Bridgeton Landfill LLC

September 22, 2017

Ms. Charlene Fitch
Chief, Engineering Section,
Solid Waste Management Program
Missouri Department of Natural Resources
1738 East Elm Street
Jefferson City, MO 65102

Dear Ms. Fitch:

In accordance with the September 13, 2017 letter *Proposed Installation of Leachate Collection Sump 5B for Bridgeton Landfill, L.L.C., Permit Number 0118912*, enclosed please find the *Construction Quality Assurance/As-Built Report for Leachate Collection Sump LCS-5B*. Startup activities for LCS-5B have been completed and routine operations are ongoing. Hard copies will also be shipped to your attention for your records.

We appreciate your review of this report. Please do not hesitate to contact me at (209) 227-9531 or email me at EFanning@republicservices.com with any questions you may have concerning this submittal.

Best regards,

Erin Fanning

Erin Fanning
Division Manager
Bridgeton Landfill, LLC

CC: Mr. Chris Nagel, Director, MDNR-SWMP
Mr. Mark Milward, Project Manager, Saint Louis County Dept. of Public Health

CONSTRUCTION QUALITY ASSURANCE / AS-BUILT REPORT

LEACHATE COLLECTION SUMP LCS-5B

BRIDGETON LANDFILL, LLC
BRIDGETON, MISSOURI

July 2017

Prepared By: Feezor Engineering, Inc.

Prepared For: Bridgeton Landfill, LLC

Engineering for a Better World
FEEZOR
ENGINEERING, INC.

406 East Walnut Street • Chatham, IL 62629
3377 Hollenberg Drive • Bridgeton, MO 63044

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LIST OF ACRONYMS

ASTM - American Society for Testing and Materials
BGS - Below Ground Surface
BLF - Bridgeton Landfill
CO - Carbon Monoxide
FEI - Feezor Engineering, Inc.
H_2S - Hydrogen Sulfide
LEL - Lower Explosive Limit
MDNR - Missouri Department of Natural Resources
PACM - Presumed Asbestos-Containing Material
PPE - Personal Protective Equipment
PPM - Parts Per Million
PSI - Pounds per Square Inch
RDS - Recovery Drilling Services
RSI - Republic Services, Inc.
TAC - Total Aromatic Compounds

1.0 INTRODUCTION

Feezor Engineering, Inc. (FEI) was tasked with providing Construction Quality Assurance services for the drilling and installation of a new leachate collection sump at the Bridgeton Landfill facility located in Bridgeton, Missouri. This document provides a summary of the field activities conducted by the selected drilling and support services contractors associated with the installation of leachate collection sump LCS-5B. FEI observed and documented the LCS-5B installation activities, and performed visual screenings of exhumed waste for the presence of presumed asbestos-containing materials (PACM) during drilling. Asbestos inspector certifications issued by the Missouri Department of Natural Resources (MDNR) to the FEI staff performing the screenings (William Abernathy, RG and Arron Weber) are included in **Appendix A**. FEI's documentation of the work performed included review of material specifications, completion of daily field summary reports and photographic records, and development of an as-built drawing of the constructed sump and the report described herein.

1.1 Overview of Project

Bridgeton Landfill is located within the West Lake Landfill Superfund Site, an approximately 200-acre property that includes several closed and inactive solid waste landfill units, a solid waste transfer station, and an asphalt batch plant. Bridgeton Landfill is located at 13570 St. Charles Rock Road in Bridgeton, Missouri, one mile north of the intersection of Interstates 70 and 270. Bridgeton Landfill was used for limestone quarrying and crushing operations before portions of the quarried areas (North Quarry and South Quarry) were used for landfilling.

Leachate collection sumps are located in both the North Quarry and South Quarry. During pump maintenance activities at LCS-5A, it was discovered that an obstruction had developed in the LCS-5A well casing at a depth of approximately 200 feet below ground surface (bgs). The obstruction prevents placement of the pump below the noted depth. Bridgeton Landfill, LLC elected to replace LCS-5A with the installation and operation of LCS-5B, to be located proximal to LCS-5A and constructed in similar fashion.

1.2 Regulatory Notification/Requirements

In anticipation of LCS-5B drilling activities generating volumes of wastes, FEI, on behalf of Bridgeton Landfill, LLC, provided notification to MDNR and the St. Louis County Department of Public Health of the facility's proposal to install LCS-5B and to include observation of the work by a state-certified asbestos inspector. The notification, dated February 7, 2017, delineated the proposed location of LCS-5B at a point approximately 100-120 feet south of LCS-5A. The location was selected due to its providing a centralized location within the deeper part of the North Quarry shelf, north of the Neck Area between the North and South Quarries.

