Permit No.	Scan Date	DIN
1812-INDUS-2008	**March 1, 2016**	**25687**

RECEIVED
February 29, 2016
Solid Waste Section
Asheville Regional Office

OPERATIONS PLAN – REVISION 5
DUKE ENERGY CAROLINAS, LLC – MARSHALL STEAM STATION
INDUSTRIAL LANDFILL NO. 1 – PHASE 1
PERMIT NO. 1812
CATAWBA COUNTY, TERRELL, NORTH CAROLINA

S&ME Project No. 7235-15-027

Prepared for:
Duke Energy Carolinas, LLC
526 South Church Street
Charlotte, North Carolina 28202

Prepared by:

S&ME, Inc.
9751 Southern Pine Boulevard
Charlotte, North Carolina 28273
S&ME Engineering License No. F-0176

February, 2016

NORTH CAROLINA PROFESSIONAL SEAL 033606 ENGINEER STEPHEN J. LOSKOTA
2-29-16

DESCRIPTION OF REVISIONS

The following table provides a brief description of the revisions to the Operations Plan for Phase 1. The Operations Plan was originally submitted to the North Carolina Department of Environment and Natural Resources (NCDENR) in November 2009 and modified as shown in the following table:

Revision	***Date of Document***	***Description of Revisions***
Initial Issue	November 24, 2009	Initial issuance of document.
Revision 1	February 3, 2010	• Revised text to explain that pump systems shall be equipped with visual and audible alarms; • Revised text to require weekly observations to confirm proper LCS and LDS system performance; • Revised text to require annual cleanouts and camera monitoring once every 5 years; and • Incorporated an Operations Quality Assurance Plan as Appendix II.
Revision 2	February 28, 2011	• Revised the operating record keeping requirements; • Removed the "Stormwater Discharge" section; • Added construction and demolition (C&D) waste as an acceptable waste; • Revised text and figures to include chimney drains; • Revised the "Waste and Cover Material Placement" section to better define the requirements for each waste stream; • Revised low level cutoff, high level run-start, and high level activation based on actual leachate levels in the landfill; • Added table to calculate the 30-day monthly volumes for the initial response and action leakage rates; and • Revised sequencing figures.

(Continued on next page)

Revision	***Date of Document***	***Description of Revisions***
Revision 3	August 3, 2011	• Provided general language in regards to filling guidance; • Incorporated a Dust Control Plan as Appendix III; and • Added sand blast material, ball mill rejects, coal waste, and pyrites as acceptable wastes.
Revision 4	September 2015	• Revisions to Operations Plan layout to match the standard Duke Energy Operations Plan template; • Revisions to chimney drain configuration; • Revisions to chimney drain figures; • Revisions to the intermediate cover section text to allow alternative cover on areas inactive for 12 months or more; • Revisions to the waste handling and landfill sequencing section to allow gypsum mining from the landfill to help manage gypsum sales and reuse; • Revisions to the Operations Plan to allow Coal Combustion Residuals (CCR) disposal from other Duke Energy Corporation facilities; • Revisions to the Operations Plan to include vacuum truck waste; • Revisions to the Operations Plan and Construction Quality Assurance Plan to include compaction requirements for CCP material, intermediate soil cover, and final cover; • Revisions to Seeding requirements to include Duke Vegetation Maintenance and Implementation Manual criteria; and • Revise Emergency Action Plan name to Landfill Emergency Response Plan
Revision 5	February 26 2016	• Revisions to Operations Plan to include instructions under operating hours for weekends and holidays; and, • Revisions to the Operations Plan to allow soil material disposal.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1. GENERAL FACILITY OPERATIONS

1.1 Overview

The purpose of this Operations Plan is to provide a plan for the safe and efficient operations of the Marshall Steam Station Industrial Landfill No.1 (ILF). This Operations Plan presents the operational requirements for: 1) General Facility Operations, 2) Operations Management, 3) Erosion and Sedimentation Control, and 4) Vegetation Management along with guidance for Landfill Closure and Required Regulatory Submittals. This Operations Plan was prepared consistent with 15A NCAC 13B .0505 Operational Requirements for Sanitary Landfills rules.

Marshall Steam Station is located in the southeastern portion of Catawba County, North Carolina, adjacent to Lake Norman. The landfill is located on the Marshall Steam Station property to the north of the steam station and approximately one (1) mile east of the intersection of Sherrills Ford Road and Island Point Road. The ILF is owned and operated by Duke Energy Carolinas, LLC (Duke).

1.2 Contact Information

Correspondence and questions concerning the operation of the Marshall ILF1 should be directed to the appropriate entity as follows:

Owner

Duke Energy Carolinas, LLC – Marshall Steam Station
8320 East NC Highway 150, Terrell, NC 28682
(828) 478-7622
Facility Contact: System Owner

State Regulatory Agency

North Carolina Department of Environment and Natural Resources
Division of Waste Management, Solid Waste Section
Asheville Regional Office
2090 US Highway 70, Swannanoa, North Carolina 28778
(828) 296-4500
Permitting Engineer: Larry Frost

1.3 Safety

Landfill operations at the ILF were developed considering the health and safety of the facility's operating staff. The operating staff is provided with site-specific safety training prior to landfill operations, and on-site activities are to be conducted according to the applicable sections of Duke's Safe Work Practices. An Emergency Response Plan (ERP) is included as Appendix I to provide guidance in the event of an on-site emergency at the landfill.

1.4 Access and Security Requirements

The ILF is located entirely within Duke Energy's Marshall Steam Station property limits. Security for the site is currently in place, consisting of fencing, gates, berms, wooded buffers, and security check stations. Unauthorized vehicle access to the site is prevented around the landfill property by security check stations, woods, fencing, gates, and stormwater conveyance features.

The access road to the site is of all-weather construction and will be maintained in good condition. Potholes, ruts, and debris on the road(s) will receive immediate attention in order to avoid damage to vehicles.

1.5 Operating Hours

The ILF is operated seven days a week, as needed. On weekends and holidays when the Landfill Operator may be offsite but when the station wastewater treatment system remains operational, the following conditions apply:

- The Landfill Operator shall place and compact all existing waste in the landfill prior to leaving the site;
- The Landfill Operator shall clearly and visibly indicate the location for weekend clarifier sludge placement in the landfill through use of signs, barrels, or other delineation aid prior to leaving the site;
- Only designated station personnel who are properly equipped and informed shall transport and place clarifier sludge in the landfill during the weekend or holiday;
- A certified Landfill Operator shall be available by phone to address issues should they arise during the weekend or holiday; and
- On the first business day following the weekend or holiday, the Landfill Operator shall incorporate any clarifier sludge placed in the ILF Landfill during the weekend or holiday in accordance with the Operations Plan.

1.6 Signs

A sign providing the landfill permit number and a statement reading "NO HAZARDOUS OR LIQUID WASTE PERMITTED" is posted at the site entrance, and shall be maintained in good condition.

Edge-of-waste markers are installed to delineate the edge of waste. These markers shall be maintained in good condition and remain visible at all times.

1.7 Training

Due to the diversity and nature of job tasks required at the ILF, personnel shall be adequately trained to handle facility operations and maintenance.

The System Owner for Landfill Operations shall have a general understanding of all the tasks required for site operations. Individuals performing the various tasks shall have adequate training for the site-specific tasks they are assigned. Duke shall provide a site-specific training program for facility personnel.

Noteworthy operations and maintenance tasks to be addressed in training include:

- Maintaining accurate records of waste loading (quantitative and qualitative);
- Operating requirements for stormwater segregation from exposed waste areas; and
- Operating and maintaining the leachate collection system (LCS) and leak detection system (LDS).

All training will be documented and training records will be kept on-site. The Station Sponsor for Landfill Operations will conduct Operations Plan training in accordance with the permit requirements.

1.8 Record Keeping

An operating record is to be maintained on-site, including but not limited to the following records:

- Leachate Collection System (LCS) – Periodic Maintenance Documentation;
- Leachate monitoring;
- Stormwater Maintenance and Inspection Logs;
- Erosion and Sedimentation Control Inspection Logs;
- Periodic Landfill Inspection Reports;
- Dust Control Plan Monitoring Worksheets (included in the Dust Control Plan);
- Groundwater Monitoring (and Sampling) Documentation; and
- Operations Plan.

The above records are to be kept in the operating record for the active life of the ILF and the post-closure care period. Information contained in the operating record must be furnished upon request to the North Carolina Department of Environment and Natural Resources Division of Waste Management, Solid Waste Section (Division) or be made available for inspection by the Division. Additional records kept on-site should include:

- Solid waste facility permits;
- Site Suitability Study;
- Permit-to-Construct Application;
- Landfill drawings and specifications;
- Record of the amount of solid waste received summarized on a monthly basis based on scale records;
- Vacuum truck waste logs;
- Regulatory agency inspection reports; and

- Employee training program and records

1.9 Design Drawings

A list of the landfill design drawings is provided in Table 1. The design drawings provide the location of landfill features, landfill construction details, and technical design and construction notes.

Table 1 - Design Drawings

Drawing Number	Title	Drawing Number	Title
C0	Cover Sheet	C17	Estimated Long Term Seasonal High Groundwater
C1	Aerial Photograph	C18	Future Phases Subgrade
C2	Existing Site Conditions	C19	Future Phases Final Cover Plan
C3	Cell 1 & 2 Subgrade Plan	C20	Final Stormwater Management Plan
C4	Cell 1 & 2 LDS Plan	C21	Force Main Plan
C5	Cell 1 & 2 LCS Plan	D1	Liner System Details
C6	Cell 1 &2 Protective Cover Plan	D2	LCS/LDS Details 1
C7	Cell 1 & 2 Interim Cover Plan	D3	LCS/LDS Details 2
C8	Cell 1 & 2 Stormwater Management Plan	D4	LDS Details
C9	Cell 3 & 4 Subgrade Plan	D5	LCS Details
C10	Cell 3 & 4 LDS Plan	D6	E&SC Details 1
C11	Cell 3 & 4 LCS Plan	D7	E&SC Details 2
C12	Cell 3 & 4 Protective Cover Plan	D8	Interim Cover Stormwater Management Details
C13	Phase 1 Interim Cover Plan	D9	Final Cover System Details 1
C14	Phase 1 Stormwater Management Plan	D10	Final Cover System Details 2
C15	Phase 1 Borrow/Stockpile Area Plan	D11	Cross Sections
C16	Estimated Top of Bedrock		

2. OPERATIONS MANAGEMENT

The primary objective of operations management at the ILF is to dispose of waste material in compliance with permit conditions while operating in a safe manner. The landfill development will be sequenced in phases as indicated on Figure 1. The Facility's final closure grading plan is presented on Figure 2. Landfilling operations will generally proceed from the north towards the south by the use of phases. In general, waste placement will be performed in 10-foot lifts with operations usually being focused within a particular cell area. Intermediate and final cover will be placed as appropriate. Soil diversion berms will be used to collect and divert the non-contact stormwater runoff from exterior landfill slopes to areas where the runoff will be directed to the inactive ash basin, and ultimately to the active ash basin or future planned basin or future planned basin. When the desired waste elevations are obtained within the cell, waste placement will move to the next cell where the process will be repeated.

2.1 Waste Handling and Landfill Sequencing

2.1.1 Landfill Capacity

The ILF is comprised of phases, which are further subdivided into cells. Phase 1 of the landfill consists of Cells 1, 2, 3, and 4. The ILF Phase 1, Cells 1 and 2 was permitted to operate on March 7, 2011.

The ILF is designed to receive waste at an annual disposal rate of 375,000 tons per year. Assuming an in-place waste density of 75 lb/ft^3 (1 tons/yd^3), the annual disposal rate is 375,000 cubic yards per year. The landfill capacity was estimated using the proposed grading and closure plans in conjunction with the anticipated annual disposal rates. The resulting airspace between the protective cover and the proposed top of waste and the landfill life for Phases 1 through 5 is estimated to be 45.9 years as represented in Table 2 below.

Table 2 - Landfill Expansion Life Estimation

Phase Number	Phase Footprint Approximate Area (Acres)[1]	Estimated Airspace Available for Waste Disposal (CY)	Estimated Lifetime (Years)
Phase 1	35.3	3,909,079	10.4
Phase 2	17.9	3,314,285	8.8
Phase 3	16.5	3,622,485	9.7
Phase 4	14.5	3,001,089	8.0
Phase 5	18.3	3,382,997	9.0
Total	102.5	17,229,935	45.9

Notes:
1. Within the limit of waste of the respective phase and rounded to the nearest tenth of an acre.

2.1.2 Waste Acceptance, Disposal, and Screening Requirements

The Marshall ILF is permitted to accept Coal Combustion Residuals (CCRs) (including fly and bottom ash, pyrites, and coal mill rejects) generated at Duke Energy Corporation facilities. The Marshall Steam Station generated waste includes the following:

- Gypsum produced during the Flue Gas Desulfurization (FGD) process;
- FGD clarifier sludge;
- Waste limestone material, boiler slag, and sand blast material;
- Ball mill rejects;
- Waste water treatment sludge; and,
- Soil material that contains any of the above material and soil used for operations

The landfill owner or operator shall notify the Division within 24 hours of attempted disposal of any wastes the landfill is not permitted to receive.

At a minimum, hazardous waste, yard waste, liquid wastes, regulated medical waste, sharps not properly packaged, polychlorinated biphenyls (PCB) waste as defined in 40 Code of Federal Regulations (CFR) 761, and wastes banned from disposal in North Carolina by General Statute 130A-309.10(f), must not be accepted at the landfill.

Asbestos waste will not be disposed of in the ILF.

The removal of waste from the landfill is prohibited without owner approval. See section 2.1.6 - Waste Placement for storage and removal (mining) of gypsum. Waste will be hauled and disposed of by dedicated and consistent operators from the waste source to the landfill. Access to the interim waste storage locations (ie: fly ash silos, gypsum storage areas, etc), haul roads, and landfill are restricted; therefore, no screening of waste is recommended.

2.1.3 Dust, Litter, Odor, and Vector Control

Litter, odors, and vectors are not anticipated to be concerns at the ILF. The waste placed in the landfill does not attract vectors, and wind blown material is not anticipated to be a problem. Odors are typically not a problem at Coal Combustion Products (CCP) waste landfills.

Dust control is addressed in the Dust Control Plan included as Appendix III. Generally, dust control measures will be implemented when necessary, and will include at a minimum watering of dusty roads and exposed work areas. Other measures include physical measures such as fencing and/or berms, temporary covers such as tarps, spraying dust suppressants, and modifying the active work area. Additionally, intermediate cover will be vegetated as soon as practical in order to minimize the blowing of dust on-site.

2.1.4 Fire Control

No open burning shall be permitted at the ILF. There are limited explosive gas concerns with aforementioned permitted waste types; therefore, the threat of fire is considered to be minimal.

