TEMPORARY CAP AND CAP INTEGRITY SYSTEM PLAN NARRATIVE

BRIDGETON LANDFILL

Prepared for
Bridgeton Landfill, LLC
April 11, 2013
Revised May 10, 2013

Prepared by

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Project Number 130140

Temporary Cap and Cap Integrity System Plan Narrative
Bridgeton Landfill
Bridgeton, Missouri

The material and data in this report were prepared under the supervision and direction of the undersigned.

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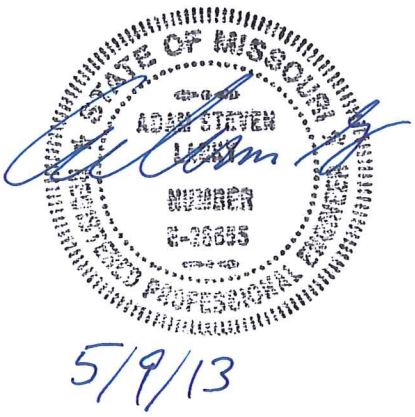

5/9/13

Adam Larky, P.E.
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1 INTRODUCTION AND BACKGROUND

1.1 Introduction and Background

Cornerstone Environmental Group, LLC (Cornerstone) has prepared this Temporary Cap and Cap Integrity System design plan for the south quarry at the Bridgeton Landfill located in Bridgeton, Missouri. This plan will supplement existing systems in existence at this time for the conditions at this landfill. This plan presents the systems to be installed during this project, including the following:

- Flexible Membrane Liner (FML) Temporary Cap
- Liquid and Vapor Cap Integrity System to protect the temporary cap
- Enhanced stormwater management system
- Light-duty access roads

Each of these engineered components will be discussed in subsequent sections of this plan along with installation considerations, installation schedule, construction quality control, and operations and maintenance considerations. This plan has been prepared to address the Missouri Department of Natural Resources Solid Waste Management Program (MDNR) comments provided to Bridgeton Landfill on April 4, 2013 and to accompany the Temporary Cap and Cap Integrity System Design Plans, Dated March 2013 and revised April 2013; and the Stormwater Management System Design report, dated April 2013.

2 KEY SYSTEM COMPONENTS

2.1 Temporary Cap

The temporary cap will consist of a green 60 mil Ethylene Vinyl Alcohol (EVOH) textured FML underlain be a minimum 6 ounce per square yard (oz/sy) geotextile. EVOH FML is manufactured as a "sandwich", the outside layers are composed of HDPE with an inner layer of semi-crystalline thermoplastic resin - EVOH manufacturer's information describing the EVOH FML is included in Appendix A.

The proposed temporary cap FML will be installed over approximately 32 acres in the South Quarry Unit as shown in Sheet 5. The temporary cap will be continuously seamed and continuously tied into the existing perimeter HDPE FML. In select areas shown on the plans, the temporary cap FML will be constructed over internal portions (1.2 acres) of the existing HDPE FML. Where existing temporary HDPE cap will be overlain by new EVOH temporary cap, the existing temporary HDPE cap will be scarified. The total FML area upon completion of construction will be approximately 42 acres.

The geotextile underlying the FML will be installed on a prepared subgrade as described on Sheets 3 – 4D. Cap integrity components discussed in this narrative will be constructed below and above the temporary cap to help preserve the temporary cap.

The temporary cap FML will be installed with panels orientated up and down slopes. The installation is planned to proceed in four relatively even phases from the southwest to northeast parts of the South Quarry although this may be modified during construction due to field conditions.

Locations and details of liner edge termination in areas where no existing FML exists are provided on Sheets 5 and 11 of the engineering plans.

The temporary cap FML will be installed by an experienced contractor and crews in accordance with the project specifications and QA/QC Plan currently as a separate submittal. The installation of the temporary cap will be monitored in accordance with the QA/QC Plan by an experienced third-party engineering firm. A final certification report will be prepared under the direction of a certified engineer and will be submitted to the MDNR.

