

NM1-62

**Permit
Application**

**Volume 2
Part 2 of 3**

**APPLICATION FOR PERMIT
SUNDANCE WEST**

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

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1.0 INTRODUCTION

Sundance West is a proposed commercial Surface Waste Management Facility for oil field waste processing and disposal services. The proposed Sundance West Facility is subject to regulation under the New Mexico Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation Division (OCD). The Facility is designed in compliance with 19.15.36 NMAC, and will be constructed and operated in compliance with a Surface Waste Management Facility Permit issued by the OCD. The Facility is owned by, and will be constructed and operated by, Sundance West, Inc.

1.1 Purpose

The purpose of this Closure/Post-Closure (C/PC) Plan (the Plan) is to comply with the requirements of 19.15.36.8.C.(9) and 19.15.36.18 NMAC. This Plan describes the proposed procedures for closure and post-closure of the Sundance West Facility, including a C/PC Cost Estimate sufficient to close the Facility in a manner that will protect fresh water, public health, safety and the environment.

The oil field waste processing and disposal infrastructure is anticipated to be developed and operated in four phases (Phases I-IV) over a projected multi-year time period to allow for the Sundance West development of services in response to the needs of the oil and gas industry. **Table II.4.1**, Sundance West Development Sequence, provides an outline of the projected phased development, including an implementation schedule for the installation of waste processing and disposal activities at the Sundance West Facility. However, different combinations of these improvements may be constructed at any time dependent on market conditions and logistical considerations. This C/PC Plan may be modified by Sundance West to address changes in site or operating conditions; and submitted and approved by OCD 30 days prior to implementation of proposed change. This Plan may also be amended at the request of OCD per 19.15.36.18.A.(5) NMAC.

TABLE II.4.1
Sundance West Development Sequence (Phasing)¹
Sundance West

Description	Summary	Year No. ²
Phase I - Initial Landfill & Produced Water Processing Operation.		
<ul style="list-style-type: none"> • Initial Landfill Cell (13.5-acres) • Produced water load-out points (4) • Tank farm berm (complete) • Boiler (75 HP) running a heat transfer fluid tank farm • Produced Water Tanks (20), 1,000 bbl capacity³ • Mechanical Oil/Water Separation Unit (2) • Evaporation Ponds (4) capable of evaporating 3,000 bbl of liquid per day • Crude Oil Recovery Tank (1), 1,000 bbl capacity • Oil Recovery Centrifuge • Oil Sale Tank (1), 1,000 bbl capacity 	<p>The oil recovered from the Produced Water Processing Operations process is anticipated to be 6 bbl per day. This material will be pumped to the heated crude oil recovery tank for further processing before being pumped to the oil sale tank.</p>	1
Phase II - Jet-Out Pit Operation.		
<ul style="list-style-type: none"> • Jet-Out Pit (six-station) for handling basic sediment and water (BS&W), tank bottoms, oily drilling muds and tank wash-outs • Additional crude oil recovery tank (1), 1,000 bbl capacity • Install 5-acre Stabilization and Solidification Area 	<p>The oil recovered from the top of the Jet-Out Pit will be pumped to a heated Crude Oil Recovery Tank installed in the Tank Farm. Oil recovery from the Produced Water Tanks will also be pumped to this tank. Water recovered from the Pit will be pumped to the Produced Water Receiving Tanks. Sediments from the Pit will be bucket-loaded out of the pit and transferred to the Stabilization and Solidification Area for processing prior to landfilling.</p>	2
Phase III - Expanded Produced Water Processing Operation.		
<ul style="list-style-type: none"> • Produced water load-out points (2) • Additional Produced Water Tanks (10), 1,000 bbl capacity • Additional (1) Mechanical Oil/Water Separation Unit • Additional ponds (4) capable of evaporating an additional 4,000 bbl per day of liquid • Additional Crude Oil Recovery Tank (1), 1,000 bbl capacity • Additional Oil Sales Tank (1), 1,000 bbl capacity 	<p>The additional oil recovered from the expanded Produced Water Processing Operation process, anticipated to be 6 bbl per day (for a total of 12 bbls per day), will be pumped to the Crude Oil Recovery tanks for further processing.</p>	3
Phase VI - Ultimate Produced Water Processing Facility.		
<ul style="list-style-type: none"> • Produced water load-out points (2) • Additional Produced Water Tanks (15), 1,000 bbl capacity • Additional (1) Mechanical Oil/Water Separation Unit • Additional ponds (2) capable of evaporating an additional 2,000 bbl per day of liquid • Additional Crude Oil Recovery Tank (1), 1,000 bbl capacity 	<p>The additional oil recovered from the ultimate Produced Water Processing Facility will be pumped to the Crude Oil Recovery Tank for further processing.</p>	4

Notes:

¹ The Sundance West site development sequence is subject to change. Different combination of these improvements may be constructed at any time.

² Estimated number of years after OCD Surface Waste Management Facility Permit issued

³ bbl = barrels of oil

1.2 Site Location

The Sundance West site is located approximately 3 miles east of Eunice, 18 miles south of Hobbs, and approximately 1.5 miles west of the Texas/New Mexico state line in unincorporated Lea County, New Mexico (NM). The Sundance West site is comprised of a 320-acre ± tract of land located in the South ½ of Section 30, Township 21 South, Range 38 East, Lea County, NM. Site access will be provided via NM 18 and Wallach Lane. A Site Location Map is provided as **Figure II.4.1**.

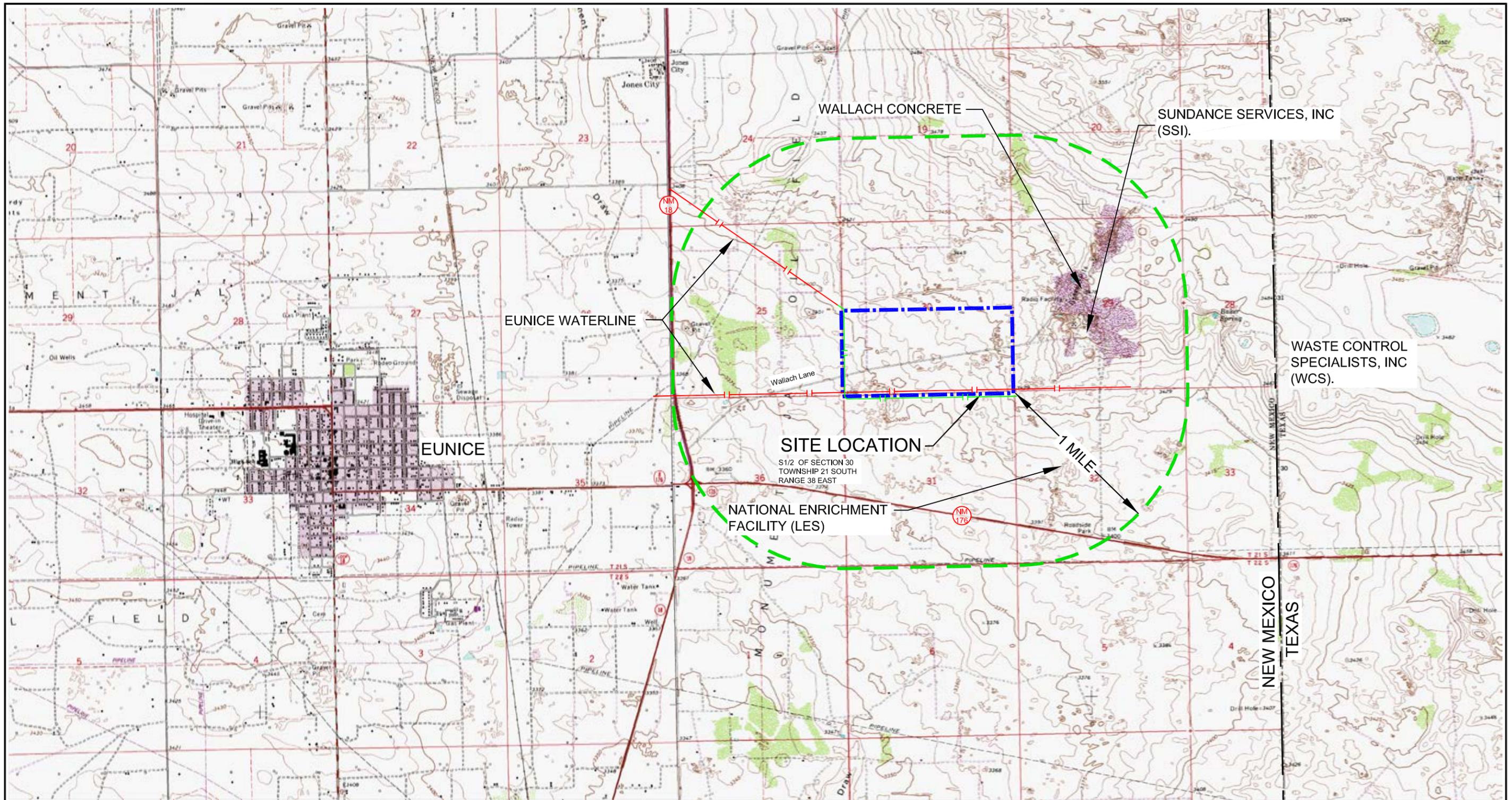
1.3 Facility Description

The Sundance West Facility is a proposed new commercial Surface Waste Management Facility that will include two main components; a liquid oil field waste Processing Area (80 acres ±), and an oil field waste Landfill (180 acres ±). Oil field wastes are anticipated to be delivered to the Sundance West Facility from oil and gas exploration and production operations in southeastern NM and west Texas. The Site **Permit Plans (Volume III.1)** identifies the locations of the Processing Area and Landfill facilities.

2.0 CLOSURE PLAN

2.1 Construction Schedule

Sundance West will notify OCD's Environmental Bureau at least 60 days prior to cessation of permanent operations at the Sundance West Facility. Included in this notification will be a proposed schedule for closure and monitoring activities. During the 60 day period after notification, it is anticipated that Sundance West will coordinate the required site inspection by OCD. During this period, Sundance West and OCD will additionally review and modify parts 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 required OCD review or site inspection(s). Should OCD not notify Sundance West of modifications or additions to the C/PC Plan, Sundance West will commence the following closure activities at the Facility provided the Director has not extended, in good cause, the OCD's response to the closure notification, as summarized on **Table II.4.2**.



Based on Eunice NE, TX.- NM (1969) Photorevised (1979);
 Eunice, NM (1969) Photorevised (1978);
 Quadrangles, USGS 7.5' SERIES (1:24,000 Scale)

NOTE:
 NO STREAMS, SPRINGS OR WATER COURSES WITHIN
 1/2 MILE OF SITE

Drawing:P:\acad 2003\530.06.01\REVISED FIGURES(RAI 1)\SITE LOC REVISED 11 x17.dwg
 Date/Time:Aug. 11, 2016-08:56:20 ; LAYOUT: B (LS)
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SITE LOCATION MAP

SUNDANCE WEST
 SURFACE WASTE MANAGEMENT FACILITY
 LEA COUNTY, NEW MEXICO



213 S. Camino del Pueblo
 Bernalillo, New Mexico, USA
 Phone: 505-867-6990
 Fax: 505-867-6991

DATE: 07/22/2016	CAD: DWG NAME.dwg	PROJECT #: 530.06.01
DRAWN BY: DMI	REVIEWED BY: CWF	FIGURE II.4.1
APPROVED BY: IKG	gei@gordonenvironmental.com	

TABLE II.4.2
Closure Procedures
Sundance West

- Processing Area:
 - Liquids Removal
 - Evaporation Pond Liner Removal
 - Tank Removal
 - Jet Wash Facility Closure
 - Treatment Plant Disassembly
 - Stabilization and Solidification Area Closure
 - Site Sampling
 - Final Site Closure
 - Process Area Closure Documentation
- Solid Waste Disposal Area:
 - Landfill Closure Construction
 - Final Cover
 - Vegetation
 - Landfill Closure Documentation
- Miscellaneous Building and Structure Removal
- Final Land Use

2.2 Liquids Removal

Produced water remaining in receiving tanks will be pumped or transported to the evaporation ponds. Once all produced water is placed into the ponds, and free floating crude oil is removed and taken to the treating plant, evaporation will be conducted with or without the aid of a mechanical evaporation system. Sundance West may introduce soils when sufficient evaporation has taken place to expedite solidification. Once solidification has been completed and the waste has been tested (paint filter), the material will be encapsulated at the solid waste disposal area (Sundance West Landfill). Although highly unlikely, should the Sundance West Landfill not be in operation at the time of closure, all remaining liquids or solids will be removed from the ponds and disposed of in an OCD-approved surface waste management facility.

2.3 Evaporation Pond Liner Removal

Upon successful liquids removal, the remaining sludge, if any, will be allowed to dry to a consistency that lends itself to management and removal (i.e., paint filter test). Although highly unlikely, should the Sundance West Landfill not be in operation at the time of closure, remaining solids will be removed from the ponds and disposed of in an OCD-approved surface waste management facility as self-generated exempt waste in conformance with current operating standards.

Once the sludge has been removed, the high-density polyethylene (HDPE) liner system components will be thoroughly cleaned in accordance with 19.15.35.8 NMAC. Sundance West proposes to cut the HDPE liner material and geocomposite into manageable pieces and dispose of the materials in the Sundance West Landfill; or to transport the materials to a New Mexico Environment Department Solid Waste Bureau approved recycling or disposal facility upon approval from OCD.

2.4 Tank Removal

Upon closure, all tanks, piping and equipment will be emptied and cleaned. Sundance West will dispose of the residual exempt oil field waste removed from the tanks and deposit it in the solidification area for processing prior to disposal in landfill. If the Sundance West Landfill is not in operation at time of closure, remaining solids will be removed and disposed of in an OCD-approved surface waste management facility capable of managing the exempt waste stream. Sundance West will reuse, recycle or remove the tanks, infrastructure, and equipment from the site within 90 days of closure and notify OCD accordingly.

2.5 Jet Wash Facility

Closure of the Jet Wash Facility will consist of dismantling the above-grade installations for recycling (of clean elements) or on-site disposal. The tanks will be cleaned for re-use or recycled as scrap metal. The liner and gravel from the leak detection zone will be exhumed and disposed of on-site. If the Sundance West Landfill is not in operation at time of closure, all remaining solids will be removed from the Facility and disposed of in an OCD-approved surface waste management facility following OCD procedures.

2.6 Treatment Plant

Once crude oil recovery processes have been completed, the treatment plant will be disassembled. Associated piping leading to or from the treatment plant will be removed, cleaned and recycled for reuse. Once equipment, tanks, piping, and buildings have been dismantled (if applicable) the treatment plant will be inspected for contamination. If contamination is discovered, the affected zone will be excavated and disposed of in the solid waste disposal area, and the area will be tested until confirmed to meet applicable regulatory standards. If the Sundance West Landfill is not in operation at time of closure, remaining solids will be removed from the Facility and disposed of in an OCD-approved surface waste management facility following OCD disposal protocols.

2.7 Stabilization and Solidification Area Closure

Upon successful completion of the stabilization and solidification of the remaining materials, if any, these materials will be allowed to dry to a consistency that lends itself to management and removal (i.e., paint filter test). Although highly unlikely, should the Sundance West Landfill not be in operation at the time of closure, remaining solids (stabilized materials and protective cover materials) will be removed from this area and disposed of in an OCD-approved surface waste management facility as self-generated exempt waste in conformance with current operating standards.

Once the materials have been removed, the high-density polyethylene (HDPE) liner system components will be thoroughly cleaned in accordance with 19.15.35.8 NMAC. Sundance West proposes to cut the HDPE liner material and geocomposite into manageable pieces and dispose of the materials in the Sundance West Landfill; or to transport the materials to a New Mexico Environment Department Solid Waste Bureau approved recycling or disposal facility upon approval from OCD. The area will be leveled and graded to drain.

2.8 Site Sampling

Once Processing Area tanks, equipment, and liners have been removed, but prior to backfilling ponds, the stabilization area, and site leveling, the site will be sampled in accordance with chapter nine of United States Environmental Protection Agency (EPA) publication SW-846;

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. A typical sampling grid is provided as **Figure II.4.2** (@ 5 tests/acres), which illustrates the proposed sampling locations for the Sundance West Processing Area to document proper closure. Soil samples will be taken at select locations in the areas used for shipping and receiving, treatment and storage areas, stabilization area, and the evaporation ponds area. The soil samples will be taken at select 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 Water Quality Control Commission (WQCC) 20.6.2.3103.A&B

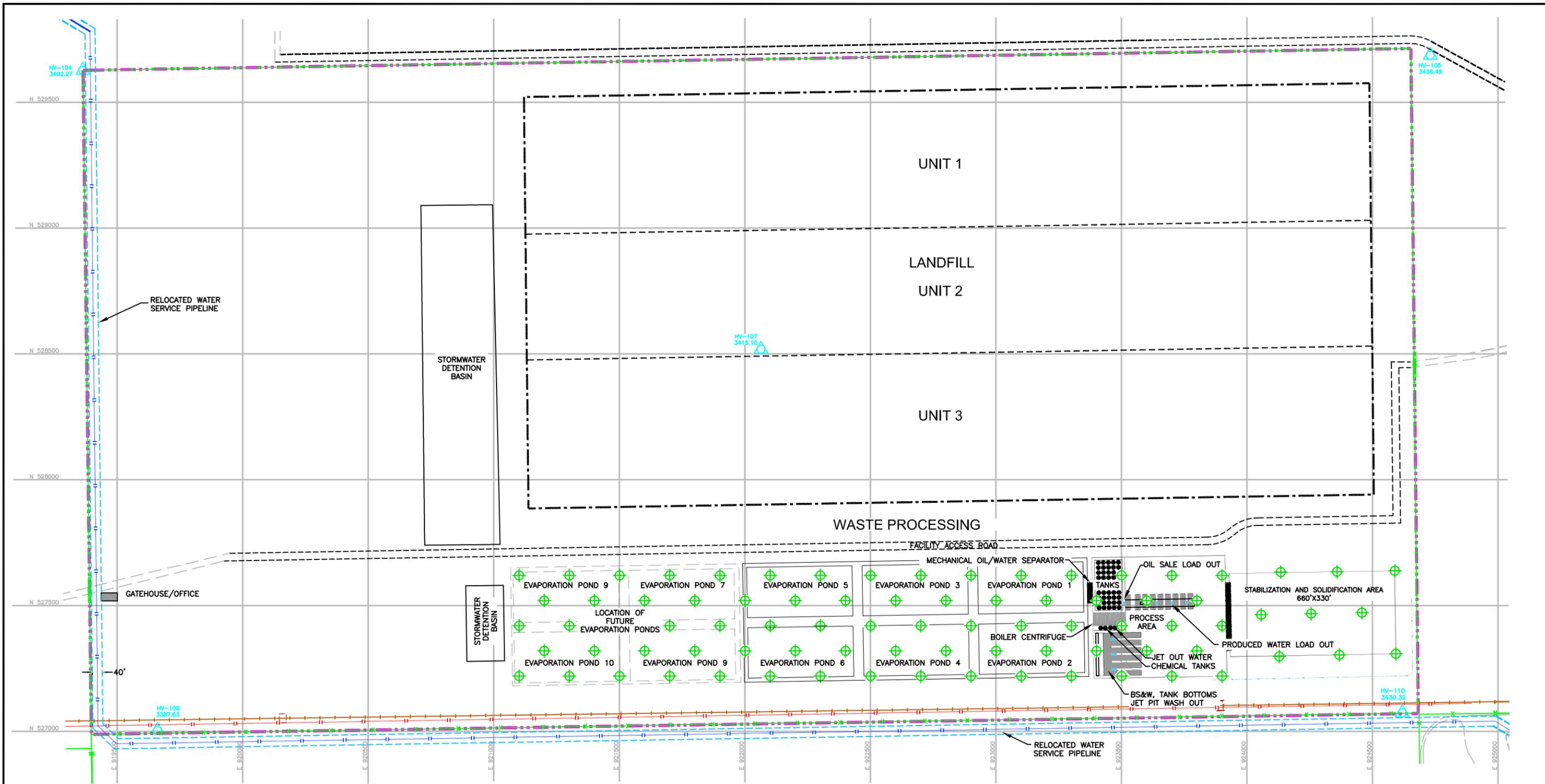
Samples will be submitted to the Environmental Bureau (Santa Fe). Provided the sample results indicate no contamination persists at the Facility in excess of allowable levels, Sundance West will proceed with final site closure and post-closure activities. If contamination is observed at 42 inches, excavation and sampling will continue to the depth where no contamination is observed.

2.9 Final Site Closure – Processing Area

Upon OCD determination that no contamination is present at Sundance West at regulatory thresholds, the Processing Area will be re-graded to the intended final use. Activities to be conducted during this period include:

- Submittal of Notice of Intent (NOI) to the EPA for a Construction General Permit (CGP) and Stormwater Pollution Prevention Plan (SWPPP) implementation
- Evaporation and sedimentation pond berm removal and backfilling
- Stabilization and solidification area containment berm removal and backfilling
- Site grading and re-contouring
- Site revegetation

Re-vegetation of the Sundance West site (equal to 70% of the nature perennial vegetative cover) will be conducted during the optimum planting period, whenever possible. Examples of seed types identified and recommended by the NRCS as acceptable cover for the local and



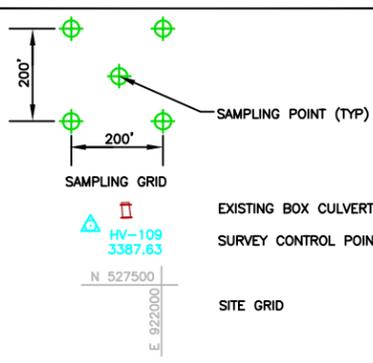
- NOTES:**
1. AERIAL SURVEY BY THOMAS R. MANN & ASSOCIATES AERIAL MAPPING SERVICES, 5115 COPPER NE, ALBUQUERQUE, NM 87108 DATE OF PHOTOGRAPHY: 10-01-08
 2. SAMPLING POINTS MAY BE ADJUSTED IN RESPONSE TO THE LEVEL OF DEVELOPMENT AT THE TIME OF CLOSURE, FIELD CONDITIONS ETC.

LEGEND

- - - - - FACILITY BOUNDARY
 - - - - - LIMIT OF WASTE BOUNDARY
 - - - - - UNIT BOUNDARY
 - - - - - FENCE (EXISTING)
 - - - - - PROPOSED 4-STRAND BARBED WIRE FENCING
 - - - - - NEW UNPAVED ROAD
 - - - - - EXISTING PAVED ROAD
 - - - - - EXISTING UNPAVED ROAD
 - - - - - RAILROAD TRACK
 - - - - - RELOCATED WATER SERVICE PIPELINE
 - - - - - EXISTING EUNICE WATERLINE
 - - - - - PIPELINE EASEMENT
 - - - - - LOCKING GATE
- ⊕ SAMPLING POINT (TYP)

△ SURVEY CONTROL POINT

□ SITE GRID



SAMPLING GRID MAP

SUNDANCE WEST
SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

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

DATE: 07/20/2016	CAD: SAMPLE.dwg	PROJECT #: 530.06.01
DRAWN BY: DMI	REVIEWED BY: CWF	FIGURE II.4.2
APPROVED BY: IKG	gei@gordonenvironmental.com	

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Date/Time: Jul, 20, 2016-06:52:52
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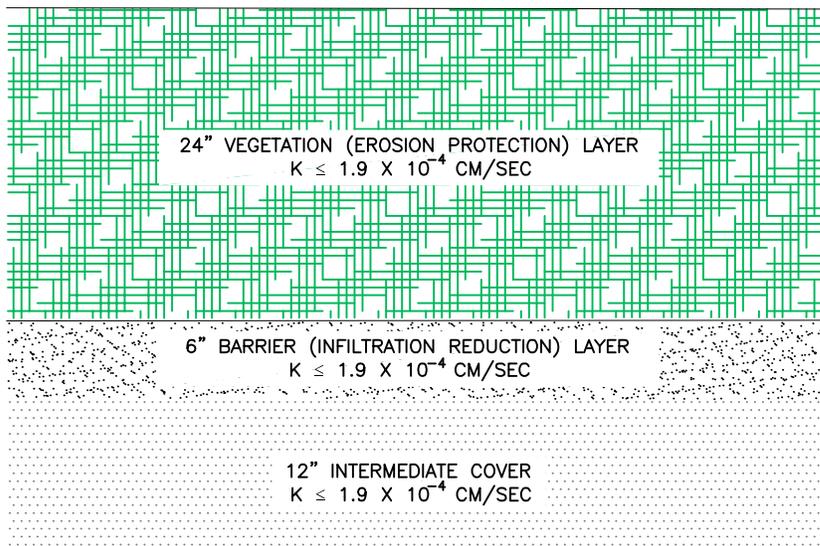
are described in **Table II.4.3**. The Closure Documentation Record (**Attachment II.4.C**), or a similar template, will be used to record the field activities specific to final site closure. A licensed New Mexico Professional Engineer, experienced in environmental engineering, will supervise closure construction and certify completion of closure activities.

2.10 Solid Waste Disposal Area

It is anticipated that the Sundance West Landfill will be the final area closed at the Sundance West Facility due to the need for disposal of wastes from other on-site process units under premature or routine closure conditions. Final cover will be installed within one year of achieving the final waste elevations, or an intermediate grading plan approved by OCD under early closure. The overall final grading contours for the Landfill are provided in the **Permit Plans (Volume III.1)**. The final cover proposed for the Sundance West Landfill includes an alternative sideslope cover configuration.

The alternative (evapotranspiration) cover for the landfill will consist of a 24-inch erosion layer; a 6-inch infiltration layer ($k \leq 5 \times 10^{-5}$ cm/sec); and a 12-inch intermediate cover layer k (value) as shown on **Figure II.4.3**. Based on the results provided in **Volume III.4** (HELP Model), the proposed alternative final cover for the landfill is proven to provide superior performance in preventing liquid migration through the cover when compared to the prescriptive cap outlined in the regulations.

Final slopes will be constructed in accordance with the Final Grading Plan (**Permit Plans, Volume III.1**). The side slopes will be no greater than 25% (4 horizontal to 1 vertical) and the top crown will be constructed at a design grade of 5%. Details for the final cover design are shown on the **Permit Plans, Volume III.1**. The final cover, as well as other disturbed areas of the site, will be seeded with native vegetation. Vegetation on the site will be planted during the optimum planting period, whenever possible. Examples of seed types identified and recommended by the Natural Resource Conservation Service (NRCS) as acceptable cover for the local climate and precipitation include, but are not limited to:



FINAL COVER DETAIL

FINAL COVER PROFILE

SUNDANCE WEST
 SURFACE WASTE MANAGEMENT FACILITY
 LEA COUNTY, 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: 07/14/2016	CAD: FINAL COVER.dwg	PROJECT #: 530.06.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.4.3
APPROVED BY: IKG	gei@gordonenvironmental.com	

TABLE II.4.3
NRCS Recommended Seed Mix
Sundance West^{1,2,3,4}

Grass Species	% of Mix	RATE (PLS/Acre)⁵	Lbs. PLS/Acre⁶
Bluegrama (Native)	40	1.5	1.2
Buffalograss (burs)	10	16	3.2
Green Sprangletop	10	1.7	0.34
Sand Dropseed	10	0.5	0.1
Sideoats (Vaughn)	20	4.5	1.8
Western Wheatgrass (Native)	10	8	1.6
Totals	100%	32.2	8.24

Notes:

1. *Lea County NRCS recommends doubling the seeding rate on critical area plantings.*
2. *These grasses are fairly shallow rooted; well adapted to Lea County; are available from area growers; and will aid in erosion control once established.*
3. *NRCS recommends that seeding a cover crop of sorghum in the spring at 8 lbs/acre will stabilize the site initially.*
4. *Subject to change based on changes in NRCS requirements, new technology, etc.*
5. *PLS = pure live seed per acre*
6. *Lbs. = pounds of PLS per acre*

The Closure Documentation Record (**Attachment II.4.C**) or a similar template will be used to record the field activities specific to final site closure. Documentation of closure activities including, but not limited to, monitoring results, site inspection data, soil sampling and maintenance procedures will be submitted to OCD in the Final Closure Report. Closure construction activities will be supervised by a licensed New Mexico Professional Engineer experienced in waste facility technology, who will certify the closure.

