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MAJOR MODIFICATION Application

Redline / Strike-out Pages

June 11, 2009

06/11/09

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APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME I: PERMIT APPLICATION TEXT

REDLINE/STRIKE-OUT

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JUN 11 2009
Environmental Bureau
Oil Conservation Division

19.15.36 Surface Waste Management Facilities

APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME I: PERMIT APPLICATION TEXT
PART 36: SURFACE WASTE MANAGEMENT FACILITIES

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(13) in the case of an application to permit a new or expanded landfill, a gas safety management plan that complies with the requirements of Subsection O of 19.15.36.13 NMAC;

Not applicable.

(14) a best management practice plan to ensure protection of fresh water, public health, safety and the environment;

Volume II, Section 1; Operations, Inspection, and Maintenance Plan describes best management practices to ensure the protection of fresh water, public health, safety, and the environment.

Deleted: *The plans provided in Volume II*

(15) 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;**

*Regional and site-specific hydrogeologic data is provided in **Volume IV, Section 2; Hydrogeology,** in a report and supplements by John Shomaker & Associates (September 2008) entitled "Subsurface and Groundwater Investigation in support of the Modification of a Surface Waste Management Facility, Basin Disposal, Inc., Bloomfield, New Mexico".*

(16) certification by the applicant that information submitted in the application is true, accurate and complete to the best of the applicant's knowledge, after reasonable inquiry; and

*The certification is located in the preface of **Volume I** of this Application (Form C-137).*

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water is less than 50 feet below the lowest elevation at which the operator will place oil field waste.

(4) No small landfarm shall be located where ground water is less than 50 feet below the lowest elevation at which the operator will place oil field waste.

Not applicable. The BDI Facility is not a landfill or landfarm.

(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.

The regional ground water elevation at the facility is estimated to be at elevation 5600 feet. The lowest elevation in the ponds (Pond 3 Sump) is set at elevation 5707 feet, which provides more than 100' of separation distance, ***therefore BDI is in compliance with this requirement.***

Volume IV, Section 2; Hydrogeology *provides the Subsurface and Ground Water Investigation reports prepared by John Shomaker & Associates, Inc. (JSAI). Included in* ***Section 2*** *is the June 2009 update by JSAI that addresses specific comments by OCD in their 05/01/09 Request for Additional Information (RAI). These reports concluded that perched groundwater exists at 42.22' below ground level (bgl) in Assessment Well AW-1 and between 17.74' and 29.25' bgl in AW-2. However, the total dissolved solids (TDS) concentration are 38,000 mg/L and 29,000 mg/L in AW-1 and AW-2, respectively, which is significantly above the 10,000 mg/L TDS groundwater protection standard. As defined in 19.15.2.7.F.(3) NMAC and New Mexico Water Quality Commission (WQCC) regulation 20.6.2.3101.A NMAC, this saturated zone is not considered fresh water to be protected. BDI will comply with this requirement by utilizing existing and proposed liner system, operating procedures, and C/PC programs as demonstrated in* ***Volume III, Engineering Design and Calculations.***

B. No surface waste management facility shall be located:

(1) within 200 feet of a watercourse, lakebed, sinkhole or playa lake;

BDI is not located within 200 feet of a watercourse, lakebed, sinkhole or playa lake. *Documentation regarding location of watercourses, lakebeds, sinkholes and playa lakes is provided in* ***Volume IV, Section 1; Siting Criteria.***

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(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.

*The **Engineering Design (Volume III, Section 1)** and **Liner Construction Quality Assurance (CQA) Plan (Volume III, Section 2)** provide detailed specifications for the installation of geosynthetics in compliance with this section, including:*

- *Foundation preparation*
- *Maximum (3:1) and minimum slopes (2%)*
- *Thermal seaming and testing procedures*
- *Field seams that will be oriented parallel to the line of maximum slope.*
- *Minimizing the number of field seams in corners and irregularly shaped areas.*
- *No horizontal seams within five feet of the toe of slope.*

All liner systems will be installed by qualified contractors with a least 10 million square feet of geosynthetic installation experience.

(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.

*The liner details shown on the **Permit Plans (Volume III, Section 1)** indicate the methods used to protect the liner. To address the hydrostatic forces and potential mechanical damage to the primary liner as a result of pumping into or suction out of the lined ponds, an additional sheet of 60-mil HDPE liner will be welded overtop of the primary liner in the*

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*areas that these activities are expected to occur. The **Permit Plans** (Sheet 3, Grading Plan) have been updated to show the location of the additional 60-mil HDPE layer.*

(7) Primary liners shall be constructed of a synthetic material.

See response to 19.15.36.17.B.(3).

(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 x 10^{-8} cm/sec. The operator shall submit results of pre-construction testing to the division for approval prior to construction.

BDI is not proposing a secondary alternate liner constructed of a soil component. BDI is proposing to utilize a secondary liner option consisting of 60-mil HDPE. See response to 19.15.36.17.B.(4).

(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.

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BDI is proposing to install a leak detection system consisting of a 200-mil geonet between the primary and secondary liners. The geocomposite will have a minimum hydraulic conductivity (-k) of 10 cm/sec. Calculations, compatibility, and technical properties of the leak detection system are included in ***Volume III, Engineering Design and Calucations.*** ***Permit Plans (Volume III, Section 1)*** *provides design elements of the leak detection system including:*

- *Minimum 2% slope on the liner and leak detection system*
- *Solid and perforated pipe details*
- *Sump and riser pipe*
- *Composite liner (i.e., FML/GCL) under each leak detection sump*

The ***Engineering Design (Volume III, Section 1)*** *and the* ***Permit Plans*** *provide detailed specifications for the piping collection systems demonstrating that the materials exceed the prescriptive standards.*

(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.

BDI will provide a milestone schedule in advance of liner construction and notify the Division at least 72 hours prior to the primary liner installation.

(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.

BDI will comply with this requirement. ***Volume III, Engineering Design and Calculations*** *provides detailed calculations on wave action, rainfall, and freeboard analysis.*

(12) The maximum size of an evaporation or storage pond shall not exceed 10 acre-feet.

BDI will comply with this requirement. The proposed ponds are each approximately 9.5 acre-feet in capacity, not including freeboard.

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APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME I: PERMIT APPLICATION TEXT
PART 36: SURFACE WASTE MANAGEMENT FACILITIES

ATTACHMENT B

PUBLIC NOTIFICATION

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Draft Public Notice

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Notice of Major Modification- Basin Disposal, Inc. (BDI)

Pursuant to 19.15.36 NMAC, Oil Conservation Division Surface Waste Management Facilities regulations; Basin Disposal, Inc. (BDI) is providing notice that the Oil Conservation Division has deemed administratively complete an Application for Modification initially submitted by BDI on November 3, 2008.

(1) Applicant's name and address: Jerry Sandel, President Basin Disposal, Inc. P.O. Box 100, Aztec, NM 87410. Contact Mr. John Volkerding, General Manager Telephone: (505) 632-8936

(2) Facility location and address: 200 Montana Street, Bloomfield, NM 87413. Location of facility is approximately 3 miles north of the intersection of State Roads 550 and 64.

(3) Brief description of proposed surface waste management facility: The major modification includes the addition of two (2) evaporation ponds (approximately 4 acres each) constructed with 60-mil high density polyethylene (HDPE) primary liner, leak detection, and secondary liner systems. In addition, six (6) additional oil field waste liquid receiving tanks and two (2) oil sales tanks will be installed at the facility.

(4) Depth and quality of shallowest aquifer: The depth to the perched water zone beneath the site ranges from 29.25 feet in assessment well (AW) AW-1 to 42 feet in AW-2 with the total dissolved solids (TDS) determined to be 38,000 mg/l and 24,000 mg/l, respectively. Fresh water beneath the site is projected at a depth of at least 105' below the lowest elevation on-site.

Interested parties may contact Mr. Edward J. Hansen, OCD Hydrologist at (505) 476-3489 or Mr. John Volkerding, BDI General Manager at (505) 632-8936 for further information.

Deleted: Brad Jones

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APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME I: PERMIT APPLICATION TEXT
PART 36: SURFACE WASTE MANAGEMENT FACILITIES

ATTACHMENT C
FINANCIAL ASSURANCE

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Financial Assurance Documentation

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New Mexico Energy, Minerals and Natural Resources Department

Bill Richardson
Governor

Joanna Prukop
Cabinet Secretary
Reese Fullerton
Deputy Cabinet Secretary

Mark Fesmire
Division Director
Oil Conservation Division

December 29, 2008

Basin Disposal, Inc.
P.O. Box 100
Aztec, NM 87410

Re: $5,000 One-Well Plugging Bond
Basin Disposal, Inc., Principal
United States Fidelity & Guaranty Company, Surety
API 30-045-26862
Disposal No. 1
2207' FNL and 1870' FWL
Section 3, Township 29 North, Range 11 West
San Juan County, New Mexico
Bond No. 01-0130-10019-88-1

Dear Sir:

The New Mexico Oil Conservation Division hereby acknowledges receipt of and approves Rider dated January 1, 2008 increasing the bond amount to **$8,836** and acknowledges receipt of and approves Rider dated September 17, 2008 changing the bond number to **400KJ7084.** We also acknowledge receipt of Letter of Explanation from Woods Insurance Service advising that U. S. Fidelity and Guaranty Company was purchased by St. Paul Travelers who was later purchased by Travelers Casualty and Surety Company of America who now holds bond No. 400KJ7084.

Sincerely,

David K. Brooks

DAVID K. BROOKS
Assistant General Counsel

DKB/dp

cc: Oil Conservation Division – Aztec, NM

Travelers Casualty and Surety Company of America
One Tower Square 3PB
Hartford, CT 06183

06/11/09

APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME II: FACILITY MANAGEMENT PLANS

REDLINE/STRIKE-OUT

Section 1 Operations, Inspection, and Maintenance Plan

APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 1: OPERATIONS, INSPECTION AND MAINTENANCE PLAN

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3.0 GENERAL FACILITY INFORMATION

3.1 Land Use and Zoning

The BDI facility is located on a 28 ± acre tract in unincorporated San Juan County adjacent to the City of Bloomfield city limits (**Figure IV.1.8; Volume IV, Section 1**). The BDI site is surrounded by commercial/industrial businesses on three sides, and buffered by a bluff on the west side of the Facility. The closest permanent public residence is located approximately 1050 feet directly south. San Juan County does not have zoning on land use.

3.2 Access Control

Access control for BDI is provided by perimeter fencing that surrounds most of the 28 acre footprint, locking gates, and 24-hour employee presence. As part of BDI's standard operating practice, the perimeter fencing and gates will be checked for integrity (**Attachment II.1.D**). The Site Location Map is plotted on the most recent USGS map (**Figure II.1.1**) and shows the Facility location in relation to state roads and Bloomfield. The Site Plan, provided as **Figure II.1.2,** provides a plan view of the BDI facility with superimposed topography.

3.3 Site Signs

Signs are posted at the facility entrance and which indicate the location of the site, hours of operation, emergency telephone numbers, and delivery instructions. Additional existing site rules that are applicable to both BDI and customers are posted along the access roads to advise drivers of limitations concerning speed limits, prohibited activities, acceptable waste types, delivery instructions, and other health and safety precautions (**Figure 2; Volume I, 19.15.36**).

3.5 Traffic

Traffic for the BDI will have a nominal impact on current transportation patterns, estimated at 90 to 200 vehicles per day including staff. On-site Traffic flow for the BDI facility is depicted on **Figure II.1.3**.

5.0 OPERATIONAL PROCEDURES

The operational procedures for the BDI are designed to maximize the efficiency of waste receiving and processing; and to protect the health and safety of facility staff and delivery personnel. Detailed operational procedures are enumerated in each of the applicable sections of this Plan for oil field waste stream processing, contingency planning, recordkeeping, personnel training, etc. Oil field waste disposal waste operations will be conducted in a safe and environmentally sound manner is accordance with 19.15.36.17 NMAC.

5.1 Noise Control

Disposal operations take place in an area surrounded by businesses in the oil and gas industry which are familiar with the processes at the facility. The closest permanent residences are 1270 feet to the northeast, 1046 feet to the south and 1306 feet to the southeast, which minimize potential noise impacts generated by processing activities. In addition, mechanical equipment, such as the pumps and injection well, are located in fully enclosed buildings.

5.2 Odor Control

Prior to oil field waste acceptance, all vehicles are screened for the presence of H_2S. If H_2S is detected, the load is treated with CaOCl to lower the H_2S to non-measureable levels prior to unloading operations. In addition, at least 1,000 gallons of chemicals such as bleach are maintained on-site to control H_2S and its potential associated odors originating from the evaporation ponds.

5.3 Dust Control

The access roads and active areas within the facility will be treated with water or approved recycled waters as needed with a water truck to reduce dust. In addition, the posted speed is 15 mph inside the property. Listed below are routine operations that are the most likely sources of dust, along with recommended primary and secondary control measures:

- **Disposal Operations -**
  - Primary Control Measure: Apply water to unpaved roads as necessary, enforce speed posted limit on site.
  - Secondary Control Measure: Apply dust surfactant to unpaved portions of the facility, provide additional pavement.

- **Excavations -**
  - Primary Control Measure: Pre-water areas prior to excavation. Water areas of excavation and haul roads during and at end of day to form crust.
  - Secondary Control Measure: Phase work to reduce the amount of disturbed surfaces, apply additional water, work when wind velocity is low.
- **Stockpiles -**
  - Primary Control Measure: Pre-water areas prior to excavation. Apply water to short-term stockpiles to form crust.
  - Secondary Control Measure: Control vehicle access to the area. Apply dust surfactant to long term stockpiles and apply seed/mulch to prevent erosion.
- **Track out extending onto public roadways –**
  - Primary Control Measure: Paved on-site entrance road
  - Secondary Control Measure: Apply recycled asphalt, gravel pads or similar at the transition from unpaved to paved roadways.
- **Unpaved roadways and parking areas –**
  - Primary Control Measure: Limit vehicle speed via posting speed limits, apply water.
  - Secondary Control Measure: Apply surfactants to unpaved roads and parking lots, as needed, provide additional pavement.

5.4 Minor Spills/Releases

The spill or release of a potentially hazardous material at BDI is most likely to involve fuel or various vehicle maintenance materials (i.e., engine oil, hydraulic oil, antifreeze, etc.). Other materials most likely to present a concern as a result of normal operations include petroleum products and petroleum wastes brought into the facility. Spills involving these types of materials could occur during fueling, routine maintenance operations or during unloading or processing of waste. These minor spills will be cleaned up immediately upon discovery. BDI maintains on site a minor spill clean-up kit that contains absorbent materials, shovels, and small containment buckets. Waste materials resulting from the minor spill and clean-up will be handled and disposed of in accordance with the Facility Oil Field Waste Management Plan (**Volume II, Section 2**). Although highly unlikely, large spill/releases from pond and tanks on site may occur. The response procedures for this type of release are detailed in the Facility Contingency Plan (**Volume II, Section 5**).

Specifications for the spray systems, photos of a sprayer similar to the ones planned for installation at the BDI Evaporation Ponds, and specifications for the injection well are included in **Attachment II.1.B**. All receiving and storage tanks used at BDI will be leak-proof and manufactured of non-biodegradable materials including steel. Evaporation pond primary liner, leak detection and secondary liner systems are constructed of HDPE (**Volume III, Sections 1** and **2**).

7.0 INSPECTION AND MAINTENANCE

7.1 Evaporation Pond Leak Detection System

Inspection of the physical condition of the evaporation ponds is typically conducted on a daily basis as a matter of routine (**Attachment II.1.D**). A more thorough inspection of the leak detection system and sump will be conducted on a monthly basis and documented on the Pond Integrity/Leak Detection Inspection Form included in **Attachment II.1.C**. At a minimum the following items will be documented:

- Inspection date
- Inspector name
- Depth of liquids in sump
- Sump and piping condition and status

Prior to placing a newly constructed pond or an evaporation pond that has undergone repair or cleaning into service, liquids will be removed from above the primary liner and from the leak detection system. Once in service, it is anticipated liquid may be present at all times due to condensation and normal leakage through the primary liner. The sumps are 2 feet deep and have a capacity of 2255 gallons using a porosity of 0.65 for the granular material. **Attachment II.1.E** is a summary table from an authoritative publication on potential geomembrane liner leakage for 40 mil HDPE lined ponds. As shown on the table, the combined projected permeation/pinhole leakage rate ranges from 9.5 to 138 gal/acre/day. Using a very conservative value of 138 gal/acre/day for the combined leakage/permeation rate (**Attachment II.1.E**), this provides 16 days of storage at a depth of 2' in the sump. The rate of 138 gal/acre/day is considered very conservative as it is based on 40 mil HDPE (vs. the actual 60 mil); a fluid depth of 10'; and a high number of large pin holes. As additional protection, a GCL will be installed under the leak detection sumps (**Volume III, Section 1, Section 3.0 and Permit Plans**).

Initially BDI will monitor the liquid levels in the sumps every two (2) week immediately after ponds are put into service and documented. Should the lack of liquids become apparent after a series of inspections, the monitoring frequency will be extended to monthly. Upon discovery of excessive liquid presence in a leak detection system, the Division will be notified within 24 hours and the affected pond area drained. Prior to placing the pond back into service, the facility will initiate corrective action which may include but is not limited to:

- actions undertaken to locate source of leakage
- repair procedures
- additional sump liquid level monitoring and pumping frequencies
- liquids testing
- groundwater monitoring (if required)

Deleted: It is anticipated that up to 12 inches of liquid may be present at all time due to construction waters, etc. In newly constructed ponds, an initial sample and analysis will be taken to confirm lack of contaminates.¶
¶
Should any liquids be present above normal levels a sample will be obtained and analyzed with the results furnished to the Division. Upon discovery of excessive liquid presence in the leak detection system the affected pond will be drained and the Division will be notified and provided a plan of action to address and locate any significant leakage from the primary liner. ¶

7.2 Evaporation Pond Containment System

The structural physical condition is typically inspected on a daily basis as a routine matter (**Attachment II.1.D**). A more thorough inspection of the berms and the outside walls of pond levees will be conducted at least quarterly, and after any major rainfall or windstorm. For purposes of this inspection frequency, a major rainfall is defined as a documented 25-year, 24-hour rainfall event, and a major windstorm is defined as sustained wind speeds in excess of 45 miles per hour. The inspections will be documented and retained on the Pond Integrity/Leak Detection Inspection Form included in **Attachment II.1.C**. At a minimum the inspection shall consist of the following:

- Inspection date
- Inspector name
- Rainfall amount (if any)
- Wind speed and direction (if any)
- Damage assessment (if any)

The inspection will address any erosion, liner damage and any maintenance required with a timeframe to complete required repairs. In addition, the depth of sludge build-up in the bottom of the pond will be measured during the quarterly inspections and documented. Sludge in excess of twelve (12) inches will be removed and disposed of at an OCD approved facility.

7.5 Below-grade Tanks and Sumps

The two below-grade sumps are inspected on a daily basis with maintenance performed on an as-needed basis but not exceeding monthly. The inspections are documented on the BDI Daily Plant Operational Inspection form included as **Attachment II.1.D**. At a minimum the following items are checked during the daily inspection:

- Cover grate condition
- Primary holding tank liquid/sludge level
- Primary holding tank condition
- Secondary tank liquid level

8.0 EMERGENCY SITUATIONS AND EQUIPMENT BREAKDOWN

Response to emergency situations discovered during routine and scheduled inspections include the actions of the Emergency Coordinator, fire prevention and protection, incident response, and notification procedures as described in the BDI Contingency Plans (**Volume II, Section 5**).

8.1 Equipment Breakdown

In the ease of unplanned equipment downtime, the following measures will be deployed:

- Delivery of oil field waste may be delayed, using storage capacity available in the receiving tanks.
- Downtime associated with mobile equipment (i.e., skid-steer loader, forklift) will be addressed by deploying alternative on-site units (e.g., end loaders) and arrangements with local equipment vendors for immediate maintenance and lease of temporary replacement units.
- BDI's preventive maintenance plan has been highly effective at preventing unplanned downtime through routine inspection and regular maintenance of processing equipment.

9.0 RECORD KEEPING REQUIREMENTS

BDI is required to keep detailed records for this facility. In addition, the facility will meet the OCD requirements for reporting as detailed in the Management Plans provided elsewhere in this Application. All records will be retained for at least 5 years and made available for OCD review and inspection.

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APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 1: OPERATIONS, INSPECTION AND MAINTENANCE PLAN

ATTACHMENT II.1.E
LEAKAGE THROUGH LINERS CONSTRUCTED WITH GEOMEMBRANES – PART 1 GEOMEMBRANE LINERS

Attachment II.1.E

Title: Leakage Through Liners Constructed with Geomembranes - Part 1. Geomembrane Liners

Written by: J.P. Giroud and R. Bonaparte
Published in: Geotextiles and Geomembranes **Volume:** 8 **Issue:** 2 **Pages:** 27 to 67
Phone: +31 20-485-3757 ~ **Web Site:** http://www.elsevier.com

How impermeable are 'impermeable liners'? All liners leak, including geomembranes, but how much? What are the mechanisms of leakage through liners constructed with geomembranes? To answer these questions, a detailed review of leakage mechanisms, published and unpublished data, and analytical studies has been carried out with the goal of providing practical design recommendations. In particular, it appears that a composite liner (i.e. geomembrane on low-permeability soil) is more effective in reducing the rate of leakage through the liner than either a geomembrane alone or a soil liner (low-permeability soil layer) alone. However, the paper shows that the effectiveness of composite liners depends on the quality of the contact between the geomembrane and the underlying low-permeability soil layer.

Table 1
Calculated Leakage Rates Due to Pinholes and Holes in a Geomembrane

	Water depth on top of the geomembrane, h_w					
	Defect Diameter	0.003 m (0.01 ft)	0.03 m (0.1 ft)	0.3 m (1 ft)	3 m (10 ft)	30 m (100 ft)
Pinholes	0.1 mm (0.004 in)	0.006 (0.0015)	0.06 (0.015)	0.6 (0.15)	6 ((1.5))	60 (15)
	0.3 mm (0.012 in)	0.5 (0.1)	5 (1)	50 (13)	500 ((130))	5000 (1 300)
Holes [a]	2 mm (0.08 in)	40 (10)	130 (30)	400 (100)	1300 (300)	4000 (1 000)
	11.3 mm (0.445 in)	1 300 (300)	4 000 (1 000)	13 000 (3 000)	40 000 (10 000)	130 000 (30 000)
	Values of leakage rate in liters/day (gallons/day)					

Table 2
Calculated Unitized Leakage Rates Due to Permeation of Water Through an HDPE Geomembrane

	Water depth on top of the geomembrane, h_w					
	0 m (0 ft)	*0.003 m (0.01 ft)*	*0.03 m (0.1 ft)*	*0.3 m (1 ft)*	*3 m (10 ft)*	*>10 m (>30 ft)*
Coefficient of migration, m_g(m^2/s)	0	$9x10^{-20}$	$9x10^{-18}$	$9x10^{-16}$	$9x10^{-14}$	$3x10^{-13}$
Unitized leakage rate, q_q (m/s)	0	$9x10^{-17}$	$9x10^{-15}$	$9x10^{-13}$	$9x10^{-11}$	$3x10^{-10}$
(lphd)	0	$8x10^{-5}$	0.008	0.8	80	260
(gpad)	0	$8x10^{-6}$	0.0008	0.08	(8)	28

Notes: These values of utilized leakage rates were calculated using eqn (5) and assuming a geomembrane thickness of 1 mm (40 mils). The coefficients of migration used to calculate the unitized leakage rates in this table were obtained from eqns (19) and (20), with $C_1 = 1x10^{-22}$ m^4 $kg^{-2}s^3$, $n = 2$, and $m_{gmax} = 3x10^{-13}$ m^2/s.

The water depths used here correspond to the typical values defined in Section1.3.6. (To use eqn (19), it is necessary to know the pressure difference, Δp. According to eqn (1), water depths, h_w, are approximately equal to hydraulic head differences, Δh, which are related by eqn (12) to pressure differences, Δp.)

Section 2 Oil Field Waste Management Plan

APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 2: OIL FIELD WASTE MANAGEMENT PLAN

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c) Basin personnel shall not step onto the truck until the driver has placed the truck in park with the brake applied, opened the door, and has his/her legs outside the cab. This is to ensure the truck does not move while Basin personnel are on the truck.

d) Basin personnel shall wear neoprene or other heavy duty non-permeable gloves.

e) The cap shall be opened and the metal rod inserted to the bottom of the tank.

f) Care shall be exercised as H_2S may be present when the cap is opened. If there is any indication that H_2S may be present, the H_2S safety procedure shall be followed (**Volume II, Section 3**).

g) Based on whether the rod contacts the metal bottom of the tank or is slowed by sludge/solid material, Basin personnel will be able to gauge if the load may potentially be laden with sediment.

h) The metal rod shall be pulled out from the tank and the fluid on the rod examined for the presence of oils or other non-exempt materials.

i) Odor can also be an indication if the load contains fluids that are non-exempt. Non-exempt waste with potential odors include:

   a. Septic conditions

   b. Caustic or acid cleaners

   c. Methanol, unused

   d. Pesticide and herbicide wastes

   e. Solvents, spent (including waste solvents)

2. Presence of H_2S

   a) In the event H_2S is suspected, one of the H_2S monitors shall be used to determine the concentration (refer to specific owner's manual for operation instructions).

   b) The battery and calibration date shall be checked to ensure both are current.

   c) The tube wand shall be used to acquire a sample.

   d) Remaining as far away from the cap opening is essential to minimize the potential for exposure. Safety is the most important consideration when checking for H_2S.

   e) If H_2S is noted, the driver shall contact his firm to determine if the company wants Basin to treat the load.

   f) The truck will "roll" the load for 15-30 minutes (trucks use their air pumps to "roll" air through the tank to allow for mixing of the contents and the added calcium hypochlorite) and be tested again. Treatment will continue until the H_2S reading is below 1 ppm.

   g) BDI will contact the Plant Manager or General Manager if assistance is needed.

