

Arrowhead MSW Landfill CCR Compliance Matrix

11/17/2015



Arrowhead Landfill is a Subtitle D **MSW Landfill** permitted by the Alabama Department of Environmental Management (ADEM) with Solid Waste Permit #53-03. The 40 CFR Part 257, Subpart D "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments" **specifically excludes MSW landfills** as noted in the following section:
§257.50(i) This subpart does not apply to municipal solid waste landfills that receive CCR.

CCR Rule Requirements:		Arrowhead Status
Location Restrictions:		
§257.60 Placement above the uppermost aquifer	(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table).	The vertical separation between the lowest liner elevation and the highest potentiometric head in the Eutaw Formation is 51.59 feet. This separation far exceeds the minimum required 5 feet of vertical separation by §257.60(a).
§257.61 Wetlands	(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in wetlands, as defined in §232.2 of this chapter, unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that the CCR unit meets the requirements of paragraphs (a)(1) through (5) of this section.	No part of the Arrowhead Landfill waste footprint is located on a wetland, as defined in §232.2 of this chapter.
§257.62 Fault Areas	(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene times unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit.	The Arrowhead Landfill is not located within 60 meters (200 feet) of the outermost zone of a fault that has had a displacement in Holocene times. (2005 Site Analysis Report by Jordan, Jones & Goulding, Inc.)

<p>§257.63 Seismic Impact Zones</p>	<p>(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in seismic impact zones unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.</p>		<p>The Arrowhead Landfill is not located in a seismic impact zone. (2005 Site Analysis Report by Jordan, Jones & Goulding, Inc.)</p>
<p>§257.64 Unstable Areas</p>	<p>(a) An existing or new CCR landfill, existing or new CCR surface impoundment, or any lateral expansion of a CCR unit must not be located in an unstable area unless the owner or operator demonstrates by the dates specified in paragraph (d) of this section that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted.</p>		<p>The Arrowhead Landfill is not located in an unstable area. (2005 Site Analysis Report by Jordan, Jones & Goulding, Inc.)</p>
Design Criteria:			
<p>§257.70 Design Criteria for new CCR landfills and any lateral expansion of a CCR landfill</p>	<p>(a)(1) New CCR landfills and any lateral expansion of a CCR landfill must be designed, constructed, operated, and maintained with either a composite liner that meets the requirements of paragraph (b) of this section or an alternative composite liner that meets the requirements in paragraph (c) of this section, and a leachate collection and removal system that meets the requirements of paragraph (d) of this section.</p>		<p>The Arrowhead Landfill has been designed, constructed, operated and maintained with a composite liner and leachate collection and removal system that meets the requirements of this section. (See attached base liner detail #17 from the approved Design & Operation Plans.)</p>
Groundwater Monitoring and Corrective Action:			
<p>§257.91 Groundwater Monitoring Systems</p>	<p>(a) <i>Performance standard.</i> The owner or operator of a CCR unit must install a groundwater monitoring system that consists of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer.</p>		<p>13 groundwater wells (2 up gradient background and 11 down gradient) are currently monitored for Tract 1. As the rest of the site is developed (Tracts 2 & 3), additional groundwater monitoring wells will be phased in. After the site has been fully built out, there will be a total of 40 wells making up the comprehensive groundwater monitoring system for the three tracts.</p>