2.11 Miscellaneous Building and Structure Removal

At this time, it is anticipated that the Sundance West Facility site following closure will revert to open space or livestock grazing. Should an alternate land use be identified that could utilize the remaining structures and buildings, they will be cleaned and left in place with the exception of below-grade sumps. If not, all buildings and miscellaneous structures will be dismantled, and where practical, recycled or reused. Non-recyclable material will be disposed of in the Sundance West Landfill, or other OCD-approved landfill. Once buildings, structures and sumps are removed, the areas will be inspected for contamination. Should contamination be discovered, the zone will be excavated and disposed of in the solid waste disposal unit, and the area will be tested until confirmed to meet regulatory standards. If the Sundance West Landfill is not in operation at time of closure, remaining materials will be removed from the Facility and disposed of in an OCD-approved surface waste management facility.

2.12 Final Land Use

At this time Sundance West has not established a use for the Facility after closure beyond open pasture. Should a specific use be determined, Sundance West will notify OCD and request approval to be released from the following post-closure activities provided there has not been a release to the vadose zone or ground water pursuant to 19.15.30 and 19.15.29 NMAC.

3.0 POST-CLOSURE PLAN

3.1 Post-Closure Maintenance

Processing Area

Sundance West will conduct post-closure monitoring of the Processing Area for a period of no less than 3 years. Should deficiencies or discrepancies be discovered during the site inspections in these areas, Sundance West will conduct corrective measures. If there has been a documented release to the groundwater or vadose zone, Sundance West will comply with the requirements of 19.15.30 and 19.15.29 NMAC.

Landfill Area

Sundance West will monitor and provide post-closure maintenance for the Landfill for a period of not less than 30 years. During the post-closure care period, Sundance West proposes to inspect and maintain the site at least quarterly, and immediately after a documented 24 hour, 25-year storm event, whichever is more frequent as defined on the Site Inspection Checklist (**Attachment II.4.D**). Upon successful re-vegetation efforts resulting in at least 70% coverage (not including noxious weeds) or other approved erosion control methods (gravel mulches, etc.), Sundance West plans to reduce the inspection frequency subject to OCD approval. Post-closure care inspections will typically include:

- Vegetative growth observation
- Erosion
- Differential settlement
- Vegetative stress (i.e., potential gas migration)

In addition, vadose zone monitoring will be performed and reported on an annual basis as shown on **Attachment II.4.A.4**.

3.2 Reporting

Reports of post-closure activities including, but not limited to site inspection data and maintenance procedures will be submitted to OCD within 45 days from the end of each calendar year or as otherwise required.

4.0 FINANCIAL ASSURANCE

4.1 Closure/Post Closure Cost Estimate

The Cost Estimate (**Attachment II.4.A**) for the closure and post-closure activities described in this C/PC Plan is presented in current dollars and conservatively assumes that third party contractors will perform closure and post closure activities at the site, as required by 19.15.36.8.C.(9) NMAC. Preparation of the C/PC Cost Estimate also assumes that no contamination or remedial activities are required due to releases into the environment. The current estimate for Phase I (**Table II.4.1**) of Sundance West closure construction and post-closure operations is provided as **Attachment II.4.A**.

This estimate will be revised accordingly as additional Phases (**Table II.4.1**) of Sundance West construction and operations are implemented, or should unforeseen conditions arise, as well as annually once Phase Development is complete. Upon Division approval of the requested permit, Sundance West will elect a financial assurance mechanism pursuant to 19.15.36.11.E NMAC and submit the appropriate documentation to OCD based on the estimates provided in this Plan.

4.2 Release of Financial Assurance

Upon successful completion of closure activities for the entire Facility, or portions of the operation (i.e., sections of the Landfill that have reached final grade; components of the process that have ceased operation); and after OCD concurrence; Sundance West will request the release of the financial assurance mechanism in-place for that component of closure of the Facility. After the post-closure periods have expired (i.e., 3 years for waste processing pits/ponds, and 30 years for the Landfill), provided there is no contamination evident and the site has established re-vegetation in accordance with the regulations, Sundance West will request release from the remaining financial assurance requirements for the Facility or portions that have been successfully closed.

**APPLICATION FOR PERMIT
SUNDANCE WEST**

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

**ATTACHMENT II.4.A
CLOSURE/POST-CLOSURE COST ESTIMATES**

**ATTACHMENT II.4.A.1
PHASE I CLOSURE/POST-CLOSURE
COST ESTIMATE SUMMARY
Sundance West**

TASK	COST ESTIMATE
1.0 LANDFILL CLOSURE CONSTRUCTION	\$216,828
2.0 LANDFILL MAINTENANCE	\$448,800
3.0 ENVIRONMENTAL MONITORING	\$125,400
4.0 POND AND PROCESSING AREA CLOSURE (see Att. II.4.A.5)	\$129,723
5.0 PROCESSING AREA MAINTENANCE	\$62,040
TOTAL COST ESTIMATE	\$982,791

**ATTACHMENT II.4.A.2
PHASE I LANDFILL CLOSURE CONSTRUCTION
CLOSURE COST ESTIMATE
Sundance West Landfill (Unit 1 - 13.5 acres ±)**

TASK 1.0	Unit Quantity	Unit	Unit Cost	Total Cost
1.1 Final Cover Installation				
1.1.1 Install and compact 6" Infiltration (Barrier) Layer	10,879	CY	\$3.50	\$38,077
1.1.2 Install 24" Erosion (Vegetative) Layer	43,516	CY	\$2.50	\$108,790
1.1.3 Vegetative Layer Seeding (Class A)	13.5	AC	\$1,500.00	\$20,250
<i>Task Subtotal</i>				\$167,117
1.2 Final Cover CQA				
1.2.1 Inspection and Testing	1	LS	\$25,000	\$25,000
1.2.2 Certification	1	LS	\$5,000	\$5,000
<i>Task Subtotal</i>				\$30,000
TASK TOTALS				\$197,117
Independent Project Manager and Contract Administration Cost (10% of Task Totals)				\$19,712
TOTAL COST				\$216,828

Notes:

- Phase I closure costs are based on contracting with a qualified third party to complete and certify closure. The activities included in this cost estimate are based on current dollars, previous experience with landfills located in arid climates, and current subcontractor costs.
- Final cover installation costs assume that:
 - ▶ The greatest area requiring final cover is 13.5 acres ± (Unit 1).
 - ▶ 12" of intermediate cover is already installed.
 - ▶ All soils necessary for closure are available on-site.
- CY = Cubic Yard
AC = Acre
LS = Lump Sum
- Due to the perimeter location there is no final cover "crown", and related geosynthetic layers in Unit 1.

ATTACHMENT II.4.A.3
PHASE I LANDFILL MAINTENANCE
POST-CLOSURE COST ESTIMATE
Sundance West

TASK 2.0	Unit Quantity	Unit	Unit Cost	Total Cost Per Year	Total Cost For 30 Years
2.1 Final Cover Inspection and Reporting					
2.1.1 Inspection	2	events/yr	\$1,000	\$2,000	\$60,000
2.1.2 Recordkeeping and Reporting	2	events/yr	\$400	\$800	\$24,000
<i>Task Subtotals</i>				\$2,800	\$84,000
2.2 Final Cover Maintenance					
2.2.1 Cover Maintenance	1	AC/yr	\$1,000	\$1,000	\$30,000
2.2.2 Vegetation	2	AC/yr	\$1,500	\$3,000	\$90,000
<i>Task Subtotals</i>				\$4,000	\$120,000
2.3 Leachate System					
2.3.1 Inspection/Repair	1	LS	\$400	\$400	\$12,000
2.3.2 Disposal	4	events/yr	\$1,000	\$4,000	\$120,000
<i>Task Subtotals</i>				\$4,400	\$132,000
2.4 Surface Water Management Systems					
2.4.1 Inspection/Repairs	2	events/yr	\$600	\$1,200	\$36,000
<i>Task Subtotals</i>				\$1,200	\$36,000
2.5 Fencing					
2.5.1 Inspection/Repairs	2	events/yr	\$600	\$1,200	\$36,000
<i>Task Subtotals</i>				\$1,200	\$36,000
TASK TOTALS				\$13,600	\$408,000
Independent Project Manager and Contract Administration Cost (10% of Task Totals)				1,360	40,800
TOTAL COST				\$13,600	\$448,800

Notes:

1. Phase I post-closure maintenance costs are based on contracting with a qualified third party to conduct post-closure care maintenance for the landfill. The activities included in this cost estimate are based on current dollars, previous experience with landfills located in arid climates, and current subcontractor costs.
2. AC = Acre
LS = Lump Sum

ATTACHMENT II.4.A.4
PHASE I ENVIRONMENTAL MONITORING
POST-CLOSURE COST ESTIMATE
Sundance West

TASK 3.0	Unit Quantity	Unit	Unit Cost	Total Cost Per Year	Total Cost
3.1 Landfill Gas Monitoring³					
3.1.1 Field Services/Reporting (30 years)	0	events/yr	\$0	\$0	\$0
<i>Task Subtotal</i>				\$0	\$0
3.2 Monitoring Well/Vadose Zone Monitoring					
3.2.1 Field Services/Lab Analysis/Reporting (30 years)	1	events/yr	\$2,300	\$2,300	\$69,000
<i>Task Subtotal</i>				\$2,300	\$69,000
3.3 NPDES Monitoring					
3.3.1 Field Services/Reporting (30 years)	1	LS	\$1,500	\$1,500	\$45,000
<i>Task Subtotal</i>				\$1,500	\$45,000
TASK TOTALS				\$3,800	\$114,000
Independent Project Manager and Contract Administration Cost (10% of Task Totals)				380	11,400
TOTAL COST				\$4,180	\$125,400

Notes:

1. Phase I closure costs are based on contracting with a qualified third party to conduct post-closure monitoring for the landfill. The activities included in this cost estimate are based on current dollars, previous experience with landfills located in arid climates, and current subcontractor costs.
2. Assume no water in vadose wells (i.e., sampling and analysis costs not included).
3. Included with Task 3.2.
4. LS = Lump Sum

ATTACHMENT II.4.A.5
PHASE I POND AND PROCESSING AREA CLOSURE CONSTRUCTION
CLOSURE COST ESTIMATE
Sundance West

Task 4.0	Units	Unit Cost	Total (10 acres)	
			Quantity	Cost
4.1 Evaporation Pond				
4.1.1 Liquids Transport/Disposal				
4.1.1.1 Transport Liquid	bbl	\$1.75	100	\$ 175
4.1.1.2 Disposal Liquids	bbl	\$0.95	100	\$ 95
4.1.1.3 Remove/Transport Sludge	ton	\$6.50	2,000	\$ 13,000
4.1.1.4 Disposal Sludge	ton	\$15.00	2,000	\$ 30,000
4.1.1.5 Liner Removal/Transport	yd ³	\$4.00	80	\$ 320
4.1.1.6 Disposal Liner	yd ³	\$4.25	80	\$ 340
			Task Subtotal	\$ 43,930
4.1.2 Pond Backfill and Contouring				
4.1.2.1 Soil On-site	yd ³	\$1.00	0	\$ -
4.1.2.2 Place and Compact Soil	yd ³	\$3.00	6,000	\$ 18,000
			Task Subtotal	\$ 18,000
4.1.3 Sampling	each	\$200	100	\$ 20,000
4.1.4 Seeding	acres	\$1,200	10	\$ 12,000
			Task Subtotal	\$ 32,000
			Pond Closure Subtotal:	\$ 93,930
4.2 Site Work				
4.2.1 Tank Removal	Lump Sum			\$ 7,500
4.2.2 Building Removal	Lump Sum			\$ -
4.2.3 Process Equipment Removal	Lump Sum			\$ 1,000
4.2.4 Earthwork	Lump Sum			\$ 7,500
			Site Work Subtotal:	\$ 16,000
4.3 Engineering				
4.3.1 CQA/Certification	Lump Sum			\$ 8,000
			Engineering Subtotal:	\$ 8,000
4.4 Totals				
4.4.1 Subtotal				\$ 117,930
4.4.2 Administration Cost (10%)				\$ 11,793
			Total:	\$ 129,723

Notes:

1. Phase I closure costs are based on contracting with a qualified third party to complete and certify closure.
2. Assume 1,000 gallons of residual water in each pond transported up to 50 miles for disposal.
3. Assume 6" of sludge remaining in each pond at closure transported up to 50 miles for disposal.
4. Site Sampling is conducted during the CQA phase.

**ATTACHMENT II.4.A.6
PROCESS AREA MAINTENANCE
POST-CLOSURE COST ESTIMATE
Sundance West**

TASK 5.0	Unit Quantity	Unit	Unit Cost	Total Cost Per Year	Total Cost For 3 Years
5.1 Surface Inspection and Reporting					
5.1.1 Inspection	2	events/yr	\$1,000	\$2,000	\$6,000
5.1.2 Recordkeeping and Reporting	2	events/yr	\$400	\$800	\$2,400
<i>Task Subtotals</i>				\$2,800	\$8,400
5.2 Surface Maintenance					
5.2.1 Cover Maintenance	1	AC/yr	\$1,000	\$1,000	\$3,000
5.2.2 Vegetation	2	AC/yr	\$1,500	\$3,000	\$9,000
<i>Task Subtotals</i>				\$4,000	\$12,000
5.3 Fencing					
5.3.1 Inspection/Repairs	2	events/yr	\$600	\$1,200	\$3,600
<i>Task Subtotals</i>				\$1,200	\$36,000
TASK TOTALS				\$8,000	\$56,400
Independent Project Manager and Contract Administration Cost (@ 10%)				\$800	\$5,640
TOTAL COST				\$8,000	\$62,040

Notes:

1. Phase I post-closure maintenance costs are based on contracting with a qualified third party to conduct post-closure care maintenance for the Processing Area. The activities included in this cost estimate are based on current dollars, previous experience with closures located in arid climates, and current subcontractor costs.
2. AC = Acre
LS = Lump Sum

**APPLICATION FOR PERMIT
SUNDANCE WEST**

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

**ATTACHMENT II.4.B
FINANCIAL ASSURANCE DOCUMENTATION
TO BE PROVIDED UPON PERMIT APPROVAL**

**APPLICATION FOR PERMIT
SUNDANCE WEST**

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

**ATTACHMENT II.4.C
CLOSURE DOCUMENTATION RECORD (TYPICAL)**

**APPLICATION FOR PERMIT
SUNDANCE WEST**

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

**ATTACHMENT II.4.D
SITE INSPECTION CHECKLIST (TYPICAL)**

**ATTACHMENT II.4.D
Post-Closure Site Inspection Checklist (Typical)
Sundance West**

Page ____ of ____

Date: _____

Inspector(s): _____

Time: _____

Weather:

Temperature _____ deg. F

Precipitation (last 24 hours) _____ inches

Skies _____

Wind Speed _____ mph

Wind Direction _____ (direction blowing from)

NOTES:

"X" indicates that a Deficiency has been noted. "P" indicates that a Photograph has been taken. "S" indicates that a Sample has been collected. Complete descriptions of Deficiencies, Photographs, and Samples are provided on attached pages. Items are referenced by Location.

Vegetation Condition

Location	Item			
	Vegetation Stress	Vegetation Dieback	Vectors	Sample

Surface Water Management System

Location	Deficiency			Sample
	Erosion/Siltation	Structural Defect	Flow Obstruction	

NOTES: _____

**APPLICATION FOR PERMIT
SUNDANCE WEST**

**VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 5: CONTINGENCY PLAN**

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**APPLICATION FOR PERMIT
SUNDANCE WEST**

**VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 5: CONTINGENCY PLAN**

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Attachment No.	Title
II.5.A	REQUEST FOR APPROVAL TO ACCEPT SOLID WASTE, OCD FORM C-138
II.5.B	INCIDENT REPORT FORM (TYPICAL)
II.5.C	RELEASE NOTIFICATION AND CORRECTION ACTION, OCD FORM C-141

**APPLICATION FOR PERMIT
SUNDANCE WEST**

**VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 5: CONTINGENCY PLAN**

1.0 INTRODUCTION

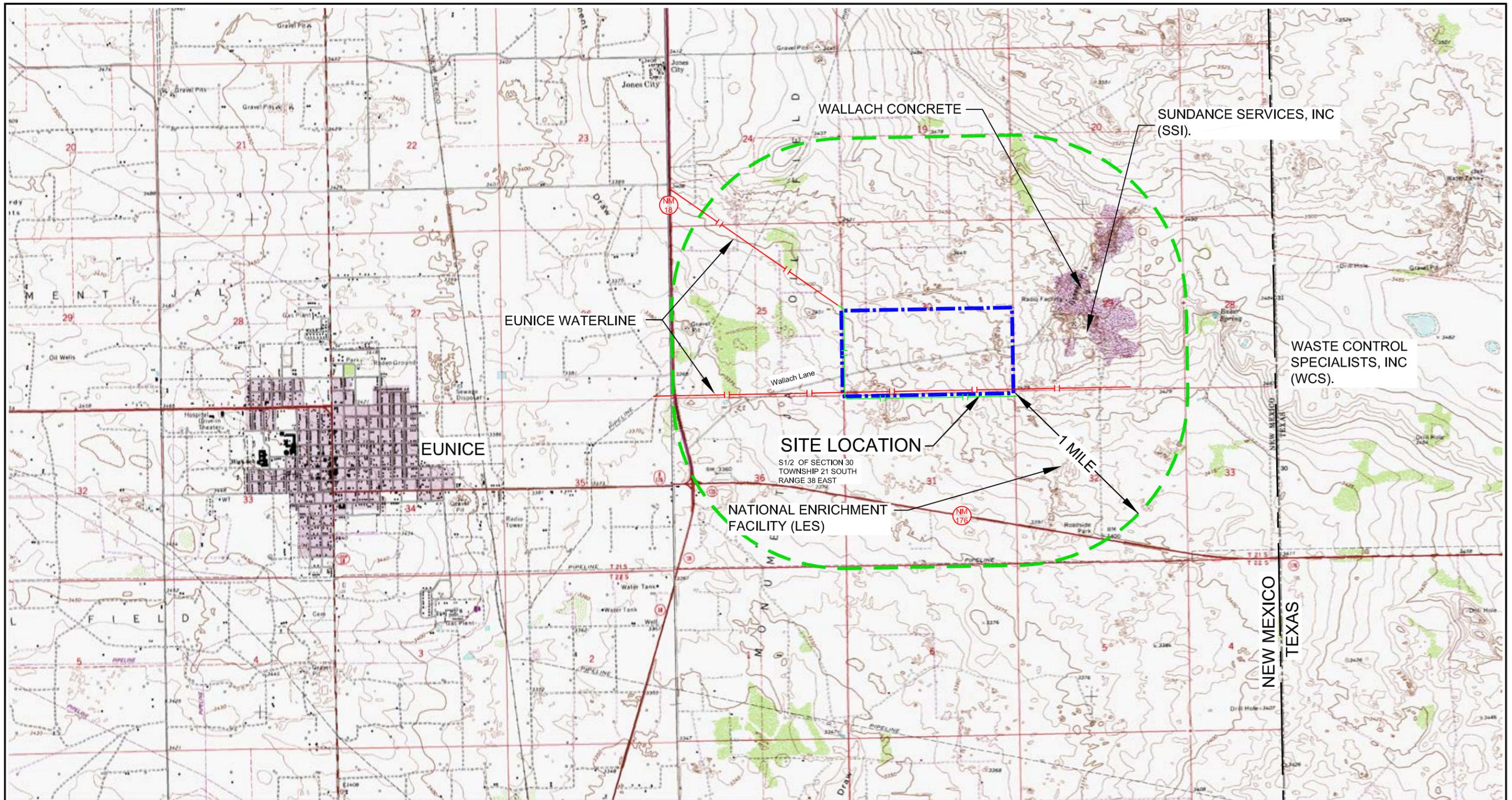
Sundance West is a proposed new commercial Surface Waste Management Facility for oil field waste processing and disposal services. The proposed Sundance West Facility is subject to regulation under the New Mexico Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation Division (OCD). The Facility is designed in compliance with 19.15.36 NMAC, and will be constructed and operated in compliance with a Surface Waste Management Facility Permit issued by the OCD. The Facility is owned by, and will be constructed and operated by, Sundance West, Inc.

1.1 Site Location

The Sundance West site is located approximately 3 miles east of Eunice, 18 miles south of Hobbs, and approximately 1.5 miles west of the Texas/New Mexico state line in unincorporated Lea County, New Mexico (NM). The Sundance West site is comprised of a 320-acre ± tract of land located in the South ½ of Section 30, Township 21 South, Range 38 East, Lea County, NM. Site access will be provided via NM 18 and Wallach Lane. A Site Location Map is provided as **Figure II.5.1**.

1.2 Facility Description

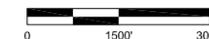
The Sundance West Facility is a proposed new commercial Surface Waste Management Facility that will include two main components; a liquid oil field waste Processing Area (80 acres ±), and an oil field waste Landfill (180 acres ±). Oil field wastes are anticipated to be delivered to the Sundance West Facility from oil and gas exploration and production operations in southeastern NM and west Texas. The Site Plan provided as **Figure II.5.2** identifies the locations of the Processing Area and Landfill facilities. The proposed facilities are detailed in **Table II.5.1**, and are anticipated to be developed in four primary phases.



Based on Eunice NE, TX.- NM (1969) Photorevised (1979);
 Eunice, NM (1969) Photorevised (1978);
 Quadrangles, USGS 7.5' SERIES (1:24,000 Scale)

NOTE:
 NO STREAMS, SPRINGS OR WATER COURSES WITHIN
 1/2 MILE OF SITE

Drawing:P:\acad 2003\530.06.01\REVISED FIGURES(RAI 1)\SITE LOC REVISED 11 x17.dwg
 Date/Time:Aug. 09, 2016-12:26:42 : LAYOUT: B (LS)
 Copyright © All Rights Reserved, Gordon Environmental, Inc. 2016



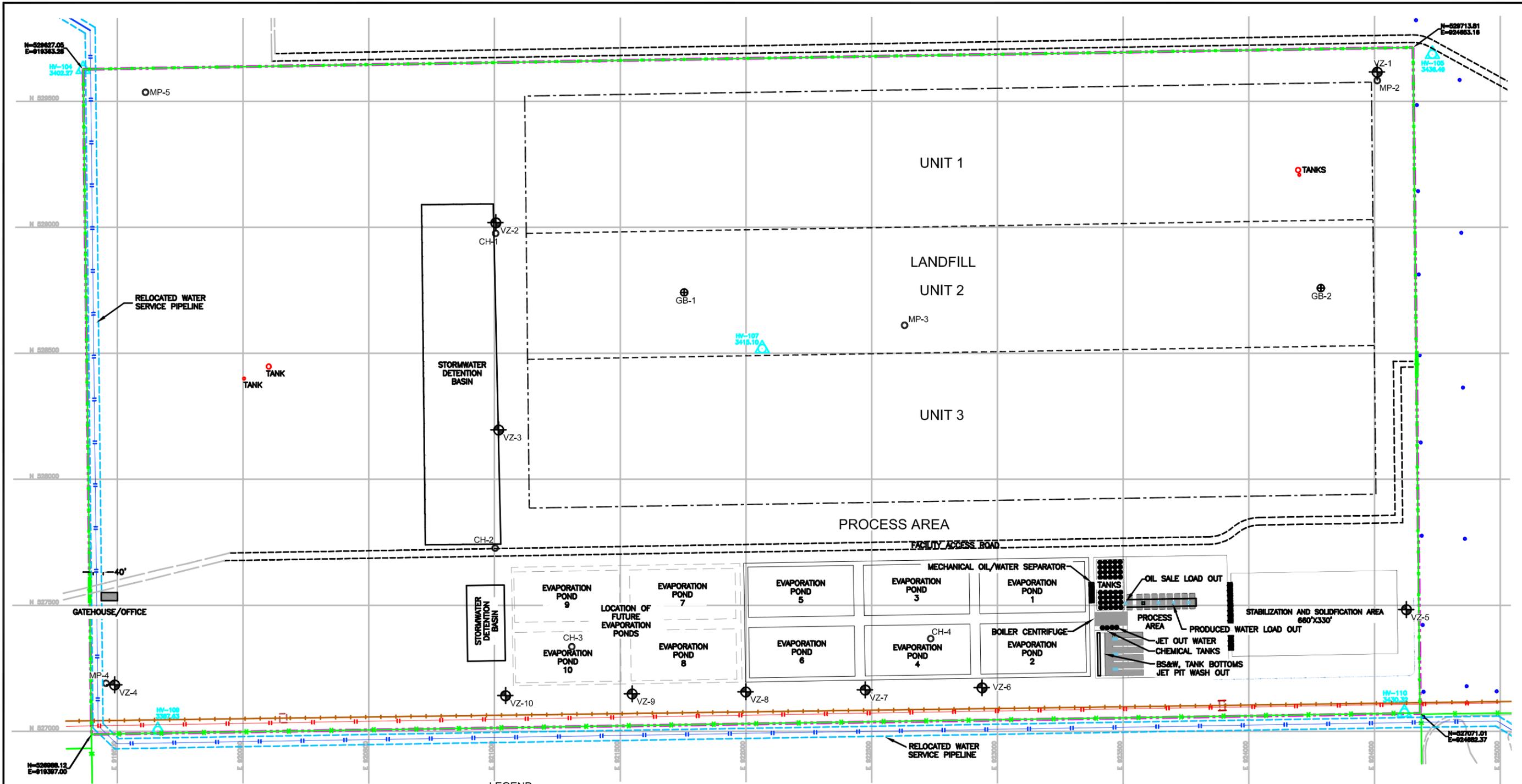
SITE LOCATION MAP

SUNDANCE WEST
 SURFACE WASTE MANAGEMENT FACILITY
 LEA COUNTY, NEW MEXICO



213 S. Camino del Pueblo
 Bernalillo, New Mexico, USA
 Phone: 505-867-6990
 Fax: 505-867-6991

DATE: 07/22/2016	CAD: DWG NAME.dwg	PROJECT #: 530.06.01
DRAWN BY: DMI	REVIEWED BY: CWF	FIGURE II.5.1
APPROVED BY: IKG	gei@gordonenvironmental.com	



NOTE
 AERIAL SURVEY BY THOMAS R. MANN & ASSOCIATES AERIAL MAPPING SERVICES, 5115 COPPER NE, ALBUQUERQUE, NM 87108
 DATE OF PHOTOGRAPHY: 10-01-08

LEGEND	
	FACILITY BOUNDARY
	LIMIT OF WASTE BOUNDARY
	UNIT BOUNDARY
	FENCE (EXISTING)
	PROPOSED 4-STRAND BARBED WIRE FENCING
	NEW UNPAVED ROAD
	EXISTING PAVED ROAD
	EXISTING UNPAVED ROAD
	RAILROAD TRACK
	RELOCATED WATER SERVICE PIPELINE
	EXISTING EUNICE WATERLINE
	PIPELINE EASEMENT
	LOCKING GATE
	GB-1 GEOTECHNICAL BOREHOLE
	MP-2 SOIL BORING
	CH-3 COREHOLE BORING
	VZ-1 VADOSE ZONE MONITORING WELL
	POWER POLE
	STORAGE TANK
	EXISTING BOX CULVERT
	SV-109 SURVEY CONTROL POINT
	SITE GRID

Drawing: P:\acad 2003\530.06.01\REVISED FIGURES(RAI 1)\SITE DEV.dwg
 Date/Time: Jul, 19, 2016-05:17:22
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SITE PLAN

SUNDANCE WEST
 SURFACE WASTE MANAGEMENT FACILITY
 LEA COUNTY, NEW MEXICO

		213 S. Camino del Pueblo Bernalillo, New Mexico, USA Phone: 505-867-6990 Fax: 505-867-6991
DATE: 07/18/2016	CAD: SITE DEV.dwg	PROJECT #: 530.06.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.5.2
APPROVED BY: IKG	gei@gordonenvironmental.com	

**TABLE II.5.1
Proposed Facilities¹
Sundance West**

Description	No.
Oil field waste disposal landfill	1
Produced water load-out points	8
Produced water tanks	45
Mechanical oil/water separator unit	4
Evaporation ponds	10
Stabilization and Solidification Area	1
Oil treatment plant	1
Crude oil receiving tanks	3
Oil sales tanks	2
Customer jet wash	1 (6 bays)

Note:

¹*Subject to change. The proposed facilities are based on projected waste types and volumes; therefore this list may be modified in response to changes in waste streams, technology, etc.*

1.3 Purpose

This document has been prepared to address the requirements of 19.15.36.13.N NMAC which specify that each operator of a surface waste management facility must prepare and have available a Contingency Plan (the Plan). This Plan is designed to minimize hazards to fresh water, public health, safety or the environment from fires, explosions or an unplanned sudden or non-sudden release of contaminants or oil field waste to air, soil, surface water or ground water. Applicable provisions of this Plan will be implemented immediately whenever there is a fire, explosion or release of contaminants or oil field waste constituents that could threaten fresh water, public health, safety or the environment. This Plan is supplemented by the H₂S Prevention and Contingency Plan (**Volume II.3**), as a cross-reference.