Although it is unlikely, if a fire occurs at the landfill, the Station Control Room (phone number: 828-478-7521) shall be notified, and equipment and stockpiled soil shall be provided to control accidental fires. Marshall Steam Station will notify the local fire department, which will be immediately dispatched to assist with fire control. Any fire that occurs at the landfill shall be reported to the Division within 24 hours and a written notification will be submitted within 15 days by the Station Sponsor for Landfill Operations.

2.1.5 Landfill Sequencing

The Marshall ILF will be developed in sequence from Phase 1 through Phase 5. Each phase has approximately nine years of life; however, more than one phase may be operational at a time. The phases may also be subdivided into cells which could be constructed sequentially or at the same time.

Contact leachate should be contained within the landfill. In order to effectively manage leachate, the waste shall initially be placed from up-gradient to down-gradient to promote drainage. The landfill surface shall be graded to promote surface water drainage to the contact water collection system. No waste shall be placed in standing water.

The attached landfill sequencing Figure 1 through Figure 8 illustrate possible sequences of operations. The actual filling sequence, fill heights, and grades may be modified at the Owner's discretion.

2.1.6 Waste Placement

2.1.6.1 Fly Ash, Bottom Ash, and FGD Gypsum

Fly ash, bottom ash, and FGD Gypsum shall be compacted using compactors and dozers in approximate 1-foot lifts to achieve a vertical operational lift thickness of 10 feet.

In order to protect the liner system and leachate components, gypsum placed in the active landfill with the potential of future mining, will be stored in designated areas with a minimum separation of:

- horizontal: 50'-0" from the landfill side slope or anchor trench
- vertical: 10'-0" vertical separation from the top of protective cover (drainage layer). The vertical separation layer typically consists of ash or other waste material.

2.1.6.2 FGD Clarifier Sludge, Coal Mill Rejects, Waste Limestone Material, Boiler Slag, Sand Blast Material, Ball Mill Rejects, Coal Waste, Wastewater Sludge, and Pyrites

FGD clarifier sludge, coal mill rejects, waste limestone material, boiler slag, sand blast material, ball mill rejects, coal waste, wastewater sludge, and pyrites will be spread in 6-inch lifts in the center of the operational area and shall not be placed within 25 feet of the exterior slopes. FGD clarifier sludge shall be blended with the other waste (i.e. ash) prior to placement of the next fill lift. FGD clarifier sludge, coal mill rejects, waste limestone material, boiler slag, sand blast material, ball mill rejects, coal waste, and pyrites shall be compacted as densely as practical and specific monitoring. In-place density testing of these materials is not required.

2.1.6.3 Vacuum truck waste

Vacuum trucks are used to remove waste materials from the plant areas that consist of various permitted CCP. The origin of the vacuum truck waste materials is typically from various sumps, catch basins, wheel wash stations, and coal pile sumps located within the plant.

The moisture contents of the vacuum truck waste materials may vary considerably with the waste varying in consistency from a relatively dry state to a wet, fluid-like state depending on the amount of liquid present in the sumps or vacuumed areas.

CCP material transported via vacuum truck will occur in a vacuum truck dedicated to Duke Energy operations or documentation will be obtained to ensure that the vacuum truck contains no human or other non-permitted waste streams. Vacuum truck waste could also mean similar waste material transported in smaller water tight units.

Vacuum truck waste shall consist of permitted waste materials. Non-permitted waste materials inadvertently included with the vacuum truck waste including but not limited to yard trash (paper, plastic, wood, aluminum, Styrofoam, etc.) shall be visually screened and immediately removed from the vacuum truck waste after the waste material is dumped in the operational area by vacuum contractor.

The consistency of the vacuum truck waste may vary from a relatively dry state to a relatively wet, fluid-like state. Vacuum truck waste material shall be moisture conditioned by initial decanting excess moisture from the waste or by mixing the waste with fly ash, bottom ash, or gypsum materials depending on its consistency. The vacuum truck waste shall be placed and spread in maximum 6-inch lifts near the center of the operational area. The vacuum truck waste shall not be placed within 50 feet horizontally from exterior landfill slopes or within 50 feet of chimney drain structure locations. The vacuum truck waste material shall be thoroughly mixed with fly ash, bottom ash, or gypsum material during waste placement using a dozer or other similar grading equipment to provide additional moisture conditioning prior to compaction. In-place density testing of the vacuum truck waste materials is not required.

The vacuum contractor shall coordinate vacuum truck waste placement with landfill operator personnel and the vacuum truck waste disposal will be documented.

Dust control measures shall be provided for the vacuum truck waste in accordance with the Dust Control Plan outlined in Appendix III.

2.1.7 Compaction Requirements

The waste stream was assumed, for design purposes, to be comprised predominantly of fly ash. Should the waste stream change at some time during operations, the design slope stability analyses must be reviewed for the changed conditions. No quality assurance testing is specified for bottom ash, FGD gypsum, asbestos, FGD clarifier sludge, coal mill rejects, waste limestone material, boiler slag, construction and demolition waste, land clearing and inert debris, sand blast material, ball mill rejects, coal waste, pyrites, or vacuum truck waste provided that these materials compose less than 15% of the monthly total waste tonnage. These wastes shall be placed and compacted as densely as practical.

Quality assurance monitoring and testing is proposed for fly ash, intermediate soil cover, and final soil cover placed on exterior slopes and soil berms at final grades. Fly ash, intermediate cover, and final cover shall be placed and compacted in accordance with the quality assurance plan requirements outlined in Appendix II.

2.1.8 Cover Requirements

2.1.8.1 Operational Cover – Other Wastes

Operational cover, consisting of soil, will be applied as needed for dust control and stormwater management. The operational cover may be applied at a thickness suited to its purpose. For example, the operational soil cover may be applied in thinner layers to provide dust control and it may be applied in thicker layers where protection from surface erosion is desired. Operational soil cover is not required, provided the Dust Control Plan included as Appendix III is followed.

2.1.8.2 Intermediate Cover

A 12-inch thick intermediate cover layer shall be placed on exterior slopes and areas where final grades have been reached. Intermediate cover material shall be free of protruding roots, stumps, and debris. Intermediate cover may not contain more than 5 percent gravel (particle sizes larger than 0.5 inches) by weight as determined by ASTM D422. Isolated rock fragments not exceeding 6 inches in diameter may be placed within the intermediate cover if completely surrounded by compacted soil if approved by the Engineer. Rock fragments shall not protrude more than 3 inches from the compacted intermediate cover fill surface. Soil shall be placed in maximum 6-inch thick compacted lifts. Intermediate cover will be seeded within 7 days in accordance with Erosion and Sediment Control requirements. Vegetation shall be removed and the intermediate cover soil shall be scarified or removed prior to placing any overlying waste.

For areas where waste placement will be inactive for 12 months or more within interior landfill areas (excluding exterior slope area), intermediate soil cover is not required, provided the Dust Control Plan included as Appendix III is followed.

2.1.8.3 Final Cover

The final cover system for the Marshall ILF will be completed within 180 days following the beginning of closure activities unless otherwise approved by the Division.

The final cover will consist of (from the bottom up) intermediate cover (on top of the waste), 40-mil thick double-sided textured linear low density polyethylene (LLDPE) geomembrane, a geocomposite drainage layer, 18-inch thick compacted soil cover, and 6-inch thick vegetative cover. Alternatively, the geosynthetic components may consist of a 50-mil LLDPE structured geomembrane and an 8 oz/sy non-woven geotextile. Should grading be required prior to closure, the final cover system (beginning with LLDPE geomembrane) may be installed directly on waste.

The vegetative layer will consist of on-site soil suitable for maintaining grass cover and controlling erosion. Surface water that percolates through the vegetative layer and 18-inch thick compacted soil layer will be collected by the geocomposite drainage layer or the structured geomembrane alternative. The cover system stormwater management structures will collect both infiltration and surface water runoff. The final cover will be vegetated with native grasses within six months following closure.

2.2 Leachate and Stormwater Management

The leachate collection system (LCS) consists of a geocomposite drainage layer and a header pipe that provides gravity drainage of the leachate to sumps. From the sumps, the leachate is pumped by force main to the active ash basin or future planned basin to replace the active ash basin which discharges in accordance with the Marshall Steam Station plant's existing National Pollutant Discharge Elimination System (NPDES) permit.

Stormwater runoff from the landfill will be directed via a system of rain gutters, tack-on benches, road ditches, downchute piping, and direct runoff to perimeter ditches surrounding the landfill limits. The perimeter ditches discharge to the inactive ash basin, and ultimately to the active ash basin on the south side of the landfill. Final and interim stormwater management drawings are contained within the Permit to Construct Application.

During initial operations within the non-active cells, a geomembrane raincover may be used to reduce leachate generation and protect against erosion of the liner system protective cover layer prior to operations. The collected water can then be pumped into the active ash basin or future planned basin. The stormwater collection and conveyance system shall be checked regularly and maintained such that necessary repairs will be made as early as practical.

2.3 Leachate Collection System (LCS)

The leachate collection system has been designed to meet the performance criteria of providing less than 1 foot of leachate head on the liner system under normal operating conditions and conveying contact water run-off generated by the 25-year, 24-hour storm event. The leachate collection system generally consists of the following components:

- Leachate collection system pipes within the landfill;
- Sumps at the low points of each phase of the landfill; and
- Force main and appurtenant structures (pumps, valves, etc.).

Each landfill cell is equipped with leachate collection system (LCS) pipes located directly above the geocomposite drainage layer that collect infiltration and chimney drain flows. The LCS pipes convey leachate and contact stormwater flows by gravity to collection sumps for removal. Clean-outs have been provided at the ends of the leachate header pipes in the event that the leachate collection and removal pipes become clogged.

Chimney drains have been installed in each cell and shall be extended vertically along with the placement of each lift. Each chimney drain comprises a vertical, perforated HDPE riser pipe surrounded by filter aggregate. At the base of the chimney drains, the riser pipe connects to a distribution pipe which conveys the flow from the riser pipe into the LCS, via infiltration through a constructed layer of drainage material. The chimney drain concept is illustrated in Figures 10 through 13. During operations, chimney drains may be modified with pipe fittings to allow the chimney drain pipe to drain contact water from the active face.

Sumps are located at the low point of the landfill cells. From the sumps, leachate is conveyed to the leachate force main via side slope risers and pumps and ultimately to the active ash basin.

The general operation required to begin waste placement includes the activation of the LCS. This task is accomplished by removing and replacing the sacrificial geotextile filter in the sump area. LCS activation within each cell shall be performed by or under the direct supervision of Duke. LCS activation shall be documented and filed in the facility operation records.

The LCS sump shall be equipped with a dedicated pump system. The LCS pump system contains one low-flow pump and one high-flow pump. The pump system shall operate automatically based on level switches with a low level cutoff and high level run-start activations. Additionally, a high level alarm shall be in place which will also have a high level activation. See the table below for LCS specific sump operations levels. The LCS system control panels will be equipped with visual and audible alarms programmed to activate at the programmed sump liquid level. The alarms will be equipped with a test function.

Pump	Low level cutoff	High level run-start	High level alarm activation
Low-flow	7 inches	17.5 inches	64 inches
High-flow	22 inches	39 inches	

2.3.1 LCS Maintenance

The maintenance of the leachate management system's physical facilities (consisting of high-density polyethylene (HDPE) piping, sumps, and pumps) and records will be performed by or under the direct supervision of Duke. Visual observations of the LCS system performance will be made monthly by Duke staff to verify that the LCS is performing properly.

Clean-out pipes are located on the LCS leachate lateral and header pipes. LCS pipes will be cleaned out by the use of a clean-out snake or high-pressure water flushing at least once a year, and the LCS piping will be remote-camera monitored at least once every 5 years. The frequency of clean-out and camera inspections may be modified based on consecutive inspection results and observed operating conditions.

2.3.2 LCS Record Keeping and Sampling

Records will be maintained documenting the leachate line cleanout and camera monitoring. Leachate from the LCS system will not be sampled on a routine basis. Leachate from the LCS system will be sampled semiannually from dedicated sample ports located on the LCS system. The following constituents will be analyzed for semi-annually:

Temperature	Arsenic	Barium
Boron	Cadmium	Chloride
Chromium	Copper	Fluoride
Iron	Lead	Manganese
Mercury	Nickel	Nitrate
pH	Selenium	Silver
Sulfate	Zinc	Total Dissolved Solids

2.3.3 Contingency Plan

In the unlikely event that leachate cannot be drained to the active ash basin or future planned basin, leachate will be temporarily stored within the landfill until such time that draining operations to the active ash basin can be restored. In such an event, the Division shall be notified in writing, within 30 days, about the events and corrective actions taken.

2.4 Leak Detection System (LDS)

A leak detection system (LDS) has been incorporated into the design of the landfill. The LDS consists of a secondary 60 mil HDPE liner system overlain by a secondary geocomposite drainage layer connected to an LDS sump. Flow collected in the sump will be transferred to the active ash basin or future planned basin via the leachate force main.

The LDS sump shall be equipped with a dedicated pump system. The LDS pump system contains one low-flow pump. The LDS pump system shall operate automatically based on level switches with a low level cutoff and a high level run-start activation. Additionally, a high level alarm shall be in place which will also have a high level activation. See the table below for LDS specific sump operations levels. The LDS system control panels will be equipped with visual and audible alarms programmed to identify sump liquid levels. The alarms will be equipped with a test function.

Pump	Low level cutoff	High level run-start	High level alarm activation
Low-flow	6 inches	18 inches	36 inches

The LDS has been designed with an Initial Response Leakage Rate (IRLR) of 300 gallons per acre per day and an Action Leakage Rate (ALR) of 500 gallons per acre per day. Should fluid collected in the LDS exceed the IRLR or ALR based on routine flow meter readings, the owner or operator shall take steps as indicated in the facility's leachate Response Action Plan presented in Section 2.4.3.

The management of the leak detection system's physical facilities (consisting of piping and flow meters) and monitoring records will be performed by or under the direct supervision of Duke.

2.4.1 LDS Maintenance

The maintenance of the leachate management system's physical facilities (consisting of high-density polyethylene (HDPE) piping, sumps, and pumps) and records will be performed by or under the direct supervision of Duke. Visual observations of the LDS system performance will be made monthly by Duke staff to verify that the LDS is performing properly.

Clean-out pipes are located on the LDS leachate lateral and header pipes. LDS pipes will be cleaned out by the use of a clean-out snake or high-pressure water flushing at least once a year, and the LDS piping will be remote-camera monitored at least once every 5 years. The frequency of clean-out and camera inspections may be modified based on consecutive inspection results and observed operating conditions.

2.4.2 Record Keeping and Monitoring

Flow will be measured at the discharge of the LDS sump by a totalizing flow meter. The facility shall maintain records of monthly flow rate data from the LDS sump from the activation of the cell drainage system and until the waste height reaches approximately 40 feet. From that point, flow rate data shall be collected on a quarterly basis until landfill closure.

