pollution.

K. Report to the OWNER or ENGINEER any product, chemical, or waste releases which occur during the course of the contract which are not large enough to require government reporting under CERCLA or SARA.

1. Report all releases required to be reported under applicable laws.

L. Maintain all sediment control structures in good repair and free of debris to perform their designed function.

M. Berm all fuel, antifreeze, and lubricant storage areas to contain spills and prevent soil and water contamination in accordance with New Mexico Environment Department regulations.

N. Do not construct any underground storage tanks for storage of oils, fuels, or other chemicals.

1. Any above-ground storage tanks must meet the requirements specified by New Mexico Environment Department or any other authorities having jurisdiction.

O. Report cultural resource or archaeological sites discovered during the course of the Work immediately to the ENGINEER before any further disturbance of such sites.

1. Work stoppage may be required or Work may be redirected to protect these discoveries until appropriate agency clearance can be obtained.

P. Perform job site inspections as directed by the Engineer.

Q. Report immediately any occurrences of slides, faults, or unstable soil to the ENGINEER immediately upon discovery.

3.07 SECURITY

A. Provide continuous security from intrusion at the site at all times during construction.

1. No unauthorized personnel are allowed onsite.

B. Mark all access roads and construction areas to restrict entry.

C. Barricade, cover, or fence as required all hazardous areas to prevent entry of people, wildlife and livestock.

3.08 SURVEYS, LINES AND GRADES

A. Construct all Work in accordance with the final grades, lines, and elevations shown on the Drawings and designated by the ENGINEER in the field.

1. Grades, lines, and elevations shown on the Drawings may be modified by the ENGINEER in the field as required.

2. Provide all required staking necessary to complete the Work that is not provided by the ENGINEER.

3. CONTRACTOR will remove all stakes from work area upon completion of the project.

B. ENGINEER will provide one-time engineering surveys at the beginning of each phase of the Work to establish reference points and lines as necessary.

1. Scheduling of the ENGINEER'S one-time surveying for each phase of the Work shall be established by mutual agreement of the ENGINEER and the CONTRACTOR during the pre-construction meeting.

a. The schedule of one-time surveying by the ENGINEER may be modified subsequent to the pre-construction meeting by mutual consent of the CONTRACTOR and the ENGINEER.

2. The specific nature and extent of one-time surveying by the ENGINEER shall be determined by the ENGINEER and may include:

a. Control points,

b. Benchmarks,

c. Construction boundaries,

d. Slope staking,

e. Embankment centerlines,

f. Structure reference points, and

g. Miscellaneous other surveying as determined by the ENGINEER.

C. Obtain from the ENGINEER written approval prior to destroying any survey stake, point, benchmark, or monument.

1. Assume full responsibility for resurveying and/or replacing any survey stake, point, benchmarks or monument that is moved or damaged by the CONTRACTOR during construction.

D. Provide the ENGINEER with reasonable notice if and when existing monuments placed by Others are encountered during construction when operations may disturb such monuments.

1. Do not commence Work that would alter or destroy such monuments until they have been referenced by the ENGINEER.

E. Provide the ENGINEER one person to serve as rod man if requested by the ENGINEER.

F. Final pay quantities shall be calculated by the ENGINEER based on comparison of pre-construction and post-construction cross sections developed from surveys of the site by the ENGINEER, by neat line methods if applicable, or by other applicable methods as determined by the ENGINEER.

1. Final pay quantities for each work related item are described in the Method of Measurement and Basis of Payment sections described herein.

3.09 SUBMITTALS

A. CONTRACTOR submittal requirements are waived for those materials and supplies which are furnished by the OWNER.

B. Provide submittals in accordance with this and other Sections of the Specifications.

C. Shop Drawings.

1. Provide Shop Drawings or manufacturer's product data and certifications for items including but not limited to:

    a. Pumps, Pipes, Inlet Box, Grate, Valves, Valve Supports, and related appurtenances,

    b. Geosynthetic materials, and

    c. All other items required by the ENGINEER.

2. Provide two prints of each Shop Drawing.

3. Provide Shop Drawings that sufficiently and clearly show all details of the item.

4. Annotate and sign each Shop Drawing.

D. Submittal scheduling

1. Provide Shop Drawings, manufacturer's product data and certifications, laboratory test results, and all other required submittals to the ENGINEER at least 5 days prior to incorporation of the item into the Work.

    a. Assume sole responsibility for the correctness of submittals, for shop fit and field connections, and for the results obtained from the submittals.

2. Do not furnish, fabricate, or incorporate into the Work any item for which a submittal(s) is required prior to the ENGINEER'S approval of the submittal.

3. If the ENGINEER returns unapproved submittal(s) to the CONTRACTOR, make required additions and/or corrections and resubmit the submittal(s) to the ENGINEER.

E. Approval of a submittal(s) by the ENGINEER shall not relieve the CONTRACTOR from responsibility for errors or omissions in the submittal(s).

F. Prepare submittals specifically for this project.

3.10 WARRANTIES

A. Provide warranties as required by the contract documents.

1. Warranties shall not limit length of time for remedy of damages OWNER may have by legal statute.

2. Warranties shall be signed by CONTRACTOR, Supplier, or Installer responsible for performance or warranty.

3.11 OPERATION AND MAINTENANCE MANUALS AND MANUFACTURER'S INFORMATION

A. Provide the OWNER with three (3) copies each of all available operation and maintenance manuals and manufacturer's information regarding all equipment provided and installed during the Work.

PART 4 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement will be made for items under this Section. Full compensation shall be considered as included in the prices paid for the various contract items and therefore no additional compensation will be allowed.

4.02 BASIS OF PAYMENT

A. No separate payment will be made for items under this Section. Full compensation shall be considered as included in the prices paid for the various contract items and therefore no additional compensation will be allowed.

4.03 ESTIMATED QUANTITIES

A. All estimated quantities stipulated in the Contract Documents which are to be paid per field measurement are to be considered approximate and are to be used only as a basis for estimating the probable cost of the work. The actual amount of work done and materials furnished under the unit-price items for those items to be field measured may differ from the estimated quantities. The actual basis of payment for work and materials will be the actual amount of work done and materials furnished to the pay lines defined in this section. They will be paid at the unit price bid for the quantities listed.

B. Pay items that are not field-measured are lump-sum items or based on neat-line plan dimensions. They will be paid at neat-line or the lump-sum price bid for the items listed.

C. The CONTRACTOR agrees to make no claim for damages, anticipated profits or otherwise on account of any difference between the amounts of work actually performed and materials actually furnished and the estimated amounts herein accept as follows. Either OWNER or CONTRACTOR may make a claim for an adjustment in the Contract Unit Price for an item in accord with the Standard General Conditions of the Construction Contract and the Supplementary Conditions.

D. Estimated Quantities:

Item No.	Description	Estimated Quantity	Unit
1	Mobilization and Demobilization	1	LS
2	Topsoil Removal and Replacement	6,200	CY
3	Unclassified Excavation	35,200	CY
4	Compacted Earth Fill	32,700	CY
5	Waste Excavation Placement	2,500	CY
6	6" Schedule 80 PVC Leak Detection Pipe	120	LF
7	6" SDR-17 HDPE Pipe	1,160	LF
8	12" SDR-17 HDPE Pipe	1,160	LF
9	Self-Priming Suction Pump/Pump House	3	LS
10	8 oz. GSE Non-Woven Geotextile Fabric	14,060	SY
11	220-mil GSE HyperNet Geonet	14,060	SY
12	60-mil GSE HD Smooth HDPE Geomembrane	28,120	SY
13	P-550 Erosion Control Blanket	3,240	SY
14	Crushed Base	900	CY
15	D50 = 12" Riprap	590	CY
16	6' 6-Strand Barb Wire Fence	3,450	LF
17	30" CMP Culvert	50	LF
18	72" CMP Culvert	160	LF
19	Revegetation	3.5	AC

SECTION 01001

MOBILIZATION AND DEMOBILIZATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Move to and remove from the project site all equipment, personnel, supplies, and incidentals which are necessary for completing the Work.

B. Establish required field office(s) at the site of the Work.

C. Provide all bonding fees, and other insurance fees not specifically called out for payment which are required for the Work or for operations which must be performed.

D. Pay costs incurred prior to the commencement of the Work for various items of the project.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

PART 4 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Payment for mobilization and demobilization shall be made as a lump sum cost. No measurement of individual items will be made.

4.02 BASIS OF PAYMENT

A. Full compensation for mobilization and demobilization, including preparation of the staging/storage area, shall be on a lump sum basis.

B. Payment shall constitute full compensation for all labor, expenses, supplies, equipment and incidentals, including bonding fees and insurance fees, required to complete the Work.

C. Progress payments will be made in proportionate amounts based on the percentage of the total original contract amount earned in accordance with the table shown below.

D. Final payment for all Work (including the lump sum amount shown on the bid form for mobilization and demobilization) can be withheld subject to ENGINEER's and OWNER's approval of finished site conditions.

Percent of total contract amount earned (excluding mobilization and demobilization)	Percent of lump sum mobilization and demobilization amount payable as a progress payment
20	50
50	75
100	100

SECTION 01002

STAGING/STORAGE AREA

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Provide staging/storage as directed by the ENGINEER area at the site.

1.02 RELATED WORK

A. SECTION 01001 - MOBILIZATION AND DEMOBILIZATION

1.03 QUALITY ASSURANCE

A. Comply with all other provisions in the Specifications, including but not limited to preventing contamination of uncontaminated soil.

B. Maintain security to prevent loss of equipment and materials belonging to the CONTRACTOR, ENGINEER, and/or OWNER.

1. Assume liability for negligent damage or loss of equipment and/or materials during construction.

C. CONTRACTOR or his designated representative shall be available at all times during normal working hours to meet with the ENGINEER onsite.

1. Furnish the ENGINEER with a telephone number(s) at which the CONTRACTOR can be reached during non-working hours.

2. Furnish the ENGINEER with an address to which all correspondence can be delivered.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 STAGING/STORAGE AREA

A. Provide the ENGINEER, for approval, a proposed staging/storage area location(s) at the site before mobilization.

B. Park all equipment and store all equipment and supplies within the staging/storage area.

C. Remove the staging/storage area at the end of construction.

1. Remove all trash, supplies, equipment, debris, and other construction items.

2. Regrade the area disturbed by the staging/storage area(s) as required by the OWNER.

3. Seed the area disturbed by the staging/storage area(s) as required by the OWNER.

PART 4 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. No payment will be made for construction and demobilization of the staging/storage area. Full compensation will be considered as part of the lump sum payment for mobilization and demobilization.

4.02 BASIS OF PAYMENT

A. No separate payment will be made for items under this section. Full compensation shall be considered as included in the lump sum price for mobilization and demobilization and no additional compensation will be allowed therefor.

SECTION 02200

TOPSOIL REMOVAL AND REPLACEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Remove topsoil from all areas that will be disturbed during construction and place this topsoil in stockpiles as shown on the Drawings and as directed by the ENGINEER in the field.

1. Areas from which topsoil may be removed generally include but may not be limited to:

a. Embankments,

b. Areas used for borrow material,

c. Areas used for field offices and staging areas and adjacent access roads,

d. Spoil stockpile locations or waste areas,

e. Any other locations as shown on the Drawings and/or as directed by the ENGINEER.

2. The ENGINEER will stake in the field all areas from which topsoil must be removed excluding the staging/storage areas.

3. Remove topsoil from each area which is to be disturbed at the start of the Work in each of those areas.

B. Replace topsoil in all disturbed areas as shown in the Drawings and as directed by the ENGINEER in the field. Topsoil will be placed on top of the constructed and approved finished ground surface as defined in the Drawings.

1. Areas in which topsoil must be replaced include but are not limited to:

a. All staging and field office areas, Pond embankments, cut and fill slopes alongside access roads, waste excavation berms, and any other disturbed areas where topsoil was removed during construction.

1.02 RELATED WORK

A. SECTION 01000 - ADMINISTRATIVE INSTRUCTIONS

B. SECTION 02201 - EARTHWORK

C. SECTION 02900 – REVEGETATION

D. NEW MEXICO STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

1. SECTION 201 – CLEARING AND GRUBBING

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil from areas that are to be disturbed during construction is soil that is suitable for the growth of grass or other cover crops and that is reasonably free of hard dirt, clay, rocks, or other materials that would inhibit the germination of seeds.

B. The Drawings identify topsoil stockpile locations.

PART 3 - EXECUTION

3.01 ORGANIZATION OF THE WORK

A. Organize topsoil removal and placement in accordance with the Drawings and as directed by the ENGINEER in the field.

3.02 REMOVAL OF TOPSOIL

A. Strip topsoil and haul directly to the designated topsoil stockpile(s) as shown on the Drawings or as directed by the ENGINEER in the field.

1. Topsoil piles will be graded to stable slopes not exceeding 3H:1V.

2. Topsoil piles greater than 40 feet high must have a 20-foot bench at an elevation of 40 feet from the existing ground surface.

3. Silt fences, straw waddles, or other ENGINEER approved BMP shall be installed around the entire perimeter of the topsoil stockpile and will be maintained until sufficient vegetation is established to prevent or minimize erosion.

B. Strip topsoil to the depth(s) as directed by the ENGINEER in the field and as specified herein.

C. Estimated average topsoil removal depth varies. Topsoil removal depths will be directed by the ENGINEER in the field.

D. Do not strip topsoil from within any topsoil stockpile footprint.

3.03 PLACEMENT OF TOPSOIL

A. Haul topsoil from stockpiles and place on top of finished ground surface as staked and approved by the ENGINEER.

B. Place topsoil to same depth as it was stripped, as directed by the ENGINEER.

C. Obtain ENGINEER's approval of final girt grades and elevations prior to replacement of topsoil, and allow ENGINEER sufficient time to perform ground surveys for earthwork pay quantities prior to placement of topsoil.

PART 4 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Measurement of topsoil shall be from measured volume in place of completed stockpiles, or by comparison of pre- and post-stripping ground surveys, in accordance with the Drawings and Specifications, measured to the nearest whole cubic yard.

B. Interim pay quantities during construction may be based on load counts and/or ground surveys by the ENGINEER.

1. The ENGINEER will determine the method(s) of measurement to be used during construction for interim pay quantities.

4.02 BASIS OF PAYMENT

A. Payment for Work described in this Section shall be based on the Contract unit price for the Work, in place, complete, and accepted as shown below:

Item	**Basis of Payment**
Topsoil Removal and Replacement	CY

B. Payment for this item shall be considered to be full compensation for furnishing all labor, materials, tools, equipment, and other incidentals necessary to complete the Work described in this Section.

C. All components of the Work described in this Section that are not called out as pay items shall be considered subsidiary items of Work. No separate measurement and payment shall be made for subsidiary items.

SECTION 02201

EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. Perform unclassified excavation.

B. Scarify and compact in-place native soil or previously disturbed soil.

C. Place compacted earth fill.

D. Place excess excavation.

1.02 RELATED WORK

A. SECTION 02200 - TOPSOIL REMOVAL AND REPLACEMENT

B. NEW MEXICO STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

1. SECTION 204 – FILL CONSTRUCTION

2. SECTION 205 – BORROW MATERIAL

3. SECTION 210 – OPEN AREA LAND LEVELING

1.03 QUALITY ASSURANCE

A. Reference Standards

1. American Society for Testing and Materials (ASTM):

D698 Standard Test Method for Moisture-Density Relations of Soil and Soil-Aggregate Mixtures using 5.5-lb Rammer and 12-in Drop

D2922 Standard Test Methods for Density of Soil Aggregates in Place by Nuclear Methods

D4318 Test for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

C33-86 Standard Specification for Concrete Aggregates

PART 2 - PRODUCTS

2.01 SUITABLE CUT MATERIAL

A. Suitable cut material is a mixture of clayey sand (SC), sandy lean clay (CL), silty sand (SM), and claystone bedrock excavated during construction, which is suitable for use as compacted fill.

B. Suitable compacted fill will be placed to construct a firm, unyielding base that is smooth and free of rocks, debris, sharp edges or irregularities in order to prevent rupture or tear of the liner.

C. Use suitable cut material as compacted berm and embankment fill and for other compacted fill during the Work.

D. Mix excavated materials to obtain as homogenous mixture of native materials as possible during placement of compacted fill.

2.02 Distribute suitable cut material in excess of that required for compacted fill in the stockpile or excess excavation stockpile area(s) as directed by the ENGINEER in the field.

A. Unified Soil Classification System (USCS) classifications for suitable cut material:

1. CL clay, silty clay, or sandy clay
2. SC clayey sand
3. SM silty sand

B. Acquire material from the excavated area shown on Drawings and/or as directed by ENGINEER.

C. Maximum rock size: 5 inches in any direction

D. Use of frozen material is prohibited.

2.03 UNSUITABLE CUT MATERIAL

A. Unsuitable cut material is rocky or carbonaceous, frozen, partially frozen, loose and/or otherwise unsuitable soil which contains appreciable quantity of roots, grass, or other organic matter excavated during the Work.

B. Distribute and grade unsuitable cut material in the spoil stockpile area(s) or blended into other unused areas of the site as directed by the ENGINEER in the field. Stockpiles shall be constructed with maximum 3H:1V slopes to ensure stability.

C. Do not use unsuitable cut material for compacted berm(s), or embankment fill or for any other component of the Work unless approved by the ENGINEER.

D. The ENGINEER will identify unsuitable cut material in the field.

PART 3 - EXECUTION

3.01 SURVEYING

A. Provide all slope staking, offsets, and/or reference markers not supplied by the ENGINEER as required during the Work as specified in this Section.

3.02 UNCLASSIFIED EXCAVATION AND BACKFILL

A. Excavate cut material from cut areas to the grades, lines, and elevations shown on the Drawings and as staked in the field by the ENGINEER.

B. Suitable cut material:

1. Direct-haul suitable cut material from cut area(s) to compacted fill area(s).

2. Direct-haul suitable cut material in excess of that required for fill from cut area(s) to stockpile area(s).

3. Construct temporary suitable cut material stockpiles and double-haul suitable cut material only under the following circumstances:

a. If authorized to do so by the ENGINEER, and

b. If temporary stockpile(s) are constructed at location(s) designated by the ENGINEER.

C. Direct-haul unsuitable cut material from cut area(s) to stockpile area(s).

D. The ENGINEER will identify unsuitable clay material and unsuitable borrow material.

3.03 PREPARING FOUNDATIONS FOR COMPACTED FILL

A. Prepare the earth foundation prior to placing compacted earth fill.

B. Remove all vegetation and other unsuitable materials.

C. Excavate to depths specified in the Drawings.

D. Grade the foundation surface to remove surface irregularities.

E. Scarify the foundation surface to a minimum depth of eight inches (8").

1. Recompact scarified subgrade material before placing overlying compacted fill.

2. Recompact scarified subgrade material to the same standards as those to be applied to overlying compacted fill as specified in 3.04 of this Section.

F. Modify moisture content of scarified native material to match that of compacted earth fill material as specified in 3.04 of this Section.

G. Ensure that the foundation and/or excavated area(s) are free of standing water and/or overly saturated material prior to and during placement of compacted earth fill.

H. Place and compact earth fill on the scarified, moisture conditioned foundation material before the foundation material dries.

I. Do not place compacted earth fill on any foundation until the entire foundation surface has been inspected and approved by the ENGINEER.

3.04 PLACING COMPACTED EARTH FILL

A. Provide compacted earth fill as shown on the Drawings and as specified herein.

B. Place and compact all material required during the Work in accordance with the Specifications in this Section.

1. Place and compact material to final grades, lines, and elevations as shown on the Drawings.

C. Suitable compacted fill will be placed to construct a firm, unyielding base that is smooth and free of rocks, debris, sharp edges or irregularities in order to prevent rupture or tear of the liner.

1. Place removed rocks, debris, sharp edges and irregularities in the designated spoil area(s) or as directed by the ENGINEER in the field.

D. Place compacted fill in horizontal lifts not exceeding eight inches (8") before compaction or six inches (6") in thickness after compaction.

1. Place homogeneous fill material that is free from lenses, pockets, streaks, or layers of material which differ substantially in texture or gradation from surrounding fill material.

2. Place material that is to be compacted in continuous horizontal lifts between compacted fill boundaries.

3. Do not place compacted earth fill on top of any frozen material.

4. Do not place earth fill that is frozen or partially frozen.

E. Establish uniform moisture content of compacted fill material that is to be compacted to within plus three percent (+3%) and minus two percent (-2%) of optimum moisture content for the material as determined by ASTM D698.

1. Moisten fill that is to be compacted at the site of excavation to the greatest possible extent.

2. Supplement moistening of earth fill that is to be compacted by addition of water after placement, if required.

3. Ensure that the earth fill that is to be compacted is uniformly moisture conditioned by disking or other acceptable means to provide a material that will be uniformly compacted throughout and will be free from lenses, pockets, streaks, laminations, or other imperfections.

4. Proceed with compaction only if the material meets moisture content criteria.

F. Ensure that compacted fill material is placed only when ambient temperatures permit placement and compaction of the materials to the specified density and moisture content.

1. Suspend placement of compacted fill during periods of sustained freezing that induce formation of frost in material during placement or in previously placed material.

2. Adding water in an attempt to thaw frozen or partially frozen material will not be allowed.

3. No construction activities shall take place when the ambient temperature is below 25°F, except when authorized by the ENGINEER.

4. Place at no additional cost to the OWNER, an insulating blanket of uncompacted approved earth fill over the entire area of compacted fill each night during times of freezing or anticipated freezing weather.

5. Remove and replace at no additional cost to the OWNER, all frozen or partially frozen insulation blanket material from the area of compacted fill.

G. Quality assurance tests will made by the CONTRACTOR for each material used for construction, to determine the laboratory maximum density values and optimum compaction moisture content under ASTM D698.

H. Compact fill to a density equal to or greater than ninety-five percent (95%) of the Standard Proctor Maximum Dry Density as determined by ASTM D698.

I. The moisture content of compacted fill shall be maintained within ± 3 percent of optimum moisture content as determined by ASTM D698.

J. The ENGINEER will conduct field moisture-density testing during placement of the compacted fill.

1. Field density and moisture testing will be performed at a frequency determined by the ENGINEER.

2. Typical field density and moisture testing frequency is as follows:

a. One test for every two thousand cubic yards (2,000 cy) of in-place compacted earth fill, OR

b. One test for each lift, and

c. One test for each two hundred cubic yards (200 cy) of in-place earth fill around pipes, and other appurtenances.

3. ENGINEER will complete Atterberg limits testing of compacted earth fill material in accordance with the provisions of ASTM D4318 at least one time for every berm.

4. Rework and recompact at no additional cost to the OWNER any and all in-place compacted fill material that fails to meet any compaction criteria specified herein as determined by the ENGINEER.

K. Remove and replace at no additional cost to the OWNER any and all compacted fill material that is found after placement to be soft, yielding, or otherwise unacceptable due to the CONTRACTOR's failure to provide proper drainage and moisture/density control.

3.05 EXCESS EXCAVATION PLACEMENT

A. Provide excess excavation placement as shown on the Drawings and as specified herein.

B. Place and compact all material required during the Work in accordance with the Specifications in this Section.

1. Place and compact material to final grades, lines, and elevations as shown on the Drawings.

C. Place compacted fill in horizontal lifts not exceeding eight inches (8") before compaction or six inches (6") in thickness after compaction.

1. Place material that is to be compacted in continuous horizontal lifts between compacted fill boundaries.

2. Do not place excess excavation on top of any frozen material.

3. Do not excess excavation that is frozen or partially frozen.

D. Establish uniform moisture content of excess excavation material that is to be compacted to within plus three percent (+3%) and minus two percent (-2%) of optimum moisture content for the material as determined by ASTM D698.

1. Moisten fill that is to be compacted at the site of excavation to the greatest possible extent.

2. Supplement moistening of excess excavation that is to be compacted by addition of water after placement, if required.

3. Ensure that the excess excavation that is to be compacted is uniformly moisture conditioned by disking or other acceptable means to provide a material that will be uniformly compacted throughout and will be free from lenses, pockets, streaks, laminations, or other imperfections.

4. Proceed with compaction only if the material meets moisture content criteria.

E. Ensure that excess excavation material is placed only when ambient temperatures permit placement and compaction of the materials to the specified density and moisture content.

1. Suspend placement of compacted fill during periods of sustained freezing that induce formation of frost in material during placement or in previously placed material.

2. Adding water in an attempt to thaw frozen or partially frozen material will not be allowed.

3. No construction activities shall take place when the ambient temperature is below 25°F, except when authorized by the ENGINEER.

F. Compact excess excavation to a density equal to or greater than ninety percent (90%) of the Standard Proctor Maximum Dry Density as determined by ASTM D698.

G. The ENGINEER will conduct field moisture-density testing during placement of the compacted fill.

1. Field density and moisture testing will be performed at a frequency determined by the ENGINEER.

2. ENGINEER will complete Standard Proctor testing of excess excavation material in accordance with the provisions of ASTM D698 at least one time for every four foot of fill or a minimum of two per berm.

3. Rework and recompact at no additional cost to the OWNER any and all in-place excess excavation material that fails to meet any compaction criteria specified herein as determined by the ENGINEER.

H. Remove and replace at no additional cost to the OWNER any and all compacted fill material that is found after placement to be soft, yielding, or otherwise unacceptable due to the CONTRACTOR's failure to provide proper drainage and moisture/density control.

3.06 GRADING

A. Grade borrow areas and spoil areas after completion of borrow and spoil placement operations.

B. Maximum graded side slope: 2H:1V

C. Merge graded surfaces smoothly with adjacent undisturbed surfaces.

D. Grade surfaces to a smooth, even consistency.

3.07 DISPOSING OF UNSUITABLE CUT MATERIAL

A. Dispose of unsuitable cut material that may be encountered during unclassified excavation and/or borrow operations.

B. Place unsuitable cut material in the excess excavation stockpile area(s).

1. After encountering unsuitable cut material and before disposing of unsuitable cut material, provide the ENGINEER with adequate time and a safe work environment to complete a GPS topographic survey of that area in which unsuitable cut material is to be placed.

2. Grade in-place relocated unsuitable cut material as specified in Sections 2.03 and 3.07.

PART 4 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Measurement of Unclassified Excavation will be cubic yards of cut material, including excavating, hauling, and separately storing materials for Compacted Earth Fill and unsuitable material to the spoil stockpile, as measured by the ENGINEER based upon a comparison of pre-construction and post-construction GPS topographic surveys, or by surveyed cross sections using average end area calculations.

B. Measurement of Compacted Earth Fill will be in cubic yards of compacted fill including hauling suitable cut material to the point of use, placing, moistening, and compacting Compacted Earth Fill to the lines and grades shown on the Drawings as staked in the field by the ENGINEER. The quantity of Compacted Earth Fill will be by the cubic yard measured in place and accepted by the ENGINEER using field staked volumes.

C. Measurement of Excess Excavation Placement will be in cubic yards of compacted fill including hauling cut material to the point of use, placing, moistening, and compacting Excess Excavation to location shown on the Drawings as staked in the field by the ENGINEER. The quantity of Excess Excavation Placement will be by the cubic yard measured in place and accepted by the ENGINEER using field staked volumes.

D. Pay quantities for earthwork will be determined by the ENGINEER as follows:

1. Pay quantities for progress payments during construction may be determined on the basis of load counts and/or ground surveys.

    a. The ENGINEER will determine the method(s) to be used for measurement of pay quantities during construction.

2. Final pay quantities will be calculated based on comparison of surveyed pre-construction and post-construction cross sections or pre-construction cross sections and finish staked lines and grades at corresponding cross sections and application of the average end area method. The ENGINEER will conduct all required surveys and will make all required calculations. The CONTRACTOR may request copies of notes and calculations.

3. Final pay quantities will be calculated by the ENGINEER.

E. No measurement or payment for scarification and compaction of in-place soil shall be made under this Contract.

F. No measurement or payment will be made for water required for dust control and/or compaction of earthwork. Water will be provided by the OWNER as described in Section 01000 3.04.

4.02 BASIS OF PAYMENT

A. Payment for Work described in this Section shall be based on the Contract unit price for each component of the Work in place, complete, and accepted as shown below:

Item	**Basis of Payment**
Unclassified Excavation	CY
Compacted Earth Fill	CY
Excess Excavation Placement	CY

B. Payment for each item shall be considered as full compensation for furnishing all labor, materials, tools, equipment, and other incidentals necessary to complete each component of the Work described in this Section.

C. All components of the Work described in this section not called out as pay items shall be considered subsidiary items of Work. No separate measurement and payment shall be made for subsidiary items.

SECTION 02203

PIPE, PUMPS, FITTINGS, AND APPURTENANCES

PART 1 – GENERAL

1.01 DESCRIPTION

A. Provide all materials, labor, and equipment required to install and/or construct the following structures as shown on the Drawings and as specified herein:

1. SDR-17 HDPE Pipe.

2. Schedule 80 PVC Pipe

3. Schedule 80 slotted PVC Pipe

4. Self-priming Suction Pumps

5. Miscellaneous fittings, valves, connections, etc.

1.02 RELATED WORK

A. SECTION 02201 – EARTHWORK

B. SECTION 02206 – GEOMEMBRANES

C. SECTION 02208 – GOETEXTILES

D. SECTION 02210 - GEONETS

E. NEW MEXICO STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTUCTION

1. SECTION 121 – PLASTIC PIPE

2. SECTION 801 – INSTALLATION OF WATER TRANSMISSION, COLLECTOR AND DISTRIBUTION LINES

1.03 QUALITY ASSURANCE

A. Reference Standards

1. American Society for Testing and Materials (ASTM):

D1785-83 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, 40, 80, and 120

D2466-78 Specification for Poly (Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40

D2564-84 Specifications for Solvent Cement for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

D3350-10 Specifications for Polyethylene Plastics Pipe and Fittings Materials

PART 2 – PRODUCTS

2.01 SDR-17 HDPE PIPE

A. Provide 6-inch diameter and 12-inch diameter SDR-17 HDPE pipe and all associated fittings as shown in Drawings and specified in this Section.

2.02 LEAK DETECTION PVC PIPE

A. Provide 6-inch diameter schedule 80 PVC pipe and all associated fittings as shown in Drawings and specified in this Section., 0.020 in. slotted SDR-17 HDPE pipe, as shown in Drawings and specified in this Section.

2.03 LEAK DETECTION SLOTTED PVC PIPE

A. Provide 6-inch diameter, 0.020 in. slotted schedule 80 PVC pipe, as shown in Drawings and specified in this Section.

2.04 SELF-PRIMING SUCTION PUMPS

A. Provide Pioneer Prime Series End Suction Centrifugal Pump (Model No. PP66S10L72-H) self priming pumps or approved equivalent as shown on Drawings and as specified herein.

B. Provide suction pumps that conform to the following specifications:

1. Total dynamic head: Varying

2. Flow rate: 1200 gpm

3. Motor: 7.5 hp

2.05 MISCELLANEOUS FITTINGS, VALVES, CONNECTIONS, ETC.

A. Provide fittings as necessary matching the schedule, grade, and/or DR of the associated pipe as shown in the Drawings and specified in this Section.

B. Provide connections as shown in the Drawings and specified in this Section

2.06 PEA GRAVEL

A. Provide clean and graded, washed river-run gravel, Size No. 7 U.S. Standard sieve, and having a saturated hydraulic conductivity of 1 x 10^{-5} cm/sec or greater to facilitate drainage.

PART 3 - INSTALLATION

3.01 HDPE PIPE INSTALLATION

A. Trench bottom:

1. Provide trench bottom that is smooth, dry, and free of projecting or loose rocks.

B. Pipe Laying:

1. Minimize lifting and moving of assembled pipe and fittings during pipe laying.

2. Do not bend pipe more than minimum allowable radii specified by the pipe manufacturer.

3. All joints shall be cleaned and fusion welded in accordance with the manufacturer's specifications.

C. Leak Testing:

1. Upon completion of all pipe construction and before any water is admitted into the system, leak testing will be required of all HDPE pipes. The contractor has the option of performing either an air test or a water exfiltration test. Testing shall be performed after complete backfill and compaction and completion of tanks.

a. Leak testing using low-pressure air shall be performed with suitable equipment specifically designed for air testing sewer or tanks.

(1) The air test shall be made when the pipes are clean. Sections of pipe to be tested may be wetted before the air test. The pipeline shall be plugged at each tank with pneumatic balls. Low-pressure air shall be introduced into the plugged pipe until the internal pressure reaches four-pounds per square inch (4 psig). At least two minutes shall be allowed for the air

temperature to stabilize before readings are taken and the time started.

(2) The portion of the pipe being tested shall pass of it does not lose air pressure.

(3) If the pipe section fails this test, the testing equipment may be used to determine the location of the pipe leak.

b. The Contractor shall furnish the plugs, standpipe, and other material and labor for placing the plugs and standpipe in the pipe.

c. The introduction of any substance into the water used for testing with the intent of sealing such leaks as may be indicated will not be permitted.

d. If results of the leakage test are not satisfactory, repairs or pipe replacement will be required until the Engineer is satisfied that the leakage requirements are being met. All repair methods and materials used shall be approved by the Engineer.

3.02 LEAK DETECTION PVC PIPE INSTALLATION

A. Trench bottom:

1. Provide trench bottom that is smooth, dry, and free of projecting or loose rocks.

B. Pipe laying:

1. Minimize lifting and moving of assembled pipe and fittings during pipe laying.

2. Do not bend pipe more than minimum allowable radii specified by the pipe manufacturer.

3. All joints shall be cleaned and glued in accordance with the manufacturer's specifications.

4. Do not bury the pipe until inspected and approved by the ENGINEER.

5. Install pea gravel and sand bags around the pipe and pea gravel in sumps as shown in the Drawings.

3.03 LEAK DETECTION SLOTTED PVC PIPE INSTALLATION

A. Trench bottom:

1. Provide trench bottom that is smooth, dry, and free of projecting or loose rocks.

B. Pipe laying:

1. Minimize lifting and moving of assembled pipe and fittings during pipe laying.

2. Do not bend pipe more than minimum allowable radii specified by the pipe manufacturer.

3. All joints shall be cleaned and glued in accordance with the manufacturer's specifications.

4. Do not bury the pipe until inspected and approved by the ENGINEER.

5. Install pea gravel around the pipe as shown in the Drawings.

3.04 SELF-PRIMING SUCTION PUMP INSTALLATION

A. Pump Installation:

1. Install pumps according to manufacturer's specifications.

2. Install throttle valves at each pump to ensure the pump operates within its service capacity.

PART 4 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Measurement of SDR-17 HDPE pipe will be per lineal foot of in-place pipe as measured by the ENGINEER to the nearest whole lineal foot.

B. Measurement of Slotted SDR-17 HDPE pipe will be per lineal foot of in-place pipe as measured by the ENGINEER to the nearest whole lineal foot.

C. No measurement will be made for pipe fittings, valves, valve supports, or connections. Installation of all fittings, valves, and connections will be considered subsidiary to other items of work.

D. No measurement will be made for pump installation. Installation of all fittings, valves, connections, and all other items necessary and incidental will be considered subsidiary to other items of work.

E. No measurement will be made for pea gravel required for leak detection pipe installation. Installation of all pea gravel will be considered subsidiary to other items of work.

4.02 BASIS OF PAYMENT

A. Payment for Work described in this Section shall be based on the Contract unit price for each component of the Work, in place, complete, and accepted by the OWNER as shown below:

Item	**Basis of Payment**
12" SDR-17 HDPE Pipe	LF
6" SDR-17 HDPE Leak Detection Pipe	LF
6" Schedule 80 PVC Pipe	LF
Self-priming Suction Pump/Pump House	LS

B. No payment will be made for pipe fittings, valves, valve supports, or connections. Installation of all fittings will be considered subsidiary to other items of work.

C. No payment will be made for pea gravel required for leak detection pipe installation. Installation of all pea gravel will be considered subsidiary to other items of work.

D. Payment for each item shall be considered as full compensation for furnishing all labor, materials, tools, equipment, and other incidentals necessary to complete each component of the Work described in this Section.

4.03 All components of the Work described in this Section not called out as pay items shall be considered subsidiary items of Work. No separate measurement or payment shall be made for subsidiary items of Work.

SECTION 02206

GEOMEMBRANES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide all materials, labor, and equipment required to provide, store, and install geomembrane liners.

1.02 RELATED WORK

B. SECTION 02200 - TOPSOIL REMOVAL

C. SECTION 02201 - EARTHWORK

D. SECTION 02203 – PIPES, FITTINGS AND APPURTENANCES

E. SECTION 02208 –GEOTEXTILES

F. SECTION 02210 - GEONET

1.03 QUALITY ASSURANCE

G. Reference Standards

1. American Society for Testing and Materials (ASTM):

D1004	Method for Initial Tear Resistance of Plastic Film and Sheeting
D1238	Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
D1505	Test Method for Density of Plastics by the Density-Gradient Technique
D1603	Test Method for Carbon Black in Olefin Plastics
D3895	Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
D4218	Standard Test Method for Determination of Carbon Black in Polyethylene Compounds

D4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
D5199	Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
D5397	Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
D5596	Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
D5994	Standard Test Method for Measuring Core Thickness of Textured Geomembranes
D6392	Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
D6693	Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
D7240	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)

1.04 SUBMITTALS

H. The INSTALLER shall furnish the following information to the ENGINEER and OWNER prior to installation:

1. Installation layout drawings

a. Must show proposed panel layout including field seams and details

b. Must be approved prior to installing the geomembrane.

2. Approved drawings will be for concept only and actual panel placement will be determined by site conditions.

3. Installer's Geosynthetic Field Installation Quality Assurance Plan

I. 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.

1.05 QUALIFICATIONS

J. 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.

K. 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

L. INSTALLER shall have installed a minimum of 5,000,000 square feet of HDPE geomembrane during the five last years.

M. INSTALLER shall have worked in a similar capacity on at least five (5) projects similar in complexity to the project described in the contract documents, and with at least 500,000 square feet of HDPE geomembrane installation on each project.

N. 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.

O. The INSTALLER shall provide a minimum of one Master Seamer for work on the project.
   1. Must have completed a minimum of 1,000,000 square feet of geomembrane seaming work using the type of seaming apparatus proposed for the use on this Project.

1.06 MATERIAL LABELING, DELIVER, STORAGE AND HANDLING

O. 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

P. Delivery- Rolls of liner will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.

Q. 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 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

R. Handling-Materials are to be handles so as to prevent damage.

PART 2 - PRODUCTS

2.01 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 2.01B: Raw Material Properties

Property	Test Method	HDPE
Density (g/cm^3)	ASTM D 1505	$\geq$0.932
Melt Flow Index (g/10 min)	ASTM D 1238 (190/2.16)	$\leq$1.0
OIT (minutes)	ASTM D 3895 (1 atm/200^{0}C)	$\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:

Table 2.01D

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.

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

Table 2.01E

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 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.

PART 3 - EXECUTION

3.01 EQUIPMENT

A. Welding equipment and accessories shall meet the following requirements:

1. Gauges showing temperatures in apparatus such as fusion welder shall be present.

2. An adequate number of welding apparati shall be available to avoid delaying work.

3. Power source must be capable of providing constant voltage under combined line load.

3.02 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. 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.

3.03 FIELD SEAMING

A. Seams shall meet the following requirements:

1. Orient seams parallel to line of 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 five-feet 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 4-inch to 6-inch overlap is required.

6. All seams shall be thermally seamed (hot wedge) with a double track weld to create an air pocket for non-destructive air channel testing

B. During Welding Operations

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

C. 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.

D. 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 table for HDPE are achieved in both peel and shear test.

Table 3.03E

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

a. The break, when peel testing, occurs in the liner material itself, not through peel separation (FTB).

b. The break is ductile.

7. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.

8. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.

E. 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.

F. 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.

3.04 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.

a. Air Pressure Testing

(1) Shall be performed in accordance with ASTM D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.

2. Destructive Testing (performed by CONSULTANT with assistance from INSTALLER)

a. 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.

b. 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.

(3) Samples shall be twelve (12) inches wide by minimal length with the seam centered lengthwise.

(4) Cut a 2-inch wide strip from each end of the sample for field-testing.

(5) Cut the remaining sample into two parts for distribution as follows:

(a) One portion for INSTALLER, 12-inches by 12 inches

(b) One portion for the Third Party laboratory, 12-inches by 18-inches

(c) Additional samples may be archived if required.

(6) Destructive testing shall be performed in accordance with ASTM D 6392, Standard Test Method for Determing the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.

(7) INSTALLER shall repair all holes in the geomembrane resulting from destructive sampling.

(8) 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 feet 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 feet 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.

3.05 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 CONSULTANT and INSTALLER by using one of the following repair methods:

1. Patching- Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.

2. Abrading and Re-welding- Used to repair short section of a seam.

3. Spot Welding- Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.

4. Capping- Used to repair long lengths of failed seams.

5. 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. Extend patches or caps at least 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.

3.06 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. CONTRACTOR shall notify the New Mexico Oil Conservation Division at least 72 hours prior to the primary geomembrane liner's installation so that a representative of the environmental bureau in the division's Sante Fe office may inspect the leak detection geonet and system before it is covered.

D. Field Testing

1. Non-destructive testing may be carried out as the seaming progresses or at completion of all field seaming.

a. Air Pressure Testing

(1) Shall be performed in accordance with ASTM D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.

(2) A stabilized air pressure of 35 psi, plus or minus one percent, shall be maintained for at least five minutes.

b. Other approved methods.

2. Destructive Testing (performed by CONSULTANT with assistance from INSTALLER)

a. 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.

b. 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.

(3) Samples shall be twelve (12) inches wide by minimal length with the seam centered lengthwise.

(4) Cut a 2-inch wide strip from each end of the sample for field-testing.

(5) Cut the remaining sample into two parts for distribution as follows:

(a) One portion for INSTALLER, 12-inches by 12 inches

(b) One portion for the Third Party laboratory, 12-inches by 18-inches

(c) Additional samples may be archived if required.

(6) 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.

(7) INSTALLER shall repair all holes in the geomembrane resulting from destructive sampling.

(8) 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 feet 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 feet 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.

PART 4 – WARRANTY

4.01 MANUFACTURER'S WARRANTY

A. Material shall be warranted, on a pro-rata basis against Manufacturer's defects for a period of 5 years from the date of geomembrane installation.

4.02 INSTALLER'S WARRANTY

B. Installation shall be warranted against defects in workmanship for a period of 1 year from the date of geomembrane completion.

PART 5 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT

5.01 METHOD OF MEASUREMENT

A. Payment for geomembrane installation will be as per contract unit pricer per square yard, as measured parallel to liner surface, including anchor trench material and is based upon net lined area.

B. Net lined area is to be the true area of all surfaces to be lined plus designed burial in all anchor trenches, rub sheets, and sacrificial layers.