This Plan is organized for easy reference by Facility personnel, whom will be required to read it. Copies of this Plan will be maintained in a readily accessible location at the Facility Gatehouse. In addition, copies of the Plan will be made available to the emergency agencies identified in **Table II.5.2**. Agencies listed on **Table II.5.2** will be invited to the site for the purposes of familiarizing themselves with the Facility and reviewing the Plan's contents with Sundance West (19.15.36.13.N.(2) NMAC). As detailed in Section 10 of this Plan, whenever significant changes to the Plan are made, revised copies of the Plan will replace existing copies, and the agencies listed in **Table II.5.2** will be provided with the most recent Plan updates. Definitions specific to this Plan are provided in **Table II.5.3** as specified in 19.15.2.7 NMAC, and a more comprehensive list of definitions is included as **Table I.5 (Volume I)**.

2.0 EMERGENCY COORDINATORS

Sundance West has designated specific individuals with the responsibility and authority to implement response measures in the event of an emergency which may threaten freshwater, public health, safety or the environment per 19.15.36.13.N.(3) NMAC. The Primary, Alternate, and On-site Emergency Coordinators (ECs; **Table II.5.4**) will be thoroughly familiar with aspects of this Plan; operations and activities at the Sundance West Facility; location and characteristics of waste to be managed; the location of records within the Facility; and the Facility layout. **Table II.5.4** lists the names, designations, titles, and phone numbers for each EC, each of whom will be designated prior to Facility operations, as notified and promptly updated to OCD.

The ECs are responsible for coordinating emergency response measures and have the authority to commit the resources required for implementation of this Plan. A designated EC is available to respond to emergencies 24 hours a day, 7 days a week. The Sundance West employee who identifies an emergency situation will contact an EC directly or via phone. Contact will be attempted with each EC (Primary, Alternate, and the On-site) until communication is achieved (**Table II.5.4**). Upon arrival at the scene of an emergency, the first EC to arrive will assume responsibility for initiating response measures. If more than one EC responds, authority is assigned to the highest-ranking EC.

**TABLE II.5.2
Emergency Response Agencies and Contacts
Sundance West**

<u>Agency/Organization</u>	<u>Emergency Number</u>
1. Fire	
Eunice Fire Department	911 or (575) 394-2112
2. Police	
Lea County Sheriff's Department	911 or (575) 396-3611
New Mexico State Police	911 or (575) 392-5580
3. Medical/Ambulance	
Eunice EMS	911 or (575) 394-2112
Lea Regional Medical Center 5419 N. Lovington Highway Hobbs, NM 88240	(575) 492-5000
4. Emergency Response Firm	
Phoenix Environmental, LLC. 2113 N French Drive Hobbs, NM 88240	(575) 391-9685
5. OCD Emergency Response Contacts	
Oil Conservation Division 1625 N. French Drive Hobbs, NM 88240	(575) 393-6161
Mobile Phone	(575) 370-3180
Oil Conservation Division 1220 South St. Francis Drive Santa Fe, NM 87505	(505) 476-3440
6. State Emergency Response Contacts	
Environmental Emergencies 24 hr. (NMED)	(505) 827-9329
New Mexico Environment Department Solid Waste Bureau, Santa Fe	(505) 827-0197
7. Local Emergency Response Contacts	
Lea County Emergency Management	(575) 391-2983
8. Federal Emergency Response Contacts	
National Emergency Response Center (U.S. Coast Guard)	(800) 424-8802
Region VI Emergency Response Hotline (USEPA)	(214) 665-2200

TABLE II.5.3
Definitions
Sundance West

Barrel: *shall mean 42 United States gallons measured at 60 degrees Fahrenheit and atmospheric pressure at the sea level. [19.15.2.7.B.(3) NMAC]*

Division: *shall mean the New Mexico energy, minerals and natural resources department, oil conservation division. [19.15.2.7.D.(4) NMAC]*

Fresh water: *(to be protected) includes the water in lakes and playas (regardless of quality, unless the water exceeds 10,000 mg/l TDS and it can be shown that degradation of the particular water body will not adversely affect hydrologically connected fresh ground water), the surface waters of streams regardless of the water quality within a given reach, and underground waters containing 10,000 mg/l or less of TDS except for which, after notice and hearing, it is found there is no present or reasonably foreseeable beneficial use that contamination of such waters would impair. [19.15.2.7.F.(3) NMAC]*

Hazard to public health:

exists when water that is used or is reasonably expected to be used in the future as a human drinking water supply exceeds at the time and place of the use, one or more of the numerical standards of Subsection A of 20.6.2.3103 NMAC, or the naturally occurring concentrations, whichever is higher, or if a toxic pollutant as defined at Subsection WW of 20.6.2.7 NMAC affecting human health is present in the water. In determining whether a release would cause a hazard to public health to exist, the director investigates and considers the purification and dilution reasonably expected to occur from the time and place of release to the time and place of withdrawal for use as human drinking water. [19.15.2.7.H.(2) NMAC]

Oil field waste:

shall mean waste generated in conjunction with the exploration for, drilling for, production of, refining of, processing of, gathering of or transportation of oil, gas or carbon dioxide;-waste generated from oil field service company operations; and waste generated from oil field remediation or abatement activity regardless of the date of release. Oil field waste does not include waste not generally associated with oil and gas industry operations such as tires, appliances or ordinary garbage or refuse unless generated at a division-regulated facility, and does not include sewage, regardless of the source. [19.15.2.7.O.(3) NMAC]

Release: *shall mean all breaks, leaks, spills, releases, fires or blowouts involving oil, produced water, condensate, drilling fluids, completion fluids or other chemical or contaminant or mixture thereof, including oil field wastes and gases to the environment. [19.15.2.7.R.(4) NMAC]*

Waste (non-hazardous):

Non-hazardous waste shall mean non-exempt oil field waste that is not hazardous waste. [19.15.2.7.W.(1) NMAC]

TABLE II.5.4
List of Emergency Coordinators
Sundance West

Primary Emergency Coordinator

Name: Joe Carrillo
 Title: Corporate Plant Manager
 Address: 605 Ave J
Eunice, NM 88231

Work Phone: (575) 394-2511
 Mobile Phone: (575) 390-0342
 Home Phone: NA

Alternate Emergency Coordinator

Name: TBD
 Title: TBD
 Address: TBD
TBD

Work Phone: TBD
 Mobile Phone: TBD
 Home Phone: TBD

Onsite Emergency Coordinator

Name: TBD
 Title: TBD
 Address: TBD
TBD

Work Phone: TBD
 Mobile Phone: TBD
 Home Phone: TBD

**Or as designated by Sundance.*

In the rare case that an EC cannot be contacted in an emergency, the Sundance West employee who identifies the situation should make every effort to follow the emergency procedures outlined in this Plan until an EC or emergency authority (local, state, or federal; **Table II.5.2**) arrives to assist or take control. The term “EC” as used throughout this Plan, references the responsible Emergency Coordinator at the scene of an emergency regardless of whether that EC is the Primary, Alternate, On-site EC, or EC designee. This Plan will be amended as described in Section 10.0, if the list of ECs changes.

3.0 PREVENTION MEASURES

3.1 Waste Inspection and Screening

RCRA-exempt oil field wastes will be accepted at the Sundance West Facility. It is unlikely that defined hazardous wastes will be delivered to this Facility, and Sundance West will implement a waste inspection and screening program at the Facility Gatehouse to preclude acceptance of unauthorized wastes as described in the Oil Field Waste Management Plan

(Volume II.2). The OCD Form C-138 (Request for Approval to Accept Solid Waste) is provided as **Attachment II.5.A**, which identifies the documentation required for each generator to certify the waste characteristics. It is possible that hazardous materials could become a concern if they arrive with other typical waste materials (19.15.36.13.N.(6) NMAC). If this occurs, the generator will be notified and the entire load will be rejected and returned for proper management. The waste inspection and screening program has been established in order to identify hazardous materials before they become a health and safety liability.

3.2 Fire Prevention and Preparedness

Sundance West will implement a program of fire preventative and preparedness measures, as well as employee training. Preventive measures taken to avoid fires will include regular inspections of incoming vehicles to identify incompatible or problematic wastes, and indication of suspect loads.

A list of available emergency response equipment is provided in **Table II.5.5** in accordance with the requirements of 19.15.36.13.N.(4) NMAC. Control preparation procedures for potential fire emergencies include:

- Placement and maintenance of ABC-type fire extinguishers in structures and equipment.
- Implementation of a site-wide communication network to optimize mobilization of appropriate response personnel and equipment.
- Well established emergency response procedures, documented and posted at the Gate House and provided to each employee on a laminated pocket cards.

Employee fire prevention and preparedness training will include the following:

- Training of equipment operators to identify suspect incompatible problematic wastes loads and measures for mitigation.
- Training of site personnel in waste screening (see Section 3.1), flammables identification, etc.
- Training on fire response technique, notification procedures, fire response equipment, etc.

TABLE II.5.5
Emergency Response Equipment List¹
Sundance West

Equipment Description	Quantity	Location	Use(s)
10 lb ABC rated fire extinguisher (1 min.)	2	Scalehouse ²	Firefighting
10 lb ABC rated fire extinguisher (1 min.)	2	Trucks	Firefighting
10 lb ABC rated fire extinguisher (1 min.)	1	Heavy Equipment	Firefighting
20 lb ABC rated fire extinguisher (2 min.)	1	Oil Process Tanks	Firefighting
20 lb ABC rated fire extinguisher (2 min.)	1	Oil Sales Tanks	Firefighting
20 lb ABC rated fire extinguisher (2 min.)	1	Produced Water Receiving Tanks	Firefighting
20 lb ABC rated fire extinguisher (2 min.)	1	Diesel Storage Tank	Firefighting
Loader (5 cy)	1	Facility	Berm Repair
Oil Booms (200 ft)	4	NE Corner of Pond	Oil Containment
Self-contained Breathing Apparatus	1 per employee	Scalehouse ²	Protective gear for employees
Pair leather gloves	1 per employee	Assigned to employee	Protective gear for employees
NOMEX Coveralls	7 per Employee	Assigned to Employee	Protective gear for employees
Pair safety glasses	1 per employee	All employee workstations	Protective gear for employees
Round-point wood handle shovels	2	Scalehouse ²	Contain spillage, putting out fires
First Aid Kit	1	Scalehouse ²	First Aid
First Aid Kit	1 per vehicle	Facility Vehicles	First Aid
Eye Wash Station	1	Produced Water Receiving Tanks	First Aid
Portable 2-way radio	1 per employee	Base unit at the Gatehouse/Scalehouse ²	Communications
Cell Phones (Unlimited Range)	min. 3	Facility Manager Facility Operator Facility Operator	Communications
Office Phone	2	Scalehouse ²	Communications
Mobile pressure washer	1	Mobile	Decontaminating equipment

Notes:

¹Subject to change in response to waste receipts, regulatory requirements, technology, etc.

²The Gatehouse is associated with the Processing Area, and the Scalehouse is associated with the Landfill.

4.0 IMPLEMENTATION, ASSESSMENT, AND NOTIFICATION

The following subsections present a series of procedures for implementation, assessment, and notification of appropriate authorities in the unlikely event that a specific emergency develops (19.15.36.13.N.(1) NMAC).

4.1 Implementation

This Contingency Plan will be implemented when an imminent or actual emergency situation develops that represents a potential impact to freshwater, public health, safety or the environment. Situations that could require implementation of this Plan include:

- fire/explosions
- release of contaminants or oil field waste constituents

Table II.5.6 lists the implementation, assessment, and notification procedures that will be followed in the case of an emergency. Assessment and notification are discussed further in subsections 4.2 and 4.3.

TABLE II.5.6
Implementation, Assessment, and Notification Procedures for Releases
(Breaks, Leaks, Spills, Releases, Fires or Blowouts)
Sundance West

1. **NOTIFY THE ECs:** The employee who first becomes aware of the emergency will immediately 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.
2. **ASSESS SOURCE, AMOUNT, AND EXTENT OF RELEASE:** The EC will assess the source, amount, and extent of spill or release, or released material resulting from a fire or explosion and determine possible hazards to fresh water, public health, safety or the environment.
3. **CONTROL MEASURES OR EVACUATION:** The EC's assessment of the emergency situation will be the basis for attempting to control the release or for implementing an evacuation, as well as for notifying the appropriate state and local authorities if their assistance is needed. **Table II.5.8** provides Evacuation Procedures and a Site Evacuation Plan is provided as **Figure II.5.3** (also refer to control measures in Section 5.0).
4. **CONTAIN AND PREVENT SPREAD OF RELEASE:** If deemed safe by the EC, the appropriate Sundance West response equipment and personnel will be dispatched to the scene of the release. Personnel will initiate actions within their scope of training to contain the release and prevent the spread and/or windblown dispersion of the release. Depending on the type of release, appropriate equipment may include deployment of absorbents for spills, fire extinguishers, and/or earthmoving equipment.

5. **NOTIFICATION OF EMERGENCY AUTHORITIES:** If the EC's assessment indicates a need to notify appropriate state and local emergency authorities, notification will be initiated immediately. A list of state and local response agencies with phone numbers is provided as **Table II.5.2**. OCD will be notified as necessary in accordance with **Table II.5.7** (Release Notification and Corrective Action).
6. **DIVERT TRAFFIC AND RESTRICT PERSONS FROM AREA:** Sundance West personnel not actively involved in release control operations will be restricted from the area until the area is determined to be safe by the EC and, if appropriate, the on-scene senior emergency authority (i.e., fire, police, hazard or other official). Vehicular traffic will be diverted away from release response activities until the situation is abated.

4.1.1 Fires/Explosions

Potential scenarios for fires include ignition of mobile equipment while operating or during servicing, or the ignition of oil-contaminated wastes. It is also possible that a chemically incompatible material may be transported to the Facility. Personnel are trained in the identification, prevention and control of fires or explosions.

4.1.2 Spills/Releases

The spill or release of a hazardous material at Sundance West is most likely to involve fuel or various vehicle maintenance materials (i.e., engine oil, hydraulic oil, antifreeze, etc.). Spills involving these types of materials could potentially occur during fueling, routine maintenance operations or during unloading or processing of waste. In addition, the possibility exists for a spill of a hazardous material that may be inadvertently transported to the Facility. Although highly unlikely, spill/releases from pond and tanks on-site are addressed in Section 5.2.

4.2 Assessment

In the event of a spill, release, fire, or explosion the EC will immediately identify the character, source, amount and extent of released materials, if possible; as well as assessing the potential impact to fresh water, public health, safety or the environment (19.15.36.13.N.(10) NMAC). During an emergency, the EC may amend this Plan as necessary to protect fresh water, public health, safety or the environment (19.15.36.13.N.(14) NMAC). The EC will also assess the circumstances of an emergency situation and determine the responses required to:

- provide notifications to appropriate agencies
- implement appropriate recordkeeping procedures

This assessment provides the EC with critical data needed to determine whether an evacuation is necessary, whether emergency authorities are needed, and whether Sundance West will attempt to control the release with on-site personnel and equipment. **Table II.5.7** provides OCD descriptions of “major” and “minor” releases which are applicable for assessment purposes (19.15.29.7 – 11 NMAC). This section prescribes additional detailed information regarding the Site Evacuation Plan, and Section 5.0 addresses control restrictions.

4.2.1 Site Evacuation Plan

Based upon operational safeguards and the type of waste materials proposed for receipt at Sundance West, the potential for a Facility evacuation is unlikely (19.15.36.13.N.(5) NMAC). In an emergency situation, the EC is the individual responsible for determining when evacuation of the Sundance West Facility is required. Imminent or actual dangers that constitute a situation that could require evacuation include:

- A generalized fire or threat of fire that cannot be avoided.
- An explosion or the threat of explosion that cannot be averted.
- A major spill or leak that cannot be contained and constitutes a potential threat to human health or the environment.

When conditions warrant immediate evacuation of on-site persons (e.g., Facility personnel, transporters, visitors, vendors, etc.) everyone will be directed to proceed immediately to the Facility Gatehouse (as applicable), Sundance West’s primary evacuation route. Sundance West personnel will exercise good judgment and common sense in using the primary evacuation route to exit the Facility, or selecting the most appropriate alternative evacuation route, if necessary. Assembly points, primary and secondary evacuation routes are provided on **Figure II.5.3**. Driving directions to the nearest hospital are included as **Figure II.5.4**, and **Table II.5.8** provides detailed procedures for evacuating the Facility.

TABLE II.5.7
Part 29: Release Notification
Sundance West

19.15.29.7 DEFINITIONS:

- A.** “Major release” means:
- (1)** an unauthorized release of a volume, excluding gases, in excess of 25 barrels;
 - (2)** an unauthorized release of a volume that:
 - (a)** results in a fire;
 - (b)** will reach a watercourse;
 - (c)** may with reasonable probability endanger public health; or
 - (d)** results in substantial damage to property or the environment;
 - (3)** an unauthorized release of gases in excess of 500 MCF; or
 - (4)** a release of a volume that may with reasonable probability be detrimental to water or exceed the standards in Subsections A and B or C of 19.15.30.9 NMAC.
- B.** “Minor release” means an unauthorized release of a volume, greater than five barrels but not more than 25 barrels; or greater than 50 MCF but less than 500 MCF of gases.

19.15.29.8 RELEASE NOTIFICATION:

- A.** The person operating or controlling either the release or the location of the release shall notify the division of unauthorized release occurring during the drilling, producing, storing, disposing, injecting, transporting, servicing or processing of oil, gases, produced water, condensate or oil field waste including regulated NORM, or other oil field related chemicals, contaminants or mixture of the chemicals or contaminants, in accordance with the requirements of 19.15.29 NMAC.
- B.** The person operating or controlling either the release or the location of the release shall notify the division in accordance with 19.15.29 NMAC with respect to a release from a facility of oil or other water contaminant, in such quantity as may with reasonable probability be detrimental to water or exceed the standards in Subsections A and B or C of 19.15.30.9 NMAC.

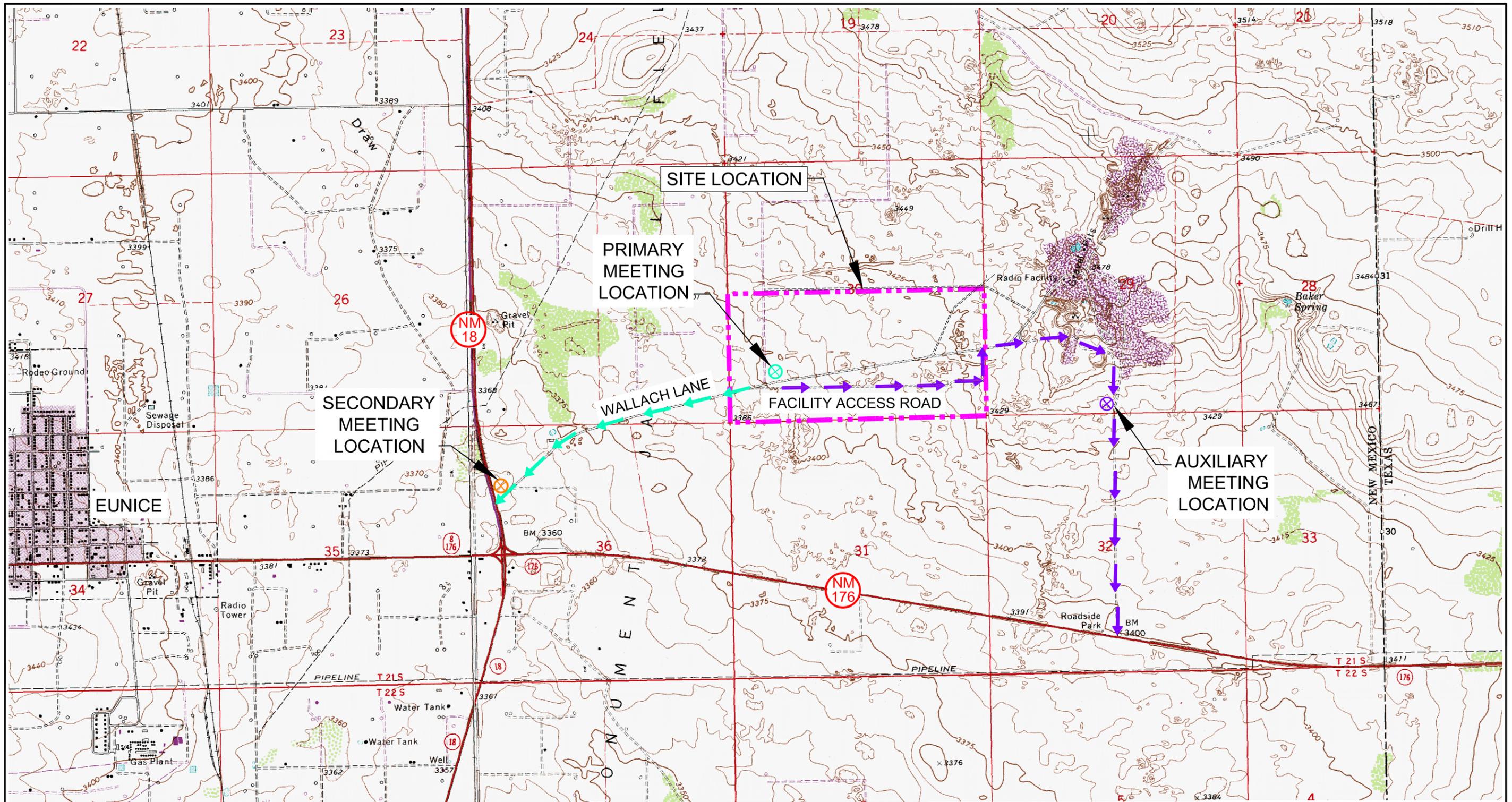
19.15.29.9 REPORTING REQUIREMENTS: The person operating or controlling either the release or the location of the release shall provide notification of releases in 19.15.29.8 NMAC as follows.

- A.** The person shall report a major release by giving both immediate verbal notice and timely written notice pursuant to Subsections A and B of 19.15.29.10 NMAC.
- B.** The person shall report a minor release by giving timely written notice pursuant to Subsection B of 19.15.29.10 NMAC.

19.15.29.10 CONTENTS OF NOTIFICATION:

- A.** The person operating or controlling either the release or the location of the release shall provide immediate verbal notification within 24 hours of discovery to the division district office for the area within which the release takes place. In addition, the person shall provide immediate verbal notification of a release of a volume that may with reasonable probability be detrimental to water or exceed the standards in Subsections A and B or C of 19.15.30.9 NMAC to the division's environmental bureau chief. The notification shall provide the information required on form C-141.
- B.** The person operating or controlling either the release or the location of the release shall provide timely written notification within 15 days to the division district office for the area within which the release occurs by completing and filing form C-141. In addition, the person shall provide timely written notification of a release of a volume that may with reasonable probability be detrimental to water or exceed the standards in Subsections A and B or C of 19.15.30.9 NMAC to the division's environmental bureau chief within 15 days after the release is discovered. The written notification shall verify the prior verbal notification and provide appropriate additions or corrections to the information contained in the prior verbal notification.

19.15.29.11 CORRECTIVE ACTION: The responsible person shall complete division-approved corrective action for releases that endanger public health or the environment. The responsible person shall address releases in accordance with a remediation plan submitted to and approved by the division or with an abatement plan submitted in accordance with 19.15.30 NMAC.



MAP BASE:
 EUNICE N. MEX. 1969, PHOTOREVISED 1979 AND EUNICE NE, TEX.-N.
 MEX. 1969, PHOTOREVISED 1979, 1:24000, USGS 7.5 MIN. SERIES
 TOPOGRAPHIC QUADRANGLES

- LEGEND**
- - - - - FACILITY BOUNDARY
 - - - - - UNPAVED ROADS
 - ⊗ PRIMARY MEETING LOCATION
 - ← PRIMARY EVACUATION ROUTE
 - ⊗ SECONDARY MEETING LOCATION
 - ⊗ AUXILIARY MEETING LOCATION
 - ← AUXILIARY EVACUATION ROUTE



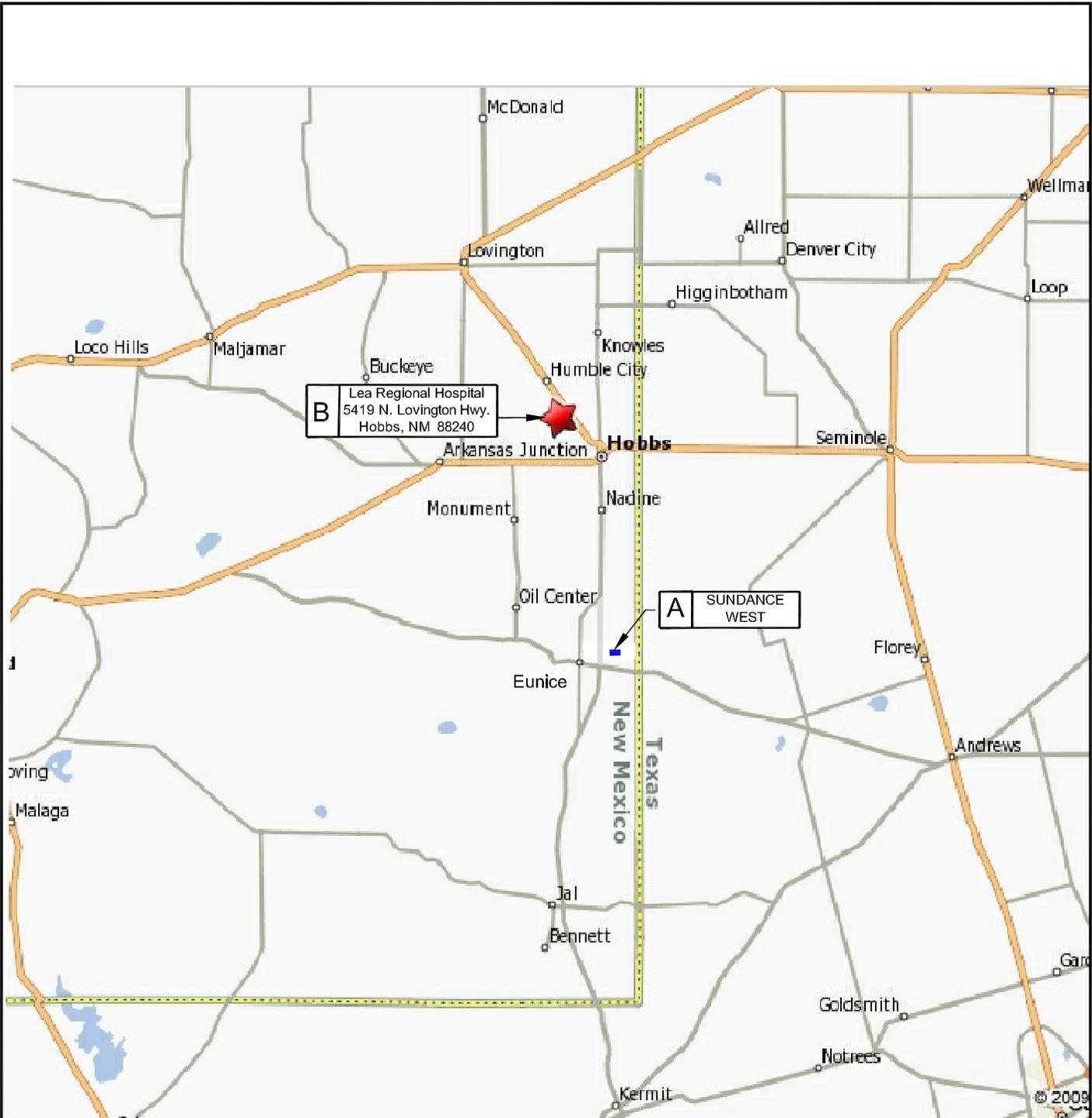
SITE EVACUATION MAP

SUNDANCE WEST
 SURFACE WASTE MANAGEMENT FACILITY
 LEA COUNTY, NEW MEXICO



213 S. Camino del Pueblo
 Bernalillo, New Mexico, USA
 Phone: 505-867-6990
 Fax: 505-867-6991

DATE: 07/19/2016	CAD: SITE EVAC.dwg	PROJECT #: 530.06.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.5.3
APPROVED BY: IKG	gei@gordonenvironmental.com	



- A: Sundance West**, Wallach Lane & NM-18, Eunice, NM 88231
- | | |
|---|---------|
| 1. Start out going WEST on WALLACH LN toward NM-18N | 0.0 mi |
| 2. Turn RIGHT on NM-18N | 18.0 mi |
| 3. Turn LEFT onto E SANGER ST/CR-65 | 0.5 mi |
| 4. Turn SLIGHT RIGHT onto N TURNER ST | 1.3 mi |
| 5. N TURNER ST becomes NM-18N | 3.1 mi |
| 6. Turn LEFT onto GERRY ST | 0.1 mi |
| 7. Arrive 5419 N LOVINGTON HWY | 0.0 mi |
- B: Lea Regional Medical Center, 5419 N Lovington Hwy, Hobbs, NM 88240-9100**

Note: A to B Travel Estimates: 35 minutes / 23.86 miles

HOSPITAL LOCATION MAP

SUNDANCE WEST
SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY, NEW MEXICO

 Gordon Environmental, Inc. <i>Consulting Engineers</i>		213 S. Camino del Pueblo Bernalillo, New Mexico, USA Phone: 505-867-6990 Fax: 505-867-6991
DATE: 02/05/2015	CAD: HOSPITAL.dwg	PROJECT #: 530.06.01
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.5.4
APPROVED BY: IKG	gei@gordonenvironmental.com	



NOT TO SCALE

TABLE II.5.8
Evacuation Procedures
Sundance West

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. Facility operating equipment will be shut down.
4. Personnel will be directed to proceed to the Facility Gatehouse, which will be the primary meeting locations (**Figure II.3.4**). The EC will identify missing persons at that time.
5. If the emergency involves the Gatehouse or its immediate environs, the Facility secondary assembly point and evacuation routes will be utilized (as applicable).
6. Once assembled, personnel will stand by to afford assistance, if and as needed, or to evacuate the Site.