During the post-closure care period, semi-annual monitoring is required. If the liquid level in the sump stays below the pump high level run-start (no pump flow) for more than 1 year, then flow rates can be recorded annually. However, if at any time during post-closure care the pump high level run-start level is exceeded on the semi-annual or annual

schedules, the facility must return to monthly monitoring, until such time as the liquid level remains below the pump high-level run start activation level for two consecutive months.

The purpose of LDS monitoring is to monitor if the leakage rates have been exceeded. Specific leakage rates are identified in Section 2.4.3. To determine if exceedances of the leakage rates have occurred, the facility must convert monitored data to an average daily flow rate for the cell (in gallons per acre per day, gpad). For example, the average daily flow rate in gpad is equal to the total monthly flow rate divided by the number of days in the month, divided by the area of the cell in acres. For calculation purposes, cell areas are summarized for Cells 1 through 4 in the table below.

Cell	Areas
Cell 1	9.9 acres
Cell 2	9.6 acres
Cell 3	7.2 acres
Cell 4	9.1 acres

If a leakage rate is exceeded, then the Division must be notified as set forth in the Response Action Plan presented in Section 2.4.3.

2.4.3 Response Action Plan

The purpose of the Response Action Plan is to describe the necessary course of action in the event the Initial Response Leakage Rate (IRLR) and/or the Action Leakage Rate (ALR) are exceeded. If the IRLR is exceeded, steps 1 through 4 will be followed. Should the ALR also be exceeded steps 1 through 6 will be followed. The IRLR and ALR are referenced collectively as "leakage rates" in the following Response Action Plan steps.

The IRLR is 300 gallons per acre per day.

The ALR is 500 gallons per acre per day.

Monthly IRLR and ALR flow volumes are calculated in the table below, assuming a 30-day month.

Cell	Areas	IRLR (Daily Rate Per Acre)	IRLR (30-Day, Monthly Volume in Gallons)	ALR (Daily Rate Per Acre)	ALR (30-Day, Monthly Volume in Gallons)
Cell 1	9.9 acres	300 gallons per acre per day	89,100	500 gallons per acre per day	148,500
Cell 2	9.6 acres		86,400		144,000
Cell 3	7.2 acres		64,800		108,000
Cell 4	9.1 acres		81,900		136,500

If the monthly volumes exceed those for the IRLR and the ALR listed in the table above, the response action steps will include:

Step 1 (IRLR and ALR):
Review physical equipment (pump and flow meter) function and data to confirm flow readings. Review operations to evaluate where operating equipment may have contacted the landfill liner or how landfill operations may have influenced the exceedance.

If the exceedance is confirmed, the cell LDS flow shall be recorded daily. If the daily monitored LDS flow continues to exceed the initial leakage rate, operational responses may include: the reduction of active face area; grading to provide improved drainage; and/or, the addition of intermediate soil cover.

Step 2 (IRLR and ALR):
Within 14 days of identifying that the leakage rate has been exceeded, the facility shall contact the Division in writing. Daily LDS flow recording shall continue. If none of the daily measured LDS flow rates exceed the leakage rate within 14 days of initial identification of the exceedance, monthly LDS flow averaging shall resume.

Step 3 (IRLR and ALR):
Within 30 days of identifying that a leakage rate has been exceeded, the facility shall submit to the Division a written preliminary assessment which shall include at a minimum:

- the amount of the liquid exceedance including initial measurement and daily measurements, if necessary, to date;
- likely sources of the liquids;
- the possible leak location;
- the possible leak size;
- the probable cause of the leak; and
- an outline of the short-term actions being taken and planned.

Step 4 (IRLR and ALR):
To the extent practicable, evaluate the location, size and cause of the leak; and assess the potential for leakage escaping into the environment and its mobility. Leachate quality shall be sampled, including a chemical analysis of LDS fluids, to evaluate potential hazards (pH and RCRA metals).

Step 5 (ALR Only):
When the ALR is exceeded, establish whether or not the unit should be closed or receipt of waste should be curtailed; and conclude whether waste should be removed from the unit for inspection, engineered controls, or repair of the liner and drainage system. Evaluate and prepare to implement what other short-term or long-term measures shall be taken to mitigate or stop any leaks according to the stage (early operations, middle operations, or closed) of landfill development..

Step 6 (ALR Only):
Within 60 days of identifying that the ALR has been exceeded, submit to the Division the results of the evaluation performed in Step 4, any actions taken according to Step 5, and any further measures planned. For as long as there is an exceedance of the action leakage rate, the owner or operator shall submit monthly reports to the Division summarizing the results of the remedial actions taken and further actions planned.

2.5 Stormwater Collection Conveyance

Stormwater that does not come in contact with waste will be treated as non-contact water. Non-contact water will be managed separately from contact water and may be used for dust control or other operational purposes. The stormwater collection system has been designed to pass the 50-year, 24-hour storm event, and generally consists of the following components:

- Tack-on benches;
- Downdrains; and
- Perimeter ditches.

Intermediate cover will be placed over waste at the exterior side slopes. Tack-on benches will be placed to convey non-contact surface water from the exterior side slopes to downdrains. The tack-on benches and downdrains will be constructed and extended as operations progress.

The downdrains discharge to perimeter ditches, which in turn discharge to the inactive ash basin, and ultimately to the active ash basin or future planned basin.

Stormwater collection and conveyance measures will be checked regularly and maintained such that necessary repairs can be made as early as practical.

2.5.1 Stormwater Discharge

The stormwater system at the landfill was designed to assist in prevention of the discharge of pollutants. Landfill operation shall not cause a discharge of pollutants into waters of the United States, including wetlands, that violates any requirement of the Clean Water Act, including, but not limited to NPDES requirements, pursuant to Section 402. In addition, under the requirements of Section 404 of the Clean Water Act, the discharge of dredged or fill material into waters of the state that would be in violation of the requirements shall not be allowed by landfill operations.

Operations at the landfill shall not cause the discharge of a non-point source of pollution to waters of the United States, including wetlands, that violates any requirement of an area-wide or statewide water quality management plan that has been approved under Section 208 or 319 of the Clean Water Act, as amended.

2.6 Landfill Gas Management

Because the nature of the waste to be placed in the Marshall ILF, the Owner does not anticipate tha methane or hydrogen sulfide gas will be generated or that odor will be an issue during operations. Therefore, landfill gas monitoring and management is not proposed.

3. EROSION AND SEDIMENTATION CONTROL

Erosion and sedimentation control (E&SC) during landfill operations will consist of monitoring and repairing E&SC stormwater conveyance features and surface erosion as defined in this Operations Plan and the active Erosion and Sediment Control Plan.

3.1 E&SC Measures Monitoring and Maintenance

Erosion control principles include:

- Disturbing as little area as practical at any one time for landfilling operations.
- Seeding/mulching of disturbed areas commencing as soon as practically possible. Employing erosion control matting or seeding and mulch on steep slopes and other erosion prone areas.
- Use of earthen berms, hay bales, wattles, silt fences, riprap, or equivalent devices downgradient of disturbed areas, stockpiles, drainage pipe inlets and outlets, and at intervals along grassed waterways, until such time as permanent vegetation is established.
- Placement of riprap at the inlets and outlets of stormwater piping.

Channels shall be observed for damage after each runoff event. Riprap-lined channels and outlet protection aprons used to prevent damage to channel vegetation shall be observed for washouts. Riprap shall be added to these areas, as needed, to maintain the integrity of the structure.

Embankment slopes shall be periodically observed for erosion. The embankment slopes shall be mowed at least once a year. The embankment slopes shall be refertilized in the second year unless vegetation growth is fully adequate. Damaged areas shall be reseeded, fertilized and mulched immediately. Seeding, fertilizing, and mulching shall be in accordance with the North Carolina Erosion and Sedimentation Control Guidelines and in accordance with the active Erosion and Sediment Control Permit.

Ground stabilization shall be performed within 7 calendar days on perimeter areas and slopes greater than 3H:1V. Ground stabilization shall be performed within 14 calendar days in other areas. Seedbed preparation, seeding, soil amendments, and mulching for the establishment of vegetative ground cover will be applied in accordance with North Carolina Erosion and Sedimentation Control Guidelines.

Prior to landfill closure, E&SC features will be checked monthly or at a minimum after every significant rainfall event. Sediment will be removed from structures to their original dimensions when conditions are warranted. Necessary repairs shall be made as soon as practical. Riprap-lined channel sections and outlet- protection aprons will be checked for washouts periodically. Riprap will be added to these areas as needed to maintain the integrity of the structure.

3.2 Surface Erosion Monitoring

Adequate erosion control measures shall be established to help prevent sediment from leaving the site. Channels will be observed once every seven days and within 24 hours after any rainfall event of 0.5 inches or greater.

Slopes will be periodically checked for erosion and vegetative quality, fertilized, and mowed. A slope or portion thereof shall be identified as needing maintenance if it meets any one of the following conditions:

- Exposed waste on exterior slopes;
- Areas of cracking, sliding, or sloughing; or
- Areas of seepage.

Slopes identified as needing maintenance shall be repaired as soon as practical and as appropriate to correct deficiencies. Repair activities may include re-dressing the slope, filling in low areas, and/or seeding.

4. VEGETATION MANAGEMENT

Within six months after final termination of disposal operations at the site, the area shall be stabilized with vegetation as required by design drawings and *Closure/Post-Closure Plan*. Temporary seeding will be applied, as required.

Temporary erosion control measures may be required until permanent cover is established. Mulching, until a vegetative cover is established, can stabilize areas where final grades have been reached. Soil mulching can be achieved using wood chips, straw, hay, asphalt emulsion, jute matting, and synthetic fibers. Mulches allow for greater water retention; reduce the amount of runoff; retain seeds, fertilizer, and lime in place; and improve soil moisture and temperature conditions.

4.1 Temporary Seeding

Temporary seeding will be applied as follows (source: *NC Erosion and Sediment Control Planning and Design Manual* [June 2006, Revised March 2009]) and the current Duke *Vegetation Maintenance Implementation Plan (VMIP)* (June 2014, Revision 1):

LATE WINTER TO EARLY SPRING

Seeds	Pounds Per Acre	Dates of Planting
Rye (grain)	125	January - April
Annual Rye	50	January - April

Note: Lespedeza is not to be used for temporary or permanent seeding applications.

SUMMER

Seeds	Pounds Per Acre	Dates of Planting
German millet	50	May - August

FALL

Seeds	Pounds Per Acre	Dates of Planting
Rye (grain)	125	August - December

4.2 Permanent Seeding

Permanent seeding will be applied as follows (source: NC *Erosion and Sediment Control Planning and Design Manual* [June 2006, Revised March 2009] and the current Duke *Vegetation Maintenance Implementation Plan (VMIP)* (June 2014, Revision 1):

Seeds	Pounds Per Acre	Dates of Planting
Kentucky 31 Tall Fescue	150	September - April
Rye (grain)	50	September - April
German Millet	50	May - August

Note: Conduct North Carolina Department of Agriculture Soil Test(s). Apply fertilizer and lime pursuant to soil sampling and testing results. Apply minimum 4,000 pounds per acre of straw mulch. Protect steeper slopes (3:1 horizontal to vertical or steeper with erosion control matting. Water (if available), monitor, and maintain.

4.3 Soil Amendments

Soil amendments will be applied as follows (source: NC *Erosion and Sediment Control Planning and Design Manual* [June 2006, Revised March 2009] and the current Duke *Vegetation Maintenance Implementation Plan (VMIP)* (June 2014, Revision 1):

Soil Amendments	Pounds Per Acre
Agricultural limestone	2,000
Fertilizer (10-10-10)	1,000
Mulch	4,000

Soil amendments are for all-season temporary seeding applications. Perform soil tests to determine proper soil amendments; if not available, use the quantities above.

4.4 Over-Seeding

Over seeding will be applied as follows (source: NC *Erosion and Sediment Control Planning and Design Manual* [June 2006, Revised March 2009] and the current Duke *Vegetation Maintenance Implementation Plan (VMIP)* (June 2014, Revision 1):

Seeds	Pounds Per Acre	Dates of Planting
Kentucky 31 Tall Fescue	50	January - April
Rye (grain)	25	January - April
German Millet	25	May - August
Kentucky 31 Tall Fescue	50	September - December
Rye (grain)	25	September - December

Note: Cut the existing turf to be over-seeded to an approximate 1-inch height. Aerate the soil and turf area to be over-seeded. Apply soil amendments pursuant to prior soil sampling and nutrient testing.

5. LANDFILL CLOSURE

The Marshall ILF will be closed in accordance with the design drawings and *Closure/Post-Closure Plan*. The *Closure/Post-Closure Plan* outlines the sequence for closing the landfill and the post-closure maintenance activities. Closure is designed to minimize the need for long-term maintenance and to control the post-closure release of contaminants. Closure activities may be revised as appropriate for materials, specifications, technology advancements, or changes in regulations at the time the landfill is closed or in post-closure. In general, the landfill development is designed so that final cover can be established as soon as possible.

6. REQUIRED REGULATORY SUBMITTALS

Submittal	Requirement	Reporting/Action Frequency
Leachate Monitoring Reports	Maintain a record of all monitoring events and analytical data. Reports of the analytical data for each water quality monitoring sampling event shall be submitted to DENR Division of Waste Management (DWM) in a timely manner.	Semiannually
Annual Tonnage Reports	Tons of waste received and disposed of in the landfill shall be reported to the DWM and to all counties from which waste was accepted on forms prescribed by the DWM. Refer to the Permit to Operate for annual reporting requirement information.	Annually Must submit no later than August 1 each year
10-Year Waste Management Plan	Per North Carolina G.S. 130A-309.09D (c): • A 10-year waste management plan shall be developed for this landfill and submitted to DWM. • The plan shall be updated and submitted to DWM at least every three years. • A report on the implementation of the plan is required to be submitted to DWM by August 1 of each year.	10-year plan prepared every 10 years 10-year plan updated every 3 years Implementation report annually

FIGURES

ISLAND POINT ROAD

PHASE 1

PHASE 2

PHASE 3

PHASE 4

PHASE 5

CLOSED C&D LANDFILL

CLOSED ASBESTOS LANDFILL

PL

LOW

LEGEND

- EXISTING MAJOR CONTOUR (10')
- EXISTING MINOR CONTOUR (2')
- OBSCURED EXISTING MAJOR CONTOUR (10')
- OBSCURED EXISTING MINOR CONTOUR (2')
- PROPOSED SUBGRADE MAJOR CONTOUR (10')
- PROPOSED SUBGRADE MINOR CONTOUR (2')
- PL — PROPERTY LINE
- LOW — LIMIT OF WASTE

0 200 400 800

(IN FEET)
1 inch = 400 ft.