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Section 3 Hydrogen Sulfide (H_2S) Prevention and Contingency Plan

APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 3: HYDROGEN SULFIDE (H_2S) PREVENTION AND CONTINGENCY PLAN

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LIST OF ATTACHMENTS

Attachment No.	Title
II.3.A	MATERIAL SAFETY DATA SHEET FOR H_2S
II.3.B	BDI INSPECTION REPORT FORM
II.3.C	BDI DAILY AIR AND WATER INSPECTION REPORT FORM H_2S MONITOR
II.3.D	BDI INCIDENT REPORT FORM
II.3.E	OCD – RELEASE NOTIFICATION AND CORRECTION ACTION FORM C-141

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TABLE II.3.2
H_2S Exposure Health Risk

H_2S EXPOSURE LEVEL[1]	HEALTH RISK
Low (0-10 ppm)	Eye, nose, and throat irritation; coughing, shortness of breath, fluid in the lungs
Moderate (10-50 ppm)	Headache, dizziness, nausea and vomiting, coughing and breathing difficulty, loss of sense of smell
High (50-200 ppm)[2]	Severe respiratory tract irritation, loss of sense of smell, eye damage, shock, convulsions, coma, pulmonary edema (swelling and/or fluid accumulation in the lungs), death

[1]*General data obtained from www.safetydirectory.com*
[2]*NIOSH Immediate Danger to Life or Health (IDLH) is 100 ppm*

The oil field waste types, and engineering design and operating procedures specific to the Basin Disposal, Inc (BDI) facility will mitigate the release of H_2S in to the environment. The factors which inhibit releases include:

- Screening of existing and new deliveries
- Load inspections for the presence of H_2S as outlined in the Oil Field Waste Management Plan (**Volume II, Section 2**)
- Onsite H_2S treatment of incoming loads to ensure acceptance criteria of no measurable H_2S (< 1ppm) is met
- Constant evaporation pond testing
- Employee training

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The cornerstone of the Hydrogen Sulfide Prevention Plan for BDI consists of routine facility H_2S monitoring conducted for the evaporation ponds and incoming waste streams to ensure that the regulatory limits of H_2S are not exceeded. The monitoring is intended to confirm that H_2S concentration being accepted at the Facility is less than 1 ppm. This monitoring and treatment to-date has proven effective in reducing H_2S concentrations and eliminating the need for H_2S Plan implementation as described in 19.15.11.9 to address H_2S > 100 ppm and to follow API Recommended Practice 55 (RP-55), paragraph 7.6 to address H_2S > 30ppm (**Table II.3.3**).

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1.3 Regulatory Requirements: 19.15.36 NMAC and 19.15.3.118

The Surface Waste Management Facilities Regulations [19.15.36 NMAC] address the monitoring and management of H_2S in Sections 8.C.(8) and 13.N.

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Table II.3.3
API Recommended Practice 55

7.6 IMMEDIATE ACTION PLAN

Each contingency plan should contain a condensed "Immediate Action Plan" to .be followed by designated personnel any time they receive notice of a potentially hazardous hydrogen sulfide or sulfur dioxide discharge. For the protection of personnel (including the general public) and abatement of the discharge, this "Immediate Action Plan" should include, but not be limited to, the following provisions:

a. Alert and account for facility personnel.
   1. Move away from the hydrogen sulfide or sulfur dioxide source and get out of the affected area.
   2. Don proper personal breathing equipment.
   3. Alert other affected personnel.
   4. Assist personnel in distress.
   5. Proceed to the designated emergency assembly area.
   6. Account for on-site personnel.

b. Take immediate measures to control the present or potential hydrogen sulfide or sulfur dioxide discharge and to eliminate possible ignition sources. Emergency shutdown procedures should be initiated as deemed necessary to correct or control the specific situation. When the required action cannot be accomplished in time to prevent exposing operating personnel or the public to hazardous concentrations of hydrogen sulfide or sulfur dioxide, proceed to the following steps, as appropriate for the site specific conditions.

c. Alert the public (directly or through appropriate government agencies) that may be subjected to an atmosphere exposure exceeding 30 ppm[21] of hydrogen sulfide or 10[21] ppm of sulfur dioxide.

d. Initiate evacuation operations.

e. Contact the first available designated supervisor on the call list (refer to Par. 7.4.a). Notify the supervisor of circumstances and whether or not immediate assistance is needed. The supervisor should notify (or arrange for notification of) other supervisors and other appropriate personnel (including public officials) on the call list.

f. Make recommendations to public officials regarding blocking unauthorized access to the unsafe area and assist as appropriate.

g. Make recommendations to public officials regarding evacuating the public and assist as appropriate.

h. Notify, as required, state and local officials and the National Response Center to comply with release reporting requirements (i.e., 40 *Code* of *Federal Regulations Parts 302* and 355) (refer to Par. 4.4).

i. Monitor the ambient air in the area of exposure (after following abatement measures) to determine when it is safe for re-entry.

[21]Emergency Response Planning Guide Level 2 (ERPG-2), refer to Reference 27. ERPG-2 is defined as the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual's ability to take protective action.

Note: This sequence (Par. 7.6) should be altered to fit the prevailing situation. Certain actions, especially those dealing with the public, should be coordinated with public officials.

This Table is extracted from the American Petroleum Institute (API) Recommended Practices for Oil and Gas Producing and Gas Processing Plant Operations Involving Hydrogen Sulfide, Recommended Practice 55, Second Edition, February 15, 1995

Additionally, this H_2S monitoring program described herein is intended to demonstrate compliance with Section 8.C.(8), and the requirements of 19.15.11 NMAC and other permit conditions that may apply to this Facility. Should monitoring results identify unexpected concentrations of H_2S in excess of 100 ppm (RP-55 limit = 30 ppm) in a public area, the requirements of 19.15.11.8.C will be implemented and a Hydrogen Sulfide Contingency Plan specific to 19.15.11.9 will be implemented as required.

2.0 EMERGENCY COORDINATORS

BDI has designated specific specialists with the responsibility and authority to implement response measures in the event of an emergency which threatens freshwater, public health, safety or the environment [19.15.36.13.N(3) NMAC]. The Primary, Alternate, and on-site Emergency Coordinators (ECs; **Table II.3.4**) will be thoroughly familiar with all aspects of this Plan; operations and activities at the facility; location and characteristics of waste to be managed; the repository of all records within the facility; and the facility layout. **Table II.3.4** lists the names, designations, titles, home addresses, and office, home, and cellular phone numbers for each EC.

TABLE II.3.4
List of Emergency Coordinators
(Updated 08/2008)

Primary Emergency Coordinator

Name:	John Volkerding, Ph.D.	Work Phone: (505) 334-3013
Title:	General Manager	Home Phone: (505) 327-1061
Address:	4105 Skyline	Mobile Phone: (505) 320-2840
	Farmington, NM 87401	

Alternate Emergency Coordinator*

Name:	Jimmy Barnes	Work Phone: (505) 632-8936
Title:	Plant Manager	Home Phone: (505) 324-1164
Address:	3925 Rochester Ave	Mobile Phone: (505) 486-3078
	Farmington, NM 87402	

Onsite Emergency Coordinator*

Name:	Jimmy Barnes	Work Phone: (505) 632-8936
Title:	Plant Manager	Home Phone: (505) 324-1164
Address:	3925 Rochester Ave	Mobile Phone: (505) 486-3078
	Farmington, NM 87402	

**Or as designated by BDI.*

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- If the generator requests treatment, calcium hypochlorite (CaOCl) will be added to the load corresponding to **Table II.3.5.**
- Once the CaOCl has been added the load will be "rolled" (trucks use their air pumps to "roll" air through the tank to allow for mixing of the contents and the added calcium hypochlorite) to assist the chemical reaction. After 20 minutes, the load will be resampled for the presence of H_2S. Once the H_2S is below 1 ppm, the load will be directed to the receiving area for processing.

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TABLE II.3.5
H_2S Treatment for Vehicles[1]

H_2S PPM	CaOCl Coffee Cans Required
<50	1.0
50-100	1.5
100-150	2.0
150-200	2.5
200-250	3.0
250-300	3.5
300-350	4.0
350-400	4.5
400-450	5.0
450-500	5.5
500-550	6.0
550-600	6.5
600-650	7.0
650-700	7.5
700-750	8.0
750-800	8.5
800-850	9.0
850-900	9.5
900-950	10.0
950-1000	10.5

1- Typical volume of truck is 80 bbl. One coffee can equals 34.5 oz of product.

3.2 Evaporation Pond Monitoring

3.2.1 Stationary Monitors

Evaporation ponds are monitored for the presence of H_2S by recording at four stationary continuous monitors maintained at each side of each pond (**Figure II.3.3**). These monitors are wired directly to the office for remote observation. H_2S readings and wind speed/direction are logged and recorded twice daily on the BDI Daily Air and Water Inspection Form (**Attachment II.3.C**). Should the reading of H_2S exceed an action level

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above 1 ppm site personnel will notify the Emergency Coordinator who will implement the procedures outlined below; and if > 10 ppm the procedures in **Table II.3.6**.

- A second reading will be taken on the downwind berm within one hour
- The dissolved oxygen and dissolved sulfide levels of the pond will be tested immediately and the need for immediate treatment determined
- Tests for H_2S levels will be made at the fenceline downwind from the area of concern

If two (2) consecutive H_2S readings of 1 ppm or greater are recorded:

- The EC will notify the Aztec office of the OCD immediately **(Table II.3.1);**
- BDI will commence hourly monitoring on a 24-hour basis;
- BDI will lower the pond level so that the aeration system will circulate the entire pond
- BDI will obtain daily analysis of dissolved sulfides in the pond.

3.2.2 Dissolved Oxygen and pH Monitoring

Dissolved oxygen and pH levels are key indicators of the efficacy of treatment and removal of H_2S during the aeration process in the evaporation ponds. The chemical reaction of H_2S and oxygen to produce sulfate as an end product is dependent upon the level of both dissolved oxygen and the pH. Daily tests will be conducted and records made for each pond. If the pH falls below 8.0, remedial steps will be taken immediately to raise the pH. BDI at this time utilizes sodium hydroxide (caustic agent) to raise the pH to the desired level of 8.2-9.0. Dissolved oxygen levels will be tested on a daily basis to ensure a residual of 0.5 ppm is maintained. The dissolved oxygen level will be taken at the beginning of each day, or at least once per 24-hour period, one foot off the bottom of each pond at various locations and recorded. If any tests show a dissolved residual oxygen level of less than 0.5 ppm, immediate steps will be under taken to oxygenate the pond and create a residual oxygen pond level to at least 0.5 ppm. Remedial measures may include addition of chemicals or increased aeration. The pH readings are logged are recorded daily on the BDI Daily Air and Water Inspection Form (**Attachment II.3.C**).

4.0 IMPLEMENTATION, ASSESSMENT, AND NOTIFICATION

The following subsections present a series of procedures for implementation, assessment, and notification of appropriate authorities in the event that a H_2S emergency develops [19.15.11.9 NMAC].

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4.1 Implementation

The Contingency Plan will be implemented when an imminent or actual emergency situation develops that represents a potential impact to fresh water, public health, safety or the environment. The circumstances that could require implementation of this Plan includes the release of H_2S gas.

Table II.3.6 lists the implementation, assessment, and notification procedures that will be followed in the event of an emergency. Assessment and notification are discussed further in subsections 4.2 and 4.3.

TABLE II.3.6
Implementation, Assessment, and Notification Procedures for H_2S

1. **EVACUATE AREA AND NOTIFY THE ECs:** The employee who first becomes aware of the H_2S alarm will immediately evacuate the area, don protective personal breathing equipment and notify the Primary EC, and the Alternate EC and On-site EC if necessary. Notification will be made in person, via telephone, or via radio. The responding EC will assume full authority over the situation. Properly protected responders will then assist any affected personnel or customers.
2. **REMAIN UPWIND OF RELEASE:** Persons evacuated from the release area should remain away and upwind from the area of the release until a determination of the conditions has been made.
3. **ASSESS THE AMOUNT OF RELEASE:** The EC will assess the source, severity, and extent of the alarm. Monitoring equipment will be operated by trained personnel.
4. **MONITOR DOWNWIND IF H_2S = 10 PPM:** In the event a reading of 10 ppm is registered, the area will be evacuated and BDI personnel will monitor the H_2S levels along the downwind boundary of the facility.
5. **EVACUATE AND CLOSE THE FACILITY IF $H_2S \geq$20 PPM AT DOWNWIND BOUNDARY:** If levels reach 20 ppm at the downwind boundary, the facility will be evacuated and closed. Evacuation procedures are enumerated in **Table II.3.7** and a Site Evacuation Plan is provided as **Figure II.3.4**. Additionally, BDI will notify all persons residing within one-half mile of the fence line.
6. **NOTIFICATION OF AUTHORITIES:** Notification will be provided to the New Mexico State Police, Bloomfield Police, San Juan County Sheriff, San Juan County Fire Marshall, and OCD (**Table II.3.1**). In addition, medical authorities will be contacted if needed. BDI will also notify EnviroTech (if necessary) in Farmington (**Table II.3.1**) to provide response personnel, equipment, and supplies to mitigate the source of an H_2S reading of 10 ppm or greater.
7. **RECORDKEEPING:** BDI will log and report to the OCD all incidences where a reading of 10 ppm H_2S or greater is registered at the facilities boundary (also see Section 6.0).

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TABLE II.3.8
Evacuation Procedures

When evacuation is required, the following procedures will be followed:

1. Facility personnel will be alerted directly or using the facility telephone, cellular telephones, or radios.
2. Vehicles delivering waste will be diverted away from the location of the emergency and routed towards the facility exit (**Figure II.3.2**).
3. All facility operating equipment will be shut down.
4. Personnel will be directed to proceed to the Site Office, which will be the designated emergency response coordination location. The EC will identify missing persons at that time.
5. If the emergency involves the Site Office or its immediate environs, the intersection of NM 550 and Montana will be the secondary assembly point for facility personnel.
6. If the emergency precludes access to both, the Site Office and the intersection of NM 550 and Montana, personnel will evaluate the site via an auxiliary access gate at the west end of the facility.
7. Once assembled, personnel will stand by to afford assistance, if and as needed, or evacuate through Site Office.

4.3 Notification of Authorities and General Public

This Section provides a series of procedures for implementation and notification of appropriate authorities in the event that a specific emergency develops [19.15.11.16 NMAC]. Whenever there is an imminent or actual emergency, the EC will immediately contact on-site persons (facility personnel, visitors, vendors, transporters, etc.) of the emergency via on-site communication systems, as well as notify the appropriate state and local agencies as necessary. OCD will be notified within 4 hours after the Contingency Plan has been activated.

Table II.3.1 provides a list of emergency response agencies and contacts that may need to be notified depending on the type and extent of an emergency situation. **Table II.3.1** will be posted as appropriate and near on-site telephones for easy access by BDI personnel. Fire, police, and medical authorities will be contacted as necessary in an emergency situation (**Table II.3.1**).

In the case of an H_2S emergency where H_2S exceeds 10 ppm, notification will be provided to the New Mexico State Police, Bloomfield Police, San Juan County Sheriff, and OCD (also included on **Table II.3.1**):

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8.0 PLAN AMENDMENT

The EC will be responsible for assuring that updates to or amendments of the Contingency Plan are conducted and recorded in the event of any of the following [19.15.11.9.F NMAC]:

1. The Facility Permit is revised or modified.
2. Division mandate or regulatory updates
3. The Plan fails in an emergency.
4. Modification to the Facility design, construction, operation, maintenance or other circumstances that changes the potential for fires, explosion, or releases of hazardous oil field waste constituents; or related changes in the appropriate emergency response.
5. The list of ECs changes.
6. The list of emergency equipment changes significantly.

The revised Hydrogen Sulfide Prevention and Contingency Plan will be distributed to OCD and made available to each of the organizations identified in **Table II.3.1** with a cover letter highlighting any substantive changes. Proposed changes will be in compliance with 19.15.36 NMAC.

9.0 TRAINING

The EC or representative will ensure all new and existing employees are trained on the Hydrogen Sulfide Prevention and Contingency Plan at least annually or when significant changes to the Plan have been made, whichever is greater. Prior to any new employee commencing work, a training session separate from the standard annual training will be conducted to provide specific proficiency in H_2S safety and procedures. Training will include both classroom drills and field exercises simulating H_2S monitoring, releases, and evacuation procedures. Included in this training, H_2S hazards, detection, personal protection, and contingency procedures will be extensively covered.

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Section 4 Closure/Post-closure Plan

APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 4: CLOSURE/POST-CLOSURE PLAN

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3.0 CLOSURE PLAN

3.1 Construction Schedule

BDI will notify the Division's Environmental Bureau at least 60 days prior to cessation of permanent operations at the facility. Included in this notification will be a proposed schedule for sampling and closure activities. During the 60 day period after notification, it is anticipated BDI will coordinate the required site inspection by the Division. Additionally, during this period, BDI and the Division will review and modify any part of this C/PC plan and proposed schedule that may be required for the protection of fresh water, public health, safety or the environment that may result from the inspection. Should the Division not notify BDI of any modification or additions to the C/PC Plan, BDI will commence the following closure activities at the facility provided the Director has not extended, in good cause, the Division's response to the closure notification.

3.2 Liquids Removal

Liquids remaining in the evaporation ponds at time of closure will be disposed of in the on-site injection well. The injection well will remain in operation until all liquids are removed from the site. Although highly unlikely, should the injection well not be operational at time of closure, all remaining liquids will be removed from the ponds and disposed of in a Division-approved surface waste management facility.

3.3 Liner Removal

Upon successful liquids removal, the remaining sludge, if any, will be allowed to dry to a consistency that lends itself to handling and removal. Testing of the sludge will be performed prior to removal and disposal at a Division-approved surface waste disposal facility in conformance with current operating standards. Testing of the sludge will be for:

- TPH
- BTEX
- RCRA metals
- Paint Filter
- Chlorides
- Any other parameters required by the disposal facility

The sample results will be to the Environmental Bureau in the Division's Santa Fe office. Once the sludge has been removed, the HDPE liner systems components will be thoroughly

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cleaned in accordance with 19.15.35.8 NMAC. BDI proposes to cut the HDPE liner material and geocomposite into manageable pieces and transport the material to a New Mexico Environment Department approved recycling or disposal facility.

3.4 Tank Removal

Upon closure all tanks and equipment will be emptied and cleaned. BDI will test accordingly and dispose of the residual oil field waste removed from the tanks at a Division-approved surface waste management facility. BDI will reuse, recycle or remove the tanks, infrastructure, and equipment from the site within 90 days of closure.

3.5 Injection Well

Once all liquids from the site has been injected or properly disposed of, the injection well will be plugged in accordance with the Plugging and Permanent Abandonment rule 19.15.25.10 NMAC within 90 days of closure. The Division will be sent Form C-103 notification as required. The Closure/Post Closure Cost Estimate (**Attachment II.4.A**) and Financial Assurance Documentation (**Attachment II.4.B**) addresses the bond issued to the OCD for plugging of the on-site injection well.

3.6 Site Sampling

Once all tanks, equipment, liners and plugging of the injection well has been completed, but prior to backfilling ponds and site leveling, the site will be sampled in accordance with chapter nine of EPA publication SW-846; Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. **Figure II.4.2**, Sampling Grid, illustrates the proposed sampling grid at the BDI site after closure. Soil samples will be taken at selected locations in the areas used for shipping and receiving, treatment and storage areas, and the evaporation ponds area. The soil samples will be taken at selected depths within the in situ soil, including at least one from the first foot of soil and one within 36 to 42 inches below the surface. Samples will be evaluated for the following constituents:

- TPH
- BTEX
- Metals and organics listed in WQCC 20.6.2.3103.A&B

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APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 4: CLOSURE/POST-CLOSURE PLAN

ATTACHMENT II.4.B

FINANICAL ASSURANCE DOCUMENTATION

New Mexico Energy, Minerals and Natural Resources Department

Bill Richardson
Governor

Joanna Prukop
Cabinet Secretary
Reese Fullerton
Deputy Cabinet Secretary

Mark Fesmire
Division Director
Oil Conservation Division

December 29, 2008

Basin Disposal, Inc.
P.O. Box 100
Aztec, NM 87410

Re: $5,000 One-Well Plugging Bond
Basin Disposal, Inc., Principal
United States Fidelity & Guaranty Company, Surety
API 30-045-26862
Disposal No. 1
2207' FNL and 1870' FWL
Section 3, Township 29 North, Range 11 West
San Juan County, New Mexico
Bond No. 01-0130-10019-88-1

Dear Sir:

The New Mexico Oil Conservation Division hereby acknowledges receipt of and approves Rider dated January 1, 2008 increasing the bond amount to **$8,836** and acknowledges receipt of and approves Rider dated September 17, 2008 changing the bond number to **400KJ7084.** We also acknowledge receipt of Letter of Explanation from Woods Insurance Service advising that U. S. Fidelity and Guaranty Company was purchased by St. Paul Travelers who was later purchased by Travelers Casualty and Surety Company of America who now holds bond No. 400KJ7084.

Sincerely,

David K. Brooks

DAVID K. BROOKS
Assistant General Counsel

DKB/dp

cc: Oil Conservation Division – Aztec, NM

Travelers Casualty and Surety Company of America
One Tower Square 3PB
Hartford, CT 06183

Section 6 Migratory Bird Protection Plan

APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 6: MIGRATORY BIRD PROTECTON PLAN

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3.2 Human and Mechanical Intervention

Basin Disposal is manned by at least two employees 24 hours per day, 7 days per week, and 52 week per year. Plant Managers and employees are trained to make hourly inspection rounds making note of any migratory bird activity in or surrounding the evaporation ponds. In addition to these routine inspections, the office is situated in a manner with a full view of the Pond #1 (existing) which essentially ensures 24 hour observation of migratory bird activity. The proposed Ponds # 2 and 3 are eighty (80) percent visible from the office. BDI will continue to make hourly inspection rounds noting any migratory bird activity. Should BDI discover migratory bird activity, inspection and scare tactics frequency will be increased to alleviate the roosting of the birds.

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In order to prevent oil sheen accumulation on the surface if the ponds [19.15.36.17.C.(1) NMAC], BDI on a constant basis throughout each working day, removes visible oil layers from the evaporation ponds. This is accomplished by using booms to bring the oil sheen to the banks of the ponds which is then removed by vacuum trucks and returned to the skimmer tanks.

The typical operations do not lend the facility to migratory bird congregation. The site is open 24 hours per day, 7 days per week, and 364 (+/- 1) days per year. During this time, the spray evaporation systems are in full operation, truck traffic is constantly coming and going from the facility, pumps are transferring waters to and from the ponds, and normal operational human activity during inspections is constantly in motion.

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4.0 MIGRATORY BIRD LANDING CONTINGENCY

4.1 Migratory Bird Rescue

In the unlikely event a bird lands on the pond and becomes contaminated, BDI employees shall immediately utilize the boat and side ropes to retrieve the bird. Upon retrieval, BDI employees will transport the bird to the shop and either transported to a local veterinary clinic, or if only lightly soiled, oil may removed by BDI personnel using procedures adapted from those of the International Bird Rescue Research Center:

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06/11/09

APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME III: ENGINEERING DESIGN AND CALCULATIONS

REDLINE/STRIKE-OUT

Section 1 Engineering Design

APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME III: ENGINEERING DESIGN AND CALCULATIONS
SECTION 1: ENGINEERING DESIGN

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The same material will be used for the primary liner, and the geonet for the leak detection layer is comprised of HDPE as well. HDPE has proven to be the preferred material for waste containment facilities due to its durability and resistance to attack by waste constituents. **Volume III, Section 3** provides documentation regarding liner and leak detection material compatibility in compliance with §19.15.36.17.B.(3). An additional layer of 60 mil HDPE (22.5' x 60' ±) welded at the seams, will be added above the primary liner, where active wastewater discharge will occur (**Permit Plan Sheet 3**). This will protect the liner from excessive hydrostatic force or mechanical damage, and external discharge lines shall not penetrate the liner.

The CQA Plan (**Volume III, Section 2**) provides the most current technical specifications for the geosynthetics. The leak detection system layer design for BDI Ponds 2 and 3 consists of a 200 mil geonet specifically prescribed for these applications (**Permit Plan Sheet 8**). With a design transmissivity of 1×10^{-3} m^2/sec, it will provide fluid flow potential superior to the prescriptive leak detection layer of 2' of pervious soils [§19.15.36.17.B.(9)].

Both the underlaying 60 mil HDPE secondary liner, and the overlaying 60 mil HDPE primary liner, slope at 2% to the 2 leak detection sumps located in each pond (**Permit Plan Sheet 3**). Fluids collected in the leak detection layer, which encompasses the entire 4 ± acre footprint for each pond, are directed with the 2% slope to one of the two leak detection sumps located on the south sidewall (**Permit Plan Sheet 3**). Each of the sumps is approximately 2' deep, as measured from the secondary liner to the primary liner. The sumps consist of ¾" to 2" dia. pre-qualified select aggregate installed on a geotextile cushion placed over the secondary liner. Classification criteria for the aggregate are specified in the CQA Plan (**Volume III, Section 2**), which state that it not be angular (i.e., sharp edges which could damage the liners) or calcareous (which could degrade over time). In addition, each sump will be equipped with a secondary liner consisting of a geosynthetic clay liner (GCL), beneath the secondary liner as shown on **Permit Plan Sheets 3** and **7**. The purpose of the GCL is to provide a composite liner for temporary storage in the leak detection system, and GCL installation/CQA specifications are included in the CQA Plan (**Volume III, Section 2**).

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The fluids collected in the leak detection sumps will be monitored and collected by sidewall riser pipes that do not penetrate the secondary liner in compliance with §19.15.36.17.B.(9). The piping is demonstrated to resist degradation by the waste constituents as documented in **Volume III, Section 3**.

Piping will consist of min. 4" diameter SDR 11 HDPE; and will be perforated or slotted for the bottom 2' depth within the sump (i.e., 6' length at 3:1 slope). HDPE piping has shown superior characteristics for waste containment applications vs. the SCH 80 PVC specified in the OCD standards: and has a greater wall thickness as shown on **Table III.1.2.**

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Table III.1.2
Comparison of PVC and HDPE Pipe

	4" Diameter Leak Detection Riser Pipes	
Characteristic	**Schedule 80**	**SDR 11 HDPE**
Dimension Ratio	13.4	11.0
Method of Joining	Gasketed	Welded
Manning's Number (n)	0.009	0.010
Outside Diameter (in)	4.500	4.500
Min. Wall Thickness (in)	0.337	0.409
Tensile Strength (psi)	5,000	5,000
Modulus of Elasticity (psi)	400,000	130,000
Flexural Strength (psi)	14,450	135,000

The details in the Permit Plans (**Sheet 7, Details 1, 2, 3, 5** and **6**) have been updated to reflect the deployment of SDR 11 HDPE piping for the leak detection sump riser pipes.

