INTEGRATED DISPOSAL FACILITY
APPENDIX ~~4A – SE~~C~~TION~~ 2
CRITICAL SYSTEMS TABLE~~S & DATA SHEETS~~

CHANGE CONTROL LOG

Change Control Logs ensure that changes to this unit are performed in a methodical, controlled, coordinated, and transparent manner. Each unit addendum will have its own change control log with a modification history table. The "**Modification Number**" represents Ecology's method for tracking the different versions of the permit. This log will serve as an up to date record of modifications and version history of the unit.

Modification History Table

Modification Date	Modification Number
03/31/2008	

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INTEGRATED DISPOSAL FACILITY
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APPENDIX ~~4A – SE~~C~~TION~~ 2
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TABLE OF CONTENTS

TABLES

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02315 – Specification for Fill and Backfill

Part 1 – General

Work Included

This section describes placement and testing of fill and backfill in general areas of the site (including stockpiles).

References

The following is a list of standards, which may be referenced in this section:

ASTM INTERNATIONAL (ASTM)

ASTM D75	Standard Practice for Sampling Aggregates
ASTM D422	Standard Test Method for Particle-Size Analysis of Soils
ASTM D698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
ASTM D1140	Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75 micrometer) Sieve
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D2216	Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
ASTM D2922	Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D3017	Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

Definitions

Relative Compaction: Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM D698.

Apply corrections for oversize material to maximum dry density.

Optimum Moisture Content: Determined in accordance with ASTM D698 specified to determine maximum dry density for relative compaction.

Prepared Ground Surface: Ground surface after completion of required demolition, clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and subgrade preparation.

Completed Course: A course or layer that is ready for next layer or next phase of Work.

Lift: Loose (uncompacted) layer of material.

Geosynthetics: Geotextiles, geocomposites, geosynthetic clay liner, or geomembranes.

Well-Graded: A mixture of particle sizes with no specific concentration or lack thereof of one or more sizes.

Does not define numerical value that must be placed on coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters.

Used to define material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

Influence Area: Area within planes sloped downward and outward at 60-degree angle from horizontal measured from:

- 1 foot outside outermost edge at base of foundations or slabs.
- 1 foot outside outermost edge at surface of roadways or shoulder.
- 0.5 foot outside exterior at spring line of pipes or culverts.

Imported Material: Materials obtained from sources offsite, suitable for specified use.

Standard Specifications: When referenced in this section, shall mean Standard Specifications for Road, Bridge, and Municipal Construction, as published by the Washington State Department of Transportation, 2002 edition, English units.

SLDS: Secondary Leak Detection System.

Permanent Stockpile: Stockpile of material that remains at the completion of construction.

Submittals–Approval Required

See Section 01300, SUBMITTALS, for submittal procedures.

Submit gradation test results for all imported materials from independent testing laboratory as specified in paragraph SOURCE QUALITY CONTROL in Part 2.

Stockpile Plan: Prior to any excavation activities associated with construction of the IDF, Construction General Contractor shall submit a Stockpile Plan for approval. The plan shall include the following information:

Scale drawing, using the project plans as a base, which shows the proposed location for stockpiles on the project site. Show all access roads around stockpiles. Address stockpile locations during construction of the IDF and permanent stockpiles, which will remain upon completion of construction activities for this project.

Stockpile layout drawings, which show the estimated location of toe of slope and top of slope for each stockpile. Drawings shall show plan and typical sections and shall be fully dimensioned.

Plan shall show how differing materials encountered during the excavation will be segregated for future use. This includes material for use as topsoil, admix base soil, and operations layer. Also, show a stockpile area for material to be used in the future as clean backfill during landfill operations by the Tank Farm Contractor.

Method by which stockpile compaction will be achieved.

Dust control for the stockpiles during active use and until grass is established.

Placing of topsoil, seeding, fertilizing, and mulching each stockpile after active use of stockpile is finished in accordance with Section 02920, RECLAMATION AND REVEGETATION.

Submittals–Approval Not Required

Information/Record (IR):

Qualifications of independent testing laboratory.

Qualifications of construction quality control personnel.

Construction quality control test reports

Sequencing and Scheduling

Complete applicable Work specified in Sections 02316, EXCAVATION, and 02319, SUBGRADE PREPARATION, prior to placing fill or backfill.

Permit Requirements

A backfill and fill permit is required for each backfill and fill work element. Construction General Contractor shall obtain from Tank Farm Contractor and post before starting backfill and fill work, as specified in Division 1, General Requirements.

Construction Quality Assurance:

The Construction General Contractor shall accommodate all CQA activities described herein and in the CPA Plan for this project. The CQA Plan is made part of these Specifications by reference.

The CQA Certifying Engineer shall determine in-place density and moisture content by any one or combination of the following methods: ASTM D2922, ASTM D3017, ASTM D1556, ASTM D2216, or other methods approved by the Construction Manager.

Testing requirements and locations will be determined by the CQA Certifying Engineer. Construction General Contractor shall cooperate with the CQA Certifying Engineer and testing work by leveling small test areas designated by the CQA Certifying Engineer. Backfill test areas at Construction General Contractor's sole expense. The CQA Certifying Engineer may have any material tested at any time, location, or elevation.

After Construction General Contractor makes repairs to any areas failing a test, the Construction General Contractor shall rerun appropriate tests, subject to the approval of the CQA Certifying Engineer, to demonstrate the area meets specifications, at the Construction General Contractor's sole expense.

The following minimum test schedule shall be assumed. Additional tests may be required as directed by CQA Certifying Engineer.

In-place density tests shall be made on the following minimum schedule:

Earth fill: One per 5,000 square feet (ft^2) per lift.

Structural Fill: One per 2,500 ft^2 per lift.