Additional pertinent temporary cap information will be presented in the following subsections including:

2.1.1 Tie-in with existing temporary cap

2.1.2 Anchorage, ballast and light duty roads

2.1.3 Pipe boots and above cap piping

Each will be discussed subsequently.

2.1.1 Tie-in with Existing Temporary Cap

The temporary cap EVOH FML is manufactured as a "sandwich", the outside layers being composed of HDPE; therefore, the proposed temporary cap FML can be welded to the existing HDPE FML with traditional welding equipment.

2.1.2 Anchorage, Ballast & Light Duty Roads

The perimeter edge of the new EVOH temporary cap will either be welded to the existing temporary HDPE cap or anchored at the perimeter as shown on Sheets 5 and 11 of the engineering plans. Light duty access roads will be constructed above the temporary cap to provide ballast for the FML and allow for maintenance activities by light duty vehicles such as a one ton pickup truck or less. The roads will be 24-inch thick and constructed of a lower base layer comprised of 2 to 4 inch sized crushed limestone capped-off with a 2 to 3 inch thickness of Missouri Department of Transportation (MDOT) Type V Dense Graded Aggregate. Calculations were performed to ensure that the proposed light-duty access roads and header piping above the temporary cap would provide adequate ballast weight against wind uplift. The results of the calculations showed that the proposed design would prevent uplift from a 75 mph wind.

2.1.3 Pipe Boots and Above Cap Piping

Pipe penetrations of the FML cap will be sealed utilizing a pipe boot. These boots, comprised of HDPE will be welded to the temporary cap and mechanically clamped to the riser pipe penetrating the membrane utilizing a worm-gear clamp or comparable securing mechanism. The position of the pipe boot relative to the riser pipe can be adjusted by monitoring personnel in the event that the local area experiences settlement. These boot seals can also be visually inspected during periodic monitoring of the cap for vapor emissions.

2.2 Integrity System

The intent of the cap integrity system is to provide a means of conveying any gas or liquid that may develop beneath the FML temporary cap to a dedicated perimeter collection system. The relatively low-permeability of this cap component, compared to the accompanying soils, provides a barrier to liquid and gas movement and requires removal mechanisms below this geosynthetic cap component to insure its integrity.

The existing LFG management components (as shown on Sheets 1 and 3 of the Design drawings), including extraction wells, "bubble-suckers," and extraction piping, will be incorporated into the cap integrity system. Those components that are current installed below grade will be maintained in this relative position, with existing access points penetrating the new temporary cap and secured to the FML via pipe boot seals. Additional or supplemental LFG management components will be installed above the FML temporary cap and connected to the existing infrastructure by means of welded, flanged or flexible connectors as appropriate for each connection point.

A discussion of the major integrity system components is included the following subsections:

2.2.1 Collector berms and access risers

2.2.2 Perimeter collection trench and collection sumps

2.2.3 Above cap piping

2.2.1 Collector Berms & Access Risers

Gas and liquids that may collect below the FML temporary cap will be intercepted and controlled by several components of the cap integrity system, including the strip drains and collector berms (refer to Sheet 3 and the "4" Series Sheets for the proposed berm collector locations and the corresponding Details 2 and 3 can be found on Sheet 10 of the Design drawings). Strip drains (as shown in Detail 5, Sheet 11) will be installed on the surface of the cap soils, at a diagonal to the slope – these will serve as interceptors for any liquids/gas moving along the soil/FML interface between collector berms. Liquids/gas collected by the strip drains will be directed to the collector berms (See Details 2 and 3 on Sheet 10), consisting of both perforated piping and stone. These collectors will provide periodic points (riser locations a minimum of every 500 feet) for gas extraction and a direct conduit for gravity drainage of liquids to the perimeter collection trench. The collector berms will be trenched into the existing cap soils as shown on Details 2 and 3 on Sheet 10.