HDPE or geonet layers will be placed beneath the beveled edge of the perforated riser in the sump profile to a minimum thickness of 200 mil to prevent potential liner damage (**Permit Plan Sheet 7**). Solid HDPE piping will extend from the riser pipe above the sumps to the permanent wellheads shown on **Permit Plan Sheet 7**. Clean select sand will be placed in the sidewall riser trench between the primary and secondary liners to provide structural stability of the solid riser pipe system and support for the primary liner (**Permit Plan Sheet 7**).

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OCD upon completion of construction.

6.0 POND OPERATION

Detailed plans for the operation of Ponds 2 and 3 are prescribed in **Volume II, Section 1**, "Operations, Maintenance, and Inspection Plan". Essentially, it is anticipated that some fluids will accumulate in the leak detection sumps as a result of condensation, construction water, etc. As described in **Volume II, Section 1**, the leak detection sumps will be monitored at least monthly for the presence of fluids, which may be extracted and tested when the level in the sump(s) exceeds 24". The design of Ponds 2 and 3 allows for isolation of potential leaks into 4 drainage basins, facilitating necessary evaluation or repair.

7.0 TANK SECONDARY CONTAINMENT

As proposed in this Application, two (2) additional oil sales tanks and six (6) receiving tanks will be installed. Detailed operations of the tanks are prescribed in **Volume II, Section 1**, "Operations, Maintenance, and Inspection Plan". The new tanks will be constructed with underlying continuous 30-mil polyester bermed liner systems, extended from the existing system and designed to capture any fluids within the watershed of Pond 1 (**Attachment III.1.C**).

The current secondary containment liner in the tank area is a 30-mil polyester liner (XR-5 8130 Reinforced Geomembrane). In the extension of the secondary containment within the tank area, a 30-mil polyester liner has been specified to allow welding between compatible materials (i.e., between the existing liner and the additional liner). The use of the XR-5 8130 Reinforced Geomembrane in the tank area is primarily based on the chemical compatibility and puncture resistance of the material compared to either PVC or HDPE material. The chemical resistance of the XR-5 material exceeds the chemical compatibility of either PVC or HDPE to hydrocarbon products (see Chemical Resistance Chart, Page 13, "Technical Data and Specifications for XR Geomembranes", **Attachment III.1.H**). Since PVC material has marginal chemical resistance in a hydrocarbon environment, physical properties of the XR-5 geomembrane (**Attachment III.1.H**) are compared to 60-mil HDPE geomembrane (**Attachment III.1.I**) as shown in **Table III.1.3**:

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Table III.1.3
Physical Properties
XR-5 8130 Reinforced Geomembrane and 60-mil HDPE Geomembrane

PROPERTY	XR-5 8130	60-MIL HDPE
THICKNESS	30-MIL	60-MIL
TEAR STRENGTH	40 LBS	42 LBS
PUNCTURE RESISTANCE	275 LBS	108 LBS
BREAK STRENGTH	400 LBS/IN	228 LBS/IN
BREAK ELONGATION	25%	700%
HYDROSTATIC RESISTANCE	800 PSI	> 450 PSI
HYDRAULIC CONDUCTIVITY	1×10^{-12} CM/SEC	2×10^{-13} CM/SEC
SEAM PROPERTIES		
SHEAR STRENGTH	500 LBS	120 LBS/IN
PEEL STRENGTH	40 LBS/2 IN	91 LBS/IN

The necessary storage capacity for the interconnected tank/containment system is sufficiently managed by the existing lined volume of Pond 1. In the unlikely event of a total catastrophic failure of all affected storage units, the contents of the tanks will flow into Pond 1, which has a lined storage capacity of 100,000 ± bbl (excluding freeboard). When the freeboard is included, the storage capacity of Pond 1 is over 135,000 bbl, which results in a net surplus of over 25,000 bbl. The entire volume of the receiving tanks, after installation of the six additional tank's surplus will be 8900 bbl, such that the net excess capacity is over 16,000 bbls. Thus, **Pond 1 will hold the entire volume of the receiving tanks within the required permanent freeboard of 3'.**

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Attachment III.1.D provides details for the containment area construction planned for completion prior to installing the additional six receiving tanks into operation. The seven (7) 440 bbl existing oil sales tanks are currently surrounded by a 30 mil polyester lined bermed area with dimensions of 140 feet long x 22 feet wide x 2.5 feet depth resulting in a capacity of 1370 bbl. With the addition of two oil sales tanks requested in this Application, the berm will be expanded to 180 feet long x 22 feet wide x 2.5 feet depth (**Attachment III.1.E**) resulting in a capacity of 1763 bbl.

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APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME III: ENGINEERING DESIGN AND CALCULATIONS
SECTION 1: ENGINEERING DESIGN

ATTACHMENT III.1.A

PERMIT PLANS

SHEET 1	SITE LOCATION AND DRAWING INDEX
SHEET 2	EXISTING SITE CONDITIONS
SHEET 3	GRADING PLAN
SHEET 4	CROSS SECTIONS
SHEET 5	DRAINAGE PLAN
SHEET 6	DRAINAGE CHANNEL PROFILES
SHEET 7	ENGINEERING DETAILS
SHEET 8	LINER DETAILS

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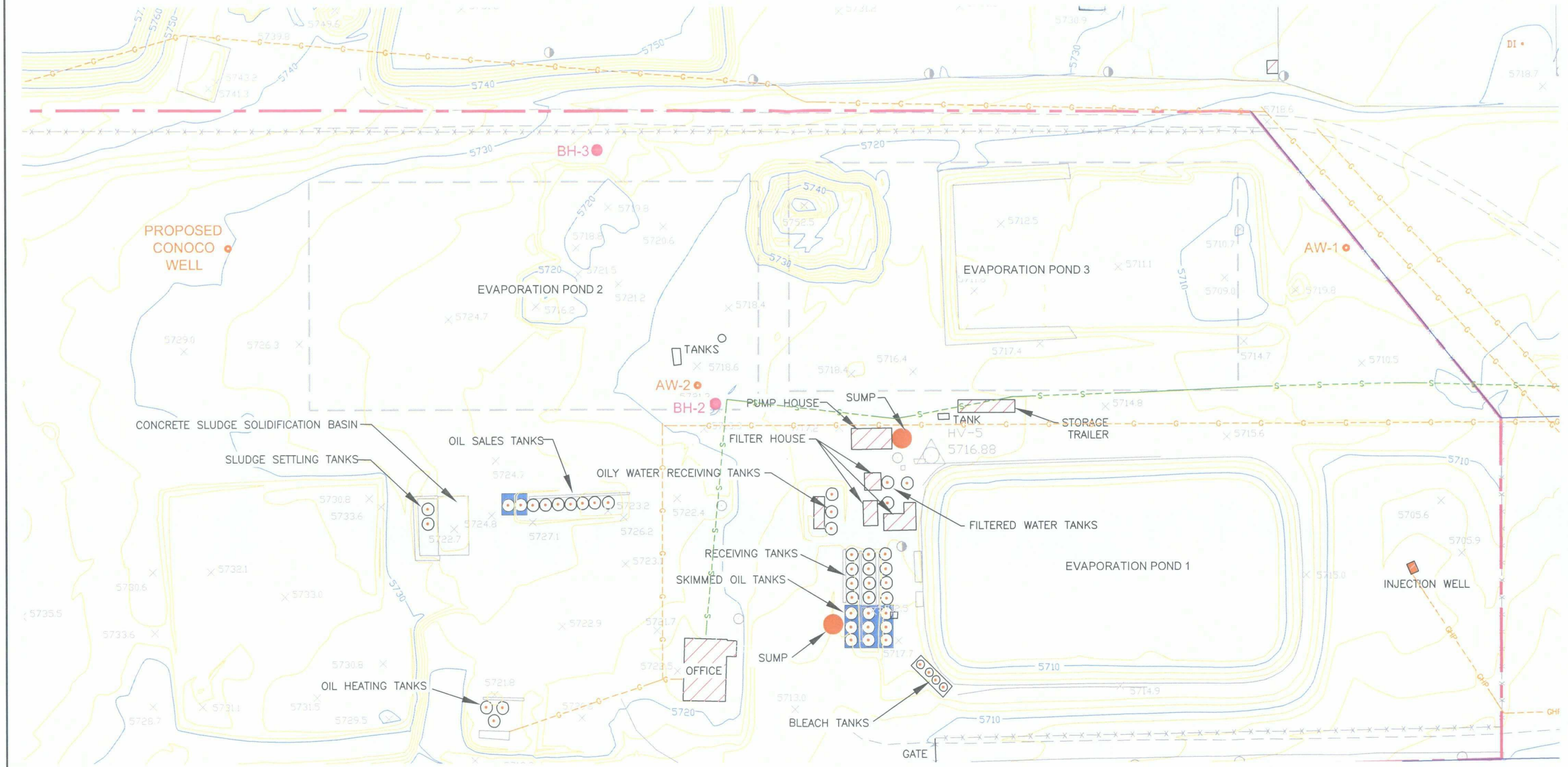

NOTES:

1. LOCATION OF SITE UTILITIES IS APPROXIMATE. LOCATIONS OF SITE UTILITIES WILL BE FIELD VERIFIED PRIOR TO CONSTRUCTION.
2. NOT FOR CONSTRUCTION

BOREHOLE LOCATIONS	
BH-2	LAT 36°45'20.54269"N (NAD 83) LONG 107°59'02.70950"W (NAD83) ELEV: 5717.98 (GROUND)
BH-3	LAT 36°45'22.92950"N (NAD 83) LONG 107°59'04.21563"W (NAD83) ELEV: 5727.46 (GROUND)
AW-1	LAT 36°45'22.01797"N (NAD 83) LONG 107°58'55.15402"W (NAD83) ELEV: 5717.85 (TOP OF CAP)
AW-2	LAT 36°45'20.58589"N (NAD 83) LONG 107°59'02.96163"W (NAD83) ELEV: 5722.20 (TOP OF CAP)

LEGEND

- SITE BOUNDARY
- 2' CONTOUR (EXISTING)
- 10 CONTOUR (EXISTING)
- 2' DEPRESSION CONTOUR (EXISTING)
- 10' DEPRESSION CONTOUR (EXISTING)
- UNPAVED ROADWAY (EXISTING)
- FENCE (EXISTING)
- 3" GAS LINE (EXISTING)
- SEWER LINE (EXISTING)
- GAS LINE (EXISTING)
- UTILITY EASEMENT
- STRUCTURE
- PROPOSED POND LOCATION
- PROPOSED NEW TANKS
- AW-1 ASSESSMENT WELL
- BH-3 BOREHOLE LOCATION
- TANKS
- LIGHT POLE
- POWER POLE
- HV-5 5716.89 SURVEY CONTROL POINT AND ELEVATION
- 5705.6 SPOT ELEVATIONS

NORTH

0 50' 100'

EXISTING SITE CONDITIONS

BASIN DISPOSAL, INC.
BLOOMFIELD, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 06/05/09	CAD: B 02 EXISTING.dwg	PROJECT #: 520.01.01
DRAWN BY: JFP	REVIEWED BY: MRH	SHEET 2 of 8
APPROVED BY: IKG	gei@gordonenvironmental.com	

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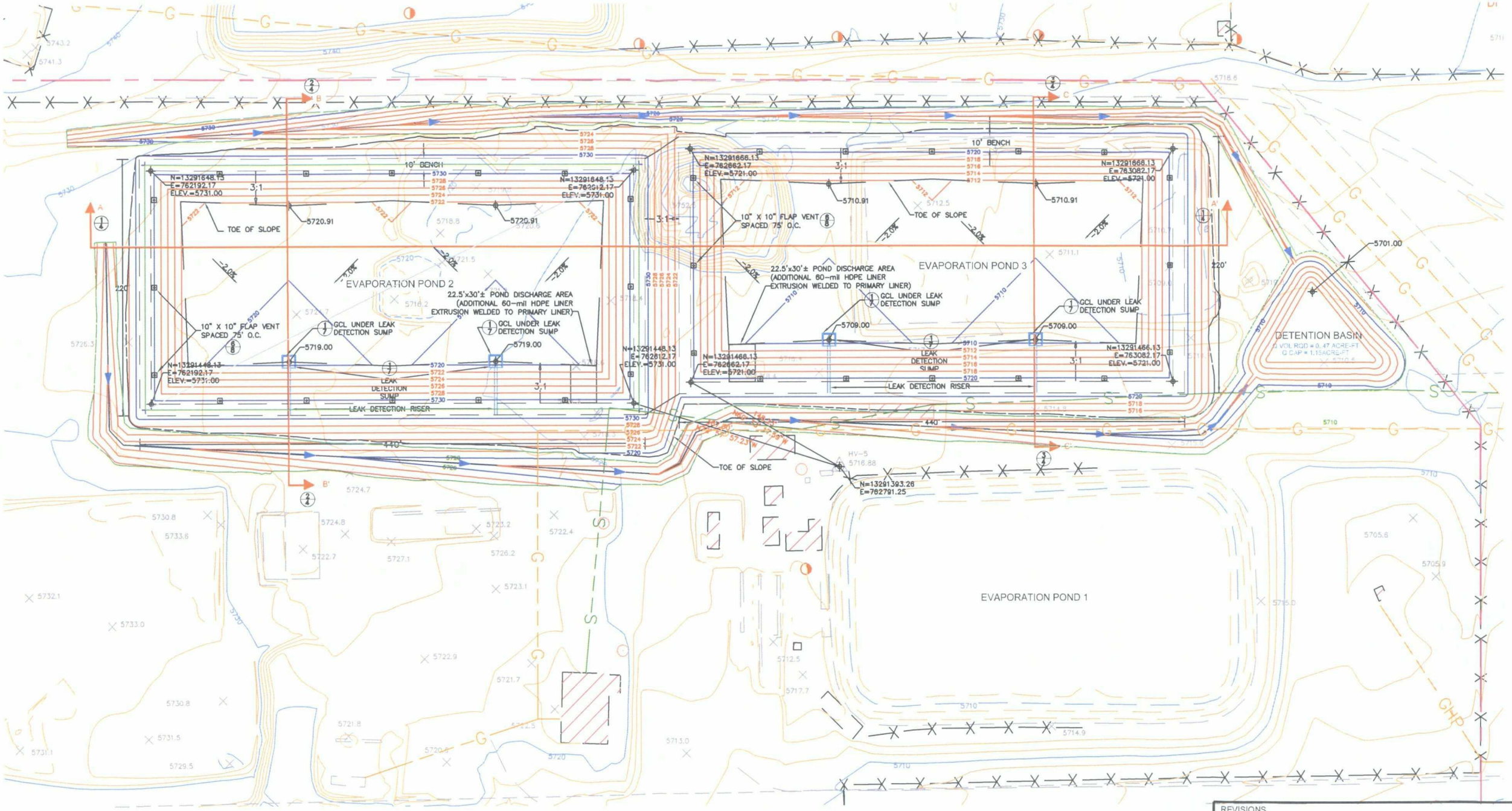


NOTES:

1. LOCATION OF SITE UTILITIES IS APPROXIMATE. LOCATIONS OF SITE UTILITIES WILL BE FIELD VERIFIED PRIOR TO CONSTRUCTION.
2. NOT FOR CONSTRUCTION

LEGEND

- SITE BOUNDARY
- 2' CONTOUR (EXISTING)
- 5700 10' CONTOUR (EXISTING)
- 2' DEPRESSION CONTOUR (EXISTING)
- 5700 10' DEPRESSION CONTOUR (EXISTING)
- 5720 DESIGN 10' CONTOUR
- 5716 DESIGN 2' CONTOUR
- UNPAVED ROADWAY (EXISTING)
- FENCE (EXISTING)
- CHANNEL FLOW LINE
- GHP 3" GAS LINE (EXISTING)
- S SEWER LINE (EXISTING)
- G GAS LINE (EXISTING)
- UTILITY EASEMENT
- CUT LIMIT
- FILL LIMIT
- LEAK DETECTION SUMP AND RISER PIPE
- FLAP VENT
- STRUCTURE
- 5705.6 SPOT ELEVATION (EXISTING)
- HV-5 5716.88 SURVEY CONTROL POINT AND ELEVATION
- 5711.04 SPOT ELEVATION (DESIGN)

NORTH

0 50' 100'

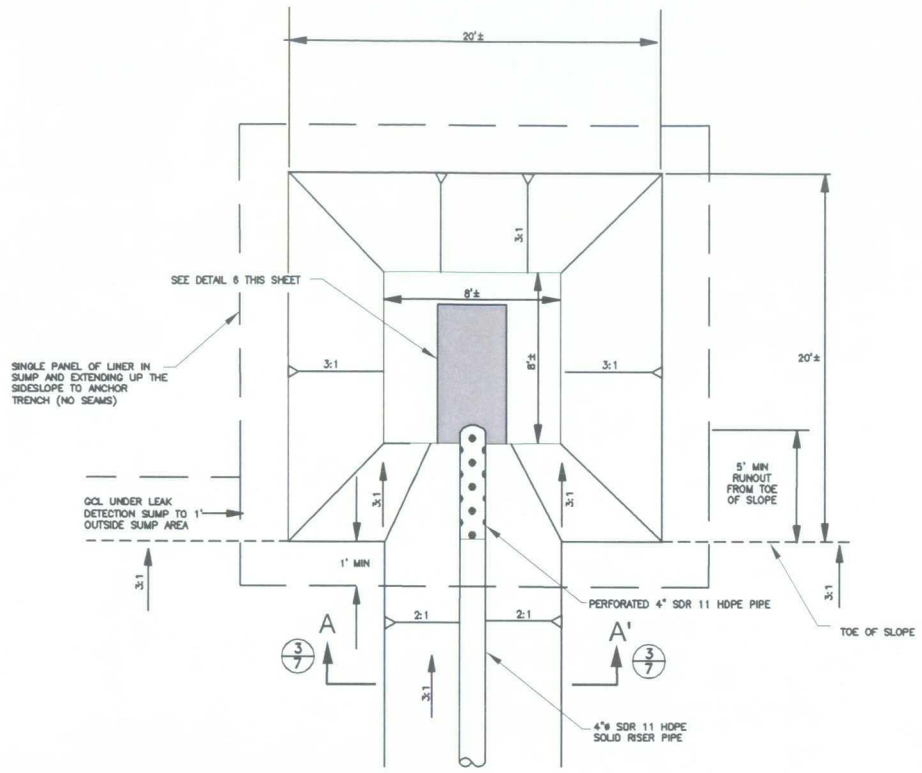
REVISIONS		
NO.	DATE	DESCRIPTION
1	05/13/09	ADD GCL UNDER LEAK DETECTION SUMP
2	05/13/09	ADD 60-mil HDPE LINER AT POND DISCHARGE AREA

GRADING PLAN

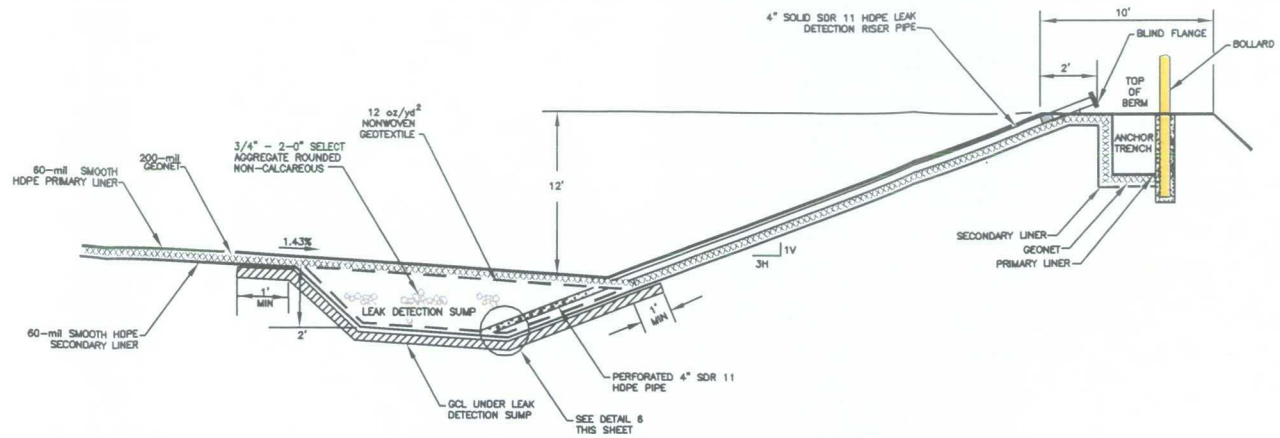
BASIN DISPOSAL, INC.
BLOOMFIELD, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

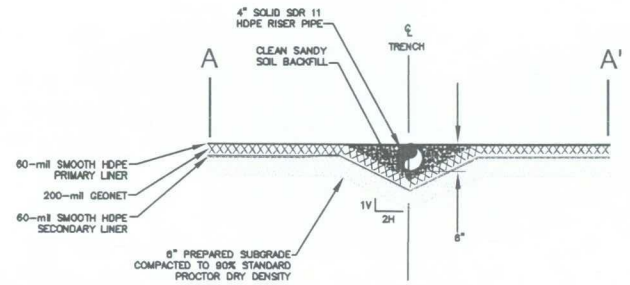
DATE: 11/19/08	CAD: 03 GRADING.dwg	PROJECT #: 520.01.01
DRAWN BY: JFP	REVIEWED BY: MRH	SHEET 3 of 8
APPROVED BY: IKG	gei@gordonenvironmental.com	



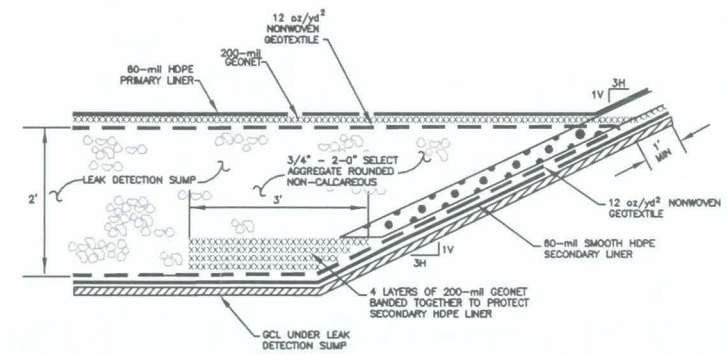
1/7 LEAK DETECTION SUMP
NOT TO SCALE



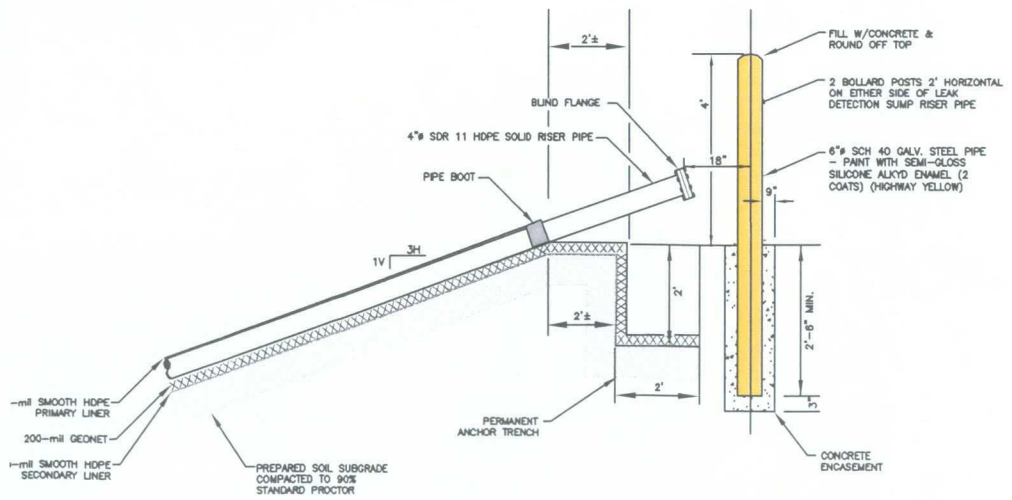
5/7 CROSS-SECTION AT LEAK DETECTION SUMP
NOT TO SCALE



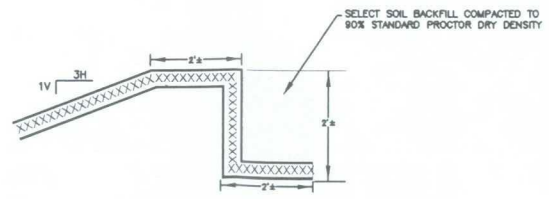
LEAK DETECTION SUMP RISER PIPE
CROSS SECTION A-A'
3/7
NOT TO SCALE



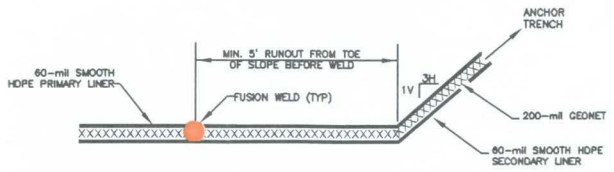
6/7 SUMP FLOOR DETAIL
NOT TO SCALE



2/7 LEACHATE COLLECTION SUMP RISER PIPE
SECTION VIEW
NOT TO SCALE



4/7 ANCHOR TRENCH DETAIL
NOT TO SCALE



7/7 LINER RUNOUT ON POND FLOOR
NOT TO SCALE

REVISIONS		
NO.	DATE	DESCRIPTION
1	05/13/09	ADD GCL UNDER LEAK DETECTION SUMP
2	05/13/09	ADD CLEAN SANDY SOIL BACKFILL IN LEAK DETECTION SUMP RISER PIPE TRENCH
3	05/13/09	SPECIFY SDR 11 HDPE PIPE

ENGINEERING DETAILS

BASIN DISPOSAL, INC.
BLOOMFIELD, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
Fax: 505-867-6991

DATE: 11/20/08	CAD: B 07 ENGR DET.dwg	PROJECT #: 520.01.01
DRAWN BY: JFP	REVIEWED BY: MRH	SHEET 7 of 8
APPROVED BY: IKG	gei@gordonenvironmental.com	

NOT FOR CONSTRUCTION

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APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME III: ENGINEERING DESIGN AND CALCULATIONS
SECTION 1: ENGINEERING DESIGN