Subgrade Preparation: Four per acre.

Operations Layer (Outside Edge of Liner): One per 5,000 ft^2 per lift.

Operations Layer Material (SLDS): Two (2) per lift.

Standard Proctor (ASTM D698) laboratory density curves (five-point minimum) shall be performed for each material by the CQA Certifying Engineer. Samples of native materials used for embankment and backfill and samples of imported materials shall be taken at locations as specified by CQA Certifying Engineer.

Gradation tests (sieve analysis) shall be performed in accordance with ASTM D422 on operations layer material obtained from required excavations to demonstrate the materials meet the Specifications. Samples of operations layer material shall be taken from each 10,000 cubic yards of placed material in accordance with ASTM D75.

Part 2 – Products

Earthfill

Excavated material from required excavations and designated borrow sites, free from rocks larger than 4 inches in the greatest dimension, from roots and other organic matter, ashes, cinders, trash, debris, and other deleterious materials.

Structural Fill

Structural fill adjacent to concrete structures shall be as specified in Section 02320, TRENCH BACKFILL, for Pipe Bedding. Structural fill beneath concrete structures and beneath leachate storage tank shall conform to the requirements of Section 9-03.9(3) Crushed Surfacing Top Course in the Standard Specifications.

Operations Layer

Meeting the requirements of earthfill above and having a maximum of 25 percent by weight passing the No. 200 U.S. sieve and a maximum particle size of 2 inches.

Drain Gravel

Material for drain gravel shall conform to the requirements of Section 9-03.12(4) of the Standard Specifications except material shall be subrounded to rounded gravel. Crushed rock and angular gravel shall not be allowed.

Crushed Surfacing

Material for crushed surfacing base course and top course shall conform to the requirements in Section 9-03 9(3) of the Standard Specifications.

Quarry Spalls

Quarry spalls shall consist of broken stone free from segregation, seams, cracks, and other defects tending to destroy its resistance to weather and shall meet the following requirements for grading:

- Maximum Size: 8 inches
- 50 percent by weight shall be larger than 3 inches
- Minimum Size: 3/4 inch

Source Quality Control

Gradation tests performed in accordance with ASTM D422 by a qualified independent testing laboratory shall be made for imported materials on samples taken at place of production prior to shipment. Imported materials shall not be shipped without submittal approval. Samples of the finished product for gradation testing shall be taken from each 2,000 tons of prepared materials in accordance with ASTM D75. Test results shall be submitted to Construction Manager within 48 hours after sampling. Size distribution for imported quarry spalls material shall be determined in accordance with one of the methods described in ASTM D5519.

Base Soil

As specified in Section 02666, ADMIX LINER.

WATER FOR MOISTURE CONDITIONING:

See Section 02200, SITE PREPARATION, for raw water supply availability and requirements for proper compaction.

Part 3 – Execution

General

Keep placement surfaces free of water, debris, and foreign material during placement and compaction of fill and backfill materials.

Place and spread fill and backfill materials in horizontal lifts of uniform thickness as specified in paragraphs BACKFILL UNDER AND AROUND STRUCTURES and FILL, in a manner that avoids segregation, and compact each lift to specified densities prior to placing succeeding lifts. Slope lifts only where necessary to conform to final grades or as necessary to keep placement surfaces drained of water.

Do not place fill or backfill, if fill or backfill material is frozen, or if surface upon which fill or backfill is to be placed is frozen.

Tolerances:

Final Lines and Grades: Within a tolerance of 0.1 foot unless dimensions or grades are shown or specified otherwise.

Grade to establish and maintain slopes and drainage as shown. Reverse slopes are not permitted.

Settlement: Correct and repair any subsequent damage to structures, pavements, curbs, slabs, piping, and other facilities, caused by settlement of fill or backfill material.

Backfill Under and Around Structures

Under Facilities: Backfill with earthfill or structural fill, as shown on the Drawings, for each structure or facility. Place earthfill or structural fill in lifts of 6-inch maximum compacted thickness and compact each lift to minimum of 95 percent relative compaction as determined in accordance with ASTM D698.

Fill

Outside Influence Areas Beneath Structures, Slabs, Piping, and Other Facilities: Unless otherwise shown, place earthfill as follows:

- Allow for 6-inch thickness of topsoil where required.
- Maximum 8-inch thick lifts.
- Place and compact fill across full width of embankment.
- Compact to minimum 95 percent relative compaction.

Replacing Overexcavated Material

Replace excavation carried below grade lines shown as follows:

Beneath IDF Cell: Earthfill as specified herein.

Beneath Fill or Backfill: Same material as specified for overlying fill or backfill.

Beneath Structures and Roadways: Structural fill or earthfill as shown on the Drawings and specified herein.

Topsoil

Place topsoil on areas disturbed by construction and on permanent stockpile slopes in accordance with Section 02920, RECLAMATION AND REVEGETATION.

Stockpiling

Material shall be placed in permanent stockpiles as follows:

Place material in maximum 3-foot lifts and compact with a minimum four passes with earth-moving equipment. Uniformly route hauls truck traffic across the surface of each lift to aid in lift compaction.

Maximum slopes shall be 3H:1V. Minimum slopes shall be 3 percent to promote drainage.

Upper 2 feet of stockpile surface shall be placed in maximum 12-inch thick lifts and compacted to minimum 90 percent relative compaction as determined in accordance with ASTM D698.

Place 6-inch thick layer of topsoil on completed slopes in accordance with Section 02920, RECLAMATION AND REVEGETATION.

Permanent stockpiles shall be seeded, fertilized, and mulched when each stockpile is completed and as directed by the Engineer in accordance with Section 02920, RECLAMATION AND REVEGETATION.