5.02 BASIS OF PAYMENT

C. Payment for the Work described in this Section shall be based on the Contract unit price for each component of the Work, in place, complete, and accepted as shown below:

Item	Basis of Payment
60-mil HDPE Geomembrane	SY

D. Prices shall include full compensation for furnishing all labor, material, tools, equipment, and incidentals.

Prices also include doing all the work involved in performing geomembrane installation completely as shown on the drawing, as specified herin, and as directed by the ENGINEER.

SECTION 02208

GEOTEXTILES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide all materials, labor, and equipment required to provide, store, and install geotextiles.

1.02 RELATED WORK

B. SECTION 02200 - TOPSOIL REMOVAL

C. SECTION 02201 - EARTHWORK

D. SECTION 02203 – PIPES, FITTINGS AND APPURTENANCES

E. SECTION 02206 – GEOMEMBRANES

F. SECTION 02210 - GEONETS

1.03 REFERENCES

G. Reference Standards

1. American Society for Testing and Materials (ASTM):

D5261	Standard Test Method for Measuring Mass per Unit Area of Geotextiles
D4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
D4533	Standard Test Method for Index Trapezoidal Tearing Strength of Geotextiles
D4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
D4491	Standard Test Method for Water Permeability of Geotextiles by Permittivity
D4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile

D4354	Standard Practice for Sampling of Geosynthetics for Testing
D4759	Standard Practice for Determining the Specifications Conformance of Geosynthetics

1.04 SUBMITTALS

H. 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.

I. The contractor shall submit, if required by the engineer, manufacturer's quality control manual for the geotextile to be delivered to the site.

PART 2 - PRODUCTS

2.01 GEOTEXTILE

A. The nonwoven needlepunched geotextile specified herin shall be made from stable 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 the table below.

Table 2.01D

Tested Property*	Test Method	Test Frequency	Minimum Average Roll Value
AASHTO M288 Class			1
Mass per Unit Area, oz/yd^2	ASTM D 5261	90,000 ft^2	8
Grab Tensile Strength, lb	ASTM D4632	90,000 ft^2	220
Grab Elongation, %	ASTM D 4632	90,000 ft^2	50
Puncture Strength, lb	ASTM D 4833	90,000 ft^2	120
Trapezoidal Tear Strength, lb	ASTM D 4533	90,000 ft^2	90
Apparent Opening Size, Sieve No. (mm)	ASTM D 4751	540,000 ft^2	80 (0.180)
Permittivity, sec^{-1}	ASTM D 4491	540,000 ft^2	1.30
Water Flow Rate, gpm/ft^2	ASTM D 4491	540,000 ft^2	95

* The property values listed are in weaker principal direction. All values are Minimum Average Roll Values except apparent opening size in mm and UV resistance. Apparent opening size (mm) is a Maximum Average Roll Value. UV is a typical value.

2.02 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.

2.03 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.

PART 3 - EXECUTION

3.01 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.

B. The engineer may decide to arrange conformance testing of the rolls delivered to the job site. For this purpose, the engineer shall take a sample three feet (along roll length) by roll width according to ASTM Practice D 4354 The sample shall be properly marked, wrapped and sent to an independent laboratory for conformance testing.

C. The pass or fail of the conformance test results shall be determined according to ASTM Practice D 4759.

3.02 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 Sun light 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.

PART 5 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT

5.01 METHOD OF MEASUREMENT

A. Payment for geotextile installation will be as per contract unit price per square yard, as measured parallel to geotextile surface, including anchor trench material.

5.02 BASIS OF PAYMENT

B. Payment for the Work described in this Section shall be based on the Contract unit price for each component of the Work, in place, complete, and accepted as shown below:

Item	**Basis of Payment**
8 oz. Nonwoven Geotextile	SY

C. Prices shall include full compensation for furnishing all labor, material, tools, equipment, and incidentals.

Prices also include doing all the work involved in performing geotextile installation completely as shown on the drawing, as specified herin, and as directed by the ENGINEER.

SECTION 02210

GEONETS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide all materials, labor, and equipment required to provide, store, and install a geonet drainage layer.

1.02 RELATED WORK

B. SECTION 02200 - TOPSOIL REMOVAL

C. SECTION 02201 - EARTHWORK

D. SECTION 02203 – PIPES, FITTINGS AND APPURTENANCES

E. SECTION 02206 – GEOMEMBRANES

F. SECTION 02208 - GEOTEXTILES

1.03 REFERENCES

G. Reference Standards

1. American Society for Testing and Materials (ASTM):

D1238-01	Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
D1505-98	Standard Test Method for Density of Plastics by the Density Gradient Technique
D1603-94	Standard Test Method for Carbon Black in Olefin Plastics
D4716-00	Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
D5035-95	Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
D5199-99	Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes

H. 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.

1.04 QUALIFICATIONS

I. MANUFACTURER

1. Geonet 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 square feet of polyethylene geonet material during the last year.

J. INSTALLER shall have installed a minimum of 5,000,000 square feet of geonet in the last 5 years.

K.

L. INSTALLER shall have worked in a similar capacity on at least ten projects similar in complexity to the project described in the contract documents, and with in at least 500,000 square feet of geonet installation on each project.

M. 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.

1.05 MATERIAL LABELING, DELIVER, STORAGE AND HANDLING

L. Labeling – Each roll of geonet delivered to the site shall be labeled by the MANUFACTURER. The label will identify:

1. manufacturer's name

2. product identification

3. length

4. width

5. roll number

M. Delivery- Rolls of geonet will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.

N. Storage- The on-site storage location for geonet, provided by the CONTRACTOR to protect the geonet from abrasions and 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

O. Handling

1. The CONTRACTOR and INSTALLER shall handle all goenet in such manner as to ensure it is not damaged in any way.

2. The INSTALLER shall take any necessary precautions to prevent damage to underlying layers during placement of the geonet.

PART 2 - PRODUCTS

2.01 GEONET PROPERTIES

A. A geonet shall be manufactured by extruding two crossing strands to form bi-planar drainage net structure.

B. The geonet specified shall have properties that meet or exceed the values listed in Table 2.01B.

Table 2.01B

Property	Test Method	Test Frequency	Value
Transimissivity[(1)], gal/min/ft (m^2/sec)	ASTM D 4716	1/540,000 ft^2	9.66 (2 x 10^{-3})
Density, g/cm^3	ASTM D 1505	1/50,000 ft^2	0.94
Tensile Strength (MD), lb/in	ASTM D 5035/7179	1/50,000 ft^2	45
Carbon Black Content, %	ASTM D 1603[(2)]/4218	1/50,000 ft^2	2.0
Geonet Thickness, mil	ASTM D 5199	1/50,000 ft^2	200

[(1)]Gradient of 0.1, normal load of 10,000 psf, water at 70°, between steel plates for 15 minutes.

[2]Modified.

C. The geonet shall be constructed with raw materials that meet or exceed the values listed in Table 2.01C.

Table 2.01C

Property	Test Method (1)	Testing Frequencies	Value
Density (g/cm^3)	ASTM D 1505	Once Per Resin Lot	>0.94
Melt Flow Index (g/10 min)	ASTM D 1238	Once Per Resin Lot	$\leq$ 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.

2.02 MANUFACTURING QUALITY CONTROL

A. The geonet shall be manufactured in accordance with the Manufacturer's Quality Control Plan submitted to and approved by the ENGINEER.

B. The geonet shall be tested according to the test methods and frequiencies listed in Table 2.01B.

PART 3 - EXECUTION

3.01 FAMILIARIZATION

A. 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.

B. If the INSTALLER has any concerns regarding the installed work of other Sections, he shall notify the Project ENGINEER.

3.02 MATERIAL PLACEMENT

A. The geonet roll should be installed in the direction of the slope and in the intended direction of flow unless otherwise specified by the ENGINEER.

B. 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.

C. In the presence of wind, all geonets shall be weighted down with sandbags or the equivalent. Such sandbags shall be used during placement and remain until replaced with cover material.

D. If the project includes an anchor trench at the top of the slopes, the geonet shall be properly anchored to resist sliding. Anchor trench compacting equipment shall not come into direct contact with the geonet.

E. In applying fill material, no equipment can drive directly across the geonet. The specified fill material shall be placed and spread utilizing vehicles with a low ground pressure.

If soil is used w/ geonet, soil must be ... in ... B(a) max 1 x 10 - 5 cm/sec

The cover soil shall be placed in the geonet in a manner that prevents damage to the geonet. Placement of the cover soil shall proceed immediately following the placement and inspection of the geonet.

3.03 SEAMS AND OVERLAPS

A. Each component of the geonet will be secured to the like component at overlaps.

B. Geonet Components

1. Adjacent edges along the length of the geonet roll shall be overlapped a minimum of 6" or as recommended by the engineer.

2. The overlapped edges shall be joined by tying the geonet structure with cable ties. These ties shall be spaced every 5 feet along the roll length.

3. Adjoining rolls across the roll width should be shingled down in the direction of the slope and joined together with cable ties spaced every foot along the roll width.

3.04 REPAIR

A. Prior to covering the deployed geonet, each roll shall be inspected for damage resulting from construction.

B. Any rips, tears or damaged areas on the deployed geonet shall be removed and patched. The patch shall be secured to the original geonet by tying every 6 inches 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.

PART 4 – WARRANTY

4.01 MANUFACTURER'S WARRANTY

A. Material shall be warranted, on a pro-rata basis against defects for aperiod of 1-year from the date of the geonet installation.

4.02 INSTALLER'S WARRANTY

B. Installation shall be warranted against defects in workmanship for a period of 1-year from the date of geonet completion.

PART 5 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT

5.01 METHOD OF MEASUREMENT

A. Payment for geonet installation will be as per contract unit price per square yard, as measured parallel to geonet surface, including anchor trench material.

5.02 BASIS OF PAYMENT

B. Payment for the Work described in this Section shall be based on the Contract unit price for each component of the Work, in place, complete, and accepted as shown below:

Item	**Basis of Payment**
200 mil Geonet	SY

C. Prices shall include full compensation for furnishing all labor, material, tools, equipment, and incidentals.

Prices also include doing all the work involved in performing geonet installation completely as shown on the drawing, as specified herin, and as directed by the ENGINEER.

SECTION 02300

ACCESS ROAD

PART 1 - GENERAL

1.01 DESCRIPTION

A. Construct new roadway from existing tank battery facility and maintenance roads shown on the plans.

B. Revegetate disturbed area along road after construction.

1.02 RELATED WORK

A. SECTION 02200 - TOPSOIL REMOVAL AND REPLACEMENT

B. SECTION 02201 – EARTHWORK

C. SECTION 02900 – REVEGETATION

D. NEW MEXICO STANDARD SPECIFICAITONS FOR PUBLIC WORKS CONSTRUCTION

1. SECTION 301 – SUBGRADE PREPARATION

2. SECTION 308 – NATURAL GRAVEL SURFACING FOR UNPAVED ROADWAYS

1.03 QUALITY ASSURANCE

A. Provide ENGINEER with aggregate gradations for approval by the ENGINEER prior to commencement of the work.

B. Reference Standards

1. New Mexico State Department of Transportation "Standard Specifications for Road and Bridge Construction", 2007 Edition

PART 2 - PRODUCTS

2.01 Crushed Base

Provide crushed base material meeting the gradation requirements of New Mexico State Department of Transportation Standard Specifications.

PART 3 - EXECUTION

3.01 SCHEDULING AND SEQUENCE OF OPERATIONS

A. Organize construction of roadway in accordance with the construction scheduling described in SECTION 01000.

B. Coordinate work to coincide with construction of other portions of the facility as directed by the ENGINEER.

3.02 ROAD CONSTRUCTION – GENERAL

A. ENGINEER will provide slope stakes or offsets to establish lines and grades for road construction.

B. Strip topsoil from the area designated by the engineer.

C. Construct earthwork for roadway subgrade in accordance with SECTION 02201 – EARTHWORK.

D. Provide, place, and compact crushed base to the lines and limits as shown in the plans and these specification.

1. Compact each placed layer of crushed base to at least 95% of ASTM D698 maximum density.

2. Compact material when moisture content is within +2% to -4% of optimum.

3. Add water and mix as necessary during compaction to obtain optimum moisture content and maximum density.

E. Place Topsoil on disturbed cut and fill slopes beyond shoulders of new road and revegetate.

PART 4 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Measurement of Topsoil Removal and Placement will be by the cubic yard as described in SECTION 02200 - TOPSOIL, as measured by the ENGINEER to the nearest whole cubic yard, in place, complete, and accepted.

B. Measurement of Unclassified Excavation will be by the cubic yard as described in SECTION 02201 - EARTHWORK, as measured by the ENGINEER to the nearest whole cubic yard, in place, complete, and accepted.

C. Measurement of Crushed Base will be by the cubic yard of material computed by using neat line for width, including one-half the taper width where applicable, multiplied by the neat line for thickness, multiplied by the neat line for length of the completed surface.

1. Interim payment before the end of the project will be based on estimated portion of work completed or by load count volume, as determined by the ENGINEER.

4.02 BASIS OF PAYMENT

A. Payment for Work described in this Section shall be based on the Contract unit price for each component of the Work in place, complete, and accepted as shown below:

Item	**Basis of Payment**
Crushed Base	CY

B. Payment for each item shall be considered as full compensation for furnishing all labor, materials, tools, equipment and other incidentals necessary to complete each component of the Work described in this Section.

C. All components of the Work described in this Section not called out as pay items shall be considered subsidiary items of Work. No separate measurement and payment shall be made for subsidiary items.

SECTION 02500

WIRE FENCE

PART 1 – GENERAL

1.01 DESCRIPTION

A. Provide all materials, labor, and equipment required to install the following structures as shown on the Drawings and as specified herein:

1. 6' 6-strand Barb Wire Fence

1.02 RELATED WORK

A. SECTION 02200 – TOPSOIL REMOVAL AND REPLACEMENT

B. SECTION 02201 – EARTHWORK

PART 2 – PRODUCTS

2.01 MATERIALS

A. Fencing Materials

1. Angles, posts, braces and wire shall be steel. Bolts, hardware and other parts shall be steel, malleable iron or ductile iron.

2. Wire:

a. Barbed wire shall conform to the requirements of ASTM A121 with a Class I coating. Barbed wire shall consist of two strands of No. 12-1/2 gauge copper-bearing steel wire with large four point hard temper round barbs spaced approximately 5 inches apart.

b. Tie wires for fastening barbed wire to steel posts shall be No. 12 gauge copper-bearing steel wire. Tie wires shall be heavily galvanized by the hot-dip process.

c. Stays shall be No. 9-1/2 gauge copper-bearing steel wire conforming to the requirements of ASTM A116. Stays shall be 42 inches long.

3. Angles, Posts and Braces: Angles and braces shall be fabricated from rail, billet or commercial grade steel which conforms to the requirements of ASTM A569. T-beam section posts shall be

fabricated from rail, billet or commercial grade steel which conforms to the requirements of ASTM A702. Angles and braces shall be galvanized by the hot-dip process after fabrication. Angles and braces conforming to ASTM A569 shall be triple coated with a minimum of 0.9 ounces per square foot of zinc, 15 micrograms per square inch of chromate and 0.3 mils of polyurethane finish. T-beam section line posts conforming to ASTM A702 shall be painted with three (3) coats of an anti-corrosive aluminum paint or suitable substitute to prevent corrosion.

a. Corner and intermediate brace posts and braces shall be angles.

b. Line posts shall have a minimum weight of 1.33 pounds per foot excluding the anchor plates. Line posts shall be T-beam sections. Line posts shall have corrugations, ribs or notches spaced at approximately one inch on center. Anchor plates shall have a minimum of 18 square inches of area and shall weigh not less than 2/3 pounds each. They shall be welded or riveted to the section so as to prevent displacement when the posts are driven.

4. Fittings: Fittings, hardware and appurtenances for fences shall be commercial quality steel, malleable iron or wrought iron which shall be galvanized in accordance with ASTM A153.

5. Gates: Gate frames shall be nominal 1-1/2 inch, 1.900 inch O.D. galvanized high carbon-welded tubing with internal bracing of nominal 1-1/4 inch, 1.660 inch O.D., galvanized high carbon-steel tubing welded at all joints to provide rigid water-tight construction. Gate fabric shall be No. 11 gauge copper bearing open-hearth steel wire, woven in a 2-inch mesh, and heavily galvanized by the hot-dip process after weaving. Gates shall be 6-feet high and shall be furnished with pivot-type hinges and center stop.

6. Gate Posts: Gate posts shall be nominal 2-1/2 inch, 2.875 inch O.D. galvanized steel pipe.

PART 3 – FENCE INSTALLATION

3.01 PREPARATION

A. The CONTRACTOR shall perform all clearing and grubbing necessary to construct the fence in the required alignment and at the required grade prior to fence construction.

3.02 ERECTION

A. Fence erection, including all connections shall be done in accordance with the Drawings and the Manufacturer's written instructions.

B. Concrete: Concrete foundations for intermediate brace posts and corner posts shall be circular in horizontal section, not less than the angle dimension plus 9 inches in diameter and 3'-6" deep. Concrete foundations for braces shall be circular in horizontal section, not less than 24 inches in diameter and 12 inches deep. Where the Drawings require that posts and braces be embedded in concrete, the CONTRACTOR shall install temporary guys or braces such that posts and braces will be held in the proper position until the concrete has set sufficiently to hold them in the proper position. No materials shall be installed on posts and braces set in concrete and no strain shall be placed on guys or bracing until seven days have elapsed from the time of placing the concrete. The CONTRACTOR shall insure that the concrete has sufficiently cured prior to pulling the wire. Excavation for footings and anchors shall be to the dimensions required to place concrete in the dimensions indicated herein.

C. Posts: All corner posts, line posts and intermediate brace posts shall be set plumb and shall be spaced in the line of the fence not to exceed 16-foot centers. All posts shall be set or driven to a depth not less than 36 inches.

1. Metal line posts may be driven.

2. Corner and intermediate brace posts shall be set in concrete.

3. Intermediate brace posts shall be placed at intervals not less than 100 feet and not more than 600 feet and shall be spaced evenly between corner and gate posts.

D. Barbed Wire: Fence wire shall be stretched by mechanical stretcher or other devices designed for this use. Stretching by motor vehicle will not be permitted. The length between pull posts shall not exceed 100 feet.

E. Stays: Stays shall be twisted into place in accordance with the manufacturer's written instructions at the spacing indicated in the Drawings.

F. Bolts and Hardware: All nuts, bolts and tie wires shall be securely fastened to preclude surreptitious removal and shall be placed to assure visual evidence of tampering.

G. Painting: Surfaces that have been cut or filed or surfaces where the galvanized coating has been broken or damaged shall be painted with three coats of an anti-corrosive aluminum paint or suitable substitute to prevent corrosion.

H. Clearance: Provide suitable closures approved by the ENGINEER at irregularities in grade such as ditches. Vertical posts shall not exceed 6 inches open space to the adjacent post or solid structure.

PART 4 – METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Measurement of 6' 6-Strand Barb Wire Fence will be per lineal foot of in-place fence.

4.02 BASIS OF PAYMENT

A. Payment for Work described in this Section shall be based on the Contract unit price for 6' 6-Strand Barb Wire Fence.

4.03 All components of the Work described in this Section not called out as pay items shall be considered subsidiary items of Work. No separate measurement or payment shall be made for subsidiary items of Work.

SECTION 02900

REVEGETATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Revegetate the area within the topsoil removal boundary.

B. Revegetate all stockpiles and staging areas.

C. Revegetate all borrow areas.

D. Provide seeding.

1.02 RELATED WORK

A. SECTION 01002 – FIELD OFFICE AND STAGING/STORAGE AREA

B. SECTION 02200 - TOPSOIL REMOVAL

C. SECTION 02201 - EARTHWORK

1.03 QUALITY ASSURANCE

A. Seed

1. Provide seed purchased from a supplier licensed to sell seed by the New Mexico Department of Agriculture.

a. Provide written confirmation to the ENGINEER that the supplier is so licensed.

2. Provide only unopened containers of seed at the site.

a. Provide seed in closed containers, each of which includes an attached tag that plainly shows:

(1) Commonly accepted name(s) of the kind(s) and variety(ies) of seed,

(2) Full name and address of the seed supplier,

(3) Percentage by weight of pure seed, crop seed, inert matter, weed seeds, germination seed, and hard seed,

(4) Month and year of the seed germination test,

(5) Origin of the seed,

(6) Lot number,

(7) Name and number of each kind of secondary noxious weed seed as listed in the New Mexico Seed Law,

(8) Net weight of seed,

(9) The words "Poisonous Treated" in bold print on the label if the seed has been treated with chemical(s) that are toxic to either humans or livestock.

b. The ENGINEER will remove and retain all tags from approved seed containers.

3. Provide to the ENGINEER for examination the following additional documents pertaining to each seed container.

a. Duplicate copies of a signed supplier's certification confirming that:

(1) The seed has been tested within nine (9) months of the date of delivery to the site by a recognized state seed testing laboratory or by a certified seed analysis technician at a commercial laboratory, and

(2) The seed in the container does not contain any primary noxious weed seeds as designated by the New Mexico Seed Law.

b. Duplicate copies of the laboratory seed analysis for the seed in the container(s) to be opened.

4. Remove the seal from and open seed containers only after approval by the ENGINEER.

a. ENGINEER'S approval for opening each seed container will be based on examination of the documents described above.

b. Leave unopened, remove from the site, and replace any seed container(s) not approved by the ENGINEER.

PART 2 - PRODUCTS

2.01 SEED MIXTURE

A. Provide seed mixture consisting of at least three native plant species, including at least one grass, but not including noxious weeds.

PART 3 - EXECUTION

3.01 REVEGETATION SCHEDULING AND SEQUENCE OF OPERATIONS

A. Organize revegetation in accordance with the construction scheduling described in SECTION 01000.

B. Revegetation procedure:

1. Disc grade, in-place soil to a minimum depth of six inches (6") before seeding.

2. Apply seed mixture.

C. Revegetate topsoil stockpiles created during the Work.

3.02 SEEDING - GENERAL

A. Commence seeding operations immediately after construction is complete and in accordance with Part B of this Section.

1. Disc grade, in-place soil prior to the application of seed mixture(s).

a. Disc parallel to contours.

b. Break up all large earth clods during discing.

B. Complete all seeding during one (1) of the following two (2) annual time periods:

1. In early spring before May 15, or

2. In late autumn after October 7.

C. Apply seed as follows:

1. Disc grade to a minimum depth of six inches (6") along contours to produce a moderately rough seedbed and to relieve surface compaction.

2. Drill seed using a rangeland drill.

3. Alternatively, apply seed by broadcasting at two times the seed application rate specified herein.

3.03 PRESERVING REVEGETATED AREAS

A. Protect revegetated areas from damage by traffic and/or damage by construction equipment or construction personnel.

B. Repair all revegetated areas and/or replace all revegetation that is damaged by traffic and/or construction equipment or construction personnel at no additional expense to the OWNER.

PART 4 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Measurement will be in acres of revegetation, as measured by the ENGINEER to the nearest one-tenth (0.1) acre, in place, complete, and accepted.

4.02 BASIS OF PAYMENT

A. Payment for Work described in this Section shall be based on the Contract unit price for each component of the Work in place, complete, and accepted as shown below:

Item	Basis of Payment
Revegetation	AC

B. Payment for each item shall be considered as full compensation for furnishing all labor, materials, tools, equipment and other incidentals necessary to complete each component of the Work described in this Section.

C. All components of the Work described in this Section not called out as pay items shall be considered subsidiary items of Work. No separate measurement and payment shall be made for subsidiary items.

Appendix C

Drainage Ditch Hydraulic Analysis Results

E. Blanco South Ditch Least Slope

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.01072	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	119.27	ft^3/s

Results

Normal Depth	2.59	ft
Flow Area	21.16	ft^2
Wetted Perimeter	14.57	ft
Hydraulic Radius	1.45	ft
Top Width	13.35	ft
Critical Depth	2.31	ft
Critical Slope	0.01773	ft/ft
Velocity	5.64	ft/s
Velocity Head	0.49	ft
Specific Energy	3.08	ft
Froude Number	0.79	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.59	ft
Critical Depth	2.31	ft
Channel Slope	0.01072	ft/ft

E. Blanco South Ditch Least Slope

GVF Output Data

Critical Slope	0.01773	ft/ft

E. Blanco South Ditch Largest Slope

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.06211	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	119.27	ft^3/s

Results

Normal Depth	1.71	ft
Flow Area	11.03	ft^2
Wetted Perimeter	10.67	ft
Hydraulic Radius	1.03	ft
Top Width	9.86	ft
Critical Depth	2.31	ft
Critical Slope	0.01773	ft/ft
Velocity	10.82	ft/s
Velocity Head	1.82	ft
Specific Energy	3.53	ft
Froude Number	1.80	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.71	ft
Critical Depth	2.31	ft
Channel Slope	0.06211	ft/ft

E. Blanco South Ditch Largest Slope

GVF Output Data

Critical Slope	0.01773	ft/ft

E. Blanco North Ditch - Least Slope

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.00500	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	125.71	ft^3/s

Results

Normal Depth	3.15	ft
Flow Area	29.25	ft^2
Wetted Perimeter	17.07	ft
Hydraulic Radius	1.71	ft
Top Width	15.59	ft
Critical Depth	2.37	ft
Critical Slope	0.01761	ft/ft
Velocity	4.30	ft/s
Velocity Head	0.29	ft
Specific Energy	3.43	ft
Froude Number	0.55	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.15	ft
Critical Depth	2.37	ft
Channel Slope	0.00500	ft/ft

E. Blanco North Ditch - Least Slope

GVF Output Data

Critical Slope	0.01761	ft/ft

E. Blanco North Ditch Largest Slope

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.09990	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	125.71	ft^3/s

Results

Normal Depth	1.57	ft
Flow Area	9.62	ft^2
Wetted Perimeter	10.01	ft
Hydraulic Radius	0.96	ft
Top Width	9.27	ft
Critical Depth	2.37	ft
Critical Slope	0.01761	ft/ft
Velocity	13.07	ft/s
Velocity Head	2.65	ft
Specific Energy	4.22	ft
Froude Number	2.26	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.57	ft
Critical Depth	2.37	ft
Channel Slope	0.09990	ft/ft

E. Blanco North Ditch Largest Slope

GVF Output Data

Critical Slope	0.01761	ft/ft

Appendix D

iWATERS Database Search

New Mexico Office of the State Engineer
Wells with Well Log Information

(A CLW##### in the POD suffix indicates the POD has been replaced & no longer serves a water right file.)

(R=POD has been replaced, O=orphaned, C=the file is closed)

(quarters are 1=NW 2=NE 3=SW 4=SE)
(quarters are smallest to largest)

(NAD83 UTM in meters)

(in feet)

POD Number	POD Code	Subbasin	County	Source	q q q 6416	4	Sec	Tws	Rng	X	Y	Distance	Start Date	Finish Date	Log File Date	Depth Well	Depth Water	Driller	License Number
SJ 01291			RA	Shallow	4	1	25	30N	04W	302930	4073243*	3034	09/29/1980	01/20/1981	01/22/1981	500	250	GILBERT, JOHN	666
SJ 03900 POD1			RA	Shallow	4 4	4	26	30N	04W	302124	4072384	4025	08/10/2009	09/13/2009	09/16/2009	380	200	BAILEY, MARK	1357
SJ 03742 POD1			RA	Shallow	4 4	3	26	30N	04W	301401	4072375*	4281	08/01/2006	12/31/2006	02/27/2007	480	210	HARGIS, WILLIAM CALVIN	1508
SJ 00042			RA	Shallow		1	28	30N	04W	297901	4073566*	5935	06/23/1952	06/23/1952	12/03/1953	62		CONLEY COX	
SJ 00049			RA	Shallow		3	33	31N	04W	298080	4080910*	6901	09/14/1953	09/14/1953	01/13/1954	112	80	CONELY COX	
SJ 00037			RA	Shallow		2	04	29N	04W	298778	4070389*	7347	06/08/1953	06/13/1953	11/17/1953	373		CONLEY COX	
SJ 02384			RA	Shallow	3 1	3	07	30N	04W	294736	4077762*	8581			01/31/1992	185	95	THOMPSON, SHORTY	
SJ 01575			RA	Shallow	2 4	4	08	29N	03W	306675	4067672*	9276		05/10/1979	05/10/1979	306		STEVENSON, T.W.	422

Record Count: 8

UTMNAD83 Radius Search (in meters):

Easting (X): 303186 **Northing (Y):** 4076267 **Radius:** 10000

***UTM location was derived from PLSS - see Help**

Appendix E

Land Ownership Information, Wetlands Map, & Mining Map

Land Ownership Information

SF-1 SHORT FORM WARRANTY DEED Rev 1/03 - New Mexico Statutory Form

WARRANTY DEED

NANCY VIGIL, a single woman for consideration paid, grant(s) to **BLACK HILLS EXPLORATION & PRODUCTION, INC., a Wyoming corporation** whose address is **350 Indiana Street, Suite 300, Golden, CO 80401,** the following described real estate in Rio Arriba County, New Mexico:

A CERTAIN PARCEL OF LAND LYING AND SITUATE IN THE COUNTY OF RIO ARRIBA, STATE OF NEW MEXICO, BEING PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT WHICH IS S. 79° 22' 44" W., A DISTANCE OF 2132.49 FEET FROM THE NORTHEAST CORNER OF SECTION 13, TOWNSHIP 30 NORTH, RANGE 4 WEST, NMPM; THENCE S. 08° 59' 03" E., A DISTANCE OF 852.68 FEET; THENCE S. 80° 06' W., A DISTANCE OF 1308.91 FEET; THENCE N. 10° 31' 33" W., A DISTANCE OF 852.62 FEET; THENCE N. 80° 06' E., A DISTANCE OF 1331.78 FEET TO THE POINT OF BEGINNING, CONTAINING 25.8423 ACRES, MORE OR LESS.

TOGETHER WITH ALL OF SELLER'S RIGHT, TITLE AND INTEREST IN ALL MINERALS, COAL, METHANE, AND OIL AND GAS RIGHTS (OF ANY FORM WHATSOVER) THAT MAY BE OWNED BY SELLER, WITH ALL OTHER IMPROVEMENTS LOCATED ON THE PROPERTY, AND SUBJECT TO RIGHTS-OF-WAY.

SUBJECT TO reservations, easements, restrictions and patent reservations, if any, and taxes for the year 2003 and thereafter with warranty covenants.

WITNESS my/our hand/s and seal/s this 12 day of September, 2003.

Nancy Vigil (Seal) _____ (Seal)

_____ (Seal) _____ (Seal)

ACKNOWLEDGEMENT FOR NATURAL PERSONS

STATE OF NEW MEXICO)
) ss.
COUNTY OF San Juan)

This instrument was acknowledged before me on this 12 day of September 2003, by **NANCY VIGIL, a single woman.**

My commission expires: 01-09-06
(Seal)

Notary Public

ACKNOWLEDGEMENT FOR CORPORATION

STATE OF NEW MEXICO)
) SS.
COUNTY OF)

This instrument was acknowledged before me on

_____, 20____,

by _____

_____ of _____
(Title of officer) (Name of Corporation

a _____ corporation, on behalf of said corporation

_____
Notary Public

My commission expires:
(Seal)

FOR RECORDER'S USE ONLY

237312

FILED IN THE COUNTY CLERK'S OFFICE
AT 1:10 O'CLOCK P M
Book 463 Page 285
SEP 18 2003
County Clerk, RA County
By _____ Deputy

285

WARRANTY DEED

FREDA WABNUM, formerly known as FREDA VIGIL and THOMAS WABNUM, husband and wife, for consideration paid, grant(s) to

BLACK HILLS GAS RESOURCES, INC., a Colorado corporation,

whose address is: P.O. Box 249
Bloomfield, New Mexico 87401

the following described real estate in Rio Arriba County, New Mexico:

A portion of H.E.S. No. 288 within Section 13, T. 30 N., R. 4 W., N.M.P.M., Rio Arriba County, New Mexico, being more particularly described as follows:

Beginning at a point, from whence the Section corner common to Sections 12 and 13, T. 30 N., R. 4 W., bears N. 55° 41' 38" E., 2288.01 feet; thence from said point and place of beginning, S. 08° 58' 58" E., 867.85 feet; thence S. 80° 05' 13" W., 1285.37 feet; thence N. 10° 31' 35" W., 867.79 feet; thence N. 80° 05' 14" E., 1308.75 feet to the point and place of beginning.

All as shown and delineated on plat of survey entitled "A Boundary Survey Retracement For Black Hills Gas Resources of Thomas and Freda Wabnum Property", prepared by Roy A. Bush, NMPLS No. 8894, filed November 9, 2006, as Document No. 200608827 and recorded in Plat Book J-1, Page 11, records of Rio Arriba County, New Mexico.

SUBJECT TO all patent and mineral reservations, restrictive covenants, restrictions and reservations of easements and rights-of-way of record, and all applicable zoning regulations, restrictions and requirements and all other matters of record and to taxes for the year 2007 and subsequent years;

with warranty covenants.

Witness our hands and seals this 24th day of January 2007.

Freda Wabnum

Thomas Wabnum

ACKNOWLEDGMENT

STATE OF NEW MEXICO

COUNTY OF RIO ARRIBA

This instrument was acknowledged before me on this 24th day of January, 2007, by Freda Wabnum, formerly known as Freda Vigil and Thomas Wabnum, husband and wife

Notary Public V Janet Duran
My Commission Expires: 09/28/08

SELLER FORWARDING ADDRESS NOTICE

January 24, 2007

Seller: Freda Wabnum and Thomas Wabnum
Property Address: , , NM
Escrow Agent: LandAmerica Espanola Abstract Company, Inc.

We, the undersigned Sellers, do hereby verify and confirm the following contact information:

Contact Information Prior to Closing:

Freda Wabnum and Thomas Wabnum
200 Sharon Dr NE
Albuquerque, NM 87123

Contact Information after Closing: ☒ Same as above

New information (below) effective date: _____

Address: _____

_____

Home Phone: _____

Business: _____

Fax Number: _____

Email: _____

Freda Wabnum

Thomas Wabnum

20060882

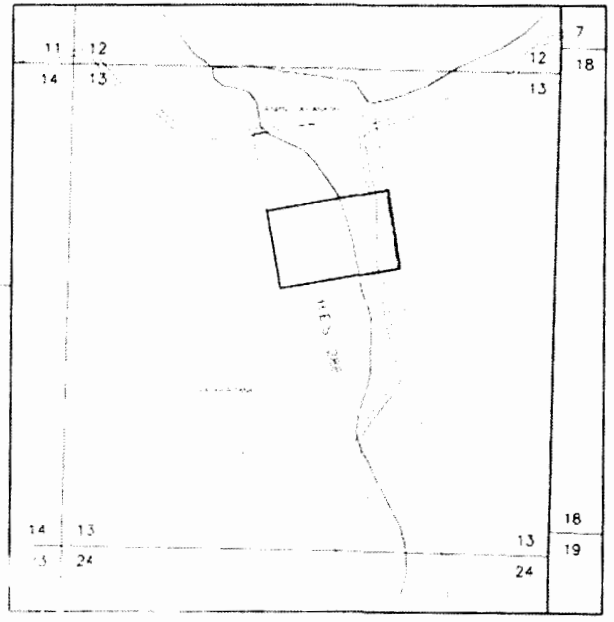
AN BOUNDARY RETRACEMENT FOR

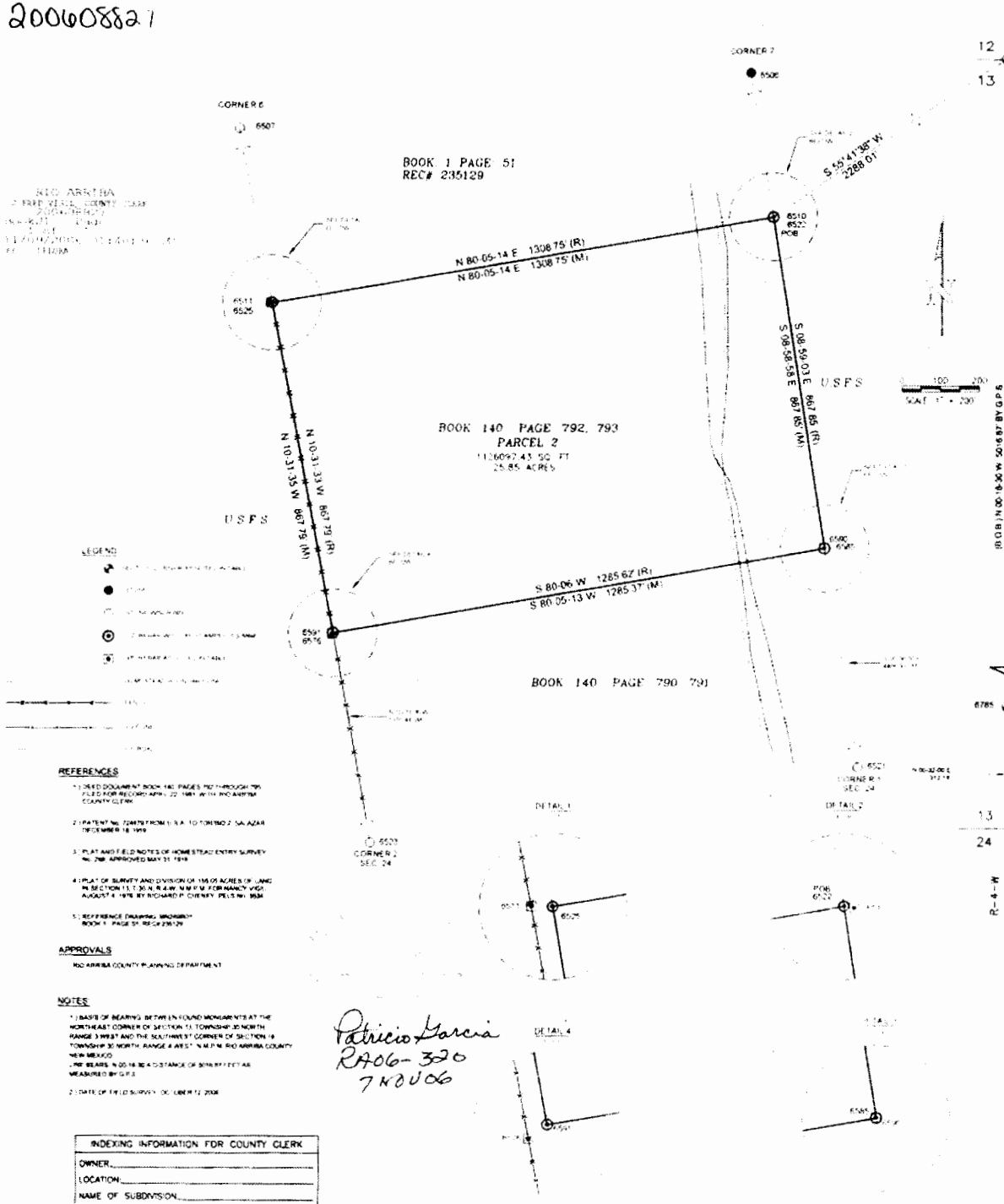
BLACK HILLS GAS RESOURCES
OF
THOMAS AND FREDA WABNUM PROPERTY

SEC 13 T-30-N R-4-W, N M P M
RIO ARRIBA COUNTY, NEW MEXICO

POINT #	DESCRIPTION	ACCEPTED
6050	NE CORNER SEC 13, FOUND BLM 3 25" B C 1953	YES
6765	SW CORNER SEC 18, FOUND GLO 2 1/2" B C 1917	YES
6506	COR 7, H E S #288, FOUND STONE	YES
6507	COR 6, H E S #288, FOUND SCRIBED STONE	YES
6510	ORIGINAL COR PARCEL1, FOUND 3/8" REBAR WITH CAP	NO
6511	ORIGINAL COR PARCEL1, FOUND 3/8" REBAR WITH CAP	NO
6521	COR 1, H E S #288, FOUND SCRIBED STONE W/ BEARING TREES	YES
6522	NE CORNER OF PARCEL FOUND 1/2" X 24" REBAR WITH 1" ALUM CAP MARKED "NM 14827"	YES
6523	COR 2, H E S #288, FOUND STONE, W/ BEARING TREES	YES
6525	NW CORNER OF PARCEL FOUND 1/2" X 24" REBAR WITH 1" ALUM CAP MARKED "NM 14827"	YES
6576	FD P&C LS# 3122, 1" CAP ON 3/8" REBAR	NO
6585	FD P&C LS# 3122, 1" CAP ON 3/8" REBAR	NO
6590	SE CORNER OF PARCEL SET 1/2" REBAR WITH 1" PLASTIC CAP MARKED "NM 8894"	
6591	SW CORNER OF PARCEL SET 1/2" REBAR WITH 1" PLASTIC CAP MARKED "NM 8894"	

VICINITY MAP
1" = 1000'





LEGEND

REFERENCES

1.) DEED DOCUMENT BOOK 140, PAGES 792 THROUGH 795 FILED FOR RECORD APR 1, 22, 1981 WITH RIO ARRIBA COUNTY CLERK

2.) PATENT No. 724979 FROM U.S.A. TO TOMASO Z. SALAZAR DECEMBER 18, 1919

3.) PLAT AND FIELD NOTES OF HOMESTEAD ENTRY SURVEY No. 288 APPROVED MAY 31, 1918

4.) PLAT OF SURVEY AND DIVISION OF 138.05 ACRES OF LAND IN SECTION 13, T 30 N, R 4 W, N M P M FOR NANCY VIGIL AUGUST 4, 1978 BY RICHARD P. CHENEY, PE/LS No. 9534

5.) REFERENCE DRAWING: BROWNBOY BOOK 1 PAGE 51 REC# 235129

APPROVALS

RIO ARRIBA COUNTY PLANNING DEPARTMENT

NOTES

1.) BASIS OF BEARING: BETWEEN FOUND MONUMENTS AT THE NORTHEAST CORNER OF SECTION 13, TOWNSHIP 30 NORTH, RANGE 3 WEST AND THE SOUTHWEST CORNER OF SECTION 18, TOWNSHIP 30 NORTH, RANGE 4 WEST, N.M.P.M. RIO ARRIBA COUNTY, NEW MEXICO.
- THE BEARING N 00°16'30" W A DISTANCE OF 5279.87 FEET AS MEASURED BY G.P.S.