4.3 Notification of Authorities

The following discussion presents a series of procedures for implementation and notification of appropriate authorities in the event that a specific emergency develops (19.15.36.13.N.(1) NMAC). Whenever there is an imminent or actual emergency, the EC will immediately notify on-site persons (Facility personnel, visitors, vendors, transporters, etc.) via on-site communication systems, as well as notify the appropriate state and local agencies as necessary (19.15.36.13.N.(9) NMAC).

Table II.5.1 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.5.1** will be posted as appropriate and near on-site telephones for easy access by Sundance West personnel. Fire, police, and medical authorities should be contacted as necessary in an emergency situation (**Table II.5.1**). The adjacent property users should be notified if there is an immediate threat to human health and the environment in the area, such as fire, explosions or H₂S release (land currently vacant).

In the case of an H₂S emergency where H₂S ≥ 10 ppm site personnel will follow the H₂S plan in **Volume II.3**. However, notification will be provided to the New Mexico State Police, Lea

County Sheriff, and OCD (also listed on **Table II.5.1**):

- OCD
Hobbs, NM (575) 393-6161
Mobile Phone (575) 370-3180
Santa Fe, NM (505) 476-3440
- New Mexico State Police 911 or (575) 392-5580
- Lea County Sherriff's Dept. 911 or (575) 396-3611
- Lea County Emergency Management (575) 391-2983

Sundance West will also notify the Emergency Response Firm if necessary (**Table II.5.2**) to provide response personnel, equipment, and supplies to mitigate the source of an H₂S reading of ≥ 10 ppm at the property boundary.

Table II.5.7 provides specific information regarding notification of OCD in the case of a release, which by definition includes breaks, leaks, spills, releases, fires or blowouts (**Table II.5.3**). In addition, **Table II.5.7** also provides OCD definitions for “major” and “minor” releases.

Additional State, Federal, and other local emergency contact numbers are provided and should be used as deemed appropriate to the situation. If the EC determines that the incident could threaten fresh water, human health, public safety or the environment beyond the limits of the Sundance West Facility, the EC will notify the National Response Center and New Mexico Environment Department (NMED) spill emergencies at the following phone numbers (also included on **Table II.5.1**):

- National Response Center - 24 Hr. Hotline: (800) 424-8802
- NMED Environmental Emergencies - 24 Hr. Hotline: (505) 827-9329

The EC's notification to authorities must include the following information, as listed on the Emergency Response Record Keeping Form:

- name and telephone number of person reporting the incident
- name and address of Facility
- time and type of incident (e.g., hazardous material release, fire)
- name and quantity of material(s) involved, to the extent known
- extent of injuries, if any
- possible hazards to human health or the environment

5.0 CONTROL PROCEDURES

This section provides information for the EC and Sundance West personnel regarding control procedures for different types of releases including fires, explosions, spills, and releases. The focus of the EC's initial efforts will be the protection of Facility personnel and those using the Facility. Control procedures should only be implemented by the EC and Sundance West personnel once an assessment of the situation and possible hazards to fresh water, public health, safety or the environment has been completed. Persons should not attempt to contain or control fires, explosions, spills, leaks, breaks, or blowouts that are beyond the scope of their safety, training, and available response equipment. Once the appropriate state and local agencies arrive on scene, these authorities will take control of the situation, as appropriate.

The following subsections provide the EC and Sundance West personnel with specific control procedures for emergency situations. Note that in the case of an H₂S emergency situation, the procedures outlined in **Volume II.3** (Hydrogen Sulfide (H₂S) Prevention and Contingency Plan) should be followed.

5.1 Fire Control Guidelines

Fire response equipment available at Sundance West is identified on **Table II.5.5**. Fire control efforts will not be initiated until untrained personnel or customers are at a safe distance. The following general guidelines for fire control will be followed in the event of a fire or explosion at Sundance West:

TABLE II.5.9
Fire/Explosion: Control Guidelines
Sundance West

1. **INITIATE FIRE CONTROL:** The EC and Sundance West personnel will initiate response actions within the scope of their training to control the spread of the fire.
2. **P.A.S.S. METHOD:** Fires will generally be controlled with ABC-type fire extinguishers using the P.A.S.S. method (Pull pin, Aim nozzle, Squeeze trigger, Sweep from side to side to extinguish).
3. **SMOTHER METHOD:** Fires may also be smothered with cover materials (i.e., soil, caliche) when possible to extinguish.
4. **AVAILABLE WATER SOURCES:** Fires may be doused or hosed with available equipment, water truck, etc. (no water on petroleum fire).
5. **EVACUATE AND NOTIFY EMERGENCY AUTHORITIES:** If at any time the scope

of the fire is beyond the capabilities of Sundance West personnel to contain and/or extinguish it, the EC will contact the local Fire Department or the Lea County Emergency Management (**Table II.5.2**) for assistance. Personnel and visitors will be instructed to evacuate the area.

6. **MONITOR SITUATION:** The EC will monitor for leaks, pressure buildup, gas generation or rupture in valves, pipes or equipment as appropriate (19.15.36.13.N.(11) NMAC).
7. **RECORDKEEPING/REPORTING:** The EC will complete an Incident Report Form (**Attachment II.5.B**) and maintain a copy in the Facility Operating Record, readily accessible for OCD inspection.

After responding to the incident, the EC will meet with involved personnel and response agencies, if appropriate, to assess the cause of the emergency and document the incident. The Incident Report Form (**Attachment II.5.B**) will reflect the details of emergency and the resulting actions. The identified causative agent will be removed from the vicinity of the Facility if the possibility of re-ignition exists. Appropriate actions to prevent recurrence of fire will be developed and implemented. Personnel involved with the handling, transport, and placement of materials at the Facility will be informed of the resultant actions. Significant changes in operating protocol or procedures resulting from this meeting will be documented and added as an amendment to the Plan (see Section 10.0).

5.2 Spills/Release Control Guidelines

The waste inspection and screening program (see Section 3.0) has been implemented in order to intercept potential unauthorized wastes inadvertently delivered to Sundance West before they are unloaded at the Facility. Emergency equipment for response to such releases includes, but is not limited to, the items provided in the Emergency Response Equipment List (**Table II.5.5**). Containment/control and characterization of potential releases will be conducted only after untrained personnel are at a safe distance. At that point, the EC will then implement the following procedures for managing existing or potential release (19.15.36.13.N.(6) NMAC):

Immediately after an emergency situation, the EC will make arrangements for the segregation, storage, or disposal of recovered wastes, water, or contaminated materials resulting from the incident. An evaluation of the contamination will be carried out as soon as time permits to prevent future accidents. The Incident Report Form (**Attachment II.5.B**) will reflect the details of the emergency and resulting actions.

Although operating procedures, roadways, unloading areas, and general areas surrounding the Sundance West Facility will be maintained in an effort to minimize the potential for a release or spill of hazardous materials, provisions have been developed to improve procedures if an event warrants review and modification. After responding to the incident, the EC will meet with involved personnel to determine the cause of the spill. Appropriate actions to prevent its recurrence will be developed and implemented. Personnel involved with the handling and transport of hazardous materials will be informed of the procedures/protocol that is developed in response to knowledge gained from past response procedures. Significant changes in operating protocol or procedures resulting from this meeting will be documented and added as an amendment to this Plan. Plan amendments will be documented and disseminated as outlined in Section 10.0, including OCD within 5 days.

TABLE II.5.10
Spill/Release: Control Guidelines
Sundance West

1. **INITIATE CONTROL:** The EC and Sundance West personnel will initiate response actions within the scope of their training to control the spill/release.
2. **REMOVAL OR SEGREGATION:** Determine if the material can be safely removed to a designated waste inspection/segregation area for further evaluation. If the materials cannot be safely relocated, contain them for investigation and sampling using the spill control list. If necessary, shut down operations until safe conditions are restored.
3. **CONTAIN RELEASE:** Attempt to contain the release to the smallest area possible. Examples of equipment available for spill containment are non-reactive sorbent materials, oil booms, sand, shovels and heavy equipment. A third-party contractor is also available for emergency response to augment efforts by on-site personnel.
4. **SAMPLING:** After isolating the contaminants and contaminated media, inspect them to determine if sampling is appropriate. If appropriate, isolate contaminants in the waste inspection or segregation area, or in designated leak-proof containers, until characterization is complete.
5. **CLEANUP:** After the release has been contained and necessary samples have been obtained, cleanup will be initiated by removing the spilled materials, sorbent materials, soils used for containment, etc.
6. **EQUIPMENT MONITORING:** Pertinent liners and equipment, including valves and pipes, will be monitored for leaks, pressure buildup, gas generation or rupture as appropriate (19.15.36.13.N.(11) NMAC).
7. **VERIFICATION SAMPLING:** Dependent on the type of material spilled, the EC will assess requirements for cleanup verification including the collection of samples for appropriate analytical testing.

8. **DISPOSAL OR PROCESSING:** When visual and/or laboratory characterization is complete, determine appropriate processing or disposal procedures for that waste type. Send residuals for disposal to a Facility that is approved for managing that type of waste.
9. **EVACUATE AND NOTIFY EMERGENCY AUTHORITIES:** If at any time the scope of the spill/release is beyond the capabilities of the on-site personnel to contain and/or extinguish it, the EC will contact the local Fire Department or Lea County Emergency Management (**Table II.5.1**) for assistance. Personnel and visitors will be instructed to evacuate the area.
10. **RECORDKEEPING/REPORTING:** The EC will complete an Incident Report Form (**Attachment II.5.B**) and maintain a copy in the Facility Operating Record, readily accessible for OCD inspection.

5.3 Clean, Replace, and Inspect Equipment

Following an emergency incident, emergency response equipment used will be inspected, decontaminated/cleaned and made fit for re-use, or replaced as necessary, so that the equipment will be available when Facility operations resume. The inspection of equipment will take place before operations resume ensuring that each item is in proper working condition. This inspection will include a review of the Facility infrastructure to ensure that a potential hazard has not been created as a result of responding to the emergency. Prescribed procedures may include lock-out/tag-out on processing equipment until inspection and repairs can be completed. Remedial activities, as a result of this inspection, may include recharging of fire extinguishers, replacement of personal protective gear, restocking of disposable items, etc. The EC will verify that response equipment has been properly decontaminated and returned to its original location and is fit for future use.

6.0 STORAGE AND TREATMENT OF RELEASED MATERIALS

Spilled or otherwise contaminated material approved for disposal at the Sundance West Landfill will be managed in accordance with standard operating practices. Other hazardous spilled materials will be containerized, stored and disposed of in accordance with applicable local, state and federal regulatory requirements; potentially including third-party services (i.e., the Emergency Response Firm). No oil field waste, which may be incompatible with the released material, will be treated, stored, or disposed of until cleanup procedures are complete (19.15.36.13.N.(12), (13) NMAC).

7.0 EMERGENCY EQUIPMENT

The following sections describe emergency equipment that is available at Sundance West for responding to emergency situations. An Emergency Response Equipment List describing the equipment, quantity, location, and uses is provided as **Table II.5.5**.

7.1 Internal Communications

Communications at the Sundance West Facility will be accomplished via cellular telephones, land lines, and two-way radios. These systems provide Facility personnel with immediate and redundant emergency notification capabilities, and the opportunity to receive instructions in the event of an emergency incident. Mechanical difficulties with the communications equipment will be promptly repaired. Internal communication devices are also listed on **Table II.5.5**.

7.2 External Communications

The telephones located at Sundance West will have outside access in the event that notification of the local emergency response authorities is required (i.e., EMS, fire department, ambulance, etc.). In addition, key Facility personnel including the ECs, General Manager, etc., will carry cellular telephones for contacting each other and outside agencies. The cellular telephones will also provide a backup means for contacting emergency authorities in the event they cannot be reached by conventional telephone lines. Emergency phone numbers will be posted in the Facility Gatehouse and provided to employees. External communication devices are also included on **Table II.5.5**.

7.3 Fire Prevention

Portable ABC-type fire extinguishers will be located in Facility vehicles and mobile equipment, as well as within the Facility Gatehouse, and tanks areas. Fire extinguishers will be maintained in accordance with state and local fire codes and regulations and routinely serviced. On-site earthmoving equipment will be available to move and apply cover material for control of smoldering loads. Cover material will be readily available throughout the site.

7.4 Personnel Protection, First Aid, and Safety Equipment

Personal protective equipment (PPE) necessary for preliminary response to a release of hazardous materials will be maintained in on-site buildings (Facility Gatehouse, etc.) and/or issued to each employee (**Table II.5.5**). These items may include Tyvek suits, gloves, safety glasses, hearing protection, etc.

First aid and safety equipment will be maintained at various locations at the Sundance West Facility (**Table II.5.4**). Safety equipment located at the Facility will include industrial first aid kits, emergency shower/eye wash station, etc. First aid kits will be placed in the Facility Gatehouse and the Process Facility. An emergency shower and eye wash station will be located at the Process Facility. In addition, first aid kits will be maintained in Facility vehicles, including heavy equipment. Prominent signs will be placed identifying the location of health and safety equipment, and emergency response items (e.g., fire extinguishers).

7.5 Spill Response Equipment

Spill response equipment, including heavy equipment and hand-gear, will be stored at specific locations around the Facility (**Table II.5.5**).

8.0 RECORDKEEPING

The EC will be responsible for ensuring that emergency response actions are fully documented. The Incident Report Form (**Attachment II.5.B**) illustrates the information that will be recorded as a result of emergency incident and related response action. This form will be signed by both the EC and the Facility Manager. Copies of the form filed for each incident will be retained as part of the Sundance West Facility Operating Record.

In addition, in the case of an unauthorized release at the Sundance West Facility, the OCD will be notified pursuant to 19.15.29 NMAC. As defined by OCD in **Table II.5.2**, a “release” is *“breaks, leaks, spills, releases, fires or blowouts involving crude oil, produced water, condensate, drilling fluids, completion fluids or other chemical or contaminant or mixture thereof, including oil field wastes and natural gases to the environment”* (19.15.2.7.R.(4) NMAC). A major release (19.15.29 NMAC; **Table II.5.6**) includes *an unauthorized release of a volume in excess of 25 barrels; or of any volume which results in a fire, will reach a water*

course, may with reasonable probability endanger public health or results in substantial damage to property or to the environment, cause detriment to water or exceed the standards in 19.15.30 NMAC. A major release requires both immediate verbal notification (within 24 hours) as well as timely written notification to OCD (within 15 days) using OCD Form C-141 (**Attachment II.5.C**) relating to *Release Notification and Corrective Action*. A minor release (**Table II.5.6**) is an unauthorized release of greater than 5 barrels but less than 25 barrels. A minor release requires timely written notice only. A copy of OCD Form C-141 is provided as **Attachment II.5.C**. Copies of the form filed for each incident will be retained as part of the Sundance West Facility Operating Record.

9.0 COORDINATION AGREEMENTS

A copy of the Contingency Plan will be made available to the organizations identified in **Table II.5.2**. The Contingency Plan serves to familiarize each of the identified organizations with the operations of the Facility and types of emergencies and responses that may be required. Each agency will be encouraged to visit the Facility for purposes of assessing site operations and providing input regarding emergency response procedures (19.15.36.13.N.(2) and (7) NMAC).

10.0 PLAN AMENDMENT

The EC will be responsible for assuring updates to or amendments of the Contingency Plan. Amendments to the Contingency Plan will be made within five working days in the event of the following (19.15.36.13.N.(8) NMAC):

1. The Facility Permit is revised or modified.
2. The Plan fails in an emergency.
3. 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.
4. The list of ECs changes.
5. The list of emergency equipment changes significantly.

The Contingency Plan amendments will be distributed to OCD and made available to each of the organizations identified in **Table II.5.1** with a cover letter highlighting substantive changes. Proposed changes will be in compliance with 19.15.36.13.N NMAC.

**APPLICATION FOR PERMIT
SUNDANCE WEST**

**VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 5: CONTINGENCY PLAN**

**ATTACHMENT II.5.A
REQUEST FOR APPROVAL TO ACCEPT SOLID WASTE
OCD FORM C-138**

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

State of New Mexico
Energy Minerals and Natural Resources

Form C-138
Revised August 1, 2011

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

*Surface Waste Management Facility Operator
and Generator shall maintain and make this
documentation available for Division inspection.

REQUEST FOR APPROVAL TO ACCEPT SOLID WASTE

1. Generator Name and Address:
2. Originating Site:
3. Location of Material (Street Address, City, State or ULSTR):
4. Source and Description of Waste:
Estimated Volume _____ yd ³ / bbls Known Volume (to be entered by the operator at the end of the haul) _____ yd ³ / bbls
5. GENERATOR CERTIFICATION STATEMENT OF WASTE STATUS
I, _____, representative or authorized agent for _____ do hereby certify that according to the Resource Conservation and Recovery Act (RCRA) and the US Environmental Protection Agency's July 1988 regulatory determination, the above described waste is: (Check the appropriate classification)
<input type="checkbox"/> RCRA Exempt: Oil field wastes generated from oil and gas exploration and production operations and are not mixed with non-exempt waste. <i>Operator Use Only: Waste Acceptance Frequency</i> <input type="checkbox"/> Monthly <input type="checkbox"/> Weekly <input type="checkbox"/> Per Load
<input type="checkbox"/> RCRA Non-Exempt: Oil field waste which is non-hazardous that does not exceed the minimum standards for waste hazardous by characteristics established in RCRA regulations, 40 CFR 261.21-261.24, or listed hazardous waste as defined in 40 CFR, part 261, subpart D, as amended. The following documentation is attached to demonstrate the above-described waste is non-hazardous. (Check the appropriate items)
<input type="checkbox"/> MSDS Information <input type="checkbox"/> RCRA Hazardous Waste Analysis <input type="checkbox"/> Process Knowledge <input type="checkbox"/> Other (Provide description in Box 4)
GENERATOR 19.15.36.15 WASTE TESTING CERTIFICATION STATEMENT FOR LANDFARMS
I, _____, representative for _____ do hereby certify that representative samples of the oil field waste have been subjected to the paint filter test and tested for chloride content and that the samples have been found to conform to the specific requirements applicable to landfarms pursuant to Section 15 of 19.15.36 NMAC. The results of the representative samples are attached to demonstrate the above-described waste conform to the requirements of Section 15 of 19.15.36 NMAC.
5. Transporter:

OCD Permitted Surface Waste Management Facility

Name and Facility Permit #:

Address of Facility:

Method of Treatment and/or Disposal:

- Evaporation Injection Treating Plant Landfarm Landfill Other

Waste Acceptance Status:

APPROVED

DENIED (Must Be Maintained As Permanent Record)

PRINT NAME: _____

TITLE: _____

DATE: _____

SIGNATURE: _____

TELEPHONE NO.: _____

Surface Waste Management Facility Authorized Agent

**APPLICATION FOR PERMIT
SUNDANCE WEST**

**VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 5: CONTINGENCY PLAN**

**ATTACHMENT II.5.B
INCIDENT REPORT FORM (TYPICAL)**

INCIDENT REPORT FORM

Sundance West

Lea County, NM

Type of Incident and General Information

- | | |
|--|--|
| <input type="checkbox"/> Work Related Injury/Illness | <input type="checkbox"/> Unsafe Act/Near Miss |
| <input type="checkbox"/> Property Damage | <input type="checkbox"/> Vandalism/Criminal Activity |
| <input type="checkbox"/> Vehicular Accident | <input type="checkbox"/> Other _____ (i.e., spill, release, fire, explosion, hot load, etc.) |

Employee Name: _____ Job Title: _____

Phone No: _____ Date of Incident: _____ Time of Incident: _____ AM/PM

Location of Incident: _____

Start of Shift: _____ Weather: _____

Date and Time Reported to Management: Date: _____ Time: _____ AM/PM

Reported to: _____ Title: _____ Reported by: _____

What was the injury category of incident at the time it was first reported to management?

- N/A. Employee does not claim an injury associated with this incident
- Notice Only of Injury, Declined Medical Treatment at this time
- First Aid done on site, Declined Medical Treatment at this time
- Medical Treatment. Transported by _____ to _____
- Fatality, employee

Employee's Description of Incident / Declaración del empleado de los hechos

Were you injured? (*Ud. se lastimó ?*) Yes No

Type of Injury: (*Tipo de lesión*) _____

Part of Body: _____ Left _____ Right _____
(*Parte del cuerpo*) (*Izq*) (*Der*)

Explain in your own words what happened. (*Explique en sus propias palabras lo que sucedió*)

Employee Signature: (*Firma del empleado*) _____

Date: (*Fecha*) _____

THIS SECTION FILLED OUT BY
EMPLOYEE

INCIDENT REPORT FORM
Sundance West

TO BE FILLED OUT BY EMERGENCY COORDINATOR

Describe in order of occurrence the events leading to the incident and/or injury. Reconstruct the sequence of events that led to the incident. _____

Identify possible hazards to human health or the environment: _____

Identify name and quantity of material(s) involved: _____

CORRECTIVE ACTIONS. (Equipment, Practices, Environment, Retraining) Steps that have been, or will be taken to prevent recurrence: _____

Date Corrective Action Completed: _____

- I have been briefed on the corrective actions outlined above
- *Estoy consciente de las acciones correctivas mencionadas anteriormente en esta hoja*

Employee's Signature

Date

Report Reviewed and Concluded By:

Emergency Coordinator's Signature

Date

**APPLICATION FOR PERMIT
SUNDANCE WEST**

**VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 5: CONTINGENCY PLAN**

ATTACHMENT II.5.C

RELEASE NOTIFICATION AND CORRECTIVE ACTION

OCD FORM C-141

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

State of New Mexico
Energy Minerals and Natural Resources

Form C-141
Revised August 8, 2011

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

Submit 1 Copy to appropriate District Office in
accordance with 19.15.29 NMAC.

Release Notification and Corrective Action

OPERATOR

Initial Report Final Report

Name of Company	Contact
Address	Telephone No.
Facility Name	Facility Type

Surface Owner	Mineral Owner	API No.
---------------	---------------	---------

LOCATION OF RELEASE

Unit Letter	Section	Township	Range	Feet from the	North/South Line	Feet from the	East/West Line	County

Latitude _____ Longitude _____

NATURE OF RELEASE

Type of Release	Volume of Release	Volume Recovered
Source of Release	Date and Hour of Occurrence	Date and Hour of Discovery
Was Immediate Notice Given? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not Required	If YES, To Whom?	
By Whom?	Date and Hour	
Was a Watercourse Reached? <input type="checkbox"/> Yes <input type="checkbox"/> No	If YES, Volume Impacting the Watercourse.	

If a Watercourse was Impacted, Describe Fully.*

Describe Cause of Problem and Remedial Action Taken.*

Describe Area Affected and Cleanup Action Taken.*

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to NMOCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the NMOCD marked as "Final Report" does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Signature:		<u>OIL CONSERVATION DIVISION</u>	
		Approved by Environmental Specialist:	
Printed Name:		Approval Date:	Expiration Date:
Title:		Conditions of Approval:	
E-mail Address:		Attached <input type="checkbox"/>	
Date:	Phone:		

* Attach Additional Sheets If Necessary

**APPLICATION FOR PERMIT
SUNDANCE WEST**

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

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**APPLICATION FOR PERMIT
SUNDANCE WEST**

**VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 6: MIGRATORY BIRD PROTECTION PLAN**

1.0 INTRODUCTION

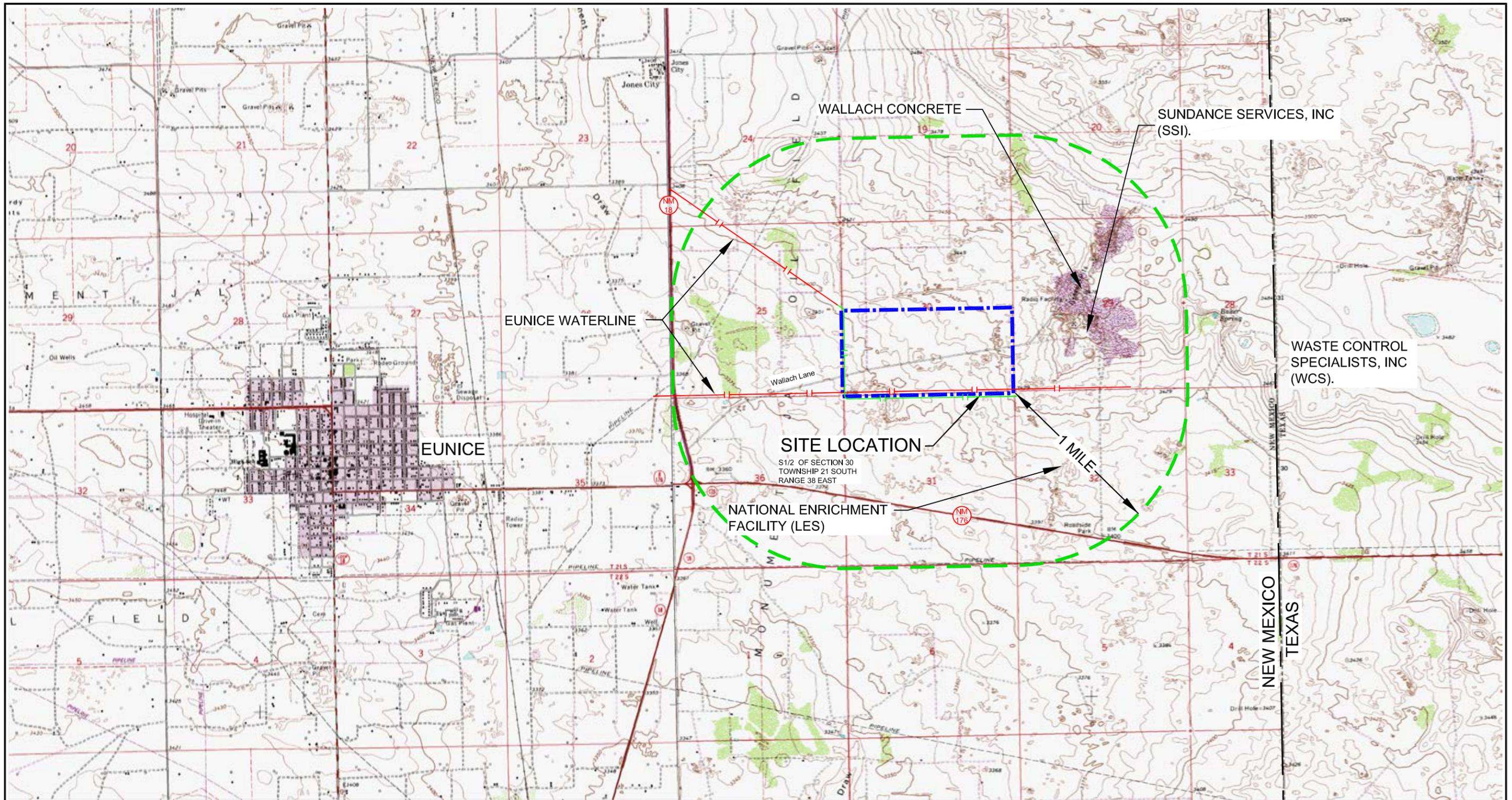
Sundance West is a proposed new commercial Surface Waste Management Facility for oil field waste processing and disposal services. The proposed Sundance West Facility is subject to regulation under the New Mexico Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation Division (OCD). The Facility is designed in compliance with 19.15.36 NMAC, and will be constructed and operated in compliance with a Surface Waste Management Facility Permit issued by the OCD. The Facility is owned by, and will be constructed and operated by, Sundance West, Inc. Sundance West will coordinate with USEPA Region 6 regarding this Plan if so directed by OCD.