Placing Crushed Surfacing

Place crushed surfacing base course and top course at locations shown on the Drawings. Placement shall conform to Section 4-04.3 of the Standard Specifications.

Thickness of the drain gravel on the cell floor shall be a minimum of 1.0 foot (increase drain gravel thickness in vicinity of LCRS collection and riser pipes as shown on drawings) and tolerances for the top of the drain gravel shall be grade to plus 0.2 foot.

Placing DRAIN GRAVEL and operations layer over geosynthetics:

Place material over geosynthetics as specified in Sections 02371, GEOTEXTILES; 02661, GEOMEMBRANES; and 02667, GEOSYNTHETIC CLAY LINER (GCL).

Compaction requirements for drain gravel on the cell floor, around pipes, and the sumps are specified in Section 02320, TRENCH BACKFILL.

Operations layer within lining system limits, except as specified for SLDS sump area, shall be placed in 12-inch thick lifts and track-walked into place with a minimum two passes with a Caterpillar D6M-LGP or equal. Operations layer material within SLDS sump area shall be placed in 12-inch thick lifts and compacted to 90 percent relative compaction. Operations layer placed outside edge of liner, such as for shine berm, shall be placed in maximum 8-inch thick lifts and compacted to 95 percent relative compaction.

Place material to the lines and grades shown and compact by tracking a minimum two passes with spreading equipment. Thickness of the operations layer shall be a minimum 3 feet and tolerances for top of operations layer shall be grade to plus 0.3 foot.

Quarry Spalls Placement

Quarry spalls shall be placed around the ends of stormwater pipes to provide erosion protection in accordance with the Plans and as directed by the Engineer. Quarry spalls shall be placed in such a manner that all relatively large stones are essentially in contact with each other and voids are filled with the finer materials to provide a well graded compact mass. Finished surface shall be free from irregularities. The stone shall be dumped on the ground in a manner that will ensure the stone attains its specified thickness in one operation. When dumping or placing, care shall be used to avoid damaging the underlying material. Stone shall not be dumped from height greater than 12 inches above surface. Material placement shall be started from the bottom of the installation, working toward edges. Geotextile damaged during the placement of quarry spalls shall be repaired at Construction General Contractor's sole expense.

Construction Quality Control

The Construction General Contractor shall perform in-place density and moisture content tests with own qualified personnel or with a qualified independent testing laboratory as specified in paragraph CONSTRUCTION QUALITY ASSURANCE, to be observed by the Construction Manager, on the following minimum schedule:

Material Placed by Stockpile (Upper 2 Feet): One per 10,000 ft^2 per lift.

Construction General Contractor shall submit qualifications of personnel or independent testing laboratory that will perform construction quality control.

END OF SECTION 0231

02319 – Specification for Subgrade Preparation

Part 1 – General

Work Included

This section describes requirements for preparation of subgrades in areas to receive fill.

References

The following is a list of standards, which may be referenced in this section:

ASTM INTERNATIONAL (ASTM)

ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

Definitions

Optimum Moisture Content: As defined in Section 02315, FILL AND BACKFILL.

Prepared Ground Surface: Ground surface after completion of clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and scarification and compaction of subgrade.

Relative Compaction: As defined in Section 02315, FILL AND BACKFILL.

SLDS: Secondary Leak Detection System.

Subgrade: Layer of existing soil after completion of excavation to grade prior to placement of fill, roadway structure, or base for floor slab.

Proof Rolling: Testing of subgrade as specified herein to identify soft or loose zones requiring correction.

Sequencing and Scheduling

Complete applicable Work specified in Section 02316, EXCAVATION, prior to subgrade preparation.

Construction Quality Assurance

The CQA Certifying Engineer shall determine in-place density and moisture for subgrade preparation as specified in Section 02315, FILL AND BACKFILL, except for prepared subgrade for admix on sideslopes.

CQA requirements for geomembrane subgrade preparation are specified in Section 02661, GEOMEMBRANES.

Part 2 – Products (Not Used)

Part 3 – Execution

General

Keep subgrade free of water, debris, and foreign matter during compaction or proof rolling.

Bring subgrade to proper grade and cross-section as shown on the Drawings, and uniformly compact surface.

Maintain prepared ground surface in finished condition until next course is placed.

Prepared Subgrade for Roadway, Embankment, and Structures

After completion of excavation and prior to foundation, road fill, structural fill, or embankment construction, compact prepared subgrade to 95 percent relative compaction. Scarify and moisture condition subgrade soil as required to achieve specified compaction.

If soft or loose zones are found, correct as specified herein. Proof-roll subgrade with a fully loaded dump truck or equal to detect soft or loose subgrade or unsuitable material.

Landfill Bottom Floor Prepared Subgrade For Admix Liner

Prior to admix liner placement, subgrade shall be back bladed to remove loose soil. Low spots or erosion rills shall be backfilled with structural fill as specified herein. Compact prepared subgrade to 95 percent relative compaction. Scarify and moisture condition subgrade soil as required to achieve specified compaction. If soft or loose zones are found, correct as specified herein. Proof-roll subgrade with a vibratory drum roller or equal to detect soft or loose subgrade or unsuitable material.

Landfill Sideslope (3H: 1V) Prepared Subgrade For Admix Liner

Prior to admix placement, the subgrade shall be back bladed to remove all loose material produced by trimming operations. Low spots or erosion rills shall be backfilled with structural fill as specified herein. The trimmed surface shall be watered so that moisture penetrates a minimum of 3 inches into the subgrade. The trimmed and watered surface shall be track-walked by D6 LGP dozer or equivalent with a minimum 4 passes to produce a firm and stable subgrade. Visual monitoring (no in-place density testing is required) of the subgrade preparation on sideslopes will be performed by the CQA Certifying Engineer.