ATTACHMENT III.1.G
PIPE WALL THICKNESS INFORMATION

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PVC PIPE DIMENSIONS

Nominal Pipe Size	Wall Thickness		Outside Diameters		
				Tolerance	
	Minimum	Tolerance	Average OD	Average	Out-of-Roundness
ASTM D 1785, PVC PIPE, SCHEDULE 40					
1	0.133	+0.020	1.315	±0.005	±0.010
1¼	0.140	+0.020	1.660	±0.005	±0.012
1½	0.145	+0.020	1.900	±0.006	±0.012
2	0.154	+0.020	2.375	±0.006	±0.012
2½	0.203	+0.024	2.875	±0.007	±0.015
3	0.216	+0.026	3.500	±0.008	±0.015
3½	0.226	+0.027	4.000	±0.008	±0.050
4	0.237	+0.028	4.500	±0.009	±0.050
5	0.258	+0.031	5.563	±0.010	±0.050
6	0.280	+0.034	6.625	±0.011	±0.050
8	0.322	+0.039	8.625	±0.015	±0.075
10	0.365	+0.044	10.750	±0.015	±0.075
12	0.406	+0.049	12.750	±0.015	±0.075
ASTM D 1785, PVC PIPE, SCHEDULE 80					
1	0.179	+0.021	1.315	±0.005	±0.010
1¼	0.191	+0.023	1.660	±0.005	±0.012
1½	0.200	+0.024	1.900	±0.006	±0.012
2	0.218	+0.026	2.375	±0.006	±0.012
2½	0.276	+0.033	2.875	±0.007	±0.015
3	0.300	+0.036	3.500	±0.008	±0.015
3½	0.318	+0.038	4.000	±0.008	±0.015
4	0.337	+0.040	4.500	±0.009	±0.015
5	0.375	+0.045	5.563	±0.010	±0.030
6	0.432	+0.052	6.625	±0.011	±0.035
8	0.500	+0.060	8.625	±0.015	±0.075
10	0.593	+0.071	10.750	±0.015	±0.075
12	0.687	+0.082	12.750	±0.015	±0.075
ASTM D 2241, PVC PIPE (SDR-PR), SDR 21 (200)					
1	0.063	+0.020	1.315	±0.005	±0.015
1¼	0.079	+0.020	1.660	±0.005	±0.015
1½	0.090	+0.020	1.900	±0.006	±0.030
2	0.113	+0.020	2.375	±0.006	±0.030
2½	0.137	+0.020	2.875	±0.007	±0.030
3	0.167	+0.020	3.500	±0.008	±0.030
3½	0.190	+0.023	4.000	±0.008	±0.050
4	0.214	+0.026	4.500	±0.009	±0.050
5	0.265	+0.032	5.563	±0.010	±0.050

PIPE INFORMATION: minimum wall, inches
weight per foot pounds
nominal I.D., inches

O.D., inches nominal	actual	7	7.3	9	9.3	11	11.5	13.5	15.5	17	21	26	32.5
		0.120	0.115	0.093	0.090	0.076	0.073						
1/2	0.840	0.12	0.11	0.09	0.09	0.08	0.08						
		0.590	0.601	0.646	0.652	0.681	0.688						
		0.150	0.144	0.117	0.113	0.095	0.091						
3/4	1.050	0.18	0.18	0.15	0.14	0.12	0.12						
		0.738	0.751	0.807	0.815	0.851	0.860						
		0.188	0.180	0.146	0.141	0.120	0.114						
1	1.315	0.29	0.28	0.23	0.22	0.19	0.19						
		0.924	0.940	1.011	1.021	1.066	1.077						
		0.237	0.227	0.184	0.178	0.151	0.144	0.123					
1 1/4	1.660	0.46	0.44	0.37	0.36	0.31	0.30	0.26					
		1.167	1.187	1.276	1.289	1.346	1.360	1.404					
		0.271	0.260	0.211	0.204	0.173	0.165	0.141	0.123				
1 1/2	1.900	0.60	0.58	0.48	0.47	0.40	0.39	0.33	0.29				
		1.335	1.359	1.461	1.475	1.541	1.556	1.607	1.645				
		0.339	0.325	0.264	0.255	0.216	0.207	0.176	0.153	0.140			
2	2.375	0.93	0.90	0.75	0.73	0.69	0.61	0.52	0.46	0.42			
		1.669	1.698	1.826	1.844	1.926	1.945	2.009	2.056	2.084			
		0.500	0.479	0.389	0.376	0.318	0.304	0.259	0.226	0.206	0.167	0.135	
3	3.500	2.03	1.96	1.64	1.59	1.37	1.32	1.14	1.00	0.92	0.75	0.61	
		2.460	2.503	2.691	2.717	2.838	2.867	2.961	3.030	3.072	3.153	3.220	
		0.643	0.616	0.500	0.484	0.409	0.391	0.333	0.290	0.265	0.214	0.173	0.138
4	4.500	3.35	3.24	2.71	2.63	2.26	2.17	1.88	1.65	1.52	1.24	1.01	0.82
		3.163	3.218	3.460	3.494	3.649	3.686	3.807	3.896	3.949	4.054	4.140	4.212
		0.795	0.762	0.618	0.598	0.506	0.484	0.412	0.359	0.327	0.265	0.214	0.171
5	5.563	5.13	4.95	4.13	4.02	3.46	3.32	2.87	2.53	2.32	1.90	1.55	1.25
		3.910	3.978	4.277	4.319	4.511	4.557	4.706	4.816	4.882	5.012	5.118	5.207
		0.946	0.908	0.736	0.712	0.602	0.576	0.491	0.427	0.390	0.315	0.255	0.204
6	6.625	7.27	7.02	5.86	5.70	4.91	4.71	4.07	3.58	3.29	2.69	2.20	1.77
		4.656	4.737	5.094	5.143	5.372	5.427	5.604	5.736	5.814	5.969	6.095	6.201
		1.232	1.182	0.958	0.927	0.784	0.750	0.639	0.556	0.507	0.411	0.332	0.265
8	8.625	12.32	11.90	9.94	9.66	8.42	7.99	6.90	6.07	5.57	4.56	3.72	3.00
		6.062	6.167	6.632	6.696	6.994	7.065	7.296	7.468	7.570	7.771	7.935	8.073
		1.536	1.473	1.194	1.156	0.977	0.935	0.796	0.694	0.632	0.512	0.413	0.331
10	10.750	19.14	18.48	15.44	15.00	12.92	12.41	10.72	9.48	8.65	7.00	5.66	4.66
		7.556	7.687	8.266	8.346	8.717	8.806	9.094	9.307	9.435	9.685	9.890	10.062

APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME III: ENGINEERING DESIGN AND CALCULATIONS
SECTION 1: ENGINEERING DESIGN

ATTACHMENT III.1.H

TECHNICAL DATA AND SPECIFICATIONS FOR XR GEOMEMBRANES

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Technical Data and Specifications for

XR® Geomembranes

XR-3®
XR-5®
XR-3® PW

Industrial, Municipal and Potable Water Grade Geomembranes

Seaman Corporation
1000 Venture Blvd.
Wooster, Ohio 44691
(330) 262-1111
www.xr-5.com

Seaman Corp. XR Geomembranes

Section 1 - Product Overview/Applications

- All XR Geomembrane products are classified as an Ethylene Interpolymer Alloy (EIA)
- XR-5 grade is high strength and chemically resistant for maximum resistance to high temperature, and broad chemical resistance, including acids, oils and methane
- XR-3 grade for moderate chemical resistant requirement applications such as stormwater and domestic wastewater
- NSF 61 approved XR-3 PW grade for potable water contact
- Heat weldable-thermal weldable for seams as strong as the membrane. Factory panels over 15,000 square feet (1400 sq meters) for less field seaming
- Stability is excellent, with low thermal expansion-contraction properties
- 30+ year application history

Product Application Chart

	XR-5			XR-3	XR-3 PW
	8130	**8138**	**6730**	**8228**	**8130**
High Puncture Resistance	X	X	X		X
UV Resistance	X	X	X	X	X
High Strength Applications	X	X	X		X
Floating Covers (Nonpotable)	X	X	X	X	
Diesel/Jet Fuel Containment	X	X	X		
Industrial Wastewater	X	X	X		
Stormwater	X	X	X	X	
Municipal/Domestic Wastewater	X	X	X	X	
Floating Diversion Baffles/Curtains	X		X		X
Potable Water					X
<-65 Deg F Applications	Contact Seaman Corp.				
Chemically Resistant Applications	X	X	X		

Section 2 - Physical Properties

Part 1- Material Specifications

Property	Test Method	8130 XR-5	8138 XR-5	6730 XR-5
Base Fabric Type Base Fabric Weight	ASTM D 751	Polyester 6.5 oz/yd² nominal (220 g/m² nominal)	Polyester 6.5 oz/yd² nominal (220 g/m² nominal)	Polyester 7 oz/yd² nominal (235 g/m² nominal)
Thickness	ASTM D 751	30 mils min. (0.76 mm min.)	40 mils nom. (1.0 mm nom.)	30 mils min. (0.76 mm min.)
Weight	ASTM D 751	30.0 +- 2 oz/sq yd (1017 +- 2 g/m²)	38.0 +- 2 oz/sq yd (1288 +- 70 g/m²)	30.0 +- 2 oz/sq yd (1017 +- 70 g/m²)
Tear Strength	ASTM D 751 Trap Tear	40/55 lbs. min. (175/245 N min.)	40/55 lbs. min. (175/245 N min.)	
Breaking Yield Strength	ASTM D 751 Grab Tensile	550/550 lbs. min. (2,447/2,447 N min.)	550/550 lbs. min. (2,447/2,447 N min.)	600/550 lbs. min. (2,670/2,447 N min.)
Low Temperature Resistance	ASTM D 2136 4 hrs-1/8" Mandrel	Pass @ -30° F Pass @ -35° C	Pass @ -30° F Pass @ -35° C	Pass @ -30° F Pass @ -35° C
Dimensional Stability	ASTM D 1204 100° C-1 Hr.	0.5% max. each direction	0.5% max. each direction	0.5% max. each direction
Hydrostatic Resistance	ASTM D 751 Procedure A	800 psi min. (5.51 MPa min.)	800 psi min. (5.51 MPa min.)	800 psi min. (5.51 MPa min.)
Blocking Resistance	ASTM D 751 180° F	#2 Rating max.	#2 Rating max.	#2 Rating max.
Adhesion-Ply	ASTM D 413 Type A	15 lbs./in. min. or film tearing bond (13 daN/5 cm min. or FTB)	15 lbs./in. min. or film tearing bond (13 daN/5 cm min. or FTB)	15 lbs./in. min. or film tearing bond (13 daN/5 cm min. or FTB)
Adhesion (minimum) Heat Welded Seam	ASTM D 751 Dielectric Weld	40 lbs./2in. RF weld min. (17.5 daN/5 cm min.)	40 lbs./2in. RF weld min. (17.5 daN/5 cm min.)	15 lbs./in. RF weld min. (15 daN/5 cm min.)
Dead Load Seam Strength	ASTM D 751, 4-Hour Test	Pass 220 lbs/in @ 70° F (Pass 980 N/2.54 cm @ 21° C) Pass 120 lbs/in @ 160° F (Pass 534 N/2.54 cm @ 70° C)	Pass 220 lbs/in @ 70° F (Pass 980 N/2.54 cm @ 21° C) Pass 120 lbs/in @ 160° F (Pass 534 N/2.54 cm @ 70° C)	
Bonded Seam Strength	ASTM D 751 Procedure A, Grab Test Method	550 lbs. min. (2,450 N min.)	550 lbs. min. (2,450 N min.)	550 lbs. min. (2,560 N min.)

Abrasion Resistance	ASTM D 3389 H-18 Wheel 1 kg Load	2,000 cycles min. before fabric exposure, 50 mg/100 cycles max. weight loss	2,000 cycles min. before fabric exposure, 50 mg/100 cycles max. weight loss	2,000 cycles min. before fabric exposure, 50 mg/100 cycles max. weight loss
Weathering Resistance	Carbon-Arc ASTM G 153	8,000 hours min. with no appreciable changes or stiffening or cracking of coating	8000 hours min. with no appreciable change or stiffening or cracking of coating	8000 hours min. with no appreciable change or stiffening or cracking of coating
Water Absorption	ASTM D 471, Section 12 7 Days	0.025 kg/m² max. @70° F/21° C 0.14 kg/m² max at 212° F/100° C	0.025 kg/m² max. @70° F/21° C 0.14 kg/m² max at 212° F/100° C	0.025 kg/m² max. @70° F/21° C 0.14 kg/m² max at 212° F/100° C
Wicking	ASTM D 751	1/8" max (0.3 cm max)	1/8" max. (0.3 cm max.)	1/8" max. (0.3 cm max.)
Bursting Strength	ASTM D 751 Ball Tip	750 lbs. min. (3,330 N min.)	750 lbs. min. (3,330 N min.)	750 lbs. min. (3,330 N min.)
Puncture Resistance	ASTM D 4833	275 lbs. min. 1,200 N min.	275 lbs. min. 1,200 N min.	275 lbs. min. 1,200 N min.
Coefficient of Thermal Expansion/ Contraction	ASTM D 696	8 x 10^{-6} in/in/° F max. (1.4 x 10^{-5} cm/cm/° C max.)	8 x 10^{-6} in/in/° F max. (1.4 x 10^{-5} cm/cm/° C max.)	8 x 10^{-6} in/in/° F max. (1.4 x 10^{-5} cm/cm/° C max.)
Environmental/Chemical Resistant Properties		See Chemical Resistance Table, Page 8	See Chemical Resistance Table, Page 8	See Chemical Resistance Table, Page 8
Puncture Resistance	FED-STD-101C Method 2031	350 lbs. (approx.)	350 lbs. (approx.)	
Cold Crack	ASTM D 2136 4 Hrs, 1/8" Mandrel	Pass at -30° F/-34° C	Pass @ -30° F/-34° C	Pass @ -30° F/-34° C

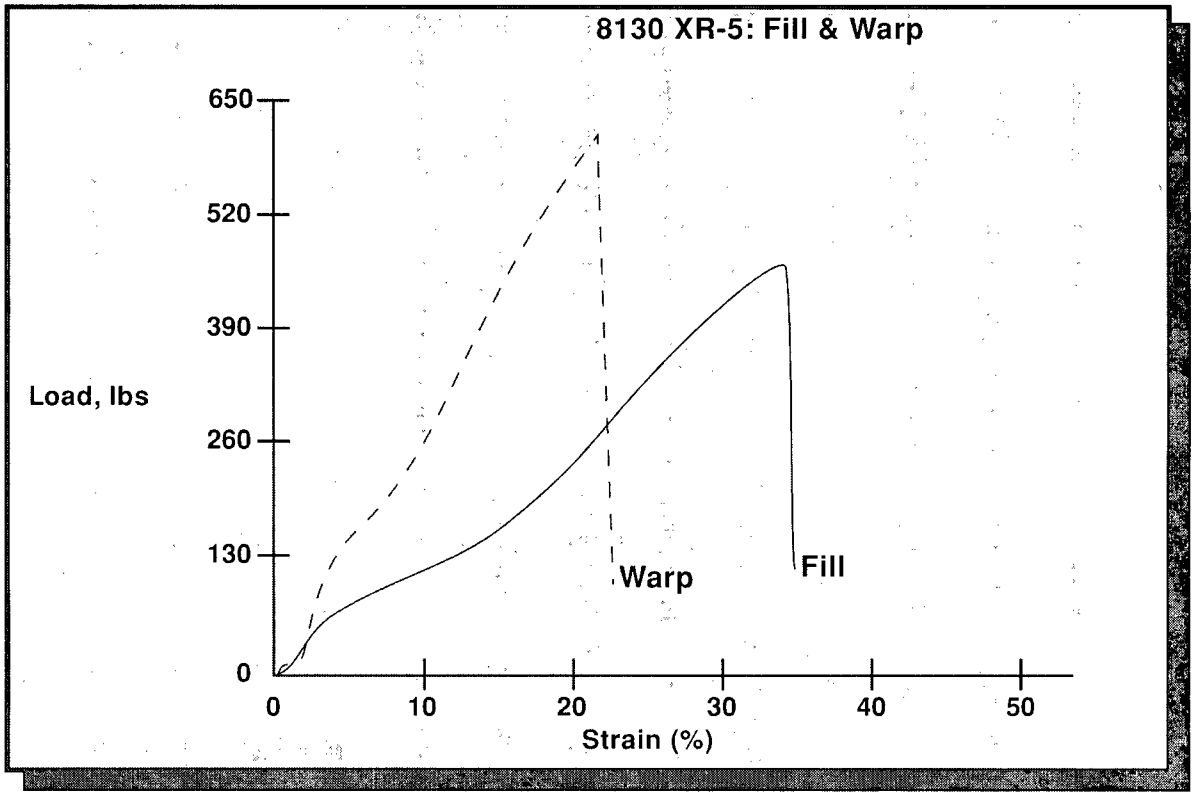
Part 1- Material Specifications (cont.)

Property	Test Method	8130 XR-3 PW	8228 XR-3
Base Fabric Type Base Fabric Weight	ASTM D 751	Polyester 6.5 oz/yd² nominal (220 g/m² nominal)	Polyester 3.0 oz/yd² nominal (100 g/m² nominal)
Thickness	ASTM D 751	30 mils min. (0.76 mm min.)	30 mils min. (0.76 mm min.)
Weight	ASTM D 751	30.0 +- 2 oz./sq. yd. (1017 +- 70 g/sq. m)	28.0 +- 2 oz./sq. yd. (950 +- 70 g/sq. m)
Tear Strength	ASTM D 751 Trap Tear	40/55 lbs. min. (175/245 N min.)	30/30 lbs. nom. (133/133 N nom.)
Breaking Yield Strength	ASTM D 751 Grab Tensile	550/550 lbs. min. (2,447/2447 N min.)	250/200 lbs. min. (1,110/890 N min.)
Low Temperature Resistance	ASTM D 2136 4hrs-1/8" Mandrel	Pass @ -30° F (Pass @ -35° C)	Pass @ -25° F (Pass @ -32° C)
Dimensional Stability	ASTM D 1204 100° C-1 hr.	0.5% max. each direction	5% max. each direction
Hydrostatic Resistance	ASTM D 751 Method A	800 psi min. (5.51 MPa min.)	300 psi min. (2.07 MPa min.)
Blocking Resistance	ASTM D 751 180° F	#2 Rating max.	#2 Rating max.
Adhesion-Ply	ASTM D 413 Type A	15 lbs./in. min. or film tearing bond (13 daN/5 cm min. or FTB)	12 lbs./in. (approx.) (10 daN/5 cm approx.)
Adhesion-Heat Welded Seam	ASTM D 751 Dielectrc Weld	40 lbs./2in. min. (17.5 daN/5 cm min.)	10 lbs./in min. (9 daN/5 cm min.)
Dead Load Seam Strength	ASTM D 751, 4-Hour Test	Pass 220 lbs/in. @ 70° F (Pass 980 N/2.54 cm @ 21° C) Pass 120 lbs/in. @ 160° F (Pass 534 N/2.54 cm @ 70° C)	Pass 100 lbs/in @ 70° F (Pass 445 N @ 21° C) Pass 50 lb @ 160° F (Pass 220 N @ 70° C)
Bonded Seam Strength	ASTM D 751 Procedure A, Grab Test Method	550 lbs. min. (2,450 N min.)	250 lbs. (approx.) (1,112 N min.)

Abrasion Resistance	ASTM D 3389 H-18 Wheel 1 kg Load	2000 cycles min. before fabric exposure, 50 mg/100 cycles max. weight loss	2000 cycles min.
Weathering Resistance	ASTM G 153	8000 hours min. with no appreciable change or stiffening or cracking of coating	8000 hours min.
Water Absorption	ASTM D 471, Section 12 7 Days	0.025 kg/m² max. @ 70° F/21° C 0.14 kg/m² max @ 212° F/100° C	0.05 kg/m² max. @ 70° F/21° C (approx.) 0.28 kg/m² max. @ 212° F/100° C (approx.)
Wicking	ASTM D 751	1/8" max. (0.3 cm max.)	1/8" max (0.3 cm max.)
Bursting Strength	ASTM D 751 Ball Tip	750 lbs. min. (3330 N min.)	350 lbs. (approx.) (1557 N min.)
Puncture Resistance	ASTM D 4833	275 lbs. min. 1200 N min.	50 lb typ. (225 N typ.)
Coefficient of Thermal Expansion/ Contraction	ASTM D 696	8 x 10^{-6} in/in/° F max. (1.4 x 10^{-5} cm/cm/° C max.)	8 x 10^{-6} in/in/° F max. (approx.) (1.4 x 10^{-5} cm/cm/° C max. approx.)
Environmental/Chemical Resistant Properties	ASTM D 741 7-Day Total Immersion With Exposed Edges	NSF 61 approved for potable water	Crude oil 5% max. weight gain Diesel fuel 5% max. weight gain
Puncture Resistance	FTMS 101C Method 2031	350 lbs. (approx.)	205 lbs. (approx.)
Tongue Tear	ASTM D 751		50 lbs. (approx.)

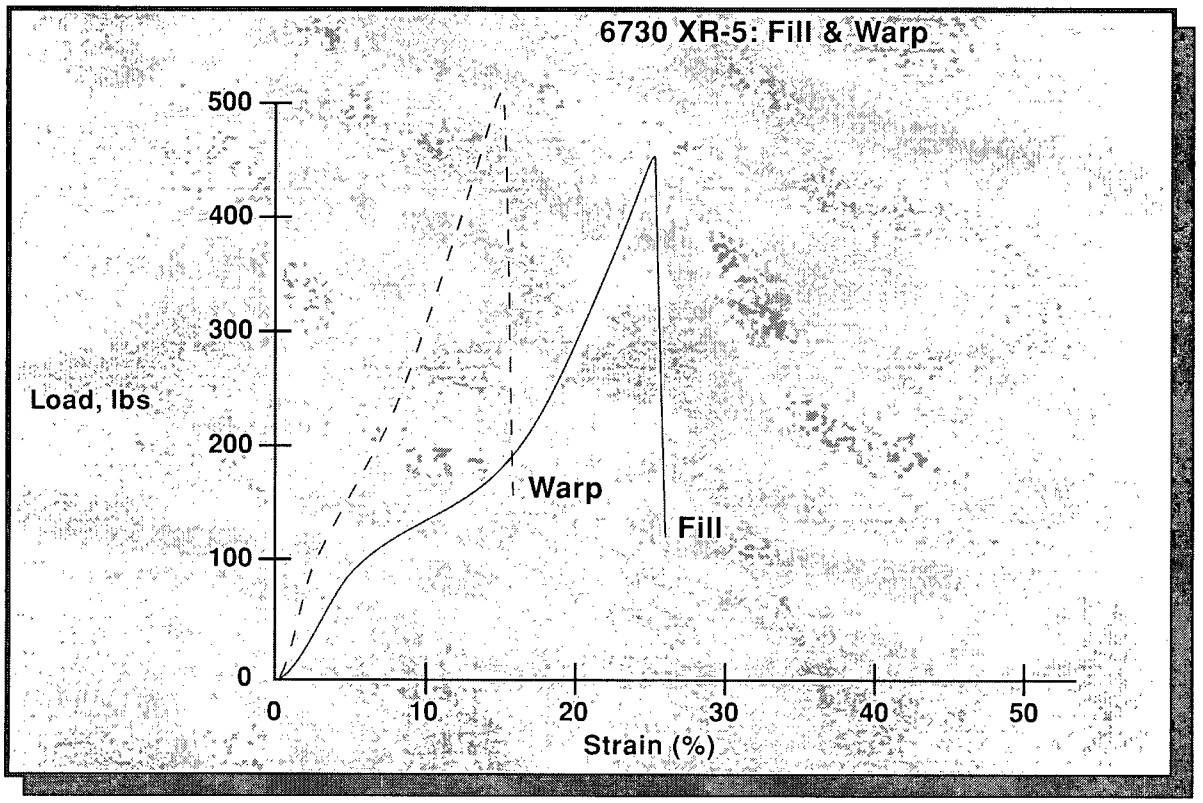
Part 2 - Elongation Properties Test

8130 XR-5



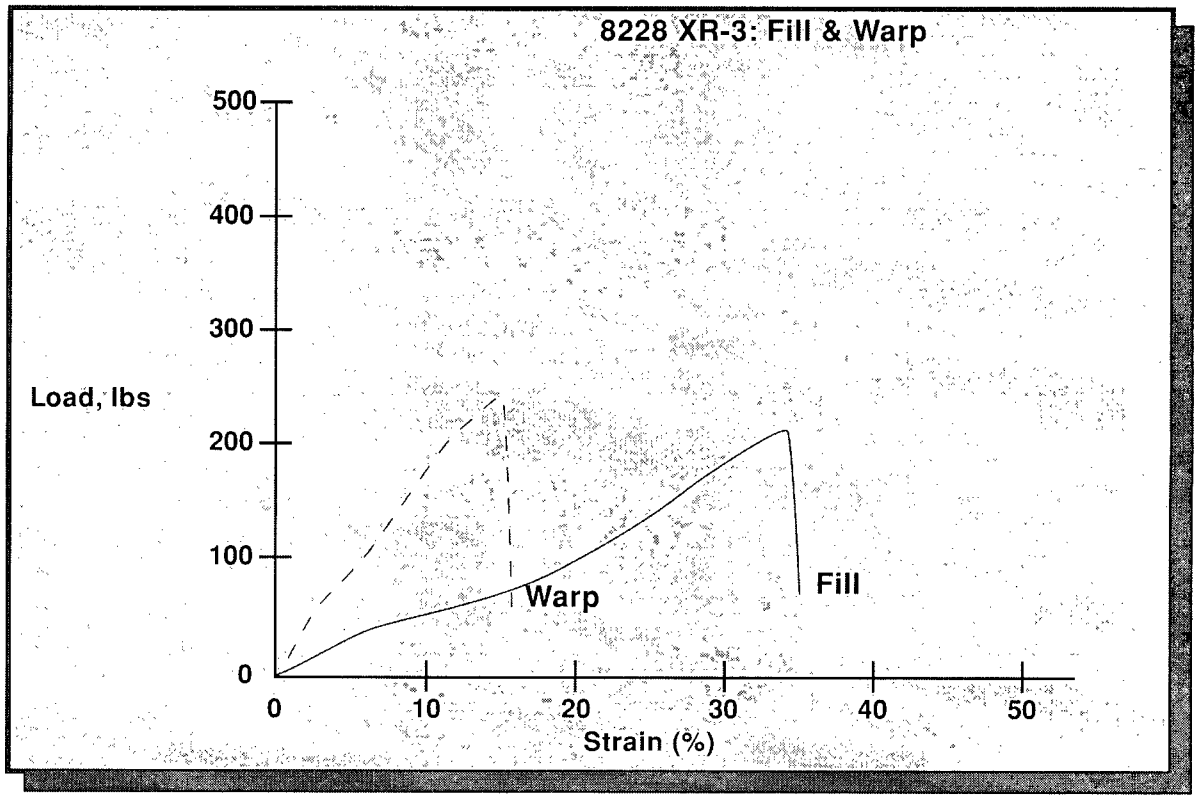
Part 2 - Elongation Properties Test

6730 XR-5



Part 2 - Elongation Properties Test

8228 XR-3



Section 3 - Chemical/Environmental Resistance

Part 1 - XR-5® Fluid Resistance Guidelines

The data below is the result of laboratory tests and is intended to serve only as a guide. No performance warranty is intended or implied. The degree of chemical attack on any material is governed by the conditions under which it is exposed. Exposure time, temperature, and size of the area of exposure usually varies considerably in application, therefore, this table is given and accepted at the user's risk. Confirmation of the validity and suitability in specific cases should be obtained. Contact a Seaman Corporation Representative for recommendation on specific applications.