SCALE: 1 " = 400'

DATE: 08-25-15

PROJECT NO. 7235-15-027

DRAWN BY: JAM

ENGINEERING LICENSE NO: F-0176

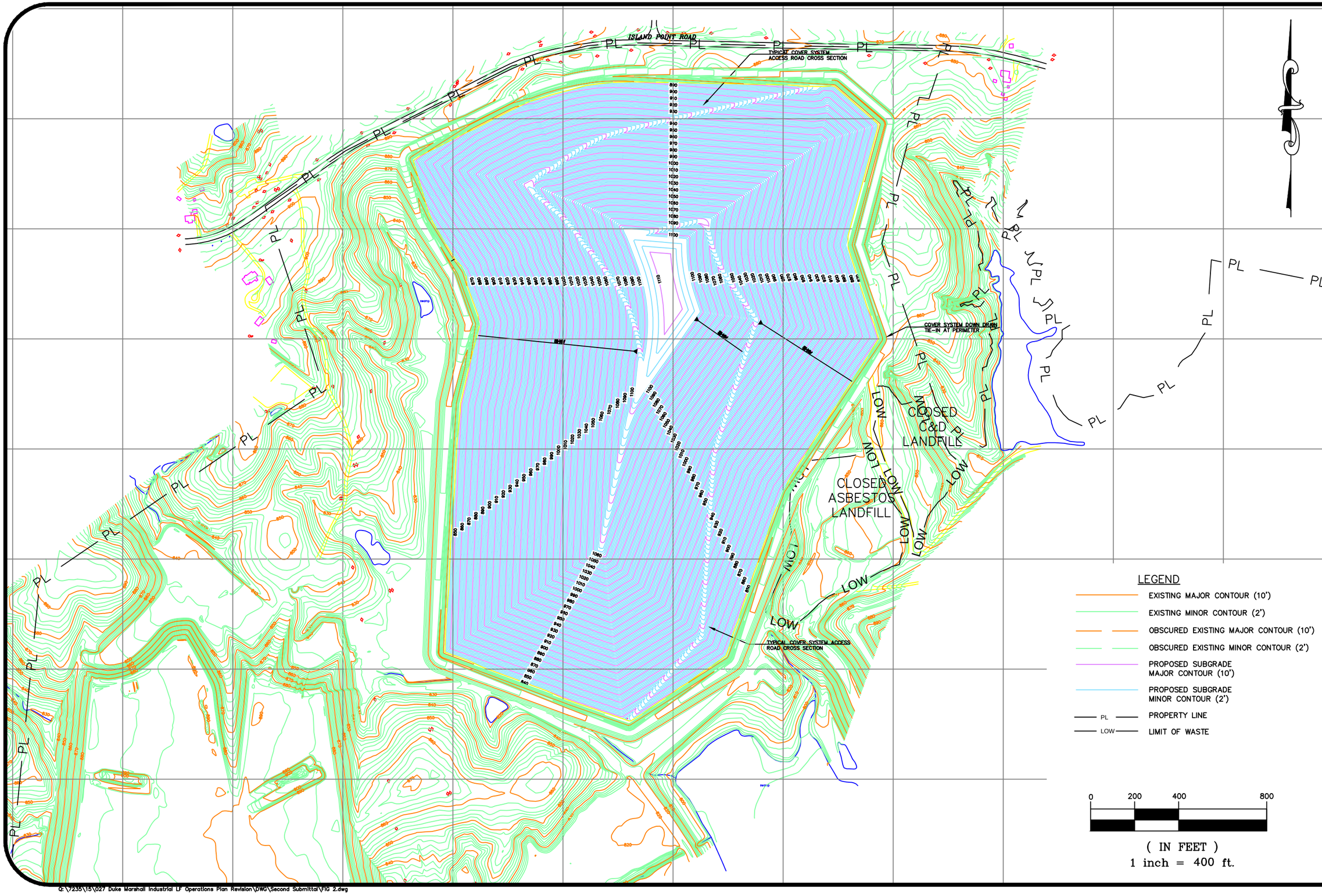
CHECKED BY: JSR

S&ME
9751 SOUTHERN PINE BLVD.
CHARLOTTE, N.C. 28273
(704)523-4726
WWW.SMEINC.COM

SUBGRADE GRADING PLAN
INDUSTRIAL LANDFILL NO. 1
MARSHALL STEAM STATION
TERRELL, NORTH CAROLINA

FIGURE NO.
1

C:\7235\15\027 Duke Marshall Industrial LF Operations Plan Revision\DWG\Second Submittal\FIG 1.dwg



SCALE: 1 " = 400'

DATE: 08-25-15

PROJECT NO. 7235-15-027

DRAWN BY: JAM

ENGINEERING LICENSE NO: F-0176

CHECKED BY: JSR

S&ME
9751 SOUTHERN PINE BLVD.
CHARLOTTE, N.C. 28273
(704)523-4726
WWW.SMEINC.COM

FINAL CLOSURE GRADING PLAN INDUSTRIAL LANDFILL NO. 1

MARSHALL STEAM STATION
TERRELL, NORTH CAROLINA

FIGURE NO.

2

Q:\7235\15\027 Duke Marshall Industrial LF Operations Plan Revision\DWG\Second Submittal\FIG 2.dwg

DRAINAGE BLANKET

CHECK DAM

FINAL SUBGRADE SLOPE FACE (BY OTHERS) (1.5-FT SOIL COVER BY OTHERS)

880 870 860

40%

LCS LDS

CQA

PL

DRAINAGE BLANKET

CHECK DAM

EPC3

LEGEND

- PROTECTIVE COVER GRADE 10'
- PROTECTIVE COVER GRADE 2'
- PROPOSED STAGE GRADE 10'
- PROPOSED STAGE GRADE 2'
- CHIMNEY DRAIN

0 50 100 200

(IN FEET)
1 inch = 100 ft.

SCALE: 1" = 100'
DATE: 08-25-15
PROJECT NO. 7235-15-027
DRAWN BY: JAM
ENGINEERING LICENSE NO: F-0176
CHECKED BY: JSR

S&ME
9751 SOUTHERN PINE BLVD.
CHARLOTTE, N.C. 28273
(704)523-4726
WWW.SMEINC.COM

CELL 2 - FILL STEP 1
INDUSTRIAL LANDFILL NO. 1
MARSHALL STEAM STATION
TERRELL, NORTH CAROLINA

FIGURE NO. 3

Q:\7235\15\027 Duke Marshall Industrial LF Operations Plan Revision\DWG\Second Submittal\FIG 3.dwg

CQA
880
870
860
890
40%
FINAL SUBGRADE SLOPE FACE (BY OTHERS)
(1.5-FT SOIL COVER BY OTHERS)
DRAINAGE BLANKET
CHECK DAM
6%M
LCS
LDS
PL
EPC3

LEGEND

- PROTECTIVE COVER GRADE 10'
- PROTECTIVE COVER GRADE 2'
- PROPOSED STAGE GRADE 10'
- PROPOSED STAGE GRADE 2'
- CHIMNEY DRAIN

0 50 100 200

(IN FEET)
1 inch = 100 ft.

DATE: 08-25-027
DRAWN BY: JAM
CHECKED BY: KRD
SCALE: 1" = 100'
PROJECT NO. 7235-15-027
ENGINEERING LICENSE NO: F-0176

S&ME
9751 SOUTHERN PINE BLVD.
CHARLOTTE, N.C. 28273
(704)523-4726
WWW.SMEINC.COM

CELL 1 - FILL STEP 2
INDUSTRIAL LANDFILL NO. 1
MARSHALL STEAM STATION
TERRELL, NORTH CAROLINA

FIGURE NO. 4

Q:\7235\15\027 Duke Marshall Industrial LF Operations Plan Revision\DWG\Second Submittal\FIG 4.dwg

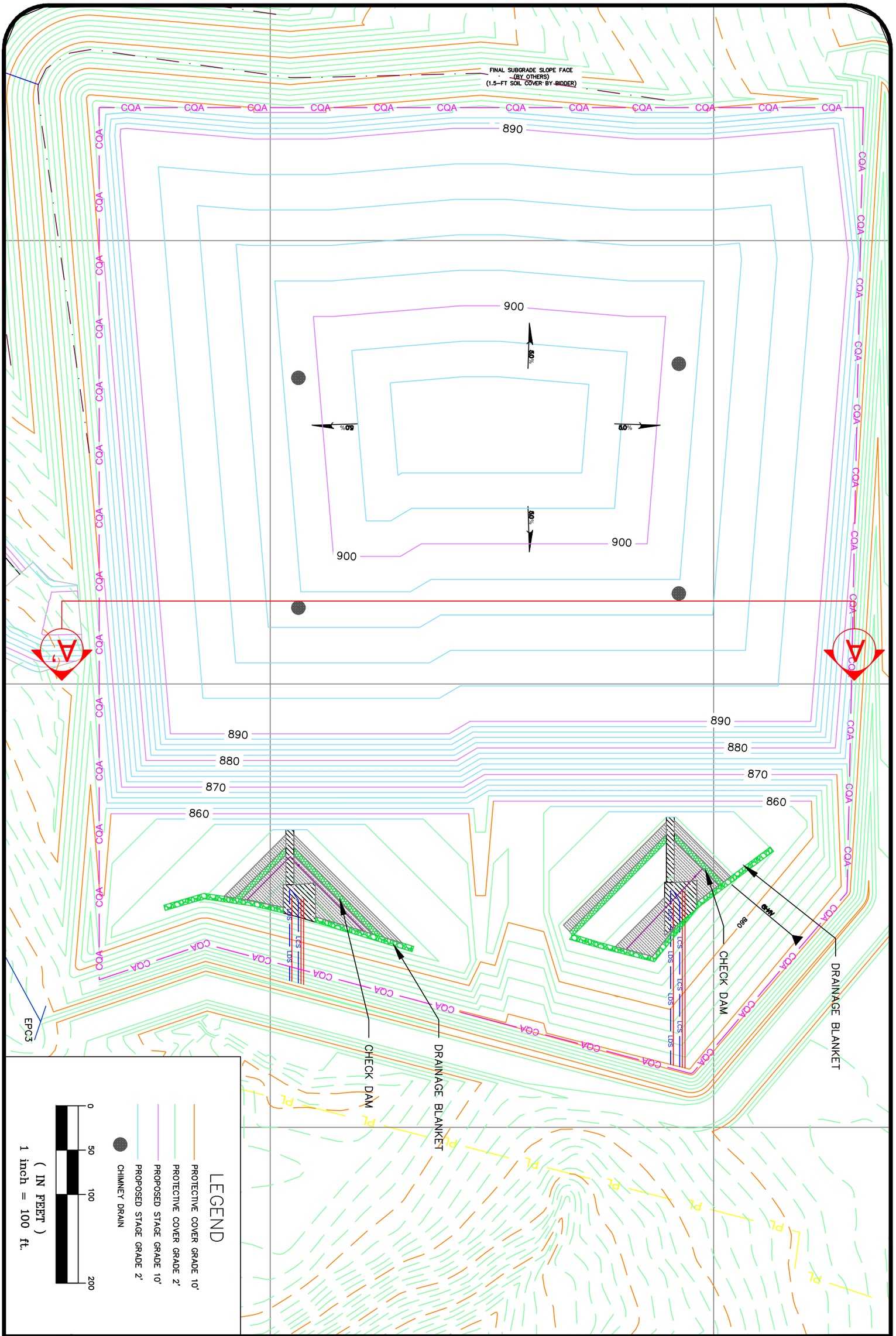


FIGURE NO. 5

CELLS 1 AND 2 – FILL STEP 4
INDUSTRIAL LANDFILL NO. 1

MARSHALL STEAM STATION
TERRELL, NORTH CAROLINA

S&ME
WWW.SMEINC.COM
9751 SOUTHERN PINE BLVD.
CHARLOTTE, N.C. 28273
(704)523-4726

SCALE: 1" = 100'	DATE: 08-25-15
PROJECT NO. 7235-15-027	DRAWN BY: JAM
ENGINEERING LICENSE NO: F-0176	CHECKED BY: JSR

Q:\7235\15\027 Duke Marshall Industrial LF Operations Plan Revision\DWG\Second Submittal\FIG 5.dwg

DOWN DRAIN OUTLET PROTECTION AT PERIMETER CHANNEL

EPC1

EPC2

NR

NHR1

3H:1V

LOW

C1

C1E

C2

52 D8 INTERIM COVER TIE-IN AT PERIMETER

REFERENCED DETAILS ARE PROVIDED ON ENGINEERING PLAN DRAWING D8

46 D8 TACK-ON BENCH / DOWN DRAIN TIE-IN PLAN

49 D8 INTERIM COVER DOWN DRAIN

51 D8 TACK-ON BENCH

40 D6 CULVERT SCHEDULE

DOWN DRAIN SCHEDULE 41 D6

OUTLET PROTECTION 42 D6

38 D6 GRASS LINED CHANNELS

A1

EPC3

PL

LEGEND

- EXISTING MAJOR CONTOUR (10')
- EXISTING MINOR CONTOUR (2')
- OBSCURED EXISTING MAJOR CONTOUR (10')
- OBSCURED EXISTING MINOR CONTOUR (2')
- PROPOSED INTERIM COVER MAJOR CONTOUR (10')
- PROPOSED INTERIM COVER MINOR CONTOUR (2')
- CELL 1 & 2 LIMIT OF WASTE
- TACK-ON BENCH
- EPC1 EPC1 CHANNEL REACH ID
- C1 CULVERT ID
- DOWN DRAIN ID
- OUTLET PROTECTION
- DOWN DRAIN OUTLET PROTECTION AT PERIMETER CHANNEL

0 60 120 240

(IN FEET)
1 inch = 120 ft.

DATE: 08-25-15
DRAWN BY: JAM
CHECKED BY: JSR
SCALE: 1" = 120'
PROJECT NO. 7235-15-027
ENGINEERING LICENSE NO: F-0176

S&ME
9751 SOUTHERN PINE BLVD.
CHARLOTTE, N.C. 28273
(704)523-4726
WWW.SMEINC.COM

CELL 1 & 2 INTERIM COVER
INDUSTRIAL LANDFILL NO. 1
MARSHALL STEAM STATION
TERRELL, NORTH CAROLINA

FIGURE NO. 6

Q:\7235\15\027 Duke Marshall Industrial LF Operations Plan Revision\DWG\Second Submittal\FIG 6.dwg

DRAINAGE BLANKET

CHECK DAM

DRAINAGE BLANKET

CHECK DAM

3H:1V

3H:1V

3H:1V

3H:1V

5.0%

5.0%

5.0%

900

890

880

870

860

850

840

830

820

1000

990

980

970

960

950

940

930

920

910

LEGEND

- PROTECTIVE COVER GRADE 10'
- PROTECTIVE COVER GRADE 2'
- PROPOSED STAGE GRADE 10'
- PROPOSED STAGE GRADE 2'
- TACK-ON BENCH

0 60 120 240

(IN FEET)
1 inch = 120 ft.