<p>§257.93 Groundwater Sampling and Analysis Requirements</p>	<p>(a) The groundwater monitoring program must include consistent sampling and analysis procedures that are designed to ensure monitoring results that provide an accurate representation of groundwater quality at the background and down gradient wells required by § 257.91.</p>	<p>Background sampling was conducted prior to waste placement to build a statistical database. The groundwater monitoring system is sampled semi-annually. Semi-annual reports include laboratory analytical results of water quality data, statistical results of the water quality data, a water table elevation contour map with groundwater flow directions, groundwater flow rates, and a determination of the technical sufficiency of the monitoring network. These reports are submitted to ADEM semi-annually.</p>
<p>§257.94 Detection Monitoring Program</p>	<p>(a) The owner or operator of a CCR unit must conduct detection monitoring at all groundwater monitoring wells consistent with this section. At a minimum, a detection monitoring program must include groundwater monitoring for all constituents listed in appendix III to this part.</p>	<p>The additional CCR groundwater parameters that are listed in appendix III were added to Arrowhead Landfill's semi-annual sampling schedule during the second semi-annual monitoring event for 2015.</p>
<p>§257.95 Assessment Monitoring Program</p>	<p>(a) Assessment monitoring is required whenever a statistically significant increase over background levels has been detected for one or more of the constituents listed in appendix III to this part.</p>	<p>Arrowhead Landfill will conduct assessment monitoring if a statistically significant increase over background levels has been detected for any constituent.</p>
<p>Closure and Post-Closure Care</p>		
<p>§257.102 Criteria for Conducting the Closure or Retrofit of CCR Units</p>	<p>(a) Closure of a CCR landfill, CCR surface impoundment, or any lateral expansion of a CCR unit must be completed either by leaving the CCR in place and installing a final cover system or through removal of the CCR and decontamination of the CCR unit, as described in paragraphs (b) through (j) of this section.</p>	<p>Arrowhead Landfill's closure plan calls for capping completed waste cells with a final cover system that meets the requirements of this section. (See attached permanent landfill cap detail #6 from the approved Design & Operation Plans.)</p>
<p>§257.102 Criteria for Conducting the Closure or Retrofit of CCR Units</p>	<p>(b) <i>Written closure plan</i> —(1) <i>Content of the plan</i>. The owner or operator of a CCR unit must prepare a written closure plan that describes the steps necessary to close the CCR unit at any point during the active life of the CCR unit consistent with recognized and generally accepted good engineering practices.</p>	<p>Arrowhead Landfill has an ADEM approved Closure Plan that complies with this section.</p>

<p>§257.104 Post-closure Care Requirements</p>	<p>(b) <i>Post-closure care maintenance requirements.</i> Following closure of the CCR unit, the owner or operator must conduct post-closure care for the CCR unit, which must consist of at least the following: (1) Maintaining the integrity and effectiveness of the final cover system, including making repairs to the final cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the final cover;</p>		<p>These requirements will be met by implementing ADEM's approved Post-closure Plan.</p>
<p>§257.104 Post-closure Care Requirements</p>	<p>(2) If the CCR unit is subject to the design criteria under § 257.70, maintaining the integrity and effectiveness of the leachate collection and removal system and operating the leachate collection and removal system in accordance with the requirements of § 257.70; and</p>		<p>These requirements will be met by implementing ADEM's approved Post-closure Plan.</p>
<p>§257.104 Post-closure Care Requirements</p>	<p>(3) Maintaining the groundwater monitoring system and monitoring the groundwater in accordance with the requirements of §§ 257.90 through 257.98.</p>		<p>These requirements will be met by implementing ADEM's approved Post-closure Plan which includes monitoring groundwater for 30 years after ultimate closure.</p>

Attachments:

1. Groundwater elevation certification letter from Professional Geologist
2. Detail #17 and #6 from approved Arrowhead Landfill Horizontal Expansion Design and Operation Plan dated April 2011
3. "Unstable Areas" excerpt from JJG Site Analysis Report dated September 2005



BUNNELL-LAMMONS ENGINEERING, INC.
GEOTECHNICAL, ENVIRONMENTAL AND CONSTRUCTION MATERIALS CONSULTANTS

November 17, 2015

Hodges, Harbin, Newberry, & Tribble, Inc.
3920 Arkwright Road, Suite 101
Macon, Georgia 31210

Attention: Mr. William F. Hodges, P.E.