1.3 General Facility Health & Safety and Control Procedures / PPE Requirements

Bridgeton Landfill provides health and safety training for its employees and contractors engaged in work at the facility. During activities associated with the installation of LCS-5B, workers followed the designated health and safety procedures, were alert to the hazards associated with their work, and exercised reasonable caution at all times. Much of the work associated with drilling and LCS-5B sump installation involved intrusive work (encountered waste). All project workers and visitors who entered a work area were provided the personal protective equipment (PPE) and information necessary for their safety. Bridgeton Landfill provided workers with

health and safety guidelines that represented minimum standard procedures for reducing potential risks associated with this project and the Bridgeton Landfill in general. The guidelines included, but were not limited to, methods of communication, first aid, work area prohibitions, exposure awareness, PPE use, etc. Also, facility control required workers and authorized visitors/guests to access the Bridgeton Landfill by coding through the main gate.

The PPE requirements for all project workers consisted of Level D equipment/materials: hard hat, normal work clothing, safety glasses, steel- or composite-toed boots, and high-visibility outerwear. For intrusive work or other activities that involved leachate and/or landfill gas, use of a 4-gas meter to monitor the area for concentrations of methane (% LEL), oxygen (%), carbon monoxide (ppm CO), and hydrogen sulfide (ppm H2S), was required. At no time during the LCS-5B installation project was work suspended or interrupted due to oxygen concentrations being less than 19.5% or exceeding 22%, methane concentrations exceeding 10% LEL, CO concentrations exceeding 50 ppm, or H_2S concentrations exceeding 10 ppm. Work area reassessment and/or implementation of additional control measures (e.g. ventilation) was not necessary.

2.0 CONSTRUCTION EQUIPMENT AND MATERIALS

2.1 Drilling and Well Installation Equipment

Drilling for LCS-5B employed both a bucket rig and a roto-sonic drilling rig (equipped for mud rotary drilling). Support equipment for drilling and well/sump installation activities included skid steer loaders, wheeled loaders, haul trailers, a water truck, an excavator, a crane, a pipe/support truck, a mud cleaning/circulation plant, and odor control equipment to address potential odor emissions from the LCS-5B wellbore during work activities. Odor control measures employed during LCS-5B drilling activities were implemented in accordance with Bridgeton Landfill's Odor Management Plan and included the use of a vacuum box positioned over the wellbore during bucket drilling work (Section 3.1) and the use of atomized mist equipment and odor control product during all subsurface activities (Section 3.4). Bird monitoring and control efforts undertaken during LCS-5B drilling and well/sump installation activities were performed in accordance with the facility's Bird Hazard Monitoring and Mitigation Plan. Drilling and primary well installation services were provided by Recovery Drilling Services and Frontz Drilling, Inc.

Recovery Drilling Services utilized a Soilmec® SR-30 drilling rig equipped with a 36-inch diameter bucket to drill the LCS-5B wellbore to a depth of approximately 43 feet. The bucket, connected to a series of telescoping Kelly bars, rotates downward into the subsurface until the bucket is full of material. The operator then engages a pair of doors integrated into the bucket to hold the drilled material in place as the bucket is retracted from the hole. Drilled material is gravity displaced from the bucket by disengaging the integrated doors and agitating the bucket. On approximate 5-ft intervals, FEI inspected the displaced material for PACM and measured the temperature of the waste using a thermocouple-type temperature probe. Drilled material from the wellbore was transferred to a plastic-lined haul trailer for off-site disposal. In accordance with the facility's odor management plan, waste placed in the haul trailer was covered with plastic during RDS drilling activities and prior to mobilizing the trailer off-site. After drilling to the prescribed depth, a winch on the bucket rig was used to lift, center, and insert a length of 24-inch diameter surface casing.

Frontz Drilling, Inc. utilized a Laibe® Versa-Sonic drilling rig and mud rotary tooling (20-inch diameter rotary bit) to deepen the LCS-5B wellbore to its final depth (268 feet). Mud rotary

drilling involves circulating drilling mud down through sections of drill pipe to a rotary bit. The drilling mud serves to 1) cool the bit as it rotates, 2) improve the bit's cutting performance, and 3) move drilled material away from the bit and out of the hole via the annulus between the drill pipe and the wellbore wall. Drilled material and mud enters a series of tubs used to separate the two before the mud is routed through a mud cleaning plant. The plant screens the mud of solids before circulating it back to the rig for reuse. Non-potable water was used as needed to supplement drilling mud. Material removed from the mud before it was recirculated back down the hole was inspected by FEI for PACM then transferred to a haul trailer for off-site disposal. After drilling to the final depth, lengths of centralized well casing (screened sections and solid riser sections) were lifted into place, threaded together, and lowered into the LCS-5B wellbore using a crane and lifting apparatus.

Skid steer loaders and wheeled loaders were used to transfer drilled materials to haul trailers. Free liquids that accumulated in the haul trailers were solidified using absorbent media (ground corn cobs/stalks). Loaders and an excavator were used for material handling during backfilling activities.

2.2 Well Construction Materials

Surface casing was installed in the LCS-5B wellbore to serve as temporary wellbore support in the uppermost horizons of North Quarry waste. The surface casing consisted of a single section of carbon steel pipe with an inside diameter of 24 inches and a length of approximately 42 feet. Installation and backfilling of the surface casing is described in Section 3.1.