CELLS 3 AND 4 FILLING
INDUSTRIAL LANDFILL NO. 1

MARSHALL STEAM STATION
TERRELL, NORTH CAROLINA

FIGURE NO.
7

DATE: 08-25-15
DRAWN BY: JAM
CHECKED BY: JSR
SCALE: 1" = 120'
PROJECT NO. 7235-15-027
ENGINEERING LICENSE NO: F-0176

S&ME
9751 SOUTHERN PINE BLVD.
CHARLOTTE, N.C. 28273
(704)523-4726
WWW.SMEINC.COM

Q:\7235\15\027 Duke Marshall Industrial LF Operations Plan Revision\DWG\Second Submittal\FIG 7.dwg

INTERIM COVER ACCESS ROAD

LEGEND

- EXISTING MAJOR CONTOUR (10')
- EXISTING MINOR CONTOUR (2')
- PROPOSED INTERIM MAJOR CONTOUR (10')
- PROPOSED INTERIM MINOR CONTOUR (2')
- LOW — PHASE 1 LIMIT OF WASTE
- TACK-ON BENCH
- DOWN DRAIN
- EPC1 EPC1 — CHANNEL REACHES
- C1 — CULVERT
- OUTLET PROTECTION
- DOWN DRAIN OUTLET PROTECTION AT PERIMETER CHANNEL

0 75 150 300

(IN FEET)
1 inch = 150 ft.

DATE: 08-25-15
DRAWN BY: JAM
CHECKED BY: JSR
SCALE: 1" = 150'
PROJECT NO. 7235-15-027
ENGINEERING LICENSE NO: F-0176

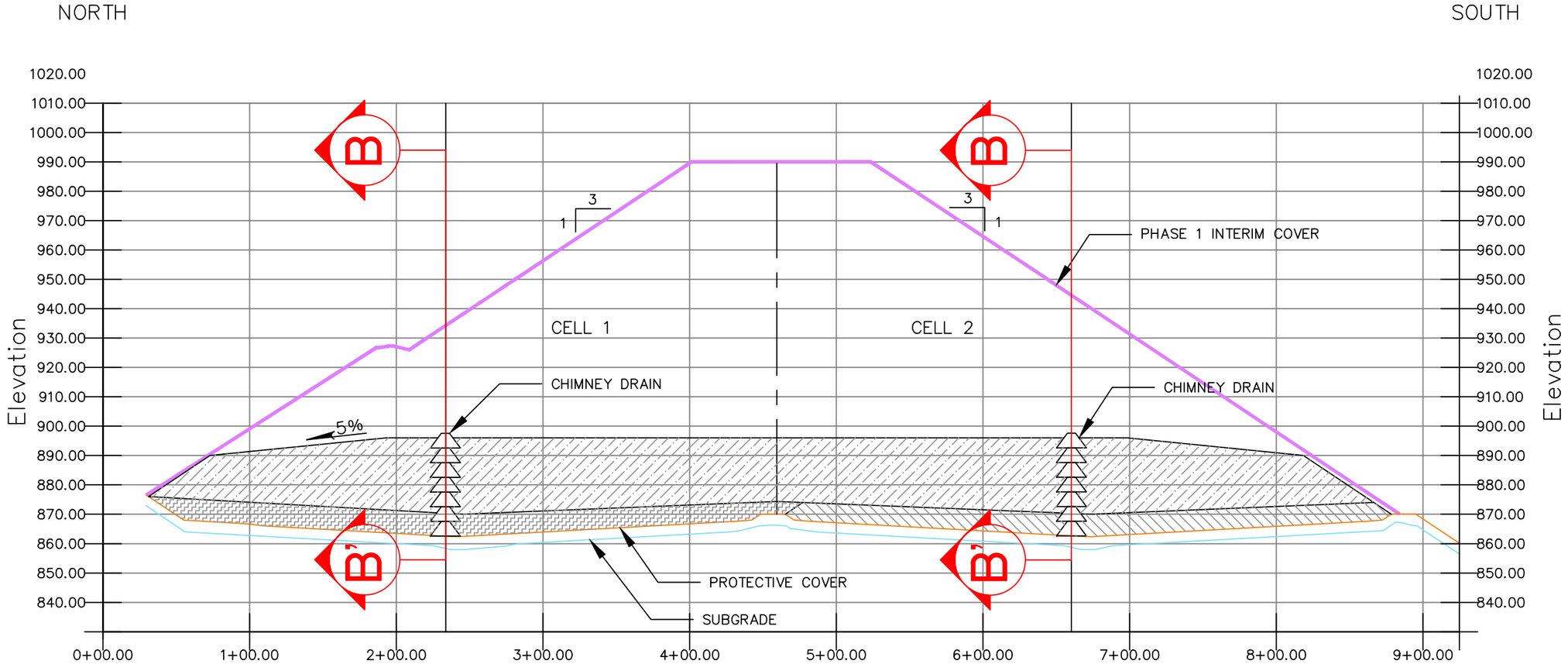
S&ME
9751 SOUTHERN PINE BLVD.
CHARLOTTE, N.C. 28273
(704)523-4726
WWW.SMEINC.COM

PHASE 1 INTERIM COVER PLAN
INDUSTRIAL LANDFILL NO. 1

MARSHALL STEAM STATION
TERRELL, NORTH CAROLINA

FIGURE NO. 8

Q:\7235\15\027 Duke Marshall Industrial LF Operations Plan Revision\DWG\Second Submittal\FIG 8.dwg



NOTE:

CELL 1 AND 2 FILLING SHALL PROGRESS IN 10-FT THICK OPERATIONAL LIFTS TO REACH PROPOSED INTERIM COVER GRADES IN A SEQUENCE SIMILAR TO THAT ILLUSTRATED HEREIN.

VERTICAL

0 20 40 80

(IN FEET)
1 inch = 40 ft.

HORIZONTAL

0 40 80 160

(IN FEET)
1 inch = 80 ft.

DATE: 08-25-15
DRAWN BY: JAM
CHECKED BY: JSR
SCALE: AS SHOWN
PROJECT NO. 7235-15-027
ENGINEERING LICENSE NO: F-0176

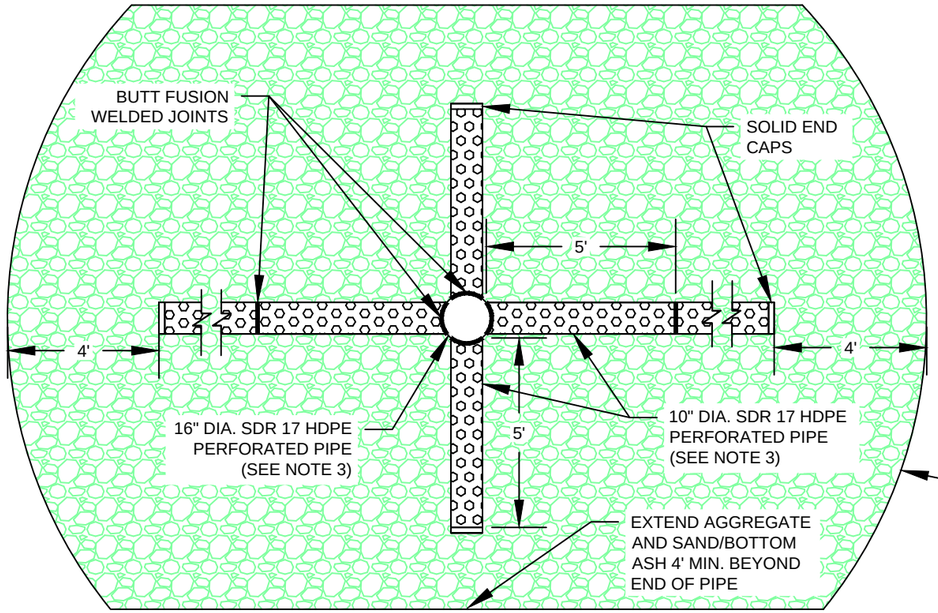
S&ME
9751 SOUTHERN PINE BLVD.
CHARLOTTE, N.C. 28273
(704)523-4726
WWW.SMEINC.COM

CROSS SECTION A - A'
INDUSTRIAL LANDFILL NO. 1
MARSHALL STEAM STATION
TERRELL, NORTH CAROLINA

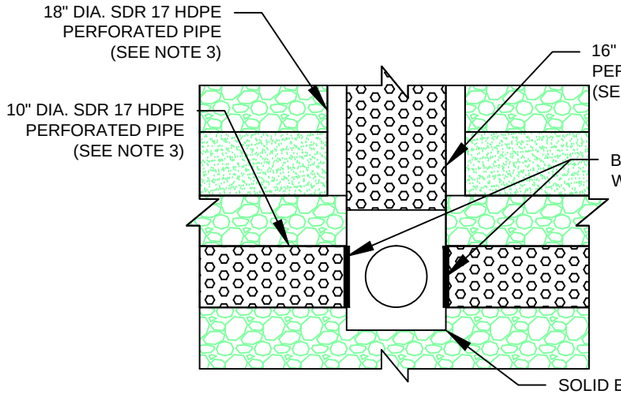
FIGURE NO.
9

NOTES:

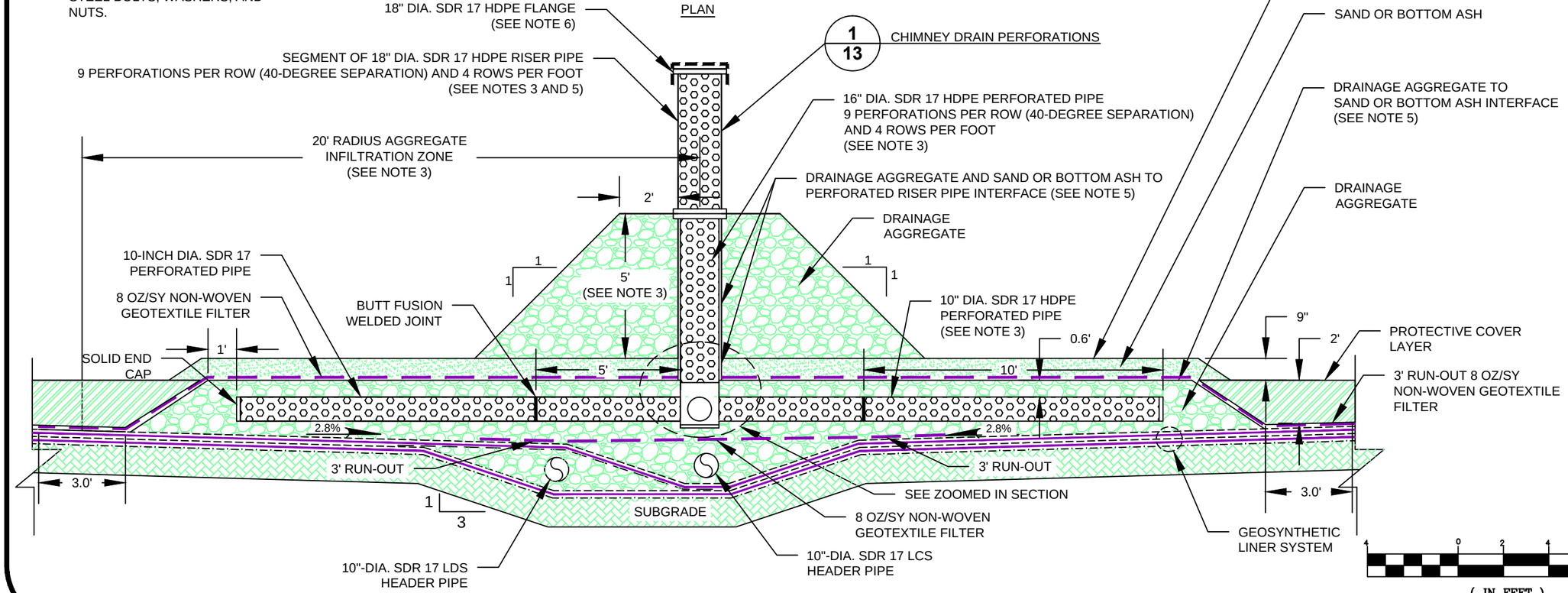
1. CHIMNEY DRAIN SHALL BE LOCATED DIRECTLY OVER LCS LATERALS AND/OR CORRIDORS. THE CHIMNEY DRAIN LOCATION MAY BE ESTABLISHED BY THE OPERATOR.
2. CHIMNEY DRAIN PIPES SHALL NOT BE DIRECTLY CONNECTED TO LCS LATERAL OR HEADER PIPES.
3. DETAIL ILLUSTRATES THE TYPICAL CHIMNEY DRAIN CONCEPT ONLY. DIMENSIONS AND MATERIALS MAY BE VARIED AND ADJUSTED TO FIT FIELD CONDITIONS AND ADAPT TO FIELD PERFORMANCE.
4. CHIMNEY DRAIN SHALL BE POSITIONED NO CLOSER THAN 50 FEET FROM AN EXTERIOR SLOPE, WITH THE EXCEPTION OF SUMP AREA DRAINAGE FEATURES.
5. DRAINAGE MEDIA AND/OR INTERFACES BETWEEN DRAINAGE MEDIA SHALL BE DESIGNED TO PROVIDE FILTRATION AND LIMIT CLOGGING.
6. CONNECT PIPE SEGMENT EXTENSIONS USING FACTORY - WELDED FLANGES AND STAINLESS STEEL BOLTS, WASHERS, AND NUTS.



PLAN



ZOOMED IN SECTION (N.T.S.)