2.) DATE OF FIELD SURVEY: DECEMBER 12, 2006

Patricio Garcia
R406-320
7 NOV 06

INDEXING INFORMATION FOR COUNTY CLERK
OWNER
LOCATION
NAME OF SUBDIVISION

ROY A. RUSH
NEW MEXICO
8894
REGISTERED LAND SURVEYOR

DATE 10-30-06

I, ROY A. RUSH, A NEW MEXICO REGISTERED PROFESSIONAL SURVEYOR, HEREBY CERTIFY THAT I PERFORMED AND AM RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, AND THAT THIS SURVEY AND PLAT MEET THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO.

FURTHER CERTIFY THAT THIS IS NOT A LAND DIVISION OR SUBDIVISION AS DEFINED IN THE NEW MEXICO SUBDIVISION ACT, AND THAT THIS SURVEY PLAT IS AN EXHIBIT OF REAL PROPERTY.

AN BOUNDARY RETRACEMENT FOR
BLACK HILLS GAS RESOURCES
OF
THOMAS AND FREDA WABNUM PROPERTY
SEC 13 T 30 N R 4 W N M P M
RIO ARRIBA COUNTY, NEW MEXICO

SCALE	BY	DATE

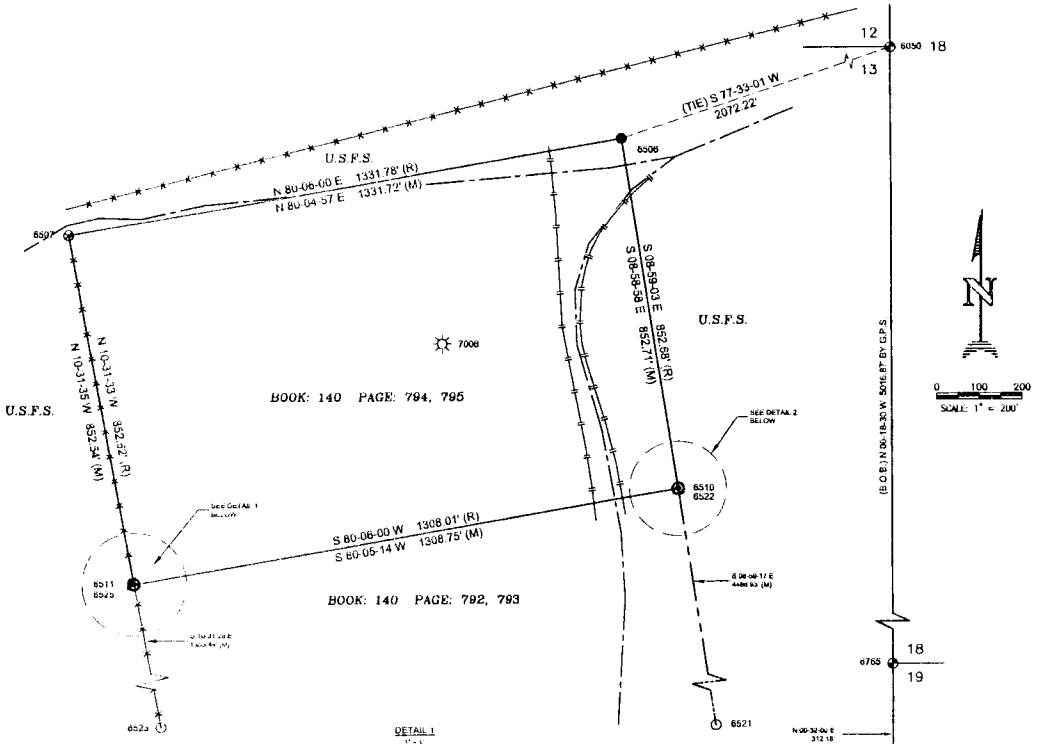
Daggett Enterprises, Inc.
Surveying and Oil Field Services
P. O. Box 15068 Farmington, NM 87401
Phone (505) 326-1772 Fax (505) 326-6019
REGISTERED LAND SURVEYOR
NEW MEXICO LS No. 8894

DRAWN	CHKD	SURVEY	DATE
RWT		12/12/06	10/29/06

AN BOUNDARY RETRACEMENT FOR

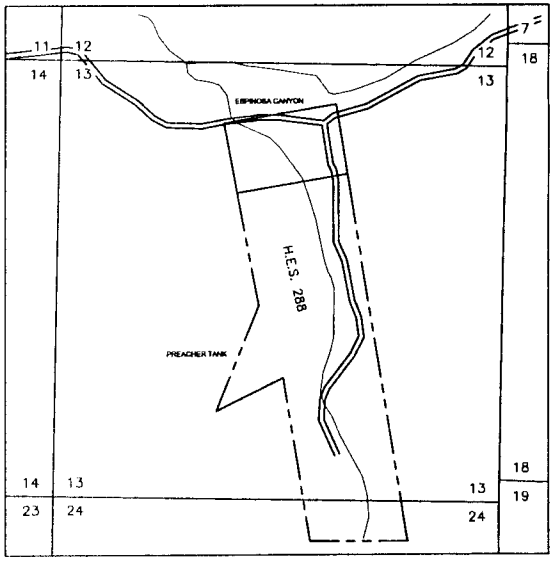
MALLON OIL COMPANY
OF
NANCY VIGIL PROPERTY

SEC. 13, T-30-N, R-4-W, N.M.P.M.
RIO ARRIBA COUNTY, NEW MEXICO



POINT #	DESCRIPTION	ACCEPTED
6050	NE CORNER SEC. 13 FOUND BLM 3 1/2" B.C. 1953	YES
6768	CORNER 6/7 SEC 18 FOUND GLO 2" B.C. 1917	YES
6506	COR. 7 H.E.S. #288 FOUND STONE	YES
6507	COR. 6 H.E.S. #288 FOUND SCRIBED STONE	YES
6510	ORIGINAL COR. PARCEL 1 FOUND 5/8" REBAR WITH CAP	YES
6511	ORIGINAL COR. PARCEL 1 FOUND 5/8" REBAR WITH CAP	YES
6521	COR. 1 H.E.S. #288 FOUND SCRIBED STONE W/ BEARING TREE	YES
6523	COR. 5 H.E.S. #288 FOUND STONE W/ BEARING TREES	YES
6525	SE CORNER OF PARCEL 1 FD. 1/2" X 24" REBAR W/1" PLASTIC CAP MARKED "NM 14827"	
6526	SW CORNER OF PARCEL 1 FD. 1/2" X 24" REBAR W/1" PLASTIC CAP MARKED "NM 14827"	
7008	WATER WELL	

VICINITY MAP
1" = 1000'



LEGEND

- SECTION CORNER AS NOTED IN TABLE
- STONE
- STONE W/BEARING
- 1/2" REBAR WIT CAP STAMPED "LS 14827"
- 5/8" REBAR AS NOTED IN TABLE
- HOMESTEAD BOUNDARY LINE
- FENCE

NOTES:

1.) BASIS OF BEARING BETWEEN FOUND MONUMENTS AT THE SOUTHWEST CORNER OF SECTION 18, TOWNSHIP 30 NORTH, RANGE 3 WEST AND THE NORTHEAST CORNER OF SECTION 13, TOWNSHIP 30 NORTH, RANGE 4 WEST, N.M.P.M. RIO ARRIBA COUNTY, N.M. MEXICO.
LINE BEARS N 00 18 30 W A DISTANCE OF 5016.87 FEET AS MEASURED BY G.P.S.

2.) DATE OF FIELD SURVEY: 5/15/00

REFERENCES

1.) DEED DOCUMENT BOOK 140 PAGES 792 THROUGH 795, FILED FOR RECORD APRIL 22, 1981, WITH RIO ARRIBA COUNTY CLERK.

2.) PATENT No. 725876 FROM U.S.A. TO TURIBIO Z. SALAZAR DECEMBER 18, 1879.

3.) PLAT AND FIELD NOTES OF HOMESTEAD ENTRY SURVEY No. 288, APPROVED MAY 31, 1918

4.) PLAT OF SURVEY AND DIVISION OF 156.06 ACRES OF LAND IN SECTION 13, T.30 N. R.4 W. N.M.P.M. FOR NANCY VIGIL, AUGUST 4, 1978, BY RICHARD P. CHENEY, FILE No. 3634

APPROVALS

RIO ARRIBA COUNTY PLANNING DEPARTMENT

INDEXING INFORMATION FOR COUNTY CLERK

OWNER:
LOCATION:
NAME OF SUBDIVISION:

_____ DATE: _____

I, DAVID A. JOHNSON, A NEW MEXICO REGISTERED PROFESSIONAL SURVEYOR CERTIFY THAT I CONDUCTED AND AM RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, AND THAT THIS SURVEY AND PLAT MEET THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO.

I FURTHER CERTIFY THAT THIS IS NOT A LAND DIVISION OR SUBDIVISION AS DEFINED IN THE NEW MEXICO SUBDIVISION ACT AND THAT THIS IS A BOUNDARY SURVEY PLAT OF AN EXISTING TRACT.

AN BOUNDARY RETRACEMENT FOR
MALLON OIL COMPANY
OF
NANCY VIGIL PROPERTY
SEC. 13, T-30-N, R-4-W, N.M.P.M.
RIO ARRIBA COUNTY, NEW MEXICO

NUMBER	REV. BY	DATE

Daggett Enterprises, Inc.
Surveying and Oil Field Services
P. O. Box 15068 Farmington, NM 87401
Phone (505) 326-1772 Fax (505) 326-6019
REGISTERED LAND SURVEYOR
NEW MEXICO LS No.14827

DRAWN BY: BB | FIELD BOOK: | CHECKED: | REVISED: | DATE: 6/12/00

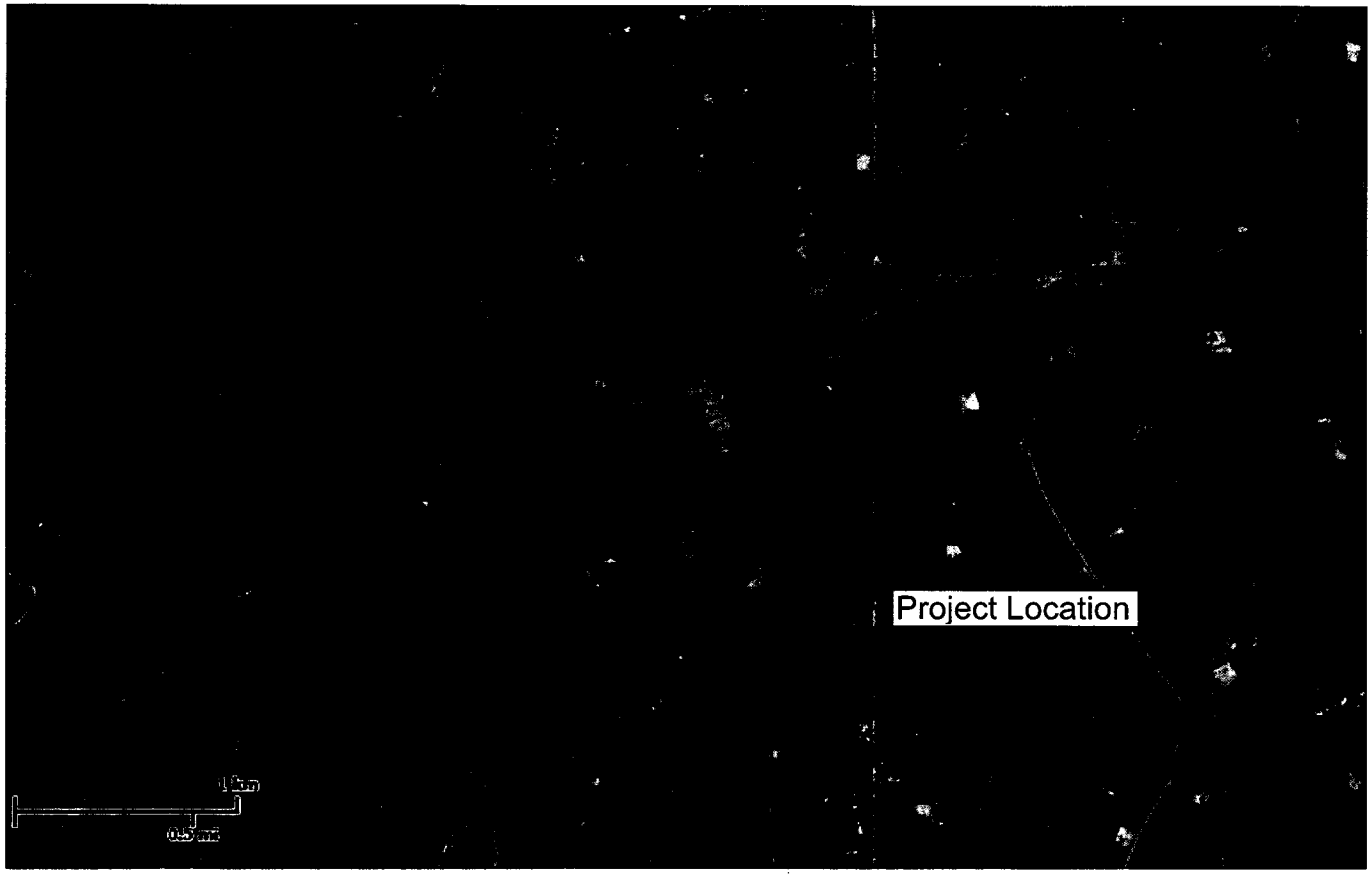
Wetlands Map

U.S. Fish and Wildlife Service

National Wetlands Inventory

East Blanco
Wetlands Map

Dec 8, 2011



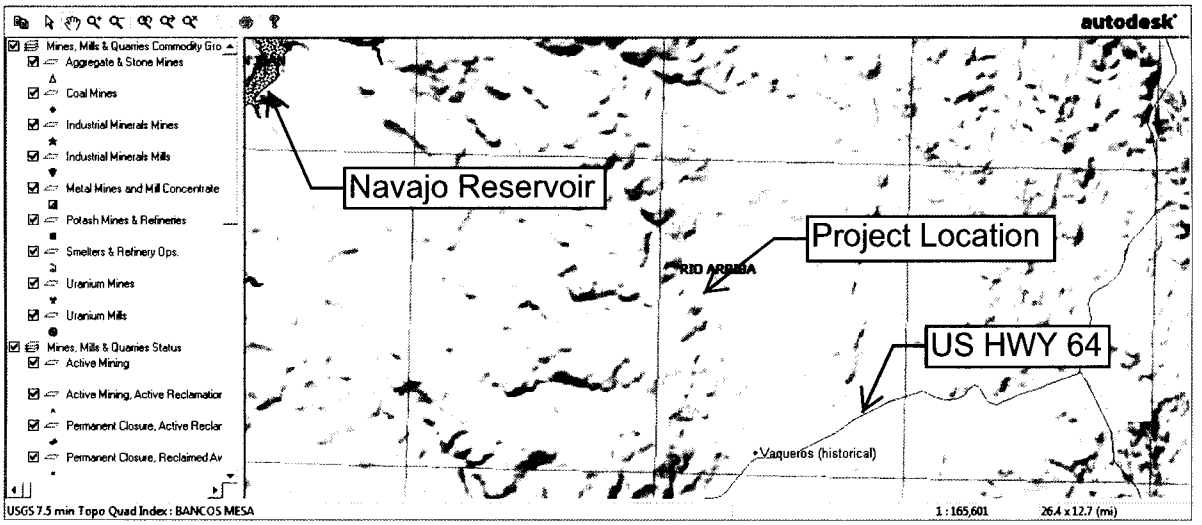
Wetlands

- Freshwater Emergent
- Freshwater Forested/Shrub
- Estuarine and Marine Deepwater
- Estuarine and Marine
- Freshwater Pond
- Lake
- Riverine
- Other

User Remarks:

Mining Map

Mines, Mills and Quarries Web Map



How to Use this Map Questions? Contact Jane Tabor or John Pfeil

The mining operation data depicted in this map was collected under the authority of NMSA, 1978, Chapter 69 by the Mine Registration, Reporting and Safeguarding (MRRS) Program of the Mining and Minerals Division. It is the sole responsibility of mine operators to register any mine, mill, smelter, pit, quarry or other mining facility with the Program prior to the start of operations; and to notify the Program of any operational changes. Data in this map is dynamically pulled from the Mining and Minerals Division Mine Registration Database. Mine registration data is verified for completeness and accuracy before being added to the map. Some of the data may not be current since information may have changed since the last reporting cycle.

Appendix F

Operation, Maintenance and Inspection Plan

Operation, Inspection And Maintenance Plan East Blanco Produced Water Reuse Facility

Prepared for:

Black Hills Gas Resources
3200 N. 1st Street
Bloomfield, NM 87413

Submitted to:

New Mexico Energy, Minerals, &
Natural Resources Department
Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, NM 87505

Prepared by:

WWC ENGINEERING

1275 Maple Street, Suite F
Helena, MT 59601
(406) 443-3962

December 2012

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East Blanco Produced Water
Reuse Facility

DESCRIPTION OF THE FACILITY

The East Blanco Produced Water Reuse Facility is designed for the storage and reuse of produced water from surrounding oil and gas operations. A pipeline connected to the existing tank battery facility located approximately 450 feet east of the proposed facility will transport the produced water to the ponds. Prior to storage, the produced water will be treated with an oil skimmer and particulate filter at the existing tank battery facility. Drilling mud and drilling fluids will not be disposed of within the proposed facility. After storage, the water will be evacuated via suction pump and pipeline to an existing header pipeline system at the tank battery facility. The header pipeline system will connect to new oil and gas well locations via surface casing.

The facility consists of three independent ponds that are designed to function as three separate ponds. Each pond has a surface area of approximately 39,500 square feet, a capacity of approximately 9.99 acre-feet (7.46 acre-feet excluding freeboard), and a working depth of 15 feet (12 feet excluding required 3 feet of freeboard). Each pond is surrounded by a 24-foot wide levee with 12-foot wide access roads. Exhibit 2 in the Permit Application provides the facility layout.

Control of Operations

The facility is owned by Black Hills Gas Resources. Operations at the facility will be directed from the Black Hills Gas Resources' Bloomfield office, and the facility supervisors will consist of employees of Black Hills Gas Resources. The day to day operation and supervision is performed by the facility supervisor who will also serve as the emergency coordinator. Emergency services including fire, ambulance, and police services will be dispatched from Dulce, NM.

CONTACTS

Owner:

Black Hills Gas Resources
3200 N. 1st Street
Bloomfield, NM 87413
(505) 634-5104

Facility Supervisor/Incident Commander:

Gary Stripling
3200 N. 1st Street
P.O. Box 249
Bloomfield, NM 87413
Office: (505) 634-5101
Cell: (505) 486-0314

Production Superintendent - Bloomfield Office:

Bruce Voiles
Office: (505) 634-5104

Production Foreman - Bloomfield Office:

Randy Thompson
Office: (505) 634-5104

Plant/Compression/Pipeline Foreman - Bloomfield Office:

Gary Stripling
Office: (505) 634-5104

Production Manager - Denver Office:

Doran Newlin
Office: (303) 568-5983

Sr. Permitting Coordinator - Denver Office

Alan Vrooman
Office: (303) 903-7520

Facility Engineer - Denver Office:

Brett Hurlbut
Office: (303) 566-3491

Vice President General Manager - Denver Office

John Benton
Office: (303) 566-3391

NORMAL OPERATIONS

General

Produced water is transported to each pond cell via a pipeline connected to the existing tank battery facility located approximately 450 feet east of the facility. The tank battery facility receives the produced water from a pipeline connected to gas/water separators at individual gas well locations. At the tank battery facility, an oil skimmer and a particulate filter will treat the water prior to storage in the ponds. The flow of water to the ponds will be controlled at the existing tank battery facility, and the discharge lines to each pond terminate along the interior slope of each pond. Projected inflows are approximately 1,500 barrels (bbl) per day. A minimum of three feet of freeboard will be maintained within each pond in the facility. A pressure transducer will be installed on the concrete anchor blocks on each pond bottom to monitor the water level within each pond. This transducer will communicate with a Programmable Logic Controller (PLC) system that will automatically shut off the pump supplying each pond to ensure that the water level does not encroach on the minimum three feet of freeboard.

Each pond utilizes a suction pump for water evacuation to an existing header pipeline system at the nearby tank battery facility. A pump house containing a 7.5 horsepower self priming pump will be placed on the levee of each individual pond. The suction pipe for each pump will extend down the interior slope to each pond bottom. Each suction pipe will be anchored at the pond bottom by weight to prevent wearing of the liner from pipe movements.

Produced water is an exempt waste and shall be the only waste stored within the facility. No wastes containing NORM shall be stored at the facility. The facility supervisor will maintain a certification on form C-138 at all times stating that the oil field wastes are generated from oil and gas exploration and production operations and are not mixed with non-exempt waste. The certification on form C-138 shall be accepted on a monthly basis.

Staffing

The facility will not typically be manned except for during times of filling, evacuating, and maintenance. Workers at the adjacent tank battery facility are in the vicinity and maintain contact with the facility supervisor via cellular phone. Additionally, Black Hills employees are available to be dispatched 24 hours a day when required.

All employees shall undergo a training program prior to working at the facility. Additionally, all personnel shall attend annual training sessions provided by the facility supervisor. This training will include the most current information involving general operations at the facility, conditions of the surface waste management facility permit, emergency procedures, proper monitoring and sampling methods and proper identification of exempt and non-exempt waste and hazardous waste. Black Hills Gas Resources will maintain records of attendance and content of training sessions for five years after closure of the facility.

Security

The facility is fenced around the perimeter and has a locking gate at the entrance road. The fence will also serve to exclude wildlife from entering the facility. Although not included in this application, it is anticipated that remote security measures will be installed at this facility in the near future. These measures may possibly consist of an electronic key or remote operated security gate.

Signs

Signs will be placed on the fence near the access road on the east side of the facility. The sign must be readable from a distance of 50 feet from the facility. The operator's name; surface waste management facility permit or order number; surface waste management facility located by unit letter, section, township and range; and emergency telephone numbers (facility supervisor/emergency coordinator) shall be displaced on the sign.

MONITORING AND INSPECTION

Leak Detection System

The liner system and leak detection riser pipes in each individual pond will be inspected on a weekly basis during the first month of operation. Thereafter, inspections will take place on a monthly basis. The liner systems will be inspected by visual inspection via the maintenance roads surrounding each pond. The leak detection riser pipes located outside the pond levees will be inspected to determine the presence or absence of moisture. Any fluids that are present shall be immediately sampled and analyzed, with the analysis of these samples provided to the Oil Conservation Division within two (2) days of discovery. This sampling will be performed to determine if the moisture was generated from condensation or if it is the result of a leak. If a leak is suspected, the pond in question shall be emptied and the liner inspected and repaired. In the event that the liner's integrity is compromised or a penetration of the liner occurs above the water surface, the facility supervisor will notify the appropriate Oil Conservation Division district office within 24 hours of the discovery and repair the damage or replace the liner. In the event that a penetration of the liner occurs below the water surface, or moisture is discovered in the leak detection riser pipes, the water within the pond will be removed below the leak line within 24 hours, and the appropriate Oil Conservation Division district office will be notified within 24 hours of discovery. The leak will then be repaired, or the liner will be replaced.

Equipment

The suction pumps, suction pipe, discharge pipe, and valves will undergo a visual inspection during initial operation to ensure no leaks occur and all components are operating correctly. After initial operation, quarterly inspections as well as periodic inspections during operation will take place. The water surface in each pond will be inspected weekly for the presence of oil and wildlife fatalities.

Levees and Embankments

The pond levees and embankments shall undergo a visual inspection on a quarterly basis to ensure that sliding, erosion, or sloughing of the embankment material does not take place. Additionally, pond levees and embankments will undergo visual inspections after major rainfall or windstorm events.

Pond Surfaces

The surfaces of the ponds within the facility will be inspected on a daily basis for the presence of oil on the water surface. Bird netting will be installed over the pond surfaces and will ensure that migratory birds are excluded from the pond surfaces.

Fences

The fencing that surrounds the facility will be inspected on a quarterly basis to ensure that damage to the fence has not occurred.

Bird Netting

The bird netting covering each pond will be inspected on a quarterly basis to ensure that damage to the netting has not occurred.

Groundwater Monitoring Wells

In the event that groundwater is encountered and monitoring wells are installed, the groundwater shall be sampled to establish the background water quality at the facility's location. After the background groundwater quality has been determined, sampling will occur on a quarterly basis. A laboratory analysis of the groundwater samples will be performed to determine the presence and quantities of constituents. Additional information regarding groundwater testing is included in the Hydrogeologic Report given in Appendix K of the Permit Application.

Record Keeping

The offices of Black Hills Gas Resources will handle record keeping for the facility. The facility supervisor will be responsible for ensuring the accuracy and completeness of the records showing volumes of water stored in the facility. The facility supervisor will maintain a certification on form C-138 at all times stating that the oil field wastes are generated from oil and gas exploration and production operations and are not mixed with non-exempt waste. The certification on form C-138 shall be accepted on a monthly basis. A copy of form C-138 is attached at the end of this Operation, Inspection and Maintenance Plan.

Records of monthly inspections of the leak detection sumps shall be maintained. These records shall include inspection dates, the name of the inspector, and the leak detection system's status. In addition, these records shall be maintained in a form readily accessible

for the Oil Conservation Division. Records of semi-annual inspections and sampling of any monitoring wells shall be maintained. These records shall include the inspection dates, the name of the inspector, and the ground water monitoring wells status.

The facility supervisor will be responsible for maintaining records of annual training session topics and attendance by facility personnel. Black Hills Gas Resources will maintain these records for five years after closure of the facility.

UNAUTHORIZED OPERATIONS

Only produced water from Black Hills Gas Resources oil and gas wells will be stored at the facility. No listed or characterized hazardous wastes may be accepted under any circumstances. Water and associated constituents that are generated from any source other than a properly permitted oil or gas well shall not be accepted unless special approval is obtained from the New Mexico Oil Conservation Division or the New Mexico Environment Department.

MAINTENANCE AND REPAIRS

Maintenance beyond minor repairs is performed by roustabout crews, either operated by Black Hills Gas Resources or subcontractors. There are no full time maintenance personnel who operate the plant or who are assigned to the site on an exclusive basis.

Equipment

Pump appurtenances, pump houses, valves, and piping shall be inspected regularly. Minor repairs that do not have the consequences of a major spill shall be performed as directed by the facility supervisor. Larger repairs involving major equipment, pump repairs, earthwork, or pipe welding, may be performed by roustabout crews, either operated by Black Hills Gas Resources or contractors.

Site/Civil

Rain and snowmelt may occasionally create mud, ruts and standing water in the vehicle travel areas. These situations shall be corrected as necessary by minor blading, with or without newly applied road base material. The pond levees and embankments shall be repaired or regraded as necessary.

Spills

Black Hills personnel shall comply with the spill reporting and corrective action provisions of 19.15.30 NMAC or 19.15.29 NMAC in the event that spills of produced water, oil, or other waste occur.

Fences

The fences that surround the pond must remain in good condition at all times to prevent wildlife and livestock from entering the facility. Fence repairs will be performed as directed by the facility supervisor.

Bird Netting

The bird netting covering each pond must remain in good condition at all times to prevent migratory birds and other wildlife from landing on the pond surface. Netting repairs will be performed as directed by the facility supervisor.

Oil on the Surface of the Ponds

Under normal conditions the pond surfaces will be free from oil. Oil on the surface of the pond is an upset situation requiring immediate corrective action. Black Hills Gas Resources' intention is to never have oil present within the storage ponds.

The ponds are inspected on a daily basis for the presence of oil. If oil is observed the first step will be to immediately shut off the pumps supplying the facility and to remove the oil from the surface of the ponds so that no accumulation occurs. Oil will be removed from the water surface via vacuum trucks and disposed of at an approved waste disposal facility. Additional in place remediation may include use of absorbent material to remove oil sheens from the ponds. Oil booms will be placed around discharge pipes in the ponds to contain oil discharges should they occur inside a smaller area. Once the oil has been removed from the ponds, necessary corrective measures will be taken to correct the source of the current oil presence and to prevent future instances from occurring.

Oil on the water surface is normally removed by skimming with a vacuum truck. Wind will typically move the oil slick about on the water, so every effort will be made to remove or contain the oil with a floating boom or barrier as quickly as possible. Once the oil is contained and accessible, it will be removed with a vacuum boom and disposed of at approved disposal facilities. In the event of a major upset or unique problem, additional equipment such as a floating pump may be employed to expedite oil removal.

EMERGENCY PROCEDURES

In the event of an emergency that requires immediate medical attention, personnel shall call 9-1-1 emergency services. The closest nearest physician is located at the Jicarilla Service Unit (Dulce Health Center). The Jicarilla Service Unit is located approximately 12 miles east of the facility, and the contact information is listed below.

Jicarilla Service Unit
500 Mundo Road
Dulce, NM 87528
(575) 759-3291

In case of a fire occurring at the facility, the contact information for the Dulce Fire Department is listed below.

Dulce Fire Department
Hawks Drive
Dulce, NM 87528
(575) 759-3222

In the event that law enforcement officials may be contacted, the New Mexico State Police and Rio Arriba County Sheriff's Office contact information is given below.

New Mexico State Police
4491 Cerrillos Road
Sante Fe, NM 87507
(505) 827-9300 (business hours)
(505) 827-3476 (emergencies)

Rio Arriba County Sheriff's Office
P.O. Box 98
Tierra Amarilla, NM 87575
(575) 588-7271

Operational emergencies including large amounts of spilled fluids or complete embankment failure, the Rio Arriba County Office of Emergency Management may be contacted. The contact information for this office is given below.

Rio Arriba County Office of
Emergency Management
1122 Industrial Park Road
Espanola, NM 87532
Office: (505) 747-1941
Fax: (505) 747-2338

In the case of a medical emergency, injury, fire, or facility operational emergency, personnel shall notify the facility supervisor immediately after contacting the appropriate emergency personnel. In the case of a fire or unauthorized release, the New Mexico Oil Conservation Division shall be notified. The contact information for the Oil Conservation Division is given below.

New Mexico Oil Conservation Division
1220 South St. Francis Dr.
Sante Fe, NM 87505
Office: (505) 476-3440
Fax: (505) 476-3462

ATTACHMENT: FORM C-138

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

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-138
Revised August 1, 2011

*Surface Waste Management Facility Operator and Generator shall maintain and make this documentation available for Division inspection.

REQUEST FOR APPROVAL TO ACCEPT SOLID WASTE

1. Generator Name and Address:

2. Originating Site:

3. Location of Material (Street Address, City, State or ULSTR):

4. Source and Description of Waste:

Estimated Volume _____ yd^3 / bbls Known Volume (to be entered by the operator at the end of the haul) _____ yd^3 / bbls

5. GENERATOR CERTIFICATION STATEMENT OF WASTE STATUS

I, _____, representative or authorized agent for _____ do hereby certify that according to the Resource Conservation and Recovery Act (RCRA) and the US Environmental Protection Agency's July 1988 regulatory determination, the above described waste is: (Check the appropriate classification)

☐ RCRA Exempt: Oil field wastes generated from oil and gas exploration and production operations and are not mixed with non-exempt waste. *Operator Use Only: Waste Acceptance Frequency* ☐ *Monthly* ☐ *Weekly* ☐ *Per Load*

☐ RCRA Non-Exempt: Oil field waste which is non-hazardous that does not exceed the minimum standards for waste hazardous by characteristics established in RCRA regulations, 40 CFR 261.21-261.24, or listed hazardous waste as defined in 40 CFR, part 261, subpart D, as amended. The following documentation is attached to demonstrate the above-described waste is non-hazardous. (Check the appropriate items)

☐ MSDS Information ☐ RCRA Hazardous Waste Analysis ☐ Process Knowledge ☐ Other (Provide description in Box 4)

GENERATOR 19.15.36.15 WASTE TESTING CERTIFICATION STATEMENT FOR LANDFARMS

I, _____, representative for _____ do hereby certify that representative samples of the oil field waste have been subjected to the paint filter test and tested for chloride content and that the samples have been found to conform to the specific requirements applicable to landfarms pursuant to Section 15 of 19.15.36 NMAC. The results of the representative samples are attached to demonstrate the above-described waste conform to the requirements of Section 15 of 19.15.36 NMAC.

5. Transporter:

OCD Permitted Surface Waste Management Facility

Name and Facility Permit #:

Address of Facility:

Method of Treatment and/or Disposal:

☐ Evaporation ☐ Injection ☐ Treating Plant ☐ Landfarm ☐ Landfill ☐ Other

Waste Acceptance Status:

☐ **APPROVED** ☐ **DENIED** (Must Be Maintained As Permanent Record)

PRINT NAME: _____ TITLE: _____ DATE: _____

SIGNATURE: _____ TELEPHONE NO.: _____

Surface Waste Management Facility Authorized Agent

Appendix G

Hydrogen Sulfide Prevention And Contingency Plan

Hydrogen Sulfide Prevention And Contingency Plan East Blanco Produced Water Reuse Facility

Prepared for:

Black Hills Gas Resources
3200 N. 1st Street
Bloomfield, NM 87413

Submitted to:

New Mexico Energy, Minerals, &
Natural Resources Department
Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, NM 87505

Prepared by:

WWC ENGINEERING

1275 Maple Street, Suite F
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(406) 443-3962

December 2012

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Hydrogen Sulfide Prevention and Contingency Plan
East Blanco Produced Water
Reuse Facility

INTRODUCTION

This Hydrogen Sulfide Contingency plan contains procedures that personnel at the East Blanco Produced Water Reuse Facility will follow in the unlikely event of a hydrogen sulfide release that occurs at or near the proposed facility. This plan complies with 19.15.11 NMAC and conforms to the standards set forth in API RP-55 "Recommended Practices for Oil and Gas Producing and Gas Processing Plant Operations Involving Hydrogen Sulfide."

SCOPE

This Hydrogen Sulfide Contingency plan provides procedures that will be followed in the unlikely event of a hydrogen sulfide release that occurs near the proposed facility. These procedures will include an emergency response as well as plans to alert and protect members of the public, nearby residents, and any contractors working at or near the proposed facility. This plan is specific to the East Blanco Produced Water Reuse Facility. The proposed facility is supplied via pipeline by the adjacent tank battery facility. Therefore, a hydrogen sulfide monitor at the tank battery will provide a means of early hydrogen sulfide detection and will ensure that an accidental release of hydrogen sulfide at the proposed facility is not possible. Additionally, all on-site personnel will be required to maintain an individual hydrogen sulfide sensor on his/her person at all times.

PLAN AVAILABILITY

This Hydrogen Sulfide Contingency plan will be available to any person who is required to perform any portion of this plan. This plan will be provided to the following agencies: New Mexico Oil Conservation Division (OCD), Rio Arriba County Office of Emergency Management, New Mexico State Police, and the Rio Arriba County Sheriff's Office. In addition, this plan will be available within the pump houses at each pond within the East Blanco Produced Water Reuse Facility, the adjacent tank battery facility, and the Black Hills office located in Bloomfield, NM.

EMERGENCY PROCEDURES

Responsibilities of Personnel

1) Facility Supervisor – The facility supervisor will serve as the incident commander (IC) for the facility. The IC is responsible for training operators working at the facility, contractors at the facility, and visitors to the facility on implementing this Hydrogen Sulfide Contingency plan. The IC will communicate with members of the public within the radius of exposure (ROE) as well as Black Hills management.

2) Facility Operators – The facility operators will perform various operations within this Hydrogen Sulfide Contingency plan including assisting with the evacuation of contractors and visitors to designated evacuation areas and keeping the facility supervisor informed on evacuation and hydrogen sulfide mitigation procedures.

3) Contractors and Visitors – Contractors and visitors to the facility will be familiar with signals and alarms at the adjacent tank battery facility with respect to this Hydrogen Sulfide Contingency plan. Contractors and visitors will follow the facility supervisor's and facility operators' instructions in the evacuation of the facility.

Immediate Action Plan

This immediate action plan will be implemented any time notice is given of a potentially hazardous hydrogen sulfide or sulfur dioxide release. The following steps will be followed in response to hydrogen sulfide detection from an individual monitor worn by facility operators at the East Blanco Produced Water Reuse Facility as well as in response to hydrogen sulfide detection from stationary or individual monitors at the tank battery facility.

Level 1 Response (4 ppm Hydrogen Sulfide Concentration Detected)

The notification of a hydrogen sulfide concentration of 4 ppm will be in the form of an audible alarm and flashing lights originating from the hydrogen sulfide sensors. At the initial sound of the alarm, any personnel within the facility will immediately move away from the release and evacuate to a designated assembly area determined by the Incident Commander (IC). The flagging station, as shown on Figure 2, will display a yellow flag indicating the presence of a hydrogen sulfide concentration of 4 ppm and provide emergency instructions to anyone attempting to enter the area via the access road to the Espinosa plant.

1) Facility operators will put on the self-contained breathing apparatus (SCBA) and assist any persons in distress to evacuate to a designated assembly area. Once at a designated assembly area, facility operators will account for all on-site personnel. Evacuation routes and designated assembly areas are shown on Figure 3. The hydrogen sulfide levels at the designated assembly areas will be monitored with personal hydrogen sulfide sensors.

2) 5-minute escape packs are available at the tank battery facility and shall be worn by evacuating personnel as needed.

3) Using the self-contained breathing apparatus (SCBA), facility operators will enter the tank battery facility at the direction of the Incident Commander (IC) and gauge the status of the storage tanks using the walkways over the tanks. Liquid levels in the tanks will be determined using radar with signals sent to the tank battery facility pump houses for monitoring.

4) If filters at the facility need to be changed to mitigate the release of hydrogen sulfide, multiple facility operators wearing the SCBA will use a buddy system to perform the task.

5) If the hydrogen sulfide presence is located at the East Blanco facility ponds, facility operators shall activate the suction pumps and evacuate the water to the tank battery facility for disposal.

6) If the release is resolved, facility operators may re-enter the facility without SCBA and return to normal operation. Hydrogen sulfide concentrations will continue to be monitored, and supervisors on the Black Hills internal call list included with this plan shall be notified of the event.

Level 2 Response (10 ppm Hydrogen Sulfide Concentration Detected)

If the release is not resolved and hydrogen sulfide concentrations of 10 ppm are detected, a Level 2 Response is required and emergency shutdown procedures will commence. The notification of a hydrogen sulfide concentration of 10 ppm will be in the form of an audible alarm and flashing lights originating from the hydrogen sulfide sensors. At the initial sound of the alarm, any personnel within the facility will immediately move away from the release and evacuate to a designated assembly area determined by the Incident Commander (IC). The flagging station, as shown on Figure 2, will display a red flag indicating the presence of a hydrogen sulfide concentration of 10 ppm and provide emergency instructions to anyone attempting to enter the area via the access road to the Espinosa plant.

1) Facility operators will put on the self-contained breathing apparatus (SCBA) and assist any persons in distress to evacuate to a designated assembly area. If necessary, the Incident Commander (IC) may instruct facility operators to contact local emergency responders to assist. Once at a designated assembly area, facility operators will account for all on-site personnel. Evacuation routes and designated assembly areas are shown on Figure 3. The hydrogen sulfide levels at the designated assembly areas will be monitored with personal hydrogen sulfide sensors.

2) 5-minute escape packs are available at the tank battery facility and shall be worn in evacuating personnel as needed.

3) The Incident Commander (IC) will instruct facility operators to notify anyone within the 100 ppm radius of exposure indicated on Figure 2 of the release. This notification will instruct anyone within the ROE to leave the area until further notice. If evacuation of nearby residences is not possible, residents will be instructed to shelter in place. This will involve closing all windows, shutting off air conditioning and heating, and staying inside until further notice. Additionally, the notification will contain information on the severity of the release and level of containment. At the time of this application however, there are no residences, businesses, schools, churches, or medical facilities located within the ROE shown

on Figure 2. Black Hills personnel will make a visual inspection of the ROE area to ensure that no individuals are present within the ROE. If individuals are present, they will be instructed to immediately evacuate the area and not return until further notice.

4) Using the self-contained breathing apparatus (SCBA), facility operators will enter the tank battery facility at the direction of the Incident Commander (IC) and eliminate any possible ignition sources. All valves will be shut to eliminate the supply of produced water to the facility.

5) Liquid levels in the tanks will be determined using radar and/or pressure gauges with signals sent to the tank battery facility pump houses for monitoring. If radar or pressure gauges are not working, the status of the storage tanks will be gauged using the walkways over the tanks. Any possible ignition sources shall be eliminated.

6) If filters at the facility need to be changed to mitigate the release of hydrogen sulfide, multiple facility operators wearing the SCBA will use a buddy system to perform the task.

7) If evacuation to designated assembly areas is ordered, facility operators will assist any local emergency responders in setting up road blocks at the locations shown on Figure 2.

8) The specific well responsible for the release will be identified, shut down, and shut in.

7) If the hydrogen sulfide presence is located at the East Blanco facility ponds, facility operators shall activate the suction pumps and evacuate the water to the tank battery facility for disposal.

9) After the release is resolved, facility operators may re-enter the facility without SCBA and return to normal operation. Hydrogen sulfide concentrations will continue to be monitored. The Oil Conservation Division (OCD) shall be notified no later than four hours after this plan is activated. In addition, supervisors on the Black Hills internal call list included with this plan shall be notified of the event. All nearby individuals within the ROE will be notified that the release has been resolved, informed of current hydrogen sulfide levels, and allowed to return.

10) Reports to various agencies will be submitted as required. A full report of the incident will be submitted to OCD on form C-141 no later than 15 days following the release.

If efforts to resolve the cannot be accomplished in time to prevent personnel or the public to hazardous concentrations of hydrogen sulfide or sulfur dioxide, emergency shutdown procedures will commence.

1) Eliminate any possible ignition sources.

2) Shut all inlet valves to eliminate the supply of produced water to the facility.

3) Once the release is resolved and hydrogen sulfide concentrations are determined to be less than 10 ppm, facility operators may re-enter the facility. The Oil Conservation division (OCD) shall be notified no later than four hours after this plan is activated.

Telephone Numbers and Communication Methods

1) Emergency Services

AGENCY	TELEPHONE NUMBER
Police Departments	
Rio Arriba County Sheriff's Office	(575) 588-7271
New Mexico State Police	(505) 827-9300 (business hours)
New Mexico State Police	(505) 827-3476 (emergencies)
Health Services	
Jicarilla Service Unit	(575) 759-3291
San Juan Regional Medical Center	(505) 609-2000

2) Government Agencies

AGENCY	TELEPHONE NUMBER
Oil Conservation Division (OCD)	(505) 476-3440 (575) 748-1283
Rio Arriba County Office of Emergency Management	(505) 747-1941

3) Black Hills Internal Call List

NAME	TITLE	OFFICE NUMBER	CELL NUMBER
Gary Stripling	Supervisor	(505) 634-5101	(505) 486-0314
Randy Thompson	Foreman	(505) 634-5103	(505) 486-0331
Bruce Voiles	Production Superintendent	(505) 634-5106	(505) 419- 6620
Eric Barndt	Environmental Engineer	(303) 566-3446	

4) Contractors and Public

The emergency contact information for the contractor responsible for the construction of the proposed facility will be provided after the contractor is selected. No contact information is provided for the public due to the absence of any nearby residences or medical facilities within the ROE.