Liquids that are directed to the perimeter collection trench will be removed at a series of collection sumps installed along the perimeter collection trench. These sumps will be installed at both natural and artificial low points within this trench and will allow for removal of collected liquids utilizing a pneumatic pumping system. The perimeter collection trench will also serve to intercept any liquids/gases collected near the perimeter of the area. Liquids will be discharged to the proposed forcemain, which will convey these liquids to the leachate management system for treatment and disposal.

Collected gas will be directed to the existing GCCS for treatment and disposal via the landfill's flaring system. Supplemental lateral piping will be constructed above the

temporary FML Cap to provide vacuum, to the extraction points and convey gas to the existing GCCS.

Component construction will generally consist of the following:

- Strip drains will be laid on the surface of the cap soil (subsequent to subgrade preparations, refer to Section 3.2) at a diagonal to the slope.

- Collector berms will be trenched into the surface of the cap soils (See Detail 2 and 3 on Sheet 10 of the revised design drawings), perpendicular to the slope to promote maximum drainage potential, and intercepting the strip drains. The collector berms will incorporate both perforated piping and 2 to 3 inch washed river stone to collect both gas and liquids. The collector berms will drain liquids to the perimeter collection trench. Collected gas will be directed to the existing GCCS for treatment and disposal. Extraction points will be installed a minimum of every 500 feet as noted on Details 2 and 3 on Sheet 10 of the design Plan set. Extraction points will be provided with a wellhead for control of both applied vacuum as well as gas flow. These extraction points will also serve as risers to allow periodic jetting of the lines in the event that they become clogged.

- The perimeter collection trench (See Sheet #3 and Details 1 and 2 on Sheet 8 of the Design plans) will be excavated near the perimeter of the project area or along the interface of the existing temporary cap and will serve to collect liquids and gas intercepted by the trench itself as well as from the strip drains and collector berms. The perimeter collection trench will incorporate both 2 to 3 inch washed river stone and perforated piping. Cleanouts will be incorporated into the piping to allow periodic jetting of the lines in the event that they become clogged. These cleanouts will be installed at intervals of approximately 500 feet or at midpoints between the collection sumps.

- Perimeter collection sumps will be excavated into the refuse utilizing a tracked excavator, common to landfill construction applications. The sump structure will be set into place and backfilled with 2 to 3 inch washed river stone to provide a conduit for liquids/gas entry into the sump. Liquids/gas will be capable of entering the sumps from the collection components by means of both the stone backfill as well as piping connections directly to the sump structure. The sumps will also be fitted with mechanisms for the vacuum extraction of collected gas and the discharge of collected liquids via a pneumatic pumping system.

2.2.2 Perimeter Collection Trench, and Collection Sumps

Bridgeton Landfill has decided to eliminate the rock chimneys and replace them with additional active collection sumps. The perimeter trench will be outfitted with a 6-inch diameter perforated SDR 17 HDPE pipe which will be connected to each collection sump

(refer to Detail 2 on Sheet 8 of the Design plans). Clean-outs will be provided between sumps to flush the piping each way ("Y" connection). All sumps will be installed to a depth of 20 feet below existing grade.

2.2.3 Above Cap Piping

Above cap piping will largely run perpendicular to the landfill slope and adjacent to the collector berms and access roads. The piping will be secured by means of FML straps wrapping the piping and welded to the cap FML. These straps will be installed at a frequency as necessary to prevent pipe movement as field conditions dictate the need. The above cap piping will be connected to the existing GCCS piping by means of standard fusion joints, flanges or flexible connectors as warranted by the conditions of individual extraction points. Refer to Sheet 6 of the Design Plans for the proposed locations of this piping.