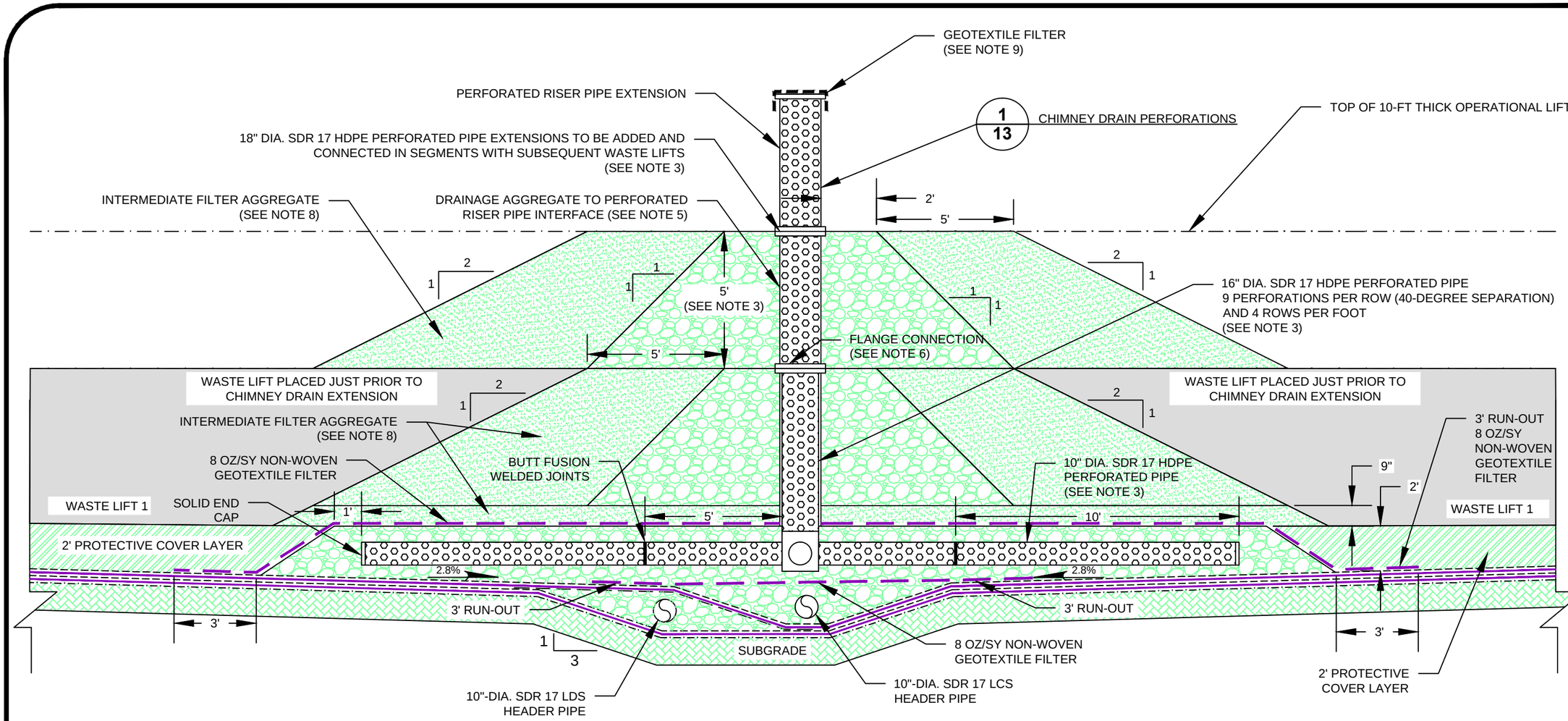
SECTION

SCALE: AS SHOWN	PROJECT NO. 7235-15-027	ENGINEERING LICENSE NO: F-0176	
DATE: 08/25/15	DRAWN BY: JAM	CHECKED BY: JSR	

9751 SOUTHERN PINE BLVD.
CHARLOTTE, N.C. 28273
(704)523-4726
S&ME
WWW.SMEINC.COM

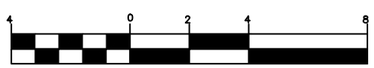
CHIMNEY DRAIN - INITIAL CONSTRUCTION
INDUSTRIAL LANDFILL NO. 1
MARSHALL STEAM STATION
TERRELL, NORTH CAROLINA

FIGURE NO.
10



NOTES:

1. CHIMNEY DRAIN SHALL BE LOCATED DIRECTLY OVER LCS LATERALS AND/OR CORRIDORS. THE CHIMNEY DRAIN LOCATION MAY BE ESTABLISHED BY THE OPERATOR.
2. CHIMNEY DRAIN PIPES SHALL NOT BE DIRECTLY CONNECTED TO LCS LATERAL OR HEADER PIPES.
3. DETAIL ILLUSTRATES THE TYPICAL CHIMNEY DRAIN CONCEPT ONLY. DIMENSIONS AND MATERIALS MAY BE VARIED AND ADJUSTED TO FIT FIELD CONDITIONS AND ADAPT TO FIELD PERFORMANCE.
4. CHIMNEY DRAIN SHALL BE POSITIONED NO CLOSER THAN 50 FEET FROM AN EXTERIOR SLOPE, WITH THE EXCEPTION OF SUMP AREA DRAINAGE FEATURES.
5. DRAINAGE MEDIA AND/OR INTERFACES BETWEEN DRAINAGE MEDIA SHALL BE DESIGNED TO PROVIDE FILTRATION AND LIMIT CLOGGING.
6. CONNECT PIPE SEGMENT EXTENSIONS USING FACTORY - WELDED FLANGES AND STAINLESS STEEL BOLTS, WASHERS, AND NUTS.
7. SDR 17 PERFORATED HDPE PIPE MAY BE USED FOR FILL HEIGHTS UP TO 175 FEET. SDR 26 PERFORATED HDPE PIPE MAY BE USED FOR FILL HEIGHTS UP TO 240 FEET. SDR 32.5 PERFORATED HDPE PIPE MAY BE USED FOR FILL HEIGHTS UP TO 190 FEET. DOUBLE-WALLED CORRUGATED HDPE PIPE MAY BE USED FOR FILL HEIGHTS UP TO 30 FEET.
8. #78M AGGREGATE MAY BE USED AS AN INTERMEDIATE FILTER AGGREGATE BETWEEN #57 DRAINAGE AGGREGATE AND SAND OR SELECT BOTTOM ASH AS DICTATED BY OPERATIONS AND FIELD CONDITIONS.
9. 8 OZ/SY NON WOVEN GEOTEXTILE WRAP TO REMAIN AROUND TOP OF PIPE AND BE REMOVED AT TOP OF PIPE TO ALLOW FOR CONNECTION.



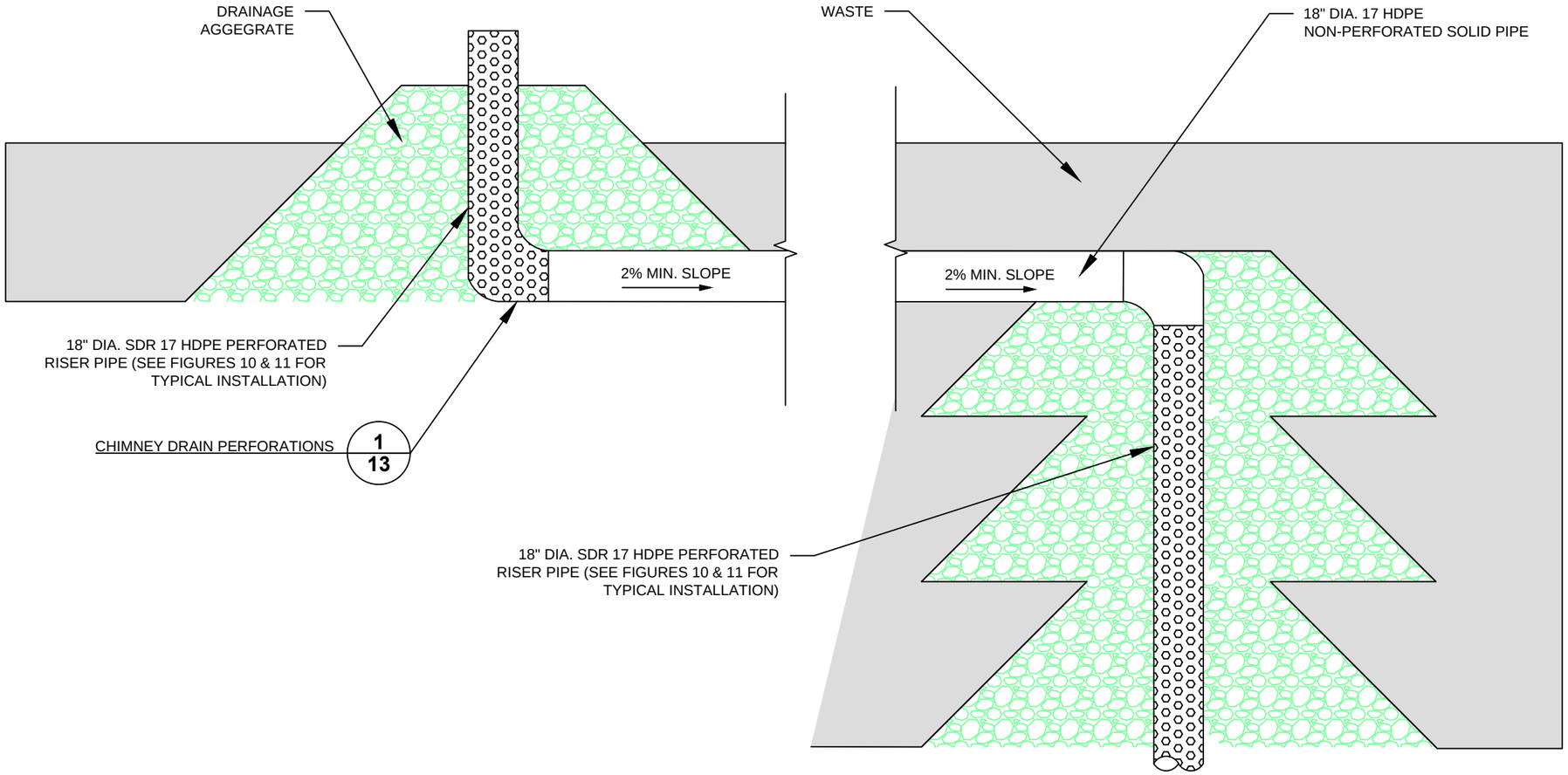
DATE: 08/25/15
DRAWN BY: JAM
CHECKED BY: JSR
SCALE: AS SHOWN
PROJECT NO. 7235-15-027
ENGINEERING LICENSE NO: F-0176

9751 SOUTHERN PINE BLVD.
CHARLOTTE, N.C. 28273
(704)523-4726
S&ME
WWW.SMEINC.COM

CHIMNEY DRAIN - VERTICAL EXTENSION
INDUSTRIAL LANDFILL NO. 1

MARSHALL STEAM STATION
TERRELL, NORTH CAROLINA

FIGURE NO.
11



NOTES:

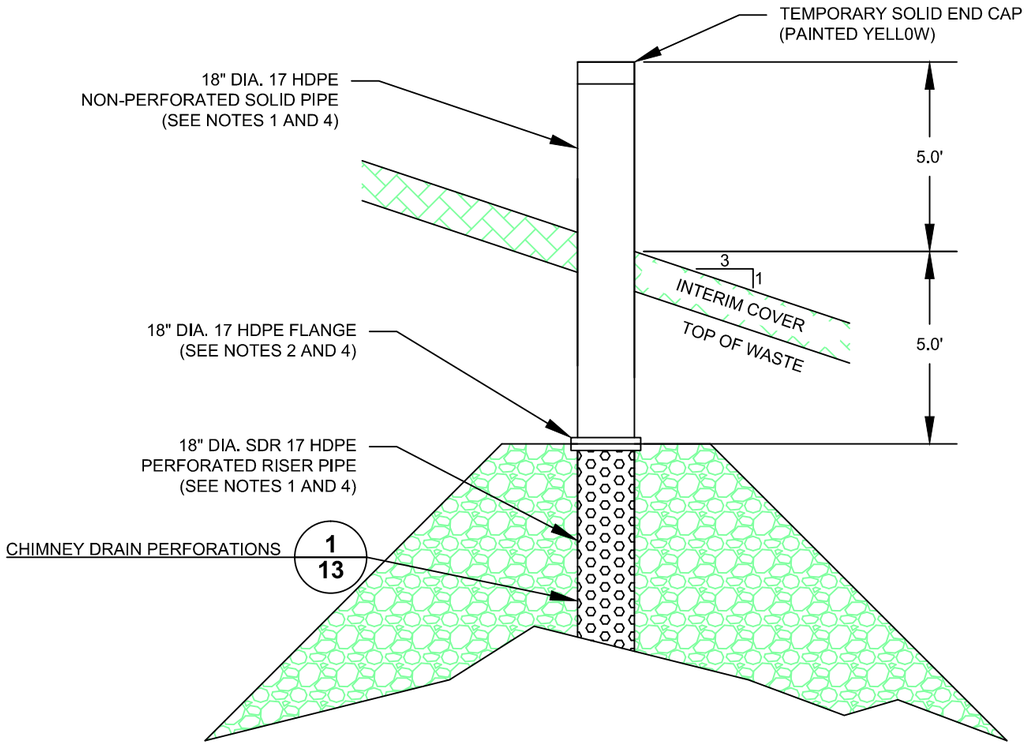
1. CHIMNEY DRAIN SHALL BE LOCATED DIRECTLY OVER LCS LATERALS AND/OR CORRIDORS. THE CHIMNEY DRAIN LOCATION MAY BE ESTABLISHED BY THE OPERATOR.
2. CHIMNEY DRAIN PIPES SHALL NOT BE DIRECTLY CONNECTED TO LCS LATERAL OR HEADER PIPES.
3. DETAIL ILLUSTRATES THE TYPICAL CHIMNEY DRAIN CONCEPT ONLY. DIMENSIONS AND MATERIALS MAY BE VARIED AND ADJUSTED TO FIT FIELD CONDITIONS AND ADAPT TO FIELD PERFORMANCE.
4. CHIMNEY DRAIN SHALL BE POSITIONED NO CLOSER THAN 50 FEET FROM AN EXTERIOR SLOPE, WITH THE EXCEPTION OF SUMP AREA DRAINAGE FEATURES.
5. DRAINAGE MEDIA AND/OR INTERFACES BETWEEN DRAINAGE MEDIA SHALL BE DESIGNED TO PROVIDE FILTRATION AND LIMIT CLOGGING.
6. HORIZONTAL EXTENSIONS MAY BE INSTALLED TO ACCESS RE-ACTIVATED CELLS OR IN OTHER AREAS AS NEEDED TO IMPROVE FIELD PERFORMANCE.