Subject: **CCR Location Restriction: Placement Above the Uppermost Aquifer
Arrowhead Landfill**
Perry County, Alabama
Permit Number 53-03
BLE Project Number J15-4999-40
HHNT Project Number 3006-141-01

Mr. Hodges,

As authorized, Bunnell-Lammons Engineering, Inc. (BLE) has performed an evaluation of the vertical separation between the landfill subgrade liner system and groundwater in the Eutaw Formation at the Arrowhead Landfill in Perry County, Alabama. This work was performed to meet the requirements of Federal Register, Volume 80, No. 74, dated April 17, 2015, Part II, 40 CFR, § 257.60(a) that requires a minimum vertical separation of five feet between the landfill post-settlement subgrade liner system and the groundwater in the uppermost aquifer at the site.

1.0 PROJECT INFORMATION

The Arrowhead Landfill is located southeast of Uniontown, Alabama. The permittee is Perry County Associates, LLC. Tract 1 of the landfill has been constructed (Cells 1 through 5 and 6A). The facility is permitted as a municipal solid waste (MSW) and can accept Coal Combustion Residuals (CCR).

Since the landfill is permitted as a Subtitle D MSW landfill, the facility is exempt from the specific federal regulations regarding the siting of CCR disposal facilities. However, Hodges, Harbin, Newberry, & Tribble, Inc. (HHNT) has requested that BLE specifically address the following rule from Federal Register, Volume 80, No. 74, dated April 17, 2015, Part II, 40 CFR:

§ 257.60 Placement above the uppermost aquifer.

(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table). The owner or operator must demonstrate by the dates specified in



paragraph (c) of this section that the CCR unit meets the minimum requirements for placement above the uppermost aquifer.

The letter contained herein provides site-specific information to address the aforementioned rule.

2.0 SUBSURFACE CONDITIONS

2.1 Site Geology/Hydrogeology

Geologic conditions for the site summarized herein are described in the *Solid Waste Permit Application, Volume 1 of 2, Site Analysis, Perry County Associates Landfill*, dated September 2005, prepared by Jordan, Jones, and Goulding (JJ&G) which has been previously reviewed and approved by ADEM. Additional information was obtained from prior well installation projects conducted at the site by BLE (2007 and 2012), as well as the most recent semi-annual sampling report prepared by BLE (2015) at the time of this letter.

The site is underlain by Cretaceous-age Coastal Plain sediments comprised of the Selma Group (clay and chalk) overlying the Eutaw Formation (sand).

Regionally, the Selma Group is comprised of the Ripley Formation, Demopolis chalk, Arcola Limestone Member, and Mooreville chalk. Locally, the Selma Group generally consists of about 440 to 563 feet of dense, low permeability, gray, clay and chalk at the landfill site. The upper 10 to 20 feet near the ground surface consists of brown clay, which represents the upper weathered portion of the formation. The existing shallow monitoring wells (GWM-12, GWM-13, GWM-14, GWM-15, GWM-16, GWM-17, and GWM-18) are set in the upper weathered portion of the Selma Group chalk to intersect potential perched groundwater, but were dry when they were installed. It is anticipated that groundwater in these shallow wells will be a seasonal feature. The Selma Group serves as the confining layer for the underlying Eutaw Formation.

Underlying the Selma Group is the Eutaw Formation, which is the uppermost aquifer and consists of gray glauconitic fine to medium sand and is a regional confined water supply aquifer. The existing deep monitoring wells (GWM-1 through GWM-6) were set to intersect the upper portion of the Eutaw Formation at depths ranging from 460.0 to 580.5 feet. Stabilized potentiometric water levels in the Eutaw Formation range from about 70 to 155 feet below ground surface, but the uppermost physical presence of groundwater is at the top of the Eutaw Formation and below the confining Selma Group clay and chalk, which ranges from approximately -240 feet MSL (GWM-1) to -294 feet MSL (GWM-4).

2.2 Historical Groundwater Levels

Twenty-one (21) rounds of semi-annual groundwater measurements have been collected from the monitoring wells at the site by the sampling contractor from June 2007 to September 2015 (BLE, 2015). The maximum observed potentiometric head observed in the Eutaw Formation monitoring wells at the site during this time period is 128.41 feet MSL in well GWM-1.