1.1 Site Location

The Sundance West site is located approximately 3 miles east of Eunice, 18 miles south of Hobbs, and approximately 1.5 miles west of the Texas/New Mexico state line in unincorporated Lea County, New Mexico (NM). The Sundance West site is comprised of a 320-acre ± tract of land located in the South ½ of Section 30, Township 21 South, Range 38 East, Lea County, NM. Site access will be provided via NM 18 and Wallach Lane. A Site Location Map is provided as **Figure II.6.1**.

1.2 Description

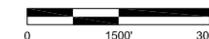
The Sundance West Facility is a proposed new commercial Surface Waste Management Facility that will include two main components; a liquid oil field waste Processing Area (80 acres ±), and an oil field waste Landfill (180 acres ±). Oil field wastes are anticipated to be delivered to the Sundance West Facility from oil and gas exploration and production operations in southeastern NM and west Texas. The Site Development Plan provided in the **Permit Plans (Volume III.1)** identifies the locations of the Processing Area and Landfill facilities.



Based on Eunice NE, TX.- NM (1969) Photorevised (1979);
 Eunice, NM (1969) Photorevised (1978);
 Quadrangles, USGS 7.5' SERIES (1:24,000 Scale)

NOTE:
 NO STREAMS, SPRINGS OR WATER COURSES WITHIN
 1/2 MILE OF SITE

Drawing:P:\acad 2003\530.06.01\REVISED FIGURES(RAI 1)\SITE LOC REVISED 11 x17.dwg
 Date/Time:Aug. 09, 2016-12:28:52 : LAYOUT: B (LS)
 Copyright © All Rights Reserved, Gordon Environmental, Inc. 2016



SITE LOCATION MAP

SUNDANCE WEST
 SURFACE WASTE MANAGEMENT FACILITY
 LEA COUNTY, NEW MEXICO



213 S. Camino del Pueblo
 Bernalillo, New Mexico, USA
 Phone: 505-867-6990
 Fax: 505-867-6991

DATE: 07/22/2016	CAD: DWG NAME.dwg	PROJECT #: 530.06.01
DRAWN BY: DMI	REVIEWED BY: CWF	FIGURE II.6.1
APPROVED BY: IKG	gei@gordonenvironmental.com	

1.3 Purpose

This Migratory Bird Protection Plan (the Plan) for the Sundance West Facility has been prepared in accordance with requirements of 19.15.36.13.I and 19.15.36.17.C.(3) NMAC. This Plan describes the procedures for migratory bird protection at Sundance West. Sundance West is not proposing to install screening, netting or covering over the evaporation ponds. Instead, Sundance West is proposing alternate procedures that have proven historically effective in discouraging bird propagation; and which fulfill the requirements of 19.15.36.13.I and 19.15.36.17.C.(3) NMAC for equal protection of migratory birds.

This Plan may be modified by Sundance West to address changes in site conditions following OCD review and approval of the proposed change. This Plan may also be amended at the request of OCD should conditions warrant.

2.0 MIGRATORY BIRD PREVENTION

2.1 Siting Perspective

Sundance West proposes an exception to the screening/netting requirements of 19.15.36.17.C.(3) NMAC, although Sundance West plans to meet the requirements of this Rule through an alternative monitoring method described herein. Additionally, Sundance West does not anticipate that the ponds will be potentially hazardous to migrating birds as oil will be removed from the water prior to discharge into ponds. There is a significant absence of habitat for migratory birds congregating around, or landing in, the vicinity of the Sundance West Facility. This is due primarily to the lack of a food source at the Facility that limits avian sustainability, and the lack of other nearby suitable habitat. In addition, as documented in **Volume IV.1** (Siting Criteria), no evidence of wetlands are documented at the site.

2.2 Human and Mechanical Intervention

Sundance West Processing Area operations, as proposed in this Application, have been designed to eliminate oil from accumulation on the evaporation ponds. This will be accomplished utilizing tanks and equipment that separate the oil from the water prior to discharge into the evaporation ponds. The anticipated absence of oil in the evaporation ponds eliminates the concerns typically associated with migratory birds being endangered if they land

on the evaporation ponds. In the unlikely event that oil is found on an evaporation pond, the following actions will be implemented. Operations at the Processing Area Facility will be manned by at least two employees 24 hours per day. During the occurrence the Facility Manager, operators and employees will conduct periodic (every fifteen minutes) inspection rounds making note of any migratory bird activity in or surrounding the evaporation ponds. Should migratory bird activity be discovered at the Facility, inspection and scare tactic frequency will be increased to alleviate the roosting of the birds.

In order to prevent oil sheen accumulation on the surface of the ponds (19.15.36.17.C.(1) NMAC), Facility personnel will work continually throughout each day to ensure the Produced Water Tanks are functioning properly, removing the oil from the water prior to discharging to the evaporation ponds. If oil is observed on the evaporation ponds, efforts will be made to remove the visible oil layer from the evaporation ponds immediately. This will be accomplished by using booms to bring the oil sheen to the banks of the ponds where the oil will be removed by vacuum trucks and returned to the Produced Water Tanks.

Operations will not lend the Facility to migratory bird congregation, with proposed operations 24 hours per day, 7 days per week, and 365 days per year. During this time, the mechanical evaporation systems will be in full operation, truck traffic will be consistently entering and leaving the Facility, and pumps will be transferring waters to and from the evaporation ponds. General activities at the site will involve human and truck motion, a natural deterrent to wildlife.

3.0 MIGRATORY BIRD LANDING CONTINGENCY

3.1 Migratory Bird Rescue

In the unlikely event that a bird lands on a pond and becomes contaminated, Facility employees will immediately utilize a boat and side ropes to retrieve the bird. Upon retrieval, Facility employees will transport the bird to a local veterinary clinic for treatment. Bird rescue procedures adapted from those of the International Bird Rescue Research Center are provided in **Table II.6.1.**

TABLE II.6.1
Bird Rescue Protocol
Sundance West

- a. The bird's entire body is immersed in a one percent solution of Dawn and warm water (warm enough to approximate the bird's internal body temperature. Once wet, the bird is unable to thermo regulate) by one person while a second vigorously agitates the water into the bird's feathers.
- b. A WaterPik® filled with the same solution is used to clean the head.
- c. A soft toothbrush and cotton swabs are used to loosen dried oil around the head and eye area.
- d. When the water becomes dirty, the bird is moved to a second pan. The washing process is repeated as often as necessary.
- e. The bird is considered clean when the tub of water is clear and free of oil.
- f. The bird is moved to another pan of clean warm water for rinsing.
- g. A WaterPik® filled with the warm water is used to clean the head.
- h. When the water becomes soapy, the bird is moved to a second pan. The rinsing process is repeated as often as necessary to remove the remaining soap.
- i. The bird is considered rinsed when no soap is visible in a fresh pan of water.
- j. After wash and rinse, the cleaned bird is placed in a protective net-bottomed pen. As it rests, the bird will begin to preen its own feathers back into place. The complete realignment of feathers in a tight overlapping pattern creates a waterproof seal.
- k. The bird is fed a nutritious food mixture to assure proper nourishment, plenty of fluids, as well as vitamins and medications, and is allowed free access to food.
- l. The bird is released when it is stable, healthy, and completed preening. The bird shall be taken to a local veterinary clinic for examination prior to release.

3.2 Screening and Netting

Although it is highly unlikely the Sundance West Facility will have a migratory bird issue based on the described preventative methodology and lack of suitable habitat and food, Sundance West is committed to the protection of migratory birds. Should migratory bird landings become an ongoing concern, Sundance West will implement more aggressive techniques, such as netting or screening, after review and discussion with OCD and wildlife experts.

**APPLICATION FOR PERMIT
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**VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 7: LINER CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN**

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**APPLICATION FOR PERMIT
SUNDANCE WEST**

**VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 7: LINER CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN**

1.0 PROJECT OBJECTIVES

The Construction Quality Assurance (CQA) Plan has been developed to document the measures that will be used to ensure that the environmental control systems will be constructed in compliance with:

- 19.15.36.14.D NMAC
- 19.15.36.14.E NMAC
- 19.15.36.17.B NMAC
- The approved Permit Plans
- The permit and any permit conditions
- This CQA Plan
- Industry standards and other applicable technical criteria

This CQA Plan establishes the quantitative criteria that will be used in the field and laboratory to measure the quality of the installed infrastructure. Specific construction elements that are addressed in this Plan includes:

- Inspection and compaction of the subgrade and liner foundation
- Installation of the geosynthetic clay liner
- Installation of the primary geomembrane
- Installation of the geonet leak detection layer
- Installation of the secondary geomembrane
- Installation of the leachate drainage layer and collection system
- Installation of the protective soil layer
- Ancillary installations as needed to complete the above

This CQA Plan is a quality control plan meeting the specifications of 19.15.36.14.D NMAC, 19.15.36.14.E NMAC, and 19.15.36.17.B NMAC. No revisions to the technical specifications should be allowed without the express approval of the Engineer. The Engineer is a registered professional engineer in New Mexico with applicable experience in geosynthetics design and construction. This Plan may be updated to address changes in materials, technologies, test methods, etc. in consultation with the New Mexico Energy, Minerals and Natural Resources Department, Oil Conservation Division; and more specifically revisions will be made to the applicable geosynthetics testing standards as implemented. Additionally, the Oil Conservation Division shall be notified at least 72 hours prior to primary liner installation so the leak detection layer may be inspected.

Table II.7.1 lists the applicable testing required for each construction element. The Table identifies:

- Key property being evaluated
- The appropriate type of test procedure and method
- The sampling strategy and frequency

TABLE II.7.1 (SHEET 1 of 2)
Summary of Required CQA Standards

Element	Key Property	CQA/CQC Test	Sampling Plan	Sampling Frequency	Standard Test Method
Excavation Required: Subgrade Layer Material Evaluation	Maximum Density	Proctor Test	Judgmental	1 per 5000 cy	ASTM D698
Fill Required: Subgrade Layer Material Evaluation	Maximum Density	Proctor Test	Judgmental	1 per 5000 cy	ASTM D698
Subgrade Layer Construction Quality Evaluation	In-Place Density	Nuclear Density Test	Random within grid	4 per acre per lift	ASTM D2922
	No angular stones greater than 1/2 inch	Visual	Judgmental	100%	NA
Geosynthetic Clay Liner	Conformance	Mass per unit area, Free Swell, Fluid Loss	Systematic	1 per 100,000 sf	ASTM D5993, D5890, D5891
	Surface Defects	Visual	100%	100%	NA
Primary and Secondary Liner Geomembrane	Conformance	Thickness, Density, Tensile properties, Tear reistance, Carbon black content, Carbon black dispersion, Puncture resistance	Systematic	1 per 100,000 sf	ASTM D5199/D5994, D1505, D6693, D1004, D1603, D5996, D4833
	Surface Defects	Visual	100%	100%	NA
Primary and Secondary Liner Geomembrane Seaming Procedures	Subgrade	Visual	100%	100%	NA
	Anchor Trench	Visual	100%	100%	NA
	Temporary Anchor	Visual	100%	100%	NA
	Sheet Placement	Visual	100%	100%	NA
	Overlap of Sheets	Measurement	100%	100%	NA
	Cleanliness of Seam	Visual	100%	100%	NA
	Extent of Grinding	Measurement	100%	100%	NA
Liner Geomembrane Seams	Test Seams	Tensiometer	Systematic	in accordance with specifications	NA
	Field Hot Wedge Seams	Non-Destructive Tests (Pressure Dual Seam)	100%	100%	NA
		Destructive Tests (peel & shear strength)	Random within a grid and Judgmental	1 per 500 feet	ASTM D413 and D6392
	Field Extrusion Fillet Seams	Non-Destructive Tests (Vacuum Box Testing)	100%	100%	ASTM D4437
		Destructive Tests (peel & shear strength)	Random within a grid and Judgmental	1 per 500 feet	ASTM D413 and D6392

TABLE II.7.1 (SHEET 2 of 2)
Summary of Required COA Standards

Element	Key Property	CQA/CQC Test	Sampling Plan	Sampling Frequency	Standard Test Method
Geonet	Conformance	Thickness, Density, Wide width tensil properties, Mass per unit area, Carbon black, Melt index	Systematic	1 per 100,000 sf	ASTM D4354, D1777, D1505, D1682, D3776, D1603, D1238
	Anchor Trench	Visual	100%	100%	NA
	Temporary Anchor	Visual	100%	100%	NA
	Sheet Placement	Visual	100%	100%	NA
	Overlap and Tying of Sheets	Measurement	100%	100%	NA
Protective Soil Layer	Permeability	Lab Permeability	Random	1 per Source	ASTM D2434 or Falling Head
	Particle Size	Gradation of Soil	Random	1 per 1,500 cy	ASTM C136
	Thickness of Protective Soil Layer	Surveying or Direct Test	Within a grid	5 per acre	NA
Geotextile	Conformance	Thickness, Weight, Tensile strength, Mullen burst strength, Puncture strength, Trapezoidal tear strength, AOS	Systematic	1 per 100,000 sf	ASTM D5199, D5261, D4632, D3786, D4833, D4533, D4751
	Overlap	Measurement	100%	100%	NA
	Seams	Visual Observation	100%	100%	NA
Leachate Collection System	Grade	Surveying	NA	1 per 50 lf	NA
	Product specs, placement and	Visual Observation	100%	100%	NA
Leachate Pipe Envelope	Minimize clogging	Gradation of Gravel rounded, not angular	Random	1 per Source	ASTM C136
	Placement and workmanship	Visual Observation	100%	100%	NA

2.0 PROJECT ORGANIZATION

2.1 Project Organization

The Project Team shall be identified in advance of construction, and each Team member will be assigned specific responsibilities as discussed in this section.

2.2 Authority and Responsibilities

2.2.1 Owner

The Owner has the responsibility for scheduling and administration, which may include, but not be limited to:

- Contractor procurement.
- Some or all of the construction tasks.
- Assignments of duties of Project Team and orientation of the Project Staff to the needs and requirements of the project.
- Approval of project-specific procedures and internally prepared plans, drawings, and reports.
- Serving as the "Collection point" for Project Staff reporting project documents and activities.
- Point of collection for archived destruction test (DT) samples.

2.2.2 Site CQA Engineer

The Site CQA Engineer shares responsibilities with the Owner/Operator for addressing technical and administrative issues. The Site CQA Engineer must be present at the outset of major undertakings and at critical times during the construction. The Site CQA Engineer's staff shall be on-site continually for construction activities. The Site CQA Engineer will also be on-site, as necessary, to perform the following:

- Periodic review of submittals from the Site CQA Manager.
- Approval of any CQA Plan revisions.
- Administrative functions as necessary to staff and maintain personnel for the CQA activities.
- Periodic review and assessment of the CQA Plan as implemented to determine completeness and compliance.
- Spot-checking of field and laboratory methods and results for accuracy.
- Acceptance and approval of materials and workmanship.
- Compilation and submission of Certification Reports and other project deliverables.
- Design and certification responsibilities mandate that this site CQA Engineer must be a Professional Engineer properly registered in the State of New Mexico; who possesses demonstrated competence and experience in waste containment engineering.

2.2.3 Site CQA Manager

- Review moisture-density curves correlated to compaction specifications for the borrow source or in-situ subgrade.
- Review Field Grain Size Analysis of materials to confirm suitability.
- Perform nuclear density testing as necessary for in-place compaction confirmations.
- Conduct verification testing for thickness and placement of materials.
- Perform inspection and documentation of synthetic materials installation.
- Review of documentation from contractors as enumerated in this CQA Plan.
- Review CQA activities.
- Notification to appropriate personnel of nonconformance, or changes in CQA procedures.
- Completion of Project CQA audits.
- Scheduling, at regular intervals, CQA meetings with project staff and Subcontractors.
- Reporting, on a regular basis, to the Site CQA Engineer the results of reviews, inspections, and audits.
- Identifying for the Site CQA Engineer project issues, which require his direct involvement.
- Maintaining records of reviews, inspections, audits, and their results.
- Collection of Daily Field Reports from Contractor, which are to be provided no later than 24 hours after each shift has ended.
- Maintenance of calibration records of the instrumentation used on-site in the implementation of this plan.
- Other duties as directed by the Site CQA Engineer.

2.2.4 Contractor

Responsibilities of the Contractor may include:

- A) Management of daily field operations (labor and equipment allocation).
- B) Submission of Daily Field Progress Reports to the Site CQA Manager.
- C) Implementation of tasks relative to this CQA Plan specific to his assigned construction activities per contract.
- D) Submittal of required as-built drawings and certificates to the Site CQA Manager.
- E) Submittal of required work plans to the Site CQA Engineer.

Work and materials installed by the Contractor shall be guaranteed for at least two (2) years from date of completion.

The Contractor/Installer must construct this project in a workmanlike manner, in conformance with the plans and specifications. The purpose of the CQA program is to provide independent confirmation of compliance with the plans and specifications for the Owner's benefit.

2.3 Documentation

1. Data will be gathered or developed in accordance with procedures appropriate for the intended use of the data and will be of significant or greater quality to stand up to scientific and regulatory scrutiny.
2. Data will be of known or acceptable precision, accuracy, representativeness, completeness, and comparability within the limits of the project.

The quality of the measurement data can be defined in terms of the following elements:

1. Completeness - the adequacy in quantity of valid measurements to reduce the potential for misinterpretation.
2. Representativeness - the extent to which discrete measurements accurately describe the greater picture of which they are intended to represent. Good representativeness is achieved through careful, informed selection of sampling site.
3. Accuracy and Precision - the agreement between a measurement and the true value and the degree of variability in this agreement, respectively. Accuracy and precision of data collected in the investigation will depend upon the measurement standards used and the competent use of them by qualified personnel.
4. Comparability - the extent to which comparisons among different measurements of the same quantity or quality will yield valid conclusions. Comparability among measurements will be achieved through the use of standard procedures and standard field data sheets.
5. Traceability - the extent to which data can be substantiated by hard-copy documentation. Traceability documentation exists in two essential forms: that which links quantitation to authoritative standards, and that which explicitly describes the history of each sample from collection to analysis.

The fundamental mechanisms that will be employed to achieve these quality goals can be categorized as prevention, assessment and correction, as follows:

1. Prevention of defects in the quality through planning and design, documented instructions and procedures, and careful selection and training of skilled, qualified personnel;
2. Quality assessment through a program of regular audits and inspections to supplement continual informal review;
3. Permanent correction of conditions adverse to quality through a closed-loop corrective action system.

The Site CQA Manager shall maintain current records, on appropriate CQA forms, of quality control operations, inspections and tests performed relative to the work of suppliers and contractors. **Table II.7.2** is an index of CQA Forms which are typically used for the Liner CQA program.

**TABLE II.7.2
CQA Forms Index**

Form No.	Title
1.	Liner Quality Control Project Specifications (Attachment II.7.A)
2.	Approval/Authorization to Proceed Form (Attachment II.7.B)
3.	Daily Summary Report (Attachment II.7.C)
4.	Field Compaction Testing Form (Attachment II.7.D)
5.	GCL Inventory Control Log (Attachment II.7.E)
6.	FML Inventory Control Log (Attachment II.7.F)
7.	Geonet Inventory Control Log (Attachment II.7.G)
8.	Geotextile Inventory Control Log (Attachment II.7.H)
9.	Leachate Collection and Extraction Pipe Inventory Control Log (Attachment II.7.I)
10.	GCL Deployment Log (Attachment II.7.J)
11.	FML Deployment Log (Attachment II.7.K)
12.	FML Trial Seaming Test Log (Attachment II.7.L)
13.	FML Seaming Log (Attachment II.7.M)
14.	FML Seam Pressure Test Log (Attachment II.7.N)
15.	FML Destructive Field Test Record (Attachment II.7.O)
16.	FML Seam Vacuum Test/Repair Log (Attachment II.7.P)
17.	Geonet Deployment Log (Attachment II.7.Q)
18.	Geotextile Deployment Log (Attachment II.7.R)

Photographs may also be used to document the progress and acceptability of the work and may be incorporated into the Daily Summary Report; if photographic documentation is used, each photo shall be identified with the following information:

- Date
- Time of Day
- Location

Originals of the photographs will be retained at the offices of the Site CQA Engineer, and select photocopies will be submitted with Engineering Certification Reports as applicable.

3.0 CONSTRUCTION QUALITY ASSURANCE OBJECTIVES

3.1 Allowable Variations

It is the objective of this CQA Plan that test results must meet the applicable specified values. Should a test result not achieve the specified value for a material, it must be replaced or repaired; or for operation, the operation must be repeated until it is acceptable. However, as stated by Daniel and Koerner, *"it is unrealistic to think that 100 percent of all CQA tests will be in compliance with specifications."* Variations due to isolated anomalies in material, sample disturbance, human testing errors, or other factors may result in failing tests, yet these tests are not indicative of the general quality of the construction. For this reason, the Site CQA Engineer may accept a small percentage of outliers. The total number of outliers will not exceed the maximum allowable number as defined in Waste Containment Facilities – Guidance for Construction Quality

4.0 SITE PREPARATION

4.1. General

The following is a list of the work to be included in site preparation by the Contractor:

- A) Field check utilities and groundwater monitoring well locations, as appropriate.
- B) Mark survey hub markers and permanent benchmarks.
- C) Strip topsoil and any other material deemed unsuitable by the Engineer, or his representative, and stockpile at designated location.
- D) Strip or remove brush, and non-mowable vegetation, surface debris and similar materials from existing surface and relocate to a designated area on the site. Stumps, logs, roots, etc. will be completely removed.
- E) Excavate to design grade at the direction of the Site CQA Manager.
- F) The existing surfaces will be proof rolled to check stability conditions of existing surface and to provide a trafficable, reasonably smooth, working surface for construction equipment.
- G) Contractor will be responsible for costs associated with repairing and/or replacement of the ground surface utilities, and appurtenant facilities damaged by the Contractor, to the satisfaction of the Owner. Any damage resulting from unauthorized intrusion upon or use of off-site areas will be completely and immediately repaired, solely at the expense of the Contractor.

The following is a list of requirements related to site grading:

- A) Relocate exposed debris outside the limits of the construction area to locations as directed by Owner.
- B) Remove and dispose of coarse vegetation. Vegetation removal will be accomplished in such a manner as to minimize the amount of bare soil exposed at any given time.
 - 1) Stripped vegetation may be stockpiled temporarily at the site, provided that it is stockpiled in a manner, which prevents movement of the material off-site due to wind, water, or other factors.
 - 2) Residual vegetative matter, such as stumps, will be transported to the designated on-site area or removed off-site by the Contractor under authorization by the Owner.

4.2. Survey Coordinate System

The site will be surveyed and integrated into a grid system so that locations of sample and testing points made during construction can be readily discernible by the CQA personnel. This grid system should consist of equidistant spaced parallel lines, 100-foot on center, projecting north to south and east to west within the limits of the site. In addition, permanent project benchmarks will be placed by the Owner or his representative in the vicinity of the site for correlation of lift thickness, site liner construction, etc. This grid system will be coincident with the existing and former site coordinate system for future reference. The project limits will be staked out by the Owner or his representative based on record drawings.

4.3. Subgrade Development

Subgrade development will be required prior to landfill cell or pond construction. The existing topography will be contoured to the subgrade elevations shown on the drawings identified by the Site CQA Manager. The subgrade will be constructed, prepared and protected in accordance with the procedures stated below.

4.3.1 Subgrade Preparation

- A) Establish required lines, levels and contours. Place grade stakes as required by Contractor's methods a minimum 100' on center.
- B) Before grading commences, adjust monitoring wells and piezometer heights in the area to be graded in accordance with details shown on the drawings if applicable. Such adjustments will be made under direct surveillance of the Site CQA Manager. Any wells adjusted without the Site CQA Manager being present will be re-established at the Contractor's expense.
- C) No subgrading will begin in a given area prior to approval of the area by the Site CQA Manager.

4.3.2 Excavating to Subgrade Elevation

- A) Excavated material will be placed on-site as directed by Owner.
- B) Adequate grade control during subgrade preparation/construction is imperative. Should insufficient grade control during this phase occur, the Site CQA Manager may stop work until the situation has been rectified.

4.3.3 Filling to Subgrade Elevation and Berm Construction

- A) Engineer will collect samples of proposed in-situ or borrow fill material in advance of construction for determination of soil characteristics (e.g. Standard Proctor).
- B) Materials will be obtained from designated in-situ areas, borrow sources, or stockpiles.
- C) No fill will be used for subgrade or berm construction without approval of the Site CQA Manager.
- D) Place fill material to the required elevations as shown on the drawings.
- E) Place suitable fine grained subgrade soils in 6-inch finished lifts and compact to 90-percent of the maximum dry density, as determined by the Standard Proctor Compaction Test (ASTM D698).
- F) Place berm material in maximum 12-inch finished horizontal lifts over the prepared surface. Compact to not less than 90-percent of the maximum dry density, as determined by the Standard Proctor Compaction Test (ASTM D698).
- G) The surface of each lift will be scarified prior to placing the next lift, if applicable.
- H) The moisture content of fill material will be adjusted in the stockpile, borrow area, and/or other approved areas to maintain uniform moisture content of fill. Uniform moisture distribution will be obtained by mixing with disc, harrow, and pulverizers or by otherwise manipulating the soil prior to compaction.
- I) The final surface of subgrade and berms will be rolled smooth, free of protrusions and will contain no lumps, angular materials or large rocks. Roll the exposed surface transverse to slopes.

4.4. Final Subgrade Inspection and Protection

The final subgrade lift will conform to the following specifications:

- A) The upper 6-inches shall be comprised of suitable fine grained soils and compacted to a minimum 90-percent of the maximum dry density as determined by the Standard Proctor Test (ASTM D698).
- B) The surface of the final lift of subgrade will be free of angular material or stones greater than one-half inch in diameter.
- C) The final lift will be wetted and smooth rolled. Abrupt changes of grade will be regraded.
- D) Completed subgrade will be protected from traffic, erosion and damage of any kind.
- E) Completed subgrade will be kept free of trash and debris.
- F) Prior to placement of liner system, any areas of subgrade damaged by traffic, erosion, settlement, or another cause, will be repaired and the grades shown on the drawings will be re-established. Exposed subgrade, which has significantly dried or exhibits desiccation will be wetted and compacted prior to fill placement. Disturbed areas will be reshaped, scarified, recompacted and rolled prior to further work.
- G) The condition of the subgrade will be approved by the Site CQA Manager prior to placement of any additional layers or liner system materials immediately in advance of installation.

4.5. Subgrade and Berm Testing

The following tests will be performed on the subgrade soils prior to compaction:

- A) One particle size distribution per 1,000-cubic yards of borrow using ASTM D422.
- B) One Standard Proctor moisture density relationship per 5,000 cubic yards of borrow using ASTM D698.
- C) One Atterberg Limits per 5,000 cubic yards of borrow using ASTM D423 and D424.

The following tests will be performed during construction:

- A) One field compaction test will be performed at a frequency of a minimum 4 tests per acre per 6-in lift for confirmation of density of the subgrade soils and 12-in for confirmation of density of soils used in berm construction.
- B) The subgrade will be required to meet an elevation tolerance of $0.2' \pm$; and the sidewalls a vertical tolerance of $0.50' \pm$ based on a regular grid established by site survey.

5.0 ANCHOR TRENCH

1. The anchor trench shall be constructed as shown on the construction drawings and as specified in the CQA Plan. The anchor trench shall be backfilled and compacted by the Contractor as approved by the Site CQA Manager. Trench backfill material shall be placed and compacted by rolling with a rubber-tired wheel or mechanical tampers. Approval of compaction equipment shall be obtained from the Site CQA Manager before any compaction begins.

2. Care shall be taken when backfilling the trenches to prevent any damage to the geomembrane. At no time shall construction equipment make direct contact with geosynthetic materials.
3. Anchor trench backfill shall be compacted to 90% Standard Proctor Dry Density.

6.0 GEOSYNTHETIC CLAY LINER (GCL)

6.1 GCL Properties

1. The GCL installed directly in contact with the subgrade material under the leak detection sumps in the ponds shall be a reinforced GCL, and as defined by compliance with the requirements listed in **Table II.7.3** or approved by Engineer as equivalent.