2.3 Collection Sumps and Wastewater Force Main

The collection sumps will have an extraction pump driven by air pressure similar to the units currently being used in extraction wells around the perimeter of the South Quarry. A new double-walled 3-inch SDR 11 / 6-inch SDR 17 HDPE perimeter forcemain will be constructed to covey the liquid pumped from the collection sumps to the leachate management system for disposal as described in Note 3 on Sheet 6. Detail 1 on Sheet 9 shows the details of the connection of the collection sump to the forcemain and airline. The forcemain will be constructed above the temporary cap to provide access for maintenance and other possible tie-ins if additional pumping units are necessary in the future. The forcemain will have cleanout risers spaced at approximately 500 feet per Detail 4, Sheet 9. The location of the forcemain will be field fit at the perimeter of the landfill for access to the proposed collection sumps.

Additionally, each sump will be fabricated with a 2-inch diameter suction line and a tank fitting. This will allow the sump to be evacuated manually during emergency situations or in the event that the pump malfunctions.

2.4 Stormwater Management System

The stormwater management system design has been described in detail in the Stormwater Management System Design Report submitted to the MDNR in April 2013 accompanied by Stormwater Management system design drawings. The report and design drawings describe how the facility will manage the increased runoff from the temporary cap. The stormwater management system has been designed for a 24-hour / 25-year storm event in accordance with the Missouri Rules of Natural Resources, Division 80 Solid Waste Management Chapter 3 Sanitary Landfill Section 10 CSR 80-3.010(8)(F) Water Quality. The stormwater management features include:

- Regrading of the existing benches to promote sheet flow
- Existing and proposed perimeter channels and culverts to collect and convey the runoff
- Three proposed detention basins located at the north, east and southwest areas of the Temporary Cap System
- Other miscellaneous details to deflect runoff or dissipate energy

3 INSTALLATION CONSIDERATIONS

3.1 Phased Installation

Bridgeton Landfill and its contractors are planning to utilize a phased installation approach for the temporary cap and the cap integrity system. The approximate phase boundaries are presented on the Plan drawings and may vary depending upon field and weather conditions. Since the entire temporary cap and integrity system requires installation as soon as practically possible, the entire project is essentially on critical path for completion; and therefore, multiple contractor crews may be working simultaneously to complete this work as quickly as possible . The project has been divided into four phases with the southern-most phase being designated as Phase one and each subsequent phase numbered two through four as one travels northward towards the "neck" between the north and south quarries. A phased approach allows for incremental quantities of geosynthetics to accomplish each phase rather than total quantities to be delivered at one time for the entire project. In addition, this phased approach allows for more than one contractor crew can be working at various landfills around and across the landfill. Each phase will have construction tasks completed sequentially to prepare for the installation of the temporary cap FML. These preparatory tasks include the following:

1. Subgrade preparations including vegetative layer stripping and existing stormwater bench and localized settlement zone re-grading.

2. Reinforced concrete pipe (RCP) Abandonments (if present within the current phase)

3. Installation of replacement leachate sumps

4. Installation of the perimeter toe collection trench (with FML seal), sump, forcemain and airline

5. Installation of strip drains and collector berms and risers

6. Below temporary cap geotextile and below and above temporary cap geocomposite placement in proposed access road areas

Subsequent to the under temporary cap preparations, the temporary cap and above cap piping will be installed. Concurrently, with this phased construction on the south quarry, stormwater management system enhancements will be occurring. It is anticipated that

one contractor would be used for the temporary cap FML / cap integrity system and a separate civil earthworks contractor will be used for the stormwater management features.

3.2 Subgrade Preparations

Bridgeton Landfill and its contractors are planning to strip as much of the vegetative cap as practically possible, but at a minimum a 20 foot strip immediately below the proposed light-duty access roads will be cleared of the existing vegetative layer. The vegetative layer is expected to range in depth from 2 inches to 8 inches depending upon the area of the landfill. The vegetative layer will be only stripped immediately prior to the placement of the temporary cap. This existing vegetative layer is an important erosion control and stormwater best management practice and therefore timely removal may not be possible depending upon weather conditions and the temporary cap placement progress. The stripped vegetative layer may be re-used for random fill in localized settlement areas in preparation for the temporary cap placement.