DATE: 08/25/15
DRAWN BY: JAM
CHECKED BY: JSR
SCALE: N.T.S.
PROJECT NO. 7235-15-027
ENGINEERING LICENSE NO: F-0176

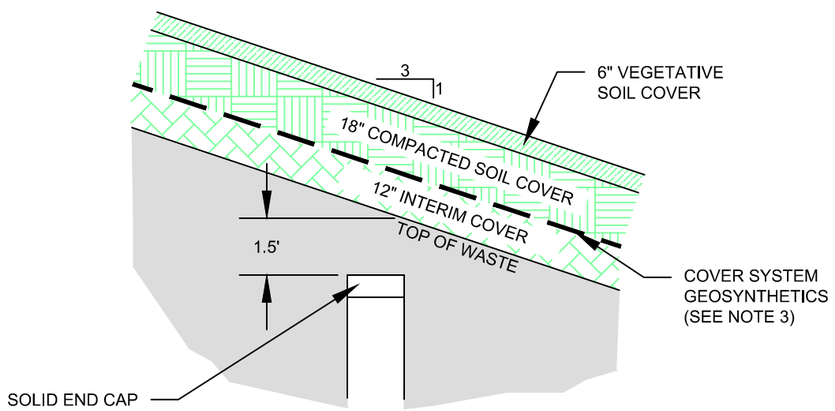
S&ME
9751 SOUTHERN PINE BLVD.
CHARLOTTE, N.C. 28273
(704)523-4726
WWW.SMEINC.COM

CHIMNEY DRAIN - HORIZONTAL EXTENSION
INDUSTRIAL LANDFILL NO. 1
MARSHALL STEAM STATION
TERRELL, NORTH CAROLINA

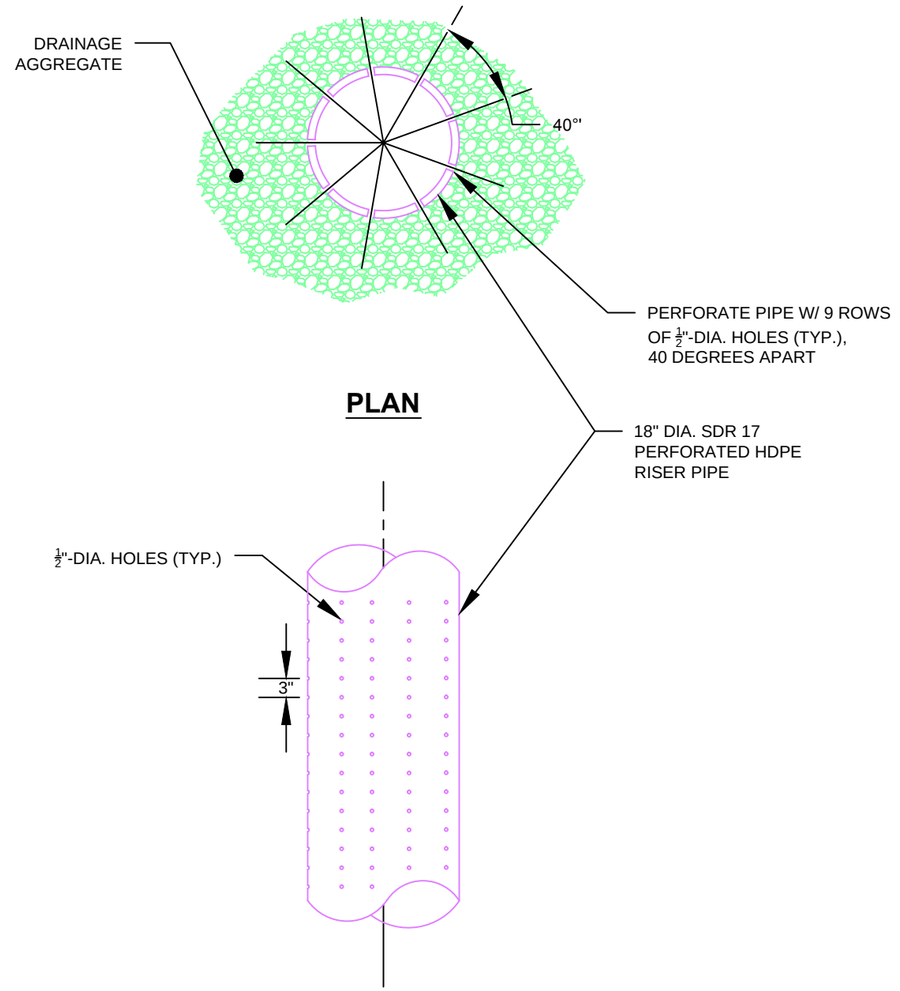
FIGURE NO.
12



INTERIM CLOSEOUT



PERMANENT CLOSEOUT



PROFILE

1/13 CHIMNEY DRAIN PERFORATIONS
SCALE: N.T.S.

NOTES:
1. DETAIL ILLUSTRATES THE TYPICAL CHIMNEY DRAIN CONCEPT ONLY. DIMENSIONS AND MATERIALS MAY BE VARIED AND ADJUSTED TO FIT FIELD CONDITIONS AND ADAPT TO FIELD PERFORMANCE.
2. CONNECT PIPE SEGMENT EXTENSIONS USING FACTORY - WELDED FLANGES AND STAINLESS STEEL BOLTS, WASHERS, AND NUTS.
3. COVER SYSTEM GEOSYNTHETICS MAY CONSIST OF, FROM BOTTOM TO TOP:
   - A 40-MIL TEXTURED LLDPE GEOMEMBRANE AND A GEOCOMPOSITE DRAINAGE LAYER; OR
   - A 50-MIL TEXTURED LLDPE STRUCTURED GEOMEMBRANE WITH INTEGRATED DRAINAGE LAYER AND AN 8 OZ/SY NON-WOVEN GEOTEXTILE.
4. HDPE VERTICAL SDR 26 OR SDR 32.5 PIPE MAY BE USED AS SHOWN IN NOTE 7 ON FIGURE 11.

DATE: 08/25/15
DRAWN BY: JAM
CHECKED BY: JSR
SCALE: N.T.S.
PROJECT NO. 7235-15-027
ENGINEERING LICENSE NO: F-0176

9751 SOUTHERN PINE BLVD.
CHARLOTTE, N.C. 28273
(704)523-4726
S&ME
WWW.SMEINC.COM

CHIMNEY DRAIN - CLOSEOUT
INDUSTRIAL LANDFILL NO. 1
MARSHALL STEAM STATION
TERRELL, NORTH CAROLINA

FIGURE NO.
13

APPENDICES

LANDFILL EMERGENCY RESPONSE PLAN (ERP)
INDUSTRIAL LANDFILL
PERMIT NO. 1812
MARSHALL STEAM STATION
TERRELL, NORTH CAROLINA

S&ME Project No. 7235-15-027

Prepared for:
Duke Energy Carolinas, LLC
526 South Church Street
Charlotte, North Carolina 28202

Prepared by:
S&ME, Inc.
9751 Southern Pine Boulevard
Charlotte, North Carolina 28273
S&ME Engineering License No. F-0176

November 24, 2009

Revised February 3, 2010
Revised February 28, 2011
Revised August 3, 2011
Revised September, 2015
Revised February, 2016

TABLE OF CONTENTS

1. STATEMENT OF PURPOSE

The purpose of this Emergency Response Plan (ERP) is to provide guidance to identify potential slope failure events of the landfill, and minimize their impacts within the Marshall Steam Station property owned by Duke Energy Carolinas, LLC (Duke Energy).

This ERP establishes slope instability identification criteria, identifies emergency response entities, identifies impacted areas, establishes procedures for notification and provides contact information for emergency notifications. This ERP provides a framework for consistent and appropriate response to slope failure events, should they occur. Implementation and familiarity with the elements of the ERP will reduce the risk associated with landfill operations and help to mitigate impacts resulting from slope failure events.

2. PROJECT DESCRIPTION & IMPACTS

The proposed landfill is located on the northern portion of the Duke Energy – Marshall Steam Station property approximately 1.5 miles north of the Marshall Steam Station in parts within the footprint of an inactive ash basin. Waste fill heights are expected to be on the order of 240 feet with slopes constructed at 3 (horizontal) to 1 (vertical) slopes.

The proposed landfill is bound by existing ground and an earthen dike at the southeast corner. Adjacent to the inactive ash basin to the east is a closed asbestos landfill. To the west of the proposed landfill is the existing structural fill area. To the north of the proposed landfill is Island Point Road. Impacted areas are located on Duke Energy's Marshall Steam Station property.

3. SLOPE FAILURE IDENTIFICATION CRITERIA

3.1 Alert Status

The following conditions indicate a potential emergency situation. If one or more of these conditions are observed, the owner should initiate Notification Sequence 1 immediately:

i. cracking on landfill slope faces;

ii. bulging on landfill slope faces;

iii. wet spots, seepage, or flow emerging from or near the landfill slope faces; and

iv. shallow sloughing up to about three feet deep.

While under Alert Status, the owner shall continuously monitor slope conditions of the landfill. The owner shall communicate regularly with North Carolina Department of Environment and Natural Resources (NCDENR) personnel and the Engineer. The owner shall evaluate if conditions warrant a transition to Emergency Status, and notify the emergency management authorities.

3.2 Emergency Status

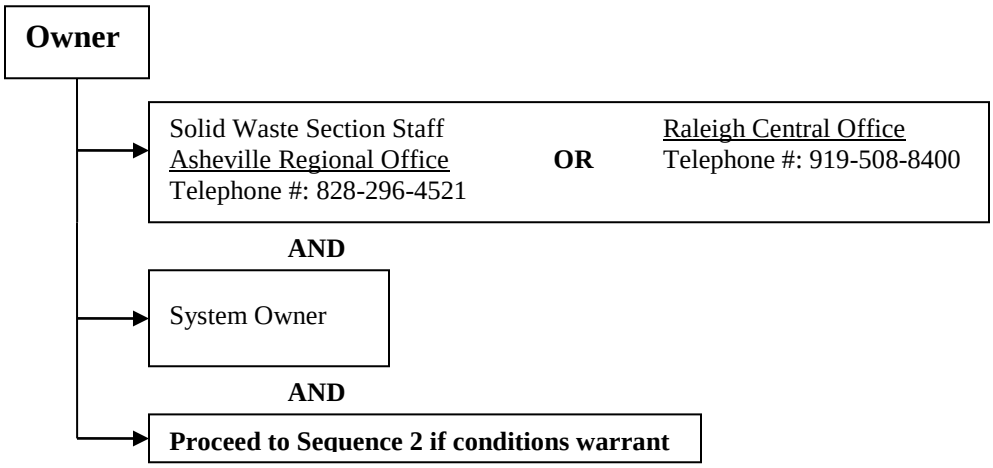
The following conditions indicate slope failure is possible. If one or more of these conditions is observed, the owner should initiate Notification Sequence 2 immediately:

i. slope faces in the process of cracking, sliding, or sloughing.

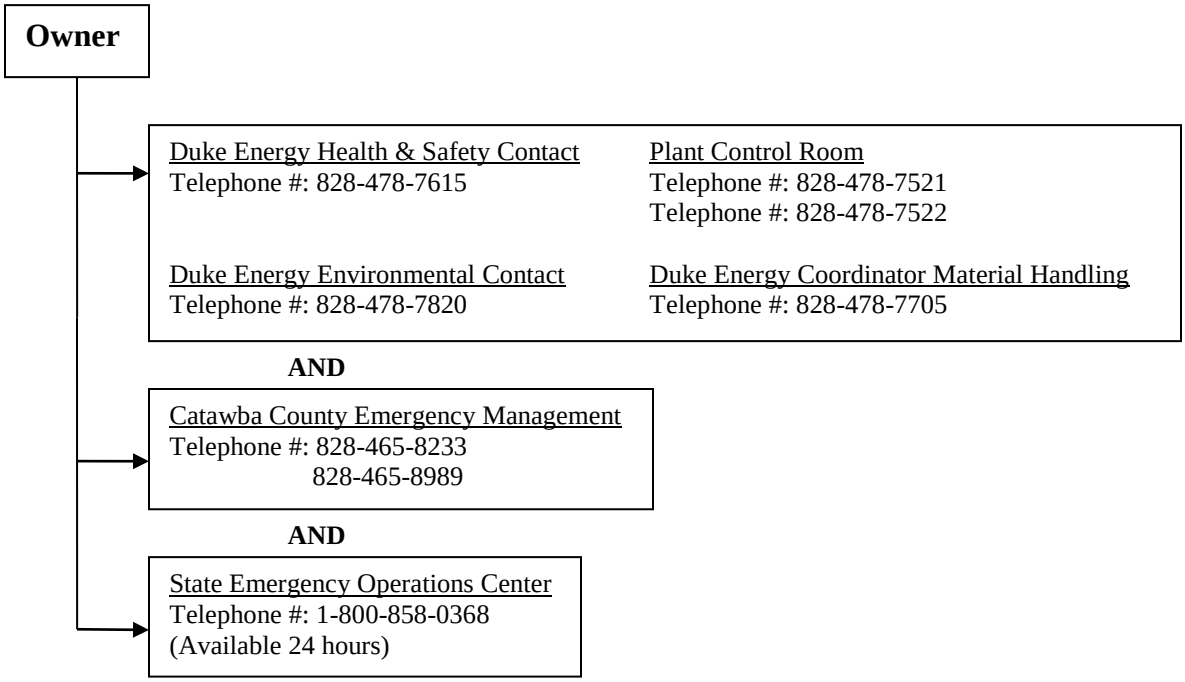
ii. turbid seepage (that is, muddy seepage) and or boils emerging from the landfill slope faces or structural fill below the landfill.

4. NOTIFICATION SEQUENCE

Sequence 1: If one of the **Alert Conditions** listed in Section 3.1 of this plan has been observed, but slope failure does not appear imminent then the following notification sequence is followed by the **Owner**:



Sequence 2: If one of the **Emergency Conditions** listed in Section 3.2 of this plan is occurring or slope failure appears to be otherwise imminent, the following notification sequence is followed by the Owner:



In the event of an **Emergency Condition**, if directed by the station, assemble at the designated Assembly Area.

OPERATIONS QUALITY ASSURANCE PLAN
INDUSTRIAL LANDFILL NO. 1
PERMIT NO. 1812
MARSHALL STEAM STATION
TERRELL, NORTH CAROLINA

S&ME Project No. 7235-15-027

Prepared for:
Duke Energy Carolinas, LLC
526 South Church Street
Charlotte, North Carolina 28202

Prepared by:
S&ME, Inc.
9751 Southern Pine Boulevard
Charlotte, North Carolina 28273
S&ME Engineering License No. F-0176

November 24, 2009

Revised February 3, 2010
Revised February 28, 2011
Revised August 3, 2011
Revised September, 2015
February, 2016

TABLE OF CONTENTS

1. PROJECT DESCRIPTION

Quality assurance (QA) monitoring and testing of waste placement during operations of the Marshall Steam Station - Industrial Landfill No. 1 shall be performed as presented herein. QA monitoring and testing will be provided by an engineering and testing firm independent of the operator specializing in the observation and testing of soils.

The landfill will accept only fly ash, bottom ash, flue gas desulfurization (FGD) gypsum, FGD clarifier sludge, asbestos material, land clearing and inert debris, coal mill rejects, waste limestone material, boiler slag, construction and demolition waste, sand blast material, ball mill rejects, coal waste, and pyrites generated at the Marshall Steam Station as well as coal combustion residuals (CCR) from other Duke Energy Corporation facilities. The waste stream was assumed for design to be comprised predominantly of fly ash. QA monitoring and testing is proposed only for fly ash. Other waste materials shall be placed consistent with Operations Plan requirements.

2. QA MONITORING AND TESTING

2.1 Waste Placement

Waste shall be placed and compacted in loose lifts to achieve a 12-inch compacted lift thickness. These incremental lifts shall be placed to achieve a vertical operational lift thickness of 10 feet maximum. The waste filling sequence shall be consistent with the Operations Plan. In general the waste filling sequence shall progress in 10-foot thick operational lifts, with each lift completed across a whole cell before beginning the next lift.