Prepared Subgrade for Geomembrane (Secondary And SLDS) And Secondary GCl

At completion of SLDS excavation and grading (SLDS geomembrane) or admix liner placement (secondary geomembrane and GCL), prepare the subgrade surface for geomembrane or GCL placement. The surface shall not have holes, depressions more than 1 inch in a 12-inch width, nor protrusions extending above the surface more than 1/2 inch. Roll surface with smooth-drum roller to form a firm stable base. Allow for leachate piping and sumps or features as shown on the Drawings.

Correction

Soft or Loose Subgrade:

Adjust moisture content and compact to meet density requirements, or

Over excavate and replace with suitable material from the excavation, as specified in Section 02315, FILL AND BACKFILL.

Unsuitable Material: Over excavate and replace with suitable material from the excavation, as specified in Section 02315, FILL AND BACKFILL. Dispose of unsuitable material excavation in accordance with Article DISPOSAL OF SPOIL in Section 02316, EXCAVATION.

END OF SECTION 02319

02371 – Table 1. Required Geotextile Properties

Value[a]

Property	Unit	Type 1	Type 2	Test Method
Mass/Unit Area	oz/yd^2	6.0[b]	12.0[b]	ASTM D5261 or D3776
Apparent Opening	U.S. Sieve	70 max opening	—	ASTM D4751
Size[b]		100 min opening		
Grab Strength	lb	140	300	ASTM D4632
Trapezoidal Tear				
Strength	lb	70		110
ASTM D4533				
Puncture Strength	lb	65	135	ASTM D4833
Permittivity	sec^{-1}	1.2	—	ASTM D4491
UV Resistance % strength	(500 hours)	retained 70	70	ASTM D4355

Notes:

[a] All values are minimum average values, except as noted. [b] Nominal values.

02373 – Table 1. Required Geonet Properties

Property	Qualifier	Unit	Value	Test
Polymer Composition	Minimum	% polyethylene	95	—
Resin Specific Gravity	Minimum	N/A	0.92	ASTM D1505
Carbon Black Content	Range	%	2 – 3	ASTM D1603 or D4218
Nominal Thickness	MARV	mils	250	ASTM D1777 or D5199
Nominal Transmissivity(1)	MARV	m^2/sec	3×10^{-3}	ASTM D4716

02373 – Table 2. Required CDN Properties

Property	Qualifier	Unit	Value	Test
Ply Adhesion	ARV	lb/in	1.0	ASTM D413 or GRI GC7
Transmissivity(1)	MARV	m^2/sec	5×10^{-4}	ASTM D4716

Notes:
MARV = Minimum Average Roll Value.
ARV = Average Roll Value.

(1)The design transmissivity is the hydraulic transmissivity of the CDN measured using water at 70 degrees F ±3 degrees F with a hydraulic gradient of 0.1, under the compressive stress of 10,000 psf. Transmissivity value shall be measured between two steel plates 15 minutes after application of the confining stress in the machine direction.

02661 – Table 1. Required Geomembrane Properties 60-Mil Textured HDPE

Specified Property	Qualifier	Unit	Value	Test Method
Physical Properties				
Thickness	min. avg. value	mils	60	ASTM D5994
	minimum		54	ASTM D5994
Specific Gravity	minimum	`N/A	0.932	ASTM D1505
Melt Index	range	g/10 min	<1.1	ASTM D1238 condition 190/2.16
Asperity	min avg. value[1]	mils	10	GRI GM12
Mechanical Properties				
Tensile Properties	(each direction)		(Type IV)	ASTM D638
Strength at yield	min. avg. value	lb/in	120	
Elongation at yield[2]	min. avg. value	%		12
Tear Resistance	min. avg. value	lb	42	ASTM D1004
Puncture Resistance	min. avg. value	lb	80	ASTM D4833
Carbon Black Content	Range	%	2-3	ASTM D1603 or D4218
Carbon Black Dispersion	Minimum[i] 8 of 10	category	1 or 2	ASTM D5596
Environmental Stress				
Crack	minimum[3]	hrs	200	ASTM D5397

[1] Of 10 readings, 8 out of 10 must be greater or equal to 7 mils, and lowest individual reading must be greater or equal to 5 mils. Provide data for both sides of textured geomembrane.

[2] Yield elongation is calculated using a gauge length of 1.3 inches.

[3] Minimum = mean minus 3 standard deviations from documented manufacturer's quality control (MQC) testing.

02661 – Table 2. Required Seam Properties HDPE Geomembranes

Property	Qualifier	Unit	Specified Value	Test Method
Shear Strength[1]	minimum	lb/in width	90% of tensile strength at yield as listed in tables in this section	ASTM D6392
Peel Adhesion	minimum	lb/in width	60% of tensile strength at yield as listed in tables in this section and FTB[2]	ASTM D6392

[1] Also called "Bonded Seam Strength".

[2] FTB = Film Tear Bond (failure occurs through intact geomembrane, not through seam).

Geomembrane Installer's Certification of Subsurface Acceptability

The geomembrane installer, _____
for the Integrated Disposal Facility (IDF), hereby certifies that the supporting prepared subgrade surfaces are acceptable for installation of the HDPE geomembrane lining system, the undersigned having personally inspected the condition of the constructed surfaces. This certification is for the areas shown on Attachment or defined as follows:

_____

_____

_____

_____

The condition of the supporting surfaces in the defined area meets or exceeds the minimum requirements for installation of the geomembrane.