Location of Nearby Residences, Businesses, Schools, Churches, Roads, and Medical Facilities

There are no residences, businesses, schools, churches, roads, or medical facilities located within the ROE. The nearest town is Dulce, NM, located approximately 11.6 miles northeast of the facility. Black Hills personnel will perform a visual inspection of the area encompassing the ROE to ensure that no individual is present. If any individuals are present within the ROE, they will be instructed to immediately evacuate to the designated assembly area.

Evacuation Routes and Road Block Locations

Evacuation routes leading outside of the facility boundary are located on Figure 3 along with designated assembly areas. Road block locations are shown on Figure 2 along with a 3,000-foot ROE.

Safety Equipment and Supplies Available

1) A stationary hydrogen sulfide sensor is located at the produced water inlet to the tank battery facility. This sensor will provide a means of early detection prior to storage within the tanks or at the East Blanco Produced Water Reuse Facility. This sensor is calibrated on a quarterly basis, and documentation is maintained for each calibration. The location of this sensor within the tank battery facility is provided on Attachment 1.

2) A flagging area is located approximately 1,500 feet northeast of the Espinosa Plant on the unnamed gravel access road as shown on Figure 2. This flagging area displays a green flag if the current hydrogen sulfide concentration at the tank battery facility is less than 4 ppm. A yellow flag is displayed if the current concentration is 4 ppm or greater. A red flag is displayed if the current concentration is 10 ppm or greater. This area displays emergency instructions to anyone attempting to enter the area in the event that a yellow or red flag is displayed.

3) Individual hydrogen sulfide sensors are required to be maintained and worn at all times by any personnel within the tank battery facility or East Blanco Produced Water Reuse Facility. Individual hydrogen sulfide sensors are calibrated on a monthly basis, and documentation is maintained for each calibration.

4) 5-minute escape packs are available at the tank battery facility and shall be worn in evacuating personnel as needed.

5) Self-contained breathing apparatus (SCBA) respirators are available at the Espinosa Plant located approximately 600 feet north of the battery facility and shall be worn by facility operators to assist in the evacuation of all on-site personnel and in release mitigation efforts.

6) Reflective traffic control vests are located at the tank battery facility for facility operators to wear during situations requiring roadblocks to be set up.

CHARACTERISTICS OF HYDROGEN SULFIDE AND SULFUR DIOXIDE

Hydrogen Sulfide

Hydrogen sulfide is a toxic and flammable gas that is soluble in water. The presence of the gas can significantly increases the risk of fire and explosion at a facility. Hydrogen sulfide is colorless and can be sensed at lower concentrations by its rotten egg smell. Additionally, hydrogen sulfide is heavier than air and will collect in low elevations and pits. Exposure to lower concentrations of hydrogen sulfide can cause eye irritation, difficulty breathing, and loss of the sense of smell. Exposure to higher concentrations can result in loss of consciousness and death. The following list provides hydrogen sulfide characteristics and corresponding symptoms that may occur from exposure to various concentrations.

Chemical Name	Hydrogen Sulfide
Molecular Formula	H_2S
Molecular Weight	34.082 g/mol
Normal Physical State	Colorless gas, slightly heavier than air.
Boiling Point	-74.4°F (-60.2°C)
Melting Point	-117.2°F (-82.9°C)
Flammable Limits	4.3 – 46 percent vapor by volume in air.
Solubility	Soluble in water and oil.
Combustibility	Burns with blue flame.

Concentration	**Physical Effects**
1 ppm	Odor can be detected (API RP-55).
10 ppm	Unpleasant odor, possible eye irritation.
20 ppm	Burning sensation in eyes and irritation of the respiratory tract after one hour or more exposure (API RP-55).
50 ppm	Loss of sense of smell after about 15 or more minutes exposure. Exposure over one hour may lead to headache, dizziness, and/or staggering (API RP-55).
100 ppm	Coughing, eye irritation, loss of sense of smell after 3 to 15 minutes. Altered respiration, pain in eyes, and drowsiness after 15 to 20 minutes, followed by throat irritation after one hour (API RP-55).
300 ppm	Marked conjunctivitis and respiratory track irritation. Immediately dangerous to life or health (API RP-55).
500 ppm	Unconsciousness after short exposure, cessation of breathing if not treated quickly. Dizziness, loss of sense of reasoning and balance (API RP-55).
700 ppm	Unconscious quickly. Breathing will stop and death will result if not rescued promptly (API RP-55).
1000 ppm	Unconsciousness at once. Permanent brain damage or death may result

Sulfur Dioxide

Sulfur dioxide is a toxic gas that results from the combustion of hydrogen sulfide and is non-flammable, colorless, heavier than air, and transparent. Sulfur dioxide has a pungent odor associated with burning sulfur and produces a suffocating effect. When inhaled at certain concentrations, sulfur dioxide can cause injury or death. The following list provides sulfur dioxide characteristics and corresponding symptoms that may occur from exposure to various concentrations.

Chemical Name	Sulfur Dioxide
Molecular Formula	SO_2
Molecular Weight	64.07 g/mol
Normal Physical State	Colorless gas appreciably heavier than air.
Boiling Point	14°F (-10°C)
Flammable Limits	Non-flammable (produced from burning hydrogen sulfide).
Solubility	Soluble in water and oil.

Concentration	**Physical Effects**
1 ppm	Pungent odor, may cause respiratory changes (API RP-55).
5 ppm	Burning eyes, breathing irritation, and minor throat irritation (API RP-55).
12 ppm	Throat-irritating cough, constriction in chest, watering eyes, and nausea (API RP-55).
100 ppm	Concentration considered immediately dangerous to life or health (API RP-55).
150 ppm	Extreme irritation. Can be tolerated for only a few minutes (API RP-55).
500 ppm	Causes a sense of suffocation, even with the first breath (API RP-55).
1000 ppm	Death may result unless rescued promptly (API RP-55).

Radius of Exposure (ROE)

The East Blanco Produced Water Reuse Facility is supplied via pipeline by the adjacent tank battery facility. Hydrogen sulfide monitors at the tank battery will provide a means of early hydrogen sulfide detection and will ensure that an accidental release of hydrogen sulfide at the proposed facility is not possible. Therefore, insufficient data exists to calculate a radius of exposure for the proposed facility, and a 100-ppm radius of exposure of 3,000 feet is assumed based on subsection K of 19.15.11.7 NMAC. This radius of exposure is shown on Figure 2 attached to this plan.

FACILITY DESCRIPTION, MAPS, AND DRAWINGS

The East Blanco Produced Water Reuse Facility is designed for the collection of produced water from surrounding oil and gas operations. The proposed ponds are located approximately 11.6 miles southwest of Dulce, New Mexico in Section 13, T30N, R4W as

shown on Figure 1. The proposed facility is located approximately 450 feet west of an existing tank battery facility owned by Black Hills Gas Resources. The site is accessed via a 450-foot access road connecting to the existing tank battery facility. There are no municipalities, schools, businesses, hospitals, churches, or institutions located within 500 feet of the proposed facility, and the nearest fresh water well is greater than two (2) miles away from the site.

Produced water from the surrounding oil and gas operations will be the only type of waste accepted at this facility. A pipeline connected to the existing tank battery located approximately 450 feet east of the proposed facility will transport the produced water to the ponds. Prior to storage, the produced water will be treated with an oil skimmer and particulate filter at the existing tank battery facility. Figure 3 includes the layout of the facility along with evacuation routes leading outside of the facility boundary.

TRAINING AND DRILLS

Responsibilities and Duties of Essential Personnel

All personnel involved in the implementation of this plan will be trained on their responsibilities during annual on-site or classroom training meetings. All facility personnel, contractors, and visitors must participate in a facility orientation containing this plan's procedures prior to entering the facility.

On-site or Classroom Drills

Black Hills will conduct on-site or classroom training meetings regarding personnel responsibilities and procedures regarding this plan. These meetings will take place on a yearly basis at a minimum. These meetings will include drills that simulate a situation in which a release is detected and will describe the responsibilities of all personnel. In addition, these meetings will include information on the hazards of hydrogen sulfide, detection, and personal protection.

Notification of Nearby Residences

There are no residences, schools, businesses, churches, roads, or medical facilities located within the ROE at the time of this application. The nearest town is Dulce, NM, located approximately 11.6 miles northeast of the facility. However, if any residences occur within or nearby the ROE during the operation of the facility, the residents will be invited to attend the annual on-site or classroom training meetings regarding the contents of this plan. These meetings will address notification of a release as well as safety precautions that include staying inside, shutting all windows, and turning off air conditioning/ heating units during an incident.

Training and Attendance Documentation

On-site and classroom training meetings will be documented. This documentation will include attendance sheets and a description of the training and activities that were conducted.

Briefing of Public Officials on Evacuation Plans

Local law enforcement officials, health officials, and other first responders listed in this plan will be invited to attend the annual on-site or classroom training meetings regarding the contents of this plan and will be notified of the contents of this plan.

COORDINATION WITH STATE EMERGENCY PLANS

Oil Conservation Division

The Oil Conservation Division (OCD) will be notified following a release of hydrogen sulfide requiring the activation of this contingency plan as soon as possible. This notification will take place no later than four hours after the activation of this plan. A full report of the incident will be submitted to OCD on form C-141 no later than 15 days following the release.

New Mexico State Police/ New Mexico Hazardous Materials Emergency Response Plan

The New Mexico State Police will be responsible for management and coordination of all resources. An emergency response officer will serve as the Incident Commander (IC) and establish the National Interagency Incident Management System (NIIMS) Incident Command System (ICS). The Incident Commander will manage the resources on scene during the incident. Designated Headquarters Emergency Response Officers will manage all off-scene resources during the incident. The New Mexico State Police will manage all law enforcement related activities during the incident.

PLAN REVIEW AND AMENDMENTS

This hydrogen sulfide contingency plan will be reviewed any time a subject addressed in the plan materially changes, and appropriate amendments will be made. Provisions or amendments to the plan will be made if OCD determines that any portion of this plan is inadequate to protect public safety. These provisions or amendments will be submitted to OCD in a timely fashion.

ANNUAL INVENTORY OF PLAN

A copy of this plan will be maintained at all times and available for OCD inspection. On an annual basis, Black Hills will file a current copy of this contingency plan with OCD, the Rio Arriba County Office of Emergency Management, and New Mexico State Emergency Response Commission.

FIGURE 1: FACILITY LOCATION MAP

FIGURE 2: RADIUS OF EXPOSURE (ROE) AND ROADBLOCK LOCATIONS

FIGURE 3: EVACUATION ROUTES

ATTACHMENT: LOCATION OF STATIONARY H_2S MONITORS

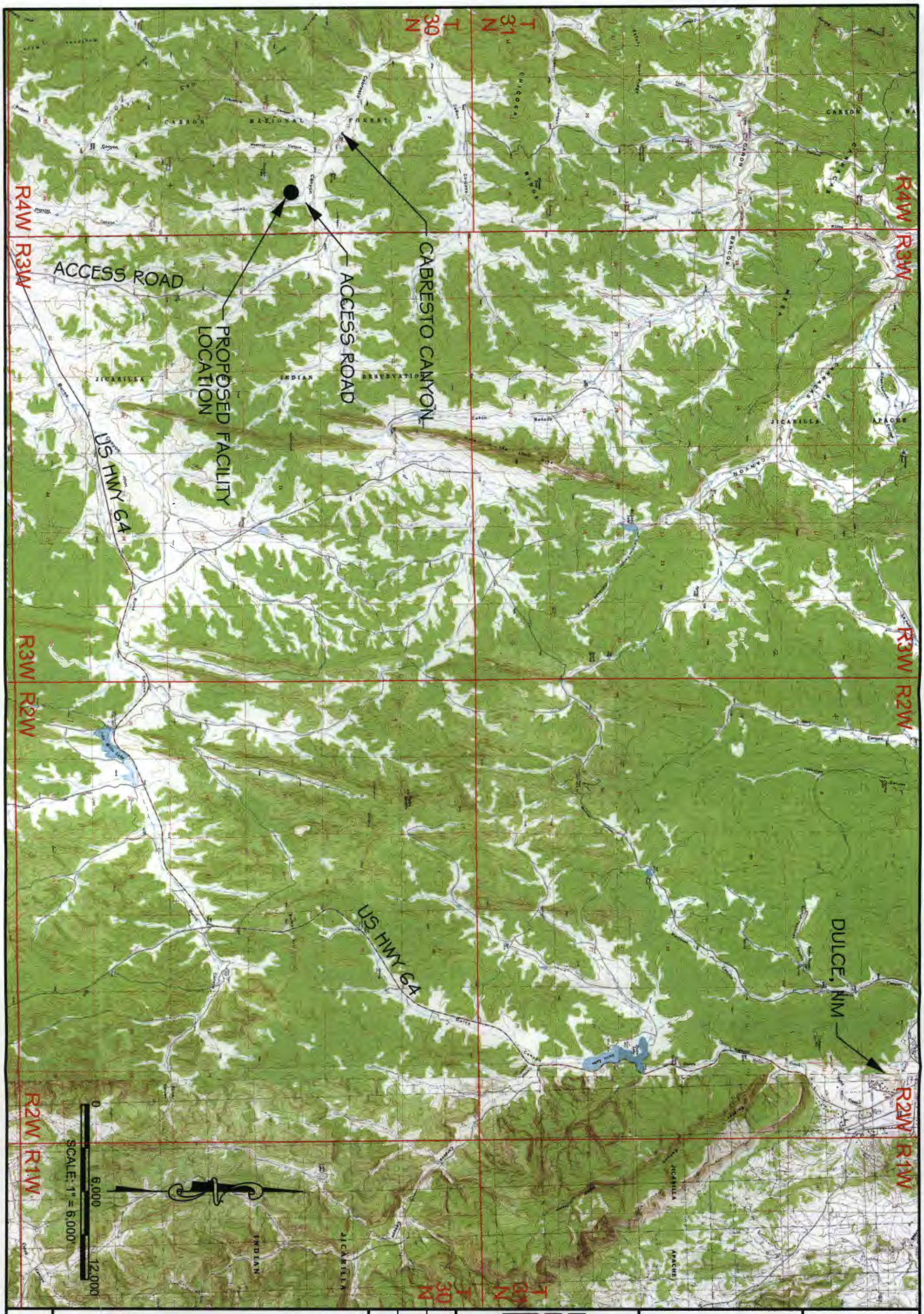

FIGURE 1

EAST BLANCO PRODUCED WATER REUSE FACILITY

FACILITY LOCATION MAP

DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD
JOB # 2011-063		

Black Hills Gas Resources
3200 N 1st Street
Bloomfield, NM 87413
(505) 634-5104

WWC ENGINEERING
1275 MAPLE STREET, SUITE F
HELENA, MT 59601
(406) 443-3962

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FIGURE 2

EAST BLANCO PRODUCED WATER REUSE FACILITY

RADIUS OF EXPOSURE AND ROADBLOCK LOCATIONS

DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD

JOB # 2011-063

Black Hills Gas Resources
3200 N 1st Street
Bloomfield, NM 87413
(505) 634-5104

WWC ENGINEERING
1275 MAPLE STREET, SUITE F
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(406) 443-3962

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FIGURE 3

EAST BLANCO PRODUCED WATER REUSE FACILITY

Evacuation Routes

DSGN	DATE	CKD
MRS	6/12	STH

REV	DATE	CKD

JOB # 2011-063

Black Hills Gas Resources
3200 N 1st Street
Bloomfield, NM 87413
(505) 634-5104

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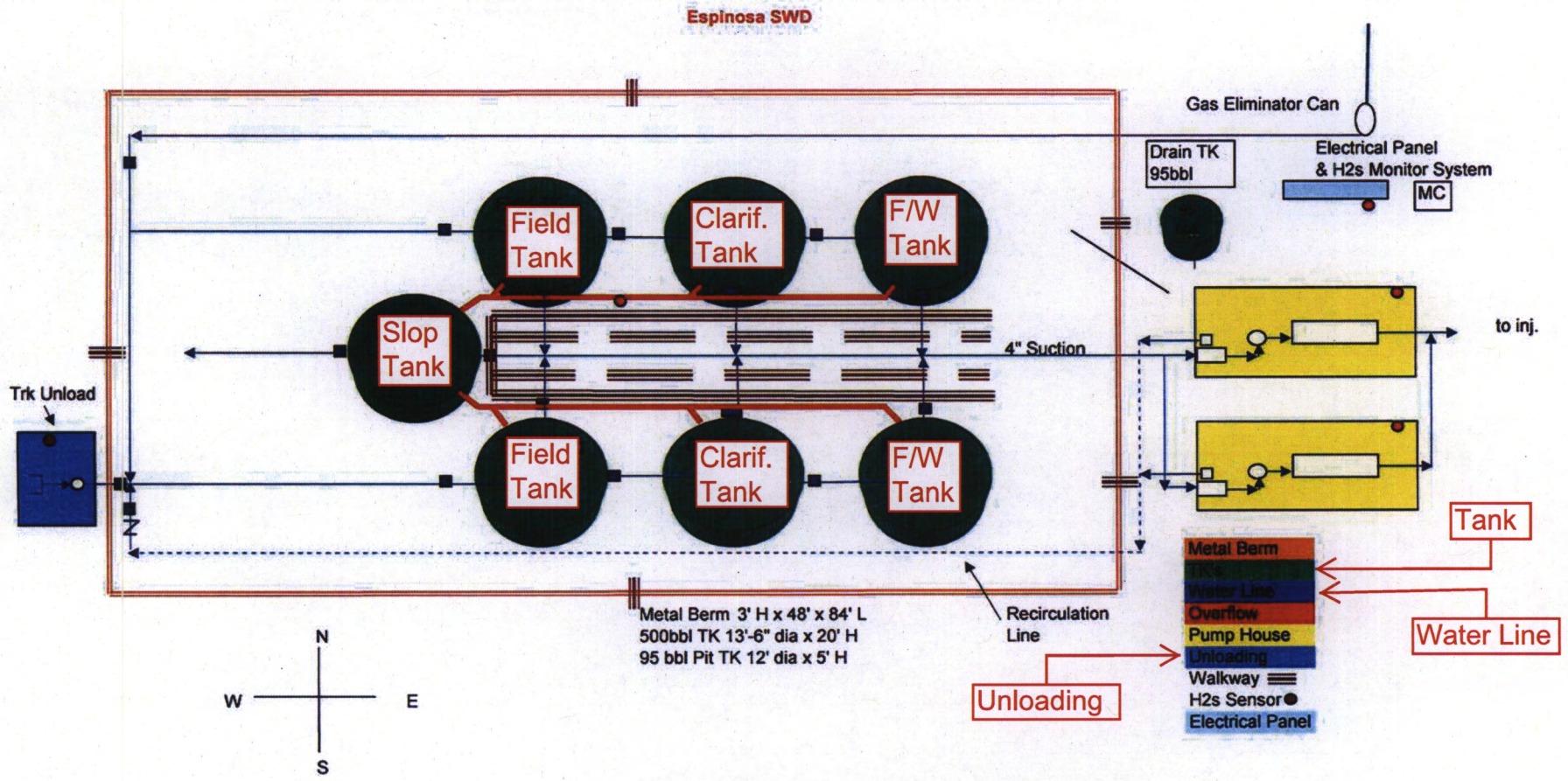
Espinosa SWD
Gas Eliminator Can
Drain TK
95bbl
Electrical Panel
& H2s Monitor System
MC
Field Tank
Clarif. Tank
F/W Tank
Slop Tank
Field Tank
Clarif. Tank
F/W Tank
4" Suction
to inj.
Trk Unload
Metal Berm 3' H x 48' x 84' L
500bbl TK 13'-6" dia x 20' H
95 bbl Pit TK 12' dia x 5' H
Recirculation Line
Metal Berm
Overflow
Pump House
Unloading
Walkway
H2s Sensor
Electrical Panel
Tank
Water Line
Unloading
N
W
E
S

Appendix H

Closure Plan

Closure Plan
East Blanco Produced Water Reuse Facility

Prepared for:

Black Hills Gas Resources
153200 N. 1st Street
Bloomfield, NM 87413

Submitted to:

New Mexico Energy, Minerals, &
Natural Resources Department
Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, NM 87505

Prepared by:

WWC ENGINEERING

1275 Maple Street, Suite F
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(406) 443-3962

December 2012

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Reuse Facility

DESCRIPTION OF THE FACILITY

The East Blanco Produced Water Reuse Facility is designed for the collection of produced water from surrounding oil and gas operations. The ponds within the facility will be constructed using a dual layer HDPE geomembrane liner system to prevent exfiltration, and geonet transmission layer is included in the liner system to provide a means for leak detection. The proposed ponds are located approximately 11.6 miles southwest of Dulce, New Mexico in Section 13, T30N, R4W. The proposed facility is located approximately 450 feet west of an existing tank battery facility owned by Black Hills Gas Resources. The site is accessed via a 450-foot proposed access road connecting to the existing tank battery facility.

There are no municipalities, schools, hospitals, churches, or institutions located within 500 feet of the proposed facility, and the nearest fresh water well is greater than two (2) miles away from the site. The eastern edge of the proposed facility is located a minimum of 215 feet west of a small ephemeral drainage that is a tributary to an ephemeral stream running through Cabresto Canyon. Both waterways are ephemeral and flow only in response to precipitation and snowmelt. The nearest continuously flowing watercourse is Navajo Reservoir, located more than 11 miles west of the proposed facility.

CLOSURE

Protocols and Procedures

The operator will notify the New Mexico Oil Conservation Division's environmental bureau at least 60 days in advance of cessation of operations at the facility. At this time, the operator shall provide the Oil Conservation Division a proposed schedule for closure. After the 60 day notice period, the operator will proceed with the approved closure schedule.

At the start of closure of the facility, the operator will remove all produced water stored in the ponds using the suction pumps. The produced water will be moved to the existing tank battery facility for storage via the pipeline connecting the East Blanco facility to the tank battery facility. The operator will remove all remaining liquids and BS&W from the ponds prior to implementing a closure method and will dispose of the liquids and BS&W in a division-approved facility. The operator will remove the pond liner system and dispose of it in a division-approved facility. In addition, on-site equipment associated with the pond will be removed from the site. Upon removal of the pond liner, the site will be sampled in accordance with the gridded plat of the site containing at least four equal sections OCD has approved. This plat is provided on Figure 1 attached to this Closure Plan. Testing will be performed for TPH, BTEX, metals and other inorganics listed in Table 1.

Table 1. Groundwater Constituent List.

A. Human Health Standards
Arsenic (As)
Barium (Ba)
Cadmium (Cd)
Chromium (Cr)
Cyanide (CN)
Fluroide (F)
Lead (Pb)
Total Mercury (Hg)
Nitrate (NO_3 as N)
Selenium (Se)
Silver (Ag)
Uranium (U)
Radioactivity: Radium-226
Radium-228
Benzene
Polychlorinated biphenyls (PCB's)
Toluene
Carbon Tetrachloride
1,2-dichloroethane (EDC)
1,1-dichloroethylene (1,1-DCE)
1,1,2,2-tetrachloroethylene (PCE)
1,1,2-trichloroethylene (TCE)
ethylbenzene
total xylenes
methylene chloride
chloroform
1,1-dichloroethane
ethylene dibromide (EDB)
1,1,1-trichloroethane
1,1,2-trichloroethane
1,1,2,2-tetrachloroethane
vinyl chloride
PAHs: total naphthalene + Monomethylnaphthalenes
benzo-a-pyrene
B. Other Standards for Domestic Water Supply
Chloride (Cl)
Copper (Cu)
Iron (Fe)
Manganese (Mn)
Phenols
Sulfate (SO_4)
Total Dissolved Solids (TDS)
Zinc (Zn)
pH

The results will be compared to the natural background results obtained prior to construction of the facility to determine whether a release has occurred. Black Hills will then notify the division of its results. If no releases have occurred the Black Hills will backfill the excavation with compacted, non-waste containing, earthen material; construct a division-prescribed soil cover; recontour and revegetate the site with methods described below in this closure plan.

Disposal Facility Name and Permit Number

Any remaining water contained in the facility will be discharged to the existing tank battery facility located adjacent to the facility.

Soil Backfill and Cover Design Specifications

The soil cover for closures where Black Hills has removed the pond contents will consist of the background thickness of topsoil or six inches of suitable material to establish vegetation at the site, whichever is greater.

Revegetation Plan

Topsoil will be redistributed over disturbed surfaces during the first growing season after grading operations are complete. Disturbed areas will be drill-seeded to obtain vegetative cover that equals 70% of the native perennial vegetative cover consisting of at least three (3) native plant species, including at least one (1) grass, but not including noxious weeds, and maintain that cover through two (2) successive growing seasons. The operator shall not artificially irrigate the vegetation.

Site Reclamation Plan

Once the operator has closed the pond they will restore the location and access roads to safe and stable conditions that blend with the surrounding undisturbed area. The operator will restore the impacted surface area to the condition that existed prior to oil and gas operations by placement of the soil cover as provided above in the Soil Backfill and Cover Design Specifications section.

POST-CLOSURE

The post-closure care period for the facility will be three years after the operator has achieved clean closure.

Monitoring

Groundwater monitoring will be performed on a quarterly basis after closure for the first year after the site has been reclaimed. Monitoring will be performed by a qualified third party subcontractor. After one full year of sampling post-closure, the frequency of monitoring will be reviewed. If testing results do not indicate the presence of contamination, monitoring will continue on a yearly basis for the remaining two years of

the three year post-closure care period. If there has been a release to the vadose zone or to ground water, the operator shall comply with the reporting and remediation requirements listed in the Contingency Plan for Emergencies given in Appendix I of the Permit Application. This plan states that Black Hills personnel shall comply with the applicable requirements of 19.15.30 NMAC and 19.15.29 NMAC.

Maintenance

Maintenance of the site will consist of periodic inspection of surrounding fences, revegetation progress and condition of erosion control. General site inspection will occur quarterly and after significant rainfall events.

FIGURE 1: CLOSURE PLAN SAMPLING GRID

FIGURE 1

EAST BLANCO PRODUCED WATER REUSE FACILITY

CLOSURE PLAN
SAMPLING GRID

DSGN	DATE	CKD
MRS	2/28/12	STH
REV	DATE	CKD
JOB # 2011-063		

Black Hills Exploration and Production
1515 Wynkoop Street
Suite 500
Denver, CO 80202
(720) 210-1300

WWC ENGINEERING
1275 MAPLE STREET, SUITE F
HELENA, MT 59601
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Appendix I

Contingency Plan for Emergencies

Contingency Plan For Emergencies East Blanco Produced Water Reuse Facility

Prepared for:

Black Hills Gas Resources
3200 N. 1st Street
Bloomfield, NM 87413

Submitted to:

New Mexico Energy, Minerals, &
Natural Resources Department
Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, NM 87505

Prepared by:

WWC ENGINEERING

1275 Maple Street, Suite F
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December 2012

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Contingency Plan for Emergencies
East Blanco Produced Water
Reuse Facility

INTRODUCTION AND SCOPE

This Contingency Plan for Emergencies contains procedures that personnel at the East Blanco Produced Water Reuse Facility will follow in the event of fire, explosion, spills, or discharges of produced water from the containment ponds. The objective of this Contingency Plan is to protect the public, first responders, and Black Hills personnel in the event of an emergency. Additionally, the actions described in this plan will minimize potential damage to fresh water, public health, safety, or the environment.

FACILITY DESCRIPTION, MAPS, AND DRAWINGS

The East Blanco Produced Water Reuse Facility is designed for the collection of produced water from surrounding oil and gas operations. The proposed ponds are located approximately 11.6 miles southwest of Dulce, New Mexico in Section 13, T30N, R4W as shown on Figure 1. The proposed facility is located approximately 450 feet west of an existing tank battery facility owned by Black Hills Gas Resources. The site is accessed via a 450-foot access road connecting to the existing tank battery facility. There are no municipalities, schools, businesses, hospitals, churches, or institutions located within 500 feet of the proposed facility, and the nearest fresh water well is greater than two (2) miles away from the site.

Produced water from the surrounding oil and gas operations will be the only type of waste accepted at this facility. A pipeline connected to the existing tank battery located approximately 450 feet east of the proposed facility will transport the produced water to the ponds. Prior to storage, the produced water will be treated with an oil skimmer and particulate filter at the existing tank battery facility. Figure 2 includes the layout of the facility along with evacuation routes leading outside of the facility boundary.

PLAN AVAILABILITY

This Contingency Plan for emergencies will be available to any person who is required to perform any portion of this plan. This plan will be provided to the following agencies: New Mexico Oil Conservation Division (OCD), Rio Arriba County Office of Emergency Management, New Mexico State Police, the Rio Arriba County Sheriff's Office, Dulce Fire Department, Jicarilla Service Unit, and San Juan Regional Medical Center. In addition, this plan will be available within the pump houses at each pond within the East Blanco Produced Water Reuse Facility, the adjacent tank battery facility, and the Black Hills office located in Bloomfield, NM.

EMERGENCY PROCEDURES

Responsibilities of Personnel

1) Facility Supervisor – The facility supervisor will serve as the incident commander (IC) for the facility. The IC is responsible for training operators working at the facility, contractors at the facility, and visitors to the facility on implementing this Contingency Plan for Emergencies. In the event of a fire, explosion, release, or other emergency situation that threatens the health or safety of on-site personnel, the IC will direct evacuations and will contact or designate facility personnel to contact emergency services. If emergency services are contacted, the IC will provide responders with information regarding the characteristic of the emergency and any on-site resources that are available.

2) Facility Operators – The facility operators will perform various operations within this Contingency Plan for Emergencies including assisting with the evacuation of contractors and visitors to designated evacuation areas and keeping the facility supervisor informed on evacuation and emergency mitigation procedures.

3) Contractors and Visitors – Contractors and visitors to the facility will be familiar with the procedures contained within this Contingency Plan for Emergencies. Contractors and visitors will follow the facility supervisor's and facility operators' instructions in the evacuation of the facility.

Fire or Explosion

No fire alarm system will be implemented at the East Blanco Produced Water Reuse Facility. Any notification of a fire or explosion will occur via visual inspection. In the case of a fire or explosion occurring at the facility, any personnel within the facility will immediately move away from the location and evacuate to a designated assembly area determined by the Incident Commander (IC).

1) Facility operators will assist any persons in distress to evacuate to a designated assembly area. Once at a designated assembly area, facility operators will account for all on-site personnel. Evacuation routes and designated assembly areas are shown on Figure 2.

2) The Incident Commander (IC) will designate facility personnel to perform a visual inspection of affected area to determine the character and source of the fire or explosion. The IC may instruct facility operators to contact local emergency responders to assist.

3) Facility operators will attempt to extinguish the fire using fire extinguishers located in one of the pump houses at the facility.

4) Valves on the produced water inlet and outlet lines shall be shut off to stop the flow of water into and out of the ponds until the threat of fire or explosion has been mitigated. During this time, the Incident Commander (IC) will monitor the pipe network and valve locations to ensure that leaks, pressure buildup, or rupturing of the valves and pipes does not occur.

5) If the fire is unable to be safely extinguished and emergency responders arrive at the facility, facility personnel shall assist emergency first responders in any way deemed necessary.

6) If the fire or explosion creates an imminent danger of a release of produced water into the environment, the suction pumps located at each pond (if operable) will be used to evacuate the water from the facility to the existing tank battery facility after the threat of fire or explosion has terminated. If the pumps are inoperable, grading and diversion channels will be constructed using the on-site backhoe to retain released water. Absorbent pads and isolation rope pads shall deployed down gradient from the facility. Water that is retained shall be cleaned up by vacuum truck and disposed of at an Oil Conservation Division approved disposal facility Any releases shall be reported to the Oil Conservation Division and appropriate State or Federal authorities. The Incident Commander shall be on site to monitor the cleanup efforts and ensure that produced water is stored at the facility until cleanup procedures are complete. All contaminated materials will be disposed of offsite at a properly permitted disposal facility.

7) It is noted that the Incident Commander (IC) may amend these procedures as seen fit during an emergency to protect fresh water, public health, safety, and the environment.

Air Release

The release of contaminants to the surrounding air would involve the release of hydrogen sulfide within the facility. A release will be detected by individual hydrogen sulfide monitors carried by facility operators. If hydrogen sulfide is detected, the steps contained in the Hydrogen Sulfide Prevention and Contingency Plan shall be followed.

Surface Release

A surface release of produced water will be indicated by visual inspection of the area. In the event of a surface release, facility operators shall comply with the spill reporting and corrective action provisions of 19.15.30 NMAC or 19.15.29 NMAC. Additionally, the following steps will be taken in response to a surface release.

1) The release shall be immediately reported to the Incident Commander (IC). The IC shall be informed of the character, source, amount, and extent of the released produced water. These determinations can be done by direct observation of the release and review of the facility's records. The IC shall also be informed of

topographic conditions, environmental conditions, circumstances that may hinder a response, and injuries caused by the release.

2) Facility operators, on the instruction of the Incident Commander, will close all inlet and outlet valves, isolating the ponds that are not releasing fluids and preventing the further release of waste. The Incident Commander will monitor the pipe network and valve locations during this time to ensure that leaks, pressure buildup, or rupturing of the valves and pipes does not occur.

3) The Incident Commander will assess possible hazards to fresh water, public health, safety, and the environment. Based on this assessment, the Incident Commander may instruct facility operators to contact appropriate emergency personnel.

4) If feasible, the Incident Commander will instruct facility operators to construct grading and diversion channels on the north and east sides of the facility (downhill from the facility) to isolate the release and prevent the produced water from reaching the ephemeral drainages within the area. Absorbent pads and isolation rope pads will also be deployed down gradient of the facility.

5) If feasible, the Incident Commander will arrange for facility operators to use vacuum trucks to clean up retained materials. All retained produced water will be disposed of at the tank battery facility.

6) If required to prevent the further release of produced water, the Incident Commander will instruct facility operators to evacuate the water from the facility to the tank battery facility using suction pumps located at each pond.

7) The Incident Commander shall remain onsite to monitor the cleanup efforts and ensure that no produced water is stored at the facility until cleanup procedures are complete. Additionally, the Incident Commander will ensure compliance with the applicable provisions of 19.15.29 NMAC and 19.15.30 NMAC regarding notice and the submittal and approval of remediation plans and/or abatement plans. All contaminated materials will be disposed of offsite at a properly permitted disposal facility.

8) Reports will be submitted to the Oil Conservation Division as required.

9) The groundwater monitoring well will be monitored after cleanup procedures are complete. Groundwater quality will be compared to background quality to determine if the release resulted in the contamination of groundwater within the area. If it is determined that the groundwater quality was affected by the release, groundwater quality mitigation efforts will be examined and performed if feasible.

Subsurface Release

A subsurface release of produced water will be indicated by the presence of water within the ponds' leak detection systems. In the event of a subsurface release, facility operators shall comply with the spill reporting and corrective action provisions of 19.15.30 NMAC or 19.15.29 NMAC. Additionally, the following steps will be taken in response to a subsurface release.

1) The release shall be immediately reported to the Incident Commander (IC). The IC shall be informed of the character, source, and location of the released produced water. These determinations can be done by direct observation of leaked material and review of the facility's records. The IC shall also be informed of topographic conditions, environmental conditions, circumstances that may hinder a response, and injuries caused by the release.

2) Facility operators, on the instruction of the Incident Commander, will close all inlet and outlet valves, isolating the ponds that are not releasing fluids and preventing the further release of waste. The Incident Commander will monitor the pipe network and valve locations during this time to ensure that leaks, pressure buildup, or rupturing of the valves and pipes does not occur.

3) The Incident Commander will assess possible hazards to fresh water, public health, safety, and the environment. Based on this assessment, the Incident Commander may instruct facility operators to contact appropriate emergency personnel.

4) If required to prevent the further release of produced water, the Incident Commander will instruct facility operators to evacuate the water from the facility to the tank battery facility using suction pumps located at each pond.

5) Approved facility personnel or subcontractors will resolve the cause of the subsurface release prior to additional produced water being stored at the facility.

6) The Incident Commander shall remain onsite to monitor the cleanup efforts and ensure that no produced water is stored at the facility until cleanup procedures are complete. Additionally, the Incident Commander will ensure compliance with the applicable provisions of 19.15.29 NMAC and 19.15.30 NMAC regarding notice and the submittal and approval of remediation plans and/or abatement plans. All contaminated materials will be disposed of offsite at a properly permitted disposal facility.

7) Reports will be submitted to the Oil Conservation Division as required.

8) The groundwater monitoring well will be monitored after cleanup procedures are complete. Groundwater quality will be compared to background quality to determine if the release resulted in the contamination of groundwater within the

area. If it is determined that the groundwater quality was affected by the release, groundwater quality mitigation efforts will be examined and performed if feasible.

Telephone Numbers and Communication Methods

1) Emergency Services

AGENCY	TELEPHONE NUMBER	ADDRESS
Police Departments		
Rio Arriba County Sheriff's Office	(575) 588-7271	P.O. Box 98, Tierra Amarilla, NM 87575
New Mexico State Police	(505) 827-9300 (business hours)	4491 Cerrillos Road, Sante Fe, NM 87507
New Mexico State Police	(505) 827-3476 (emergencies)	
Health Services		
Jicarilla Service Unit	(575) 759-3291	500 Mundo Road, Dulce, NM 87528
San Juan Regional Medical Center	(505) 609-2000	801 W. Maple, Farmington, NM 87401
Fire Departments		
Dulce Fire Department	(575) 759-3222	Hawks Drive, Dulce, NM 87528

2) Government Agencies

AGENCY	TELEPHONE NUMBER	
Oil Conservation Division (OCD)	(505) 476-3440 (575) 748-1283	1220 South St. Francis Dr., Sante Fe, NM 87505
Rio Arriba County Office of Emergency Management	(505) 747-1941	1122 Industrial Park Road, Espanola, NM 87532

3) Black Hills Internal Call List

NAME	TITLE	OFFICE NUMBER	CELL NUMBER
Gary Stripling	Supervisor	(505) 634-5101	(505) 486-0314
Randy Thompson	Foreman	(505) 634-5103	(505) 486-0331
Bruce Voiles	Production Superintendent	(505) 634-5106	(505) 419- 6620
Eric Barndt	Environmental Engineer	(303) 566-3446	

Safety Equipment and Supplies Available

Because the produced water stored at this facility will undergo basic treatment processes including oil skimming and particulate filtration prior to storage, no decontamination equipment will be kept on site. No communication or fire alarm system will be installed at the facility, and facility operators will communicate via cell phone. The following is a list of emergency equipment that will be maintained within the northern most pump house at the facility. First aid kit, defibrillator, fire extinguisher, oil absorbent pads

1) Standard first aid kits are available to be used in response to minor injuries.

2) Individual hydrogen sulfide sensors are required to be maintained and worn at all times by any personnel within the East Blanco Produced Water Reuse Facility. Individual hydrogen sulfide sensors are calibrated on a monthly basis, and documentation will be maintained for each calibration.

3) A flagging area is located approximately 1,500 feet northeast of the Espinosa Plant on the unnamed gravel access road as shown on Figure 2. This flagging area displays a green flag if the current hydrogen sulfide concentration at the tank battery facility is less than 4 ppm. A yellow flag is displayed if the current concentration is 4 ppm or greater. A red flag is displayed if the current concentration is 10 ppm or greater. This area displays emergency instructions to anyone attempting to enter the area in the event that a yellow or red flag is displayed.

4) Fire extinguishers with 6" x 17" dimensions and rated 2-A:10-B:C are available. This fire extinguisher can fight wood, fabric, paper, flammable liquid, and electrical fires.

5) 2' x 3' absorbent pads are available for quick absorption of released liquids.

6) 8' x 3" diameter absorbent rope pads are available for quick absorption of released liquids.

7) A backhoe is available at the tank battery facility and will be used to isolate releases and construct grading and diversion channels if necessary.

8) Cell phones will be carried by all on-site personnel and will be used for communication and notification of emergencies.

NOTIFICATION

The Incident Commander shall report a major release by providing verbal notification within 24 hours as well as written notice within 15 days to the Oil Conservation Division. This notification shall provide the information required on form C-141. The criteria for a major release are provided below:

1) An unauthorized release of a volume in excess of 25 barrels;

2) An unauthorized release of a volume that results in a fire; will reach a watercourse; may with reasonable probability endanger public health; or results in substantial damage to property or the environment;

3) A release of a volume that may with reasonable probability be detrimental to water.

Minor releases shall be reported to the Oil Conservation Division within 15 days. This notification shall provide the information required on form C-141.

TRAINING AND DRILLS

Responsibilities and Duties of Essential Personnel

All personnel involved in the implementation of this plan will be trained on their responsibilities during annual on-site or classroom training meetings. All facility personnel, contractors, and visitors must participate in a facility orientation containing this plan's procedures prior to entering the facility.

On-site or Classroom Drills

Black Hills will conduct on-site or classroom training meetings regarding personnel responsibilities and procedures regarding this plan. These meetings will take place on a yearly basis at a minimum. These meetings will include drills that simulate a situation in which a fire, explosion, or release is detected and will describe the responsibilities of all personnel.

Training and Attendance Documentation

On-site and classroom training meetings will be documented. This documentation will include attendance sheets and a description of the training and activities that were conducted.

Briefing of Public Officials on Plans

Local law enforcement officials, health officials, and other first responders listed in this plan will be invited to attend the annual on-site or classroom training meetings regarding the contents of this plan. These officials will be notified on the contents of this plan.