TABLE II.7.3
Technical Specifications
Geosynthetic Clay Liner (GCL)

MATERIAL	PROPERTY	UNIT	CERTIFIED VALUE	TEST METHOD ¹
Nonwoven Cover Geotextile	Grab Strength	lbs	170	ASTM D4632
	Grab Elongation	%	50	ASTM D4632
	Mass/Unit Area	oz/yd ²	6.0	ASTM D5261
Bentonite	Free Swell	ml	24/2g min	ASTM D5890
	Fluid Loss	ml	18 max	ASTM D5891
	Bentonite Mass/Unit Area	lbs/ft ²	0.75	ASTM D5993
	Grab Strength ²	lbs	90	ASTM D4632
	Permeability	cm/sec	5x10 ⁻⁹	ASTM D5887
Woven Base Fabric	Mass/Unit Area	oz/yd ²	3.2	ASTM D5261
GCL Hydrated Internal	Shear Strength	lbs/ft ²	500	ASTM D5321 ASTM D6243

Notes:

1. Standard test methods will be updated to reflect the most current industry standards.
2. Grab tensile tests in machine direction.

2. The primary component in the GCL is high-quality sodium bentonite (montmorillonite). The bentonite used in the manufacture of the GCL must be demonstrated to meet the testing and acceptance criteria listed in **Table II.7.3**. The testing shall be performed on the bentonite obtained from the finished GCL product.
3. Bentonite Sealing Compound (BSC) and Granular Bentonite (GB) shall be applied to ensure tightness at penetrations and structures. The BSC and GB shall be supplied by the manufacturer and shall be comprised of the same bentonite used in the manufacturing of the GCL. The BSC shall be a mixture of non-aqueous liquid suspension agent, which creates a paste-like texture. The suspension agents used in the manufacture of the BSC

shall be non-toxic, water-soluble and shall not restrict the bentonite's ability to swell and absorb water upon hydration.

4. Longitudinal seams can also be sealed using the Winning Edge™ which eliminates the need for free bentonite on those seams.

6.2 Delivery, Storage and Handling

1. The GCL rolls shall be packaged and shipped by appropriate means to prevent damage of the geomembrane rolls. Off-loading and storage of the GCL is the responsibility of the Contractor/Installer. The Contractor shall be responsible for replacing any damaged or unacceptable material discovered upon arrival at no cost to the Owner.
2. The GCL storage area will be designated by the Site CQA Manager/Owner. No off-loading shall be performed unless the Site CQA Manager is present. Damage during off-loading shall be documented by the Site CQA Manager. Any damaged rolls must be separated from the undamaged rolls until the proper disposition of that material has been determined by the Site CQA Manager.
3. A steel support pipe shall be inserted through the roll core. Slings or lifting chains shall be attached at the ends of the support pipe to the bucket of a front-end loader or lifting device. A spreader bar, which is used to support the pipe, must be long enough to prevent damage to the edges of the GCL during hoisting.
4. The rolls of GCL shall be stored in their original, unopened, wrapped cover in a clean, dry area, stacked no higher than three rolls high. The material shall be stored off the ground on pallets and shall be covered with a heavy, protective tarpaulin or enclosed within a storage facility. Care shall be used to keep the bentonite clean and free from debris prior to installation.
5. The installer shall be responsible for the transportation of each roll of GCL from the storage area to its proposed panel location. The contractor shall not drive upon the GCL panels with equipment exceeding 6 psi and shall be responsible for replacing any material damaged during installation until the GCL is accepted by the Site CQA Manager/Owner.

6.3 Manufacturer Quality Control Documentation

Prior to installation commencement of any GCL material, the Contractor shall provide the following information to the Site CQA Manager, certified by the manufacturer for the delivered GCL.

1. Manufacturer's certification verifying that the quality of the raw materials used to manufacture the GCL meets the Manufacturer specifications.
2. Each roll delivered to the project site shall have the following identification information:
 - Manufacturer's name
 - Product identification
 - Roll number
 - Roll dimensions
3. Quality control certificates, signed by the manufacturer's quality assurance manager. Each certificate shall have roll identification number, sampling procedures, frequency and test results. At a minimum, the following results shall be provided in accordance with test requirements specified in **Table II.7.3:**
 - Free swell (ASTM D5890)

- Fluid loss (ASTM D5891)
- Bentonite mass/unit area (ASTM D5993)
- Grab strength (ASTM D4632)
- Permeability (ASTM D5887)

6.4 Conformance Testing

1. The Site CQA Manager will group the documentation of the delivered rolls into the manufacturer's listed lot numbers. The Site CQA Manager may, at his/her discretion, subdivide the manufacturer's listed lots into smaller lots for purposes of conformance testing.
2. Based on the requirements outlined in ASTM D4354, the Site CQA Manager will determine the number of sampling units within each lot or at a minimum, 1 test per 100,000 ft² of delivered GCL.
3. The Site CQA Manager shall cut or observe the sampling (i.e. if contractor is responsible for conformance samples) from randomly selected rolls which have been delivered to the site, one foot wide by roll width Sampling Units, which shall be used for field and laboratory testing as described below. A measuring device and straight edge shall be used to ensure uniformity of length and width. Moisture content, bentonite content, and unit weight testing shall be performed on delivered rolls by an approved independent laboratory. The method used for determining specification conformance shall be in accordance with ASTM D4759.
 - a) The entire sample unit will be loosely rolled and the width of each sample shall also be measured and recorded.
 - b) The sample shall then be unrolled and spread out on a clean, dry area at the site. The Site CQA Manager (or Contractor) shall randomly cut five 12 inch by 6 inch specimens from varying places across the sample. Each specimen will be immediately packaged up in a "zip-lock" bag marked with the project name, roll number, lot number, and specimen number.
 - c) The five specimens shall be sent to an independent laboratory for fluid loss, bentonite content and mass per unit area testing (ASTM D5891, ASTM D5890 and ASTM D5993, respectively).
 - i. The average of the fluid loss, bentonite content, and mass per unit area of the five specimens will be provided by the independent laboratory in accordance with ASTM D5891, ASTM D5890, and ASTM D5993.
 - ii. If any two samples from a given lot being tested for bentonite content falls below the specified values, the entire lot shall be rejected.
 - iii. If any one of the samples from a given lot being tested for bentonite content falls below the specified values, an additional set of samples shall be taken from the lot (the number of samples taken for the second set shall be equal to that taken from the first set). If any one of the samples from the second set fails to meet the specified criteria, the entire lot shall be rejected.
4. Conformance test results shall be reviewed by the Site CQA Officer and lots shall be accepted or rejected, prior to the placement of the GCL. Test results shall meet, or exceed, the property values listed in **Table II.7.3**. In case of failing test results for any given lot sample, the lot shall be resampled and retested. This retesting shall be paid for by the

manufacturer. If the test values from the resamples pass the acceptable specification values listed in **Table II.7.3**, then the lot shall be accepted.

6.5 GCL Placement

1. As each roll is moved from the storage area by the Installer, the labels shall be removed by the installer and submitted to the Site CQA Manager. The rolls of GCL shall be brought to the area to be lined with a front-end loader and support pipes set up such that the GCL roll is fully supported across its length. A spreader bar or similar device shall be used to prevent the lifting chains or slings from damaging the edges. Dragging of the GCL panels over the surface shall be minimized. Travel on the GCL is permissible if low-ground pressure equipment (6 psi or less) is used. The Site CQA Manager shall be informed as to the equipment to be used and shall approve same.
2. The flexible membrane liner shall be placed over the GCL during the same day as the placement of the GCL. Only those GCL panels which can be anchored and covered the same day shall be placed in position.
3. The GCL shall not be installed in standing water or during rain. The GCL must be dry when installed and must be dry when covered.
4. In areas where wind is prevalent, GCL installation should be started at the upwind side of the project and proceed downwind. The leading edge of the GCL shall be secured at times with sandbags or other means sufficient, and approved by the Site CQA Manager, to secure it down during high winds.
5. The GCL shall be installed in a relaxed condition and shall be free of tension or stress upon completion of the installation. Stretching of the GCL to fit will not be allowed. The GCL shall be straightened to smooth out creases or irregularities in the runs.

6.6 Field Seams

1. Longitudinal seams shall be a minimum of 9 inches on the cell floor (up to 10% slope); and 12 inches for sideslopes (>10%).
2. Soil, gravel, or other debris shall be removed from the overlap area.
3. Seam overlap shall be placed such that the direction of flow is from the top sheet to the bottom sheet to form a shingle effect.
4. On slopes, runs shall be from crest to toe with the GCL machine direction running perpendicular to the base. On slopes greater than or equal to 20%, the number of seams will be minimized, and end seam overlap will be increased to a minimum of 36 inches.
5. If the temperatures are higher than 85°F and humidity is low, contraction may occur soon after placement when no confining stress or soil cover is placed. In order to account for the possibility of contraction under these conditions, the seam overlap shall be increased to a minimum of twelve inches on longitudinal seams and 36 inches on end seams, or 4% of the distance to the next parallel seam, whichever is greater. Free bentonite shall be used to seal seam. Free bentonite is not necessary on longitudinal seams if the Winning Edge™ seam is used.
6. Once the first run has been laid, adjoining runs shall be laid with 9-inch minimum overlap or use of the Winning Edge™, on the longitudinal seams and 12 inches on end seams.

6.7 Field Quality Control

1. The Installer shall provide the Site CQA Manager with daily reports addressing the following:
 - subgrade approval for areas expected to be covered by GCL
 - the total amount and location of panels placed
 - total amount and location of seams completed
 - location of repairs
 - weather conditions
2. The Installer's Superintendent and the Site CQA Manager shall provide 100% inspection of the installation to ensure compliance with the construction drawings, technical specifications, and manufacturer recommended procedures.
 - a) The surface of the GCL shall be clean and free of debris at the time of inspection.
 - b) The Installer and the Site CQA Manager shall record each roll number and lot number as panels are deployed and a general description of the location of each panel.
 - c) The Installer and the Site CQA Manager shall inspect the overlap for each panel.
 - d) The Installer and the Site CQA Manager shall inspect the anchoring and sealing around penetrations and structures.
 - e) The Installer and the Site CQA Manager shall inspect the geotextile quality, bentonite uniformity, and degree of hydration on the GCL. Areas requiring repair shall be marked and subsequently repaired in accordance with the Repair Procedures listed in this CQA Plan.
 - f) The Installer and the Site CQA Manager shall re-inspect areas previously marked as requiring repair.

6.8 Repair Procedures

1. Seam and non-seam areas of the GCL shall be inspected for identification of defects, holes, and any sign of contamination by foreign matter in accordance with the Field Quality Control procedures listed in this CQA Plan.
2. Any defects shall be repaired by the Installer, by placing a GCL patch with a minimum 12 inch overlap in all directions.
3. Horizontal patch seams shall be secured with adhesive glue as approved by the Site CQA Manager and manufacturer's recommendations.
4. Patches and repairs shall not be allowed on slopes greater than 5H:1V, unless they are securely anchored with an adhesive or other approved method. Alternatively, the patches can be placed under the defective liner in order to prevent slippage of the patch.
5. For any repair method, surfaces shall be clean and dry at the time of the repair.
6. Each completed repair shall be inspected in accordance with the Field Quality Control procedures listed in this CQA Plan.

6.9 GCL Acceptance

1. The GCL shall be accepted by the Site CQA Manager when the installation is complete, and documentation of installation is completed and verification of the adequacy of field seams and repairs, are complete.

2. Approval of any subsequent post-liner construction, as well as payment requests of the same, will not be granted until required documentation is provided by the Installer and approved by the Site CQA Officer.

7.0 FLEXIBLE GEOMEMBRANE LINER (FML)

1. The flexible membrane (FML) used for liner installation shall be textured 60-mil thick HDPE for landfill sideslopes and smooth 60-mil thick HDPE for the landfill floor and ponds. Reinforced polyester 30-mil geomembrane will be used for the tank farm and jet out pit.
2. The geomembrane shall be manufactured of new, prime first-quality products designed and manufactured specifically for the purpose of liquid containment in hydraulic structures and chemically resistant to leachate.
3. The geomembrane material shall be so produced as to be free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter.
4. The sheets shall have NSF label of approval and shall be manufactured in a minimum 15 foot seamless width. Labels on the roll shall identify the thickness, length, width and manufacturer's lot number.
5. The geomembrane rolls shall meet the minimum properties listed in **Table II.7.4** for textured HDPE liner, **Table II.7.5** for smooth HDPE liner, and **Table II.7.6** for reinforced polyester liner.
6. Extrudate welding rods shall be of the same compound as the geomembrane and supplied by the manufacturer and shall be delivered in the original sealed containers. Each container shall have a label bearing the brand name, manufacturer's lot number and complete directions as to proper storage.

7.1 Manufacturer Quality Control Documentation

Prior to installation commencement of any geomembrane material, the Contractor shall provide to the Site CQA Manager the following information certified by the manufacturer for the delivered geomembrane.

1. Origin, identification and production of the resin (supplier's name, brand name and production plant).
2. Copies of quality control certificates issued by the resin supplier.
3. Manufacturer's certification verifying that the quality of the resin used to manufacture the geomembrane meets the resin specifications fingerprint properties shown in **Table II.7.4** for 60-mil textured HDPE liner, **Table II.7.5** for smooth HDPE liner, and **Table II.7.6** for the reinforced polyester liner.
4. Each roll delivered to the project site shall have the following identification information:
 - Manufacturer's name
 - Product identification
 - Thickness
 - Roll number
 - Roll dimensions
5. Quality control certificates, signed by the manufacturer's quality assurance manager. Each certificate shall have roll identification number, sampling procedures, frequency, and test

results. At a minimum, the following test results shall be provided in accordance with applicable test requirements specified in **Tables II.7.4** and **II.7.5** for the HDPE liner:

- Thickness (smooth, ASTM D 5199; textured, ASTM D5994)
 - Density (ASTM D1505)
 - Tensile properties (ASTM D638, as modified by annex A)
 - Tear properties (ASTM D6693)
 - Carbon black content (ASTM D 1603 or ASTM D 4218)
 - Carbon black dispersion (ASTM D5596)
 - Puncture Resistance (ASTM D4833)
 - Notched constant tensile load (ASTM D 5397, Appendix)
 - Interface Friction Angle (Textured Geomembrane) [GRI - GS -7]
6. Quality control certificates, signed by the manufacturer's quality assurance manager. Each certificate shall have roll identification number, sampling procedures, frequency, and test results. At a minimum, the following test results shall be provided in accordance with applicable test requirements specified in **Table II.7.6** for the reinforced polyester liner:
- Thickness (ASTM D751, Optical Method)
 - Weight (ASTM D751)
 - Break strength (ASTM D751 Grab Tensile Method, Procedure A)
 - Break elongation (ASTM D751)
 - Tear strength (ASTM D751)
 - Puncture Resistance (ASTM D4833)
 - Hydrostatic resistance (ASTM D751, Procedure A)
 - Bursting strength (ASTM D751, Ball Tip)

7.2 Conformance Testing

1. Conformance testing shall be performed by an independent Quality Assurance Laboratory at a minimum of 1 per 100,000 ft². As stated in the contract documents, the Site CQA Manager or Installer shall obtain the samples from the roll, mark the machine direction and identification number. The number of lots and samples will be determined in accordance with ASTM D4354. The following conformance tests shall be conducted at the independent laboratory for the HDPE liner material:
 - Thickness (ASTM D5199, or ASTM D5994)
 - Density (ASTM D1505)
 - Tensile properties (ASTM D6693)
 - Tear resistance (ASTM D1004)
 - Carbon black content (ASTM D1603, or ASTM D4218)
 - Carbon black dispersion (ASTM D5996)
2. Conformance testing shall be performed by an independent Quality Assurance Laboratory at a minimum of 1 per 100,000 ft². As stated in the contract documents, the Site CQA Manager or Installer shall obtain the samples from the roll, mark the machine direction and identification number. The number of lots and samples will be determined in accordance with ASTM D4354. The following conformance tests shall be conducted at the independent laboratory for the reinforced polyester liner material:
 - Thickness (ASTM D751, Optical Method)

- Weight (ASTM D751)
 - Break strength (ASTM D751, Grab Test Method, Procedure A)
 - Break elongation (ASTM D751)
 - Tear strength (ASTM D751)
 - Puncture resistance (ASTM D4833)
3. These conformance tests shall be performed in accordance with **Tables II.7.4, II.7.5, and II.7.6.**
 4. Conformance test results shall be reviewed by the Site CQA Officer, and lots shall be accepted or rejected prior to the placement of the geomembrane. Test results shall meet, or exceed, the property values listed in **Tables II.7.4 and II.7.5.** If the sampling results do not meet property values for any individual lot sample, the lot shall be resampled and retested. This retesting shall be paid for by the manufacturer or installer. If the test values from the resamples pass the acceptable specification values listed in **Tables II.7.4, II.7.5, and II.7.6,** the lot shall be accepted.

7.3 Delivery, Storage and Handling

1. The geomembrane rolls shall be packaged and shipped by appropriate means to prevent damage of the geomembrane rolls. Off-loading and storage of the geomembrane is the responsibility of the Installer. The Installer shall be responsible for replacing any damaged or unacceptable material at no cost to the Owner.
2. No off-loading shall be performed unless the Site CQA Manager is present. Damage during off-loading shall be documented by the Site CQA Manager. Damaged rolls must be separated from the undamaged rolls until the proper disposition of that material has been determined collectively by the installer and Site CQA Manager.
3. The geomembrane rolls shall be stored so as to be protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions and excessive heat that may damage the geomembrane material. The rolls shall be stored on a prepared surface (not wooden pallets) and shall not be stacked more than two rolls high.

7.4 Guarantee

1. The Contractor shall guarantee the HDPE and reinforced polyester geomembrane against defects in installation and workmanship for the period of two years commencing with the date of final acceptance by the Owner. The guarantee shall include the services of qualified service technicians and materials required for the repairs at no expense to the Owner.

7.5 Quality Assurance

1. In addition to manufacturer and installer requirements for qualifications and certification specified in submittals, the Quality Assurance consists of conformance testing of the material delivered to the site and field quality control during installation.
2. Conformance testing requirements are listed in this CQA Plan. The purpose of conformance testing is to assure that the supplied material conforms to the specifications and to the manufacturer's quality control certificates.

TABLE II.7.4
Technical Specifications
60-mil HDPE Textured Geomembrane

PHYSICAL PROPERTIES				
PROPERTY	QUALIFIER	UNIT	VALUE	TEST METHOD³
Thickness	Minimum Average	mils	57	ASTM D5994
	Lowest individual for 8 out of 10 values	mils	54	
	Lowest individual for any of the 10 values	mils	51	
Density	Minimum	g/cc	0.94	ASTM D1505
Melt Index	Range	g/10 min	≤1.0	ASTM D1238
Tensile Properties (each direction):				ASTM D6693, Type IV Dumbbell, 2 ipm
Break Strength	Minimum Average	lb/in	90	
Yield Strength	Minimum Average	lb/in	126	
Elongation at Break	Minimum Average	%	100	G.L. = 2.0 in
Elongation at Yield	Minimum Average	%	12	G.L. = 1.3 in
Tear Resistance	Minimum	lb	42	ASTM D1004
Puncture Resistance	Minimum	lb	90	ASTM D4833
Carbon Black Content	Minimum	%	2.0	ASTM D1603
Carbon Black Dispersion	Rating	N/A	Note 1	ASTM D5596
Asperity Height	Minimum Average	N/A	Note 2	GRI GM 12
Notched Constant Tensile Load	Minimum	hours	300	ASTM D5397, Appendix
SEAM PROPERTIES				
PROPERTY	QUALIFIER	UNIT	VALUE	TEST METHOD³
Thickness	Minimum	mils	60	ASTM D5199/ D5994
Bonded Seam Strength	Minimum	lb/in	120	ASTM D6392
Tensile Properties:				
Fusion Weld	Minimum	lb/in	90	ASTM D 6392
Extrusion Weld	Minimum	lb/in	78	ASTM D6392

Notes:

- (1) *Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.*
- (2) *10 mil average. 8 of 10 readings ≥ 7 mils. Lowest individual reading ≥ 5 mils.*
- (3) *Standard test methods will be updated to reflect the most current industry standards.*

TABLE II.7.5
Technical Specifications
60-mil HDPE Smooth Geomembrane

PHYSICAL PROPERTIES				
PROPERTY	QUALIFIER	UNIT	VALUE	TEST METHOD²
Thickness	Minimum Average	mils	60	ASTM D5199
	Minimum	mils	54	
Density	Minimum	g/cc	0.94	ASTM D1505
Melt Index	Range	g/10 min	≤1.0	ASTM D1238
Tensile Properties (each direction):				ASTM D6693, Type IV Dumbell, 2 ipm
Break Strength	Minimum Average	lb/in	228	G.L. = 2.0 in G.L. = 1.3 in
Yield Strength	Minimum Average	lb/in	126	
Elongation at Break	Minimum Average	%	700	
Elongation at Yield	Minimum Average	%	12	
Tear Resistance	Minimum	lb	42	ASTM D1004
Puncture Resistance	Minimum	lb	108	ASTM D4833
Carbon Black Content	Minimum	%	2.0	ASTM D1603
Carbon Black Dispersion	Rating	N/A	Note 1	ASTM D5596
Notched Constant Tensile Load	Minimum	hours	300	ASTM D5397, Appendix
SEAM PROPERTIES				
PROPERTY	QUALIFIER	UNIT	VALUE	TEST METHOD²
Thickness	Minimum	mils	60	ASTM D5199/ D5994
Bonded Seam Strength	Minimum	lb/in	120	ASTM D6392
Tensile Properties:				
Fusion Weld	Minimum	lb/in	90	ASTM D6392
Extrusion Weld	Minimum	lb/in	78	ASTM D6392

Notes:

- (1) *Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.*
- (2) *Standard test methods will be updated to reflect the most current industry standards.*

TABLE II.7.6
Technical Specifications
30-mil Reinforced Polyester Geomembrane

PHYSICAL PROPERTIES				
PROPERTY	QUALIFIER	UNIT	VALUE	TEST METHOD¹
Thickness	Minimum Average	mils	30	ASTM D751 (Optical Method)
Weight	Minimum	oz/yd ²	30 ± 2	ASTM D751
Break Strength	Minimum	lb	550	ASTM D751 Grab Test Method Procedure A
Break Elongation	Minimum	%	20	ASTM D751
Tear Strength	Minimum	lb	40	ASTM D751
Puncture Resistance	Minimum	lb	275	ASTM D4833
Hydrostatic Resistance	Minimum	psi	800	ASTM D751, Procedure A
Bursting Strength	Minimum	lb	750	ASTM D751, Ball Tip
SEAM PROPERTIES				
PROPERTY	QUALIFIER	UNIT	VALUE	TEST METHOD¹
Bonded Seam Strength	Minimum	lb	575	ASTM D751 Grab Test Method Procedure A
Peel Adhesion	Minimum	lb/2 in	40	ASTM D413

Notes:

(1) Standard test methods will be updated to reflect the most current industry standards.

3. Field quality control requirements are specified in this CQA Plan. The purpose of field quality control procedures is to assure that the geomembrane has been installed in accordance with the specifications and manufacturer's recommendations.
4. Quality control forms for geomembrane installation documentation are used for field installation documentation. Sample project forms are listed on **Table II.7.7**.

TABLE II.7.7
FML Project CQA Forms

<u>Form No.</u>	<u>Title</u>
1.	Liner Quality Control Project Specifications (Attachment II.7.A)
2.	Approval/Authorization to Proceed Form (Attachment II.7.B)
3.	Daily Summary Report (Attachment II.7.C)
4.	FML Inventory Control Log (Attachment II.7.F)
5.	FML Deployment Log (Attachment II.7.K)
6.	FML Trial Seaming Test Log (Attachment II.7.L)
7.	FML Seaming Log (Attachment II.7.M)
8.	FML Seam Pressure Test Log (Attachment II.7.N)
9.	FML Destructive Field Test Record (Attachment II.7.O)
10.	FML Seam Vacuum Test/Repair Log (Attachment II.7.P)

Photo-documentation will be also used to record the cell construction. Select photographs shall include date, time, location, and Site CQA Manager; and shall be included in the Liner Certification Report submitted to OCD.

7.6 Geomembrane Placement

1. Weather Conditions

Geomembrane placement shall not proceed at an ambient temperature below 40 degrees F or above 104 degrees F unless otherwise authorized, in writing, by the Site CQA Manager. Geomembrane placement shall not be performed during precipitation, excessive moisture, in an area of ponded water, or excessive winds. Observation of temperature, humidity, precipitation, and wind shall be noted on CQA forms to ensure that weather conditions are acceptable prior to geomembrane placement.
2. Method of Placement
 - a) No more material than can be seamed on that same day shall be deployed.
 - b) Each panel of the geomembrane shall be rolled out and installed in accordance with the approved construction drawings. The layout shall be designed to keep field joining of the HDPE geomembrane to a minimum and consistent with proper methods of HDPE geomembrane installation, seaming, etc.
 - c) Geomembrane rolls shall be placed using proper spreader and rolling bars with cloth slings.
 - d) The Site CQA Manager shall inspect each panel, after placement and prior to seaming, for damage and/or defects. Defective or damaged panels shall be replaced or repaired, as approved by the Site CQA Manager.
 - e) The installer shall avoid dragging the geomembrane sheets on rough soil subgrades.

- f) Geomembranes shall be anchored as shown on the construction drawings and consistent with manufacturer's recommendations.
 - g) Personnel working on the geomembrane shall not smoke, wear damaging shoes or involve themselves in any activity that may damage the geomembrane.
 - h) Vehicular traffic across the geomembrane shall not be allowed on the liner material.
 - i) Damage shall be recorded and located on the as-built drawings.
 - j) When tying into existing geomembrane, final excavation to previously installed liner segments shall be performed by hand to prevent damage. Damaged sections of previously installed liner at the boundary zone shall be removed and replaced. New liner segments shall be seamed only to competent segments of previously installed liner as approved by the Site CQA Manager.
 - k) The geomembrane shall be kept free of debris, unnecessary tools and materials. In general, the geomembrane area shall remain neat in appearance.
 - l) The method used to unroll the panels shall neither score, scratch or crimp the geomembrane, nor damage the underlying liner system components or subgrade.
 - m) Adequate loading (e.g., sand bags or similar items that will not damage the geomembrane) shall be placed to prevent uplift by wind. In cases of high wind, continuous loading is recommended along edges of panels to minimize wind flow under the panels.
 - n) Direct contact with the geomembrane shall be minimized; i.e., the geomembrane under traffic areas shall be protected by geotextile, extra geomembrane, or other suitable materials.
 - o) Sufficient slack shall be placed in the geomembrane to compensate for the coldest temperatures envisioned so that no tensile stresses are generated in the geomembrane or in its seams either during installation or subsequently after the geomembrane is covered.
 - p) The geomembrane shall have adequate slack such that it does not lift up off of the subgrade or substrate material at any location within the facility, i.e., no "trampolining" of the geomembrane shall be allowed to occur at any time.
 - q) The geomembrane shall not have excessive slack to the point where creases fold over upon themselves either during placement and seaming, or when the protective soil or drainage materials are placed on the geomembrane.
 - r) Permanent (fold over type) creases in the covered geomembrane shall not be permitted. Creases shall be repaired in accordance with this CQA Plan and manufacturer's recommendations.
 - s) The amount of slack to be added to the deployed and seamed geomembrane should be carefully considered and calculated, taking into account the type of geomembrane and the geomembrane's temperature during installation versus its final temperature in the completed facility.
3. Field Seams
- a) Individual panels of geomembrane shall be laid out and overlapped by a minimum of 4 inches (or three inches for extrusion fillet welding) but no more than 6 inches prior to welding. The area to be welded shall be cleaned and prepared in accordance with the quality control welding procedures.
 - b) If the overlap is too wide to contain the hot wedge welding machine, "float" the liner into better position by lifting it high enough to draw air beneath it, guiding it upon the

- air to an improved position. Avoid dragging the liner, particularly across rough soil subgrades.
- c) If overlap between the placed liners is excessive, the excess must be trimmed away. This should be done by trimming the lower sheet. If this is not possible and the upper sheet must be trimmed, use a knife with a shielded or hook blade.
 - d) Cutting and preparation of odd-shaped sections or small fitted pieces should be completed at least 50 feet ahead of the seaming operation, so that seaming may be conducted with the fewest interruptions.
 - e) Liner panel overlaps shall be shingled so the upper panel is hydraulically upgradient of lower panel.
 - f) Sheets which are overlapped and ready for seaming must be clean. If dirty, they must be wiped clean with dry rags.
 - g) The seam area must be completely free of moisture before the overlapping sheets can be properly seamed. Dry rags should be used to wipe any such moisture up from the seam surface. Air blowers may also be used.
 - h) Seaming is not to be performed when the soil surface beneath the liners is saturated, because the hot seaming apparatus will draw moisture into the ongoing seam. Seaming activity on frozen soil is unacceptable for the same reason.
 - i) Double track hot wedge fusion welder shall be used for straight welds.
 - j) Extrusion welder shall be used for cross seam tees, patches and repairs and penetration boots.
 - k) The welding equipment used shall be capable of continuously monitoring and controlling the temperatures in the zone of contact where the machine is actually fusing the geomembrane material so as to ensure that changes in environmental conditions will not affect the integrity of the weld.
 - l) No “fish mouths” will be allowed within the seam area. Where “fish mouths” occur, the material shall be cut, overlapped and a patch fusion weld shall be applied. Welds upon completion of the work shall be tightly bonded. Any geomembrane area showing damage due to excessive scuffing, puncture, or distress from any cause shall be replaced or repaired with an additional piece of geomembrane. The number of patches per 100 foot length shall not exceed five. If more than five patches per 100 foot length are necessary, then the entire 100 foot length of seam shall be removed. Further welding will cease at this time and the Site CQA Manager shall be notified.
 - m) Seams shall have a seam number that corresponds with the panel layout numbers. The numbering system shall be used in the development of the as-built drawings. Seam numbers shall be derived from the combination of the two panel numbers that are to be welded together.
 - n) Fusion welded “T” seams (i.e., the result of the geomembrane panels placed perpendicular to each other) shall be double welded where possible. Extrusion welding shall be used for the second weld.
 - o) Extrudate shall be free of debris, dry and protected from damage.
 - p) If an extrusion welder is stopped for longer than one minute, it shall be purged to remove heat-degraded extrudate. Purged extrudate shall be placed on a sacrificial sheet and disposed of.
 - q) No horizontal seams shall be constructed on slopes greater than or equal to 5H:1V and no horizontal seams shall be located within 5 feet of the sideslope toe.