The LCS-5B sump structure itself is constructed of 10-inch diameter 316L stainless steel screen and riser sections. Each of the spiral-welded screen and riser sections (8 sections of screen, 6 sections of riser) has a wall thickness of 0.375 inches (Schedule 40) resulting in an outside diameter of the pipe of 10.75 inches. The well pipe conforms to the ASTM A778 standard. Flush-threaded box and pin fittings (4 threads per inch) are welded onto the opposing ends of each screen and riser section. Each screen section employs louvered slots of 0.100-inch width. The screen sections have a collapse strength of 1,177 psi; that of the riser sections is 981 psi. **Appendix B** includes a description of the well pipe provided by the manufacturer (Roscoe Moss Company). Installation of the stainless steel well pipe is described in Section 3.2.

Non-carbonate aggregate was utilized to backfill the LCS-5B annulus from the base of the wellbore up to a depth of approximately 20 feet bgs. The aggregate consisted of washed river rock (chert pea gravel) with nominal diameters ranging from 0.125 to 0.25 inches. **Appendix C** includes the results of grain size distribution testing of the aggregate performed by Geotechnology, Inc. Installation of the aggregate (and an annular seal of bentonite and soil above it) is described in Section 3.2. Section 3.2 also describes removal of the temporary surface casing.

3.0 LEACHATE COLLECTION SUMP INSTALLATION ACTIVITIES

3.1 Shallow Drilling and Surface Casing Installation

Recovery Drilling Services utilized a Soilmec® SR-30 bucket rig to drill the LCS-5B wellbore. Support work included the use of a vacuum box, positioned over the wellbore and connected to the facility's gas collection system, to facilitate control of any landfill gas emitted by the wellbore during drilling. A laborer, wearing respiratory protection (Level C PPE), was responsible for

monitoring the vacuum box during drilling activities, including covering the box temporarily after each drill string retraction / drilled material displacement event. The cover was then moved off of the vacuum box to allow for drill string re-insertion.

Upon reaching the target depth of 43 feet bgs and transferring all drilled material to a haul trailer, Recovery Drilling Services (RDS) covered the wellbore opening with a fabricated grate, used by the contractor for safety around the open hole and to assist in positioning downhole casing. With the grate in place, RDS then connected the rig's winch cable to the flange ring welded to the top of the 24-in diameter surface casing and suspended the casing over the wellbore. The surface casing was centered and lowered into the wellbore through the grate.

To minimize the migration of fugitive landfill gas from the LCS-5B wellbore, the annular space between the surface casing and the wellbore wall was backfilled with a flowable mixture of non-potable water and soil. The annulus was backfilled with this flowable mud from the bottom of the surface casing up to about 4 feet bgs. A 2-ft layer of bentonite powder was emplaced on top of the flowable mud in the annulus and hydrated. Dry soil was then installed in the annulus on top of the hydrated bentonite up to the ground surface, a safety cage made of rebar was set in place around the surface casing, and a blind plate was bolted in place to cover the surface casing opening. The LCS-5B shallow drilling and surface casing installation activities took place on February 9, 2017.

3.2 Mud Rotary Drilling of Wellbore and Casing Installation

Frontz Drilling, Inc. utilized a Laibe® Versa-Sonic drilling rig and mud rotary tooling to deepen the LCS-5B wellbore to its final depth. Ancillary equipment included a 20-inch diameter rotary bit mounted on 6-in diameter drill pipe, a 36-in diameter thimble that directs return drilling mud coming out of the top of the wellbore to a series of mud tubs, and a pump to transfer the return mud to a mud cleaning plant. During drilling activities, return mud was discharged out of the top of the wellbore and routed through the first of two mud tubs. The return mud was screened of drilled material by hand using strainers as it flowed through the first mud tub. This material (basically ground-up landfilled waste) was collected in buckets and a small-capacity waste bin before being transferred to a haul trailer. The screened mud then gravity flowed to a second mud tub in which a centrifugal pump was mounted. The pump routed the return mud to the mud cleaning plant.

The mud cleaning plant screens the mud of remaining solids before it is pumped back to the drilling rig for reuse. Mud coming into the plant passes over a series of fine screens mounted on an inclined vibrating table. Solids too large to pass through the screens move up the incline and are discharged off of the shaker table, collecting in a waste bin. The bin was emptied into a haul trailer as needed. The mud cleaning plant also removes fine sand and silt from the return mud; the screened sediments are also discharged off of the shaker and collected in the waste bin. Once drilled material and sediments are removed from the mud, non-potable water and specific additives were added to the mud before it was pumped back to the rig. Additives included soda ash for pH control, defoamer to suppress the development of problematic foam, and a polymer used to thicken the mud and protect against lost circulation in the subsurface.