Re-grading will occur at a minimum at the existing stormwater benches to promote positive drainage down across these zones. Other localized settlement areas will be re-graded as needed to maintain positive surface drainage across these portions of the landfill soil cap. A field decision will be made by the Bridgeton Landfill engineer's representative during subgrade preparations to identify those areas that require additional random fill or just a re-grading effort. These decisions will be governed by the overlying integrity components and their required minimum slopes during placement. Re-grading areas to maintain positive drainage will be surveyed and documented in the CQA report and system as-built drawings.

3.3 Waste Management

It is expected that minimal waste will be generated from construction of the temporary cap project. Solid waste will be generated during the installation of the perimeter collection sumps. It is anticipated that approximately 10 feet of soil cover underlain by solid waste will be disturbed. Therefore 10 foot depth of solid waste with a three foot diameter at each perimeter collection sump would generate approximately 2.6 bank cubic yards of solid waste from each sump location. During the excavation of the waste, the material will be placed directly into lined roll-off containers or in a haul truck provided by Bridgeton Landfill. Once the containers are full, they will be tarped and transported to the on-site transfer station or hauled directly to Roxanna Landfill. Bridgeton Landfill will be handling the transportation of these wastes either from the transfer station or the direct haul to Roxanna Landfill.

The waste handling protocol at the Transfer Station is to place the initial lifts with the excavated spoil material in each transfer trailer or truck, and then spoil material will be capped with waste that has been received at the Transfer Station from other sources. This

approach minimizes odors from emanating to the atmosphere during waste transport to the landfill.

4 INSTALLATION SCHEDULE

4.1 Installation Schedule

Weather dependent, RCP Abandonment at location GC-4 is scheduled to start on April 15, 2013 and should be completed within 2 to 3 days. This is the only RCP abandonment location that requires completion in advance of the temporary cap placement in Phase one. Temporary cap placement will be initiated following the completion of abandonment of RCP location GC-4, subgrade preparations, and perimeter collection trench, and sump installation within Phase One. An estimated start-up date for the temporary cap placement is April 22, 2013.

Stormwater management system construction will be initiated immediately following receipt of the necessary permits from the MDNR – Water Pollution Control Program (WPP) and the City of Bridgeton. This work will be conducted concurrently with the temporary cap and integrity system installations.

Replacement leachate collection sump, LCS-4D, is scheduled for installation start-up on April 12, 2013 and should be completed within 2 weeks of initiation. (5 day per week work schedule for this drilling contractor). This work requires completion in order to complete the temporary cap placement over Phase Two. If this replacement leachate collection sump work is delayed for any reason, cap installation will proceed with a revised phased approach or a revised phase configuration to support the completion of this work.

Bridgeton Landfill has scheduled completion of the temporary cap and integrity system in a four phase approach according to the Figure 1 Gantt chart for overall project installation.

5 CONSTRUCTION QUALITY CONTROL AND SURVEYING

5.1 Construction Quality Control & Surveying

A detailed construction quality assurance / quality control plan is being prepared and will be submitted under separate cap. This plan will address the measures to confirm industry accepted practices for the installation of the geosynthetic products and earthworks related to the temporary cap and cap integrity system.

Bridgeton Landfill will continue to monitor settlement at the south quarry of the landfill on a monthly basis using the existing 50 / 100 foot grid system via ground survey methods. The existing grid system will be transposed to the top of the temporary cap following its installation. In addition, the landfill will continue to aerially map the landfill on an annual frequency. Both methods will adequately monitor settlement at the landfill.