FIGURE 1: FACILITY LOCATION MAP

FIGURE 2: EVACUATION ROUTES

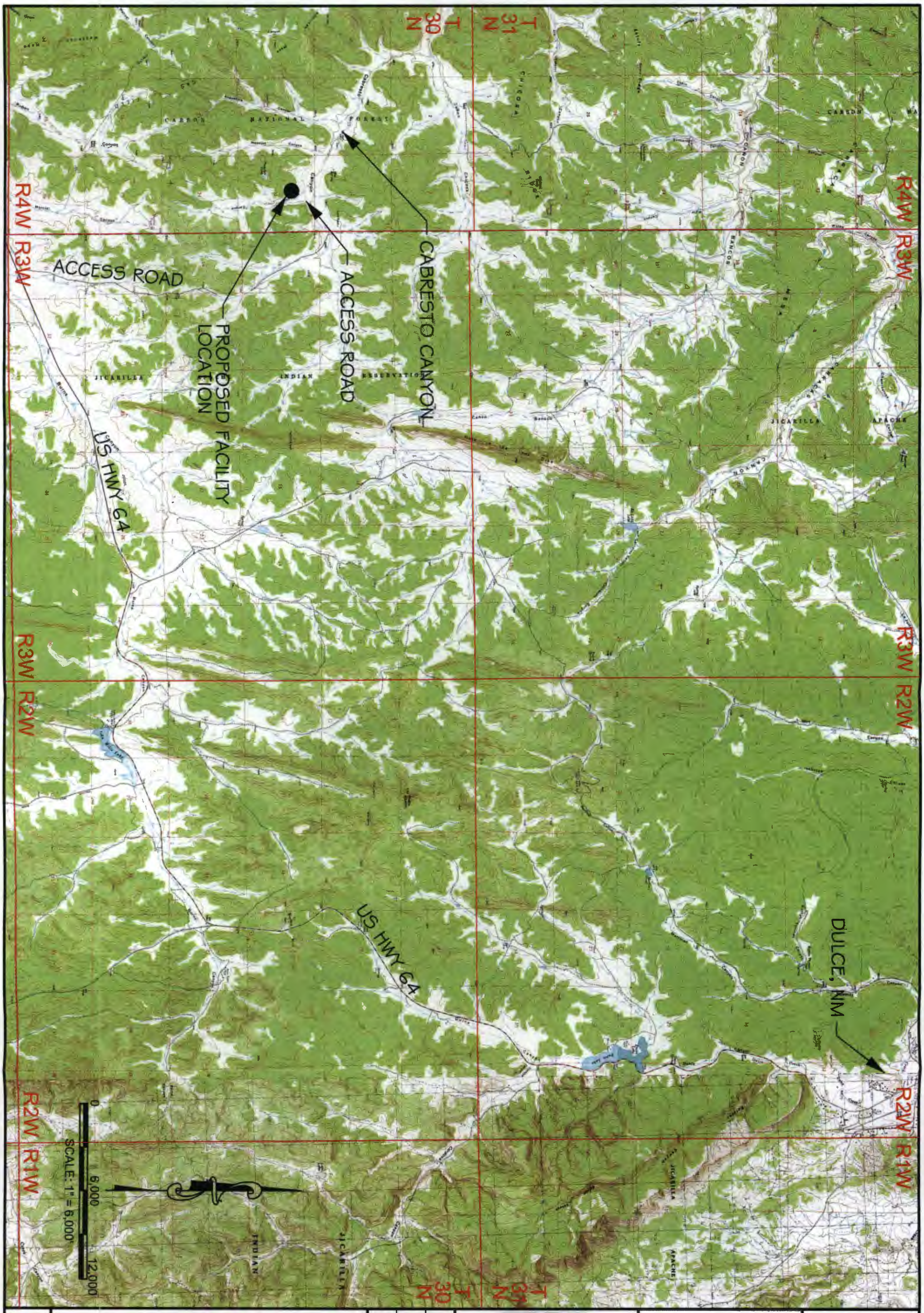

FIGURE 1

EAST BLANCO PRODUCED WATER REUSE FACILITY

FACILITY LOCATION MAP

DSGN	DATE	CKD
MRS	6/12	STH

REV	DATE	CKD

JOB # 2011-063

Black Hills Gas Resources
3200 N 1st Street
Bloomfield, NM 87413
(505) 634-5104

WWC ENGINEERING
1275 MAPLE STREET, SUITE F
HELENA, MT 59601
(406) 443-3962

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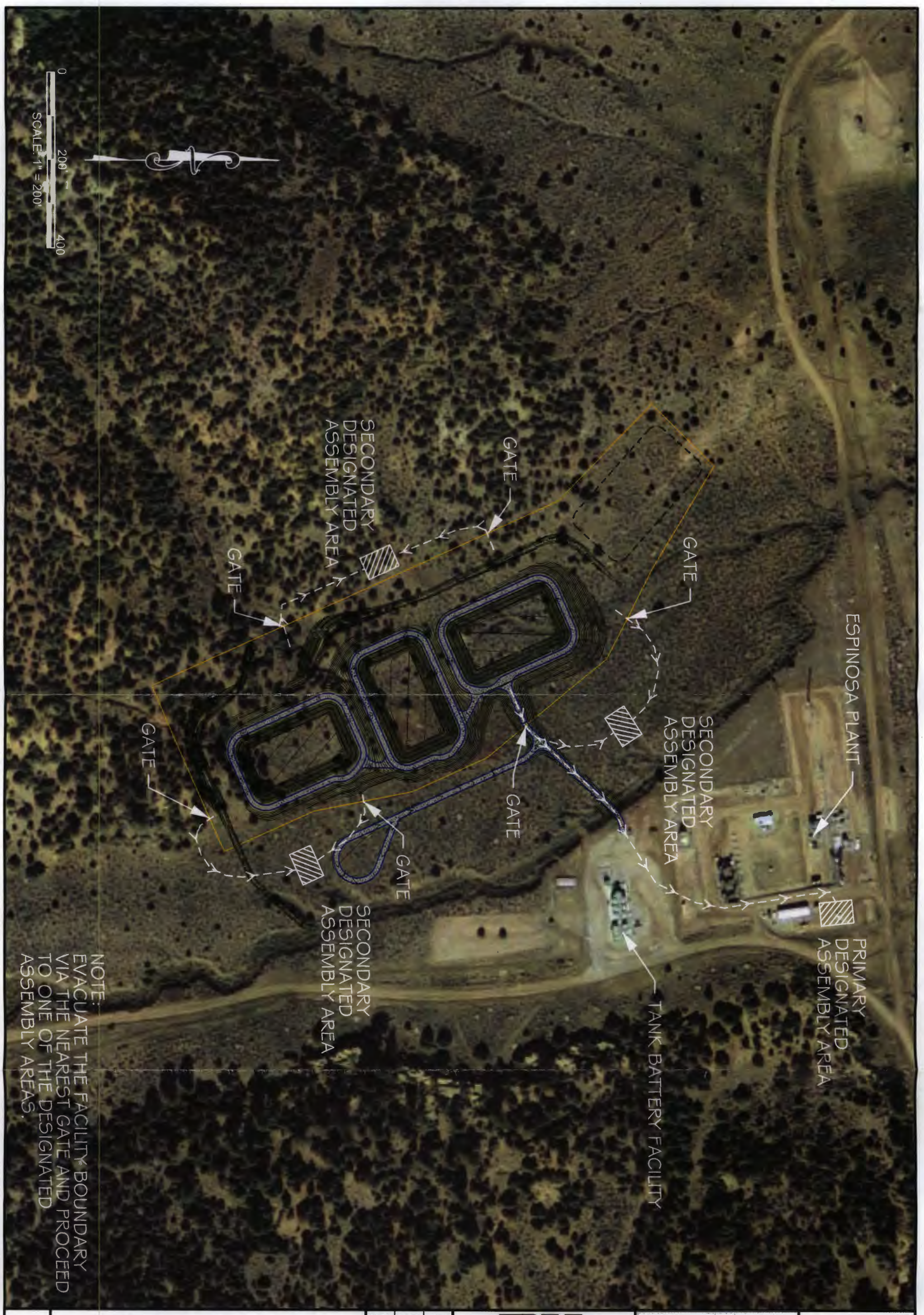

FIGURE 2

EAST BLANCO PRODUCED WATER REUSE FACILITY

Evacuation Routes

DSGN	DATE	CKD
MRS	6/12	STH

REV	DATE	CKD

JOB # 2011-063

Black Hills Gas Resources
3200 N 1st Street
Bloomfield, NM 87413
(505) 634-5104

WWC ENGINEERING
1275 MAPLE STREET, SUITE F
HELENA, MT 59601
(406) 443-3962

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Appendix J

Best Management Practice and Storm Water Management Plan

Best Management Practices and Storm Water Management Plan East Blanco Produced Water Reuse Facility

Prepared for:

Black Hills Gas Resources
3200 N. 1st Street
Bloomfield, NM 87413

Submitted to:

New Mexico Energy, Minerals, &
Natural Resources Department
Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, NM 87505

Prepared by:

WWC ENGINEERING

1275 Maple Street, Suite F
Helena, MT 59601
(406) 443-3962

December 2012

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Best Management Practice Plan
East Blanco Produced Water
Reuse Facility

SITE DESCRIPTION

Project Name and Location

The East Blanco Produced Water Reuse Facility is located approximately 11.6 miles southwest of Dulce, New Mexico in Section 13, T30N R4W as shown in Exhibits 1 and 2 in the Design Report. The proposed facility is located approximately 450 feet west of an existing tank battery facility owned by Black Hills Gas Resources. The site is accessed via a 450-foot proposed access road connecting to the existing tank battery facility.

There are no municipalities, schools, hospitals, churches, or institutions located within ¼ mile of the proposed facility, and the nearest fresh water well is greater than two (2) miles away from the site. The eastern edge of the proposed facility is located a minimum of 215 feet west of a small ephemeral drainage that is a tributary to an ephemeral stream running through Cabresto Canyon. Both waterways are ephemeral and flow only in response to precipitation and snowmelt. The nearest continuously flowing watercourse is Navajo Reservoir, located more than 11 miles west of the proposed facility.

Owner Name and Address

Black Hills Gas Resources
3200 N. 1st Street
Bloomfield, NM 87413
(505) 634-5104

Project Description

The East Blanco Produced Water Reuse Facility is designed for the storage and reuse of produced water from surrounding oil and gas operations. A pipeline connected to the existing tank battery facility located approximately 450 feet east of the proposed facility will transport the produced water to the ponds. Prior to storage, the produced water will be treated with an oil skimmer and particulate filter at the existing tank battery facility. Drilling mud and drilling fluids will not be disposed of within the facility. After storage, the water will be evacuated via suction pump and pipeline to an existing header pipeline system at the tank battery facility. The header pipeline system will connect to new oil and gas well locations via surface casing.

The facility consists of three independent ponds that are designed to function as three separate ponds. Each pond has a surface area of approximately 39,500 square feet, a capacity of approximately 9.99 acre-feet (7.46 acre-feet excluding freeboard), and a working depth of 15 feet (12 feet excluding required 3 feet of freeboard). Each pond is surrounded by a 24-foot wide levee with 12-foot wide access roads.

Hydrology and Hydraulics

The peak discharge from a 25-year storm was used to determine drainage ditch dimensions to protect the west side of the facility from storm water run-on. These ditches are labeled North Ditch and South Ditch on the Engineering Plans provided in Appendix A. With a drainage area of approximately 19 acres, a peak discharge of 125.7 cfs was used for the North Ditch. The South Ditch has a drainage area of approximately 17 acres and a peak discharge of 119.3 cfs. These peak discharges were obtained using the following regression equation:

$$Q_{25} = 5.91 * 10^2 * A^{0.44}$$

Q_{25} = Peak discharge from a 25-year storm (cfs)
A = Drainage area (square miles).

The regression equation provides the peak discharge for small drainage basins in New Mexico with an area of 10 square miles or less and a mean basin elevation less than 7,500 feet. The regression equation was provided in a water-resources investigations report by Scott D. Waltemeyer and the U.S. Geological Survey in cooperation with the New Mexico State Highway and Transportation Department.

The total capacity of the 3 ponds within the facility is 22.38 acre-feet. Projected inflows are 1,500 barrels (bbl) per day for the entire facility. Water balances were performed based on estimated produced water and precipitation inflows, calculated evaporation rates, and the assumption that all 3 ponds were to be evacuated at the end of a three month period. These water balances were performed for the three-month period with the lowest evaporation rates, November through January, and for the three-month period with the highest evaporation rates, April through June. These water balances are presented in Table 1 and Table 2 of this Best Management Practices plan.

Evaporation rates used in the water balance were obtained by averaging pan evaporation rates from Abiquiu Dam (56 miles southwest of the facility, 6200 ft elevation), El Vado Dam (30 miles west southwest of the facility, 6900 ft elevation), and Navajo Dam (24 miles west of the facility, 6100 ft elevation). Two of these sights lie to the west of mountain ranges, similar to the facility. A conservative pan evaporation rate was obtained by multiplying this average value by a pan factor of 0.7, and the rate is expected to be higher than those used in the water balance. Precipitation values were obtained from the Western Regional Climate Center (WRCC) Dulce, NM meteorological site located approximately 11.6 miles northeast of the proposed facility. The monthly average data period of record for this site is 6/1/1906 to 12/31/2005.

Sequence of Activities

The sequence of soil disturbing activities will be as follows:

1. Clearing and grubbing,
2. Topsoil stripping and stockpiling,

3. Constructing access road culverts to enable the producer to safely traverse drainages,
4. Excavation of cut and fill material,
5. Installing water evacuation, supply, and power lines,
6. Final Grading of site,
7. Topsoil Replacement,
8. Revegetation.

Disturbed Areas

Black Hills Gas Resources will disturb approximately 9.0 acres at the facility's location and surrounding areas during construction activities.

Vegetation and Soils

Vegetation within the project area consists of relatively undisturbed rangeland. The vegetative ground cover is estimated at between 40 and 60 percent. Soils within the project area vary due to the size of the area and varied topography. The soils range from a mild to moderate erosion hazard with moderate runoff.

Runoff Coefficient

During construction, runoff will increase by approximately 10 to 30 percent over the natural runoff typical to the area. This increase will only be seen during construction periods. Following construction, the disturbance areas within the site will be revegetated, and runoff will return to less than historical values.

Site Map

Exhibits 1 and 2 in the Design Report depict the location of the proposed facility including the individual ponds, access roads, drainage ditch, and topsoil stockpile location. Construction of the facility will not affect prominent drainage patterns. Both exhibits show the location of the ephemeral drainage that will receive any stormwater runoff.

Receiving Waters

The receiving water for any stormwater runoff is the ephemeral drainage (Espinosa Canyon) that is a tributary to an ephemeral stream running through Cabresto Canyon. Cabresto Canyon will be the receiving water for any stormwater runoff. The facility's boundary is located approximately 215' west of the ephemeral drainage running through Espinosa Canyon. Both waterways are ephemeral and flow only in response to precipitation and snowmelt. The locations of both waterways are shown in Exhibits 1 and 2 of the Design Report. These drainages eventually empty into Navajo Reservoir, located more than 11 miles west of the facility.

Potential Pollutants

There are no discharges related to this construction site. No hazardous products or wastes and/or materials will be stored at this site. Fuel will be hauled to the site to fuel equipment being used in the construction process. Care will be taken to ensure that fuel will not be spilled at the construction site.

Wetlands

According to the U.S. Fish and Wildlife Service National Wetlands Inventory, the nearest identified wetland is located approximately 12 miles west of the proposed facility near Navajo Reservoir. This wetland is classified as Riverine and includes channels that contain flowing water for part of the year. The remainder of the year the water table lies below the soil surface.

STORMWATER RUN-OFF CONTROL

All BMPs used in erosion and sediment control described in this section will be properly selected to best suit each situation. BMPs will be installed in accordance with the manufacturer's recommendations. Each BMP selected for use within the project will be able to withstand and function properly during the 2-year 24-hour storm event. BMP locations are shown on Figure 3 at the end of this Best Management Practices Plan.

Stabilization Practices

Pre-Construction Stabilization:

Prior to construction, the proposed disturbance areas will be analyzed to determine potential areas of increased erosion that may occur before the area can be re-vegetated. Areas perceived to contribute sediment or have erosion potential within proposed disturbance areas associated with construction activities at this site shall have BMPs installed in downstream areas prior to disturbance. These areas may require control structures such as water bars, temporary diversion channels, and excelsior logs. Site-specific measures will be taken to ensure that the proper control structures are in place prior to start-up of construction.

During-Construction Stabilization:

Topsoil and fill stockpiles will be located away from drainages to prevent storm water contamination during construction. Temporary BMPs will be utilized to minimize sediment migration from disturbed areas such as fills, grades, and pipeline trenches. Pre-construction controls will be removed as necessary and replaced with control structures required during construction. The control structures could include excelsior logs, straw bales, silt fences, slope roughening, mulch application, and/or erosion control fabrics.

Post-Construction Stabilization:

Roads and drainage crossings will be stabilized with graded road base material to prevent erosion after construction. Culverts will be properly armored and monitored. All other disturbed areas will have the topsoil replaced and will be seeded immediately following completion of construction activities. In addition, straw matting, excelsior logs, slope roughening, mulch application, and/or grass/coconut matting may be necessary on sloped areas. BMPs will only be removed once vegetation has been well established.

Non-Structural Practices

Cleared areas will be re-vegetated as soon as practicable following completion of construction activities. Existing vegetation will be preserved wherever possible to minimize disturbance in the area. Non-structural practices may include temporary and permanent seeding, mulching, buffer strips, erosion blankets, geotextiles and preservation of existing vegetation.

Structural Practices

Roads:

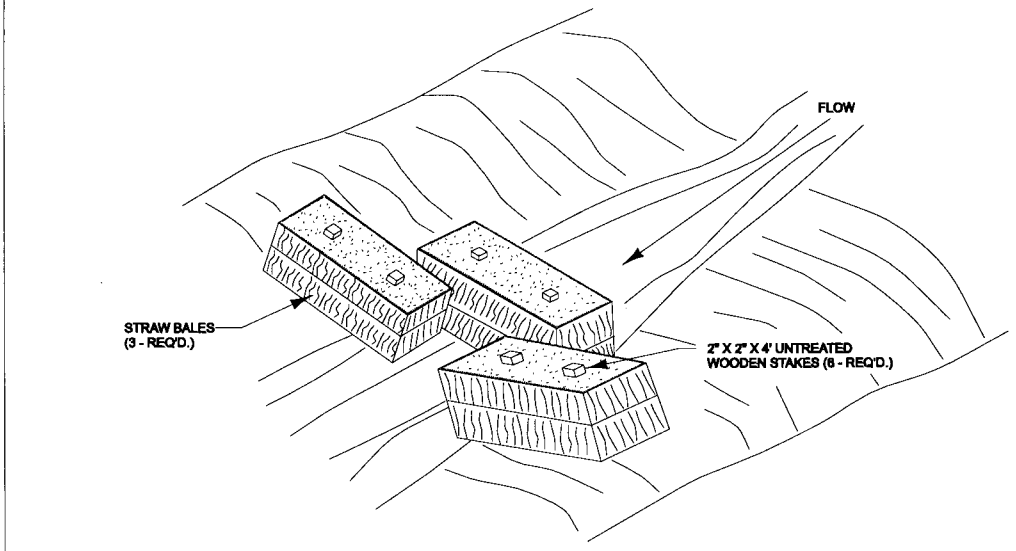
As indicated in Exhibit 2 in the Design Report, access and maintenance roads will be constructed on pond levees where possible to avoid storm water flows. Where it is necessary to cross minor drainages, the disturbed ground will be armored with graded road base material and/or geotextile separation fabric as necessary. Road grades will be protected by crown and ditch construction with sediment traps as depicted on Figure 1 and described below.

Excelsior Logs:

Areas on fill slopes, and especially where the fill slopes are near receiving streams, excelsior logs will be installed at the toe of the fill slopes to prevent off-site sediment migration. A typical excelsior log installation is shown on Figure 1.

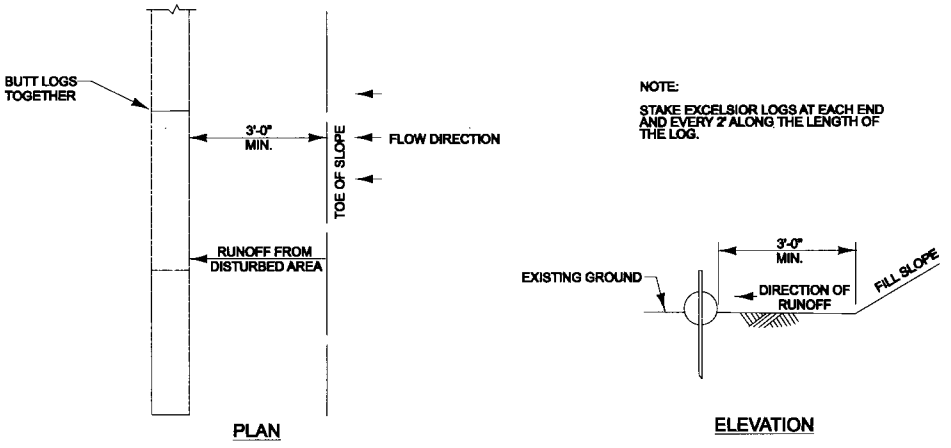
Sediment Traps:

Drainage ditch areas will require sediment traps. On ditch slopes exceeding 7%, straw bale check dams (three bales each) will be installed every 100 to 200 feet. For slopes less than 7%, check dams will be placed on an as need basis, determined by the contractor. The dams will serve to maintain flow at non-erosive velocities and to remove sediments. The dams are meant to temporarily stabilize ditches until adequate vegetation is available. A typical straw bale check dam is shown on Figure 1.



TYPICAL STRAW BALE CHECK DAM SEDIMENT TRAP INSTALLATION

NOT TO SCALE



TYPICAL EXCELSIOR LOG INSTALLATION

NOT TO SCALE

Figure 1. Typical Sediment Control Structure

Silt Fences:

Areas where fill slopes or stockpile areas are located near receiving streams, silt fences will be installed around the perimeter to prevent off-site sediment migration. Typical silt fence installation is shown on Figure 2.

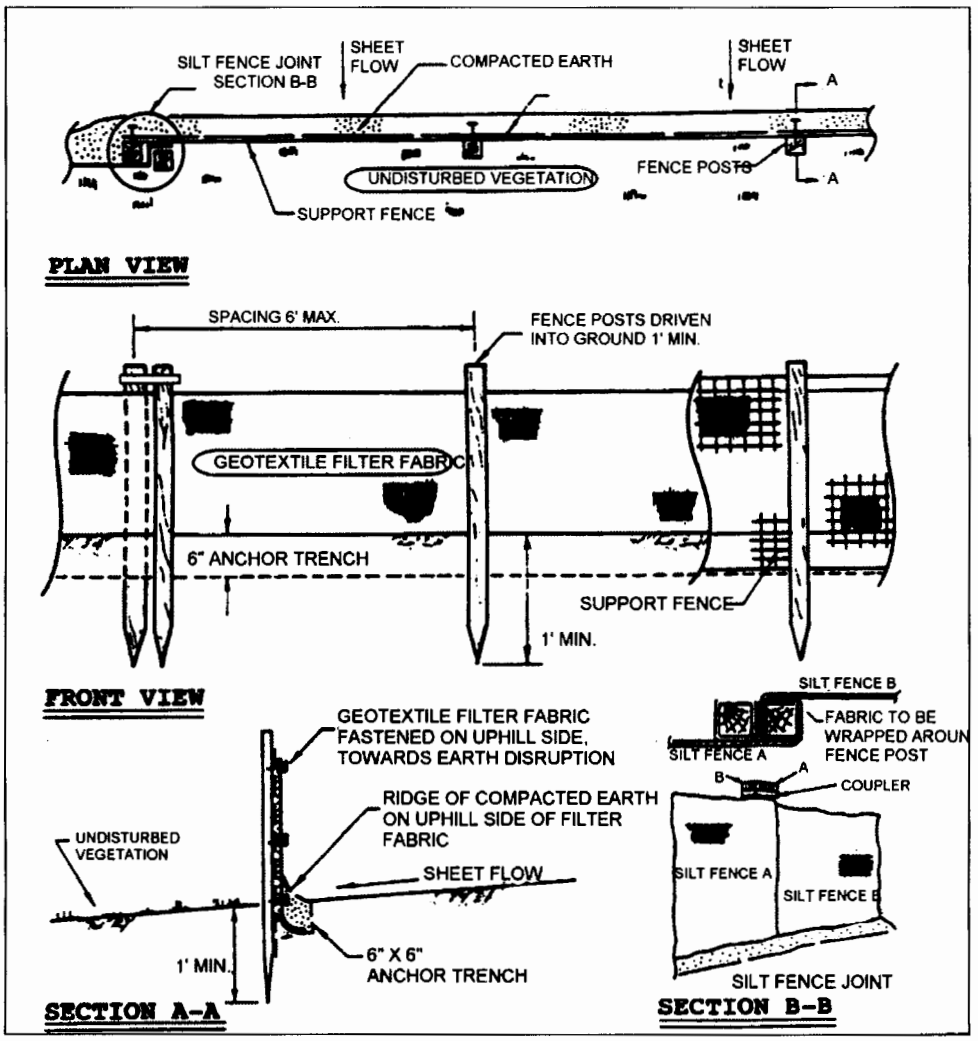


Figure 2. Typical Silt Fence Construction (Nebraska H2O n.d.)

STORMWATER RUN-ON CONTROL

As shown on Figure 3, the pond surfaces are elevated approximately 5 to 22 feet above existing ground on the north, east, and south sides of the facility. Additionally, 3-foot deep trapezoidal drainage ditches along the west side of the facility will prevent surface water run-on during the peak discharge from a 25-year storm. Each pond will maintain 3 feet of freeboard throughout operation and will prevent run-off from occurring from the facility's active portion from occurring. A hydraulic analysis was performed to ensure that the drainage ditches could adequately convey the peak discharge from a 25-year storm. Results from the hydraulic analysis are provided in Attachment 1.

STORM WATER MANAGEMENT

With the exception of excelsior logs and sediment traps, which will not be required after permanent vegetation has been re-established; all structural controls installed during the construction process will be left in place after construction has been completed.

Other Controls

Solid Waste:

No solid materials, including building materials, will be discharged to receiving waters. Construction materials will be stored at a central location. Trash will be placed in wire cage storage bins, which will be emptied by the contractor, roustabout crews, or a waste disposal contractor.

Sediment Tracking:

Black Hills Gas Resources maintains a "no-track" policy that applies to all personnel and contractors. This policy prevents any vehicle from traveling off of all-weather roads or surfaces during wet conditions. Sediments transported off of the construction site shall either be hauled back to the construction site or disposed of in an approved facility.

Sanitary Facilities:

Portable sanitary units will be provided. The units will be located near the construction site or at the existing tank battery facility. Sanitary waste will be collected weekly or as needed and transported off-site for disposal.

Materials and Substances:

The following materials or substances are expected to be present at the facility during construction.

- Diesel and gasoline
- HDPE pipe and appurtenances
- Oils
- Paints
- Graded road base material
- Revegetation seed

Non-Stormwater Discharges:

No non-stormwater discharges will take place at this facility during construction or operation.

Good Housekeeping:

Good housekeeping practices will be used to minimize the potential for storm water pollution during and after construction. Vehicle speeds will be reduced on access roads to minimize dust. Trash will be remanded to wire cages and transported off site.

MAINTENANCE

The following items will be performed as necessary to reduce storm water pollution potential during and after construction.

- Resurface access and maintenance roads
- Resurface drainage crossings
- Remove sediment from excelsior logs and sediment traps

INSPECTIONS

All control measures, including off-channel ponds, road base surfacing, excelsior logs, and sediment traps, will be inspected at least once every 14 calendar days and within 24 hours of any storm event exceeding 0.5-inch of rain, during construction. During inactive periods, when construction is halted or ended, inspections will be conducted monthly. Once construction has been completed and it has been determined, by a qualified inspector, that site stabilization has been achieved, inspections will occur yearly. Any degradation noted during an inspection will be corrected immediately.

SPILL PREVENTION

Material Management Practices

The following are material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to storm water runoff;

1. An effort will be made to store only enough product required to do the job.
2. All materials stored on site will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.
3. Products will be kept in their original containers with the original manufacturer's label.
4. Substances will not be mixed with one another unless recommended by the manufacturer.
5. Whenever possible, all of a product will be used before disposing of the container.
6. Manufacturer's recommendations for proper use and disposal will be followed.
7. The facility supervisor will inspect regularly to ensure proper use and disposal of materials.

Product Specific Practices

Petroleum Products:

All on site vehicles will be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage. Diesel, gasoline and motor oil will be delivered to the site and will not be stored in bulk on site.

Paints:

All containers will be tightly sealed and stored when not required for use. Excess paint and empty paint containers will be removed from the site.

Other Agents:

Any bonding agents, sealers, and primers required during construction will be used according to manufacturer's and State of New Mexico recommendations.

REFERENCES

Nebraska H2O. *Construction BMPs: Silt Fence.* http://www.nebraskah2o.org/2011/construction-bmps-silt-fence/ (accessed December 20, 2012).

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Western Regional Climate Center. (n.d.). *Average Pan Evaporation Data by State.* Retrieved from http://www.wrcc.dri.edu/htmlfiles/westevap.final.html

Western Regional Climate Center. (n.d.). *Monthly Climate Summary.* Retrieved from http://www.wrcc.dri.edu/Climsum.html

Table 1. Water Balance for East Blanco Produced Water Reuse Facility (Lowest Evaporation Rates).

Month	Pan Evap. (in)	Pan Evap. Per Day (bpd)	Total Water Evap. Per Day (bpd)	Days per Month	Total Water Evap. Per Month (bbl)	Monthly Precip.[1] (in)	Precip. Inflow per Month (bbl)	Produced Water Inflow per Month[2] (bbl)	Total Inflow per Month (bbl)	Cumulative Water Storage (bbl)	Available Pond Capacity (bbl)
Nov	1.13	41	41	30	1,225	1.31	2,366	45,000	47,366	46,141	127,459
Dec	0.52	18	18	31	564	1.31	2,366	46,500	48,866	94,443	79,157
Jan	0.00	0	0	31	0	1.37	2,474	46,500	48,974	143,417	30,183

[1] Monthly precipitation from WRCC, Dulce, NM Site.

[2] Assuming 1,500 bbl/day produced water inflow.

gpm = gallons per minute

gpd = gallons per day

bbl = barrels (42 gallons)

bpd = barrels per day

in = inch

Table 2. Water Balance for East Blanco Produced Water Reuse Facility (Highest Evaporation Rates).

Month	Pan Evap. (in)	Pan Evap. Per Day (bpd)	Total Water Evap. Per Day (bpd)	Days per Month	Total Water Evap. Per Month (bbl)	Monthly Precip.[1] (in)	Precip. Inflow per Month (bbl)	Produced Water Inflow per Month[2] (bbl)	Total Inflow per Month (bbl)	Cumulative Water Storage (bbl)	Available Pond Capacity (bbl)
Apr	4.54	163	163	30	4,902	1.13	2,041	45,000	47,041	42,139	131,461
May	6.19	217	217	31	6,724	1.08	1,951	46,500	48,451	83,866	89,734
Jun	7.30	256	256	31	7,922	0.80	1,445	46,500	47,945	123,889	49,711

[1] Monthly precipitation from WRCC, Dulce, NM Site.

[2] Assuming 1,500 bbl/day produced water inflow.

gpm = gallons per minute

gpd = gallons per day

bbl = barrels (42 gallons)

bpd = barrels per day

in = inch

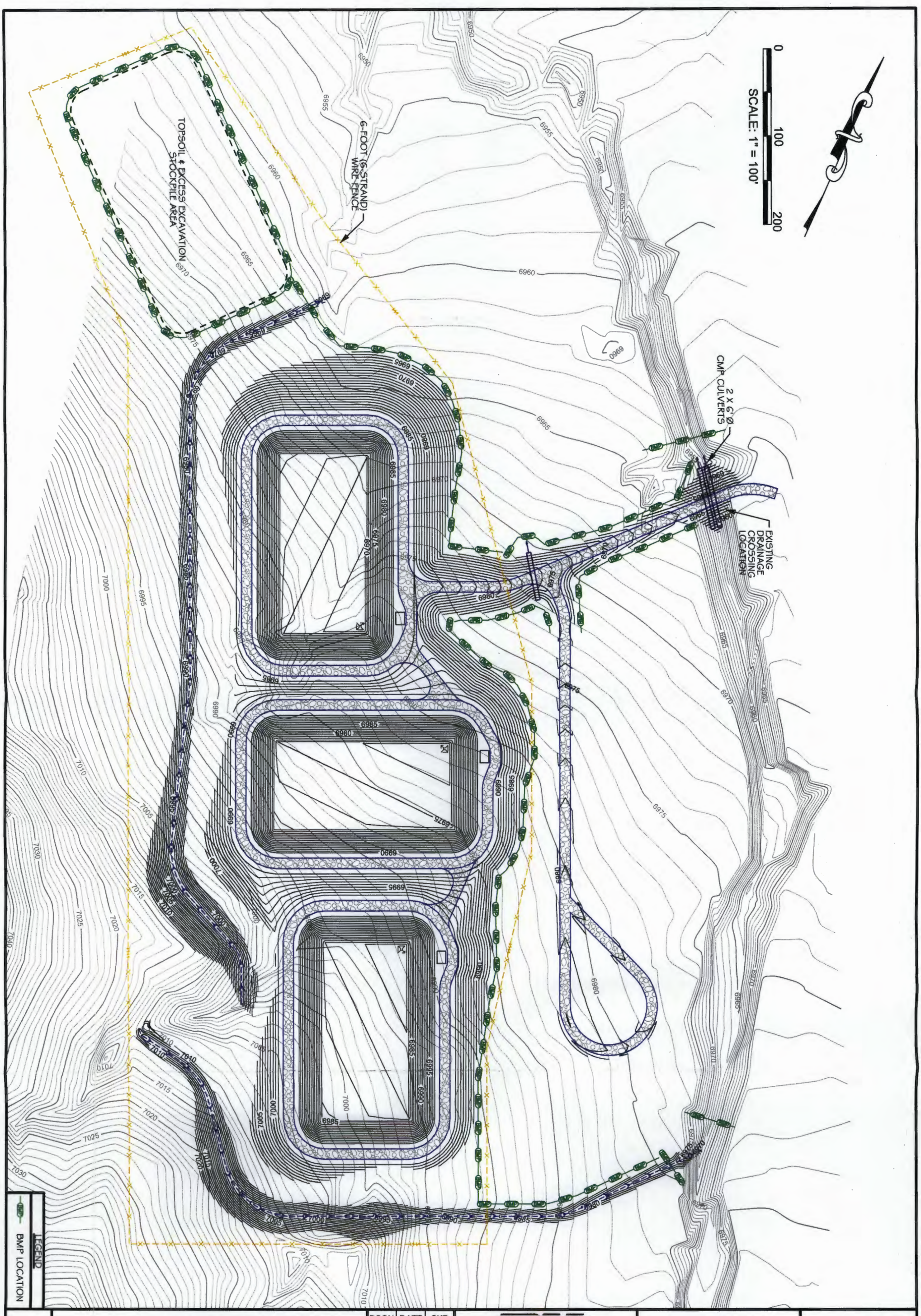

FIGURE 3

EAST BLANCO PRODUCED WATER REUSE FACILITY

Erosion Control Sheet

DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD

JOB # 2011-063

Black Hills Gas Resources
3200 N 1st Street
Bloomfield, NM 87413
(505) 634-5104

WWC ENGINEERING
1275 MAPLE STREET, SUITE F
HELENA, MT 59601
(406) 443-3962

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Attachment 1

Drainage Ditch Hydraulics

E. Blanco South Ditch Least Slope

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.01072	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	119.27	ft^3/s

Results

Normal Depth	2.59	ft
Flow Area	21.16	ft^2
Wetted Perimeter	14.57	ft
Hydraulic Radius	1.45	ft
Top Width	13.35	ft
Critical Depth	2.31	ft
Critical Slope	0.01773	ft/ft
Velocity	5.64	ft/s
Velocity Head	0.49	ft
Specific Energy	3.08	ft
Froude Number	0.79	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.59	ft
Critical Depth	2.31	ft
Channel Slope	0.01072	ft/ft

E. Blanco South Ditch Least Slope

GVF Output Data

Critical Slope	0.01773	ft/ft

E. Blanco South Ditch Largest Slope

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.06211	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	119.27	ft^3/s

Results

Normal Depth	1.71	ft
Flow Area	11.03	ft^2
Wetted Perimeter	10.67	ft
Hydraulic Radius	1.03	ft
Top Width	9.86	ft
Critical Depth	2.31	ft
Critical Slope	0.01773	ft/ft
Velocity	10.82	ft/s
Velocity Head	1.82	ft
Specific Energy	3.53	ft
Froude Number	1.80	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.71	ft
Critical Depth	2.31	ft
Channel Slope	0.06211	ft/ft

E. Blanco South Ditch Largest Slope

GVF Output Data

Critical Slope	0.01773	ft/ft

E. Blanco North Ditch - Least Slope

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.00500	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	125.71	ft^3/s

Results

Normal Depth	3.15	ft
Flow Area	29.25	ft^2
Wetted Perimeter	17.07	ft
Hydraulic Radius	1.71	ft
Top Width	15.59	ft
Critical Depth	2.37	ft
Critical Slope	0.01761	ft/ft
Velocity	4.30	ft/s
Velocity Head	0.29	ft
Specific Energy	3.43	ft
Froude Number	0.55	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.15	ft
Critical Depth	2.37	ft
Channel Slope	0.00500	ft/ft

E. Blanco North Ditch - Least Slope

GVF Output Data

Critical Slope	0.01761	ft/ft

E. Blanco North Ditch Largest Slope

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.09990	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	125.71	ft^3/s

Results

Normal Depth	1.57	ft
Flow Area	9.62	ft^2
Wetted Perimeter	10.01	ft
Hydraulic Radius	0.96	ft
Top Width	9.27	ft
Critical Depth	2.37	ft
Critical Slope	0.01761	ft/ft
Velocity	13.07	ft/s
Velocity Head	2.65	ft
Specific Energy	4.22	ft
Froude Number	2.26	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.57	ft
Critical Depth	2.37	ft
Channel Slope	0.09990	ft/ft

E. Blanco North Ditch Largest Slope

GVF Output Data

Critical Slope	0.01761	ft/ft

Appendix K

Hydrogeologic Investigation Report

Hydrogeologic Investigation Report
East Blanco Produced Water Reuse Facility

Prepared for:

Black Hills Gas Resources
3200 N. 1st Street
Bloomfield, NM 87413

Submitted to:

New Mexico Energy, Minerals, &
Natural Resources Department
Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, NM 87505

Prepared by:

WWC ENGINEERING

1275 Maple Street, Suite F
Helena, MT 59601
(406) 443-3962

December 2012

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East Blanco
Produced Water Reuse Facility

INTRODUCTION

The East Blanco Produced Water Reuse Facility is designed for the collection of produced water from surrounding oil and gas operations so that it may be reused in hydraulic fracturing operations in lieu of fresh water. This document presents the results from a subsurface hydrogeologic investigation that was conducted in support of a Form C-137 Application for a Surface Waste Management Facility. The ponds within the proposed facility will be constructed using a dual layer HDPE geomembrane liner system to prevent exfiltration, and a geonet transmission layer is included in the liner system to provide a means for leak detection. The proposed containment ponds are located approximately 11.6 miles southwest of Dulce, New Mexico in Section 13, T30N, R4W. The proposed facility is located approximately 450 feet west of an existing water disposal tank battery facility owned by Black Hills Gas Resources. The site will be accessed via a proposed access road 450 feet in length connecting to the tank battery facility.

The eastern edge of the proposed facility is located a minimum of 210 feet west of a small ephemeral channel that is a tributary to an ephemeral stream running through Cabresto Canyon. Both waterways are ephemeral and flow only in response to precipitation and snowmelt. The nearest continuously flowing watercourse (Navajo River) is located more than 11 miles west of the proposed facility. The primary objective of this Hydrogeologic Investigation was to characterize subsurface conditions in order to determine the potential environmental risks associated with the construction of the proposed reuse facility.

Problem Statement

Ground water and subsurface soil conditions must be identified to determine the potential environmental impacts from the proposed facility. These conditions must be determined before final design and construction of the proposed facility can begin. Therefore, drilling activities focused on the identification of potential groundwater conditions and soil characteristics beneath the proposed pond locations. The following sections provide further detail and descriptions of how the subsurface investigation was performed.

SCOPE OF WORK

An extensive hydrogeologic investigation of the proposed site was performed. A total of six boreholes were drilled to determine subsurface conditions and depth to ground water at the location. The initial portion of this investigation included two boreholes located directly where the proposed ponds will be located. These boreholes were drilled in December 2011 and are labeled WB4 #1 and WB4 #2. These boreholes were drilled and logged by Geomat, Inc.. An additional four boreholes were drilled in February 2012 and March 2012 pursuant to the Hydrogeologic Investigation Work Plan approved by OCD. These boreholes were located in specific locations surrounding the proposed pond

location in order to adequately determine a potentiometric map of the area. These boreholes are labeled B-1, B-2, B-3, and B-4. The location and depth to ground water of each borehole is shown in Figure 1. Borehole logs for each drilling location are provided in Attachment 1.

Groundwater was encountered at two borehole locations, B-1 and B-4. Borehole B-1 is located approximately 85' west of the proposed pond locations, and Borehole B-4 is located at the western limits of the proposed ponds. Due to ground water being encountered, a monitoring well was installed at the Borehole B-1 location. A water quality analysis was performed on ground water samples taken from B-1 and B-4. The results of this analysis are provided in Attachment 2.

DISCUSSION OF RESULTS

As a result of this hydrogeologic investigation and ground water quality analysis, the following items were analyzed or developed in order to satisfy Form C-137 application requirements: water quality analysis; aquifer description; lithologic soil description; geologic cross-sections; potentiometric map; and soil characteristics.

Water Quality Analysis

A ground water monitoring well was installed at the Borehole B-1 location. This borehole is located approximately 85 feet west of the western limits of the proposed ponds. In addition, a temporary monitoring well was installed at the B-4 location. The groundwater at this location represented the shallowest fresh water aquifer beneath the proposed site. A temporary well was installed at B-4 due to its location within the construction limits of the proposed facility. After construction of the proposed facility is complete, a permanent well will be installed at this location. A laboratory analysis was performed on samples from B-1 and B-4 that focused on major cations and anions; benzene, toluene, ethyl benzene and xylenes (BTEX); RCRA metals; and total dissolved solids (TDS). Table 1 shows the results of this analysis. Detailed laboratory data is provided in Attachment 2 of this report.

Aquifer description

Groundwater was encountered at a depth of 49.7 feet below the ground surface at Borehole B-1, resulting in a groundwater elevation at this location of 6,948.3 feet. At Borehole B-4, groundwater was encountered at a depth of 77.7 feet below the ground surface, placing the ground water location at 6,912.3 feet at this location.

The groundwater encountered at Boreholes B-1 and B-4 is most likely hydraulically connected. This assumption is supported by similarities in water chemistry at each location as shown in Table 1 as well as the close proximity between the two locations. If it is assumed that the groundwater encountered at Borehole B-1 was a perched aquifer located above the confining shale layer shown on the attached geologic cross sections, it is expected that this perched aquifer would also be encountered at Borehole B-4. However, no groundwater was encountered above the shale layer at Borehole B-4.