When considering XR-5 for specific applications, it is suggested that a sample be tested in actual service before specification. Where impractical, tests should be devised which simulate actual service conditions as closely as possible.

EXPOSURE	RATING	EXPOSURE	RATING
AFFF	A	JP-4 Jet Fuel	A
Acetic Acid (5%)	B	JP-5 Jet Fuel	A
Acetic Acid (50%)	C	JP-8 Jet Fuel	A
Ammonium Phosphate	T	Kerosene	A
Ammonium Sulfate	T	Magnesium Chloride	T
Antifreeze (Ethylene Glycol)	A	Magnesium Hydroxide	T
Animal Oil	A	Methanol	A
Aqua Regia	X	Methyl Alcohol	A
ASTM Fuel A (100% Iso-Octane)	A	Methyl Ethyl Ketone	X
ASTM Oil #2 (Flash Pt. 240° C)	A	Mineral Spirits	A
ASTM Oil #3	A	Naphtha	A
Benzene	X	Nitric Acid (5%)	B
Calcium Chloride Solutions	T	Nitric Acid (50%)	C
Calcium Hydroxide	T	Perchloroethylene	C
20% Chlorine Solution	A	Phenol	X
Clorox	A	Phenol Formaldehyde	B
Conc. Ammonium Hydroxide	A	Phosphoric Acid (50%)	A
Corn Oil	A	Phosphoric Acid (100%)	C
Crude Oil	A	Phthalate Plasticizer	C
Diesel Fuel	A	Potassium Chloride	T
Ethanol	A	Potassium Sulphate	T
Ethyl Acetate	C	Raw Linseed Oil	A
Ethyl Alcohol	A	SAE-30 Oil	A
Fertilizer Solution	A	Salt Water (25%)	B
#2 Fuel Oil	A	Sea Water	A
#6 Fuel Oil	A	Sodium Acetate Solution	T
Furfural	X	Sodium Bisulfite Solution	T
Gasoline	B	Sodium Hydroxide (60%)	A
Glycerin	A	Sodium Phosphate	T
Hydraulic Fluid- Petroleum Based	A	Sulphuric Acid (50%)	A
Hydraulic Fluid- Phosphate Ester Based	C	Tanic Acid (50%)	A
Hydrocarbon Type II (40% Aromatic)	C	Toluene	C
Hydrochloric Acid (50%)	A	Transformer Oil	A
Hydrofluoric Acid (5%)	A	Turpentine	A
Hydrofluoric Acid (50%)	A	Urea Formaldehyde	A
Hydrofluosilicic Acid (30%)	A	UAN	A
Isopropyl Alcohol	T	Vegetable Oil	A
Ivory Soap	A	Water (200°F)	A
Jet A	A	Xylene	X
		Zinc Chloride	T

Ratings are based on visual and physical examination of samples after removal from the test chemical after the samples of Black XR-5 were immersed for 28 days at room temperature. Results represent ability of material to retain its performance properties when in contact with the indicated chemical.

Rating Key:

A – Fluid has little or no effect
B – Fluid has minor to moderate effect
C – Fluid has severe effect
T – No data - likely to be acceptable
X – No data - not likely to be acceptable

Vapor Transmission Data

Tested according to ASTM D814-55 Inverted Cup Method

Perhaps a more meaningful test is determination of the diffusion rate of the liquid through the membrane. The vapor transmission rate of Style 8130 XR-5® to various chemicals was determined by the ASTM D814-55 inverted cup method. All tests were run at room temperature and results are shown in the table.

Chemical	8130 XR-5 Black g/hr/m2
Water	0.11
#2 Diesel Fuel	0.03
Jet A	0.11
Kerosene	0.15
Hi-Test Gas	1.78
Ohio Crude Oil	0.03
Low-Test Gas	5.25
Raw Linseed Oil	0.01
Ethyl Alcohol	0.23
Naphtha	0.33
Perchlorethylene	38.58
Hydraulic Fluid	0.006
100% Phosphoric Acid	7.78
50% Phosphoric Acid	0.43
Ethanol (E-96)	0.65
Transformer Oil	0.005
Isopropyl Alcohol	0.44
JP4 (E-96)	0.81
JP8 (E-96)	0.42
Fuel B (E-96)	6.28
Fuel C (E-96)	7.87

Note: The tabulated values are measured Vapor Transmission Rates (VTR). Normal soil testing methods to determine permeability are impractical for synthetic membranes. An "equivalent hydraulic" permeability coefficient can be calculated but is not a direct units conversion. Contact Seaman Corporation for additional technical information.

Seam Strength

Style 8130 XR-5 Black Seam Strength After Immersion

Two pieces of Style 8130 were heat sealed together (seam width 1 inch overlap) and formed into a bag. Various oils and chemicals were placed in the bags so that the seam area was entirely covered. After 28 days at room temperature, the chemicals were removed and one inch strips were cut across the seam and the breaking strength immediately determined. Results are listed below.

Chemical	Seam Strength
None	340 Lbs. Fabric Break- No Seam Failure
Kerosene	355 Lbs. Fabric Break- No Seam Failure
Ohio Crude Oil	320 Lbs. Fabric Break- No Seam Failure
Hydraulic Fluid- Petroleum Based	385 Lbs. Fabric Break- No Seam Failure
Toluene	0 Lbs. Adhesion Failure
Naphtha	380 Lbs. Fabric Break- No Seam Failure
Perchloroethylene	390 Lbs. Fabric Break- No Seam Failure

Even though 1-inch overlap seams are used in the tests to study the accelerated effects, it is recommended that XR-5 be used with a 2-inch nominal overlap seam in actual application. In some cases where temperatures exceed 160°F and the application demands extremely high seam load, it may be necessary to use a wider width seam.

Long Term Seam Adhesion

11 Years Immersion
ASTM D 751
Lbs./In.

Seam samples of 8130 XR-5® were dielectrically welded together and totally immersed in the liquids for 11 years. The samples were taken out, dried for 24 hours and visually observed for any signs of swelling, cracking, stiffening or degradation of the coating. The coating showed no appreciable degradation and no stiffening, swelling, cracking or peeling.

The adhesion, or resistance to separation of the coating from the base cloth, was then measured by ASTM D 751. Results show 8130 XR-5 maintains seam strength over this long period (11 years).

	Control	Crude Oil	JP-4 Jet Fuel	Diesel Fuel	Kerosene	Naphtha
8130 XR-5	20+	18	33	25	40	33*

Values in lbs./in.

*The naphtha sample was sticky.

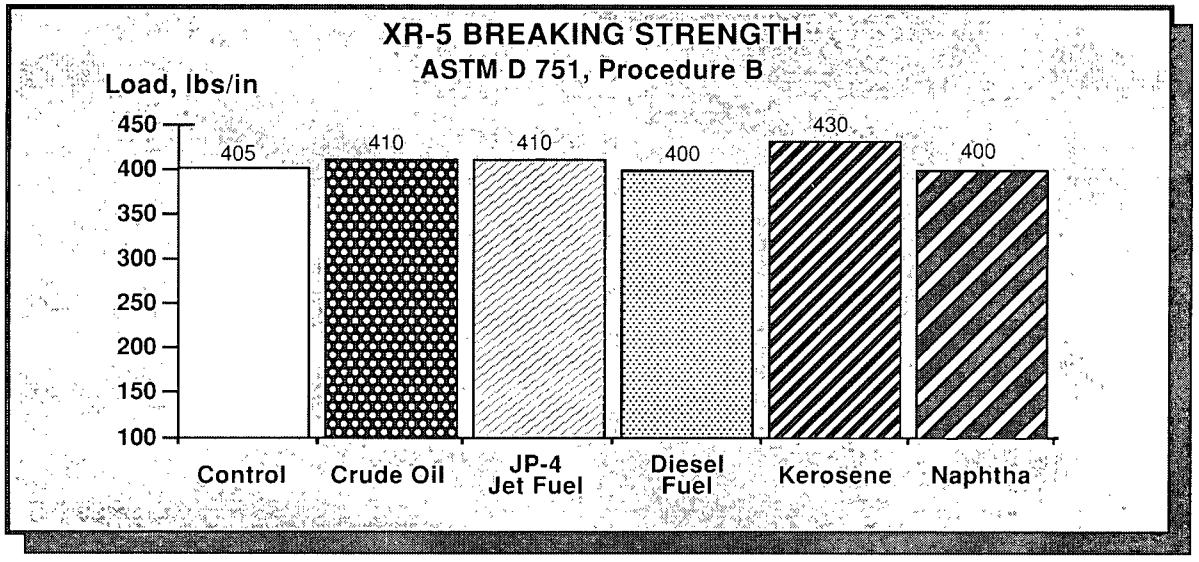
Fuel Compatibility - Long Term Immersion

Test: Samples of 8130 XR-5® Black were immersed in Diesel Fuel, JP-4 Jet Fuel, Crude Oil, Kerosene, and Naphtha for 6 1/2 years.

The samples were then taken out of the test chemicals, blotted and dried for 24 hours. The samples were observed for blistering, swelling, stiffening, cracking or delamination of the coating from the fiber.

Results: It was found in all cases that the 8130 XR-5, after immersion for six years, maintained its strength and there was no evidence of blistering, swelling, stiffening, cracking or delamination.

The strip tensile strength, or breaking strength, of the samples was measured after six years of immersion and the following are the results.



XR-3 Chemical Resistance Statement (Summary)

XR-3® is recommended for moderate chemical resistant applications such as stormwater and municipal wastewater and is not recommended for prolonged contact with pure solutions. XR-3 PW® membranes are recommended only for contact with drinking water and are resistant to low levels of chlorine found in drinking water. XR-5 has a broad range of chemical resistance which is detailed in this section.

Part 2: XR-5® Comparative Chemical Resistance

Chemical Resistance Chart
Comparative Chemical Resistance

	XR-5	HDPE	PVC	Hypalon	Polypropylene
Kerosene	A	B	C	C	C
Diesel Fuel	A	A	C	C	C
Acids (General)	A	A	A	B	A
Naphtha	A	A	C	B	C
Jet Fuels	A	A	C	B	C
Saltwater, 160° F	A	A	C	B	A
Crude Oil	A	B	C	B	C
Gasoline	B	B	C	C	C

A= Excellent **B= Moderate** **C= Poor**

Source: Manufacturer's Literature

XR-5 data based on conditions detailed in Section 3, Part 1.

Part 3: Weathering Resistance

Accelerated Weathering Test

XR-5 has been tested in the carbon arc weatherometer for over 10,000 hours of exposure and in the Xenon weatherometer for over 12,000 hours of exposure. The sample showed no loss in flexibility and no significant color change. Based on field experience of Seaman Corporation products and similar weatherometer exposure tests, XR-5 should have an outdoor weathering life significantly longer than competitive geomembranes, particularly in tropical or subtropical applications.

EMMAQUA Testing: ASTM E-838-81 was performed on a modified form of XR-5, FiberTite, used in the single-ply roofing industry. After 3 million Langleys in Arizona, no signs of degradation were noted with no evidence of cracking, blistering, swelling or adhesion delamination failure of the coating.

Natural Exposure

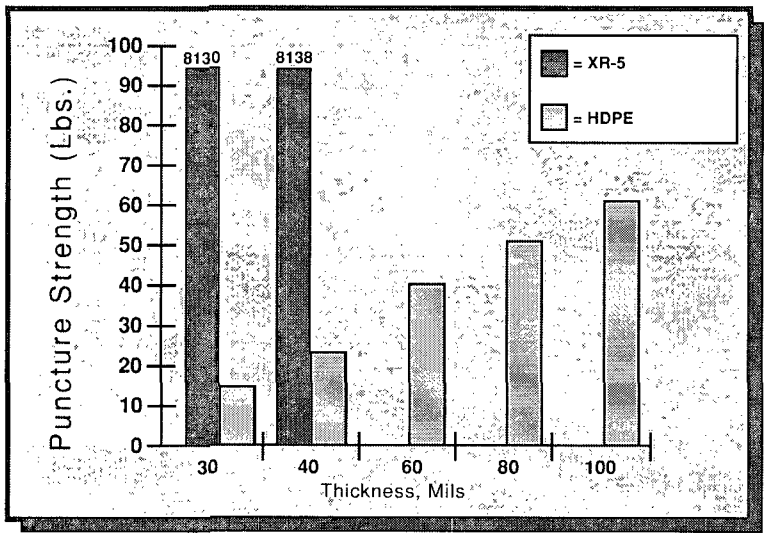
After over 17 years as a holding basin at a large oil company in the Texas desert, XR-5 showed no signs of environmental stress cracking, thermal expansion/contraction, or low yield strength problems. Temperature ranges from near zero to over 100° F.

In service approximately 17 years in a solar pond application at a research facility in Ohio, UV exposed samples, as well as immersed samples, retained over 90% of the tensile strength. Examination of the material determined there was little effect on the coating compound. The solar pond was exposed to temperatures from below zero to over 100° F.

XR5 was exposed for 12½ years in Sarasota, Florida, on a weathering rack, facing the southern direction at 45°. No significant color loss, cracking, crazing, blistering, or adhesion delamination failure of the coating was noted.

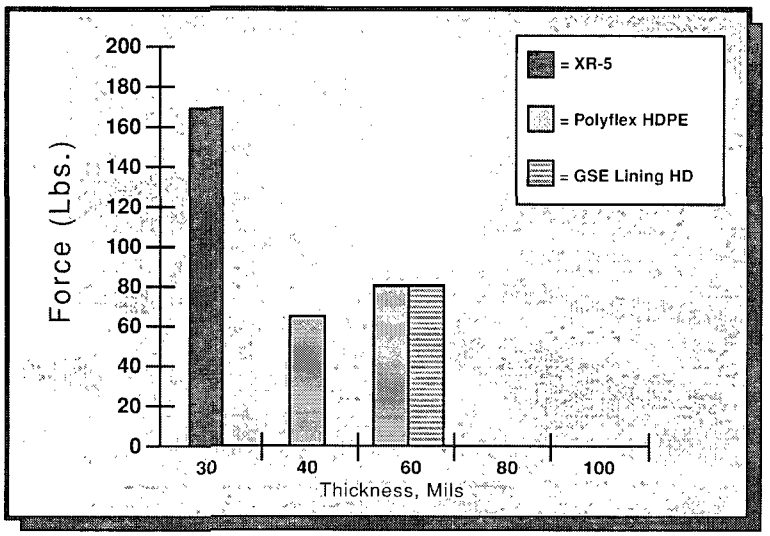
Section 4 - Comparative Physical Properties

XR-5/HDPE Comparative Properties

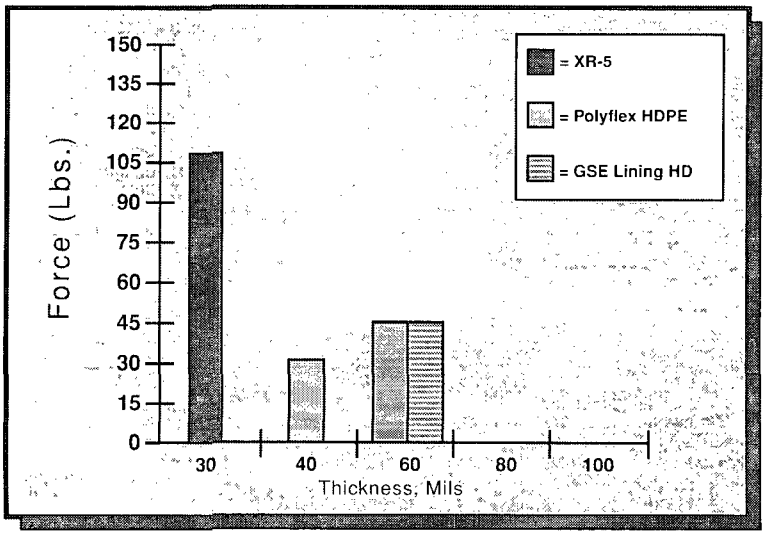


Puncture Resistance

1. ASTM D 751, Screwdriver Tip, 45° Angle (Room Temperature) Puncture Resistance, XR5 vs. HDPE



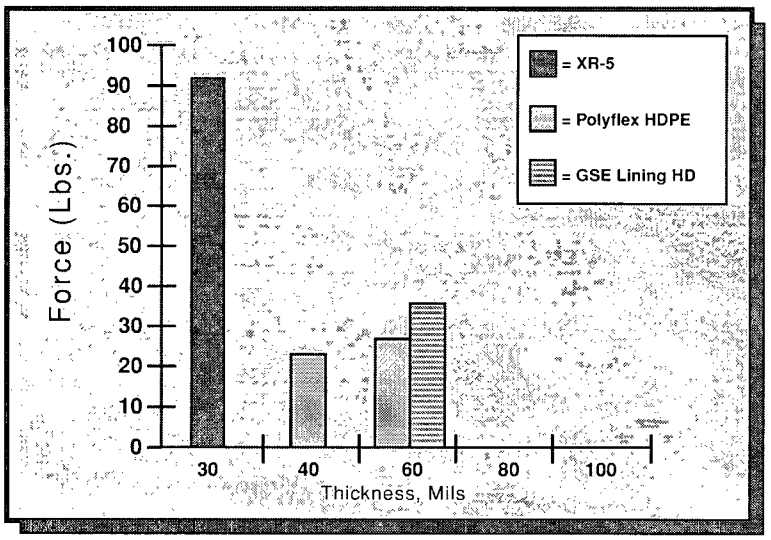
2. FED-STD-101C Method 2065 (Room Temperature)*



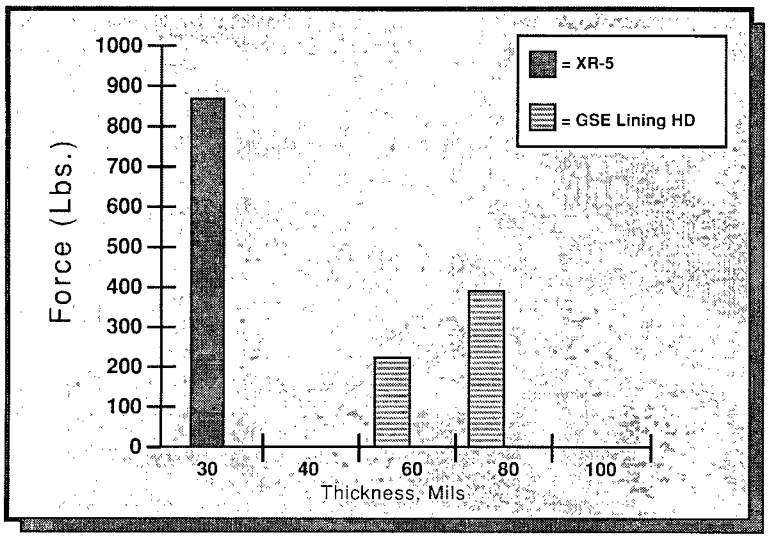
3. FED-STD-101C Method 2065 (70°C)*

* Data provided by E.I. DuPont de Nemours & Co. Wilmington, Delaware

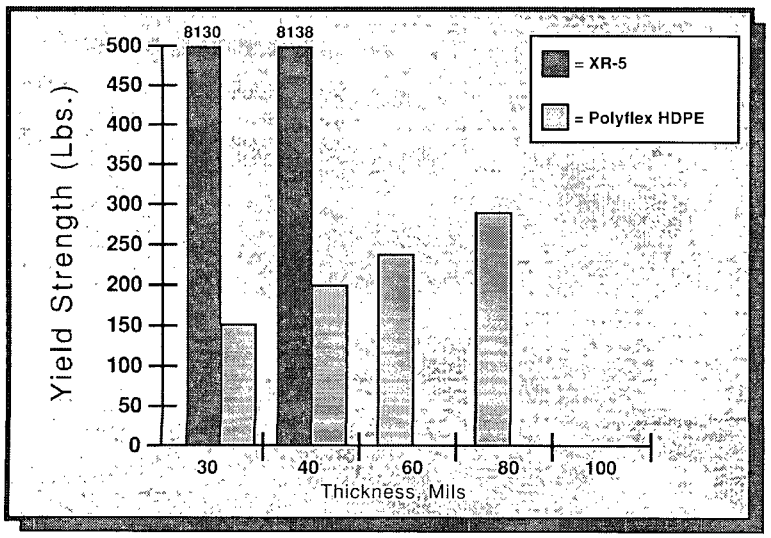
GSE is a registered trademark of GSE Lining Technology, Inc.



4. FED-STD-101C Method 2065 (100°C)*



5. ASTM D 751 Ball Burst Puncture



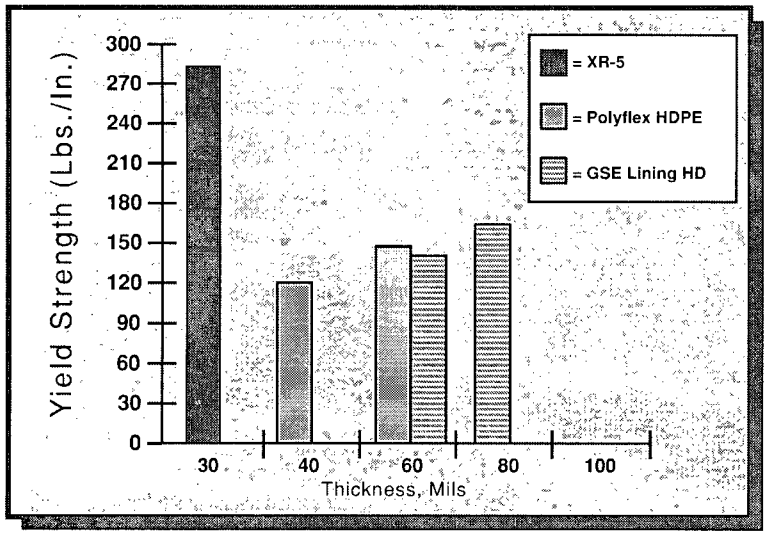
Yield Strength

1. Yield Strength, XR-5 vs. HDPE

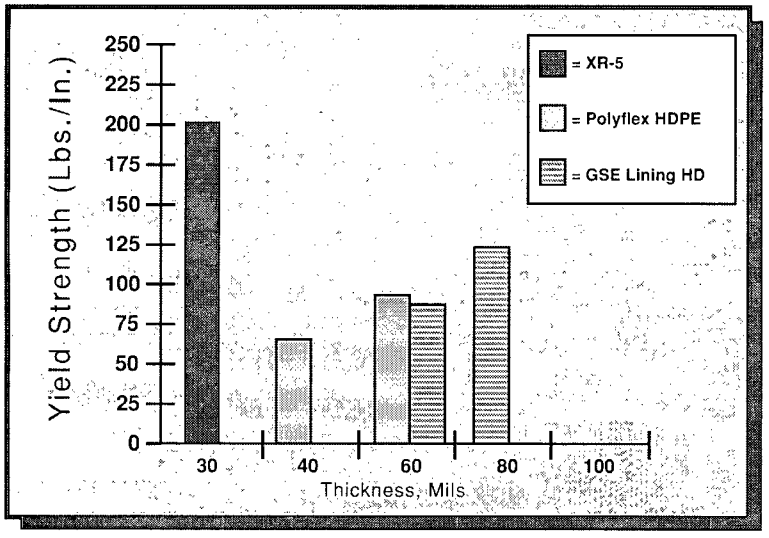
Test Method: Grab Tensile, ASTM D 751, 70° C

* Data provided by E.I. DuPont de Nemours & Co. Wilmington, Delaware

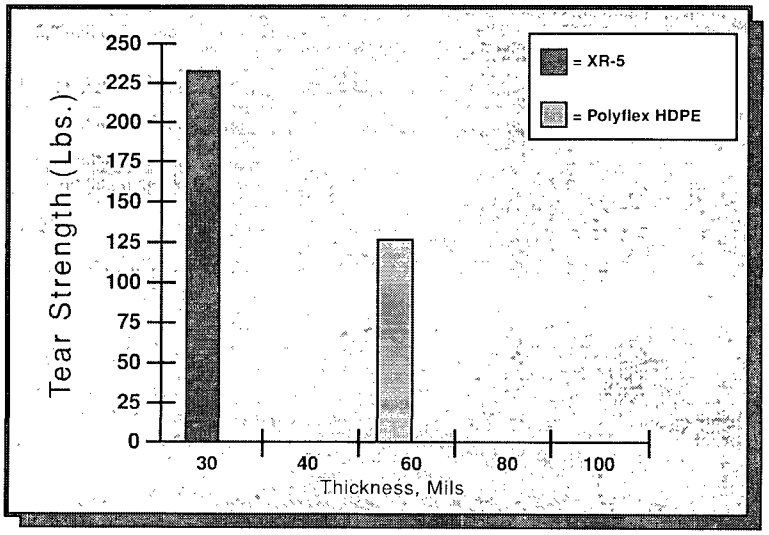
GSE is a registered trademark of GSE Lining Technology, Inc.