6 OPERATIONS MAINTENANCE PLAN

6.1 Operations Maintenance Plan

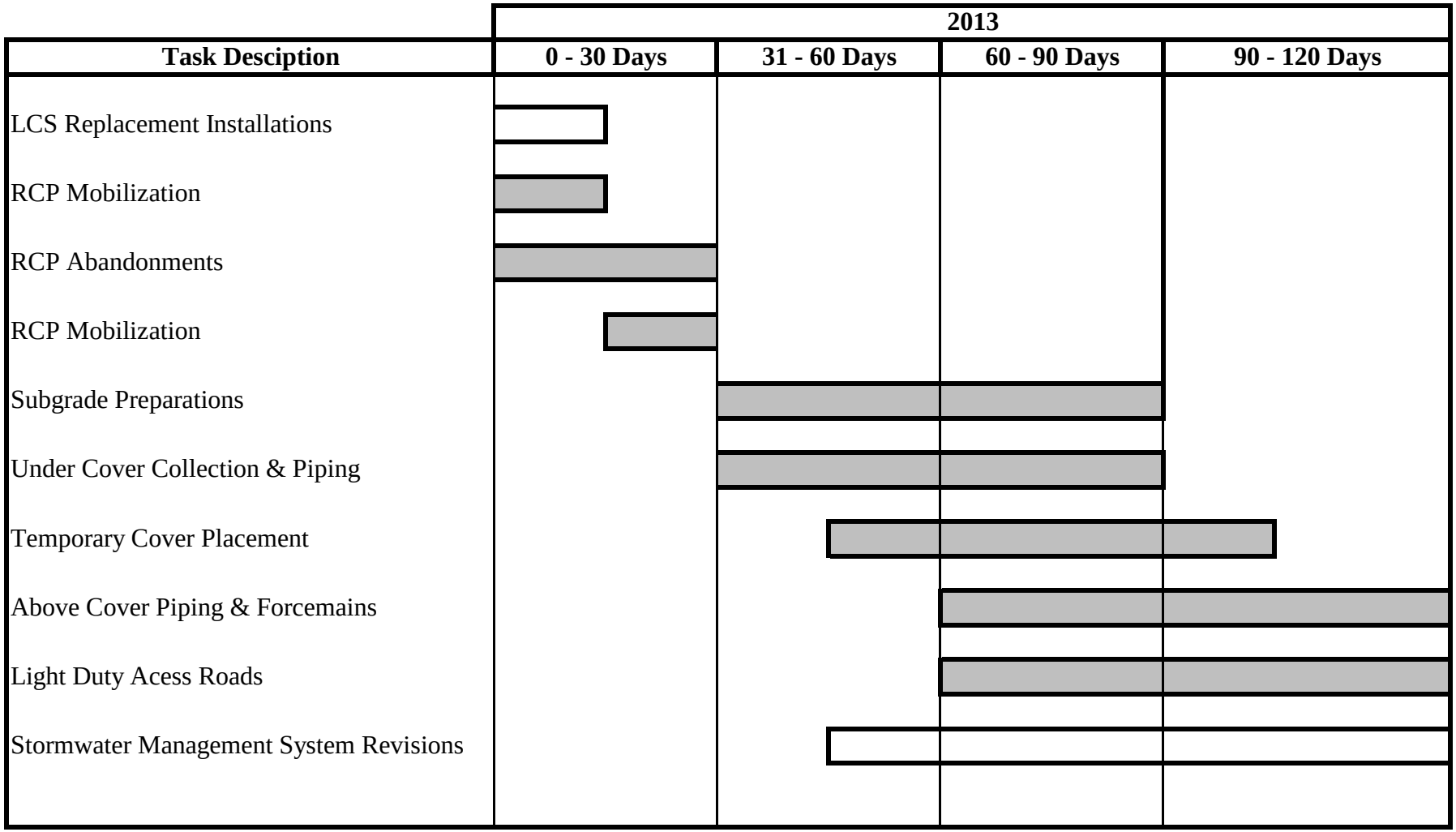
A detailed operations maintenance and monitoring plan (OM&M Plan) is being prepared and will be submitted under separate cover once the Cap Project is completed. The OM&M Plan will address the measures and guidelines for maintaining the integrity and operations of the temporary cap and its underlying integrity system.