Signed: _____	Signed: _____
Geomembrane Installer	Construction General Contractor
_____	_____
Date Signed	Date Signed

11305-01 – Sump Pump Data Sheet

Tag Numbers: 219A-LH-P-207, 219E-LH-P-207

Pump Locations and I.D.: Buildings 219A and 219E, Combined Sump Pump

Manufacturer and Model Number: (1) Hydromatic Pump Co., Model SB3S
(2) Barnes
(3) Or approved equal

Service Conditions

Liquid Pumped (Material and Percent): Leachate from low-level radioactive waste disposal facility and rain/snow melt

Pumping Temperature (Fahrenheit): Normal: 55 Max: 130 Min: 27

Specific Gravity at 60 Degrees F: 1.0 Viscosity Range: N/A pH: 5.0-9.3

Abrasive (Y/N): (fine/coarse soil particles) Possible Scale Buildup (Y/N): Y

Total suspended solids (mg/L): 200 (estimated)

Largest diameter solid pump can pass (inches): 0.5

Performance Requirements

Capacity (US gpm): Rated: 250
Total Dynamic Head (Ft): Rated: 19
Maximum Shutoff Pressure (Ft): 50
Min. Rated Pump Hydraulic Efficiency at Rated Capacity (%): 50
Max. Pump Speed at Rated Capacity (rpm): 1,750
Constant (Y/N): Y Adjustable (Y/N): N

Design and Materials

Pump Type: Heavy-Duty Nonclog (Y/N) Y

Volute Material: Cast Iron ASTM A48

Pump Casing Material: Cast Iron ASTM A48

Motor Housing Material: Cast Iron ASTM A48

Induction Drive Motor

Horsepower: 0.30 Voltage: 460 Phase: 3 Speed (rpm): 1,750

Service Factor: 1.15 Inverter Duty (Y/N): N

Motor nameplate horsepower shall not be exceeded at any head-capacity point on the pump curve.

Enclosure: Explosion-proof, submersible, Class 1, Div. 1 or Div. 2, Groups C and D

11305-02 – Sump Pump Data Sheet

Tag Numbers: 219A-LH-P-205, 219E-LH-P-205

Pump Locations and I.D.: Buildings 219A and 219E, Floor Sump

Manufacturer and Model Number: (1) Hydromatic Pump Co.
(2) Barnes

Service Conditions

Liquid Pumped: Leachate from low-level radioactive waste disposal facility

Pumping Temperature (Fahrenheit): Normal: 55 Max: 130 Min: 27

Specific Gravity at 60 Degrees F: 1.0 Viscosity Range: N/A pH: 5-9.3

Abrasive (Y/N): Y (fine/coarse soil particles) Possible Scale Buildup (Y/N): Y

Total suspended solids (mg/L): 200 (estimated)

Largest diameter solid pump can pass (inches): 0.5

Performance Requirements

Capacity (US gpm): Rated: 28

Total Dynamic Head (Ft): Rated: 14

Maximum Shutoff Pressure (Ft): 30

Min. Rated Pump Hydraulic Efficiency at Rated Capacity (%): 45

Max. Pump Speed at Rated Capacity (rpm): 1,750

Constant (Y/N): (Y/N):

Design and Materials

Pump Type: Heavy Duty Nonclog (Y/N): Y

Volute Material: Cast Iron ASTM A48

Pump Casing Material: Cast Iron ASTM A48

Motor Housing Material: Cast Iron ASTM A48

Induction Drive Motor

Horsepower: 0.30 Voltage: 460 Phase: 3 Speed (rpm): 1,750

Service Factor: 1.15 Inverter Duty (Y/N): N

Motor nameplate horsepower shall not be exceeded at any head-capacity point on the pump curve.

Enclosure: Submersible

11306-01 Leachate Pump Data Sheet

Tag Numbers: 219A-LH-P-202, 219E-LH-P-202

Pump Locations and I.D.: Cell 1 LCRS Sump, Low Flow

Cell 2 LCRS Sump, Low Flow

Manufacturer and Model Number: (1) EPG Companies; Model WSD 3-3

(2) Or equal

Service Conditions

Liquid Pumped (Material and Percent): Leachate from low-level radioactive waste landfill

Pumping Temperature (Fahrenheit): Normal: 55 F Max: 130 F Min: 27 F

Specific Gravity at 60 Degrees F: 1.0 Viscosity Range: NA pH: 5.0-9.3

Abrasive (Y/N): Y (infrequent fine soil particles) Possible Scale Buildup (Y/N): Y

Total Suspended Solids (mg/l): 200 (estimated)

Performance Requirements at Primary Design Point

Capacity (US gpm): Rated: 13

Total Dynamic Head (Ft): Rated: 66

Min. Hydraulic Efficiency (%): 60

Maximum Shutoff Pressure (Ft): 90

Max. Pump Speed at Design Point (rpm): 3,450

Constant (Y/N): Y Adjustable (Y/N): N

~~Design and Materials~~

~~Design: Wheeled enclosure frame Back Pullout (Y/N): Y~~

~~Discharge Orientation: Center~~

~~Casing Materials: Type 304 SST~~

~~Case Wear Ring (Y/N): NA Material: NA~~

~~Impeller: Type: Closed Material: Type 304 SST~~

~~Impeller Wear Ring (Y/N): Y Material: E-Glide (engineered plastic) or equal~~

~~Shaft Material: Type 304 SST Shaft Sleeve Material: E-Glide or equal~~

~~Shaft Seal: Y Ring Material: E-Glide or equal Lubrication: Fluid~~

~~AFBMA B-10 Bearing Life (Hrs): NA Lubrication: NA~~

~~Drive Type: Direct Coupled~~

~~Induction Drive Motor~~

~~Horsepower: 0.5 Voltage: 460 Phase: 3~~

~~Speed (rpm): 3,450~~

~~Service Factor: 1.15 Inverter Duty (Y/N): N~~

~~Motor nameplate horsepower shall not be exceeded at any head-capacity point on the pump curve.~~