Historical potentiometric surface elevation contour maps included in the semi-annual sampling reports have indicated very little potentiometric head difference in the water levels between the six



existing monitoring wells set to intersect the Eutaw Formation; potentiometric head differences among the six wells across the site during each of the 21 semi-annual sampling events since 2007 have ranged from 0.65 feet (N3; July 2, 2007) to 6.27 feet (N8; March 3, 2009) indicating a relatively flat potentiometric surface. Additionally, water level fluctuations in each of the Eutaw Formation monitoring wells have ranged from 8.70 feet (GWM-6) to 16.36 feet (GWM-1) during this time period.

2.3 Subgrade Liner System Elevation

The lowest elevation of the built, as well as the permitted but not yet constructed cells, is 180 feet MSL in at the cell sumps of Proposed Tract 3, Cells No. 10 and 11 (HHNT, 2011).

2.4 Vertical Separation Between Groundwater and the Subgrade Liner System

We make the following observations based on site specific information:

- The lowest elevation of the landfill’s subgrade liner system is 180 feet MSL.
- The highest observed potentiometric surface elevation observed at the site from the Eutaw Formation monitoring wells is 128.41 feet. However, the groundwater is confined in the Eutaw Formation and the highest physical presence of groundwater in the monitoring wells is approximately -240 feet MSL.
- **The vertical separation between the lowest liner elevation and the highest potentiometric head in the Eutaw Formation is 51.59 feet. This separation far exceeds the minimum required 5 feet of vertical separation by § 257.60(a).**
- The vertical separation between the lowest liner elevation and the highest elevation of the physical presence of groundwater in the Eutaw Formation is 420 feet. This separation far exceeds the minimum required 5 feet of vertical separation by § 257.60(a).
- The landfill subgrade is constructed on the dense Selma Group clay and chalk and anticipated subgrade settlement as a result of landfill construction should be nominal.

3.0 CONCLUSION

In conclusion, the landfill post-settlement subgrade liner system has been designed to meet the requirements of Federal Register, Volume 80, No. 74, dated April 17, 2015, Part II, 40 CFR, § 257.60(a) that requires a minimum vertical separation of five feet.

4.0 REFERENCES

Bunnell-Lammons Engineering, Inc.; July 13, 2007; *Groundwater Monitoring Well Installation Report (Tract 1), Perry County Associates Landfill, Perry County, Alabama*; BLE Project Number J07-4999-05.

Bunnell-Lammons Engineering, Inc.; December 31, 2012; *Groundwater Monitoring Well Installation Report (Tract 1), Perry County Associates Landfill, Perry County, Alabama*; BLE Project Number J12-4999-30.



Arrowhead Landfill – Perry Co., Alabama

November 17, 2015

CCR Location Restriction: Placement Above the Uppermost Aquifer

BLE Project Number J15-4999-40

Bunnell-Lammons Engineering, Inc.; October 27, 2015; *Report of Groundwater Quality Results & Statistical Analysis, Second Semi-Annual Sampling Event of 2015 (N21), Arrowhead Landfill, Perry County, Alabama*; BLE Project Number J15-4999-37.

Hodges, Harbin, Newberry, & Tribble, Inc.; April 2011; *Arrowhead Landfill Horizontal Expansion for Perry County Associates, LLC, Perry County, Alabama*; Sheet 3 of 19 titled *Top of Clay Liner Grading Plan – Tracts 1, 2, and 3*.

Jordan, Jones, and Goulding; September 2005; *Solid Waste Permit Application, Volume 1 of 2, Site Analysis, Perry County Associates Landfill*

5.0 CLOSING

We appreciate the opportunity to serve as your geological consultant on this project and look forward to working with you on future projects. If you have any questions, please contact us at (864) 288-1265.

Sincerely,

BUNNELL-LAMMONS ENGINEERING, INC.