2. Strip Tensile, ASTM D 751, Room Temperature*



3. Strip tensile, ASTM D 751, 70°C*



Tear Strength

1. Tongue Tear (8" x 10" Specimens), ASTM D 751, Room Temperature*

* Data provided by E.I. DuPont de Nemours & Co. Wilmington, Delaware

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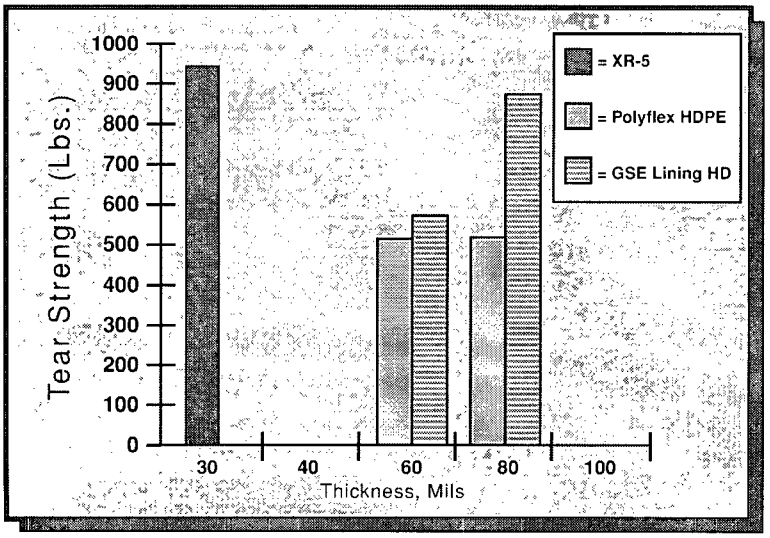
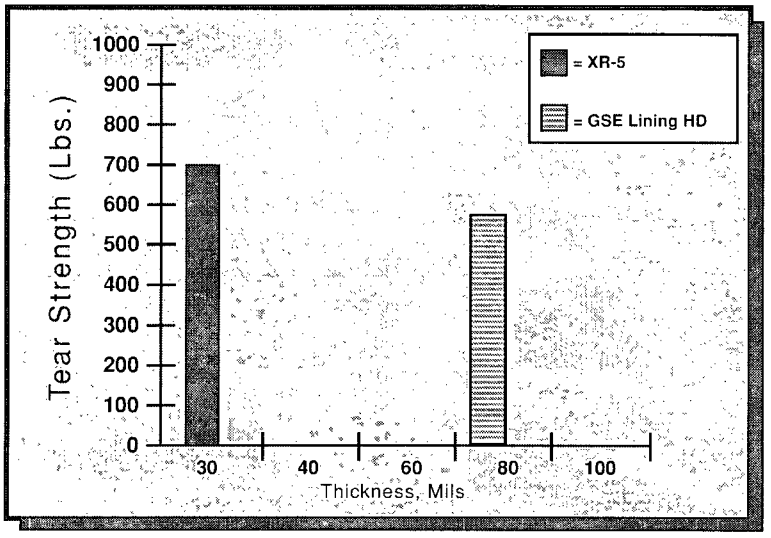


1. Graves Tear, ASTM D 624, Die C, Room Temperature*

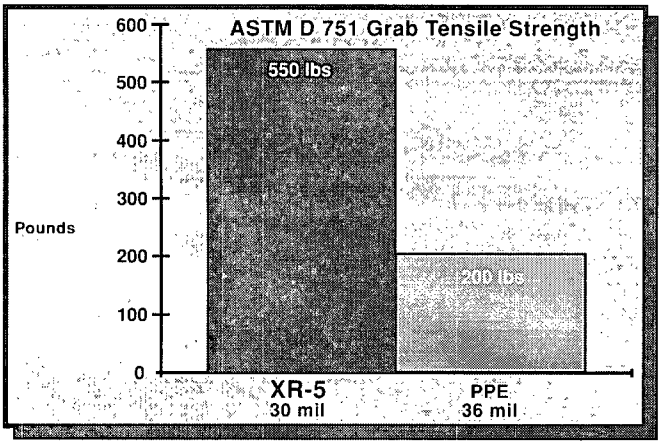


2. Graves Tear, ASTM D 624, Die C, 70°C*

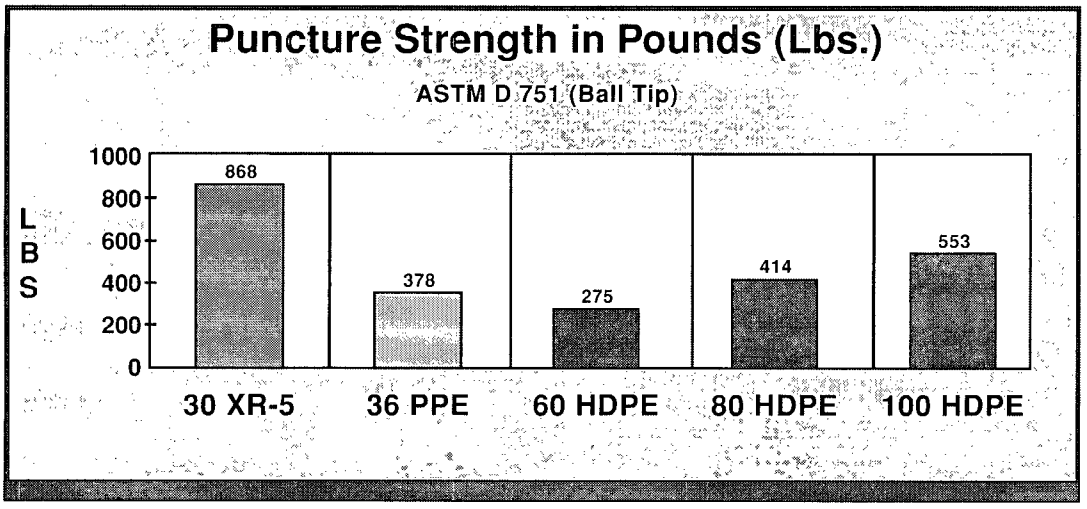
* Data provided by E.I. DuPont de Nemours & Co. Wilmington, Delaware

GSE is a registered trademark of GSE Lining Technology, Inc.

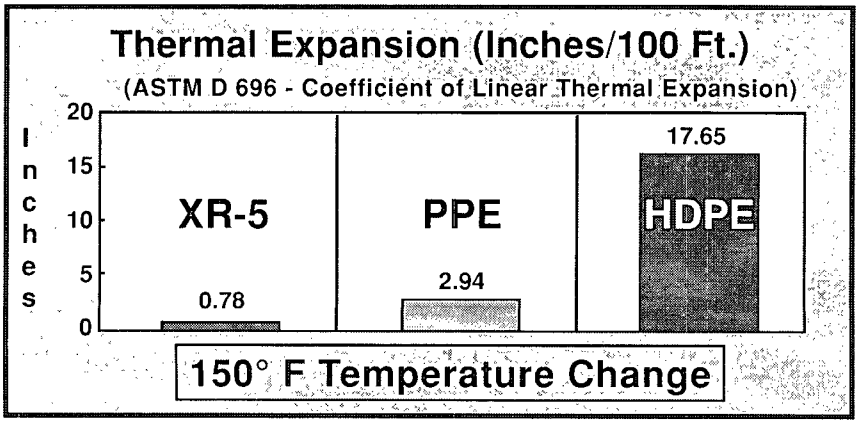
Grab Strength – XR-5® vs. Polypropylene Tensile



Puncture Strength Comparison



Coated Fabric Thermal Stability



Specification For Geomembrane Liner

(Sample specification: 8130 XR-5®. For other product specifications, go to www.xr-5.com)

General

1.01 Scope Of Work

Furnish and install flexible membrane lining in the areas shown on the drawings. All work shall be done in strict accordance with the project drawings, these specifications and membrane lining fabricator's approved shop drawings.

Geomembrane panels will be supplied sufficient to cover all areas, including appurtenances, as required in the project, and shown on the drawings. The fabricator/installer of the liner shall allow for shrinkage and wrinkling of the field panels.

1.02 Products

The lining material shall be 8130 XR-5 as manufactured by Seaman Corporation (1000 Venture Boulevard, Wooster, OH 44691; 330-262-1111), with the following physical specifications:

Base- (Type)	Polyester
Fabric Weight (ASTM D 751)	6.5 oz./sq. yd.
Finished Coated Weight (ASTM D 751)	30 ± 2 oz./sq. yd.
Trapezoid Tear (ASTM D 751)	40/55 lbs. min.
Grab Yield Tensile (ASTM D 751, Grab Method Procedure A)	550/550 lbs. min.
Elongation @ Yield (%)	20% min.
Adhesion- Heat Seam (ASTM D 751, Dielectric Weld)	40 lbs./2in. weld min.
Adhesion- Ply (ASTM D 413, Type A)	15 lbs./in. or film tearing bond
Hydrostatic Resistance (ASTM D 751, Method A)	800 psi min.
Puncture Resistance (ASTM D 4833)	275 lbs. min.
Bursting Strength (ASTM D 751 Ball Tip)	750 lbs. min.
Dead Load (ASTM D 751) Room Temperature	220 lbs. min.
(2" overlap seam, 4 hours) 160°F	120 lbs. min.
Bonded Seam Strength (ASTM D 751 Grab Test Method, Procedure A)	575 lbs. min.
Low Temperature (ASTM D 2136, 4 hours- 1/8" Mandrel)	Pass @ -30°F
Weathering Resistance ASTM G 153 Carbon Arc	8,000 hours min. With no appreciable changes or stiffening or cracking of coating
Dimensional Stability (ASTM D 1204, 212°F 1 Hour, Each Direction)	0.5% max.
Water Absorption (ASTM D 471, 7 Days)	0.025 kg/m² max. @ 70°F 0.14 kg/m² max. @ 212°F
Abrasion Resistance ASTM D 3389,	2000 cycles before fabric exposure;
H-18 Wheel, 1000 g load	50 mg/100 cycles max. wgt. Loss
Coefficient of Thermal Expansion/Contraction (ASTM D 696)	8×10^{-6} in/in/° F max.

1.03 Submittals

The fabricator of panels used in this work shall prepare shop drawings with a proposed panel layout to cover the liner area shown in the project plans. Shop drawings shall indicate the direction of factory seams and shall show panel sizes consistent with the material quantity requirements of 1.01.

Details shall be included to show the termination of the panels at the perimeter of lined areas, the methods of sealing around penetrations, and methods of anchoring.

Placement of the lining shall not commence until the shop drawings and details have been approved by the owner, or his representative.

1.04 Factory Fabrication
The individual XR-5® liner widths shall be factory fabricated into large sheets custom designed for this project so as to minimize field seaming. The number of factory seams must exceed the number of field seams by a factor of at least 10.

A two-inch overlap seam done by heat or RF welding is recommended. The surface of the welded areas must be dry and clean. Pressure must be applied to the full width of the seam on the top and bottom surface while the welded area is still in a melt-type condition. The bottom welding surface must be flat to insure that the entire seam is welded properly. Enough heat shall be applied in the welding process that a visible bead is extruded from both edges being welded. The bead insures that the material is in a melt condition and a successful chemical bond between the two surfaces is accomplished.

Two-inch overlapped seams must withstand a minimum of 240 pounds per inch width dead load at 70° F. and 120 pounds per inch width at 160° F. as outlined in ASTM D 751. All seams must exceed 550 lbs. bonded seam strength per ASTM D 751 Bonded Seam Strength Grab Test Method, Procedure A.

1.05 Inspection And Testing Of Factory Seams
The fabricator shall monitor each linear foot of seam as it is produced. Upon discovery of any defective seam, the fabricator shall stop production of panels used in this work and shall repair the seam, and determine and rectify the cause of the defect prior to continuation of the seaming process.

The fabricator must provide a Quality Control procedure to the owner or his representative which details his method of visual inspection and periodic system checks to ensure leak-proof factory fabrication.

1.06 Certification and Test Reports
Prior to installation of the panels, the fabricator shall provide the owner, or his representative, with written certification that the factory seams were inspected in accordance with Section 1.05.

1.07 Panel Packaging and Storage
Factory fabricated panels shall be accordian-folded, or rolled, onto a sturdy wooden pallet designed to be moved by a forklift or similar equipment. Each factory fabricated panel shall be prominently and indelibly marked with the panel size. Panels shall be protected as necessary to prevent damage to the panel during shipment.

Panels which have been delivered to the project site shall be stored in a dry area.

1.08 Qualifications of Suppliers
The fabricator of the lining shall be experienced in the installation of flexible membrane lining, and shall provide the owner or his representative with a list of not less than five (5) projects and not less than 500,000 square feet of successfully installed XR-5 synthetic lining. The project list shall show the name, address, and telephone number of an appropriate party to contact in each case. The manufacturer of the sheet goods shall provide similar documentation with a 10 million square foot minimum, with at least 5 projects demonstrating 10+ years service life.

The installer shall provide similar documentation to that required by the fabricator.

1.09 Subgrade Preparation By Others
Lining installation shall not begin until a proper base has been prepared to accept the membrane lining. Base material shall be free from angular rocks, roots, grass and vegetation. Foreign materials and protrusions shall be removed, and all cracks and voids shall be filled and the surface made level, or uniformly sloping as indicated

on the drawings. The prepared surface shall be free from loose earth, rocks, rubble and other foreign matter. Generally, no rock or other object larger than USCS sand (SP) should remain on the subgrade in order to provide an adequate safety factor against puncture. Geotextiles may be used to compensate for irregular subgrades. The subgrade shall be uniformly compacted to ensure against settlement. The surface on which the lining is to be placed shall be maintained in a firm, clean, dry and smooth condition during lining installation.

1.10 Lining Installation
Prior to placement of the liner, the installer will indicate in writing to the owner or his representative that he believes the subgrade to be adequately prepared for the liner placement.

The lining shall be placed over the prepared surface in such a manner as to assure minimum handling. The sheets shall be of such lengths and widths and shall be placed in such a manner as to minimize field seaming.

In areas where wind is prevalent, lining installation should be started at the upwind side of the project and proceed downwind. The leading edge of the liner shall be secured at all times with sandbags or other means sufficient to hold it down during high winds.

Sandbags or rubber tires may be used as required to hold down the lining in position during installation. Materials, equipment or other items shall not be dragged across the surface of the liner, or be allowed to slide down slopes on the lining. All parties walking or working upon the lining material shall wear soft-sole shoes.

Lining sheets shall be closely fit and sealed around inlets, outlets and other projections through the lining. Lining to concrete seals shall be made with a mechanical anchor, or as shown on the drawings. All piping, structures and other projections through the lining shall be sealed with approved sealing methods.

1.11 XR-5 Field Seaming
All requirements of Section 1.04 and 1.05 apply. A visible bead should be extruded from the hot air welding process.

Field fabrication of lining material will not be allowed.

1.12 Inspection
All field seams will be tested using the Air Lance Method. A compressed air source will deliver 55 psi minimum to a 3/16 inch nozzle. The nozzle will be directed to the lip of the field seam in a near perpendicular direction to the length of the field seam. The nozzle will be held 4 inches maximum from the seam and travel at a rate not to exceed 40 feet per minute. Any loose flaps of 1/8" or greater will require a repair.

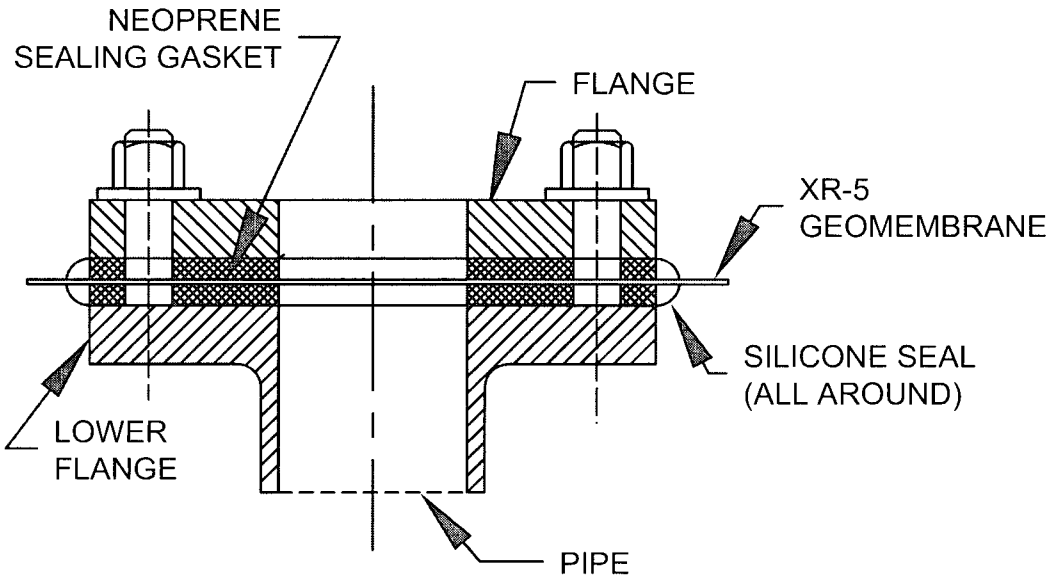
Alternatively all field seams should also be inspected utilizing the Vacuum Box Technique as described in Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber (ASTM D 5641-94 (2006)), using a 3 to 5 psi vacuum pressure. All leaks shall be repaired and tested.

All joints, on completion of work, shall be tightly bonded. Any lining surface showing injury due to scuffing, penetration by foreign objects, or distress from rough subgrade, shall as directed by the owner or his representative be replaced or covered, and sealed with an additional layer of lining of the proper size, in accordance with the patching procedure.

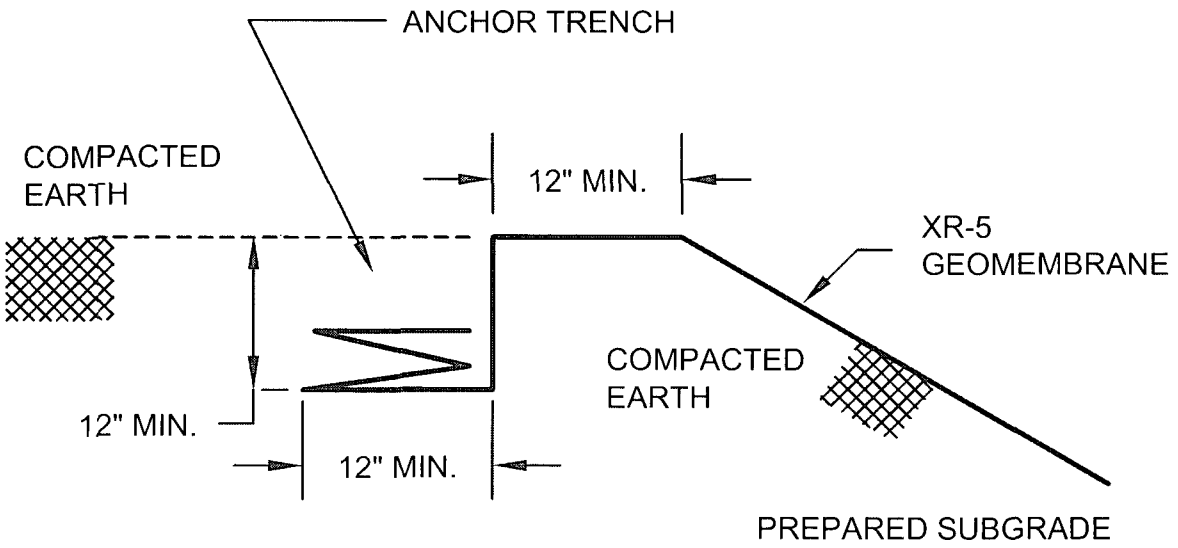
1.13 Patching
Any repairs to the lining shall be patched with the lining material. The patch material shall have rounded corners and shall extend a minimum of four inches (4") in each direction from the damaged area.

Seam repairs or seams which are questionable should be cap stripped with a 1" wide (min.) strip of the liner material. The requirements of Section 1.11 apply to this cap stripping.

1.14 Warranty
The lining material shall be warranted on a pro-rated basis for 10 years against both weathering and chemical compatibility in accordance with Seaman Corporation warranty for XR-5® Style 8130. A test immersion will be performed by the owner and the samples evaluated by the manufacturer. Workmanship of installation shall be warranted for one year on a 100% basis.



Seaman Corporation ENGINEERED PRODUCTS GROUP 1000 Venture Blvd.,Wooster, Ohio 44691	
FLANGE CONNECTION TO PIPE SECTION	
SCALE: NONE	
SHEET 1 of 1	DRAW NO. XRD-019



Seaman Corporation

ENGINEERED PRODUCTS GROUP

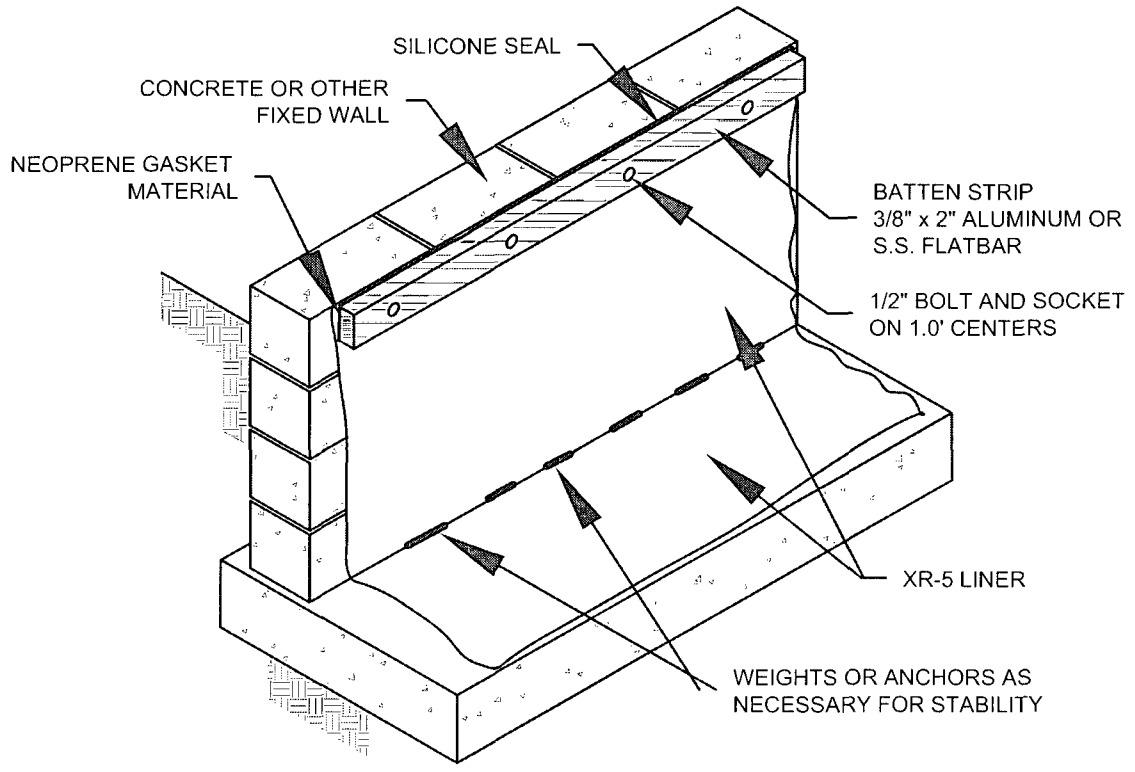
1000 Venture Blvd.,Wooster, Ohio 44691

ELEVATION VIEW
TYPICAL ANCHOR DETAILS
XR-5 LINER

SCALE: NONE

SHEET 1 of 1

DRAW NO. XRD-001



Seaman Corporation

ENGINEERED PRODUCTS GROUP

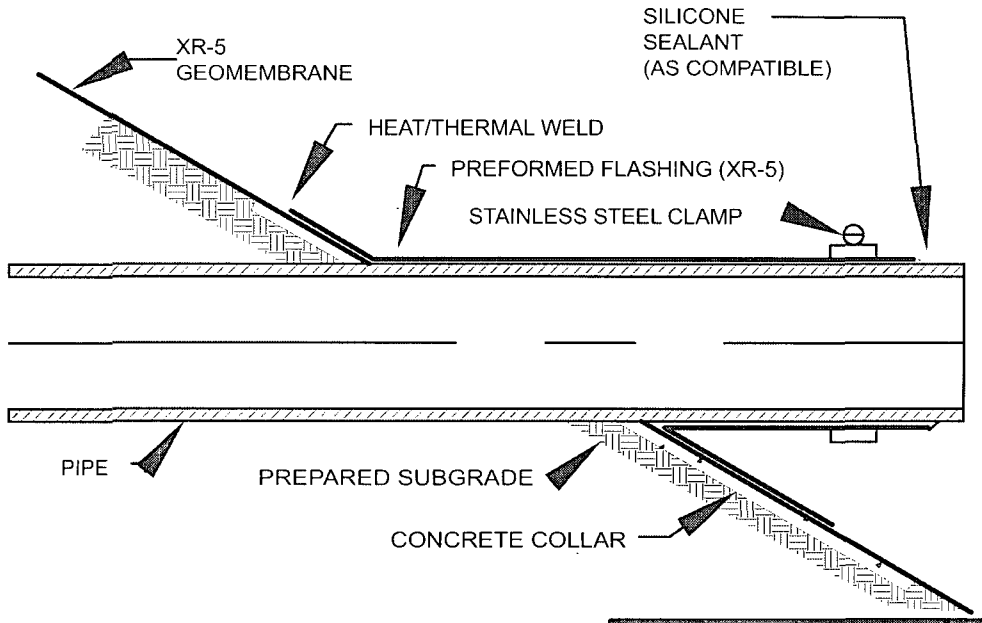
1000 Venture Blvd.,Wooster, Ohio 44691

ANCHORING DETAIL
XR-5 LINER TO FIXED WALL

SCALE: NONE

SHEET 1 of 1

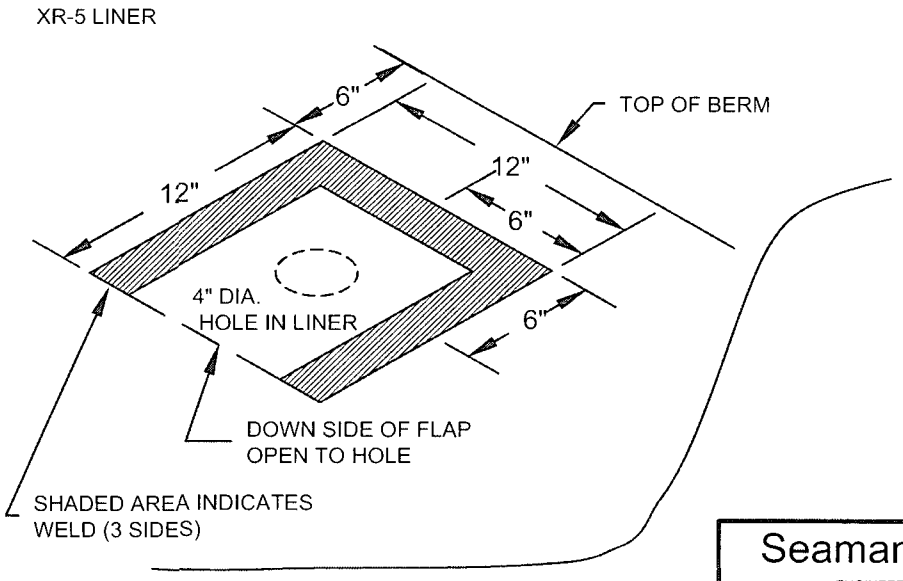
DRAW NO. XRD-023



Seaman Corporation
ENGINEERED PRODUCTS GROUP
1000 Venture Blvd.,Wooster, Ohio 44691

ELEVATION VIEW
TYPICAL PIPE PUNCTURE
SEAL DETAIL XR-5 LINER

SCALE: NONE
SHEET 1 of 1
DRAW NO. XRD-018



Seaman Corporation
ENGINEERED PRODUCTS GROUP
1000 Venture Blvd.,Wooster, Ohio 44691

PLAN VIEW
FLAP VENT DETAIL
XR-5 LINER

SCALE: NONE
SHEET 1 of 1
DRAW NO. XRD-012

Section 6 - Warranty Information

Warranty

XR-5® is offered with Seaman Corporation standard warranty which addresses weathering and chemical compatibility for a 10-year period. A test immersion is required with subsequent testing and approval by Seaman Corporation.