~~Enclosure: Submersible~~

11306-02 Leachate Pump Data Sheet

Tag Numbers: 219A-LH-P-203, 219E-LH-P-203

Pump Location and I.D.: Cell 1 LCRS Sump, High Flow

Cell 2 LCRS Sump, High Flow

Manufacturer and Model Number: (1) EPG Companies; Model WSD 30-4

(2) Or equal

Service Conditions

Liquid Pumped (Material and Percent): Leachate from low-level radioactive waste landfill

Pumping Temperature (Fahrenheit): Normal: 55 F Max: 130 F Min: 27 F

Specific Gravity at 60 Degrees F: 1.0 Viscosity Range: NA pH: 5.0-9.3

Abrasive (Y/N): Y (infrequent fine soil particles) Possible Scale Buildup (Y/N): Y

Total Suspended Solids (mg/l): 200 (estimated)

Performance Requirements at Primary Design Point

Capacity (US gpm): Rated: 155

Total Dynamic Head (Ft): Rated: 118

Min. Hydraulic Efficiency (%): 60

Maximum Shutoff Pressure (Ft): 208

Max. Pump Speed at Design Point (rpm): 3,450

Constant (Y/N): Y Adjustable (Y/N): N

Design and Materials

Design: Wheeled enclosure frame (Y/N): Y

Discharge Orientation: Center

Casing Materials: Type 304 SST

Case Wear Ring (Y/N): NA Material: NA

Impeller: Type: Closed Material: Type 304 SST

Impeller Wear Ring (Y/N): Y Material: E-Glide (engineered plastic), or equal

Shaft Material: Type 304 SST Shaft Sleeve Material: E-Glide (engineered plastic), or equal

Shaft Seal: Y Ring Material: E-Glide or equal Lubrication: Fluid

AFBMA B-10 Bearing Life (Hrs): NA Lubrication: NA

Drive Type: Direct Coupled

Induction Drive Motor

Horsepower: 7.5 Voltage: 460 Phase: 3

Speed (rpm): 3,450

Service Factor: 1.15 Inverter Duty (Y/N): N

Motor nameplate horsepower shall not be exceeded at any head-capacity point on the pump curve.

Enclosure: Submersible

11306-03 Leachate Pump Data Sheet

Tag Numbers: 219A-LH-P-204, 219E-LH-P-204

Pump Locations and I.D.: Cell 1 LDS Sump

Cell 2 LDS Sump

Manufacturer and Model Number: (1) EPG Companies; Model WSD 1.5-3

(2) Or equal

Service Conditions

Liquid Pumped (Material and Percent): Leachate from low-level radioactive waste landfill

Pumping Temperature (Fahrenheit): Normal: 55 F Max: 130 F Min: 27 F

Specific Gravity at 60 Degrees F: 1.0 Viscosity Range: NA pH: 5.0-9.3

Abrasive (Y/N) Y (infrequent fine soil particles) Possible Scale Buildup (Y/N): Y

Total Suspended Solids (mg/l): 200 (estimated)

Performance Requirements at Primary Design Point

Capacity (US gpm): Rated: 4

Total Dynamic Head (Ft): Rated: 65

Min. Hydraulic Efficiency (%): 60

Maximum Shutoff Pressure (Ft): 80

Max. Pump Speed at Design Point (rpm): 3,450

Constant (Y/N): Y Adjustable (Y/N): N

Design and Materials

Design: Wheeled enclosure frame Back Pullout (Y/N): Y

Discharge Orientation: Center

Casing Materials: Type 304 SST

Case Wear Ring (Y/N): NA Material: NA

Impeller: Type: Closed Material: Type 304 SST

Impeller Wear Ring (Y/N): Y Material: E-Glide (engineered plastic) or equal

Shaft Material: Type 304 SST Shaft Sleeve Material: E-Glide or equal

Shaft Seal: Y Ring Material: E-Glide or equal Lubrication: Fluid

AFBMA B-10 Bearing Life (Hrs): NA Lubrication: NA

Drive Type: Direct Coupled

Induction Drive Motor

Horsepower: 0.5 Voltage: 460 Phase: 3

Speed (rpm): 3,450

Service Factor: 1.15 Inverter Duty (Y/N): N

Motor nameplate horsepower shall not be exceeded at any head-capacity point on the pump curve.

Enclosure: Submersible

11312-01 – Horizontal End Suction Centrifugal Pump Data Sheet

Tag Numbers: _____

Pump Name: _____

Manufacturer and Model Number: (1) _____

_____ (2) _____

Service Conditions:

Liquid Pumped (Material and Percent): _____

Pumping Temperature (Fahrenheit): Normal: 55 Max: 130 Min: 27

Specific Gravity at 60 Degrees F: 1.0 Viscosity Range: N/A pH: 5.0-9.3

Abrasive (Y/N): Y (fine soil particles) Possible Scale Buildup (Y/N): Y

Total suspended solids (mg/L): 200 (estimated)

Largest diameter solid pump can pass (inches): .25

Performance Requirements at Primary Design Point

Capacity (US gpm): Rated: 250

Total Dynamic Head (Ft): Rated: 25

Min. Hydraulic Efficiency (%): 75

Maximum Shutoff Pressure (Ft): 40

Max. Pump Speed at Design Point (rpm): 1,750

Constant (Y/N): Y Adjustable (Y/N): N

Design and Materials

ANSI (Y/N): Y Standard (Y/N): Y Design: Frame-mounted (Y/N): Y

Close-Coupled Casing (Y/N): N Back Pullout (Y/N): Y

Discharge Orientation: 12:00 Rotation (view from end coupling): CW

Shaft Seal: Packing (Y/N): N

Mechanical (Y/N): _____

Lubrication: Process Water

Drive Type: Direct-Coupled: _____ Belt _____ Adjustable Speed _____

Induction Drive Motor

Horsepower: _____ Voltage: _____ Phase: _____ Speed (rpm): 1,750

Service Factor: 1.15 Inverter Duty (Y/N): _____

Motor nameplate horsepower shall not be exceeded at any head-capacity point on the pump curve.