Therefore, the groundwater encountered above the shale layer at Borehole B-1 is most likely hydraulically connected with the groundwater encountered below the shale layer at Borehole B-4. The change in groundwater elevation between both locations occurs because the shale layer is most likely a fractured bedrock layer and does not act as a continuous confining layer. The absence of groundwater at the Borehole B-2, B-3, WB4 #1, and WB4 #2 locations indicates that the groundwater surface continues deeper to the east of the B-4 location. The groundwater surface is then expected to flatten in a fashion similar to the topography of the ground surface. Borehole logs for each drilling location are provided in Attachment 1.

The facility is located within the San Jose Formation which is a Tertiary bedrock unit. This formation begins at the ground surface and has a thickness of approximately 2,000 to 3,000 feet at the proposed facility location (Stone, Lyford, Frenzel, Mizell, & Padgett, 1983).

Lithologic Soil Description

The three boreholes that are located at or within the limits of the proposed ponds are WB4 #1, WB4 #2, and B-4. These boreholes indicate that the existing subgrade at the proposed pond locations consist primarily of clayey sand (USCS soil type SC) or sandy lean clay (USCS soil type CL) overlaying sandstone and shale rock layers. Detailed lithological descriptions of the soil and rock beneath the proposed facility are given in the borehole logs for WB4 #1, WB4 #2, and B-4 located in Attachment 1. In addition, lithologic descriptions of the soil and rock members encountered in the other three boreholes are provided in Attachment 1.

Geologic Cross-Sections

Two geologic cross-sections were developed for the proposed location. These cross-sections were determined using the existing site topography in combination with the borehole logs from the six drilling locations. These geologic cross sections include subsurface soil stratigraphy along with the known and estimated ground water surface elevation and are shown on Figure 2 and Figure 3.

Potentiometric Map

Groundwater was encountered at two borehole locations, B-1 and B-4. Borehole B-1 is located approximately 85 feet west of the proposed pond locations, and groundwater was encountered at a depth of 49.7 feet. This placed the groundwater elevation at 6,948.3 feet at this location. Borehole B-4 is located at the western limits of the proposed ponds, and groundwater was located at a depth of 77.7 feet. This placed the groundwater elevation at 6,912.3 feet at the western edge of the ponds. Groundwater was not encountered at the B-2, B-3, WB4 #1, and WB4 #2 locations.

The groundwater encountered at Boreholes B-1 and B-4 is most likely hydraulically connected. This assumption is supported by similarities in water chemistry at each location as shown in Table 1 as well as the close proximity between the two locations. If

it is assumed that the groundwater encountered at Borehole B-1 was a perched aquifer located above the confining shale layer shown on the attached geologic cross sections, it is expected that this perched aquifer would also be encountered at Borehole B-4. However, no groundwater was encountered above the shale layer at Borehole B-4. Therefore, the groundwater encountered above the shale layer at Borehole B-1 is most likely hydraulically connected with the groundwater encountered below the shale layer at Borehole B-4. The drastic change in groundwater elevation between both locations occurs because the shale layer is most likely a fractured bedrock layer and does not act as a continuous confining layer.

The absence of groundwater at the Borehole B-2, B-3, WB4 #1, and WB4 #2 locations indicates that the groundwater surface continues deeper to the east of the B-4 location. The groundwater surface is then expected to flatten in a fashion similar to the topography of the ground surface. It should be noted that the groundwater surface at these locations is not known, and therefore, an estimated groundwater surface elevation was assumed at these locations. A shallow aquifer potentiometric surface map was developed for the proposed location based on the known and expected groundwater surface elevations. This map is located on Figure 4 and includes both the known groundwater surface between the B-1 and B-4 locations as well as the estimated groundwater surface at the Borehole B-2, B-3, WB4 #1, and WB4 #2 locations.

Soil Characteristics

A series of laboratory tests were performed on soil samples taken from Borehole B-4 to obtain various engineering parameters of the existing soils that will be used to construct the proposed facility. Samples were obtained using a continuous split spoon sampler from 0 to 10 feet below the ground surface. The results of this testing program are presented in Table 2. The laboratory testing report summarizing this testing program is provided in Attachment 3.

As evidenced in the laboratory testing results presented in Table 2, the existing soils are classified as Sandy Lean Clay and are suitable for construction of the proposed ponds. The in-situ soils have an average hydraulic conductivity of 3.1×10^{-5} cm/s, percent voids of 28.9% on a sample remolded to 95% of the maximum dry density, and slight to moderate swell potential of 6.9%. Additionally, these soils will be compacted to 95% Standard Proctor compaction pursuant to ASTM D698 as specified in Section 02201 of the Technical Specifications provided in Appendix B of the Permit Application.

Table 1. Results of ground water quality analysis from sample taken at Borehole B-1 and Borehole B-4 locations.

Analysis	B-1 Sample	B-4 Sample	Reporting Limits	Units
General Parameters				
pH	8	8.2	0.1	s.u.
Total Dissolved Solids (180)	290	760	10	mg/L
Anions				
Alkalinity, Bicarbonate As HCO3	165	238	5	mg/L
Alkalinity, Carbonate as CO3	ND	ND	5	mg/L
Alkalinity, Hydroxide as OH	-	ND	5	mg/L
Chloride	3	5	1	mg/L
Fluoride	-	0.2	0.1	mg/L
Nitrogen, Nitrate-Nitrite (as N)	-	ND	0.1	mg/L
Sulfate	72	338	1	mg/L
Cations				
Calcium	48	106	1	mg/L
Magnesium	10	26	1	mg/L
Potassium	5	4	1	mg/L
Sodium	30	99	1	mg/L
RCRA Metals				
Arsenic	0.01	ND	0.01	mg/L
Barium	0.834	0.256	0.005	mg/L
Cadmium	0.001	ND	0.001	mg/L
Chromium	0.195	ND	0.005	mg/L
Lead	0.03	ND	0.01	mg/L
Mercury	ND	ND	0.001	mg/L
lenium	ND	ND	0.025	mg/L
ver	ND	ND	0.005	mg/L
0B MBTEXN				
zene	ND	ND	1	µg/L
ıene	ND	ND	1	µg/L
lbenzene	ND	ND	1	µg/L
Xylenes	ND	ND	2	µg/L
ene	ND	ND	1	µg/L
es, Total	ND	ND	3	µg/L
GRO by 8260 (nC6-nC10)	ND	ND	20	µg/L
Surr: 4-Bromofluorobenzene	87.9	102	81-115	%REC

[1] – ND indicates constituent not detected at the reporting limit

[2] – Blank indicates that no test results are available.

Table 2. Results of laboratory testing of soil samples taken from Borehole B-4 location at depths from 0 to 10 feet.

Sieve Analysis (ASTM C117, C136)		**Atterberg Limits (ASTM D4318)**	
Sieve Size	% Passing	Liquid Limit	38
No. 4	100	Plastic Limit	14
No. 8	100	Plasticity Index	24
No. 10	99	**Hydraulic Conductivity (ASTM D5084)**	
No. 16	99	Average	3.1×10^{-5} cm/sec
No. 30	95	**Porosity****	
No. 40	91	Percent Voids	28.90%
No. 50	88	**Moisture-Density Relationship (ASTM D698)**	
No. 100	80	Maximum Dry Density	111.7 pcf
No. 200	70	Optimum Moisture Content	14.8%
Classification of Soil (ASTM D2487)		**Remolded Swell Potential*****	
CL, Sandy Lean Clay		Swell	6.90%

asd*measured on sample remolded to 95% of 111.7 pcf at 14.8% moisture content

**performed on a trimmed split spoon sample and may not be representative of in situ conditions

***measured on sample remolded to 95% of 111.7 pcf at 11.8% moisture content (3% below optimum)

Figures

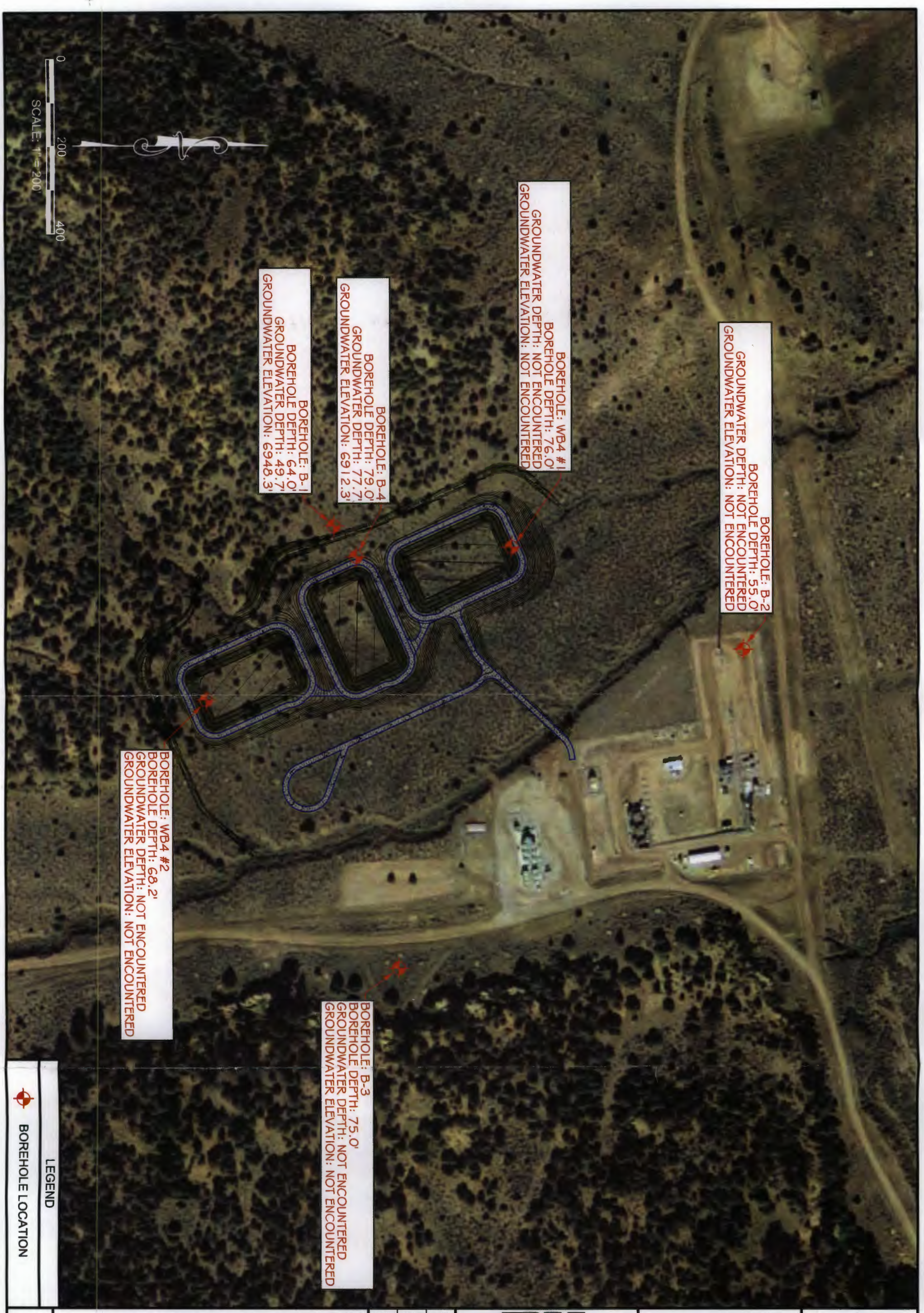

FIGURE 1

EAST BLANCO PRODUCED WATER REUSE FACILITY

HYDROGEOLOGIC INVESTIGATION BOREHOLE LOCATIONS

DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD

JOB # 2011-063

Black Hills Gas Resources
3200 N 1st Street
Bloomfield, NM 87413
(505) 634-5104

WWC ENGINEERING
1275 MAPLE STREET, SUITE F
HELENA, MT 59601
(406) 443-3962

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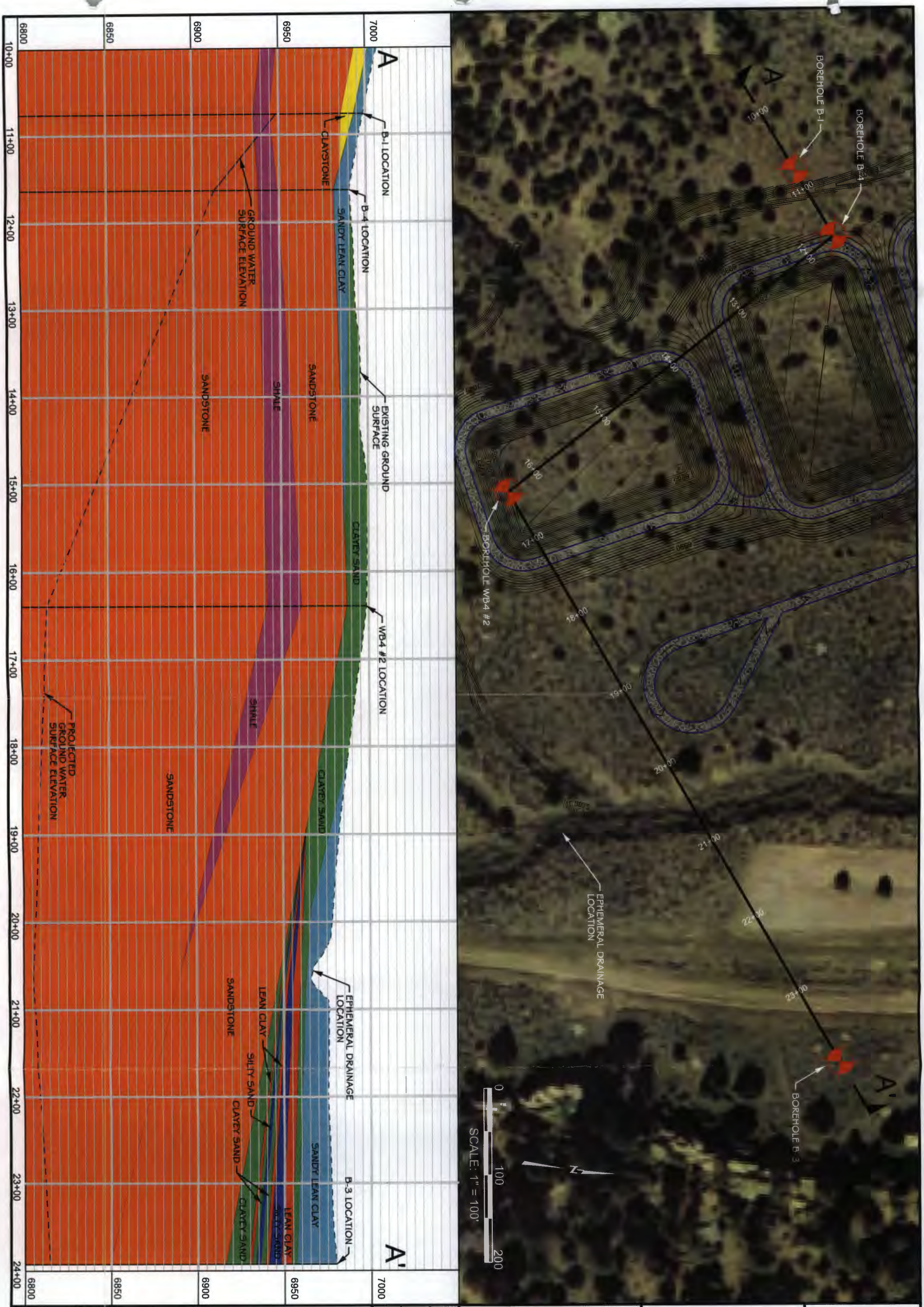

EAST BLANCO PRODUCED WATER REUSE FACILITY

HYDROGEOLOGIC INVESTIGATION
GEOLOGIC CROSS SECTION 1

FIGURE 2

DSGN	DATE	CKD
MRS	6/12	STH

REV	DATE	CKD

JOB # 2011-063

Black Hills Gas Resources
3200 N 1st Street
Bloomfield, NM 87413
(505) 634-5104

WWC ENGINEERING
1275 MAPLE STREET, SUITE F
HELENA, MT 59601
(406) 443-3962

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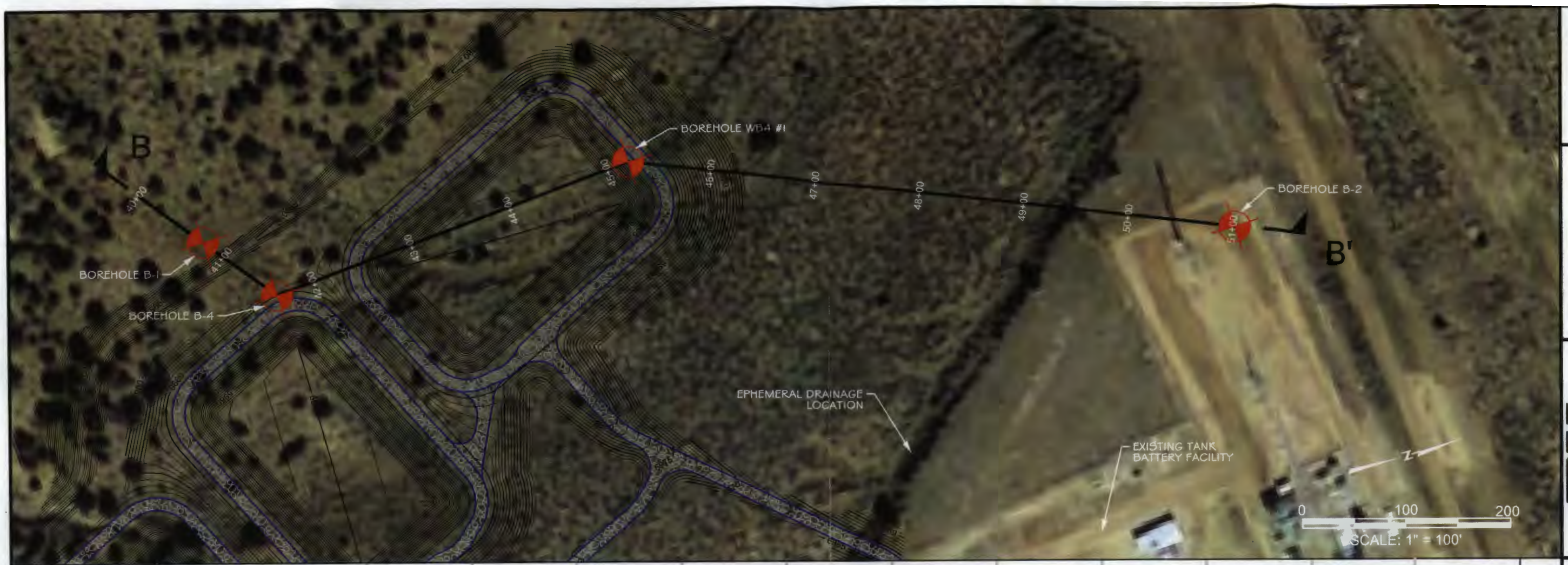

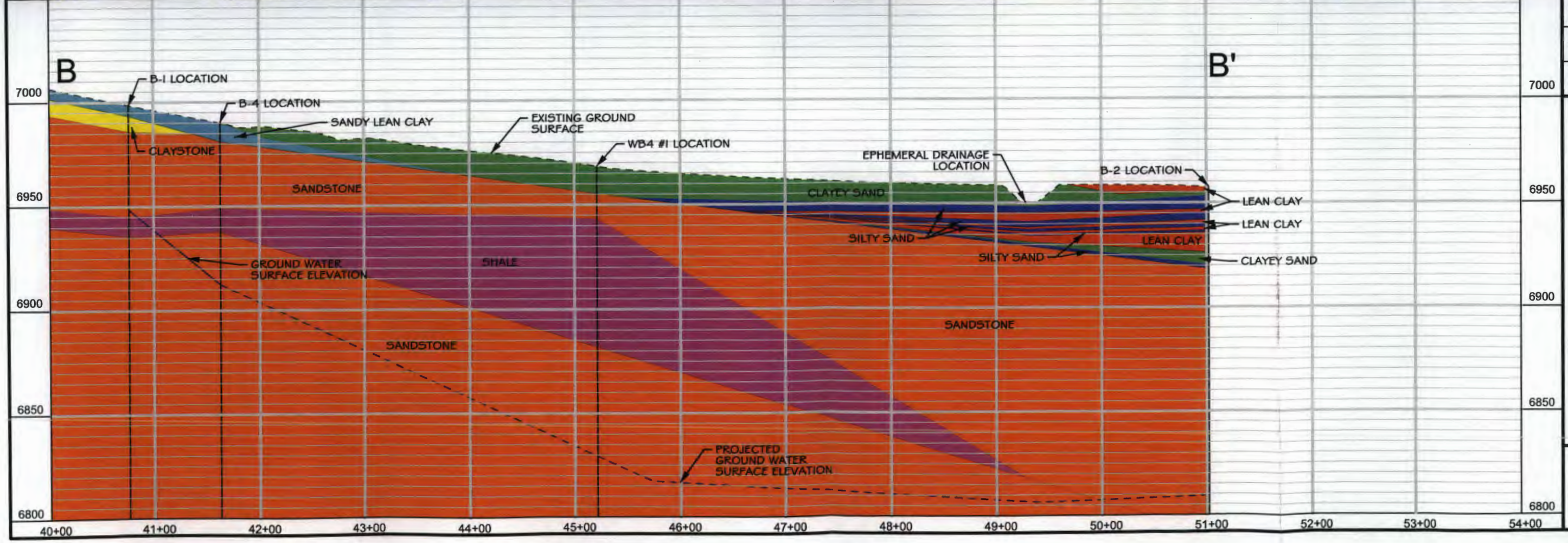

WWC ENGINEERING
1275 MAPLE STREET, SUITE F
HELENA, MT 59601
(406) 443-3962

Black Hills Gas Resources
3200 N 1st Street
Bloomfield, NM 87413
(505) 634-5104

PEN TABLE PATH: K:\BLACK HILLS\11063 - E. BLANCO FIELDPOP\EAST BLANCO PERMITS PLAN PROFILE.tbl
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DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD

JOB # 2011-063

EAST BLANCO PRODUCED WATER REUSE FACILITY

HYDROGEOLOGIC INVESTIGATION
GEOLOGIC CROSS SECTION 2

FIGURE
3

LEGEND

BOREHOLE LOCATION

FIGURE 4

EAST BLANCO PRODUCED WATER REUSE FACILITY

HYDROGEOLOGIC INVESTIGATION
SHALLOW AQUIFER POTENTIOMETRIC SURFACE MAP

DSGN	DATE	CKD
MRS	6/12	STH

REV	DATE	CKD

JOB # 2011-063

Black Hills Gas Resources
3200 N 1st Street
Bloomfield, NM 87413
(505) 634-5104

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6/19/2012 FILE PATH: K:\BLACK HILLS\11063 - E. BLANCO FIELD\DGN\East Blanco Field - Hydrogeologic Exhibits.dgn

Attachment 1

Hydrogeologic Investigation Results

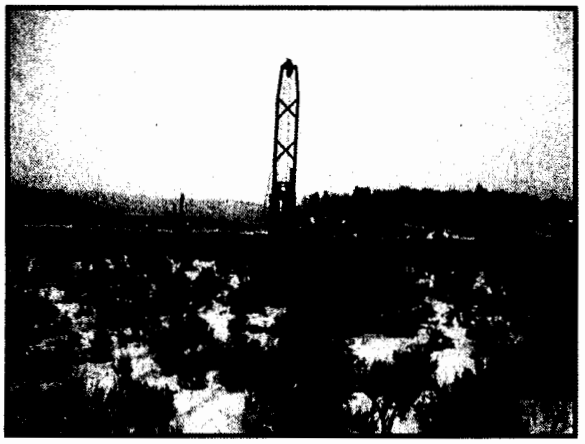
GEOMAT INC
915 Malta Avenue ◆ Farmington, NM 87401 ◆ Tel (505) 327-7928 ◆ Fax (505) 326-5721

January 3, 2012

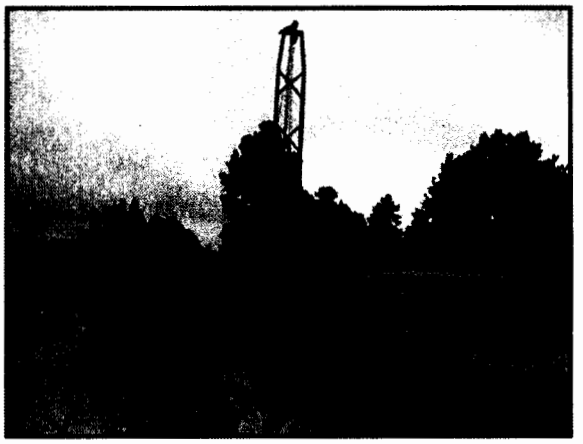
Daniel Manus
Black Hills Gas Resources
3200 North 1st Street
P.O. Box 249
Bloomfield, NM 87413

RE: East Blanco Field
Proposed Evaporation Pond Locations
Well-bore #4 Locations
GEOMAT Project No. 112-1366

As requested, GEOMAT has completed the sub-surface exploration and soil classification services for the above referenced project at the two locations identified by Black Hills Gas Resources. Present at the site during the exploration was our sub-contracted drill crew from Enviro-Drill Inc., George Madrid P.E. of GEOMAT, and yourself. The sites were drilled on December 22, 2011. The purpose of the exploratory work was to determine the soil profile and depth to groundwater at the drilled locations. The following photographs depict the site at the time of our exploration.



View of WB4 #1 Looking East



View of WB4 #2 Looking South

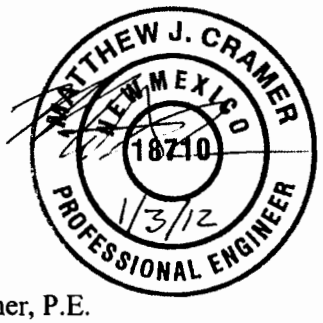
For your use, we have attached the site plans and boring logs. Groundwater was not encountered during the sub-surface exploration. The table below is a summary of our findings.

Location	Boring Number	Depth to Groundwater During Drilling (feet)	Total Boring Depth (feet)
Wellbore #4	#1	None Encountered	76.0
	#2	None Encountered	68.2

It should be noted that groundwater elevations can fluctuate over time depending upon precipitation, irrigation, runoff and infiltration of surface water. We do not have any information regarding the historical fluctuation of the groundwater level in this vicinity.

Thank you for the opportunity to work with you on this project. If you have any questions or need additional information, please let us know.

Sincerely yours,
GEOMAT Inc.



Matthew J. Cramer, P.E.
Civil/Structural Engineer

Attachments

Copies to: Addressee (1)

Approximate Not to Scale	OVERALL SITE PLAN Boring Locations (approximate) GEOMAT Project No. 112-1366 Date of Exploration: 12-22-11	PROJECT Black Hills East Blanco Field Rio Arriba County, New Mexico

GEOMAT INC

Approximate

Not to Scale

ENLARGED SITE PLAN

Boring Locations (approximate)

GEOMAT Project No. 112-1366
Date of Exploration: 12-22-11

PROJECT

Black Hills East Blanco Field
Rio Arriba County, New Mexico

GEOMAT INC

GEOMAT INC
915 Malta Avenue
Farmington, NM 87401
Tel (505) 327-7928
Fax (505) 326-5721

Boring WB4 #1

Project Name:	East Blanco Field	Date Drilled:	12/22/2011
Project Number:	112-1366	Latitude:	36° 48' 56.24" N
Client:	Black Hills Gas Resources	Longitude:	107° 12' 25.98" W
Site Location:	Rio Arriba County, New Mexico	Elevation:	Not Determined
Rig Type:	CME - 75	Boring Location:	See Site Plan
Drilling Method:	7" O.D. Hollow Stem Auger	Groundwater Depth:	None Encountered
Sampling Method:	Hand and Split spoon samples	Logged By:	GM
Hammer Weight:	140 lbs	Remarks:	8" - 12" of snow on ground
Hammer Fall:	30 inches		

Laboratory Results				Blows per 6"	Sample Type & Length (in)	Recovery	USCS	Soil Symbol	Depth (ft)	Soil Description
Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)							
							SC		1–13	CLAYEY SAND, dark brown, fine-grained, loose, damp
							RK		14–25	SANDSTONE, light brown, fine- to medium-grained, damp, highly weathered dark brown coarse-grained
							RK		26–40	SHALE, dark gray, damp

A = Auger Cuttings GRAB = Hand Sample MC = Modified California (Ring Sample) SS = Split Spoon MD = Nuclear Moisture-Density Gauge

GEOMAT INC
915 Malta Avenue
Farmington, NM 87401
Tel (505) 327-7928
Fax (505) 326-5721

Boring WB4 #1

Project Name: East Blanco Field
Project Number: 112-1366
Client: Black Hills Gas Resources
Site Location: Rio Arriba County, New Mexico
Rig Type: CME - 75
Drilling Method: 7" O.D. Hollow Stem Auger
Sampling Method: Hand and Split spoon samples
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 12/22/2011
Latitude: 36° 48' 56.24" N
Longitude: 107° 12' 25.98" W
Elevation: Not Determined
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: GM
Remarks: 8" - 12" of snow on ground

Laboratory Results: Dry Density (pcf)	Laboratory Results: % Passing #200 Sieve	Laboratory Results: Plasticity Index	Laboratory Results: Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Recovery	USCS	Soil Symbol	Depth (ft)	Soil Description
									41	SHALE, dark gray, damp
									42	
									43	
									44	
									45	interbedded with dark brown, fine- to medium-grained
									46	sandstone 44' - 46'
									47	hard drilling
									48	light gray
									49	
									50	
									51	
									52	
									53	interbedded with brown to gray, coarse-grained sandstone 52'
									54	- 55'
									55	
									56	
									57	
							RK		58	hard drilling 57' - 58'
									59	
									60	
									61	gray
									62	
									63	
									64	
									65	
									66	
									67	
									68	
									69	
									70	
									71	dark brown
									72	
									73	
									74	
					SS 12				75	
									76	
									77	Total Depth 76 feet
									78	
									79	
									80	

A = Auger Cuttings GRAB = Hand Sample MC = Modified California (Ring Sample) SS = Split Spoon MD = Nuclear Moisture-Density Gauge

GEOMAT INC.
915 Malta Avenue
Farmington, NM 87401
Tel (505) 327-7928
Fax (505) 326-5721

Boring WB4 #2

Project Name:	East Blanco Field	Date Drilled:	12/22/2011
Project Number:	112-1366	Latitude:	36° 48' 49.26" N
Client:	Black Hills Gas Resources	Longitude:	107° 12' 21.75" W
Site Location:	Rio Arriba County, New Mexico	Elevation:	Not Determined
Rig Type:	CME - 75	Boring Location:	See Site Plan
Drilling Method:	7" O.D. Hollow Stem Auger	Groundwater Depth:	None Encountered
Sampling Method:	Hand and Split spoon samples	Logged By:	GM
Hammer Weight:	140 lbs	Remarks:	8" - 12" of snow on ground
Hammer Fall:	30 inches		

Laboratory Results				Blows per 6"	Sample Type & Length (in)	Recovery	USCS	Soil Symbol	Depth (ft)	Soil Description
Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)							
	39				GRAB		SC		1 2 3 4 5 6 7 8 9 10 11	CLAYEY SAND, dark brown, fine-grained, loose, damp
							RK		12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37	SANDSTONE, light brown, fine- to medium-grained, damp, highly weathered hard drilling 11' - 13' dark brown easier drilling light brown coarse-grained
							RK		38 39 40	SHALE, gray, damp

A = Auger Cuttings GRAB = Hand Sample MC = Modified California (Ring Sample) SS = Split Spoon MD = Nuclear Moisture-Density Gauge

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Boring WB4 #2

Project Name:	East Blanco Field	Date Drilled:	12/22/2011
Project Number:	112-1366	Latitude:	36° 48' 49.26" N
Client:	Black Hills Gas Resources	Longitude:	107° 12' 21.75" W
Site Location:	Rio Arriba County, New Mexico	Elevation:	Not Determined
Rig Type:	CME - 75	Boring Location:	See Site Plan
Drilling Method:	7" O.D. Hollow Stem Auger	Groundwater Depth:	None Encountered
Sampling Method:	Hand and Split spoon samples	Logged By:	GM
Hammer Weight:	140 lbs	Remarks:	8" - 12" of snow on ground
Hammer Fall:	30 inches		

Laboratory Results: Dry Density (pcf)	Laboratory Results: % Passing #200 Sieve	Laboratory Results: Plasticity Index	Laboratory Results: Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Recovery	USCS	Soil Symbol	Depth (ft)	Soil Description
									41	SHALE, gray, damp
									42	hard drilling 40' - 41.5'
									43	
									44	interbedded with light brown, medium-grained sandstone
									45	
									46	hard drilling 45' - 46'
									47	
									48	
							RK		49	
									50	
									51	
									52	
									53	
									54	
									55	
									56	
									57	
									58	SANDSTONE, light brown, medium- to coarse-grained, damp
									59	
									60	hard drilling
									61	
									62	
							RK		63	interbedded with shale
									64	
									65	
									66	gray, fine-grained
									67	hard drilling
									68	
					SS 2				69	Auger refusal on sandstone at 68.2 feet
									70	Total Depth 68.2 feet
									71	
									72	
									73	
									74	
									75	
									76	
									77	
									78	
									79	
									80	

A = Auger Cuttings GRAB = Hand Sample MC = Modified California (Ring Sample) SS = Split Spoon MD = Nuclear Moisture-Density Gauge

BORING TABLE

BORING	LATITUDE	LONGITUDE	ELEVATION (FEET)
B-1	36.81450	-107.20739	6997
B-2	36.81708	-107.20641	6957
B-3	36.81489	-107.20395	6980
B-4	36.81464	-107.20715	6990

* LATITUDE AND LONGITUDE TAKEN FROM GOOGLE EARTH. ELEVATIONS TAKEN FROM CLIENT PROVIDED TOPO MAPS

Approximate

Not to Scale

SITE PLAN

Boring Locations (approximate)

GEOMAT Project No. 122-1468
Date of Exploration: 02-15-12 through 03-26-12

PROJECT

Black Hills East Blanco Field
Water Reuse Facility
Rio Arriba County, New Mexico

GEOMAT INC

PRELIMINARY

GEOMAT INC.
915 Malta Avenue
Farmington, NM 87401
Tel (505) 327-7928
Fax (505) 326-5721

Borehole B-1

Project Name: East Blanco Field
Project Number: 122-1468
Client: Black Hills Gas Resources
Site Location: Rio Arriba County, New Mexico
Rig Type: CME - 75
Drilling Method: Hollow-Stem Auger & NX Core
Sampling Method: 5 ft continuous barrel & NX rock core
Hammer Weight: N/A
Hammer Fall: N/A

Date Drilled: 2/21/2012
Latitude: 36.81450° (from GoogleEarth)
Longitude: -107.20739° (from GoogleEarth)
Elevation: 6997 (from client-provided topo)
Boring Location: See Site Plan
Groundwater Depth: Approx. 49.7 ft
Logged By: DB
Remarks: None

PRELIMINARY

Laboratory Results: Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Recovery	USCS	Soil Symbol	Depth (ft)	Soil Description
					CS 60		CL		1–5	SANDY LEAN CLAY, dark brown, very stiff to hard, damp
					CS 60		RK		6–10	CLAYSTONE, brown, hard, massive, damp tan, fissile
					CS 60				11–20	SANDSTONE, tan, fine-grained, highly weathered
					CS 60				21–25	green-gray medium-grained, slightly weathered
					CS 60		RK		26–29	hard drilling light gray
					CS 48				30–31	green-gray, fresh
					NX 36				32–35	Practical auger refusal at 34 feet Begin NX rock coring
					NX 60				36–40	34' to 37' --> NX core recovery = 89%, RQD = 72% good air return - dusty air return dusty
					NX 60				41–45	37' to 42' --> NX core recovery = 97%, RQD = 40%

A = Auger Cuttings CS = 5' Continuous Barrel MC = Modified California (Ring Sample) SS = Split Spoon NX = 2" Rock Core G = Grab Sample

GEOMAT INC
915 Malta Avenue
Farmington, NM 87401
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Borehole B-1

Project Name: East Blanco Field
Project Number: 122-1468
Client: Black Hills Gas Resources
Site Location: Rio Arriba County, New Mexico
Rig Type: CME - 75
Drilling Method: Hollow-Stem Auger & NX Core
Sampling Method: 5 ft continuous barrel & NX rock core
Hammer Weight: N/A
Hammer Fall: N/A

Date Drilled: 2/21/2012
Latitude: 36.81450° (from GoogleEarth)
Longitude: -107.20739° (from GoogleEarth)
Elevation: 6997 (from client-provided topo)
Boring Location: See Site Plan
Groundwater Depth: Approx. 49.7 ft
Logged By: DB
Remarks: None

PRELIMINARY

Laboratory Results: Dry Density (pcf)	Laboratory Results: % Passing #200 Sieve	Laboratory Results: Plasticity Index	Laboratory Results: Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Recovery	USCS	Soil Symbol	Depth (ft)	Soil Description
					NX 60		RK		46	42' to 47' --> NX core recovery = 100%, RQD = 95%
									47	SANDSTONE, tan, fine-grained, highly weathered
									48	air return dusty
									49	
									50	▽
									51	47' to 52' --> NX core recovery = 100%, RQD = 100%
									52	Water in return during drilling at approx. 50 feet
									53	lost return at 52 feet
									54	unable to sample below 52 feet due to core barrel clogging
									55	with wet shale
									56	
									57	advanced boring to 64 feet with auger
							RK		58	SHALE, dark gray, fresh, fissile
									59	
									60	
									61	
									62	
									63	
							RK		64	SANDSTONE, tan, fresh, hard drilling
									65	
									66	
									67	Installed 2-inch diameter monitor well
									68	
									69	0.010" slotted screen 44' - 64'
									70	10-20 sand pack 60' - 64'
									71	hydrated bentonite chips 60' to surface
									72	Above-ground monument
									73	Casing stick-up above ground surface approx. 30 inches
									74	Total Depth 64 feet
									75	
									76	
									77	
									78	
									79	
									80	
									81	
									82	
									83	
									84	
									85	
									86	
									87	
									88	
									89	
									90	

A = Auger Cuttings CS = 5' Continuous Barrel MC = Modified California (Ring Sample) SS = Split Spoon NX = 2" Rock Core G = Grab Sample

GEOMAT INC
915 Malta Avenue
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Borehole B-2

Project Name: East Blanco Field
Project Number: 122-1468
Client: Black Hills Gas Resources
Site Location: Rio Arriba County, New Mexico
Rig Type: CME - 75
Drilling Method: 7.25" O.D. Hollow Stem Auger
Sampling Method: 5 ft continuous barrel
Hammer Weight: N/A
Hammer Fall: N/A

Date Drilled: 2/15/2012
Latitude: 36.81708° (from GoogleEarth)
Longitude: -107.20641° (from GoogleEarth)
Elevation: 6957 (from client-provided topo)
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: DB
Remarks: None

PRELIMINARY

Laboratory Results: Dry Density (pcf)	Laboratory Results: % Passing #200 Sieve	Laboratory Results: Plasticity Index	Laboratory Results: Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Recovery	USCS	Soil Symbol	Depth (ft)	Soil Description
					CS 60		CL		1	LEAN CLAY, brown, moist
							SC		3	CLAYEY SAND, brown, fine-grained, damp to moist
					CS 60		SM		5	SILTY SAND, brown, fine-grained, damp fine- to coarse-grained
					CS 60		CL		11	LEAN CLAY, brown, damp
							SM		13	SILTY SAND, brown, fine- to medium-grained, damp
					CS 60		CL		16	LEAN CLAY, brown, damp, interlayered with silty sand
							SM		18	SILTY SAND, brown, fine-grained, damp
					CS 60		CL		20	LEAN CLAY, brown, damp
							SM		21	SILTY SAND, brown, fine-grained, damp
					CS 60		CL		23	LEAN CLAY, dark brown, damp sandy lean clay massive, very stiff to hard, damp
					CS 60		SC		32	CLAYEY SAND, brown, fine-grained, damp contains black organic specks/nodules occasional thin layers/lenses of silty sand
							SM		38	SILTY SAND, brown, fine- to medium-grained, damp
					CS 60		RK		40	SANDSTONE, tan, fine- to coarse-grained, highly weathered, slightly damp

A = Auger Cuttings CS = 5' Continuous Barrel MC = Modified California (Ring Sample) SS = Split Spoon NX = 2" Rock Core G = Grab Sample

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Borehole B-2

Project Name: East Blanco Field
Project Number: 122-1468
Client: Black Hills Gas Resources
Site Location: Rio Arriba County, New Mexico
Rig Type: CME - 75
Drilling Method: 7.25" O.D. Hollow Stem Auger
Sampling Method: 5 ft continuous barrel
Hammer Weight: N/A
Hammer Fall: N/A

Date Drilled: 2/15/2012
Latitude: 36.81708° (from GoogleEarth)
Longitude: -107.20641° (from GoogleEarth)
Elevation: 6957 (from client-provided topo)
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: DB
Remarks: None

PRELIMINARY

Laboratory Results: Dry Density (pcf)	Laboratory Results: % Passing #200 Sieve	Laboratory Results: Plasticity Index	Laboratory Results: Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Recovery	USCS	Soil Symbol	Depth (ft)	Soil Description
					CS 60		RK		46 47 48 49 50 51 52 53 54 55	SANDSTONE, tan, fine- to coarse-grained, highly weathered, slightly damp tan to brown, slightly damp
									56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90	Total Depth 55 feet

A = Auger Cuttings CS = 5' Continuous Barrel MC = Modified California (Ring Sample) SS = Split Spoon NX = 2" Rock Core G = Grab Sample

GEOMAT INC
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Borehole B-3

Project Name: East Blanco Field
Project Number: 122-1468
Client: Black Hills Gas Resources
Site Location: Rio Arriba County, New Mexico
Rig Type: CME - 75
Drilling Method: 7.25" O.D. Hollow Stem Auger
Sampling Method: 5 ft continuous barrel & SPT
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 2/16/2012
Latitude: 36.81489° (from GoogleEarth)
Longitude: -107.20395° (from GoogleEarth)
Elevation: 6980 (from client-provided topo)
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: DB
Remarks: None