LIMITATIONS

The work product included in the attached was undertaken in full conformity with generally accepted professional consulting principles and practices and to the fullest extent as allowed by law we expressly disclaim all warranties, express or implied, including warranties of merchantability or fitness for a particular purpose. The work product was completed in full conformity with the contract with our client and this document is solely for the use and reliance of our client (unless previously agreed upon that a third party could rely on the work product) and any reliance on this work product by an unapproved outside party is at such party's risk.

The work product herein (including opinions, conclusions, suggestions, etc.) was prepared based on the situations and circumstances as found at the time, location, scope and goal of our performance and thus should be relied upon and used by our client recognizing these considerations and limitations. Cornerstone shall not be liable for the consequences of any change in environmental standards, practices, or regulations following the completion of our work and there is no warrant to the veracity of information provided by third parties, or the partial utilization of this work product.

FIGURE 1
TEMPORARY CAP INTEGRITY SYSTEM INSTALLATION SCHEDULE
BRIDGETON LANDFILL **Prepared April 11, 2013**



Notes:

1. **All task completions dependent upon weather.**
2. **Start date contingent upon approval of Plans.**

APPENDIX A

MANUFACTURER'S INFORMATION FOR EVOH FML

RAVEN
INDUSTRIES

TO: Republic Services

SUBJECT: Raven X60FC1 QA testing methods and frequency (rev. 3)

DATE: April 12, 2013

IN REFERENCE TO: Bridgeton Landfill project, Bridgeton, MO

Raven X60FC1 geomembrane and its components undergo an extensive array of testing and measurement during the manufacturing process. The required tests, methods, and sampling frequency are based on the requirements set forth in GRI GM 13 ('Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes')

The minimum test values for X60FC1 using these test methods are listed the table provided with this letter.

Clint Boerhave

Clint Boerhave
Quality Manager
Raven Industries - Engineered Films Division

RAVEN INDUSTRIES

STATEMENT OF PERFORMANCE

SUBJECT: Raven X60FC1

IN REFERENCE TO: Seam testing minimum values and material separation in plane (SIP)
Republic Services Landfill cap project - Bridgeton, Missouri
SO# 195942-195948, 195950-195954

DATE: April 5, 2013

Absolute Barrier™ X60FC1 is a seven layer co-extruded textured geomembrane consisting of polyethylene with a core layer designed specifically as a barrier against radon, methane and VOCs on brownfield sites, residential and commercial buildings, and geomembrane containment and covering systems. A robust stabilization package provides long-term protection from thermal oxidation and ultraviolet degradation in exposed applications.

Due to the multilayer construction and the presence of a barrier core in this product, some separation in plane may occur during destructive seam testing. This is normal and should not be of concern as long as the tested peel and shear results meet the minimum values for this product:

Hot Wedge Seams	Minimum value
Shear Strength (lb/in)	80
Peel Strength (lb/in)	60
Extrusion Fillet Seams	
Shear Strength (lb/in)	80
Peel Strength (lb/in)	52

Clint Boerhave

Clint Boerhave
Quality Manager
Engineered Films Division

Test methods, minimum values, and test frequency for Raven X60FC1

Properties	Test Method	Test Value	Testing Frequency (minimum)
Thickness mils (min. ave.) • lowest individual for 8 out of 10 values • lowest individual for any of the 10 values	D 5994	50 mils 45 mils 35 mils	per roll
Asperity Height mils (min. ave.)	GM 12	10 mils	per roll
Tensile Properties (3) (min. ave.) • break strength – lb/in. • MD break elongation - % (min. avg.) • TD break elongation - % (min. avg.)	6693 Type IV	 75 200 30	20,000 lb
Tear Resistance – lb (min. ave.)	D 1004	27	45,000 lb
Puncture Resistance – lb (min. ave.)	D 4833	55	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) (a) Standard OIT — or — (b) High Pressure OIT	 D 3895 D 5885	 100 400	200,000 lb