Enclosure: Totally enclosed fan cooled

Mounting Type: Horizontal _____ Nonreverse Ratchet (Y/N): _____

Testing

Pump Tests: Factory Functional (Y/N): _____ Field Performance (Y/N): N

Factory Hydrostatic Casing Pressure Test (Y/N): _____

Field Functional (Y/N): _____ Field Performance (Y/N): _____

Field Vibration (Y/N): N

C2.1 INTRODUCTION

This appendix discusses the critical systems at the Integrated Disposal Facility (IDF) dangerous waste management units that comprise Operating Unit Group 11 of WA7890008967, Hanford Facility Resource Conservation and Recovery Act Permit (hereinafter referred to as the Hanford Facility Resource Conservation and Recovery Act [RCRA] Permit).

C2.2 CRITICAL SYSTEMS

Table C2-1 identifies the critical systems at the IDF. Table C2-1 also provides a crosswalk to the applicable construction specification section(s) of Appendix C6, "Construction Specifications," and Appendix C9, "Infrastructure Construction Specification," for each critical system.

Table C2-1 Integrated Disposal Facility Critical Systems

System	Subsystem	2nd Subsystem	Subsystem Description	Reference Drawings [a]	Permit Reference	Section
Liner	Bottom Liner	Operations Layer	3-foot-thick granular soil from IDF Phase I excavation.	H-2-830838-1 H-2-830839-1 H-2-830840-1	Appendix C6, "Construction Specifications"	Section 02315 – Fill and Backfill Sched. A & B
Liner	Bottom Liner	Separation Geotextile (polypropylene)	Type 1 geotextile has a nominal weight of 6 oz/yd^2. Able to retain the soil and prevent the soil from entering the LCRS drain gravel.	H-2-830838-1 H-2-830839-1 H-2-830840-1	Appendix C6, "Construction Specifications"	Section 02371 – Geotextiles Sched. B
Liner	Bottom Liner	Leachate Drain Gravel Layer	1-foot-thick drain gravel with a hydraulic conductivity of at least 10^{-2} cm/sec.	H-2-830838-1 H-2-830839-1 H-2-830840-1	Appendix C6, "Construction Specifications"	Section 02315 – Fill and Backfill Sched. A & B
Liner	Bottom Liner	Cushion Geotextile (polypropylene)	Minimum 12 oz/yd^2; designed to prevent geomembrane puncture.	H-2-830838-1 H-2-830839-1 H-2-830840-1	Appendix C6, "Construction Specifications"	Section 02371 – Geotextiles Sched. B
Liner	Bottom Liner	Textured Primary HDPE Geomembrane	60-mil nominal thickness HDPE.	H-2-830838-1 H-2-830839-1 H-2-830840-1	Appendix C6, "Construction Specifications"	Section 02661 – Geomembranes Sched. B
Liner	Bottom Liner	Internally-Reinforced GCL	Bentonite sandwiched between a woven and 1 non-woven geotextile that are then needle-punched together.	H-2-830838-1 H-2-830839-1 H-2-830840-1	Appendix C6, "Construction Specifications"	Section 02667 –GCL Sched. B
Liner	Bottom Liner	CDN Drainage Layer	Puncture resistant CDN-HDPE interface.	H-2-830838-1 H-2-830839-1 H-2-830840-1	Appendix C6, "Construction Specifications"	Section 02373 –CDN Sched. B
Liner	Bottom Liner	Textured Secondary HDPE Geomembrane	60-mil nominal thickness HDPE.	H-2-830838-1 H-2-830839-1 H-2-830840-1	Appendix C6, "Construction Specifications"	Section 02661 – Geomembranes Sched. B
Liner	Bottom Liner	Low-Permeability Admix Liner	3-foot-thick compacted soil-bentonite layer.	H-2-830838-1 H-2-830839-1 H-2-830840-1	Appendix C6, "Construction Specifications"	Section 02666 – Admix Liner Sched. B
Liner	Side Slope Liner	Operations Layer	3-foot-thick granular soil from IDF Phase I excavation.	H-2-830838-1 H-2-830839-1	Appendix C6, "Construction Specifications"	Section 02315 – Fill and Backfill Sched. A & B