PRELIMINARY

Laboratory Results: Dry Density (pcf)	Laboratory Results: % Passing #200 Sieve	Laboratory Results: Plasticity Index	Laboratory Results: Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Recovery	USCS	Soil Symbol	Depth (ft)	Soil Description
					CS 60				1	SANDY LEAN CLAY, brown, damp
									2	
									3	
									4	
					CS 60				5	moisture content below plastic limit
									6	
									7	
									8	
									9	
					CS 60				10	
									11	
							CL		12	
									13	varies between sandy clay and clayey sand
									14	
					CS 60				15	
									16	
									17	
									18	
									19	contains black organic specks/nodules and thin layers/lenses
					CS 60				20	of silty sand
									21	
									22	
									23	
									24	CLAYEY SAND, brown, fine-grained, damp
							SC		25	
					CS 60				26	
									27	LEAN CLAY, brown to gray, very stiff, damp
									28	
									29	
							CL		30	
									31	
									32	
									33	SILTY SAND, brown to gray, fine-grained, damp
									34	
									35	
					CS 60		SM		36	contains thin layers/lenses of sandy clay
									37	
									38	
									39	
									40	LEAN CLAY, brown, very stiff, damp
					CS 60		CL		41	
									42	CLAYEY SAND, brown, fine-grained, damp
							SC		43	
									44	
							SM		45	

A = Auger Cuttings CS = 5' Continuous Barrel MC = Modified California (Ring Sample) SS = Split Spoon NX = 2" Rock Core G = Grab Sample

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Borehole B-3

Project Name: East Blanco Field
Project Number: 122-1468
Client: Black Hills Gas Resources
Site Location: Rio Arriba County, New Mexico
Rig Type: CME - 75
Drilling Method: 7.25" O.D. Hollow Stem Auger
Sampling Method: 5 ft continuous barrel & SPT
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 2/16/2012
Latitude: 36.81489° (from GoogleEarth)
Longitude: -107.20395° (from GoogleEarth)
Elevation: 6980 (from client-provided topo)
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: DB
Remarks: None

PRELIMINARY

Laboratory Results: Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Recovery	USCS	Soil Symbol	Depth (ft)	Soil Description
					CS 60		SC		46	SILTY SAND, brown, fine- to medium-grained, damp
									47	CLAYEY SAND, yellow-brown, fine-grained, damp
									48	
									49	
					CS 60		CL		50	LEAN CLAY, brown, very stiff, damp
									51	
									52	CLAYEY SAND, yellow-brown, fine- to medium-grained, damp
									53	
									54	orange-brown
					CS 60				55	
									56	yellow-brown to gray
							SC		57	
									58	contains occasional black organic specks/nodules
									59	
					CS 60				60	
									61	
									62	
									63	gray to brown, damp
									64	
									65	SANDSTONE, tan, fine- to medium-grained, highly weathered, slightly damp
									66	
									67	
									68	
									69	
							RK		70	
									71	
									72	
									73	
									74	fresh
									75	
				50/0"	SS 0				76	Total Depth 75 feet
									77	
									78	
									79	
									80	
									81	
									82	
									83	
									84	
									85	
									86	
									87	
									88	
									89	
									90	

A = Auger Cuttings CS = 5' Continuous Barrel MC = Modified California (Ring Sample) SS = Split Spoon NX = 2" Rock Core G = Grab Sample

GEOMAT INC
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Borehole B-4

Project Name:	East Blanco Field	Date Drilled:	3/26/2012
Project Number:	122-1468	Latitude:	36.81464° (from GoogleEarth)
Client:	Black Hills Gas Resources	Longitude:	-107.20715° (from GoogleEarth)
Site Location:	Rio Arriba County, New Mexico	Elevation:	6990 (from client-provided topo)
Rig Type:	CME - 75	Boring Location:	See Site Plan
Drilling Method:	Hollow-Stem Auger & NX Core	Groundwater Depth:	Approx. 77.7 ft
Sampling Method:	5 ft continuous barrel & NX rock core	Logged By:	DB
Hammer Weight:	N/A	Remarks:	None
Hammer Fall:	N/A		

PRELIMINARY

Laboratory Results: Dry Density (pcf)	Laboratory Results: % Passing #200 Sieve	Laboratory Results: Plasticity Index	Laboratory Results: Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Recovery	USCS	Soil Symbol	Depth (ft)	Soil Description
					CS 60				1	SANDY LEAN CLAY, dark brown, moist
									2	
									3	
									4	
					CS 60		CL		5	
									6	
									7	
									8	damp
									9	
					CS 60				10	SANDSTONE, tan, fine- to medium-grained, moderately weathered, damp
									11	
									12	
									13	
									14	hard drilling - squealing
					CS 60				15	
									16	
									17	
									18	
									19	
					NX 60				20	
									21	Auger refusal at 20 feet - begin NX rock coring
									22	
									23	green-gray, medium- to coarse-grained
									24	
					NX 60		RK		25	20' to 25' --> NX core recovery = 100%, RQD = 82%
									26	
									27	
									28	25' to 30' --> NX core recovery = 97%, RQD = 88%
									29	
					NX 60				30	medium-grained, occasional joints approx. 60°
									31	
									32	
									33	30' to 35' --> NX core recovery = 100%, RQD = 8%
									34	
					NX 48				35	near-horizontal joints spaced 1" to 3"
									36	
									37	
									38	35' to 39' --> NX core recovery = 100%, RQD = 0%
					NX 60				39	medium- to coarse-grained
									40	
									41	
									42	SHALE, dark gray, fresh, damp, near-horizontal joints spaced 1' to 3"
							RK		43	
					NX				44	39' to 44' --> NX core recovery = 100%, RQD = 0%
									45	

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Farmington, NM 87401
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Fax (505) 326-5721

Borehole B-4

Project Name: East Blanco Field
Project Number: 122-1468
Client: Black Hills Gas Resources
Site Location: Rio Arriba County, New Mexico
Rig Type: CME - 75
Drilling Method: Hollow-Stem Auger & NX Core
Sampling Method: 5 ft continuous barrel & NX rock core
Hammer Weight: N/A
Hammer Fall: N/A

Date Drilled: 3/26/2012
Latitude: 36.81464° (from GoogleEarth)
Longitude: -107.20715° (from GoogleEarth)
Elevation: 6990 (from client-provided topo)
Boring Location: See Site Plan
Groundwater Depth: Approx. 77.7 ft
Logged By: DB
Remarks: None

PRELIMINARY

Laboratory Results: Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Recovery	USCS	Soil Symbol	Depth (ft)	Soil Description
					60				46	SHALE, dark gray, fresh, damp, near-horizontal joints spaced 1' to 3"
					NX 60		RK		49	44' to 49' --> NX core recovery = 100%, RQD = 28%
									52	49' to 54' --> NX core recovery = 100%, RQD = 0%
					NX 60				53	SANDSTONE, tan, medium-grained, fresh, slightly damp
									58	54' to 59' --> NX core recovery = 70%, RQD = 0%
					NX 60				60	
					NX 60		RK		64	tan, fine- to medium-grained, near-horizontal joints spaced 1" to 3"
									65	59' to 64' --> NX core recovery = 50%, RQD = 0%
									66	medium- to coarse-grained
									68	64' to 69' --> NX core recovery = 48%, RQD = 0%
					NX 60				70	
									73	69' to 74' --> NX core recovery = 62%, RQD = 0%
					NX 60				74	near-horizontal joints spaced 3/4" to 2"
									75	fine- to coarse-grained
									77	74' to 79' --> NX core recovery = 60%, RQD = 0%
									78	▽
									79	green-gray, core wet
									80	Total Depth 79 feet
									90	

A = Auger Cuttings CS = 5' Continuous Barrel MC = Modified California (Ring Sample) SS = Split Spoon NX = 2" Rock Core G = Grab Sample

Attachment 2

Ground Water Quality Analysis Results

Inter-Mountain Laboratories, Inc
555 Absaraka Street, Sheridan, Wyoming 82801
(307) 674-7506

Date: 3/28/2012

CLIENT: Black Hills Gas Resources
Project: East Blanco Monitor Wells
Lab Order: O1203002

CASE NARRATIVE

Report ID: O1203002001

This data package consists of the following:
Case Narrative - 1 page
Sample Analysis Reports - 2 pages
Quality Control Reports - 4 pages
Condition Upon Receipt form - 1 page
Copy of the Chain of Custody Record - 1 page

Samples were analyzed for organic constituents using the methods outlined in the following references:

- Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition, United States Environmental Protection Agency (USEPA).

All method blanks, duplicates, laboratory spikes, and/or matrix spikes met quality assurance objectives.

Data qualifiers are defined at the bottom of each page.

Inter-Mountain Laboratories, Inc
555 Absaraka Street, Sheridan, Wyoming 82801
(307) 674-7506

Sample Analysis Report

CLIENT: Black Hills Gas Resources
3200 North 1st Street
PO Box 249
Bloomfield, NM 87413

Date Reported: 3/28/2012
Report ID: O1203002001

Project: East Blanco Monitor Wells
Lab ID: O1203002-001
Client Sample ID: East Blanco
Matrix: Water

Work Order: O1203002
Collection Date: 2/27/2012 1:25:00 PM
Date Received: 2/29/2012 1:25:00 PM
COC: 143913

Analyses	Result	RL	Limits	Qual	Units	Date Analyzed/Init	
8260B MBTEXN-Water						**Prep Date: 3/12/2012**	
Benzene	ND	1.0			µg/L	03/12/2012	SK
Toluene	ND	1.0			µg/L	03/12/2012	SK
Ethylbenzene	ND	1.0			µg/L	03/12/2012	SK
m,p-Xylenes	ND	2.0			µg/L	03/12/2012	SK
o-Xylene	ND	1.0			µg/L	03/12/2012	SK
Xylenes, Total	ND	3.0			µg/L	03/12/2012	SK
GRO by 8260 (nC6-nC10)	ND	20			µg/L	03/12/2012	SK
Surr: 4-Bromofluorobenzene	87.9		81-115		%REC	03/12/2012	SK
8015C Diesel Range Organics-Water						**Prep Date: 3/8/2012**	
Diesel Range Organics (nC10-nC32)	2.1	0.50			mg/L	03/12/2012	MAB
Surr: o-Terphenyl	42.7		41-119		%REC	03/12/2012	MAB

These results apply only to the samples tested.

RL - Reporting Limit

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Diluted out of recovery limit	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	M	Matrix Effect
ND	Not Detected at the Reporting Limit	S	Spike Recovery outside accepted recovery limits

Reviewed by: Connie Mattson

Connie Mattson, Project Manager

Inter-Mountain Laboratories, Inc
555 Absaraka Street, Sheridan, Wyoming 82801
(307) 674-7506

Sample Analysis Report

CLIENT: Black Hills Gas Resources
3200 North 1st Street
PO Box 249
Bloomfield, NM 87413

Date Reported: 3/28/2012
Report ID: O1203002001

Project: East Blanco Monitor Wells
Lab ID: O1203002-002
Client Sample ID: TRIPBLANK
Matrix: Water

Work Order: O1203002
Collection Date:
Date Received: 2/29/2012 1:25:00 PM
COC: 142117

Analyses	Result	RL	Limits	Qual	Units	Date Analyzed/Init	
8260B MBTEXN-Water						**Prep Date: 3/12/2012**	
Naphthalene	ND	5.0			µg/L	03/13/2012	SK
Surr: 4-Bromofluorobenzene	82.3		81-115		%REC	03/13/2012	SK

These results apply only to the samples tested. **RL - Reporting Limit**

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Diluted out of recovery limit	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	M	Matrix Effect
ND	Not Detected at the Reporting Limit	S	Spike Recovery outside accepted recovery limits

Reviewed by: Connie Mattson

Connie Mattson, Project Manager

Inter-Mountain Laboratories, Inc
555 Absaraka Street, Sheridan, Wyoming 82801
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ANALYTICAL QC SUMMARY REPORT

Date: 3/28/2012

CLIENT: Black Hills Gas Resources
Work Order: O1203002
Project: East Blanco Monitor Wells

Report ID: O1203002001Q
TestCode: **8015C_DROW**

Sample ID: **MB-4919** SampType: **MBLK** TestCode: **8015C_DRO** Units: **mg/L** Prep Date: **3/8/2012** RunNo: **6397**
Client ID: **ZZZZZ** Batch ID: **4919** Analysis Date: **3/12/2012** SeqNo: **93844**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel Range Organics (nC10-nC32)	ND	0.50									
Surr: o-Terphenyl					32.3	41	119				S

Sample ID: **LCS-4919** SampType: **LCS** TestCode: **8015C_DRO** Units: **mg/L** Prep Date: **3/8/2012** RunNo: **6397**
Client ID: **ZZZZZ** Batch ID: **4919** Analysis Date: **3/12/2012** SeqNo: **93845**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel Range Organics (nC10-nC32)	0.8325	0.50	4		20.8	49	96				S
Surr: o-Terphenyl					25.8	41	119				S

Sample ID: **LCSD-4919** SampType: **LCSD** TestCode: **8015C_DRO** Units: **mg/L** Prep Date: **3/8/2012** RunNo: **6397**
Client ID: **ZZZZZ** Batch ID: **4919** Analysis Date: **3/12/2012** SeqNo: **93846**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel Range Organics (nC10-nC32)	1.157	0.50	4	0	28.9	49	96	0.8325	32.6	20	SR
Surr: o-Terphenyl				0	35.7	41	119	0	0	20	S

Qualifiers:

D	Diluted out of recovery limit	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	M	Matrix Effect	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	S	Spike Recovery outside accepted recovery limits		

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ANALYTICAL QC SUMMARY REPORT

Date: 3/28/2012

CLIENT: Black Hills Gas Resources
Work Order: O1203002
Project: East Blanco Monitor Wells

Report ID: O1203002001Q
TestCode: **8015C_DROW**

Sample ID: **O1203004-003BDUP** SampType: **DUP** TestCode: **8015C_DRO** Units: **mg/L** Prep Date: **3/8/2012** RunNo: **6397**
Client ID: **ZZZZZ** Batch ID: **4919** Analysis Date: **3/12/2012** SeqNo: **93852**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel Range Organics (nC10-nC32)	ND	0.62	0	0	0	0	0	0	0	20	
Surr: o-Terphenyl				0	47.5	41	119	0	0	20	

Qualifiers:

D	Diluted out of recovery limit	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	M	Matrix Effect	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	S	Spike Recovery outside accepted recovery limits		

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ANALYTICAL QC SUMMARY REPORT

Date: 3/28/2012

CLIENT: Black Hills Gas Resources
Work Order: O1203002
Project: East Blanco Monitor Wells

Report ID: O1203002001Q
TestCode: **8260MBTEXN_W**

Sample ID: **MB-4921** SampType: **MBLK** TestCode: **8260MBTEXN** Units: **µg/L** Prep Date: **3/12/2012** RunNo: **6386**
Client ID: **ZZZZZ** Batch ID: **4921** Analysis Date: **3/13/2012** SeqNo: **93718**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	1.0									
Toluene	ND	1.0									
Ethylbenzene	ND	1.0									
m,p-Xylenes	ND	2.0									
o-Xylene	ND	1.0									
Xylenes, Total	ND	3.0									
Naphthalene	ND	5.0									
GRO by 8260 (nC6-nC10)	ND	20									
Surr: 4-Bromofluorobenzene					92.9	81	115				

Sample ID: **LCS-4921** SampType: **LCS** TestCode: **8260MBTEXN** Units: **µg/L** Prep Date: **3/12/2012** RunNo: **6386**
Client ID: **ZZZZZ** Batch ID: **4921** Analysis Date: **3/12/2012** SeqNo: **93711**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	32.77	1.0	30		109	75	125				
Toluene	34.43	1.0	30		115	80	122				
Ethylbenzene	34.35	1.0	30		114	85	115				
m,p-Xylenes	68.16	2.0	60		114	83	116				
o-Xylene	34.82	1.0	30		116	84	115				S
Naphthalene	25.02	5.0	30		83.4	74	129				
GRO by 8260 (nC6-nC10)	434.8	20	390		111	79	119				
Surr: 4-Bromofluorobenzene					101	81	115				

Qualifiers:

D	Diluted out of recovery limit	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	M	Matrix Effect	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	S	Spike Recovery outside accepted recovery limits		

Inter-Mountain Laboratories, Inc
555 Absaraka Street, Sheridan, Wyoming 82801
(307) 674-7506

ANALYTICAL QC SUMMARY REPORT

Date: 3/28/2012

CLIENT: Black Hills Gas Resources
Work Order: O1203002
Project: East Blanco Monitor Wells

Report ID: O1203002001Q
TestCode: **8260MBTEXN_W**

Sample ID: **O1202028-006ADUP** SampType: **DUP** TestCode: **8260MBTEXN** Units: **µg/L** Prep Date: **3/12/2012** RunNo: **6386**
Client ID: **ZZZZZ** Batch ID: **4921** Analysis Date: **3/13/2012** SeqNo: **93716**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	13.15	2.5	0	0	0	0	0	13.22	0.569	20	
Toluene	2.700	2.5	0	0	0	0	0	2.55	5.71	20	
Ethylbenzene	278.2	2.5	0	0	0	0	0	277.6	0.225	20	
m,p-Xylenes	ND	5.0	0	0	0	0	0	0	0	20	
o-Xylene	3.150	2.5	0	0	0	0	0	2.85	10.0	20	
Xylenes, Total	ND	7.5	0	0	0	0	0	0	0	20	
Naphthalene	22.12	12	0	0	0	0	0	21.78	1.59	20	
GRO by 8260 (nC6-nC10)	855.1	50	0	0	0	0	0	863.9	1.03	20	
Surr: 4-Bromofluorobenzene				0	111	81	115	0	0	20	

Qualifiers:

D	Diluted out of recovery limit	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	M	Matrix Effect	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	S	Spike Recovery outside accepted recovery limits		

INTER-MOUNTAIN LABS

Condition Upon Receipt (Attach to COC)

Sample Receipt

1 Number of ice chests/packages received: 1

Note as "OTC" if samples are received over the counter, unpackaged

2 Temperature of cooler/samples. Temps (°C): 4.5

Acceptable is 0.1 to 6°C. Also acceptable is "Received on Ice" (ROI) for samples received on the same day as sampled or "Received at Room Temperature" (RRT) for samples received within one hour of sampling.

Client contact for temperature failures must be documented below.

3 Emission rate of samples for radiochemical analyses < 0.5mR/hr?	Yes	No	(N/A)
4 COC Number (If applicable): 14393			
5 Do the number of bottles agree with the COC?	(Yes)	No	N/A
6 Were the samples received intact? *(no broken bottles, leaks, etc.)*	(Yes)	No	N/A
7 Were the sample custody seals intact?	Yes	No	(N/A)
8 Is the COC properly completed, legible, and signed?	Yes	(No) – 1) Attached	

Sample Verification, Labeling & Distribution

1 Were all requested analyses understood and appropriate?	(Yes)	No		
2 Did the bottle labels correspond with the COC information?	Yes	(No) - 1)		
3 Samples collected in proper containers?	(Yes)	No		
4 Were all containers properly preserved?	(Yes)	No	N/A	Added at Lab

Client contact for preservation failures must be documented below.

For Total Metals samples preserved at Lab, record date and time of preservation: _____

pH of each WY STP (LAUST) sample must be checked and recorded. _____

pH Met ~1

* 5 VOA vials have <6mm headspace?	Yes	No	N/A
6 Were all analyses within holding time at the time of receipt?	(Yes)	No	
7 Have rush or project due dates been checked and accepted?	(Yes)	No	N/A

Attach Lab ID labels to the containers and deliver to appropriate lab section. *Set ID:* 51202394

Sample Receipt, Verification, Login, Labeling & Distribution completed by *(initials)*: KB

Discrepancy Documentation *(use back of sheet for notes on discrepancies)*

Any items listed above with a response of "No" or do not meet specifications must be resolved.

Person Contacted: _____ Telephone Number: _____

Initiated By: _____ Date/Time: _____

Problem: 1) under Sample ID on COC - Has bottle Type - Label color

Resolution: • Got Sample ID from Bottles

Person Contacted: _____ Telephone Number: _____

Initiated By: _____ Date/Time: _____

Problem:

Resolution:

Inter-Mountain Labs

Sheridan, WY and Gillette, WY

CHAIN OF CUSTODY RECORD

Page ____ of ____

All shaded fields must be completed.
This is a legal document: any misrepresentation may be construed as fraud.

143913

Client Name	Project Identification	Sampler (Signature/Attestation of Authenticity)	Telephone #
BLACKHILLS GAS RESOURCES	EAST BLANCO MONITOR WELLS		(505) 327-7928

Report Address	Contact Name	Email	Phone
3200 N. 1ST STREET BLOOMFIELD, NM 87413	DANIEL MANUS	DANIEL.MANUS@BLACKHILLSCORP.COM	(505) 486-0327

Invoice Address	Purchase Order #	Quote #
-SAME AS ABOVE		

ITEM	LAB ID (Lab Use Only)	DATE SAMPLED	TIME SAMPLED	SAMPLE IDENTIFICATION	Matrix	# of Containers	ANALYSES / PARAMETERS	REMARKS
1	512023941	2/27/12	12:30	WHITE LABEL - AMBER BOTTLE		1		ANALYSIS PER ATTACHED
2		2/27/12	12:50	WHITE LABEL - CLEAR BOTTLE		1		
3	002	2/27/12	1:02	ORANGE LABEL - CLEAR BOTTLE		1		
4		2/27/12	1:10	WHITE LABEL - AMBER BOTTLES		3		
5		2/27/12	1:25	" "		3		
6	002			Trip Blank				
7								
8								
9								
10								
11								
12								
13								
14								

LAB COMMENTS	Relinquished By (Signature/Printed)	DATE	TIME	Received By (Signature/Printed)	DATE	TIME
		2/28	11:00	Kathy Boyd	2-29-12	13:52
	Kathy Boyd	3/1/12	9:29			

SHIPPING INFO	MATRIX CODES		TURNAROUND TIMES	COMPLIANCE INFORMATION	ADDITIONAL REMARKS
☐ UPS	Water	WT	Check desired service	Compliance Monitoring? (Y) / N	-ADDITIONAL CONTACT
☒ Fed Express	Soil	SL	☒ Standard turnaround	Program (SDWA, NPDES,...) NMOCD	MATT CRAMER
☐ US Mail	Solid	SD	☐ RUSH - 5 Working Days	PWSID / Permit #	(505) 327-7928
☐ Hand Carried	Filter	FT	☐ URGENT - < 2 Working Days	Chlorinated? Y / N	
☐ Other _____	Other	OT	*Rush & Urgent Surcharges will be applied*	Sample Disposal: Lab / Client	

Inter-Mountain Labs
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Your Environmental Monitoring Partner

Sample Analysis Report

CLIENT: Black Hills Gas Resources
3200 North 1st Street; P.O. Box 249
Bloomfield, NM 87413

Date Reported: 3/7/2012
Report ID: S1202394001

Project: East Blanco Monitor Wells
Lab ID: S1202394-001
Client Sample ID: Black Hills E. Blanco Fields
COC: 143913

Work Order: S1202394
Collection Date: 2/27/2012 1:25:00 PM
Date Received: 2/29/2012 1:52:00 PM
Sampler:
Matrix: Water

Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
General Parameters						
pH	8.0	0.1		s.u.	03/05/2012 1723 MZ	SM 4500 H B
Electrical Conductivity	479	5		µmhos/cm	03/05/2012 1723 MZ	SM 2510B
Total Dissolved Solids (180)	290	10		mg/L	02/28/2012 1321 ARF	SM 2540
Alkalinity, Total (As CaCO3)	136	5		mg/L	03/05/2012 1723 MZ	SM 2320B
Anions						
Alkalinity, Bicarbonate as HCO3	165	5		mg/L	03/05/2012 1723 MZ	SM 2320B
Alkalinity, Carbonate as CO3	ND	5		mg/L	03/05/2012 1723 MZ	SM 2320B
Chloride	3	1		mg/L	03/01/2012 2002 AMB	EPA 300.0
Sulfate	72	1		mg/L	03/01/2012 2002 AMB	EPA 300.0
Cations						
Calcium	48	1		mg/L	03/01/2012 1817 DG	EPA 200.7
Magnesium	10	1		mg/L	03/01/2012 1817 DG	EPA 200.7
Potassium	5	1		mg/L	03/01/2012 1817 DG	EPA 200.7
Sodium	30	1		mg/L	03/01/2012 1817 DG	EPA 200.7
Total Metals						
Arsenic	0.01	0.01		mg/L	03/05/2012 1510 DG	6010C
Barium	0.834	0.005		mg/L	03/05/2012 1510 DG	6010C
Cadmium	0.001	0.001		mg/L	03/05/2012 1510 DG	6010C
Chromium	0.195	0.005		mg/L	03/05/2012 1510 DG	6010C
Lead	0.03	0.01		mg/L	03/05/2012 1510 DG	6010C
Mercury	ND	0.001		mg/L	03/06/2012 1301 BK	EPA 245.1
Selenium	ND	0.025		mg/L	03/05/2012 1510 DG	6010C
Silver	ND	0.005		mg/L	03/05/2012 1510 DG	6010C

These results apply only to the samples tested.

Qualifiers:

*	Value exceeds Maximum Contaminant Level
C	Calculated Value
H	Holding times for preparation or analysis exceeded
L	Analyzed by a contract laboratory
ND	Not Detected at the Reporting Limit
S	Spike Recovery outside accepted recovery limits

RL - Reporting Limit

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
M	Value exceeds Monthly Ave or MCL
O	Outside the Range of Dilutions

Reviewed by: Connie Mattson
Connie Mattson, Project Manager

Inter-Mountain Labs
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Your Environmental Monitoring Partner

ANALYTICAL QC SUMMARY REPORT

CLIENT: Black Hills Gas Resources
Work Order: S1202394
Project: East Blanco Monitor Wells

Date: 3/7/2012
Report ID: S1202394001

Alkalinity

Sample Type **MBLK** Units: mg/L

Sample ID	RunNo: 80358	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
BLANK	03/05/12 16:46	Alkalinity, Total (As CaCO3)	5	5					B

Sample Type **LCS** Units: mg/L

Sample ID	RunNo: 80358	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
ATQC	03/05/12 16:33	Alkalinity, Total (As CaCO3)	591	5	601		98.3	90 - 110	

Sample Type **DUP** Units: mg/L

Sample ID	RunNo: 80358	Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual
S1203019-002AD	03/05/12 19:37	Alkalinity, Bicarbonate as HCO3	82	5	78	5.53		20	
		Alkalinity, Carbonate as CO3	ND	5	ND			20	
		Alkalinity, Total (As CaCO3)	68	5	66	2.41		20	

Conductivity

Sample Type **MBLK** Units: µmhos/cm

Sample ID	RunNo: 80358	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
BLANK	03/05/12 16:46	Electrical Conductivity	10	5					

Sample Type **LCS** Units: µmhos/cm

Sample ID	RunNo: 80358	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
ATQC	03/05/12 16:33	Electrical Conductivity	1100	5	1120		97.7	90 - 110	

Sample Type **DUP** Units: µmhos/cm

Sample ID	RunNo: 80358	Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual
S1203019-002AD	03/05/12 19:37	Electrical Conductivity	5680	5	ND				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
L	Analyzed by a contract laboratory	ND	Not Detected at the Reporting Limit
O	Outside the Range of Dilutions	R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits		

ANALYTICAL QC SUMMARY REPORT

CLIENT: Black Hills Gas Resources
Date: 3/7/2012
Work Order: S1202394
Report ID: S1202394001
Project: East Blanco Monitor Wells

Anions by ION Chromatography

Sample Type **LCS** Units: mg/L

Sample ID	RunNo: 80292	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
DIONEC QC	03/01/12 11:06	Chloride	28	1	30		94.7	90 - 110	
		Sulfate	163	1	150		109	90 - 110	

Sample Type **MS** Units: mg/L

Sample ID	RunNo: 80292	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
S1202395-021ASPK	03/01/12 22:07	Chloride	414	1	390	32	98.0	80 - 120	
		Sulfate	1890	1	1040	764	108	80 - 120	

Sample Type **DUP** Units: mg/L

Sample ID	RunNo: 80292	Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual
S1202392-001A	03/01/12 19:16	Chloride	8	1	8	0.313		20	
		Sulfate	1770	1	1770	0.193		20	

Cations by ICP (Method 200.7)

Sample Type **MBLK** Units: mg/L

Sample ID	RunNo: 80278	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
MBLK DISS/CAT	03/01/12 11:39	Calcium	ND	1					
		Magnesium	ND	1					
		Potassium	ND	1					
		Sodium	ND	1					

Sample Type **LCS** Units: mg/L

Sample ID	RunNo: 80278	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
CAT LCS IML3	03/01/12 11:44	Calcium	40	1	40		99.4	85 - 115	
		Magnesium	39	1	40		96.7	85 - 115	
		Potassium	40	1	40		99.0	85 - 115	
		Sodium	40	1	40		98.7	85 - 115	

Sample Type **DUP** Units: mg/L

Sample ID	RunNo: 80278	Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual
S1202395-048AD	03/01/12 15:18	Calcium	178	1	174	2.04		20	
		Magnesium	44	1	43	1.71		20	
		Potassium	13	1	13	0.379		20	
		Sodium	622	1	619	0.620		20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
L	Analyzed by a contract laboratory	ND	Not Detected at the Reporting Limit
O	Outside the Range of Dilutions	R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits		

ANALYTICAL QC SUMMARY REPORT

CLIENT: Black Hills Gas Resources
Work Order: S1202394
Project: East Blanco Monitor Wells

Date: 3/7/2012
Report ID: S1202394001

Solids By SM 2540

Sample Type **LCS** Units: mg/L

Sample ID	RunNo: 80310	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
CONTROL	02/28/12 13:18	Total Dissolved Solids (180)	220	10	226		96.5	90 - 110	

Sample Type **DUP** Units: mg/L

Sample ID	RunNo: 80310	Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual
S1202370-030A	02/28/12 14:04	Total Dissolved Solids (180)	90	10	90	6.82		20	

Total Mercury by EPA 245.1 - Water

Sample Type **MBLK** Units: mg/L

Sample ID	RunNo: 80382	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
LRB	03/06/12 11:04	Mercury	ND	0.001					

Sample Type **LCS** Units: mg/L

Sample ID	RunNo: 80382	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
LCS	03/06/12 11:02	Mercury	0.002	0.001	0.002		101	85 - 115	

Sample Type **MS** Units: mg/L

Sample ID	RunNo: 80382	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
S1202394-001B	03/06/12 13:04	Mercury	0.002	0.001	0.00244	ND	95.9	70 - 130	

Sample Type **MSD** Units: mg/L

Sample ID	RunNo: 80382	Analyte	Result	RL	Conc	%RPD	%REC	% RPD Limits	Qual
S1202394-001B	03/06/12 13:06	Mercury	0.002	0.001	0.002	0.824	96.7	20	

Sample Type **DUP** Units: mg/L

Sample ID	RunNo: 80382	Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual
S1202394-001B	03/06/12 13:03	Mercury	ND	0.001	ND			20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
L	Analyzed by a contract laboratory	ND	Not Detected at the Reporting Limit
O	Outside the Range of Dilutions	R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits		

ANALYTICAL QC SUMMARY REPORT

CLIENT: Black Hills Gas Resources
Work Order: S1202394
Project: East Blanco Monitor Wells

Date: 3/7/2012
Report ID: S1202394001

Total(3020) Metals by ICP - 6010C

Sample Type **MBLK** Units: mg/L

Sample ID	RunNo: 80364	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
MB-5889	03/05/12 14:42	Arsenic	ND	0.01					
		Barium	ND	0.005					
		Cadmium	ND	0.001					
		Chromium	ND	0.005					
		Lead	ND	0.01					
		Selenium	ND	0.025					
		Silver	ND	0.005					

Sample Type **LCS** Units: mg/L

Sample ID	RunNo: 80364	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
LCS-5889	03/05/12 14:44	Arsenic	0.20	0.01	0.2		102	80 - 120	
		Barium	0.218	0.005	0.2		109	80 - 120	
		Cadmium	0.205	0.001	0.2		102	80 - 120	
		Chromium	0.204	0.005	0.2		102	80 - 120	
		Lead	0.20	0.01	0.2		99.0	80 - 120	
		Selenium	0.383	0.025	0.4		95.8	80 - 120	
		Silver	0.098	0.005	0.1		97.7	80 - 120	

pH Water

Sample Type **LCS** Units: s.u.

Sample ID	RunNo: 80358	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
ATQC	03/05/12 16:33	pH	8.5	0.1	8.48		101	90 - 110	

Sample Type **DUP** Units: s.u.

Sample ID	RunNo: 80358	Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual
S1203010-001AD	03/05/12 18:11	pH	8.6	0.1	ND				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
L	Analyzed by a contract laboratory	ND	Not Detected at the Reporting Limit
O	Outside the Range of Dilutions	R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits		

Inter-Mountain Laboratories, Inc
555 Absaraka Street, Sheridan, Wyoming 82801
(307) 674-7506

Date: 11/6/2012

CLIENT: Black Hills Exploration & Production
Project: East Blanco Facility-Boring 'TW4'
Lab Order: O1211009

CASE NARRATIVE

Report ID: O1211009001

This data package consists of the following:
Case Narrative - 1 page
Sample Analysis Reports - 2 pages
Quality Control Reports - 2 pages

Samples were analyzed for organic constituents using the methods outlined in the following references:

- Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition, United States Environmental Protection Agency (USEPA).

All method blanks, duplicates, laboratory spikes, and/or matrix spikes met quality assurance objectives.

Data qualifiers are defined at the bottom of each page.

Inter-Mountain Laboratories, Inc
555 Absaraka Street, Sheridan, Wyoming 82801
(307) 674-7506

Sample Analysis Report

.IENT: Black Hills Exploration & Production
1515 Wynkoop, Suite 500
Denver, CO 80202

Date Reported: 11/6/2012
Report ID: O1211009001

Project: East Blanco Facility-Boring 'TW4'
Lab ID: O1211009-001
Client Sample ID: TW4103112
Matrix: Water

Work Order: O1211009
Collection Date: 10/31/2012 10:00:00 AM
Date Received: 11/1/2012
COC: 148721

Analyses	Result	RL	Limits	Qual	Units	Date Analyzed/Init	
8260B MBTEXN-Water						**Prep Date: 11/5/2012**	
Benzene	ND	1.0			µg/L	11/05/2012	SK
Toluene	ND	1.0			µg/L	11/05/2012	SK
Ethylbenzene	ND	1.0			µg/L	11/05/2012	SK
m,p-Xylenes	ND	2.0			µg/L	11/05/2012	SK
o-Xylene	ND	1.0			µg/L	11/05/2012	SK
Xylenes, Total	ND	3.0			µg/L	11/05/2012	SK
Surr: 4-Bromofluorobenzene	102		81-115		%REC	11/05/2012	SK

These results apply only to the samples tested. **RL - Reporting Limit**

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Diluted out of recovery limit	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	M	Matrix Effect
ND	Not Detected at the Reporting Limit	S	Spike Recovery outside accepted recovery limits

Reviewed by: Lisa Balstad
Lisa Balstad, Project Manager

Inter-Mountain Laboratories, Inc
555 Absaraka Street, Sheridan, Wyoming 82801
(307) 674-7506

Sample Analysis Report

.IENT: Black Hills Exploration & Production
1515 Wynkoop, Suite 500
Denver, CO 80202

Date Reported: 11/6/2012
Report ID: O1211009001

Project: East Blanco Facility-Boring 'TW4'
Lab ID: O1211009-002
Client Sample ID: Trip Blank
Matrix: Water

Work Order: O1211009
Collection Date: 10/31/2012
Date Received: 11/1/2012
COC: 148721

Analyses	Result	RL	Limits	Qual	Units	Date Analyzed/Init	
8260B MBTEXN-Water						**Prep Date: 11/5/2012**	
Benzene	ND	1.0			µg/L	11/05/2012	SK
Toluene	ND	1.0			µg/L	11/05/2012	SK
Ethylbenzene	ND	1.0			µg/L	11/05/2012	SK
m,p-Xylenes	ND	2.0			µg/L	11/05/2012	SK
o-Xylene	ND	1.0			µg/L	11/05/2012	SK
Xylenes, Total	ND	3.0			µg/L	11/05/2012	SK
Surr: 4-Bromofluorobenzene	97.3		81-115		%REC	11/05/2012	SK

These results apply only to the samples tested. **RL - Reporting Limit**

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
D	Diluted out of recovery limit	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	M	Matrix Effect
ND	Not Detected at the Reporting Limit	S	Spike Recovery outside accepted recovery limits

Reviewed by: Lisa Balstad
Lisa Balstad, Project Manager

Inter-Mountain Laboratories, Inc
555 Absaraka Street, Sheridan, Wyoming 82801
(307) 674-7506

ANALYTICAL QC SUMMARY REPORT

Date: 11/6/2012

CLIENT: Black Hills Exploration & Production
Work Order: O1211009
Project: East Blanco Facility-Boring 'TW4'

Report ID: O1211009001Q
TestCode: **8260MBTEXN_W**

Sample ID: **MB-5269** SampType: **MBLK** TestCode: **8260MBTEXN** Units: **µg/L** Prep Date: **11/5/2012** RunNo: **6759**
Client ID: **ZZZZZ** Batch ID: **5269** Analysis Date: **11/5/2012** SeqNo: **101030**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	1.0									
Toluene	ND	1.0									
Ethylbenzene	ND	1.0									
m,p-Xylenes	ND	2.0									
o-Xylene	ND	1.0									
Xylenes, Total	ND	3.0									
Surr: 4-Bromofluorobenzene					97.7	81	115				

Sample ID: **LCS-5269** SampType: **LCS** TestCode: **8260MBTEXN** Units: **µg/L** Prep Date: **11/5/2012** RunNo: **6759**
Client ID: **ZZZZZ** Batch ID: **5269** Analysis Date: **11/5/2012** SeqNo: **101029**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	21.63	1.0	20		108	75	125				
Toluene	21.39	1.0	20		107	80	122				
Ethylbenzene	21.96	1.0	20		110	85	115				
m,p-Xylenes	43.39	2.0	40		108	83	116				
o-Xylene	22.22	1.0	20		111	84	115				
Surr: 4-Bromofluorobenzene					100	81	115				

Qualifiers:

D	Diluted out of recovery limit	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	M	Matrix Effect	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	S	Spike Recovery outside accepted recovery limits		

Inter-Mountain Laboratories, Inc
555 Absaraka Street, Sheridan, Wyoming 82801
(307) 674-7506

ANALYTICAL QC SUMMARY REPORT

Date: 11/6/2012

CLIENT: Black Hills Exploration & Production
Work Order: O1211009
Project: East Blanco Facility-Boring 'TW4'

Report ID: O1211009001Q
TestCode: **8260MBTEXN_W**

Sample ID: **O1210029-001AMS** SampType: **MS** TestCode: **8260MBTEXN** Units: **µg/L** Prep Date: **11/5/2012** RunNo: **6759**
Client ID: **ZZZZZ** Batch ID: **5269** Analysis Date: **11/5/2012** SeqNo: **101033**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	19.63	1.0	20	0	98.2	75	130	0	0		
Toluene	20.49	1.0	20	0	102	78	129	0	0		
Ethylbenzene	21.21	1.0	20	0	106	81	121	0	0		
m,p-Xylenes	42.30	2.0	40	0	106	78	124	0	0		
o-Xylene	21.56	1.0	20	0	108	80	123	0	0		
Surr: 4-Bromofluorobenzene				0	104	81	115	0	0		

Sample ID: **O1210029-001ADUP** SampType: **DUP** TestCode: **8260MBTEXN** Units: **µg/L** Prep Date: **11/5/2012** RunNo: **6759**
Client ID: **ZZZZZ** Batch ID: **5269** Analysis Date: **11/5/2012** SeqNo: **101032**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	1.0	0	0	0	0	0	0	0	20	
Toluene	ND	1.0	0	0	0	0	0	0	0	20	
Ethylbenzene	ND	1.0	0	0	0	0	0	0	0	20	
m,p-Xylenes	ND	2.0	0	0	0	0	0	0	0	20	
o-Xylene	ND	1.0	0	0	0	0	0	0	0	20	
Xylenes, Total	ND	3.0	0	0	0	0	0	0	0	20	
Surr: 4-Bromofluorobenzene				0	96	81	115	0	0	20	

Qualifiers:

D	Diluted out of recovery limit	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	M	Matrix Effect	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	S	Spike Recovery outside accepted recovery limits		

Inter-Mountain Labs
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Your Environmental Monitoring Partner

Date: 11/8/2012

CLIENT: Black Hills Exploration & Production
Project: East Blanco Facility-Boring "TW4"
Lab Order: S1211023

CASE NARRATIVE

Report ID: S1211023001

Samples Trip Blank, and TW4103112 were received on November 1, 2012.

All samples were received and analyzed within the EPA recommended holding times, except those noted in this case narrative. Samples were analyzed using the methods outlined in the following references:

U.S.E.P.A. 600 "Methods for Chemical Analysis of Water and Wastes", 1993
"Standard Methods For The Examination of Water and Wastewater", 20th ed., 1998
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846, 3rd Edition
Methods indicated with the Monday, March 12, 2007 Federal Register, 40 CFR Part 122, 136 et al.

All Quality Control parameters met the acceptance criteria defined by EPA and Inter-Mountain Laboratories except as indicated in this case narrative.