Upon reaching the final wellbore depth of 268 feet bgs, Frontz Drilling flushed the wellbore of any loose drilled material, retracted the drill string and rotary bit, and moved the drilling rig and thimble off of the hole. After re-installing the safety cage around the top of the surface casing, a pair of well pipe suspension jigs, each utilizing a pair of U-bolts and an I-beam, were set in place on top of the surface casing flange ring. After attaching a lifting cap to the 20-ft bottom section

of well screen (base cap attached), a crane was used to lift the screen section in position and lower it into the wellbore. The suspension jigs were used to hold the first section in place while the second section was lifted by the crane and positioned over the first; an O-ring was fitted onto the threaded pin, thread lubricant was applied, and the sections were threaded together using chain tongs and manual labor. This process was repeated until all 14 sections of well pipe were threaded together and lowered to the bottom of the wellbore as one 270-ft piece of casing.

Immediately following completion of the well casing installation, the well pipe suspension jigs were disassembled and backfilling activities began. To facilitate leachate recovery, coarse aggregate gravel was selected as the backfill material to be emplaced in the LCS-5B annulus between the well casing and the wellbore wall. A bin mounted to a skid steer was utilized to emplace the 0.125-0.25-in gravel described previously. The material was slowly poured into the annulus until the level of rock had reached a height of approximately 50 feet bgs; additional gravel was then shoveled into place by hand up to a height of 40 feet bgs. The rock level was monitored continuously as the backfilling progressed. Sand was manually emplaced on top of the aggregate up to a height of approximately 38 feet bgs, at which point the crane was utilized to pull the 24-in surface casing out of the wellbore and set it aside. A smaller safety cage was set in place around the well casing stickup and then annular backfilling activities continued with the emplacement of approximately 6 feet of hydrated bentonite chips and 32 feet of dry soil up to the ground surface. The well casing was sealed by threading the lifting cap in place. The LCS-5B mud rotary drilling and casing installation activities took place from February 16 through February 24, 2017.

3.3 Well Development Activities

Frontz Drilling performed well development activities following installation of the stainless steel LCS-5B well casing and annular backfill materials. Well development has two primary objectives, with the common goal of maximizing liquid flow into a well. First, to address any damage to the formation in the vicinity of the wellbore caused by the physical process of drilling, fluids introduced during drilling should be flushed out of the wellbore and any mud cake that may have formed on the wellbore wall should be removed. Second, to enhance well permeability and stability, sediment and fine material from the wellbore that may cause reduced liquid flow should be evacuated from the well casing.

Frontz repositioned the rotary rig over the LCS-5B well casing and reinstalled the 36-inch diameter thimble (and trough connecting it to the mud tubs). Sections of 4-in diameter drill pipe were then threaded together and the drill string was lowered to the bottom of the well casing. Non-potable water was then pumped from the mud plant through the drill string to the bottom of the well casing to flush drilling fluids and fine material out of the sump. Over the course of three days, the drill string was gradually retracted from the well casing (5 feet every hour, 50 feet per day) as the process of flushing and recirculating water through the screened interval continued. **Appendices D** and **E** include descriptions and photographs, respectively, of the well development activities performed by Frontz Drilling, Inc.

3.4 Waste Handling and Decontamination

Waste generated during the rotary drilling and installation of LCS-5B consisted primarily of materials manually removed from drilling mud as it was routed through the mud tubs and mechanically screened from the mud as it entered the mud cleaning plant. Material collected manually was first collected in buckets, then transferred to a 1-cy waste bin. The waste bin was emptied into haul trailers as needed using a skid steer. Mechanically screened material

continuously discharged from the mud cleaning plant was collected into either a 2-cy waste bin or the bucket of a loader and likewise emptied into haul trailers when they were full. Haul trailers were tarped when waste was not being transferred into them. Waste mud was also transferred to haul trailers following drilling and well development activities. Absorbent material (ground corn husks and stalks) was incorporated into the waste in the haul trailers, which were exchanged (full for empty) as necessary.

Management of potential odor emissions was maintained during the LCS-5B drilling and installation activities by utilizing atomized mist equipment. The trailer-mounted equipment (atomizing nozzle and water-supply tubing mounted within a large-diameter fan housing, water supply tank and enclosure, stand-alone generator) was positioned/repositioned on a daily basis in such a manner that a solution of non-potable water and odor-neutralizing agent was continuously dispersed over an area generally downwind of the LCS-5B activities. Granular odor control product was dispersed (broadcast by hand) over waste materials during bucket rig drilling activities and occasionally broadcast over waste transferred into bins and haul trailers (prior to tarping).

Following LCS-5B well development activities, waste mud/water was transferred out of the mud cleaning plant, rotary rig pump and hoses, and mud tubs. The equipment was cleaned using a power washer to remove any accumulations of mud and grit prior to being stowed for demobilization from the facility. Drill pipe and the rotary bit was secured on the pipe/support truck after cleaning.