Table C2-1 Integrated Disposal Facility Critical Systems

System	Subsystem	2nd Subsystem	Subsystem Description	Reference Drawings [a]	Permit Reference	Section
Liner	Side Slope Liner	CDN Drainage Layer for LCRS	Puncture resistant CDN-HDPE interface.	H-2-830838-1 H-2-830839-1 H-2-830840-1	Appendix C6, "Construction Specifications"	Section 02373 –CDN Sched. B
Liner	Side Slope Liner	Textured Primary HDPE Geomembrane	60-mil nominal thickness HDPE.	H-2-830838-1 H-2-830839-1 H-2-830840-1	Appendix C6, "Construction Specifications	Section 02661 – Geomembranes Sched. B
Liner	Side Slope Liner	CDN Drainage Layer for LDS	Puncture resistant CDN-HDPE interface.	H-2-830838-1 H-2-830839-1 H-2-830840-1	Appendix C6, "Construction Specifications	Section 02373 –CDN Sched. B
Liner	Side Slope Liner	Textured Secondary HDPE Geomembrane	60-mil nominal thickness HDPE.	H-2-830838-1 H-2-830839-1 H-2-830840-1	Appendix C6, "Construction Specifications	Section 02661 – Geomembranes Sched. B
Liner	Side Slope Liner	Low-Permeability Admix Liner	3-foot-thick compacted soil-bentonite layer	H-2-830838-1 H-2-830839-1 H-2-830840-1	Appendix C6, "Construction Specifications"	Section 02666 – Admix Liner Sched. B
LCRS	Leachate Collection System Piping	Leachate Collection Piping	12-inch diameter HDPE slotted pipe running the length of the cell centerline from south to north, used to convey leachate by gravity to the leachate collection piping and to the LCRS sump area.	H-2-830845-1 H-2-830848-1 H-2-830854-1 H-2-830854-3	Appendix C6, "Construction Specifications"	Section 15021 – HDPE Pipe Sched. B
LCRS	Leachate Transfer Piping	Leachate Collection System Piping	Leachate transfer piping begins with the piping from the pumps in the LCRS sumps to the Crest Pad Building.	H-2-830845-1 H-2-830848-1 H-2-830854-1 H-2-830854-3	Appendix C6, "Construction Specifications"	Section 15021 –HDPE Pipe Sched. B
LDS	Leachate Transfer Piping	Leak Detection System Piping	Leachate transfer piping begins with the piping from the pumps in the LDS sumps to the Crest Pad Building.	H-2-830845-1 H-2-830848-1 H-2-830854-1 H-2-830854-3	Appendix C6, "Construction Specifications"	Section 15021 –HDPE Pipe Sched. B

Table C2-1 Integrated Disposal Facility Critical Systems

System	Subsystem	2nd Subsystem	Subsystem Description	Reference Drawings [a]	Permit Reference	Section
LCRS	Leachate System Pumps	LCRS Pumps	Two submersible pumps are located within the LCRS sump area of each cell above the primary liner. One low-flow pump is required for typical pumping of leachate; a high-flow pump is necessary in the event that a large storm (24-hour, 25-year storm event) exceeds the capacity of the low-flow pump.	H-2-830845-1 H-2-830848-1 H-2-830854-1 H-2-830854-3	Appendix C6, "Construction Specifications"	Section 11306 – Leachate Pumps Sched. B [b]
LDS	Leachate System Pumps	LDS Pumps	Submersible pumps are located within each cell in the LDS sumps, under the primary liner and above the secondary liner.	H-2-830845-1 H-2-830848-1 H-2-830854-1 H-2-830854-3	Appendix C6, "Construction Specifications"	Section 11306 – Leachate Pumps Sched. B [b]
LCRS	Leachate System Pumps	Crest Pad Building Sump Pump	The sump pump removes leachate that accumulates in the Crest Pad Building as a result of unexpected spills or pipe leaks.	H-2-830854-1 H-2-830854-3	Appendix C6, "Construction Specifications"	Section 11305 - Combined and Building Sump Pumps Sched. B [b]
LCRS	Building Systems	Crest Pad Building	The building slab is separated into two portions. The lower portion of the slab is where the piping associated with the leachate pipe is contained, and the higher slab is where the electrical and control equipment is located.	H-2-830854-1 H-2-830854-3	Appendix C6, "Construction Specifications"	Section 03301 – Concrete Sched. A & B Section 07210 – Building Insulation Sched. B Section 09900 – Paint Coating Systems Sched. A & B Section 13122 – Metal Building Systems Sched. B
PICS	Pump Controls and System Instrumentation	PICS	The PICS design identifies level instrumentation, consisting of radio frequency admittance probes and transmitters that enable operators to monitor discrete liquid levels inside the leachate collection tank system.	H-2-830854-1 H-2-830854-3	Appendix C6, "Construction Specifications"	Section 13401 –PICS Sched. B

Table C2-1 Integrated Disposal Facility Critical Systems

System	Subsystem	2nd Subsystem	Subsystem Description	Reference Drawings [a]	Permit Reference	Section
LCT	LCTs	LCTs	The leachate collection tanks are used to store leachate from the disposal cells.	H-2-830869-1 H-2-837964-6 H-2-837973-1 H-2-837973-2	Appendix C6, "Construction Specifications"	Section 13205 – Lined Bolted Steel Liquid Storage Tanks Sched. B
					Appendix C9, "Infrastructure Construction Specifications"	Section 05 12 00 – Structural Steel Framing Section 05 50 00 – Metal Fabrications Section 05 51 19 – Metal Grating Stairs Section 13 34 23.19 – Fabricated Dome Structures Section 31 20 00 – Earth Moving Section 33 05 05.31 – Hydrostatic Testing Section 33 05 31.13 – Polyvinyl Chloride Pressure Pipe Section 33 05 33.23 – Polyethylene Pressure Pipe & Tubing Section 33 05 73 – Polyethylene Manholes Section 33 06 05 – Schedules for Utility Piping

[a]Reference drawings are located in Appendix C3, "Design Drawings."

[b]Section includes pump data sheet.

CDN = Composite drainage net
GCL = Geosynthetic clay liner
HDPE = High density polyethylene
IDF = Integrated Disposal Facility
LCRS = Leachate Collection and Removal System
LCT = Leachate Collection Tank
LDS = Leak Detection System
PICS = Process Instrument Control System

C2.3 REFERENCES

Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901, et seq. Available at: http://www.epa.gov/epawaste/inforesources/online/index.htm.

WA7890008967, Hanford Facility Resource Conservation and Recovery Act Permit, as amended, Washington State Department of Ecology, Richland, Washington, Available at: https://fortress.wa.gov/ecy/nwp/permitting/hdwp/rev/8c/index.html.

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