- r) Vertical panels placed on sloped surfaces shall extend 10 feet inward from the toe of slope and 3 feet from the edge of the trench.
- s) In the anchor trench, seams shall extend a minimum 12 inches.
- t) Factory seams, field seams and repair welds shall meet seam strength requirements specified in **Tables II.7.4, II.7.5, and II.7.6.**
- u) For geomembrane installation in geometrically unique areas, the number of field seams shall be minimized.
- v) No solvent or adhesive may be used unless the product is approved by the Site CQA Officer.

7.7 Hot Wedge Fusion Welding

The objective of hot wedge seaming is to heat two facing liner surfaces to their melting point before forcing them together and creating a permanent bond. The wedge is situated between the overlap of the two liners; it reduces the surface tension of the viscous polymer sheets and acts as a scraper and mixer, so that the nip rollers can pressure the two liners together. The result is that the two facing surfaces are bonded into one continuous molecular structure. Types of thermoplastic liners can be seamed by the hot wedge method, but temperature settings will vary according to their specific polymer components:

TABLE II.7.8
Typical Wedge Temperature Ranges for
Hot Wedge Seaming of Thermoplastic Liners

LINER TYPE	FAHRENHEIT (°F)	CELSIUS (°C)
HDPE		
Minimum ¹ Temperature	600	320
Maximum ² Temperature	750	400

¹ For dry, warm weather seaming conditions

² For damp, cold weather seaming conditions

- a) The hot wedge system should be properly positioned for completing the desired single or dual (split) seam.
- b) Ambient variables such as temperature, cloud cover, and wind speed may make it necessary to vary the temperatures used successfully in a variety of ambient conditions, so that the hot wedge can be more accurately adjusted if new conditions are met, or if personnel changes are necessary.
- c) The drive motor should be off when positioning the welding machine to seam. Place the machine where the sheets overlap. Guide the overlapped material between the idlers and the wedge, and into the drive/nip rollers. When continuing a weld that has been abandoned mid-seam, the liners must be spread where the seam leaves off and loaded into the respective sides of the machine. Raise the machine a few inches, load the bottom sheet first, and then load the top sheet. When the nip rollers engage and the wedge is in position, turn on the drive motor. Immediately engage the sheets when they are between the nip rollers to prevent an imminent melt-through. Move the hot wedge into position and lock it.

- d) The Operator must constantly monitor the temperature controls, as well as the completed seam passing out of the machine. Occasional adjustments in temperature or speed will be necessary to maintain a consistent weld. Visual inspection and constant hand testing by the peel method (or other) is also recommended.
- e) On some soils, the device tends to "bulldoze" into the ground as it travels, causing soil to enter the weld. A seam with soil trapped in its weld is unacceptable. To keep this from happening, the operator should lift the front of the machine slightly. Alternatively, a moveable base for the machine to travel on can be used. Scrap strips of geotextile or geomembrane have proven to be effective materials upon which the welder can maintain traction. It may also be necessary to change the size of the rollers in loose soils.
- f) A small amount of "squeeze-out" or "flashing" is a reliable indication that proper temperatures have been achieved. The melted polymer will laterally extrude, or squeeze-out of the seam zone in properly welded seams, but not to excess. An excessive amount of extruded hot melt indicates that excessive heat or pressure, or both, was applied. Reduce the temperature and/or pressure to correct the situation.
- g) The hot wedge device has just a few adjustable parts, but it is critical that they be checked after a day of seaming. The machine should be cleaned daily.

7.8 Extrusion Welding

- a) The upper sheet's leading edge must be ground to a 45° bevel. It is imperative that the sheet be lifted up and away from the lower sheet during the beveling so that no deep gouges are cut in the lower sheet. Grinding should therefore be done before tack welding.
- b) After beveling, the upper sheet is lowered and laid flat against the lower sheet. The horizontal surface grinding across the interface of both sheets is completed. Surface sheen in the area to be seamed must be removed. Material dust generated by grinding the liner sheets must be wiped or blown away from the seaming zone.
- c) Grinding marks should run perpendicular to the seam. Though this process is slower than grinding parallel to the seam, it does not create the deep parallel grooves that significantly decrease the thickness of the parent material that can lead to seam failure. Parallel grinding marks can also initiate stress cracking.
- d) Grind marks should never be deeper than 10% of the sheet thickness. Optimally, they should be about 5% of the sheet thickness. The only purpose of grinding is the removal of oxide layers and dirt from the liner surfaces, and the roughening of their interface for extrudate.
- e) Grinding marks should not extend beyond 1/4 inch of either side of the extrudate after its placement. For example, if the final extrudate bead width is 1-1/2 inches, the width of the grinding trail should not exceed 2 inches.
- f) Seaming must take place no more than 10 minutes after grinding, so that surface oxide layers do not reappear where the extrudate must be placed.
- g) The hand grinder should never be left running when it is not in use. If it makes contact with the liner while running it will cause serious damage.
- h) A hot air gun may be used to "tack" the two sheets together, ahead of the extrusion welder. The hot air gun prepares the seam for the extrusion welder by heating the ground surface and by creating a light bond between the two sheets, securing their position. The hot air gun is not meant to create a primary seam. No heat distortion should be evident on the surface of the upper sheet.

- i) The extrusion welder's barrel shall be purged of heat-degraded extrudate before starting a seam. This must be done every time the extruder is restarted after two or more minutes of inactivity. The purged extrude shall not be discharged onto the surface of previously placed liner, or onto prepared subgrade, where it would eventually form a hard lump under the liner and cause stress concentrations and possibly premature failure.
- j) Molten, highly viscous extrudate is deposited along the overlapped seam. The center of the extrudate pass directly along the edge of the upper liner, at sufficient width to completely cover the edge and most of the outlying grind marks, at least to within 1/4 inch of their extremity.
- k) The extrudate should be approximately twice the specified sheet thickness, measured from the top of the bottom sheet to the top or "crown" of the extrudate. Excessive "squeeze out" is acceptable, if it is equal on both sides and will not interfere with subsequent vacuum box testing. If however, the extrudate can be pulled by its squeeze-out off the seam, the extrudate is unacceptable. The presence of squeeze-out may indicate that the extrusion die was not riding directly against the liner, that the extrudate temperature was improper for adequate flow, or that the seaming rate was too slow.
- l) Where possible, inspect the underside of the lower for heat distortion. This can be done at the end of seams, and wherever samples are cut out of the seam. A slight amount of thermal "puckering" on relatively thin liners (less than 50 mil) is acceptable. It indicates that heat penetrated entirely through the sheet. However, if the underside is greatly distorted, either lower the temperature or increase the rate of seaming.
- m) If the seaming process must be interrupted at mid-seam, the extrudate should trail off gradually, not terminate in a large mass of solidified extrudate. Where such welds are abandoned long enough to cool, they must be ground prior to continuing with new extrudate over the remainder of the seam. Grind where the extrudate trail-off begins. This restart procedure must be followed for patches, pipes, fittings, appurtenances and "T" and "Y" shaped items.
- n) The extrudate bead should be visually inspected. Look to see that its alignment is straight, its height is appropriate, and its surface texture is uniform. No bubbles or pock marks should appear in the extrudate, which indicate the undesirable presence of air, water or debris within the extrudate rod or palletized polymer.
- o) Grind marks should not be visible more than 1/4 inch beyond the extrudate. These should be very light and not contain heavy gouges. As stated previously, grinding is considered excessive when it is deeper than 10% of the liner thickness. It is unacceptable to apply additional extrudate over the original extrusion fillet seam in an area of excessive grinding. A cap strip shall be placed over the entire portion of the seam where excessive grinding is seen.

7.9 Field Quality Control

1. Start-up Testing

A trial weld, 10 feet long for hot wedge welding and 3 feet long for extrusion welding, from each welder/welding machine shall be run upon the beginning of each shift, every four hours thereafter and at the discretion of the Site CQA Manager, under the same conditions that exist for the geomembrane welding. The trial weld shall be marked with date, ambient temperature, welder's name, and welding machine number. A tensiometer provided by the Installer shall be required to be on-site before and during geomembrane

installation for the purpose of testing samples. Specimens of weld 1 inch wide shall be cut from the trial weld and tested on site for shear and peel strength in accordance with **Tables II.7.4, II.7.5, and II.7.6**. No welder may start work until the trial weld has been approved by the Site CQA Manager.

2. Nondestructive Seam Testing

a) The installer shall perform nondestructive tests on field seams over their full length. The purpose of this test is to assure continuity and integrity of the seams. Vacuum and air pressure tests shall be used for nondestructive testing. The vacuum test shall be used for extrusion welds and single-track hot wedge welds. The air pressure test shall be used for double track hot wedge welds.

b) Vacuum Testing

Equipment for testing single wedge fusion seams and extrusion seams shall be comprised of the following:

- (1) A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft rubber gasket attached to the bottom, porthole or valve assembly and a vacuum gauge.
- (2) A vacuum tank and pump assembly equipped with a pressure controller and pipe connections.
- (3) A rubber pressure/vacuum hose with fittings and connections.
- (4) A plastic bucket and wide paintbrush.
- (5) A soapy solution.

The following procedures shall be followed by the installer:

- (1) Excess sheet overlap shall be trimmed away.
- (2) Clean the window, gasket surfaces and check for leaks.
- (3) Energize the vacuum pump and reduce the tank pressure to approximately 5 psi.
- (4) Wet a strip of geomembrane approximately 12 inch by 48 inch (length of box) with the soapy solution.
- (5) Place the box over the wetted area and compress.
- (6) Close the bleed valve and open the vacuum valve.
- (7) Ensure that a leak-tight seal is created.
- (8) For a minimum period of ten seconds, examine the geomembrane through the viewing window for the presence of soap bubbles.
- (9) If no bubbles appear after ten seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum of 3 inch overlap and repeat the process.
- (10) Areas where soap bubbles appear shall be marked and repaired in accordance with the Repair Procedures contained in this CQA Plan.

If the seam cannot be tested prior to final installation, the seaming operations shall be observed by the Site CQA Manager for uniformity and completeness.

3. Air Pressure Testing (for double track fusion seams only)

The following procedures are applicable to those processes which produce a double seam with an enclosed space. Equipment for testing double fusion seams shall be comprised of the following:

- (1) An air pump equipped with pressure gauge capable of generating and sustaining a pressure of 35 psi and mounted on a cushion to protect the geomembrane.
- (2) A manometer equipped with a sharp hollow needle, or other approved pressure feed device.

The following procedures shall be followed by the installer:

- (1) Seal one end of the seam to be tested.
- (2) Insert needle or other approved pressure feed device through the sealed end of the channel created by the double wedge fusion weld.
- (3) Energize the air pump to verify the unobstructed passage of air through the channel.
- (4) Seal the other end of the channel.
- (5) Energize the air pump to a pressure of 35 psi, close valve, and sustain pressure for approximately 5 minutes.
- (6) If loss of pressure exceeds 1% \pm , or pressure does not stabilize, locate faulty area, repair and retest.
- (7) Remove needle or other approved pressure feed device and seal.

7.10 Destructive Seam Testing

The purpose of the destructive testing is to evaluate seam strength properties. An average minimum of one test sample shall be obtained per 500 feet of performed seam length. The location of samples shall be determined by the Site CQA Manager. Selection of such locations may be prompted by suspicion of overheating, contamination, or other potential cause that may adversely impact the welds. This may result in more than one sample per 500 feet of seam length. Sampling shall be performed by the installer. Testing of field samples shall be performed by the installer in the presence of the Site CQA Manager as described below.

1. Sampling Procedures

- a) Samples shall be cut by the installer at locations chosen by the Site CQA Manager as the seaming progresses.
- b) The seams shall not be covered by another material before they have been tested and accepted by the Site CQA Manager.
- c) Upon obtaining each sample, assign a number to the sample and mark it accordingly.
- d) Record sample location on layout drawing.
- e) Record purpose of the sample, statistical routine or suspicious weld area.
- f) Record date, time, location, roll, seam number, master seamer, welding apparatus, and ambient temperature.
- g) Holes in the geomembrane resulting from destructive seam testing shall be immediately repaired in accordance with the Repair Procedures contained in this CQA Manual.

2. Size and Disposition of Samples

- a) The samples shall be 12 inches wide by 36 inches long with the seam centered lengthwise. The sample shall be cut into three pieces of equal length and distributed as follows:
 - (1) One portion to the Installer for field testing; 12 inch by 12 inch.
 - (2) One portion for the independent geosynthetic laboratory quality assurance testing; 12 inch by 12 inch.
 - (3) One portion to the Landfill Manager for archive storage in the Site Operating Record; 12 inch by 12 inch.

- b) The portion of the seam samples for geosynthetic laboratory quality assurance testing will be packed and shipped to an independent lab for testing by the Installer.
3. Field Testing
- a) The following shall be performed by the Installer in the presence of the Site CQA Manager for samples designated for field sampling.
 - (1) The Installer shall cut ten 1-inch wide replicate specimens from the sample to be tested for shear and peel strength, in accordance with the criteria set in **Tables II.7.4, II.7.5, and II.7.6.**
 - (2) Any specimen that fails through the weld or by fusion at the weld sheet interface is a non-FTB (Film Tearing Bond) break and shall be considered a failure.
 - (3) The Installer shall test five specimens for shear seam strength and five for peel strength. Four out of the five replicate test specimens shall pass for the seam to be acceptable. A specimen must pass both Sections 1 and 2 above to be acceptable.
4. Quality Assurance Laboratory Test
- a) The Installer shall package and ship destructive test samples designated for laboratory testing to the independent Quality Assurance Laboratory. The laboratory must be approved by the Site CQA Officer.
 - b) Laboratory tests shall include shear and peel strength tests. The minimum acceptable values obtained in these tests shall be in accordance with **Tables II.7.4, II.7.5, and II.7.6.**
 - c) At least five specimens shall be tested each for shear and peel strength. A passing test shall meet the minimum required values in at least four of the five specimens tested for each method.
 - d) Any specimen that fails through the weld or by fusion at the weld sheet interface is a non-FTB (Film Tearing Bond) break and shall be considered a failure.
 - e) The Independent Laboratory shall provide verbal test results to the Site CQA Manager no more than 24-hours after they receive the samples. The Site CQA Manager shall review the laboratory results as soon as they become available.
5. Procedures for Destructive Test Failure
- a) The following procedures shall apply whenever a sample fails a destructive test, whether that test is conducted in the field or by the laboratory. The Installer has two options:
 - (1) The installer can repair the seam between any two passing test locations.
 - (2) The installer can retrace the welding path to an intermediate location 10 feet (on both sides) from the location of the failed test and take a sample for an additional field test. If these tests pass, then the seam shall be repaired. If the test fails, then the process is repeated to establish the zone in which the seam should be repaired. This process may only be repeated twice. After the third failed test, the entire seam must be repaired.
 - b) Acceptable repaired seams shall be bound by two locations from which sample passing destructive tests have been taken. In cases where repaired seam exceeds 150 feet, a sample taken from the zone in which the seam has been repaired must pass destructive testing. Repairs shall be made in accordance with this CQA Plan.
 - c) The Installer shall document actions taken in conjunction with destructive test failures.

7.11 Repair Procedures

1. Any portion of the geomembrane exhibiting signs of defect, failing a destructive or a nondestructive test, shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be made by the Site CQA Manager.
2. The repair procedures available include:
 - a. Defective seams shall be restarted/reseamed as described in this CQA Plan.
 - b. Small holes shall be repaired by extrusion cap welding. If the hole is larger than 1/4 inch, it shall be patched with a piece of material extending six inches out from the damaged area.
 - c. Tears shall be repaired by patching. The sharp end of a tear on a slope, or in an area of particular stress, must be rounded prior to patching.
 - d. Blisters, large holes, undispersed raw materials, and contamination by foreign matter shall be repaired by patches.
 - e. HDPE surfaces to be patched shall be abraded and cleaned no more than one hour prior to the repair. No more than 10% of the thickness shall be removed.
 - f. Patches shall be round or oval in shape, made of the same geomembrane, and extend to a minimum of six inches beyond the edge of defects. Patches shall be of the same compound and thickness as the geomembrane specified. Patches shall have their top edge beveled prior to placement on the geomembrane in accordance with this CQA Plan. Patches shall be applied and the repair made using methods discussed in the CQA Plan.
3. Restart/Reseaming Procedures - Fillet Extrusion Welds
The Fillet Extrusion Welds process shall restart by grinding the existing seam and rewelding a new seam. Welding shall commence where the grinding started and must overlap the previous seam by at least two inches. Reseaming over an existing seam without regrinding shall not be permitted.
4. Restart/Reseaming Procedures - Hot Wedge Welds
Over the length of the seam failure, the Installer shall either cut out the old seam, reposition the panel and reseam, or add a cap strip, as required by the Site CQA Manager.
5. For any repair method, the following provisions shall be satisfied:
 - a) Surfaces of the geomembrane which are to be repaired using extrusion methods shall be abraded no more than one hour prior to the repair.
 - b) Surfaces shall be clean and dry at the time of the repair.
6. Repair Verification
 - a) Each repair shall be numbered and logged by the installer and the Site CQA Manager. Each repair shall be nondestructively tested using the methods described in Section 5.10, Subsection 2 "Non-Destructive Testing" as appropriate. Repairs which pass the nondestructive test shall be taken as an indication of an adequate repair. Repairs more than 150 feet long may be of sufficient length to require destructive test sampling, at the discretion of the Site CQA Manager. Failed tests indicate that the repair shall be redone and retested until passing test results are achieved. The Site CQA Manager shall observe nondestructive testing of repairs. The installer shall record the number of each repair, date and test outcome.
7. Disposal of Waste Material

Upon completion of installation, the Installer shall dispose of trash, waste material, etc., and shall leave the premises in a neat and acceptable condition.

7.12 Geomembrane Acceptance

The Installer shall retain ownership and responsibility for the geomembrane until acceptance by the Owner. The geomembrane liner shall be accepted by the Owner when the following conditions are met:

1. Installation is finished.
2. Verification in the form of a certificate of acceptance of the adequacy of field seams and repairs, including associated testing, is complete.
3. Certification by the Site CQA Manager that the geomembrane was installed in accordance with the Construction Drawings, this CQA Plan and manufacturers recommendations.
4. Certification, including "as built" drawing(s) and installation documentation, is provided by the Installer to the Site CQA Manager.

8.0 GEONET

8.1. Geonet Properties

Geonet is proposed as the leak detection layer for the evaporation ponds and landfill.

1. The geonet shall be manufactured of new, prime first-quality materials designed and manufactured specifically for the purpose of planar drainage of liquid and chemically resistant to leachate.
2. Geonets are unitized sets of parallel ribs positioned in layers to form a three-dimensional structure such that liquid can be transmitted within their open spaces.
3. The geonet material shall meet the minimum properties listed in **Table II.7.9**.

8.2 Manufacturer Quality Control Documentation

Prior to installation commencement of any geonet material, the Contractor shall provide to the Site CQA Manager the following information certified by the manufacturer for the delivered geomembrane.

1. Origin, identification and production of the resin (supplier's name, brand name and production plant).
2. Copies of quality control certificates issued by the resin supplier.
3. Manufacturer's certification verifying that the quality of the resin used to manufacture the geonet meets the resin specifications fingerprint properties shown in **Table II.7.9**.
4. Each roll delivered to the project site shall have the following identification information:
 - Manufacturer's name
 - Product identification
 - Thickness
 - Roll number
 - Roll dimensions
5. Quality control certificates, signed by the manufacturer's quality assurance manager. Each certificate shall have roll identification number, sampling procedures, frequency, and test results. At a minimum, the following test results shall be provided in accordance with applicable test requirements specified in **Tables II.7.9**.

TABLE II.7.9
Technical Specifications
HDPE Geonet

PHYSICAL PROPERTIES				
PROPERTY	QUALIFIER	UNIT	VALUE	TEST METHOD
Thickness	Minimum	mils	200	ASTM D1777
Density	Minimum	g/cc	0.94	ASTM D1505
Melt Index	Range	g/10 min	0.1 - 1.1	ASTM D1238
Carbon Black Content	Range	%	2.0 - 3.0	ASTM D1603
Tensile Strength	Minimum	lb/in	42	ASTM D1682
Mass Per Unit Area	Minimum	lb/ft ²	0.16	ASTM D3776
Transmissivity (loaded)	Minimum	m ² /sec	1x10 ⁻³	ASTM D4716

Notes:

1. Values representative of GSE 200-mil geonet or equivalent.
2. Standard test methods will be updated to reflect the most current industry standards.

8.3 Conformance Testing

1. Conformance testing shall be performed by an independent Quality Assurance Laboratory at a minimum of 1 per 100,000 ft². The Site CQA Manager or Installer shall obtain the samples from the roll, mark the machine direction and identification number. The number of lots and samples will be determined in accordance with ASTM D4354. The following conformance tests shall be conducted at the independent laboratory:
 - Thickness (ASTM D 1777)
 - Density (ASTM D 1505)
 - Wide width tensile properties (ASTM D 1682)
 - Mass per unit area (ASTM D 3776)
 - Carbon black (ASTM D 1603)
 - Melt Index (ASTM D 1238)
2. These conformance tests shall be performed in accordance with **Tables II.7.9**.
3. Conformance test results shall be reviewed by the Site CQA Officer, and lots shall be accepted or rejected prior to the placement of the geomembrane. Test results shall meet, or exceed, the property values listed in **Tables II.7.9**. If the sampling results do not meet property values for any individual lot sample, the lot shall be resampled and retested. This retesting shall be paid for by the manufacturer or installer. If of the test values from the resamples pass the acceptable specification values listed in **Tables II.7.9**, the lot shall be accepted.

8.4 Delivery, Storage and Handling

1. The geonet rolls shall be packaged and shipped by appropriate means to prevent damage of the geonet rolls. Off-loading and storage of the geomembrane is the responsibility of the Installer. The Installer shall be responsible for replacing any damaged or unacceptable material at no cost to the Owner.

2. No off-loading shall be performed unless the Site CQA Manager is present. Damage during off-loading shall be documented by the Site CQA Manager. Damaged rolls must be separated from the undamaged rolls until the proper disposition of that material has been determined collectively by the installer and Site CQA Manager.
3. The geonet rolls shall be stored so as to be protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions and excessive heat that may damage the geonet material. The rolls shall be stored on a prepared surface (not wooden pallets) and shall be elevated from the ground (a minimum of 3 inches) to protect the geonet from standing water.

8.5 Guarantee

1. The Contractor shall guarantee the HDPE geonet against defects in installation and workmanship for the period of two years commencing with the date of final acceptance by the Owner. The guarantee shall include the services of qualified service technicians and materials required for the repairs at no expense to the Owner.

8.6 Geonet Installation

8.6.1 Geonet Placement

- a. As each roll is moved from the storage area by the Installer, the labels shall be removed by the Installer and submitted to the Site CQA Manager. The rolls of geonet shall be brought to the area to be lined with a front-end loader and support pipes set up such that the geonet roll is fully supported across its length. A spreader bar or similar device shall be used to prevent the lifting chains or slings from damaging the edges.
- b. Care shall be taken to keep the geonet clean and free from debris prior to installation. If the geonet is not clean, it should be washed using a high-pressured hose prior to installation.
- c. Each panel of the geonet shall be rolled out and installed in accordance with the approved shop drawings prepared by the Installer. The layout shall be designed to keep field joining of the geonet to a minimum and consistent with proper methods of geonet installation.
- d. On slopes, the geonet shall be secured and rolled down the slope in such a manner as to continually keep the geonet panel in tension. If necessary, the geonet shall be positioned by hand after being unrolled to minimize wrinkles.
- e. In areas where wind is prevalent, geonet installation should be started at the upwind side of the project and proceed downwind. The leading edge of the geonet shall be secured at times with sandbags or other means sufficient to hold it down during windy conditions.
- f. The geonet shall not be welded to the geomembrane.
- g. The geonet shall only be cut using scissors or other cutting tools approved by the Manufacturer that will not damage the underlying geosynthetics. Care shall be taken not to leave tools on the geonet.
- h. Necessary precautions shall be taken to prevent damage to underlying layers during placement of the geonet.
- i. During placement of geonet, care shall be taken not to entrap dirt or excessive dust within the geonet that could cause clogging of the drainage system and/or stones that

could damage the adjacent geomembrane. If dirt or excessive dust is entrapped in the geonet, it should be hosed clean prior to placement of the next material on top of it. In this regard, care shall be taken in handling the sandbags to prevent rupture or damage of the sandbag.

- j. Once the geonet is removed from the storage area by the Installer, it becomes the responsibility of the Installer.

8.6.2 Field Seams

The following requirements shall be met during installation of the geonet:

- a. Adjacent rolls shall be overlapped by a minimum of 4 inches.
- b. Overlaps shall be secured by tying. Tying can be achieved by HDPE fasteners or polymer braids. Tying devices shall be white or yellow for easy inspection. Metallic devices will not be permitted.
- c. Tying shall be every 5 feet along the slope and base, every 6 inches in the anchor trench, and every 6 inches along end-to-end seams on the floor of the landfill and pond.
- d. No horizontal seams shall be allowed on side slopes.
- e. In the corners of the side slopes where overlaps between perpendicular geonet panels are required, an extra layer of geonet shall be unrolled along the slope, on top of the previously installed geonet from top to bottom of the slope.
- f. When more than one layer of geonet is installed, joints shall be staggered.

8.7 Field Quality Control

1. The Installer shall provide the Site CQA Manager with Daily Summary Reports addressing the following:
 - Underlying geomembrane approval for areas anticipated to be covered by geonet
 - The total number and location of panels placed
 - Location of repairs
2. The Field Installation Team Manager and the Site CQA Manager shall provide 100% inspection of the installation to ensure compliance with these technical specifications and Manufacturer recommended procedures.
 - a. The surface of the geonet shall be clean and free of debris at the time of inspection.
 - b. The Field Installation Manager shall record each roll number and lot number as panels are deployed, and a general description of the location of each panel.
 - c. The Field Installation Manager and the Site CQA Manager shall inspect the overlap for each panel.
 - d. The Field Installation Manager and the Site CQA Manager shall inspect the anchoring of the geonet.
 - e. The Field Installation Manager and the Site CQA Manager shall inspect the geonet for any signs of defects or holes. Any areas requiring repair shall be marked and subsequently repaired in accordance with the Repair Procedures listed in these specifications.
 - f. The Field Installation Manager and the Site CQA Manager shall reinspect, verify, and approve repairs and patches.
3. Repair Procedures

- a. Seams and non-seam areas of the geonet shall be inspected for defects, holes, and any sign of contamination by foreign matter in accordance with the Field Quality Control procedures listed in these specifications.
- b. Any defects shall be repaired by the Installer by placing a geonet patch with a minimum 12-inch overlap in all directions.
- c. The patch shall be secured to the original geonet panel by placing HDPE fasteners or polymer braids every 6 inches along the perimeter of the patch.
- d. For any repair method, surfaces shall be clean and dry at the time of the repair.
- e. Each completed repair shall be inspected and approved in accordance with the Field Quality Control procedures listed in this CQA Plan.