Reviewed by: Connie J Mattson
Connie Mattson, Project Manager

Inter-Mountain Labs
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Your Environmental Monitoring Partner

Sample Analysis Report

CLIENT: Black Hills Exploration & Production
1515 Wynkoop Ste 500
Denver, CO 80202

Date Reported: 11/8/2012
Report ID: S1211023001

Project: East Blanco Facility-Boring "TW4"
Lab ID: S1211023-001
Client Sample ID: TW4103112
COC: 148721

Work Order: S1211023
Collection Date: 10/31/2012 10:00:00 AM
Date Received: 11/1/2012 12:00:00 PM
Sampler: DB
Matrix: Water

Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
General Parameters						
pH	8.2	0.1		s.u.	11/05/2012 1441 KV	SM 4500 H B
Electrical Conductivity	1010	5		µmhos/cm	11/05/2012 1441 KV	SM 2510B
Total Dissolved Solids (180)	760	10		mg/L	11/01/2012 1638 JCG	SM 2540
Solids, Total Dissolved (Calc)	700	10		mg/L	11/06/2012 1539 CJM	SM 1030E
Alkalinity, Total (As CaCO3)	195	5		mg/L	11/05/2012 1441 KV	SM 2320B
Hardness, Calcium/Magnesium (As CaCO3)	372	1		mg/L	11/06/2012 1539 CJM	SM 2340B
Resistivity	10	5		ohm-m	11/06/2012 1542 CJM	Calculation
Anions						
Alkalinity, Bicarbonate as HCO3	238	5		mg/L	11/05/2012 1441 KV	SM 2320B
Alkalinity, Carbonate as CO3	ND	5		mg/L	11/05/2012 1441 KV	SM 2320B
Alkalinity, Hydroxide as OH	ND	5		mg/L	11/05/2012 1441 KV	SM 2320B
Chloride	5	1		mg/L	11/02/2012 641 AM	EPA 300.0
Fluoride	0.2	0.1		mg/L	11/05/2012 1441 KV	SM 4500FC
Nitrogen, Nitrate-Nitrite (as N)	ND	0.1		mg/L	11/06/2012 858 AMB	EPA 353.2
Sulfate	338	1		mg/L	11/02/2012 641 AM	EPA 300.0
Cations						
Calcium	106	1		mg/L	11/02/2012 1416 DG	EPA 200.7
Magnesium	26	1		mg/L	11/02/2012 1416 DG	EPA 200.7
Potassium	4	1		mg/L	11/02/2012 1416 DG	EPA 200.7
Sodium	99	1		mg/L	11/02/2012 1416 DG	EPA 200.7
Cation/Anion-Milliequivalents						
Bicarbonate as HCO3	3.90	0.01		meq/L	11/06/2012 1539 CJM	SM 1030E
Carbonate as CO3	ND	0.01		meq/L	11/06/2012 1539 CJM	SM 1030E
Hydroxide as OH	ND	0.01		meq/L	11/06/2012 1539 CJM	SM 1030E
Chloride	0.12	0.01		meq/L	11/06/2012 1539 CJM	SM 1030E
Fluoride	0.01	0.01		meq/L	11/06/2012 1539 CJM	SM 1030E
Nitrate + Nitrite as N	ND	0.01		meq/L	11/06/2012 1539 CJM	SM 1030E
Sulfate	7.04	0.01		meq/L	11/06/2012 1539 CJM	SM 1030E
Calcium	5.31	0.01		meq/L	11/06/2012 1539 CJM	SM 1030E
Magnesium	2.12	0.01		meq/L	11/06/2012 1539 CJM	SM 1030E
Potassium	0.09	0.01		meq/L	11/06/2012 1539 CJM	SM 1030E
Sodium	4.31	0.01		meq/L	11/06/2012 1539 CJM	SM 1030E

These results apply only to the samples tested.

Qualifiers:

*	Value exceeds Maximum Contaminant Level
C	Calculated Value
H	Holding times for preparation or analysis exceeded
L	Analyzed by a contract laboratory
ND	Not Detected at the Reporting Limit
S	Spike Recovery outside accepted recovery limits

RL - Reporting Limit

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
M	Value exceeds Monthly Ave or MCL
O	Outside the Range of Dilutions

Reviewed by: Connie Mattson
Connie Mattson, Project Manager

Inter-Mountain Labs
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Your Environmental Monitoring Partner

Sample Analysis Report

CLIENT: Black Hills Exploration & Production
1515 Wynkoop Ste 500
Denver, CO 80202

Date Reported: 11/8/2012
Report ID: S1211023001

Work Order: S1211023
Project: East Blanco Facility-Boring "TW4"
Collection Date: 10/31/2012 10:00:00 AM
Lab ID: S1211023-001
Date Received: 11/1/2012 12:00:00 PM
Client Sample ID: TW4103112
Sampler: DB
COC: 148721
Matrix: Water

Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
Cation / Anion Balance						
Cation Sum	11.84	0.01		meq/L	11/06/2012 1539 CJM	SM 1030E
Anion Sum	11.08	0.01		meq/L	11/06/2012 1539 CJM	SM 1030E
Cation-Anion Balance	3.31	0.01		%	11/06/2012 1539 CJM	SM 1030E
Total Metals						
Arsenic	ND	0.005		mg/L	11/05/2012 1726 MS	EPA 200.8
Barium	0.256	0.005		mg/L	11/05/2012 1726 MS	EPA 200.8
Cadmium	ND	0.002		mg/L	11/05/2012 1726 MS	EPA 200.8
Chromium	ND	0.01		mg/L	11/06/2012 1828 DG	EPA 200.7
Lead	ND	0.02		mg/L	11/05/2012 1726 MS	EPA 200.8
Mercury	ND	0.001		mg/L	11/06/2012 1339 CS	EPA 245.1
Selenium	ND	0.005		mg/L	11/05/2012 1726 MS	EPA 200.8
Silver	ND	0.003		mg/L	11/05/2012 1726 MS	EPA 200.8

These results apply only to the samples tested.

Qualifiers:

*	Value exceeds Maximum Contaminant Level
C	Calculated Value
H	Holding times for preparation or analysis exceeded
L	Analyzed by a contract laboratory
ND	Not Detected at the Reporting Limit
S	Spike Recovery outside accepted recovery limits

RL - Reporting Limit

B	Analyte detected in the associated Method Blank
E	Value above quantitation range
J	Analyte detected below quantitation limits
M	Value exceeds Monthly Ave or MCL
O	Outside the Range of Dilutions

Reviewed by: Connie J Mattson
Connie Mattson, Project Manager

INTER-MOUNTAIN LABS

Condition Upon Receipt (Attach to COC)

Sample Receipt

1 Number of ice chests/packages received: 1

Note as "OTC" if samples are received over the counter, unpackaged

2 Temperature of cooler/samples. Temps (°C): 11.4 blue ice

Acceptable is 0.1 to 6°C. Also acceptable is "Received on Ice" (ROI) for samples received on the same day as sampled or "Received at Room Temperature" (RRT) for samples received within one hour of sampling.

Client contact for temperature failures must be documented below.

3	Emission rate of samples for radiochemical analyses < 0.5mR/hr?	Yes	No	(N/A)
4	COC Number (If applicable): 149721			
5	Do the number of bottles agree with the COC?	(Yes)	No	N/A
6	Were the samples received intact? *(no broken bottles, leaks, etc.)*	(Yes)	No	N/A
7	Were the sample custody seals intact?	Yes	No	(N/A)
8	Is the COC properly completed, legible, and signed?	(Yes)	No	

Sample Verification, Labeling & Distribution

1	Were all requested analyses understood and appropriate?	(Yes)	No		
2	Did the bottle labels correspond with the COC information?	(Yes)	No		
3	Samples collected in proper containers?	(Yes)	No		
4	Were all containers properly preserved?	(Yes)	No	N/A	Added at Lab

Client contact for preservation failures must be documented below.

For Total Metals samples preserved at Lab, record date and time of preservation: _____

pH of each WY STP (LAUST) sample must be checked and recorded. _____

5	VOA vials have <6mm headspace?	(Yes)	No	N/A
6	Were all analyses within holding time at the time of receipt?	(Yes)	No	
7	Have rush or project due dates been checked and accepted?	(Yes)	No	N/A

Attach Lab ID labels to the containers and deliver to appropriate lab section. Set ID: S1211023

Sample Receipt, Verification, Login, Labeling & Distribution completed by *(initials)*: KB

Discrepancy Documentation *(use back of sheet for notes on discrepancies)*

Any items listed above with a response of "No" or do not meet specifications must be resolved.

Person Contacted: Brett Hurlbut Telephone Number: _____

Initiated By: KB Date/Time: 11.1.12

Problem: Left vm re sample Rec'd today - only Rec'd 500mL RAW - No Metals or BTEX VOA's

Resolution: Please call — Found BOTTLES — Called + Let him know.

Person Contacted: _____ Telephone Number: _____

Initiated By: _____ Date/Time: _____

Problem: Rec'd Xtra 1Hr 11.2.12 Amber Glass

Resolution:

Inter-Mountain Labs

Sheridan, WY and Gillette, WY

CHAIN OF CUSTODY RECORD -

Page of

148721

All shaded fields must be completed.
This is a legal document: any misrepresentation may be construed as fraud.

Client Name	Project Identification	Sampler (Signature/Attestation of Authenticity)	Telephone #
BLACK HILLS EXPLORATION & PROD	EAST BLANCO FACILITY - BORING TW #4	D Baldwin / GEOMAT	(505) 327-7928

Report Address	Contact Name	Email	Phone
1515 WYNKOOP, SUITE 500 DENVER, CO 80202	BRETT HURLBUT	BRETT.HURLBUT@BLACKHILLSCORP.COM	(303) 566-3491

Invoice Address	Purchase Order #	Quote #
-SAME AS ABOVE		

ITEM	LAB ID (Lab Use Only)	DATE SAMPLED	TIME	SAMPLE IDENTIFICATION	Matrix	# of Containers	MAJOR CATIONS / ANIONS	BTEX	RCRA METALS	TDS	CONDUCTIVITY @ RESISTIVITY CALC	PH			REMARKS
1	5121023-002	10/31/12	1000	TW4 103112	WT	6	X	X	X	X	X	X			
2				Trip Blank											
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															

LAB COMMENTS	Relinquished By (Signature/Printed)	DATE	TIME	Received By (Signature/Printed)	DATE	TIME
KB 8.4 8.4 blue ice	T Baldwin DON BALDWIN	10/31/12	1400	[signature]	11/1/12	12:00

SHIPPING INFO	MATRIX CODES		TURNAROUND TIMES	COMPLIANCE INFORMATION	ADDITIONAL REMARKS
☐ UPS	Water	WT	**Check desired service**	Compliance Monitoring? Y (N)	-PLEASE E-MAIL ADDITIONAL
☐ Fed Express	Soil	SL	Standard turnaround	Program (SDWA, NPDES,...)	COPY OF THE REPORT TO
☐ US Mail	Solid	SD	(RUSH) - 5 Working Days	PWSID / Permit #	MATT.CRAMER@GEOMATENGINEERING.COM
☐ Hand Carried	Filter	FT	☐ URGENT - < 2 Working Days	Chlorinated? Y (N)	
☐ Other _____	Other	OT	***Rush & Urgent Surcharges will be applied***	Sample Disposal: Lab X Client	

Inter-Mountain Labs
Your Environmental Monitoring Partner
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

ANALYTICAL QC SUMMARY REPORT

CLIENT: Western Water Consultants **Date:** 11/8/2012
Work Order: S1211023 **Report ID:** S1211023001
Project: East Blanco Facility-Boring "TW4"

Alkalinity

Sample Type **MBLK** Units: mg/L

Sample ID	RunNo: 89228	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
BLANK	11/05/12 12:11	Alkalinity, Total (As CaCO3)	ND	5					

Sample Type **LCS** Units: mg/L

Sample ID	RunNo: 89228	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
ATQC	11/05/12 11:58	Alkalinity, Total (As CaCO3)	572	5	598		95.7	90 - 110	

Sample Type **DUP** Units: mg/L

Sample ID	RunNo: 89228	Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual
S1211041-001AD	11/05/12 19:44	Alkalinity, Bicarbonate as HCO3	303	5	303	0.0928		20	
		Alkalinity, Carbonate as CO3	ND	5	ND			20	
		Alkalinity, Total (As CaCO3)	249	5	248	0.0928		20	

Conductivity

Sample Type **MBLK** Units: µmhos/cm

Sample ID	RunNo: 89228	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
BLANK	11/05/12 12:11	Electrical Conductivity	ND	5					

Sample Type **LCS** Units: µmhos/cm

Sample ID	RunNo: 89228	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
ATQC	11/05/12 11:58	Electrical Conductivity	1050	5	1100		95.3	90 - 110	

Sample Type **DUP** Units: µmhos/cm

Sample ID	RunNo: 89228	Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual
S1211033-001BD	11/05/12 18:31	Electrical Conductivity	683	5	ND				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
L	Analyzed by a contract laboratory	ND	Not Detected at the Reporting Limit
O	Outside the Range of Dilutions	R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits		

ANALYTICAL QC SUMMARY REPORT

CLIENT: Western Water Consultants
Date: 11/8/2012
Work Order: S1211023
Report ID: S1211023001
Project: East Blanco Facility-Boring "TW4"

Fluoride by SM 4500

Sample Type **MBLK** Units: mg/L

Sample ID	RunNo: 89228	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
BLANK	11/05/12 12:11	Fluoride	ND	0.1					

Sample Type **LCS** Units: mg/L

Sample ID	RunNo: 89228	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
ATQC	11/05/12 11:58	Fluoride	3.1	0.1	2.96		105	90 - 110	

Sample Type **MS** Units: mg/L

Sample ID	RunNo: 89228	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
S1211041-014ASPK	11/05/12 22:51	Fluoride	2.4	0.1	2.5	0.1	88.6	80 - 120	

Sample Type **DUP** Units: mg/L

Sample ID	RunNo: 89228	Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual
S1211041-011AD	11/05/12 22:04	Fluoride	ND	0.1	ND			20	

Anions by ION Chromatography

Sample Type **MBLK** Units: mg/L

Sample ID	RunNo: 89107	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
BLK	11/01/12 14:00	Chloride	ND	1					
		Sulfate	ND	1					

Sample Type **LCS** Units: mg/L

Sample ID	RunNo: 89107	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
DIONEX	11/01/12 13:35	Chloride	30	1	30		98.5	90 - 110	
		Sulfate	143	1	150		95.2	90 - 110	

Sample Type **MS** Units: mg/L

Sample ID	RunNo: 89107	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
S1210451-004ASPK	11/01/12 19:21	Chloride	65	1	55	6	106	80 - 120	
		Sulfate	839	1	440	311	120	80 - 120	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
L	Analyzed by a contract laboratory	ND	Not Detected at the Reporting Limit
O	Outside the Range of Dilutions	R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits		

ANALYTICAL QC SUMMARY REPORT

CLIENT: Western Water Consultants
Date: 11/8/2012
Work Order: S1211023
Report ID: S1211023001
Project: East Blanco Facility-Boring "TW4"

Cations by ICP (Method 200.7)

Sample Type **MBLK** Units: mg/L

Sample ID	RunNo: 89141	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
MBLK DISS/CAT	11/02/12 11:02	Calcium	ND	1					
		Magnesium	ND	1					
		Potassium	ND	1					
		Sodium	ND	1					

Sample Type **LCS** Units: mg/L

Sample ID	RunNo: 89141	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
CAT LCS IML3	11/02/12 11:06	Calcium	41	1	40		101	85 - 115	
		Magnesium	42	1	40		105	85 - 115	
		Potassium	40	1	40		100	85 - 115	
		Sodium	40	1	40		99.8	85 - 115	

Sample Type **MS** Units: mg/L

Sample ID	RunNo: 89141	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
S1211024-001AS	11/02/12 14:23	Calcium	116	1	100	11	105	70 - 130	
		Magnesium	113	1	100	4	109	70 - 130	
		Potassium	138	1	100	5	133	70 - 130	S
		Sodium	1190	1	100	1120	64.4	70 - 130	S

Sample Type **MSD** Units: mg/L

Sample ID	RunNo: 89141	Analyte	Result	RL	Conc	%RPD	%REC	% RPD Limits	Qual
S1211024-001ASD	11/02/12 14:25	Calcium	120	1	116	3.01	109	20	
		Magnesium	117	1	113	3.56	113	20	
		Potassium	141	1	138	1.92	136	20	S
		Sodium	1220	1	1190	2.65	95.9	20	

Sample Type **DUP** Units: mg/L

Sample ID	RunNo: 89141	Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual
S1211023-001AD	11/02/12 14:18	Calcium	107	1	106	0.283		20	
		Magnesium	26	1	26	0.367		20	
		Potassium	4	1	4	1.08		20	
		Sodium	99	1	99	0.467		20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
L	Analyzed by a contract laboratory	ND	Not Detected at the Reporting Limit
O	Outside the Range of Dilutions	R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits		

ANALYTICAL QC SUMMARY REPORT

CLIENT: Western Water Consultants
Date: 11/8/2012
Work Order: S1211023
Report ID: S1211023001
Project: East Blanco Facility-Boring "TW4"

Nitrogen, Nitrate-Nitrite (as N)

Sample Type **MBLK** Units: mg/L

Sample ID	RunNo: 89243	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
BLANK	11/06/12 8:49	Nitrogen, Nitrate-Nitrite (as N)	ND	0.1					

Sample Type **LCS** Units: mg/L

Sample ID	RunNo: 89243	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
QC	11/06/12 8:51	Nitrogen, Nitrate-Nitrite (as N)	19.1	0.1	19.3		99.1	90 - 110	

Solids By SM 2540

Sample Type **MBLK** Units: mg/L

Sample ID	RunNo: 89155	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
DI	11/01/12 15:02	Total Dissolved Solids (180)	ND	10					

Sample Type **LCS** Units: mg/L

Sample ID	RunNo: 89155	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
CONTROL	11/01/12 15:03	Total Dissolved Solids (180)	210	10	226		93.8	90 - 110	

Sample Type **DUP** Units: mg/L

Sample ID	RunNo: 89155	Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual
S1210534-010A	11/01/12 15:14	Total Dissolved Solids (180)	330	10	350	6.78		20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
L	Analyzed by a contract laboratory	ND	Not Detected at the Reporting Limit
O	Outside the Range of Dilutions	R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits		

ANALYTICAL QC SUMMARY REPORT

CLIENT: Western Water Consultants
Date: 11/8/2012
Work Order: S1211023
Report ID: S1211023001
Project: East Blanco Facility-Boring "TW4"

Total Mercury by EPA 245.1 - Water

Sample Type **MBLK** Units: mg/L

Sample ID	RunNo: 89278	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
LRB	11/06/12 9:25	Mercury	ND	0.001					

Sample Type **LCS** Units: mg/L

Sample ID	RunNo: 89278	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
LCS	11/06/12 9:24	Mercury	0.002	0.001	0.002		99.4	85 - 115	

Sample Type **MS** Units: mg/L

Sample ID	RunNo: 89278	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
S1211023-001B	11/06/12 13:43	Mercury	0.002	0.001	0.00244	ND	101	70 - 130	

Sample Type **MSD** Units: mg/L

Sample ID	RunNo: 89278	Analyte	Result	RL	Conc	%RPD	%REC	% RPD Limits	Qual
S1211023-001B	11/06/12 13:45	Mercury	0.003	0.001	0.002	2.17	103	20	

Sample Type **DUP** Units: mg/L

Sample ID	RunNo: 89278	Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual
S1211023-001B	11/06/12 13:41	Mercury	ND	0.001	ND			20	

Total (200.2) Metals by EPA 200.7 ICP - Water

Sample Type **MBLK** Units: mg/L

Sample ID	RunNo: 89293	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
MB-6552	11/06/12 18:23	Chromium	ND	0.01					

Sample Type **LCS** Units: mg/L

Sample ID	RunNo: 89293	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
LCS-6552	11/06/12 18:26	Chromium	0.20	0.01	0.2		98.2	85 - 115	

Sample Type **MS** Units: mg/L

Sample ID	RunNo: 89293	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
S1211023-001BS	11/06/12 18:33	Chromium	0.21	0.01	0.2	ND	100	70 - 130	

Sample Type **MSD** Units: mg/L

Sample ID	RunNo: 89293	Analyte	Result	RL	Conc	%RPD	%REC	% RPD Limits	Qual
S1211023-001BMSD	11/06/12 18:42	Chromium	0.20	0.01	0.21	0.875	99.5	20	

Sample Type **DUP** Units: mg/L

Sample ID	RunNo: 89293	Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual
S1211023-001BD	11/06/12 18:30	Chromium	ND	0.01	ND			20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
L	Analyzed by a contract laboratory	ND	Not Detected at the Reporting Limit
O	Outside the Range of Dilutions	R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits		

ANALYTICAL QC SUMMARY REPORT

CLIENT: Western Water Consultants
Date: 11/8/2012
Work Order: S1211023
Report ID: S1211023001
Project: East Blanco Facility-Boring "TW4"

Total (200.2) Metals by EPA 200.8 - Water

Sample Type **MBLK** Units: mg/L

Sample ID	RunNo: 89240	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
MB-6552	11/05/12 17:06	Arsenic	ND	0.005					
		Barium	ND	0.005					
		Cadmium	ND	0.002					
		Chromium	ND	0.001					
		Lead	ND	0.02					
		Selenium	ND	0.005					
		Silver	ND	0.003					

Sample Type **LCS** Units: mg/L

Sample ID	RunNo: 89240	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
LCS-6552	11/05/12 17:21	Arsenic	0.100	0.005	0.1		99.5	85 - 115	
		Barium	0.092	0.005	0.1		92.3	85 - 115	
		Cadmium	0.096	0.002	0.1		96.4	85 - 115	
		Chromium	0.093	0.001	0.1		93.1	85 - 115	
		Lead	0.09	0.02	0.1		92.9	85 - 115	
		Selenium	0.200	0.005	0.2		100	85 - 115	
		Silver	0.048	0.003	0.05		96.5	85 - 115	

Sample Type **MS** Units: mg/L

Sample ID	RunNo: 89240	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
S1211023-001BS	11/05/12 17:36	Arsenic	0.180	0.005	0.2	ND	88.0	70 - 130	
		Barium	0.435	0.005	0.2	0.256	89.3	70 - 130	
		Cadmium	0.191	0.002	0.2	ND	95.7	70 - 130	
		Lead	0.19	0.02	0.2	ND	94.7	70 - 130	
		Selenium	0.379	0.005	0.4	ND	94.5	70 - 130	
		Silver	0.093	0.003	0.1	ND	93.2	70 - 130	

Sample Type **MSD** Units: mg/L

Sample ID	RunNo: 89240	Analyte	Result	RL	Conc	%RPD	%REC	% RPD Limits	Qual
S1211023-001BMSD	11/05/12 17:41	Arsenic	0.208	0.005	0.180	15.7	102	20	
		Barium	0.435	0.005	0.435	0.00458	89.3	20	
		Cadmium	0.186	0.002	0.191	2.63	93.2	20	
		Lead	0.19	0.02	0.19	0.636	95.3	20	
		Selenium	0.383	0.005	0.379	1.15	95.6	20	
		Silver	0.092	0.003	0.093	1.42	91.8	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
L	Analyzed by a contract laboratory	ND	Not Detected at the Reporting Limit
O	Outside the Range of Dilutions	R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits		

ANALYTICAL QC SUMMARY REPORT

CLIENT: Western Water Consultants
Date: 11/8/2012
Work Order: S1211023
Report ID: S1211023001
Project: East Blanco Facility-Boring "TW4"

Total (200.2) Metals by EPA 200.8 - Water

Sample Type **DUP** Units: mg/L

Sample ID	RunNo: 89240	Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual
S1211023-001BD	11/05/12 17:31	Arsenic	ND	0.005	ND			20	
		Barium	0.253	0.005	0.256	1.22		20	
		Cadmium	ND	0.002	ND			20	
		Lead	ND	0.02	ND			20	
		Selenium	ND	0.005	ND			20	
		Silver	ND	0.003	ND			20	

pH Water

Sample Type **LCS** Units: s.u.

Sample ID	RunNo: 89228	Analyte	Result	RL	Spike	Ref Samp	%REC	% Rec Limits	Qual
ATQC	11/05/12 11:58	pH	8.6	0.1	8.6		100	90 - 110	

Sample Type **DUP** Units: s.u.

Sample ID	RunNo: 89228	Analyte	Result	RL	Ref Samp	%RPD	%REC	% RPD Limits	Qual
S1211014-009AD	11/05/12 13:12	pH	7.9	0.1	7.9	0.0226		20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
L	Analyzed by a contract laboratory	ND	Not Detected at the Reporting Limit
O	Outside the Range of Dilutions	R	RPD outside accepted recovery limits
S	Spike Recovery outside accepted recovery limits		

Attachment 3

Soil Test Results

GEOMAT INC
915 Malta Avenue ◆ Farmington, NM 87401 ◆ Tel (505) 327-7928 ◆ Fax (505) 326-5721

June 7, 2012

Daniel R. Manus
Black Hills Gas Resources
3200 North 1st Street
Bloomfield, New Mexico 87413

RE: East Blanco Produced Water Reuse Facility Site
Section 13, T30N, R4W
Rio Arriba County, New Mexico
GEOMAT Project No. 122-1468

As requested, GEOMAT Inc. has completed laboratory testing of a soil sample from the above referenced project. The sample tested was a continuous sampler split spoon sample obtained from 0 to 10 feet in boring B-4 located at latitude 36.81464 and longitude -107.20715. The test results are presented below.

Sieve Analysis (ASTM C117, C136)		**Atterberg Limits (ASTM D4318)**	
Sieve Size	% Passing	Liquid Limit	38
No. 4	100	Plastic Limit	14
No. 8	100	Plasticity Index	24
No. 10	99	**Hydraulic Conductivity (ASTM D5084)***	
No. 16	99	Average	3.1 E-05 cm/sec
No. 30	95	**Porosity****	
No. 40	91	Percent Voids	28.9%
No. 50	88	**Moisture-Density Relationship (ASTM D698)**	
No. 100	80	Maximum Dry Density	111.7 pcf
No. 200	70	Optimum Moisture Content	14.8%
Classification of Soil (ASTM D2487)		**Remolded Swell Potential*****	
CL, Sandy Lean Clay		Swell	6.9%

*measured on sample remolded to 95% of 111.7 pcf @ 14.8% moisture content

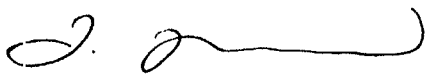
**performed on a trimmed split spoon sample and may not be representative of in situ conditions

***measured on sample remolded to 95% of 111.7 pcf @ 11.8% moisture content (3% below optimum)

We understand this testing was performed to provide an approximation of the various engineering parameters of the existing soils at the site and that further sampling and testing may be required.

Thank you for the opportunity to work with you on this project. If you have any questions or need additional information, please let us know.

Respectfully submitted,
GEOMAT Inc.



Thomas Madrid
Construction Services Manager

Copies to: Addressee (1); Shawn Higley, P.E., WWC Engineering (1);

Appendix L

Pond Volume Reports

```
**********************************************************************
**                                                                  **
** Plane to Object Volume Report -- Tue Dec 18 09:06:02 2012        **
**                                                                  **
** From Elevation <6998.000> to Object <Tilted Ponds>               **
**                                                                  **
** Prismoidal Volume                                                **
**                                                                  **
**                                                                  **
**********************************************************************
**                                                                  **
**  Total Cut =          9.9749 Acre Feet                           **
**  Total Fill =         0.0000 Acre Feet                           **
**  Area =               39755.115 Sq Feet                          **
**  Balance =            9.9749 Acre Feet                           **
**                                                                  **
** No Quantity Depth Used                                           **
** Boundary Polygon Used                                            **
**********************************************************************
```

```
**********************************************************************
**                                                                  **
** Plane to Object Volume Report -- Tue Dec 18 09:04:25 2012        **
**                                                                  **
** From Elevation <6990.000> to Object <Tilted Ponds>               **
**                                                                  **
** Prismoidal Volume                                                **
**                                                                  **
**                                                                  **
**********************************************************************
**                                                                  **
**  Total Cut =          9.9749 Acre Feet                           **
**  Total Fill =         0.0000 Acre Feet                           **
**  Area =               39755.115 Sq Feet                          **
**  Balance =            9.9749 Acre Feet                           **
**                                                                  **
** No Quantity Depth Used                                           **
** Boundary Polygon Used                                            **
**********************************************************************
```

```
**********************************************************************
**                                                                  **
** Plane to Object Volume Report -- Tue Dec 18 08:57:48 2012        **
**                                                                  **
** From Elevation <6985.000> to Object <Tilted Ponds>               **
**                                                                  **
** Prismoidal Volume                                                **
**                                                                  **
**                                                                  **
**********************************************************************
**                                                                  **
**  Total Cut =          9.9749 Acre Feet                           **
**  Total Fill =         0.0000 Acre Feet                           **
**  Area =               39755.115 Sq Feet                          **
**  Balance =            9.9749 Acre Feet                           **
**                                                                  **
** No Quantity Depth Used                                           **
** Boundary Polygon Used                                            **
**********************************************************************
```

Appendix M

Flood Analysis Report

Flood Hazard Analysis Report
East Blanco Produced Water Reuse Facility

Prepared for:

Black Hills Gas Resources
3200 N. 1st Street
Bloomfield, NM 87413

Submitted to:

New Mexico Energy, Minerals, &
Natural Resources Department
Oil Conservation Division
1220 S. St. Francis Drive
Santa Fe, NM 87505

Prepared by:

WWC ENGINEERING

1275 Maple Street, Suite F
Helena, MT 59601
(406) 443-3962

December 2012

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Flood Hazard Analysis
East Blanco
Produced Water Reuse Facility

INTRODUCTION

The East Blanco Produced Water Reuse Facility is designed for the collection of produced water from surrounding oil and gas operations so that it may be reused in hydraulic fracturing operations in lieu of fresh water. The proposed containment ponds are located approximately 11.6 miles southwest of Dulce, New Mexico in Section 13, T30N, R4W. The proposed facility is located approximately 450 feet west of an existing water disposal tank battery facility owned by Black Hills Gas Resources. The site will be accessed via a proposed access road 450 feet in length connecting to the tank battery facility.

The eastern edge of the proposed facility is located a minimum of 210 feet west of a small ephemeral channel that is a tributary to an ephemeral stream running through Cabresto Canyon. Both waterways are ephemeral and flow intermittently in response to precipitation and snowmelt events. The proposed facility is located in FEMA Flood Zone D as shown on the FEMA map provided in Attachment 1. This indicates that this area has possible but undetermined flood hazards. As required by 19.15.36 NMAC, the proposed facility shall not be located within a 100-year floodplain. Therefore, a flood hazard analysis has been conducted for the ephemeral drainage located within Espinosa Canyon to satisfy this requirement.

HYDROLOGY

The peak discharge from a 100-year event was determined using a regression equation for small drainage basins in New Mexico with an area of 10 square miles or less and a mean elevation basin elevation less than 7,500 feet. This regression equation was provided in a water-resources investigations report by Scott D. Waltemeyer and the U.S. Geological Survey in cooperation with the New Mexico State Highway and Transportation Department. The drainage area for the ephemeral stream located within Espinosa Canyon was determined to be approximately 1.55 square miles. Therefore, the peak discharge from a 100-year storm was determined to be 1,260.7 cfs based on the following regression equation:

$$Q_{100} = 1.03*10^{3}*A^{0.46}$$

Q_{100} = Peak discharge from a 100-year storm (cfs)
A = Drainage area (square miles).

HYDRAULICS

The hydraulics of the channel was analyzed using the hydraulic modeling software Bentley® Flowmaster which utilizes the Manning's Equation that provides a conservative normal depth flow calculation to determine the water surface elevation at a given flowrate and a given cross sectional area. The Manning's Equation is as follows:

$Q = (1.49/n)*A*R^{2/3}*S^{1/2}$
n = Coefficient of Roughness
A = Flow Area (ft^2)
R = Hydraulic Radius (ft)
S = Slope of Energy Line (ft/ft).

A conservative Manning's "n" value of 0.45 was assumed at each cross section. The detailed results from this hydraulic analysis are provided in Attachment 2. The results are summarized in Table 1 below.

Table 1. Hydraulic Results

Cross Section	Top of Bank Elevation (ft)	100-Year Water Surface Elevation (ft)
1	6981.51	6976.28
2	6969.97	6966.51
3	6962.48	6959.55

CONCLUSION

From Table 1, it is evident that the peak discharge from a 100-year storm will result in water level surface elevation below the top of bank elevations at each cross section location. The 100-year flood will be contained within the banks of the ephemeral drainage located within Espinosa Canyon. Therefore, the East Blanco facility is not located within a 100-year floodplain and will not be impacted by runoff events equal to or less than a 100-year recurrence interval frequency.

REFERENCES

Waltemeyer, Scott D. *Analysis of the Magnitude and Frequency of Peak Discharge and Maximum Observed Peak Discharge in New Mexico*. Water-Resources Investigations Report 96-41 12, Albuquerque, New Mexico: U.S. Geological Survey, Prepared in cooperation with the New Mexico State Highway and Transportation Department, 1996.

LEGEND

3 CROSS SECTION LOCATION

Figure 1

EAST BLANCO PRODUCED WATER REUSE FACILITY

100-Year Flood Analysis Cross Section Locations

DSGN	DATE	CKD
MRS	6/12	STH
REV	DATE	CKD

JOB # 2011-063

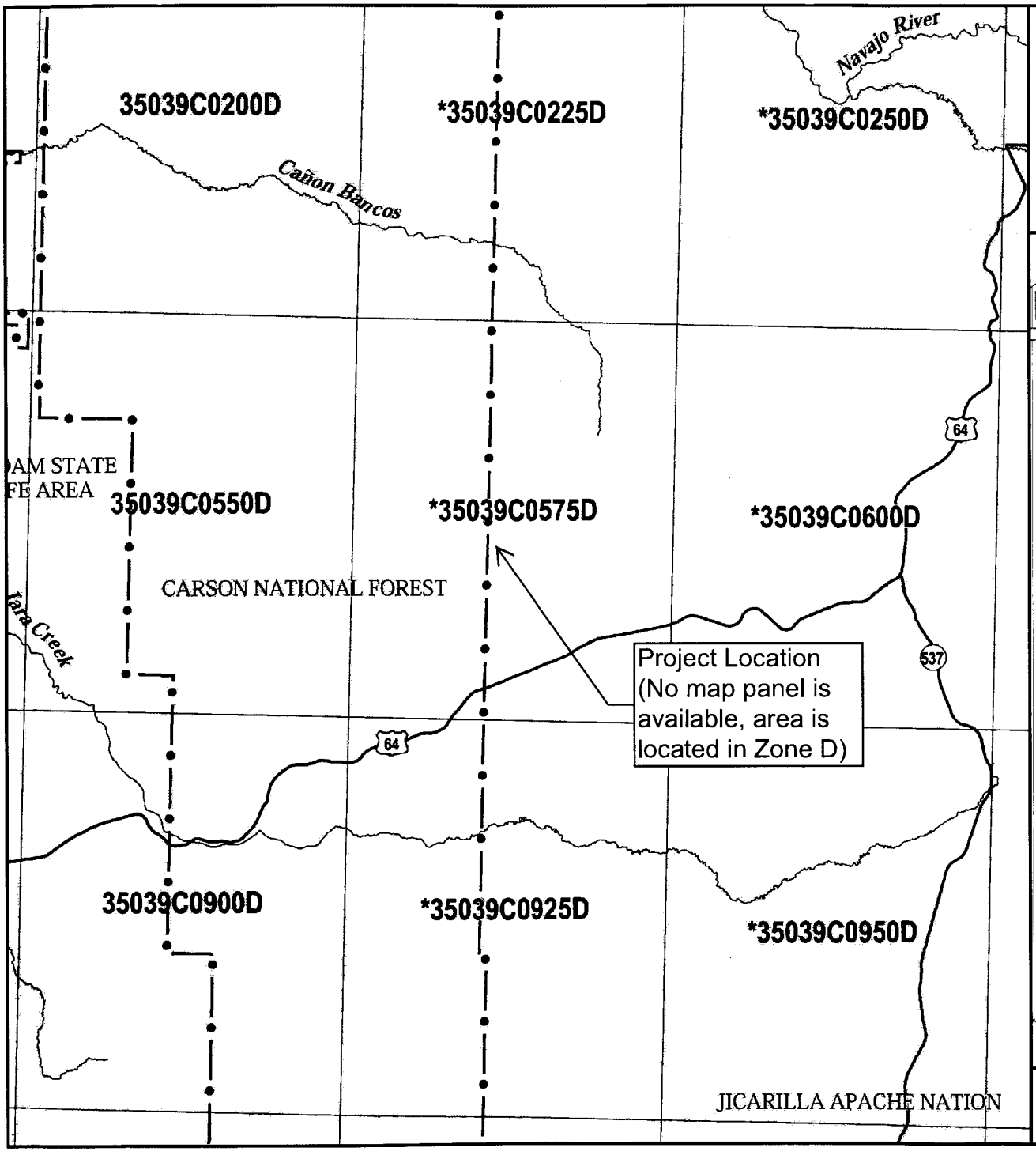
Black Hills Gas Resources
3200 N 1st Street
Bloomfield, NM 87413
(505) 634-5104

WWC ENGINEERING
1275 MAPLE STREET, SUITE F
HELENA, MT 59601
(406) 443-3962

PEN TABLE PATH: K:\BLACK HILLS\11063 - E. BLANCO FIELD\PDF\EAST BLANCO PLAN SET.tbl
12/21/2012 FILE PATH: K:\BLACK HILLS\11063 - E. BLANCO FIELD\DGN\East Blanco Field - Permit Exhibits 1.dgn

Attachment 1

FEMA Map



* PANEL NOT PRINTED - AREA IN ZONE D

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

MAP INDEX

FIRM

FLOOD INSURANCE RATE MAP

RIO ARRIBA COUNTY, NEW MEXICO

AND INCORPORATED AREAS

(SEE LISTING OF COMMUNITIES TABLE)

MAP INDEX

SHEET 1 OF 2

PANELS PRINTED: 25, 50, 125, 150, 175, 200, 275, 500, 525, 550, 625, 850, 875, 900, 1200, 1225, 1250, 1275, 1325, 1350, 1575, 1600, 1625, 1675, 1700, 1725, 1950, 1975, 2000, 2050, 2075, 2100, 2325, 2350, 2450

MAP NUMBER
35039CIND1A

EFFECTIVE DATE
MARCH 15, 2012

Federal Emergency Management Agency

Attachment 2

Hydraulic Analysis Results

Worksheet for Section 1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01720	ft/ft
Discharge	1260.69	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
7+50	6986.24
8+00	6984.06
8+50	6982.25
9+00	6982.56
9+22	6982.21
9+30	6980.42
9+43	6972.42
9+75	6972.88
9+94	6981.51
10+82	6980.99

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(7+50, 6986.24)	(10+82, 6980.99)	0.045

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	3.86	ft
Elevation Range	6972.42 to 6986.24 ft	
Flow Area	141.08	ft²

Worksheet for Section 1

Results

Wetted Perimeter		47.60	ft
Hydraulic Radius		2.96	ft
Top Width		45.76	ft
Normal Depth		3.86	ft
Critical Depth		3.63	ft
Critical Slope		0.02174	ft/ft
Velocity		8.94	ft/s
Velocity Head		1.24	ft
Specific Energy		5.11	ft
Froude Number		0.90	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.86	ft
Critical Depth	3.63	ft
Channel Slope	0.01720	ft/ft
Critical Slope	0.02174	ft/ft

Cross Section for Section 1

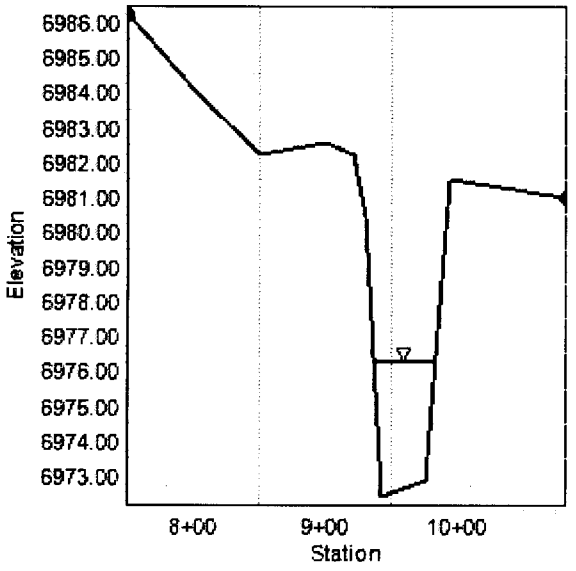
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01720	ft/ft
Normal Depth	3.86	ft
Discharge	1260.69	ft³/s

Cross Section Image



Worksheet for Section 2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00990	ft/ft
Discharge	1260.69	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
7+50	6973.84
8+00	6971.81
8+50	6970.62
8+70	6970.11
8+99	6958.16
9+24	6969.97
9+58	6969.62

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(7+50, 6973.84)	(9+58, 6969.62)	0.045

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	8.35	ft
Elevation Range	6958.16 to 6973.84 ft	
Flow Area	157.17	ft²
Wetted Perimeter	41.20	ft
Hydraulic Radius	3.81	ft
Top Width	37.65	ft

Worksheet for Section 2

Results

Normal Depth		8.35	ft
Critical Depth		7.21	ft
Critical Slope		0.02170	ft/ft
Velocity		8.02	ft/s
Velocity Head		1.00	ft
Specific Energy		9.35	ft
Froude Number		0.69	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth		0.00	ft
Length		0.00	ft
Number Of Steps		0	

GVF Output Data

Upstream Depth		0.00	ft
Profile Description			
Profile Headloss		0.00	ft
Downstream Velocity		Infinity	ft/s
Upstream Velocity		Infinity	ft/s
Normal Depth		8.35	ft
Critical Depth		7.21	ft
Channel Slope		0.00990	ft/ft
Critical Slope		0.02170	ft/ft

Cross Section for Section 2

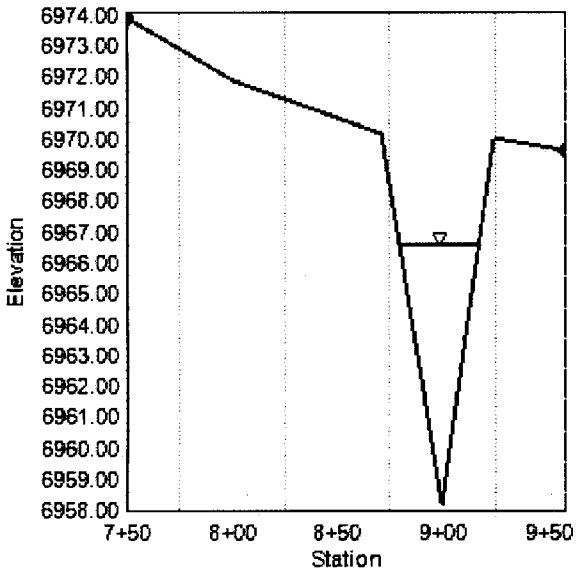
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00990	ft/ft
Normal Depth	8.35	ft
Discharge	1260.69	ft³/s

Cross Section Image



Worksheet for Section 3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01964	ft/ft
Discharge	1260.69	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
6+00	6964.57
6+50	6963.86
7+03	6962.48
7+30	6952.16
7+50	6963.11
8+00	6963.79

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(6+00, 6964.57)	(8+00, 6963.79)	0.045

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	7.39	ft
Elevation Range	6952.16 to 6964.57 ft	
Flow Area	121.38	ft²
Wetted Perimeter	36.10	ft
Hydraulic Radius	3.36	ft
Top Width	32.85	ft
Normal Depth	7.39	ft

Worksheet for Section 3

Results

Critical Depth		7.25	ft
Critical Slope		0.02179	ft/ft
Velocity		10.39	ft/s
Velocity Head		1.68	ft
Specific Energy		9.07	ft
Froude Number		0.95	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	7.39	ft
Critical Depth	7.25	ft
Channel Slope	0.01964	ft/ft
Critical Slope	0.02179	ft/ft

Cross Section for Section 3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01964	ft/ft
Normal Depth	7.39	ft
Discharge	1260.69	ft³/s

Cross Section Image