3.5 Construction Quality Assurance

Construction Quality Assurance for the LCS-5B installation program included FEI inspection of the well construction materials used (including testing of the backfill aggregate) and observation of general equipment operations, well construction and development procedures, waste handling efforts, and adherence to general and site-specific health and safety protocols. FEI field monitoring included photographic documentation, maintenance of a field log, and general health and safety monitoring. FEI supplied 4-gas meters to Frontz Drilling personnel and provided continuous air monitoring of the work area during drilling activities, including passive monitoring for concentrations of total aromatic compounds (TAC), i.e. benzene, toluene, ethylbenzene, and xylenes. Air monitoring during the LCS-5B installation activities did not indicate detectable TAC concentrations.

Well construction materials included threaded stainless steel well casing (riser/screen sections and caps), carbon steel surface casing, non-carbonate aggregate backfill, bentonite chips, and various drilling mud additives. Inspection of these materials was required to ensure that they were acceptable and consistent with design plans. All stainless steel pipe appeared new and was furnished in lengths as specified in the design plan. Stainless steel pipe sections appeared straight throughout their lengths and maintained the specified inner diameters. All stainless steel pipe thread connections were made with full seating achieved.

Operations of the well drilling equipment (bucket rig and roto-sonic drilling rig) and support equipment (skid steer loaders, wheeled loaders, water truck, excavator, crane, pipe/support truck, mud cleaning plant) was performed by qualified operators in a safe and efficient manner. All equipment performed as designed without significant malfunction.

Well construction and well development activities were performed by Recovery Drilling Services and Frontz Drilling, Inc., with support services provided by Sharp Services, Bridgeton Landfill,

LLC, and FEI. Crane operations were provided by Budrovich Crane. Support services included general labor during bucket rig drilling and surface casing installation activities, material and waste handling, rotary drilling support, mud plant operation, and well casing installation. Well construction and development activities were performed in accordance with design plans and standard industry practices by experienced, qualified personnel. Health and safety protocols were followed throughout the work, with no incidents or violations reported.

FEI documented the performance and progress of all LCS-5B drilling, installation, and development activities on a daily basis, noting any problems, delays, and remedies associated with the project. The documentation includes Daily Field Summary Reports, photographs, and an as-built diagram of LCS-5B (**Appendix F**).

4.0 CERTIFICATION

I, William J. Abernathy, R.G., do hereby certify to my best knowledge and belief, that the LCS-5B leachate collection sump at the Bridgeton Landfill was constructed in accordance with the approved Construction Quality Assurance Program.

William J. Abernathy, R.G.

STATE OF MISSOURI
WILLIAM J ABERNATHY
RG
2016016274
REGISTERED GEOLOGIST

Missouri R.G. Number 2016016274

Appendix A
Missouri Asbestos Inspector Certifications

Expiration Date **9/20/2017** Certificate Number: 7118090916MOIR17479

Training Date: **9/9/2016**

Missouri State Certificate for Asbestos Related Occupations

issued by Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102
Phone (573) 751-4817

William J. Abernathy

has successfully completed the requirements for certification as a INSPECTOR. This Missouri State Certification is subject to review and the director may deny, suspend or revoke the certification per RSMo chapter 643.230.

9/20/2016

Date

Kyra L Moore

Director of Air Pollution Control Program

Expiration Date **12/9/2017** Certificate Number: 7118120916MOIr18135

Training Date: **12/9/2016**

Missouri State Certificate for Asbestos Related Occupations

issued by Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102
Phone (573) 751-4817

Arron A Weber

has successfully completed the requirements for certification as a INSPECTOR. This Missouri State Certification is subject to review and the director may deny, suspend or revoke the certification per RSMo chapter 643.230.

1/25/2017

Date

Director of Air Pollution Control Program

Appendix B
Well Casing Specifications

RMC ORDER BREAKDOWN 2/8/2017

WO #: 13913
CUSTOMER: REPUBLIC SERVICES
JOB NAME: BIRDGETON LANDFILL
SHIP DATE: 2/11/2017

FOOT.	DESCRIPTION	PC NO.	BLANK HEAT(S)	INITIAL
150 FT	10 3/4"OD x 3/8" 316L (0.100"STANDARD, 6R) F480 BOX x PIN (4TPI W/OR GROOVE)	20FT		
	*SLOT TOLERANCE, +0.00" - 0.010"	20FT		
	*SHOULDER TO SHOULDER LENGTHS	20FT		
		20FT		
	7 PCS @ 20' LENGTH	20FT		
	1 PC @ 10' LENGTH	20FT		
		20FT		
160 FT	10 3/4"OD x 3/8" 316L BLANK F480 BOX x PIN (4TPI W/OR GROOVE)	20FT		
	*SHOULDER TO SHOULDER LENGTHS			
	8 PCS @ 20' LENGTH			
	ACCESSORIES			
	1 ONLY - 10 3/4"OD 316L BOX END CAP, LOOSE			
	33EA - 3/8" 316L C TYPE CASING GUIDE, 2" BEND			
	2EA - 10 3/4"OD SCH 80 (SCH 40 THREAD) CARBON HALF NIPPLE			
	2EA - 10 3/4"OD LCS TOP PLATE, W/HOLE IN MIDDLE (SIZE TBD)			