9.0 PROTECTIVE SOIL LAYER AND SELECT AGGREGATE

9.1 Protective Soil Layer

1. Protective soil layer material shall be comprised of readily available on-site materials free from organic substance and other deleterious matter typically comprised of materials from the unconsolidated formation at the surface of the site (sometimes referred to as "OAG").
2. Protective soil layer material will be in direct contact with the geocomposite and shall have rounded particle shapes to avoid potential for damage.

9.2 Select Aggregate

Leachate Collection System Bedding Layer and Sumps

1. Washed select aggregate, shall be used for bedding material around the leachate collection pipes. The select aggregate shall be durable, resistant to weathering and shall be free organic material, and fines < 2% by dry weight.
2. The bedding aggregate shall have particle sizes that range from ¾ inch minimum diameter to 2.0 inch maximum diameter in accordance with ASTM C136.
3. The select aggregate shall have particle shapes that will not damage the HDPE liner with the use of a 10 oz/yd² non-woven geotextile cushion layer. The select aggregate shall be approved by the Engineer.

9.3 Conformance Testing

Protective Soil Layer

1. Conformance testing shall be performed on samples from each source of protective soil layer to assure compliance with the specifications. The following tests shall be performed on the samples:
 - a. Permeability (ASTM D2434 or Falling Head) [min. 1 test per 2 acres]
 - b. Total Thickness Test (survey or direct test) [min. 5 per acre]

Select Aggregate.

1. Gradation analysis shall be performed on samples from each source of the select aggregate to assure compliance with the project specifications.

9.4 Delivery, Storage and Handling

If protective soil/select aggregate materials are delivered to the site prior to approval, materials shall be stockpiled on-site in areas as dictated by the Owner to facilitate approval by the Engineer. Provision shall be implemented to minimize surface water or dust impacts on the stockpile. Removal and placement of the materials shall be conducted in a manner to minimize intrusion of soils adjacent to and beneath the stockpile.

9.5 Protective Soil Layer Placement

1. After the completion of installation and acceptance of the liner system and related work activities, placement of the minimum 24 inch thick protective soil layer will be initiated following approval by the Engineer.
2. During the placement of the protective soil layer material, no construction equipment shall be allowed directly on the geocomposite and any damage shall be repaired immediately by the Contractor in accordance with this CQA Plan.
3. Care shall be taken to protect the liner system. Ramps shall be provided at down slopes and in other heavily traveled areas. Heavily traveled areas shall have a minimum of 3 feet of select material above the liner system.
4. Protective soil layer shall not be placed over folds in the geocomposite.
5. Protective soil material shall be placed on the side slopes starting at the toe of the slope and working toward the top of the slope/berm.
6. The protective soil layer should be spread when the geocomposite is taut or stretched evenly over the base of the landfill. The protective soil layer material shall not be spread when the geocomposite is elongated due to higher daytime temperatures and/or exposure to sun.
7. Protective soil layer shall not be placed while the soil is frozen or thawing, or during unfavorable weather conditions.

9.6 Select Aggregate Placement

Leachate Collection System Bedding Layer and Sump Select Aggregate

After geosynthetic placement has been approved, placement of non-woven geotextile in the floor of the leachate collection system trench, leachate collection sump and leak detection sump will ensure protection of the geosynthetics from the overlying select aggregate layer.

- A. Leachate Collection System Bedding Layer
 1. Placement of a 3 inch bedding layer in the bottom of the trench and on top of the geotextile consisting of select aggregate, 0.75 inch minimum diameter to 2.0 inch maximum diameter (maximum 2% fines by dry weight).
 2. Backfilling of the leachate pipe will be allowed only after placement and workmanship have been approved by the Site CQA Manager.
 3. Backfilling around the leachate pipe will be with the select aggregate to the depth and width shown on the construction drawings.
 4. Haunching of the select aggregate will provide stability to the pipe from the sides and from underneath.
 5. Placement of the select aggregate should be in gradual 4 inch to 6 inch lifts and tamped simultaneously with a blunt tamping tool to ensure the material is well consolidated under and around the pipe.

6. Backfilling, with the select aggregate, should be brought up to a height of a minimum of 12 inches above the top of the pipe.
- B. Leachate Collection Sump and Leachate Detection Sump Select Aggregate Placement
1. Placement of a 2 foot layer in the sumps and on top of the geotextile consisting of select aggregate, 0.75 inch minimum diameter to 2.0 inch maximum diameter (maximum 2% fines by dry weight).
 2. Backfilling of the leachate collection and riser pipes will be allowed only after placement and workmanship have been approved by the Site CQA Manager.
 3. Backfill around the leachate collection and riser pipes will be with the select aggregate to the depth and width shown on the construction drawings.
 4. Placement of the select aggregate should be in gradual 4 inch to 6 inch lifts and teamped simultaneously with a blunt tamping tool to ensure the aggregate is well consolidated under the sides of the pipes as well as around it.
 5. Care shall be taken during backfilling such that damage to the leachate collection and riser pipes is avoided.

9.7 Field Quality Control

- A. The protective soil layer thickness shall be verified by survey on a minimum frequency of 5 survey points per acre.
- B. The protective soil layer thickness may be measured periodically throughout the day during construction to confirm that the thickness of the installed material is in accordance with the Engineering Drawings.
 1. Protective Soil Layer Thickness (i.e., Survey 5/acre, Test Probe, Calibrated cones).

9.8 Protective Soil Layer - Thickness Confirmation Procedure

Due to the effects of wind and stormwater, the protective soil may not maintain a full 24 inch thickness at locations over time. The following procedure (**Table II.7.10**) has proven effective at confirming protective layer thickness at the most important point in time when the protective soil layer is being covered with waste.

TABLE II.7.10
Protective Soil Layer – Supplemental Thickness
Confirmation Procedure

1. Prior to advancing the fill face over new sections of the liner, the protective soil cover in these areas may be tested to confirm a thickness not less than 24 inches.
2. The area that may be tested will include the footprint where the next lift of waste will be placed over the protective cover; plus a buffer zone at least 50 feet ahead of the advancing fill face.
3. Add select protective soil material from the designated stockpile in the area to be tested if additional thickness is required.
4. Perform protective cover depth probe by field survey, with a blunt instrument or construction cones (i.e., no shovels) on a spacing not to exceed 100 feet. The instrument shall have a smooth rounded or flat tip, and it shall be advanced carefully until contact with the geosynthetic surface is confirmed. Care must be taken not to damage the geosynthetic surface.

5. The probes or traffic cones shall be calibrated such that the 24 inch length is visible and prominently marked. Record probe test results (both passing and failing) in the Site Log Book and/or on forms provided specifically for this purpose.
6. In sections where the protective cover is less than 24 inches thick, add additional protective soil to the area and retest. Continue this procedure until test locations meet the 24 inch thickness criterion, and the intervening protective cover layer surface appears level and smooth.
7. Record any retest data results in the Site Log Book and/or on forms provided specifically for that purpose (example included in appendix). The information recorded shall include, at a minimum;
 - Testing Date
 - Testing Personnel
 - Probe Identification
 - Approximate Probe Locations
 - Probe Test Results
 - Probe Retest Results
8. Maintain records regarding the protective soil layer on-site at all times for review by OCD inspectors, and by landfill management and engineering personnel.

10.0 GEOTEXTILE

10.1 Geotextile Properties

1. The 10 oz/yd² non-woven geotextile shall meet the specifications provided in **Table II.7.11**.
2. The minimum roll width shall be 15 feet, and the maximum roll length shall be 300 feet.

10.2 Manufacturer's Quality Control Documentation

Prior to installation commencement of any geonet composite material, the Contractor shall provide to the Site CQA Manager the following information certified by the manufacturer for the delivered geotextile.

1. Each roll delivered to the project site shall have the following identification information:
 - Manufacturer's name
 - Product identification
 - Thickness
 - Roll number
 - Roll dimensions
2. Quality control certificates, signed by the manufacturer's quality assurance manager. Each certificate shall have roll identification number, sampling procedures, frequency, and test results. At a minimum, the following test results shall be provided in accordance with applicable test requirements specified in **Table II.7.11**:
 - Thickness (ASTM D5199)
 - Weight (ASTM D5261)
 - Tensile strength (ASTM D4632)
 - Elongation (ASTM D4632)
 - Puncture strength (ASTM D4833)
 - Mullen burst strength (ASTM D3786)
 - Trapezoidal tear strength (ASTM D4533)
 - Coefficient of permeability (ASTM D4491)

- Permittivity (ASTM D4491)
- Flow rate (ASTM D4491)
- UV resistance (ASTM D4355)
- Apparent opening size (ASTM D4751)

**TABLE II.7.11
Technical Specifications
Non-Woven Geotextile¹**

PHYSICAL PROPERTIES (MARV²)				
PROPERTY	QUALIFIER	10 oz/yd² UNIT	VALUE	TEST METHOD⁴
Weight	MARV	10.0	oz/yd ²	ASTM D5261
Thickness	MARV	105	Mils	ASTM D5199
Tensile Strength	MARV	270	Lbs	ASTM D4632
Elongation	MARV	50	%	ASTM D4632
Puncture Strength	MARV	180	Lbs	ASTM D4833
Mullen Burst Strength	MARV	520	psi	ASTM D3786
Tapezoidal Tear Strength	MARV	105	lbs	ASTM D4533
Apparent Opening Size (AOS)	Max ARV ³	100	US Sieve	ASTM D4751
Coefficient of Permeability	MARV	0.30	cm/sec	ASTM D4491
Permittivity	MARV	1.20	sec ⁻¹	ASTM D4491
Flow Rate	MARV	85	gpm/ft ²	ASTM D4491
UV Resistance	MARV	70	% Retained @ 500 hrs	ASTM D4355
Roll Width (Nominal)	Measured	15	feet	n/a
Roll Length (Nominal)	Measured	300	feet	n/a

Notes:

1. Values reported represent Propex Geosynthetics (formerly Synthetic Industries) 1071 Nonwoven.
2. Values shown are in weaker principal direction. Minimum average roll values (MARV) are calculated as the typical minus two standard deviations. Statistically, this yields a 97.7% degree of confidence that any samples from quality assurance testing will be in compliance with the target values.
3. Maximum Average Roll Values (Max ARV) represent typical plus two standard deviations.
4. Geotextiles with greater or equivalent properties may be used for select application.
5. Standard test methods will be updated to reflect the most current industry standards.

10.3 Conformance Testing

1. Conformance testing shall be performed by an independent Quality Assurance Laboratory approved by the Engineer at a minimum of one (1) per 100,000 ft². The Site CQA Manager or Installer shall obtain the samples from the roll, mark the machine direction and identification number. The number of lots and samples will be determined in accordance with ASTM D4354. The following conformance tests shall be conducted at the independent laboratory:
 - Weight (ASTM D5261)
 - Tensile strength (ASTM D4632)
 - Puncture strength (ASTM D4833)
 - Mullen burst strength (ASTM D3786)

- Trapezoidal tear strength (ASTM D4533)
 - Apparent opening size (ASTM D4751)
2. These conformance tests shall be performed in accordance with **Table II.7.11**.
 3. Conformance test results shall be reviewed by the Site CQA Officer, and lots shall be accepted or rejected prior to the placement of the geotextile. Test results shall meet, or exceed, the property values listed in **Tables II.7.11**. If the sampling results do not meet property values for any individual lot sample, the lot shall be resampled and retested. This retesting shall be paid for by the manufacturer or installer. If the test values from the resamples pass the acceptable specification values listed in **Table II.7.11**, the lot shall be accepted.

10.4 Installation

1. Leachate Trench/Sump Preparation
 - a. Before the geotextile is placed into position in the leachate collection pipe trench, leachate collection sumps, and leak detection sumps, the following procedures will be completed.
 - (1) The subgrade at the bottom and sides of the trench and sumps shall be carefully prepared in accordance with this CQA Plan.
 - (2) Underlying geosynthetics have been installed in accordance with this CQA Plan.
2. Geotextile Installation
 - a. After geosynthetic placement has been approved by the Site CQA Manager, the Geotextile Installer shall place the non-woven geotextile in the bottom of the trench, leachate collection and leachate detection sumps to ensure protection of the underlying geosynthetics from the overlying select aggregate layer.
 - (1) Exposure of the geotextiles to the elements between lay down and cover shall be a maximum of 14 days.
 - (2) The 10 oz/yd² non-woven geotextile shall be placed atop the underlying geosynthetics in the trenches, leak detection sump and leachate collection sump. The geotextile shall be placed such that the centerline of the geotextile lines up with the centerline of the trench. The geotextile shall be joined by overlapping and sewing. Overlapped seams shall have a minimum overlap of 6 inches.
 - (3) The Installer shall take care not to damage the underlying geosynthetic materials. The Installer is responsible for any damage to the geotextile and underlying geosynthetics caused during geotextile installation.
3. Field Quality Control
 - a. The Site CQA Manager shall inspect the installation for proper placement, sufficient overlap and damaged material. Damaged areas will be repaired in accordance with the Repair Procedures of this CQA Plan.
4. Repair Procedures
 - a. A geotextile patch shall be placed over the damaged area and extend three feet beyond the perimeter of the tear or damage.
 - b. The Site CQA Manager shall verify repairs.
5. Select Aggregate Installation
 - a. Placement of a 3 inch bedding layer in the bottom of the leachate collection pipe trench and on top of the geotextile will be performed by the Contractor.

- b. Placement of the 2 feet of select aggregate in the leachate collection and leak detection sumps shall be performed by the Contractor.
- 6. Leachate Pipe Installation
 - a. Installation of the slotted or perforated Sch 80 PVC or SDR 11 HDPE leachate collection pipe onto the bedding layer will be performed in accordance with the Leachate Pipe Specifications.
 - b. Installation of the Sch 80 PVC or SDR 11 HDPE sump riser pipes will be performed in accordance with the Geopipe Specifications.
- 7. Select Aggregate Backfill
 - a. Backfill of completed sections of the leachate trench shall be completed only after placement and workmanship have been approved by the Site CQA Manager and the top of leachate pipe has been surveyed to verify grade.
 - b. Backfill of the leachate collection and leak detection sumps shall be completed only after placement and workmanship of the riser pipes has been approved by the Site CQA Manager.

11.0 GEOPIPE

11.1 General

The design of the evaporation ponds and landfill cells employ a leak detection system with sumps atop of the secondary liner that are monitored with piping to allow for the removal of liquids that may collect in the detection sump.

The landfill design employs a leachate collection system atop the primary composite liner that includes leachate collection piping and leachate extraction piping. The leachate collection system is comprised of slotted or perforated geopipes which collect leachate seepage through the drainage layer directing it to the permanent or temporary leachate collection sumps where leachate extraction piping is installed. These geopipes are placed within select aggregate and wrapped with a non-woven geotextile material and covered by the granular drainage layer. At the end of each slotted or perforated permanent leachate collection geopipe, a solid geopipe is attached which rises up along the landfill sideslope to allow cleanout of the pipe. The sump extraction geopipes rise along the landfill and pond sideslope to allow extraction of liquid from the leachate collection and leak detection sumps. Leachate collection and leak detection piping design is shown on Engineering Drawings.

11.2 HDPE Geopipe Material Properties

- 1. High Density Polyethylene (HDPE) Pipe utilized for the leachate collection pipe and leachate extraction pipe will be manufactured in accordance with ASTM D714 and have the following physical characteristics:
 - a) Perforated 6-inch diameter HDPE Driscopipe as manufactured by Phillips 66, or approved equal, with a standard dimension ratio (SDR) of 11 as shown on the Engineering Drawings.
 - b) Solid wall 12-inch diameter HDPE Driscopipe as manufactured by Phillips 66, or approved equal, with a standard dimension ratio (SDR) of 11 as shown on the Engineering Drawings.

- c) Solid wall 4-inch diameter HDPE Discopipe as manufactured by Phillips 66, or approved equal, with a standard dimension ratio (SDR) of 11 as shown on the Engineering Drawings.
 - d) HDPE pipe shall meet the requirements of cell classification PE 345464C or higher cell classification in accordance with ASTM D3350.
 - e) The slots or perforations must conform with the Engineering Drawings.
 - f) The pipe shall be as uniform as commercially practical in color, opacity, density, and other physical properties.
 - g) Apart from structural voids and hollows associated with some profile wall designs, the pipe fittings shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions or other defects.
2. HDPE Pipe Fittings
- a) HDPE fittings shall be manufactured in accordance with the requirements of ASTM E714.
 - b) End caps for the clean-out risers will be of low pressure type HDPE, or similar.

11.3 Polyvinyl Chloride (PVC) Geopipe Material Properties

If Polyvinyl Chloride (PVC) Pipe is utilized for the leak extraction or leachate collection pipe, the material will be manufactured in accordance with ASTM D1784 and have the following physical characteristics:

- a) PVC pipe will be Schedule 80 or as indicated on the Drawings. The pipes will conform to the requirements of ASTM D1785 and will have the nominal dimensions shown on the Engineering Drawings.
- b) Pipe and fitting will be manufactured from a PVC compound which meets the requirements of Type 1, Grade 1, Polyvinyl chloride (PVC) as outlined in ASTM D1784. A Type1, Grade 1 compound is characterized as having the highest requirements for mechanical properties and chemical resistance.
- c) Pipe will be furnished in standard laying lengths not exceeding twenty (20) feet.
- d) Fittings will conform to the requirements of ASTM D2467 for socket type joints.
- e) Slotted or perforated 6- inch diameter PVC leachate collection pipe as shown on the Engineering Drawings.
- f) Solid wall 12-inch diameter PVC leachate extraction pipe as shown on the Engineering Drawings.
- g) Solid wall leak detection pipe as shown on the Engineering Drawings.
- h) The pipe will be solvent welded according to manufacture specifications.

11.4 Manufacturer's Quality Control Documentation

Prior to installation of the geopipe, the Contractor shall provide the following information certified by the manufacturer for the delivered geopipe:

1. Manufacturer's certification verifying that the quality of the raw materials used to manufacture the geopipe meets the Manufacturer specifications.
2. Each geopipe length delivered to the project site shall have the following identification information:
 - Manufacturer's name
 - Pipe size

- Ring stiffness constant classification or SDR number.
- Production code designating plant location, machine, and date of manufacture.

11.5 Delivery, Storage and Handling

1. Off-loading and storage of the geopipe shall be performed by the Contractor.
2. Storage of the geopipe shall not exceed 17 rows high, as per Manufacturer's recommendation.
3. The Contractor shall be responsible for moving the pipes and fittings from the storage area to the area of pipe installation. The Contractor shall be responsible for replacing any material damaged during transport or installation.

11.6 Quality Assurance

1. Finished Product Evaluation
 - A. Each length of pipe produced shall be checked by production staff for the items listed below. The results of measurements shall be recorded on production sheets which become part of the Manufacturer's permanent records.
 - 1) Pipe in process shall be checked visually, inside and out for cosmetic defects (grooves, pits, hollows, etc.).
 - 2) Pipe outside diameter shall be measured using a suitable periphery tape to ensure conformance with ASTM D1785.
 - 3) Pipe wall thickness shall be measured at 12 equally spaced locations around the circumference at both ends of the pipe to ensure conformance with the Manufacturer's specifications.
 - 4) Pipe length shall be measured.
 - 5) Pipe marking shall be examined and checked for accuracy.
 - 6) Pipe ends shall be checked to ensure they are cut square and clean.

11.7 Installation

11.7.1 Leachate Collection Pipe

1. Leachate Collection Trench Preparation
 - A. Before the geopipe is placed into position in the trench, the following procedures will be completed:
 - 1) The subgrade at the bottom and sides of the trench shall be carefully prepared as shown on the Engineering Drawings by the Contractor.
 - 2) The subgrade will be covered by a composite liner by the Liner Installer according to the Engineering Drawings.
2. Geotextile Installation
 - A. After composite liner placement has been approved, the Liner Installer shall place the non-woven geotextile in the bottom of the leachate trench to ensure protection of the composite liner from the overlying select aggregate layer in accordance with the Geotextile Cushioning Fabric specifications.
3. Bedding Layer Installation

- A. Placement of a three 3-inch bedding layer in the V-notch trench and above the geotextile consisting of select aggregate, 0.75 inch minimum diameter to 2.0 inch maximum diameter (maximum 2% fines by dry weight) will be performed.
 - 1) "Spading" with shovels or any other activities which could jeopardize the underlying liner's integrity will not be allowed.
 - 2) The three (3) inch bedding layer is discussed in more detail under Protective Soil Layer and Select Aggregate (Section 9.0).
- 4. Leachate Collection Pipe Installation
 - A. Polyvinyl Chloride (PVC) Leachate Collection Pipe Installation.
 - 1) Installation of the 6-inch diameter perforated SCH 80 PVC pipe onto the bedding layer will be performed in such a manner as not to jeopardize the integrity of the pipe.
 - 2) Each pipe section shall be accurately placed to the line and grade called for on the Engineering Drawings.
 - 3) Pipe and fittings shall be inspected before being placed and no defective pipe shall be laid. Installation practices shall conform with ASTM D2321 and specific Manufacturer's recommendations.
 - 4) Trenches shall be kept free from water during pipe laying, jointing or before sufficient backfill has been placed to prevent flotation of the pipe. The Pipe Contractor shall provide ample means and devices to remove and dispose of water promptly from any source entering the construction area of pipe laying.
 - 5) No connection shall be made where joint surfaces and joint materials have been soiled by earth handling until such surfaces are thoroughly cleaned.
 - 6) As the work progresses, the interior of pipes shall be kept clean by the Contractor. After each line of pipe has been laid, it shall be carefully inspected and earth, trash, rags, and other foreign matter removed from the interior.
 - 7) Slots/perforations on adjoining sections of pipe shall remain in alignment after fusion welding.
 - 8) Two sets of pipe slots/perforations shall be facing vertically down after pipe placement in the trench.
 - B. High Density Polyethylene (HDPE) Leachate Collection Pipe Installation
 - 1) Installation of the 6-inch diameter perforated SDR 11 HDPE pipe onto the bedding layer will be performed in such a manner as not to jeopardize the integrity of the pipe.
 - 2) Trenches shall be kept free from any deleterious material, water or backfill to prevent damage to the pipe. The Contractor shall provide means and devices to remove promptly and dispose of any deleterious material, or water entering the area of pipe laying.
 - 3) Installation practices shall conform with ASTM D2321 and any specific manufacturer's recommendations.
 - 4) HDPE pipe joints shall be butt fused in the field in accordance with the manufacturer's instructions. Fused joints, when tested for tension and pressure, shall be stronger than the pipe itself.
 - 5) As many sections of pipe as practical shall be fused together outside of the lined landfill cell to minimize damage to the liner system during pipe fusion.

- 6) No connection shall be made where joint surfaces and joint materials have been soiled until such surfaces are thoroughly cleaned.
 - 7) As the work progresses, the interior of pipes shall be kept clean. After each line of pipe has been laid, it shall be carefully inspected and earth, trash, rags, and other foreign matter removed from the interior.
 - 8) Slots/perforations on adjoining sections of pipe shall remain in alignment after fusion welding.
 - 9) Two sets of pipe slots/perforations shall be facing vertically down after pipe placement in the trench.
5. Field Quality Control
 - a) After completion of any section of geopipe; the grades, joints, and alignment shall be true to line and grade.
 - b) The leachate collection pipe grade shall be surveyed on maximum 50 foot centers for compliance with the approved design.
 - c) The Site CQA Manager shall inspect the installation. The pipe shall be completely free from any cracks and from protruding joint materials, deposits of sand, mortar, dirt, debris or other materials on the inside.
 6. Leachate Trench Backfill
 - 1) The Contractor shall backfill completed sections of pipe trench with additional select aggregate (0.75 inch to 2.0 inch diameter) around and above the pipe to a minimum thickness of 12 inches above the pipe as shown on the Engineering Drawings. Backfilling over the pipe trench will be allowed only after placement and workmanship have been approved by the Site CQA Manager.
 - 2) Placement of a geotextile layer will be completed as shown on the Engineering Drawings.

11.7.2 Leachate Collection and Leak Detection Sumps

1. Leachate Collection and Leak Detection Sump Preparation
 - A. Before the leachate collection and leak detection riser geopipe is placed into position in the sumps, the following procedures will be completed:
 - 1) The subgrade at the bottom and sides of the sumps shall be carefully prepared as shown on the Engineering Drawings by the Contractor.
 - 2) The subgrade will be covered by a composite liner by the Liner Installer according to the Engineering Drawings.
2. Geotextile Installation
 - A. After composite liner placement has been approved, the Installer shall place the non-woven geotextile in the bottom of the leachate collection and leak detection sumps to ensure protection of the composite liner from the overlying select aggregate layer in accordance with the Geotextile Cushioning Fabric specifications.
3. Select Aggregate Installation
 - A. Placement of 2 feet of select aggregate in the sumps and above the geotextile consisting of 0.75 inch minimum diameter to 2.0 inch maximum diameter (min 2% fines by dry weight) will be performed. "Spading" with shovels or any other activities which could jeopardize the underlying composite liner's integrity will not be allowed.
4. Leachate Extraction and Leak Detection Pipe Installation
 - A. Polyvinyl Chloride (PVC) Leachate Extraction and Leak Detection Pipe Installation.

- 1) Installation of the 12-inch pipe in the leachate collection and leak detection sumps will be performed in such a manner as not to jeopardize the integrity of the pipe.
 - 2) Each pipe section shall be accurately placed to the line and alignment called for on the Engineering Drawings.
 - 3) Pipe and fittings shall be inspected before being placed and no defective pipe shall be laid. Installation practices shall conform with ASTM D2321 and specific Manufacturer's recommendations.
 - 4) Sumps shall be kept free from water during extraction pipe installation, jointing or before sufficient select aggregate backfill has been placed to prevent flotation of the pipe. The Pipe Contractor shall provide ample means and devices to remove and dispose of water promptly from any source entering the construction area of pipe laying.
 - 5) No connection shall be made where joint surfaces and joint materials have been soiled by earth handling until such surfaces are thoroughly cleaned.
 - 6) As the work progresses, the interior of pipes shall be kept clean by the Contractor. After each extraction pipe has been laid along the side slope, it shall be carefully inspected and earth, trash, rags, and other foreign matter removed from the interior.
 - 7) Slots/perforations on the bottom 6 feet of the leachate extraction and leak detection riser pipes shall be as shown on the Engineering Drawings.
- B. High Density Polyethylene (HDPE) Leachate Collection and Leak Detection Pipe Installation
- 1) Installation of the 12-inch or 4-inch diameter SDR 11 HDPE pipe in the leachate collection and leak detection sumps will be performed in such a manner as not to jeopardize the integrity of the pipe.
 - 2) Each pipe section shall be accurately placed to the line and alignment called for on the Engineering Drawings.
 - 3) The leachate collection and leak detection sumps shall be kept free from any deleterious material, water or backfill to prevent damage to the pipe. The Contractor shall provide means and devices to remove promptly and dispose of any deleterious material, or water entering the area of pipe laying.
 - 4) Installation practices shall conform with ASTM D2321 and any specific manufacturer's recommendations.
 - 5) HDPE pipe joints shall be butt fused in the field in accordance with the manufacturer's instructions. Fused joints, when tested for tension and pressure, shall be stronger than the pipe itself.
 - 6) As many sections of pipe as practical shall be fused together outside of the composite lined area to minimize damage to the composite liner during pipe fusion.
 - 7) No connection shall be made where joint surfaces and joint materials have been soiled until such surfaces are thoroughly cleaned.
 - 8) As the work progresses, the interior of pipes shall be kept clean. After each line of pipe has been laid along the side slope, it shall be carefully inspected and earth, trash, rags, and other foreign matter removed from the interior.
 - 9) Slots/perforations on the bottom 6 feet of the leachate extraction and leak detection riser pipes shall be as shown on the Engineering Drawings.

5. Field Quality Control

- a) After completion of any section of the leachate collection and leak detection geopipe; the joints and alignment along the side slopes shall be true to line and alignment.
- b) The Site CQA Manager shall inspect the installation. The pipe shall be completely free from any cracks and from protruding joint materials, deposits of sand, mortar, dirt, debris or other materials on the inside.
- c) Placement of a geotextile layer will be completed as shown on the Engineering Drawings.

12.0 ENGINEERING CERTIFICATION

An Engineering Certification Report, incorporating the laboratory and field data, shall be submitted by Engineer to the New Mexico Energy, Minerals and Natural Resources Department, Oil Conservation Division confirming that the subgrade, liner, leak detection system and leachate collection system have been installed in compliance with the project specifications and the CQA Plan. The Engineering Certification Report shall be sealed by a Professional Engineer registered in good standing with New Mexico; and who has applicable expertise in landfill liner engineering.