Mark S. Preddy, P.G.
Senior Geologist
Registered, Alabama #801

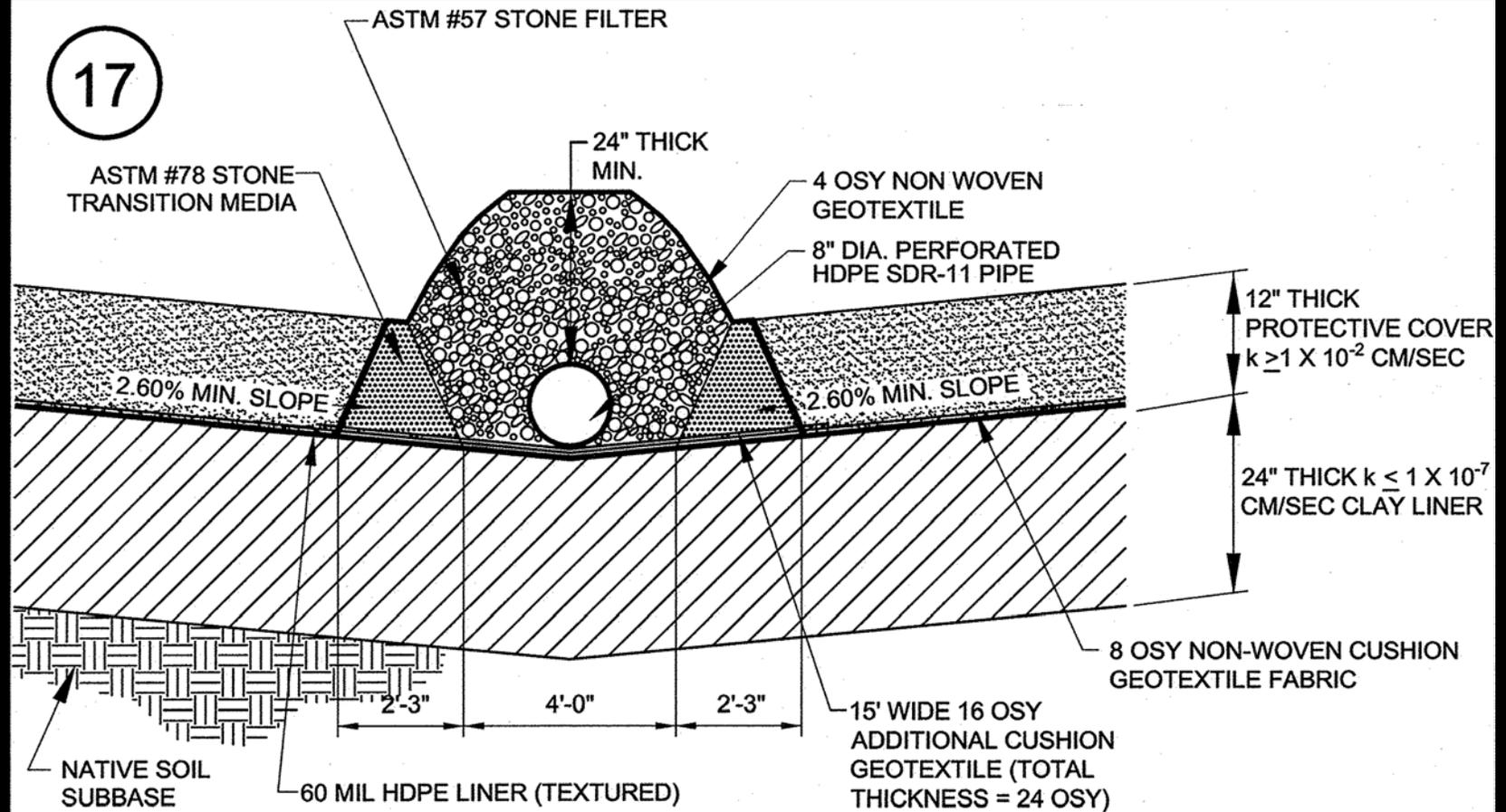


11/17/15

cc: Daniel B. Bunnell, P.E. – BLE
Clint L. Courson, CHMM – HHNT

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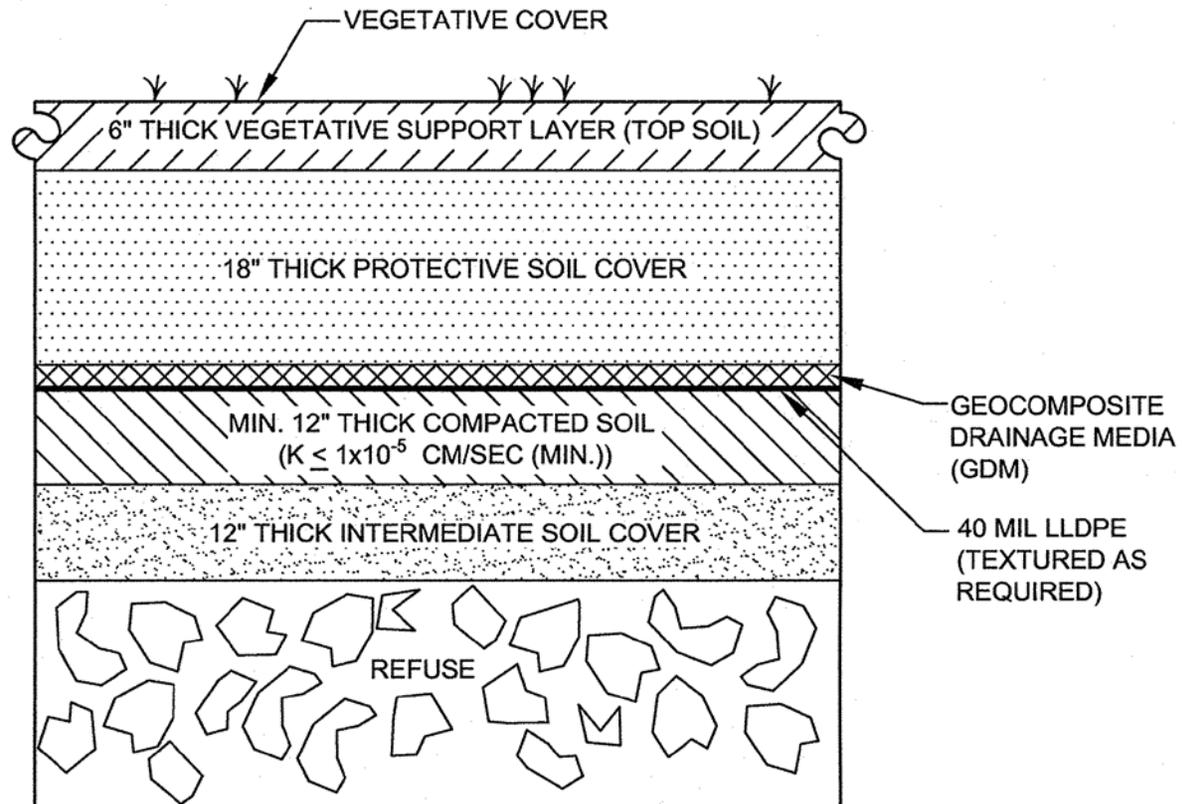


NOTES:

1. GRAVEL COLUMN FILTER NOT REQUIRED FOR SOLID HDPE PIPE.
2. 8 OSY NON-WOVEN CUSHION GEOTEXTILE FABRIC SHALL BE PLACED ON TOP OF 60 MIL MHDPE LINER WHEN 12" THICK PROTECTIVE COVER MATERILA IS USED. IF PROTECTIVE COVER MATERIAL THICKNESS INCREASES TO 24", THE 8 OSY NON-WOVEN CUSHION GEOTEXTILE FABRIC MAY BE ELIMINATED.