PERFORATION COMPLIANCE

MANAGERIAL CHECK FOR ANY SLOT OR STEEL DEFICIENCIES AFTER PERFORATING, ROUNDNESS AND F480 FIT-UP

NO.		INITIAL	HEAT	DATE	NO.	INITIAL	HEAT	DATE
1	20FT ATW				16			
2	20FT ATW				17			
3	20FT ATW				18			
4	20FT ATW				19			
5	20FT ATW				20			
6	20FT ATW				21			
7	20FT ATW				22			
8	10FT ATW				23			
9					24			
10					25			
11					26			
12					27			
13					28			
14					29			
15					30			

Manager Signature

Albert Martinez _____

Michael Navarro _____

Pablo Pineda _____

Ruben Sandoval _____

Appendix C
Grain Size Analysis of Backfill Aggregate

Via email: bvits@feezorengineering.com

February 20, 2017 J022255.01.6005

Mr. Brad Vits
Feezor Engineering, Inc.
406 East Walnut
Chatham, Illinois 62629

Re: PG-LCS-5 Grain Size Analysis
LCS-5A Replacement (BT-146)
Bridgeton, Missouri

Dear Brad:

Included in this report are the test results for an aggregate sample received in our laboratory on February 17, 2017. The sample was tested in general accordance with the test method listed below.

Test to Determine	Method of Test
Sieve Analysis of Coarse and Fine Aggregate	ASTM C136

We trust this is the information you require. Please contact the undersigned if you have any questions regarding this report.

Respectfully submitted,

GEOTECHNOLOGY, INC.

Lucas Heuerman
Illinois Office Manager

JMM/LPH:lph/

Attachment: Test Result Summary

TEST RESULT SUMMARY

Project Identification: LCS-5A
Material: PG-LCS-5 PEA GRAVEL

Sieve Size (U.S.)	Sieve Size (mm)	Percent Passing
3/4”	19.0	100
1/2”	12.5	99
1/4"	6.35	45
#8	2.36	1
#16	1.18	0
#30	0.60	0
#200	0.075	0

Appendix D
Daily Field Summary Reports

Feezor Engineering, Inc.
3377 Hollenberg Drive
Bridgeton, MO 63044

Daily Field Summary Report

Client:	Bridgeton Landfill	**Job No.:**	BT-146
Project:	LCS-5B Installation	**Task No.:**	-
Location:	Bridgeton, MO	**Date:**	2/9/2017
Contractor(s):	Recovery Drilling Services, Sharp Services	**Report No.:**	
Weather:	Mostly clear		
Temperature:	19 °F		

Description of field activities (include labor, equipment, site conditions, sampling, etc.)

0637 – FEI and RDS on-site, warming up Soilmec bucket rig

0716 – Sharp on-site, prepping site/equipment for drilling

0753 – Begin drilling LCS-5B wellbore
- 5 ft 43.4 °F – brown clay fill
- 10 ft 55.7 °F – fill as above to 8 ft, then waste
- 15 ft 60.2 °F – dry waste, carpet, wood, plastic, wire
- 20 ft 62.4 °F – dry waste as above, paper, strapping
- 25 ft 89.4 °F – clay layer 22-24 ft
- 30 ft 77.8 °F – chain link fence, concrete, posts
- 35 ft 91.4 °F – dry waste, wire, gravel, metal, plastic
- 39.5 ft 124.0 °F – dry cardboard, wood, plastic

0933 – Drilling completed, RDS and Sharp prep to install 24-in surface casing

1048 – RDS moves vac box off hole, sets casing, then repositions vac box while waiting on backfill mud (hydrants are frozen so jetter being filled via garden hose)

1202 – Casing pulled in order to deepen wellbore to 42.5 ft to accommodate 42-ft casing; casing reset and leveled

1441 – Wetted soil emplaced in annulus up to 3 ft bgs; 2 ft of powdered bentonite emplaced; safety cage set over casing, soil emplaced up to ground surface; blind flange bolted to casing

1512 – FEI off-site

Copies to: Dan Feezor

FEI Representative: William J Abernathy, RG

Feezor Engineering, Inc.
3377 Hollenberg Drive
Bridgeton, MO 63044

Daily Field Summary Report

Client:	Bridgeton Landfill	**Job No.:**	BT-146
Project:	LCS-5B Installation	**Task No.:**	-
Location:	Bridgeton, MO	**Date:**	2/16/2017
Contractor(s):	Frontz Drilling, Sharp Services	**Report No.:**	01
Weather:	Sunny		
Temperature:	71°F		

Description of field activities (include labor, equipment, site conditions, sampling, etc.)

0700 – Frontz and Sharp are onsite with 3 workers each. Equipment onsite is: a Komatsu WA270, a CAT330C LME, a Bobcat, 2 Mud Technology Mud Plants, and a Versasonic Drill Rig with 2 support trucks. The Frontz workers begin to setup the drill rig and the Mud Plant, Sharp begins to setup the odor control device.

0900 – The odor control device is up and operational.

1045 – Frontz begins drilling LCS-5B.