Instructions for XR-5 Test Immersions and Warranty Requests

1. Completely immerse six Style 8130 XR-5 samples (8-1/2" x 11" size) in the liquid to be contained.
2. At the end of approximately thirty days, retrieve three of the samples. The samples should be rinsed with fresh water and dried.
3. Send the three samples to:

   Attn: Geomembrane Department
   Seaman Corporation
   1000 Venture Blvd.
   Wooster, OH 44691

4. Keep the other three samples immersed until further notice in case longer immersion data is required.
5. Complete and return the information form on the liner application.

8228 XR-3® and all PW Geomembranes are offered with a standard 10-year warranty for weathering. The attached information form should be completed.

XR® Membrane Application and Utilization Form

Installation Owner and Address:

Physical Location of Installation:

Expected Date of Installation:

Expected Beginning Date of Service:

Description of Application:
(Example: impoundment used to contain brine on an emergency basis.)

Physical Features of Application:
(Example: 1.3 million gallon earthen impoundment with overall top dimensions of 160' x 160' with 3:1 slopes and 10' deep.)

Description of Liquid:

(Describe content of liquid including pollutants and expected temperature extremes in basin and at application point. Attach analysis of liquid chemistry, composition taken on a representative basis.)

Operational Characteristics:

(Describe the operation of the facility such as filling schedules, fluctuating liquid levels, operating temperatures, etc.)

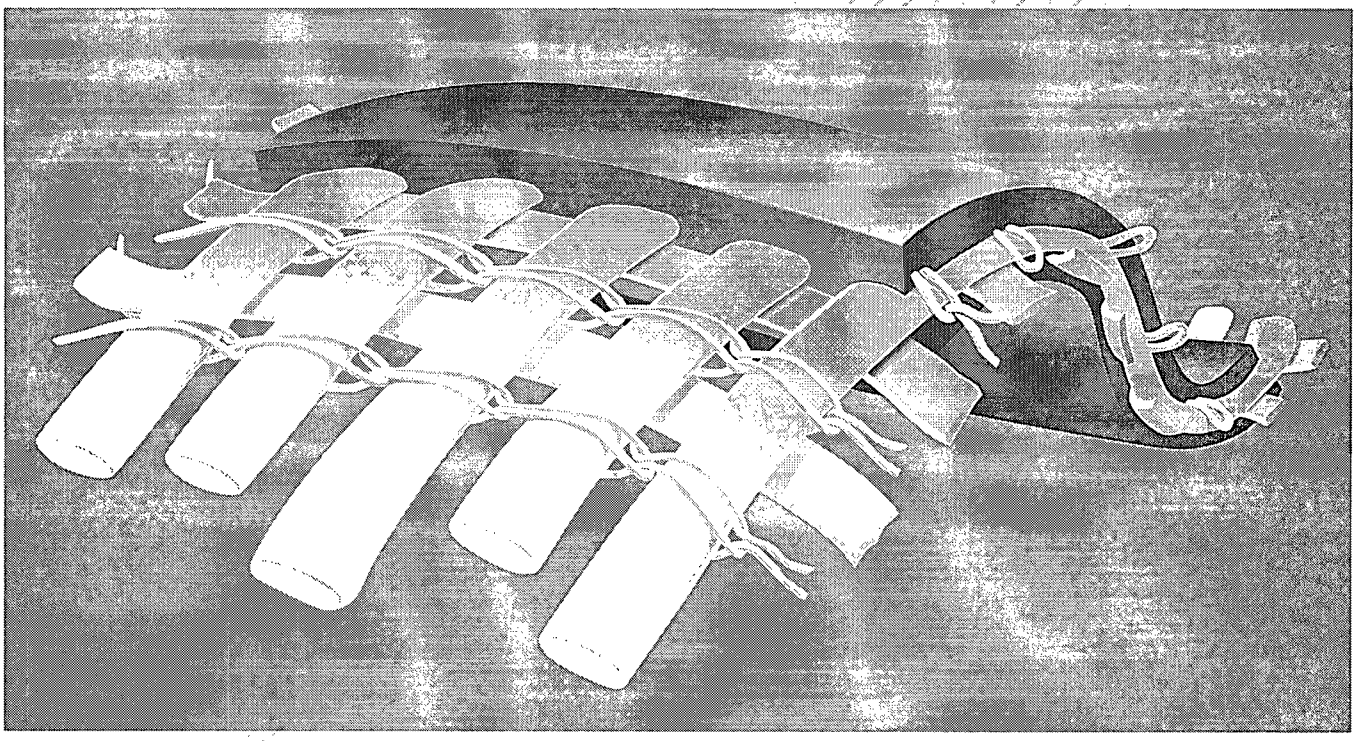
Performance Requirements, Etc:

(State any other requirements, such as rate of permeability required.)

Owner represents the information herein is complete and accurate, and understands and agrees that issuance of Seaman Corporation Warranty for XR products are conditioned upon such completeness and accuracy.

OWNER'S SIGNATURE

Reference Materials:



XR-5®: High Performance Composite Geomembrane

Seaman Corporation

1000 Venture Blvd.
Wooster, Ohio 44691
(330) 262-1111
www.xr-5.com

APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME III: ENGINEERING DESIGN AND CALCULATIONS
SECTION 1: ENGINEERING DESIGN

ATTACHMENT III.1.I

SMOOTH HDPE GEOMEMBRANE

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SMOOTH HDPE GEOMEMBRANE
ENGLISH UNITS

Property	Test Method	Minimum Average Values 30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, mils	ASTM D 5199					
minimum average		30	40	60	80	100
lowest individual reading		27	36	54	72	90
Sheet Density, g/cc	ASTM D 1505/D 792	0.940	0.940	0.940	0.940	0.940
Tensile Properties[1]	ASTM D 6693					
1. Yield Strength, lb/in		63	84	126	168	210
2. Break Strength, lb/in		114	152	228	304	380
3. Yield Elongation, %		12	12	12	12	12
4. Break Elongation, %		700	700	700	700	700
Tear Resistance, lb	ASTM D 1004	21	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	54	72	108	144	180
Stress Crack Resistance[2], hrs	ASTM D 5397 (App.)	300	300	300	300	300
Carbon Black Content[3], %	ASTM D 1603	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			--Note 4--		
Oxidative Induction Time (OIT)						
Standard OIT, minutes	ASTM D 3895	100	100	100	100	100
Oven Aging at 85°C	ASTM D 5721					
High Pressure OIT - % retained after 90 days	ASTM D 5885	60	60	60	60	60
UV Resistance[5]	GRI GM11					
High Pressure OIT[6] - % retained after 1600 hrs	ASTM D 5885	50	50	50	50	50
Seam Properties	ASTM D 6392 (@ 2 in/min)					
1. Shear Strength, lb/in		57	80	120	160	200
2. Peel Strength, lb/in - Hot Wedge		45	60	91	121	151
- Extrusion Fillet		39	52	78	104	130
Roll Dimensions						
1. Width (feet):		23	23	23	23	23
2. Length (feet)		1000	750	500	375	300
3. Area (square feet):		23,000	17,250	11,500	8,625	6,900
4. Gross weight (pounds, approx.)		3,470	3,470	3,470	3,470	3,470

1 Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Yield elongation is calculated using a gauge length of 1.3 inches; Break elongation is calculated using a gauge length of 2.0 inches.
2 The yield stress used to calculate the applied load for the SP-NCTL test should be the mean value via MQC testing.
3 Other methods such as ASTM D 4218 or microwave methods are acceptable if an appropriate correlation can be established.
4 Carbon black dispersion for 10 different views: Nine in Categories 1 and 2 with one allowed in Category 3.
5 The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
6 UV resistance is based on percent retained value regardless of the original HP-OIT value.

Section 4 Stormwater Management Plan

APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME III: ENGINEERING DESIGN AND CALCULATIONS
SECTION 4: STORMWATER MANAGEMENT PLAN

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SECTION 4: STORMWATER MANAGEMENT PLAN

1.0 DESIGN CRITERIA

The stormwater management systems for the Basin Disposal, Inc. Evaporation Ponds are designed to meet the requirements of the regulatory standards identified in the Oil Conservation Division 19.15.36 NMAC (Regulations), New Mexico Energy, Minerals, and Natural Resources Department. More specifically, §19.15.36.8.C.(11) requires:

> *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;*

and further §19.15.36.13.M specifies that:

> *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.*

2.0 SITE CONDITIONS

The Basin Disposal, Inc. site is comprised of 28 acres± located in S3; T29N; R11W NMPM, 3 miles north of the intersection of U.S. Highway 550 and U.S. Highway 64. Existing topography for the site generally drains to the east/southeast at 2% to 5% slopes. The northern boundary of the site is contiguous with commercial properties, portions of which contribute run-on to the stormwater management footprint (Watershed #1, **Figure III.4.1**). On-site run-off (Watersheds #2 and #3) will be controlled, along with run-on, by the installation of a new Stormwater Detection Basin located east of Evaporation Pond 3. Site drainage will be conveyed by two new perimeter channels; one to the north of Evaporation Ponds 2 and 3, and one to the south of the Ponds (**Figure III.4.1**).

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3.0 METHODOLOGY

The approach for the calculation of run-on and run-off stormwater flows was based on the Drainage Manual (New Mexico State Highway and Transportation Department, "Drainage Manual, Volume 1, Hydrology). The Drainage Manual specifies that the Simplified Peak Flow method should be used to compute run-off from watersheds less than 5 square miles. The total drainage basin acreage for the project area is determined to be approximately 10 acres (**Table III.4.6**), when the two new Ponds (2 and 3) are subtracted out.

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06/11/09

APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME IV: SITING AND HYRDOGEOLOGY

REDLINE/STRIKE-OUT

Section 1 Siting Criteria

APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME IV: SITING AND HYDROGEOLOGY
SECTION 1: SITING CRITERIA

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LIST OF ATTACHMENTS

Attachment No.	Title
IV.1.A	MONTHLY AVERAGE PAN EVAPORATION (INCHES)
IV.1.B	PERIOD OF RECORD MONTHLY CLIMATE SUMMARY (FARMINGTON AG SCIENCE CENTER, NM)
IV.1.C	PERIOD OF RECORD GENERAL CLIMATE SUMMARY – TEMPERATURE (FARMINGTON AG SCIENCE CENTER, NM)
IV.1.D	PERIOD OF RECORD GENERAL CLIMATE SUMMARY – TEMPERATURE (AZTEC RUINS NATIONAL MONUMENT, NM)

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3.0 WATERCOURSE, LAKEBED, SINKHOLE, OR PLAYA LAKE

19.15.36.13.B. No surface waste management facility shall be located:
(1) within 200 feet of a watercourse, lakebed, sinkhole or playa lake;

BDI waste disposal facilities are not located within 200 feet of a watercourse, lakebed, sinkhole or playa lake. Figure IV.1.3, USGS Quadrangle Map (11" x 17"), shows surface features on and adjacent to the Basin Disposal site, and **Figure IV.1.2** provides detailed topographic information for the footprint of the facility. These figures, accompanied by focused site reconnaissance, document that there are no regulated surface water features on or adjacent to the site. The intermittent drainage feature, shown on the USGS Quadrangle Map (**Figure IV.1.3**) is limited to the extreme southwest corner of the property over 750' from any waste management installations. The "Karst Terrain Map" (**Figure IV.1.9**) also shows that the potential for subsidence features that might create sinkhole or playa conditions are absent from the region.

4.0 WELLHEAD PROTECTION AREA; 100-YEAR FLOODPLAIN

19.15.36.13.B. No surface waste management facility shall be located:
(2) within an existing wellhead protection area or 100-year floodplain

BDI is **not located within an existing wellhead protection area or 100-year floodplain.** The Wellhead Protection Area Map (**Figure IV.1.4**) provides the locations, with 200' setbacks, for water supply wells in the area based on data provided by the Office of the State Engineers (OSE). The closest water wells are more than 1,000 feet from the facility in accordance with the definition of wellhead protection area in 19.15.2.7.W.(8) NMAC. The closest municipal water supply well belongs to the city of Bloomfield and is located over 3 miles south-southeast of the BDI site.

Deleted: Not only are there no water supply wells on-site, the nearest Wellhead Protection Area is over 1100' from the BDI Facility.

Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM FM3500640550B, August 1988) was reviewed for 100-year floodplain delineations near the facility (**Figure IV.1.5**). A Letter of Correction (LOMA) from December 2001 was issued for this map for an area 2.86 miles southeast of the BDI property line. A review of these maps, in addition to site inspections, did not indicate watercourses or surface features characteristic of a regulated floodplain within or adjacent to the site; or any "waters of the

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document that foundation conditions are suitable for the surface ponds at this site. In summary, the topography of the site, and the nature of the sediments beneath the facility, indicate that the site is stable and suitable for the installation of existing and proposed waste processing and containment facilities.

9.0 MAXIMUM SIZE

19.15.36.13.C. No surface waste management facility shall exceed 500 acres.

The BDI occupies approximately 28 acres, in northwest quarter of Section 3, Township 29 North, Range 11 West of the New Mexico Principal Meridian. The Site Location Map, included as **Figure IV.1.1**, identifies the limits of the BDI facility; and the detailed Plat Survey Map is provided as **Figure IV.1.12**. The facility's permitted footprint includes 13.18 acres (Tract 2: Remainder Tract) and 14.59 acres as shown on **Figure IV.1.12**.

10.0 CLIMATOLOGY

The Basin Disposal site is located in a region of low precipitation and high evaporation, which optimizes the performance of the evaporation ponds. Although pan evaporation rates are low from November to March, the annual evaporation rate is over 66' per year (**Attachment IV.1.A**).

The precipitation is low, at 8.5" ± per year (**Attachment IV.1.B**), with most of the rainfall occurring during the high evaporation season. The net difference of evaporation vs. precipitation (i.e., 66.8" – 8.5") provides a net treatment rate of over 58" annually (i.e., potential evaporation rate of 6 million gallons/yr for Ponds 2 and 3). **Attachments IV.1.C** and **IV.1.D** provide additional detail regarding temperature and precipitation trends.

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APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME IV: SITING AND HYDROGEOLOGY
SECTION 1: SITING CRITERIA

ATTACHMENT IV.1.A

MONTHLY AVERAGE PAN EVAPORATION (INCHES)

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ATTACHMENT IV.1.A

NEW MEXICO
MONTHLY AVERAGE PAN EVAPORATION (INCHES)

	PERIOD OF RECORD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
ABIQUIU DAM	1957-2005	0.00	0.00	6.06	7.43	9.95	11.39	10.52	8.90	7.23	5.30	3.13	2.22	72.13
AGRICULTURAL COLLEGE	1892-1959	3.01	4.00	7.89	10.20	8.65	13.99	12.33	11.16	8.31	6.28	4.35	2.89	93.06
ALAMOGORDO DAM	1939-1975	3.73	4.35	8.21	11.30	12.88	14.43	13.66	11.59	9.17	7.19	4.89	3.46	104.86
ANIMAS	1923-2005	3.87	4.91	8.29	10.78	12.36	14.25	11.60	11.07	8.54	6.71	4.69	3.61	100.68
ARTESIA 6 S	1914-2005	4.38	3.03	7.25	7.66	12.11	13.13	10.86	10.44	9.36	6.34	3.12	0.00	87.68
BITTER LAKES WL REFUGE	1950-2005	2.67	3.93	6.82	9.60	11.31	12.62	11.88	10.16	8.02	5.85	3.53	2.50	88.89
BOSQUE DEL APACHE	1914-2005	3.21	4.20	7.76	10.20	11.61	13.13	11.56	10.36	8.03	6.25	3.66	2.54	92.51
BRANTLEY DAM	1987-2005	4.65	0.00	8.62	11.77	14.61	15.46	14.19	12.22	9.88	7.97	5.77	4.34	109.48
CABALLO DAM	1938-2005	4.42	5.10	8.56	11.37	13.59	14.80	13.08	11.35	9.26	7.27	4.78	3.48	107.06
CAPULIN NATL MONUMENT	1966-1979	0.00	0.00	0.00	0.00	9.08	10.57	9.71	9.18	7.65	0.00	0.00	0.00	46.19
CLOVIS 13 N	1929-2005	3.83	4.12	6.63	8.72	10.15	11.45	11.65	9.55	7.64	5.78	3.95	3.21	86.68
COCHITI DAM	1975-2005	0.00	4.14	6.44	8.48	11.07	12.95	12.38	10.62	8.91	6.29	3.94	2.79	88.01
CONCHAS DAM	1938-2005	0.00	0.00	7.35	8.88	10.29	11.69	11.37	10.06	8.24	6.18	4.04	2.79	80.89
EAGLE NEST	1937-2005	0.00	0.00	0.00	4.91	7.67	7.83	7.07	5.87	5.30	4.31	0.00	0.00	42.96
EL VADO DAM	1923-2005	0.00	0.00	3.61	5.43	7.46	8.84	8.52	6.91	5.66	3.84	1.72	0.00	51.99
ELEPHANT BUTTE DAM	1917-2005	3.47	4.87	8.61	12.22	14.94	16.37	14.15	12.05	9.78	7.70	4.91	3.34	112.41
ESTANCIA	1914-2005	0.00	0.00	3.26	6.79	8.56	9.27	8.61	7.10	5.60	3.82	2.62	0.00	55.63
FARMINGTON AG SCIENCE C	**1978-2005**	**0.00**	**0.00**	**0.00**	**7.97**	**10.06**	**12.00**	**12.52**	**10.70**	**8.15**	**5.41**	**0.00**	**0.00**	**66.81**
FLORIDA	1939-1992	3.54	4.81	8.10	10.94	13.03	14.80	11.84	10.10	8.51	6.58	4.57	3.11	99.93
GALLUP RANGER STN	1966-1975	0.00	0.00	0.00	6.61	9.31	12.12	10.50	8.70	7.95	5.07	2.20	0.00	62.46
JEMEZ DAM	1953-2005	0.00	0.00	0.00	9.91	12.27	13.95	14.29	11.45	9.80	6.72	3.65	0.00	82.04
JORNADA EXP RANGE	1925-2005	2.50	4.18	7.24	10.06	11.94	12.85	10.88	9.53	7.82	5.71	3.61	2.50	88.82
LAGUNA	1914-2005	0.00	0.00	0.00	8.47	9.33	11.98	10.76	8.88	6.83	5.00	1.98	0.00	63.23
LAKE AVALON	1914-1979	4.49	5.33	9.42	12.36	14.31	15.16	14.14	12.33	9.25	7.26	4.68	4.20	112.93
LAKE MC MILLAN	1941-1949	0.00	0.00	0.00	13.78	8.14	14.26	13.38	13.45	10.35	6.15	0.00	0.00	79.51
LOS LUNAS 3 SSW	1923-2005	1.87	2.81	5.27	7.77	9.74	10.49	10.06	8.67	6.58	4.64	2.75	2.45	73.10
NARROWS	1948-1964	3.09	5.67	7.62	11.07	13.37	15.44	13.07	11.42	9.97	7.20	4.32	2.64	104.88
NAVAJO DAM	1963-2005	0.00	0.00	0.00	6.58	9.10	11.07	11.24	9.66	7.22	4.74	0.00	0.00	59.61
PORTALES 7 WNW	1934-1960	3.26	4.57	8.24	8.85	10.72	12.16	10.44	9.28	7.95	5.98	4.15	3.53	89.13
HOOD RANGER STN	1954-2005	0.00	0.00	0.00	7.84	9.02	10.81	8.25	6.87	6.12	5.14	2.65	0.00	56.70
ROSWELL WSO AIRPORT	1893-1972	0.00	0.00	0.00	11.29	0.00	15.87	12.11	12.63	7.92	6.97	4.66	4.51	75.96
SANTA FE	1867-1972	0.00	0.00	3.00	7.28	8.73	10.93	9.95	8.26	7.15	5.10	2.50	0.00	62.90
SANTA FE 2	1972-2005	0.00	0.00	0.00	7.10	9.76	11.31	10.36	9.20	7.41	5.08	0.00	0.00	60.22
SHIPROCK	1926-2005	0.00	0.00	0.00	7.84	10.57	14.44	13.17	10.80	9.80	6.54	0.00	0.00	73.16
SOCORRO	1914-2005	0.00	0.00	4.83	7.09	9.17	9.35	8.56	7.57	5.73	4.14	0.00	0.00	56.44
STATE UNIVERSITY	1959-2005	3.00	4.33	7.40	9.90	12.03	12.91	12.05	10.34	8.14	6.17	3.85	2.79	92.91
SUMNER LAKE	1921-2005	0.00	0.00	7.33	10.22	12.35	13.54	13.36	11.16	9.02	6.97	4.92	3.17	92.04
TUCUMCARI 4 NE	1904-2005	0.00	0.00	0.00	9.83	11.53	13.11	13.00	11.13	8.96	6.74	0.00	0.00	74.30
UTE DAM	1965-2005	4.38	4.91	7.53	8.78	10.75	10.49	10.92	9.42	7.56	6.68	4.98	3.04	89.44

Western Regional Climate Center, wrcc@dri.edu

APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME IV: SITING AND HYDROGEOLOGY
SECTION 1: SITING CRITERIA

ATTACHMENT IV.1.B

PERIOD OF RECORD MONTHLY CLIMATE SUMMARY

(Farmington AG Science Center, NM)

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Attachment IV.1.B

FARMINGTON AG SCIENCE C, NEW MEXICO (293142)

Period of Record Monthly Climate Summary

Period of Record : 5/ 1/1978 to 12/31/2008

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	41.9	48.2	57.4	66.1	75.8	86.7	91.0	87.6	80.5	68.0	53.4	42.6	66.6
Average Min. Temperature (F)	19.3	24.2	29.9	36.1	44.8	53.3	60.0	58.5	51.0	39.4	28.2	19.9	38.7
Average Total Precipitation (in.)	0.52	0.57	0.75	0.67	0.58	0.21	0.90	1.10	1.06	0.91	0.76	0.48	**8.51**
Average Total SnowFall (in.)	2.8	3.7	1.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.5	2.9	11.3
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

Percent of possible observations for period of record.
Max. Temp.: 99.2% Min. Temp.: 99.2% Precipitation: 99.2% Snowfall: 96.8% Snow Depth: 93.2%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME IV: SITING AND HYDROGEOLOGY
SECTION 1: SITING CRITERIA

ATTACHMENT IV.1.C

PERIOD OF RECORD GENERAL CLIMATE SUMMARY – TEMPERATURE

(Farmington AG Science Center, NM)

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Attachment IV.1.C
FARMINGTON AG SCIENCE C, NEW MEXICO
Period of Record General Climate Summary - Temperature

Station:(293142) FARMINGTON AG SCIENCE C

From Year=1978 To Year=2008

	Monthly Averages			Daily Extremes				Monthly Extremes				Max. Temp.		Min. Temp.	
	Max.	Min.	Mean	High	Date	Low	Date	Highest Mean	Year	Lowest Mean	Year	>= 90 F	<= 32 F	**<= 32 F**	<= 0 F
	F	F	F	F	dd/yyyy or yyyymmdd	F	dd/yyyy or yyyymmdd	F	-	F	-	# Days	# Days	**# Days**	# Days
January	41.9	19.3	30.6	66	17/2000	-8	30/1979	37.9	2003	23.9	2008	0.0	4.2	**29.7**	0.5
February	48.2	24.2	36.2	70	27/1986	-14	07/1989	43.3	1995	31.0	1982	0.0	1.0	**24.2**	0.2
March	57.4	29.9	43.6	82	21/2004	3	03/2002	49.9	2004	38.8	1987	0.0	0.1	**19.7**	0.0
April	66.1	36.1	51.1	86	30/1992	16	02/1979	56.6	2002	44.9	1983	0.0	0.0	**9.2**	0.0
May	75.8	44.8	60.3	97	30/2000	23	03/2008	65.2	2006	55.9	1983	0.9	0.0	**1.5**	0.0
June	86.7	53.3	70.0	100	26/1981	32	05/1999	75.1	2002	66.3	1983	12.1	0.0	**0.0**	0.0
July	91.0	60.0	75.5	103	07/1989	44	25/1981	80.3	2003	71.6	1992	20.6	0.0	**0.0**	0.0
August	87.6	58.5	73.1	99	06/1983	27	08/1984	76.4	2003	63.5	1984	12.0	0.0	**0.0**	0.0
September	80.5	51.0	65.7	97	02/1995	28	29/1999	69.8	1998	61.0	2006	2.2	0.0	**0.2**	0.0
October	68.0	39.4	53.7	87	02/2003	15	30/1989	58.5	2003	47.0	1984	0.0	0.0	**5.6**	0.0
November	53.4	28.2	40.8	75	07/1999	4	30/2006	45.4	1999	34.8	1992	0.0	0.2	**20.9**	0.0
December	42.6	19.9	31.2	64	02/1995	-16	24/1990	37.1	1980	22.9	1990	0.0	3.2	**29.6**	0.5
Annual	**66.6**	**38.7**	**52.7**	**103**	**19890707**	**-16**	**19901224**	**54.7**	**2003**	**50.6**	**1982**	**47.8**	**8.7**	**140.8**	**1.1**
Winter	44.2	21.1	32.7	70	19860227	-16	19901224	37.0	1995	26.9	1979	0.0	8.4	**83.5**	1.1
Spring	66.4	36.9	51.7	97	20000530	3	20020303	55.9	1989	47.5	1983	0.9	0.1	**30.4**	0.0
Summer	88.5	57.3	72.9	103	19890707	27	19840808	75.7	2003	69.4	1984	44.6	0.0	**0.1**	0.0
Fall	67.3	39.5	53.4	97	19950902	4	20061130	57.2	2001	51.0	1993	2.2	0.2	**26.8**	0.0

Table updated on Apr 28, 2009

For monthly and annual means, thresholds, and sums:
Months with 5 or more missing days are not considered
Years with 1 or more missing months are not considered
Seasons are climatological not calendar seasons

Winter = Dec., Jan., and Feb. Spring = Mar., Apr., and May

Summer = Jun., Jul., and Aug. Fall = Sep., Oct., and Nov.

APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION PONDS

VOLUME IV: SITING AND HYDROGEOLOGY
SECTION 1: SITING CRITERIA

ATTACHMENT IV.1.D

PERIOD OF RECORD GENERAL CLIMATE SUMMARY – TEMPERATURE

(Aztec Ruins National Monument, NM)

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Attachment IV.1.D
AZTEC RUINS NATL MONUME, NEW MEXICO
Period of Record General Climate Summary - Temperature

Station:(290692) AZTEC RUINS NATL MONUME

From Year=1895 To Year=2008

	Monthly Averages			Daily Extremes				Monthly Extremes				Max. Temp.		Min. Temp.	
	Max.	Min.	Mean	High	Date	Low	Date	Highest Mean	Year	Lowest Mean	Year	>= 90 F	<= 32 F	**<= 32 F**	<= 0 F
	F	F	F	F	dd/yyyy or yyyymmdd	F	dd/yyyy or yyyymmdd	F	-	F	-	# Days	# Days	**# Days**	# Days
January	43.2	15.3	29.3	69	01/1981	-23	07/1971	38.1	1956	14.8	1937	0.0	3.1	**30.1**	2.6
February	49.5	20.4	35.0	78	21/1958	-27	08/1933	42.6	1995	21.2	1933	0.0	0.9	**26.3**	0.7
March	58.2	25.5	41.8	82	10/1989	-3	03/2002	49.1	2004	35.5	1897	0.0	0.1	**25.7**	0.0
April	67.8	32.1	50.0	89	30/1943	10	04/1955	55.6	1946	44.4	1975	0.0	0.0	**15.4**	0.0
May	77.1	40.5	58.8	98	31/2002	12	07/1975	64.4	1934	53.4	1930	0.9	0.0	**3.7**	0.0
June	86.9	48.6	67.8	103	22/1954	24	09/1974	72.9	1959	61.6	1945	11.5	0.0	**0.2**	0.0
July	91.2	56.9	74.1	105	13/1971	39	19/1897	77.0	1966	69.5	1897	21.1	0.0	**0.0**	0.0
August	88.6	55.7	72.2	105	04/1960	36	28/1920	75.5	1970	68.2	1989	14.1	0.0	**0.0**	0.0
September	81.7	47.2	64.5	100	13/2008	22	20/1978	70.0	1960	60.5	2006	2.7	0.0	**0.7**	0.0
October	70.1	36.0	53.1	92	12/1928	10	31/1900	59.3	1963	47.8	1984	0.0	0.0	**9.5**	0.0
November	55.1	24.2	39.7	80	09/1947	-7	23/1931	45.2	1999	33.0	1938	0.0	0.2	**25.7**	0.1
December	43.9	16.3	30.1	67	02/1926	-24	25/1924	36.2	1946	17.1	1898	0.0	3.1	**29.9**	2.1
Annual	**67.8**	**34.9**	**51.4**	**105**	**19600804**	**-27**	**19330208**	**53.9**	**1954**	**48.2**	**1897**	**50.4**	**7.4**	**167.1**	**5.6**
Winter	45.5	17.3	31.4	78	19580221	-27	19330208	36.9	1995	21.0	1899	0.0	7.1	**86.3**	5.4
Spring	67.7	32.7	50.2	98	20020531	-3	20020303	55.1	1934	46.0	1975	0.9	0.1	**44.8**	0.0
Summer	88.9	53.7	71.3	105	19600804	24	19740609	74.1	1981	68.0	1949	46.7	0.0	**0.2**	0.0
Fall	69.0	35.8	52.4	100	20080913	-7	19311123	57.0	1963	49.8	1930	2.7	0.2	**35.9**	0.1

Table updated on Apr 28, 2009

For monthly and annual means, thresholds, and sums:
Months with 5 or more missing days are not considered
Years with 1 or more missing months are not considered
Seasons are climatological not calendar seasons

Winter = Dec., Jan., and Feb. Spring = Mar., Apr., and May

Summer = Jun., Jul., and Aug. Fall = Sep., Oct., and Nov.

Section 2 Hydrogeology

APPLICATION FOR MODIFICATION
BASIN DISPOSAL, INC.
OIL FIELD WASTE EVAPORATION BASINS

VOLUME IV: SITING AND HYDROGEOLOGY
SECTION 2: HYDROGEOLOGY

- JOHN SHOMAKER & ASSOCIATES, INC., SEPTEMBER 2008, SUBSURFACE AND GROUNDWATER INVESTIGATION IN SUPPORT OF THE MODIFICATION OF A SURFACE WASTE MANAGEMENT FACILITY, BASIN DISPOSAL, INC., BLOOMFIELD, NM.

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- JOHN SHOMAKER & ASSOCIATES, INC., NOVEMBER 2008, RESULTS FROM WATER-QUALITY TESTING OF ASSESSMENT WELL NO. 2 AT BASIN DISPOSAL, INC., BLOOMFIELD, SAN JUAN COUNTY, NM.

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- JOHN SHOMAKER & ASSOCIATES, INC., MAY 2009, GROUNDWATER AND POND WATER COMPARISON AT BASIN DISPOSAL, INC., BLOOMFIELD, NM.

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JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS
2611 BROADBENT PARKWAY NORTHEAST
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-3407, FAX (505) 345-9920
www.shomaker.com

May 22, 2009

John Volkerding, Ph.D.
Basin Disposal, Inc.
P.O. Box 100
Aztec, New Mexico 87410

Re: Ground-water and pond-water comparison at Basin Disposal, Inc., Bloomfield, NM

Dear John:

This letter report is in response to the May 1, 2009 New Mexico Oil Conservation Division (NMOCD) request for additional information, and compares water-quality test results of perched ground water at the Basin Disposal Site to the pond water at the Basin Disposal facility and to regional "fresh" ground water. Water-quality test results of the perched water were obtained from the two assessment wells drilled in May of 2008 and sampled on May 27, and October 30, 2008 at Basin Disposal, Inc. (NMOCD Permit application Volume IV, Section 2; JSAI, 2008; JSAI Memorandum of November 19, 2008). Basin Disposal's pond water was sampled by GE Osmonics on August 4, 2006, with the laboratory report completed by GE Infrastructure, Water and Process Technology Division on August 16, 2006. Locations of the two assessment wells (AW-1 and AW- 2) and the existing pond are shown on the map attached as Figure 1. The five regional wells used as an average to represent the background "fresh" ground-water quality are summarized from Stone et al., 1983 and are shown in Figure 2. Water-quality results are presented in Table 1.

Basin Disposal Assessment Wells

Borehole data strongly suggest that ground water at the Site is present under perched conditions. Physical evidence includes moist fracture zones, moist 'clay-rich' areas prone to dissolution within the Nacimiento Formation cores retrieved during drilling at the Site, and assessment wells that collected ground water at the Site, above a level at which a core in the same borehole was dry. On May 29, 2008, two assessment wells, AW-1 and AW-2 at Basin Disposal, Inc., had respective water elevations of 5,672.83 and 5,690.05 ft above mean sea-level (ft amsl) (figures 7 and 8 in JSAI, 2008 used with Bore Hole Survey dated December 2, 2008 and provided by Basin Disposal, Inc.). In contrast, the regional water-level elevation is between 5,600 ft and 5,500 ft amsl (figure 6 in JSAI, 2008).

Ground water in these assessment wells was submitted for analysis and the total dissolved solids (TDS), anions, mercury, dissolved metals, and the total recoverable metals are summarized from reports by JSAI (2008; JSAI Memorandum dated November 19, 2008). Perched ground water at the Site has TDS concentrations of between 24,000 and 38,000 mg/L, above the TDS concentration of 10,000 mg/L for fresh water (to be protected), per NMAC 19.15.36.8 C. (15) (b), as defined in NMAC 19.15.1.7 F. (3), and outside the jurisdiction of the NMOCD (JSAI, 2008). Water produced from the assessment wells had elevated concentrations of TDS, chloride, fluoride, nitrate, sulfate, and lead (EPA method 6010 measures total recoverable metals) when compared to the New Mexico Water Quality Control Commission (NMWQCC) standards (see Table 1). The ground water in the assessment wells can be classified as Na-SO_4 type water on a Piper diagram (Figure 3). Piper diagrams plot the number of major ions in water, balancing mass and electric charge.

Regional Ground-Water Quality

As mentioned in the ground-water investigation (JSAI, 2008), regional ground water has a relatively high average specific conductance and TDS content, except where shallow recharge decreases these parameters (Stone et al., 1983). Recharge occurs from the Animas River, the San Juan River, and irrigation canals in the floodplain, lowering the average specific conductance of ground water in alluvial wells (1,690 micromhos per centimeter; μmhos/cm) as compared to water from wells completed in the underlying Nacimiento Formation (5,660 μmhos/cm).

Water-quality results for wells completed in the Nacimiento Formation on Crouch Mesa, near the Basin Disposal Site, are unavailable (Stone et al., 1983). Wells in the Nacimiento Formation but south of the San Juan River are characterized as Na-Ca-SO_4 ground water. This same characterization applies to alluvial ground water in an 8-mile radius of the Basin Disposal Site. In these wells, ground water contains high concentrations of calcium, sodium, and sulfate, and is also classified as Na-Ca-SO_4 type water (see Table 1).

The "fresh" ground-water aquifer probably encompasses the Ojo Alamo Sandstone in addition to the Nacimiento Formation, which lies on top of a relatively impermeable Kirtland Shale. For the purposes of this report the Kirtland Shale is considered an aquiclude. The thickness of the Nacimiento Formation and the Ojo Alamo Sandstone under the Basin Disposal Site is considered to be less than 941 ft (NMOCD oil & gas well records). Taking the thickness of these units and subtracting the unsaturated thickness based on water-elevation contours leads to an estimated maximum saturated thickness of at most 869 ft under the Basin Disposal Site and in some areas significantly less.

Disposal Pond Water Quality

Disposal-pond water, sampled on August 4, 2006 and reported by the laboratory on August 16, 2006, can be classified as a Na-Cl (sodium-chloride) type water that plots in different regions of a tri-linear (Piper) diagram (Figure 3).

Table 1. Summary of water-quality analysis results at the Basin Disposal Site and the surrounding area in Bloomfield, San Juan County, New Mexico

constituent	unit	AW-1 water sample	AW-2 water sample	average of 5 wells in a 8-mile radius (Stone et al., 1983)	Basin Disposal surface pond water sample	NMWQCC discharge standards
date sampled		5/27/2008	10/30/2008	ranges from 1933 to 1974	08/04/2006	
water type[1]		$Na\text{-}SO_4$	$Na\text{-}SO_4$	$Na\text{-}Ca\text{-}SO_4$	Na-Cl	not applicable
TDS	mg/L	**38,000**	**29,000**	**1,577**	**15,721**[2]	1,000
bromide	mg/L	6.3	9.5	NA	NA	no standards
chloride	mg/L	**2,300**	**2,600**	25	**7,600**	250
fluoride	mg/L	**1.7**	<1.0	0.7	<0.1	1.6
nitrate	mg/L	**11**	<1.0	1.9	<1.0	10 (total)
phosphorus	mg/L	<5.0	<5.0	NR	5.3	no standards
sulfate	mg/L	**18,000**	**17,000**	**1,249**	**978**	600
arsenic (total)	mg/L	<0.20	<0.10	NA	NA	0.10
barium	mg/L	<0.20	<0.10	NA	**3.1**	1.0
cadmium	mg/L	<0.020	<0.010	NA	NA	0.01
calcium	mg/L	480	420	188	139	no standard
chromium	mg/L	<0.060	<0.030	NA	NA	0.05
lead	mg/L	**0.098**	<0.025	NA	0.019	0.05
magnesium	mg/L	300	230	24	31.5	no standard
mercury	mg/L	<0.00020	<0.00020	NA	0.001	0.002
potassium	mg/L	15	32	6	571	no standard
selenium	mg/L	<0.50	<0.25	NR	NA	0.05
silver	mg/L	<0.050	<0.025	NA	NA	0.05
sodium	mg/L	10,000	10,000	650	4,970	no standard

[1] - water type calculated by aqueous geochemistry software AquaChem, version 3.7.42 by Waterloo Hydrogeologic
[2] - calculated total dissolved solids concentration from charge balance
NMWQCC - New Mexico Water Quality Control Commission
TDS - total dissolved solids
bold - result exceeds standard
mg/L - milligrams per liter
NA - not analyzed
ND - not determined

Conclusions

In summary, the water in the disposal ponds, assessment wells, and the regional "fresh" ground water are distinct and different from each other. The pond water has a higher chloride and lower sulfate concentration compared to the perched water in the assessment wells. In turn, assessment well (perched) water has higher concentrations of sulfate, TDS, and sodium compared to the regional "fresh" ground water in either bedrock or alluvial aquifers near the Basin Disposal Site (Stone et al., 1983). The differences in water quality indicate that the perched water is not from the disposal ponds, and that there is little or no hydraulic connection between the perched aquifer and the water in the regional "fresh" ground-water system.

Sincerely,

JOHN SHOMAKER & ASSOCIATES, INC.

Erwin A. Melis, Ph.D.
Hydrogeologist

Em:em

Enc: Figures 1, 2, and 3

References:

[JSAI] John Shomaker & Associates, Inc., 2008, Subsurface and ground-water investigation in support of the modification of a surface waste management facility Basin Disposal, Inc. Bloomfield, New Mexico: consultant's report to Basin Disposal, Inc., 14 p., plus figures and appendices.

[JSAI] John Shomaker & Associates, Inc., Memorandum of November 19, 2008, Results from water-quality testing of assessment well No. 2 at Basin Disposal, Inc., Bloomfield, San Juan County, New Mexico, 3 p.

Stone, W.J., Lyford, F.P., Frenzel, P.F., Mizell, N.H., and Padgett, E.T., 1983, Hydrogeologic Map of the San Juan Basin, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Hydrologic Report 6, scale 1:500,000.

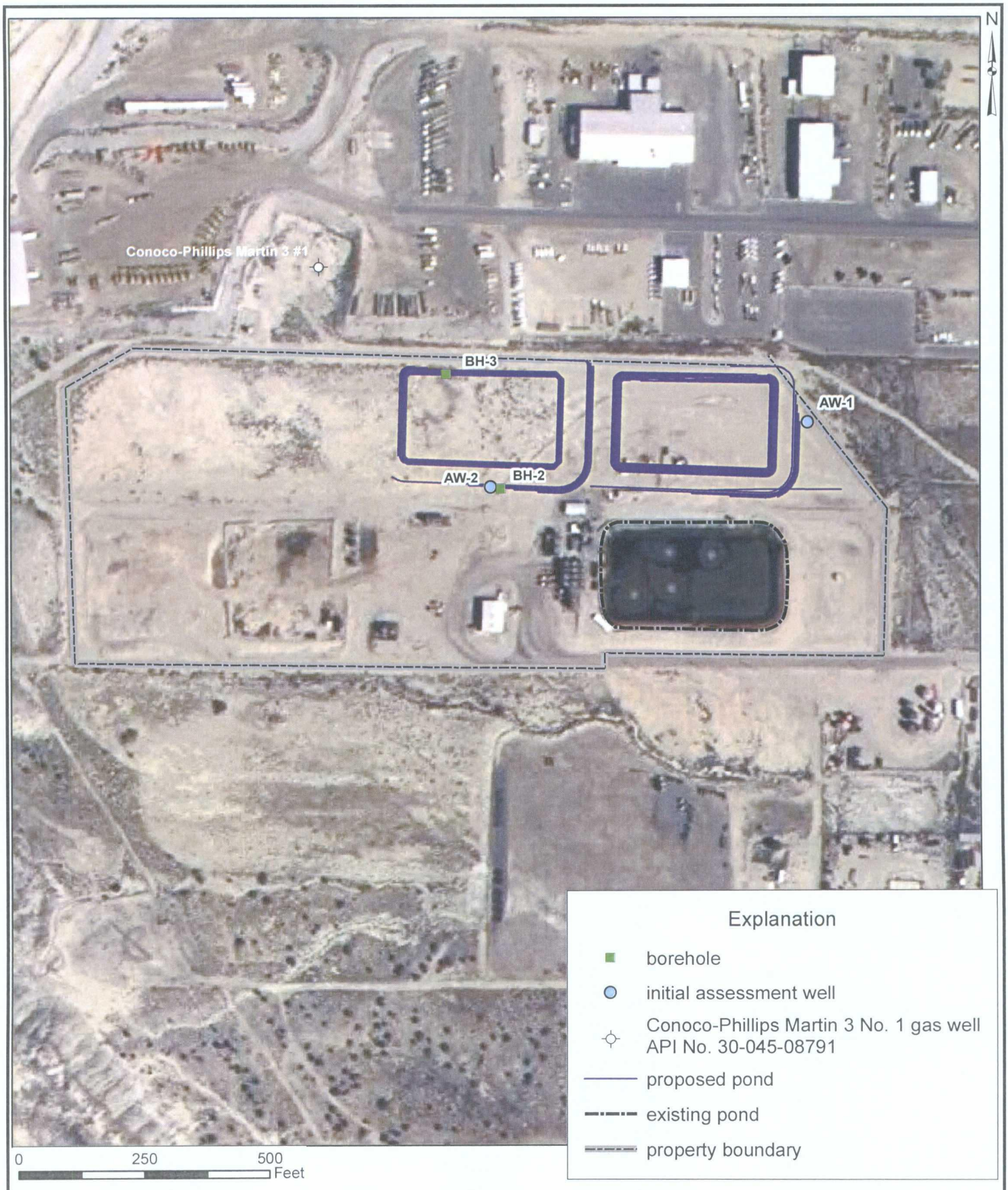

Figure 1. Aerial photograph showing the locations of the existing pond, the drilled boreholes, initial assessment wells, *proposed evaporation ponds*, and well site of the Conoco-Phillips Martin 3 No. 1, Basin Disposal Site, Bloomfield, New Mexico.

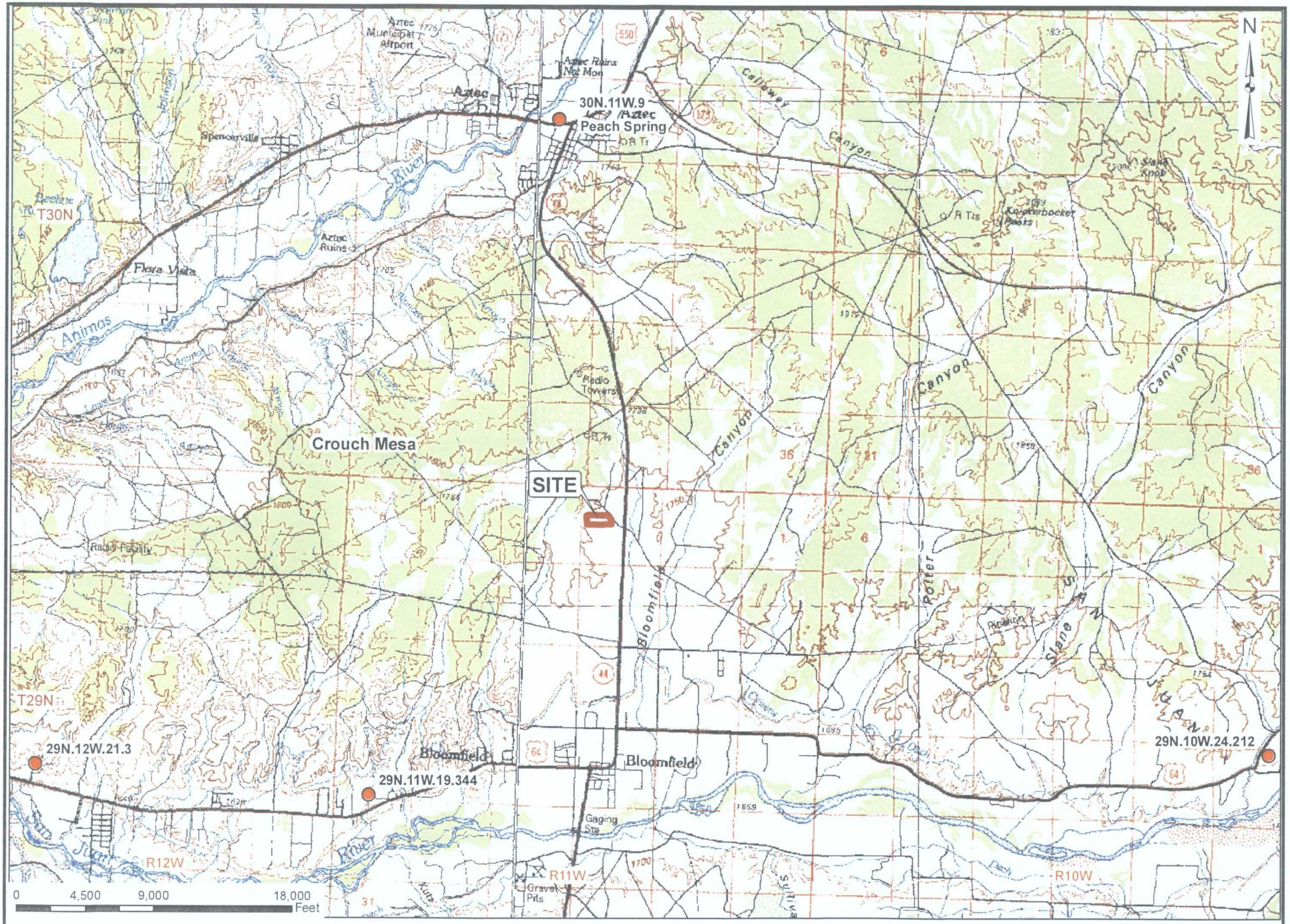

Figure 2. Topographic map of the Crouch Mesa area showing regional wells used to calculated the ground-water quality (Stone et al., 1983) within an 8-mile radius of the Basin Disposal site, Bloomfield, New Mexico.

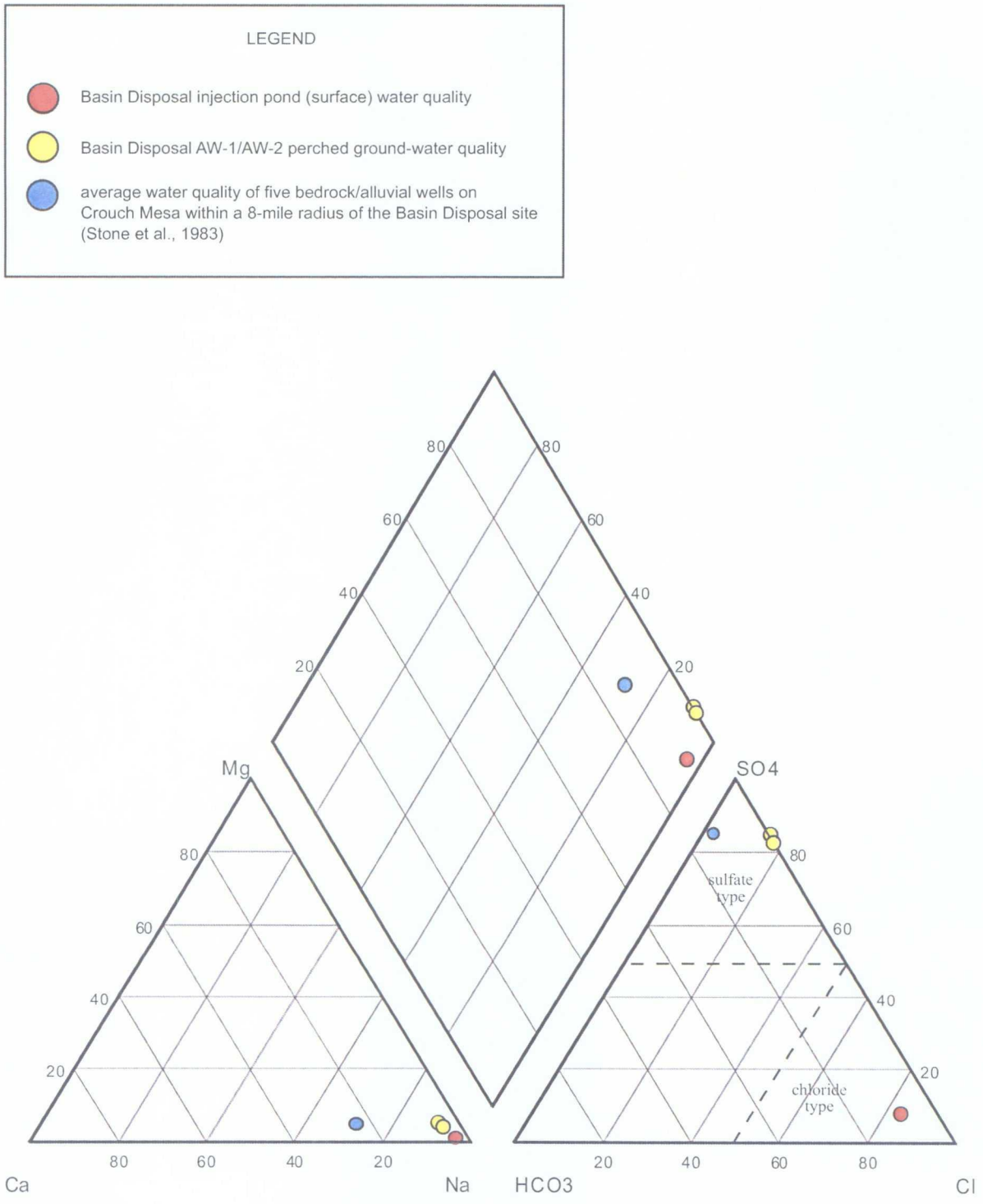

Figure 3. Tri-linear (Piper) diagram of three distinct types of water quality, including injection pond water, at the Basin Disposal site, north of Bloomfield, San Juan County, New Mexico.