2.2 Intermediate Cover Placement

A 12-inch thick intermediate cover layer shall be placed on exterior slopes and areas where final grades have been reached. Intermediate cover material shall be free of protruding roots, stumps, and debris. Intermediate cover may not contain more than 5 percent gravel (particle sizes larger than 0.5 inches) by weight as determined by ASTM D422. Isolated rock fragments not exceeding 6 inches in diameter may be placed within the intermediate cover if completely surrounded by compacted soil if approved by the Engineer. Rock fragments shall not protrude more than 3 inches from the compacted intermediate cover fill surface. Soil shall be placed in maximum 6-inch thick compacted lifts. Intermediate cover will be seeded within 7 days in accordance with Erosion and Sediment Control requirements. Vegetation shall be removed and the intermediate cover soil shall be scarified or removed prior to placing any overlying waste.

2.3 QA Field Monitoring

QA field monitoring shall be performed to verify that operations are being performed in accordance with the general steps outlined in Section 2 of the Operations Plan. The

engineering technician responsible for field monitoring shall document the waste type, location of waste placement, and general placement and compaction methods during waste placement. Documentation shall include information, such as the operator's equipment types and number of passes to achieve the minimum compaction requirements. Waste placement monitoring documentation shall be maintained with the on-site operation records.

2.4 QA Field Testing

QA field testing shall be performed to monitor the compaction and moisture conditioning during waste placement. Waste and interim cover soil shall be compacted to a minimum 95 percent of its Standard Proctor (ASTM D 698) maximum dry density. Compacted moisture content shall be within 5 percent of optimum moisture content.

In-place density and moisture content testing shall be performed at a frequency of one test per 10,000 cubic yards of waste placed. In-place density testing shall be performed using the Sand-Cone Method (ASTM D 1556), Nuclear Methods (ASTM D 6938), or the Drive-Cylinder Method (ASTM D 2937). Moisture content testing shall be performed using the Direct Heating Method (ASTM D 4959) or Nuclear Methods (ASTM D 6938). Density test locations shall generally be documented on a referenced grid system. Waste placement testing records shall be maintained with the on-site operations records.

In the event that an in-place density and moisture content test fails, the area of waste placement shall be reworked, reconditioned, and retested until the minimum compaction requirement is met.

Compaction Requirements and Testing

After the waste is dumped from the trucks and placed on the active face, the waste will be placed in consecutive, approximate 1-foot thick lifts that do not exceed a 10-foot operational lift. Prior to compaction of an existing lift, the existing and new material should be adequately blended.

In-Place Density and Moisture Content Testing

In-place density tests shall be performed at the following frequencies:

Waste: One test per 10,000 cubic yards (or one test per 270,000 square feet per 12-inch thick lift.

Interim Cover: One test per 288 cubic yards.

For the purposes of tracking and performing in-place density and moisture content testing, a waste unit weight of 1 ton per cubic yard is assumed.

Waste and interim cover soil shall be compacted to a minimum 95 percent of its Standard Proctor (ASTM D 698) maximum dry density. Compacted moisture content of waste shall be within 5 percent of the material's optimum moisture content and within 3 percent for interim cover soil as determined by ASTM D 698. If field density tests indicate that the relative compaction or moisture content requirements are not met, the material shall be moisture conditioned and/or re-worked and re-tested until the compaction density and moisture requirements are met. The field density testing report should document any failing tests and re-work required to meet testing requirements.

In-place density tests shall be performed using the Sand Cone Method (ASTM D 1556), Drive-Cylinder Method (ASTM D 2937), or Nuclear Method (ASTM D 6938). If the nuclear method is selected, a minimum of one comparison density test using the Sand Cone or Drive Cylinder method shall be performed for every five nuclear density tests, and correlations between the test methods shall be developed and reviewed by the Engineer. A sample of ash material shall be collected from each density test location and placed in a sealed container for subsequent field and laboratory moisture testing.

A family of Proctor curves shall be developed for the on-site ash material as standard Proctor moisture-density tests are performed as a reference for the field density testing. A minimum of one (1) one-point field Proctor test shall be performed for each day of field density testing. Additional one-point field Proctors shall be performed if the material changes. A material change is defined when the maximum dry density of the referenced standard Proctor test varies by more than 2 pounds per cubic foot (pcf). If the estimated standard Proctor maximum dry density based on the results of one-point Proctor testing indicates that the maximum dry density varies by more than 5 pcf from the nearest representative standard Proctor moisture-density relationship, an additional bulk sample of ash material shall be obtained and standard Proctor testing shall be performed for the sample as a reference for the field density testing.

Field moisture content testing shall be performed for each density test using the Direct Heating Method (ASTM D 4959). The Nuclear Method (ASTM D 6938) shall not be used for moisture content testing on the waste material. Comparison laboratory moisture content testing for waste shall be performed using the Oven Method (ASTM D 2216), at an oven temperature of 60 degrees Celsius. The laboratory moisture content shall control in the event of a discrepancy between laboratory moisture content and in-place moisture content.

2.5 Laboratory Testing

Laboratory testing shall be performed at a frequency of one Standard Proctor test (ASTM D 698) per 50,000 cubic yards of waste placed. Laboratory testing records shall be maintained with the on-site operations records.

Laboratory Testing
Laboratory moisture content testing shall be performed in conjunction with the field density testing as described above. The laboratory moisture content testing shall be performed using the Oven Method (ASTM D 2216), at an oven temperature of 60 degrees Celsius.

Standard Proctor moisture-density relationship (ASTM D 698) testing shall be performed at a minimum frequency of one test for every 50,000 cubic yards of material placed. As previously mentioned, additional standard Proctor samples shall be obtained and tested if one-point Proctor testing indicates that the estimated maximum dry density of the material varies by more than 5 pcf from the nearest representative standard Proctor moisture-density relationship as determined by the one-point Proctor method.

2.6 Cover Requirements

Operational Cover

Operational soil cover should be applied, as needed, for dust control and stormwater management. If needed, operational soil cover should be applied at a thickness suited to its purpose. For example, operational soil cover may be applied thinner to provide dust control and it may be applied thicker to tolerate erosion. Operational covers to provide dust control shall be as described in the Dust Control Plan in Appendix I.

Downdrains, tack-on benches, and chimney drains will be installed and extended as appropriate. Soil diversion berms will be used to direct water as appropriate.

Waste will be covered with interim and final cover as applicable, in accordance with the following sections in this plan. Operational soil cover is not required, provided the Dust Control Plan included as Appendix I is followed.

Interim Cover

A 12-inch thick interim cover layer shall be placed on exterior slopes and areas where final grades have been reached. Interim cover will be seeded within 7 days in accordance with Erosion and Sediment Control requirements. Vegetation shall be removed and the interim cover soil shall be scarified or removed prior to placing any overlying waste.

For areas where waste placement will be inactive for 12 months or more, interim soil cover is not required, provided the Dust Control Plan included as Appendix I is followed.

Final Cover

The final cover system for the Marshall Industrial Landfill will be completed within 180 days following the beginning of closure activities unless otherwise approved by the Division.

The final cover will consist of (from the bottom up) interim cover (on top of the waste), 40-mil thick double-sided textured linear low density polyethylene (LLDPE) geomembrane, a geocomposite drainage layer, 18-inch thick compacted soil cover, and 6-inch thick vegetative cover. Should grading be required prior to closure, the final cover system (beginning with LLDPE geomembrane) may be installed directly on waste.

The vegetative layer will consist of on-site soil suitable for maintaining grass cover and controlling erosion. Alternatively, the geosynthetic components may consist of a 50-mil LLDPE structured geomembrane and an 8 oz/sy non-woven geotextile.

Surface water that percolates through the vegetative layer and 18-inch thick compacted soil layer will be collected by the geocomposite drainage layer or the structured geomembrane alternative. The cover system stormwater management structures will collect both infiltration and surface water runoff. The final cover will be vegetated with native grasses within six months following closure.

Please refer to the *Closure/Post-Closure Plan* for final cover specifications and maintenance and operations requirements.

DUST CONTROL PLAN
INDUSTRIAL LANDFILL NO.1
PERMIT NO. 1812
MARSHALL STEAM STATION
TERRELL, NORTH CAROLINA

S&ME Project No. 7235-15-027

Prepared for:
526 South Church Street
Charlotte, North Carolina 28202

Prepared by:
S&ME, Inc.
9751 Southern Pine Boulevard
Charlotte, North Carolina 28273
S&ME Engineering License No. F-0176

August 3, 2011
Revised September, 2015
February, 2016

TABLE OF CONTENTS

1. INTRODUCTION AND SITE DESCRIPTION

This Dust Control Plan is for the Industrial Landfill No.1 (ILF) at Duke Energy's Marshall Steam Station. This Plan provides dust control methods for managing dust emissions at the landfill, and it provides a monitoring program and corrective action response to contain coal combustion product (CCP's) to prevent dust nuisances to employees and the public. The monitoring program will aid Duke Energy and the landfill operator in evaluating the dust control methods, or combination of dust control methods, that prove effective with site specific conditions.

This Dust Control Plan addresses operations of Phase 1, Cells 1 and 2 of the ILF, with an approximate 36-acre footprint.

The ILF is used for CCP management. CCP's primarily consist of fly ash, bottom ash, flue gas desulfurization (FGD) gypsum, FGD clarifier sludge, coal mill rejects, waste limestone material, boiler slag, ball mill rejects, coal waste, wastewater treatment sludge, and pyrites as defined in Section 2.1.2 of the Operations Plan.

This Plan is used as an appendix to the approved landfill Operations Plan. Refer to the Operations Plan for a description of revisions.

2. DUST CONTROL METHODS

The primary potential source of dust emissions in the landfill is the top deck area and active area of waste placement. These areas are at a higher risk for producing dust due to vehicular and equipment traffic and earthworks-like construction. Exterior landfill slopes are less of a dust control concern as they have intermediate or operational soil covers which are vegetated as required in the Operations Plan.

Dust emissions from the landfill can be controlled through a variety of dust control methods. Possible dust control methods are identified herein. Dust control methods may be characterized as products and/or applications, structural wind breaks and/or covers, and operational methods.

Dust control methods for the landfill area include:

- Watering;
- Establishing vegetative cover;
- Mulching;
- Structural controls consisting of:
    - Wind breaks (i.e. fencing and/or berms); and
    - Temporary coverings (i.e. tarps);
- Spray applied dust suppressants consisting of, and not limited to:
    - Anionic asphalt emulsion;
    - Latex emulsion;
    - Resin in water;

  - Polymer based emulsion; and
  - Mineral mortar coatings (i.e. posi-shell);
- Calcium chloride;
- Soil stabilizers (i.e. soil cements);
- Operational soil cover;
- Modifying the active working area; and
- Modifying operations during dry and windy conditions.

The operator may use, and is not limited to, combinations of these dust control methods or any method that is technically sound to control dust for the specific site conditions. If the operator intends to use a dust control method not presented above, the proposed dust control method will be evaluated on a case-by-case basis to assess the effectiveness with specific site conditions. For the purposes of this Plan, operational soil cover will be defined as soil material applied at a suitable thickness to provide dust control. The effectiveness of the dust control methods implemented should be evaluated through a dust monitoring program outlined in Section 3.

Operational equipment generally consists of dump trucks, vibratory smooth drum roller, bulldozer, water truck, spray trailer, track hoe, and service truck. Operational equipment will be used to construct, install, apply, and/or repair dust control methods. The operator will make provisions to alleviate any on-site issues that arise when primary equipment is being maintained or is inoperable. Marshall Steam Station contains multiple landfill facilities, and the landfill operator will make provisions to have the necessary equipment to control multiple fugitive CCP dusting emission events.

3. MONITORING AND CORRECTIVE ACTION RESPONSE

This section describes a dust monitoring program and suggests corrective action responses should fugitive emissions be observed.

3.1 Monitoring

During landfill operations, a dust monitoring program will be implemented to evaluate the dust control measure performance and observe the areas for dust emissions. The dust monitoring program consists of performing visual observations of dust prone areas, dust control measures, and monitoring existing and forecasted weather conditions.

Dust emissions can occur under many conditions. For the purposes of this Plan, dust emissions are characterized as fugitive emissions, where CCP dust is located outside the limit of landfill waste. This is most likely to occur during windy, dry, and hot weather conditions. Therefore, the operator will monitor both existing and forecasted weather conditions and use dust control measures suited to the weather conditions. The dust control measures shall be implemented prior to the forecasted weather conditions.

Equipment operators shall continuously observe the active face and other areas within the landfill limit for dust emissions. In addition, preventative dust control measures should be observed and documented at least twice daily (morning and afternoon) when the landfill is in operation to evaluate the dust control measure performance. Additional

observations may be necessary as site and weather conditions dictate. Observations will be documented on the attached "*Monitoring Worksheet*," or online database/worksheet, etc. Due to the continual maintenance necessary on moisture conditioned and spray-applied areas, the operator shall pay particular attention to these areas. Structural controls shall be observed to monitor that they are achieving their intended purpose. Observations in the landfill area may be made with reference to the Phase 1 Operations Grid shown in the attached Figure 1.

Monitoring will be conducted during times when the landfill is in operations. The operator shall continue to provide necessary dust control measures during periods when operations are inactive (i.e. outages, weekends, and holidays). Operators are to establish appropriate measures so that dust emissions are not reasonably likely to occur during inactive operations periods when monitoring is not being conducted.

3.2 Corrective Action

If fugitive dust emissions are observed and observations indicate dust control measures are not achieving their intended purpose, then appropriate corrective actions will be taken. Dust control measures should be reapplied, repaired, or added, as necessary, to control dust emissions. The operator will construct, install, apply, and/or repair dust control measures prior to the end of the work day to control dust emissions during non-operating hours. The operator will implement dust control measures as preventative controls rather than in response to fugitive dust emissions.

ISLAND POINT ROAD

1 2 3 4 5 6 7 8 9 10 11 12 13 14

A B C D E F

CELL 3

CELL 1

CELL 4

CELL 2

GRAPHIC SCALE

150 0 75 150 300

(IN FEET)

DATE: DEC. 2012

DRAWN BY: KB

CHECKED BY:

SCALE: 1" = 150'

PROJECT NO. 1356-11-032

S&ME

WWW.SMEINC.COM

PHASE 1 OPERATIONS GRID
DUST CONTROL PLAN

MARSHALL INDUSTRIAL LANDFILL NO. 1
TERRELL, NORTH CAROLINA

FIGURE NO.

1

Q:\1356\DUKE ENERGY\11-032 MSSILF#1 Cells 3 and 4\DWG\Rev PTC Drawings\Operations Plan\Dust Control Plan Figure.dwg

Industrial Landfill No. 1
Permit No. 1812

Dust Control Plan -
Monitoring Worksheet

Marshall Steam Station
Terrell, North Carolina

Week:

Date/Time	Dust Control Method in Use	Effective Yes/No	Observation Location	Preventative or Corrective Action Taken Yes/No	Observations/comments including: weather conditions, wind speeds, precipitation, forecast, preventative or corrective actions taken (if needed), additional operational notes	Name of Observer