1230 – Lunch

1300 – Frontz resumes drilling LCS-5B.

1630 – Frontz stops drilling at 73ft, and begins cleanup.

1700 – Frontz and Sharp leave the site for the day.

Copies to: Dan Feezor

FEI Representative: Arron Weber

Feezor Engineering, Inc.
3377 Hollenberg Drive
Bridgeton, MO 63044

Daily Field Summary Report

Client: Bridgeton Landfill
Project: LCS-5B Installation
Location: Bridgeton, MO
Contractor(s): Frontz Drilling, Sharp Services
Weather: Sunny
Temperature: 51 °F

Job No.: BT-146
Task No.: -
Date: 2/17/2017
Report No.:

Description of field activities (include labor, equipment, site conditions, sampling, etc.)

0634 – FEI and Frontz on-site, warming up VersaSonic sonic rig (equipped for rotary drilling)

0703 – Sharp on-site, prepping to resume drilling; wellbore depth 73 ft

1003 – Depth = 83 ft

1015 – Backfill gravel delivered; 1/8 to ¼-in washed river rock

1103 – Depth = 93 ft

1219 – Depth = 103 ft; lunch

1319 – Depth = 113 ft

1326 – Changing out MBI trailer

1458 – Depth = 123 ft

1522 – Depth = 133 ft

1607 – Depth = 143 ft; buttoning up for the day

1640 – FEI off-site

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FEI Representative: William J Abernathy, RG

Feezor Engineering, Inc.
3377 Hollenberg Drive
Bridgeton, MO 63044

Daily Field Summary Report

Client: Bridgeton Landfill
Project: LCS-5B Installation
Location: Bridgeton, MO
Contractor(s): Frontz Drilling, Sharp Services
Weather: Cloudy
Temperature: 54 °F

Job No.: BT-146
Task No.: -
Date: 2/18/2017
Report No.:

Description of field activities (include labor, equipment, site conditions, sampling, etc.)

0640 – FEI and Frontz on-site, warming up VersaSonic sonic rig (equipped for rotary drilling)

0700 – Sharp on-site, prepping to resume drilling; wellbore depth 143 ft

0823 – Depth = 153 ft

0908 – Depth = 163 ft

1000 – Depth = 173 ft

1106 – Depth = 183 ft

1418 – Depth = 203 ft

1437 – Depth = 213 ft

1510 – Depth = 223 ft; buttoning up for the day

1538 – FEI off-site

Copies to: Dan Feezor

FEI Representative: William J Abernathy, RG

Feezor Engineering, Inc.
3377 Hollenberg Drive
Bridgeton, MO 63044

Daily Field Summary Report

Client:	Bridgeton Landfill	**Job No.:**	BT-146
Project:	LCS-5B Installation	**Task No.:**	-
Location:	Bridgeton, MO	**Date:**	2/19/2017
Contractor(s):	Frontz Drilling, Sharp Services	**Report No.:**	
Weather:	Foggy		
Temperature:	48 °F		

Description of field activities (include labor, equipment, site conditions, sampling, etc.)

0754 – FEI and Frontz on-site, warming up VersaSonic sonic rig (equipped for rotary drilling)

0800 – Sharp on-site, prepping to resume drilling; wellbore depth 223 ft

0915 – Waiting on water truck; scheduled driver had a traffic accident

0951 – Resume drilling

1019 – Depth = 233 ft

1051 – Depth = 243 ft

1245 – Depth = 253 ft

1434 – Depth = 263 ft

1531 – Depth = 268 ft; bit behavior and rotational pressures indicate change in drilled material

1613 – Depth = 273 ft; buttoning up for the day; sand accumulating in mud tub

1653 – FEI off-site

Copies to: Dan Feezor

FEI Representative: William J Abernathy, RG

Feezor Engineering, Inc.
3377 Hollenberg Drive
Bridgeton, MO 63044

Daily Field Summary Report

Client:	Bridgeton Landfill	**Job No.:**	BT-146
Project:	LCS-5B Installation	**Task No.:**	-
Location:	Bridgeton, MO	**Date:**	2/20/2017
Contractor(s):	Frontz Drilling, Sharp Services	**Report No.:**	
Weather:	Mostly cloudy		
Temperature:	53 °F		

Description of field activities (include labor, equipment, site conditions, sampling, etc.)

0643 – FEI and Frontz on-site, warming up VersaSonic sonic rig (equipped for rotary drilling)

0700 – Sharp on-site, prepping to resume drilling; wellbore depth 273 ft

0859 – Tag bedrock at 275 ft; final depth of wellbore

1015 – Well pipe arrives on-site; Frontz offloads

1200 – FEI and Frontz off-site for meeting in landfill office

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FEI Representative: William J Abernathy, RG

Feezor Engineering, Inc.
3377 Hollenberg Drive
Bridgeton, MO 63044

Daily Field Summary Report

Client:	Bridgeton Landfill	**Job No.:**	BT-146
Project:	LCS-5B Installation	**Task No.:**	-
Location:	Bridgeton, MO	**Date:**	2/21/2017
Contractor(s):	Frontz Drilling, Sharp Services	**Report No.:**	
Weather:	Rain		
Temperature:	60 °F		

Description of field activities (include labor, equipment, site conditions, sampling, etc.)