BOTTOM LINER AND PROTECTIVE COVER SYSTEMS

6



NOTE: GEOCOMPOSITE DRAINAGE MEDIA (GDM) SHALL CONSIST OF 6 OZ / SY NONWOVEN GEOTEXTILE HEAT BONDED TO BOTH SIDES OF GEONET.

PERMANENT LANDFILL CAP SYSTEM (4H:1V)

report

September 2005

Solid Waste Permit Application
Volume 1/2

Site Analysis

Perry County Associates Landfill

Perry County, Alabama

Prepared for

Alabama Department of
Environmental Management

Perry County Associates, L.L.C.



working to better our communities and environment

Unstable Areas

An evaluation of the PCA landfill site was performed to assess whether the site is located in a zone of active faults, seismic impact zone, or unstable area. To evaluate proximity to active (e.g., Holocene age) faults, available literature from the Geological Survey of Alabama was reviewed and site reconnaissance was performed. The Selma Group chalks (Demopolis chalk) crop out at the PCA landfill site. Faults in the Selma Group chalk occur as irregularly distributed normal faults with less than one foot of displacement and a zone of more pronounced normal and reverse faulting (Beg and Odom, 1985). The latter type of faulting is associated with an area referred to as the Livingston Fault zone, located 15 miles west the PCA landfill site, in Sumter and Marengo Counties (Beg and Odom, 1985). Based on the literature review, no Holocene-age faulting is located at the site or within 200 feet of the site. Faulting in the Selma Chalk has been dated at 130,000 to 300,000 years ago; using Uranium-Thorium techniques. Site reconnaissance did not reveal the presence of fault scarps, or areas of pronounced visible jointing which could indicate faults.

Further evaluation was performed to assess whether the PCA landfill site is located in a seismic impact zone. As defined by 40 CRF 258.14, a seismic impact zone is an area where a 10-percent or greater probability that the maximum horizontal acceleration in lithified earth material, expressed as a percentage of the earth's gravitational pull (g) will exceed 0.10g in 250 years. Figure 4 shows a portion of the USGS Map MF2120 - Probabilistic Earthquake Acceleration and Velocity Maps for the U.S. and Puerto, Rico (Adgermissen, 1991). The Perry County site is located in an area where there is less than 10 percent probability that earthquake acceleration will exceed 0.10g, and is therefore not located in a seismic impact zone. Based on this criteria, the nearest seismic impact zone is located approximately 30 miles northeast of the PCA landfill site.

Unstable areas are defined under 40 CRF 258.15 as locations which are susceptible to natural or human induced events or forces capable of impairing the integrity of some or all of the landfill structural components responsible for preventing releases from a landfill. Examples of unstable areas can include poor foundation conditions, areas susceptible to mass movements, and karst terrains. Central Alabama, including Perry County is underlain by thick (400 to 500 feet) chalk sequences which comprise the Cretaceous Selma Group. The chalk can weather to varying depths, and form a thin soil layer and alluvial accumulation in low-lying areas. However, the chalk is considered a structurally stable material for foundations. Construction of the landfill will require removal of soil and weathered chalk to depths of up to 20 feet to provide cover material during landfill operation. Therefore, the landfill foundation will be constructed primarily upon unweathered chalk bedrock. No mines or oil/gas wells have been identified on

site or in the vicinity of the PCA landfill site. The PCA landfill site is not located in an unstable area.

The site topography is flat to gently sloping from elevation of about 290 feet at the southeast corner to about 180 feet in the northeast corner of the site. The PCA landfill site is not considered prone to mass movement due to relatively flat topography together with shallow stable bedrock. Furthermore, the site is not located in an area of karst terrain. The Selma group chinks are massive, low-permeability formations, which generally do not contain groundwater (Reed et al, 1972). As such, development of karst conditions in the Selma Group chinks have not been identified in the geological literature, nor was evidence of karst (such as surface sinkholes, or voids during drilling) identified on site.