0626 – FEI and Frontz on-site, warming up VersaSonic sonic rig (equipped for rotary drilling)

0700 – Sharp on-site, prepping to flush out wellbore

0740 – Circulating mud/water through wellbore

0822 – Crane moving into place; today's work suspended due to weather

0945 – FEI and Frontz off-site

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3377 Hollenberg Drive
Bridgeton, MO 63044

Daily Field Summary Report

Client:	Bridgeton Landfill	**Job No.:**	BT-146
Project:	LCS-5B Installation	**Task No.:**	-
Location:	Bridgeton, MO	**Date:**	2/22/2017
Contractor(s):	Frontz Drilling	**Report No.:**	
Weather:	Fog		
Temperature:	51 °F		

Description of field activities (include labor, equipment, site conditions, sampling, etc.)

0619 – FEI and Frontz on-site, flushing wellbore with clean water circulation

0852 – Extracting drill pipe and rotary bit from wellbore

1012 – Drill pipe removed from wellbore; prepping to install well pipe (10-in diameter 316L SS, threaded)

1045 – First section of well pipe (20 ft of 0.1-in louvered screen) lowered into wellbore using crane/rigging and threaded lifting cap; pipe suspension apparatus (I-beam with U-bolts) in place on top of 24-in surface casing

1105 – Request 2nd pipe suspender from RSI

1135 – Second 20-ft section of well pipe suspended above first piece; O-ring installed, lubricant applied liberally, but difficulty threading pipe together due to threads being slightly out-of-round; 40 ft of screen in the hole

1323 – Chain wrench is undersized for diameter of pipe and effort needed to thread together; lunch

1520 – Third 20-ft section of well pipe fully threaded; 60 ft of screen lowered into hole

1550 – Extract 60-ft section of well pipe prior to meeting in landfill conference room to discuss alternatives for connecting remaining pipe sections

1620 – Wellbore closed, head to conference room for meeting

1847 – Meeting over; RSI to drive to Ohio to pick up chain tong; FEI and Frontz off-site

Copies to: Dan Feezor

FEI Representative: William J Abernathy, RG

Feezor Engineering, Inc.
3377 Hollenberg Drive
Bridgeton, MO 63044

Daily Field Summary Report

Client:	Bridgeton Landfill	**Job No.:**	BT-146
Project:	LCS-5B Installation	**Task No.:**	-
Location:	Bridgeton, MO	**Date:**	2/23/2017
Contractor(s):	Frontz Drilling	**Report No.:**	
Weather:	Partly cloudy		
Temperature:	55 °F		

Description of field activities (include labor, equipment, site conditions, sampling, etc.)

0630 – FEI and Frontz on-site to continue LCS-5B install; RSI has procured chain tongs

0648 – Reinstalling drill string in wellbore to clean out any accumulated material

0736 – Tag bottom of wellbore at 268 ft bgs

0745 – Waiting on crane operator to arrive

0900 – Crane operator on-site, reinstall/re-suspend 60-ft section of well pipe in wellbore

1210 – Fourth section of well pipe fully threaded and lowered into wellbore; 80 ft of screen in the hole

1240 – Fifth section of well pipe fully threaded and lowered into wellbore; 100 ft of screen in the hole

1308 – Sixth section of well pipe fully threaded and lowered into wellbore; 120 ft of screen in the hole

1412 – Seventh section of well pipe fully threaded and lowered into wellbore; 140 ft of screen in the hole

1427 – Eighth section of well pipe (10 ft) fully threaded and lowered into wellbore; 150 ft of screen in the hole; 6 20-ft sections of riser to install

1449 – 9th section of well pipe (1st riser section) fully threaded and lowered into wellbore; 170 ft of well pipe in the hole

1525 - 10th section of well pipe (2nd riser section) fully threaded and lowered into wellbore; 190 ft of well pipe in the hole

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1552 - 11th section of well pipe (3rd riser section) fully threaded and lowered into wellbore; 210 ft of well pipe in the hole

1616 – 12th section of well pipe (4th riser section) fully threaded and lowered into wellbore; 230 ft of well pipe in the hole

1637 - 13th section of well pipe (5th riser section) fully threaded and lowered into wellbore; 250 ft of well pipe in the hole

1700 - 14th and final section of well pipe (6th riser section) fully threaded and lowered into wellbore; 270 ft of well pipe in the hole; bottom of well = 268 ft bgs

1723 – Begin backfilling annulus with 0.125/0.25-in washed river rock using 2-cy bin and skid steer

1822 – Light plant fired up, and lights on the back of the Frontz water truck directed toward work area

1858 – Backfill has bridged at about 104 ft bgs; securing area, will check settlement tomorrow

1937 – FEI and Frontz off-site

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Bridgeton, MO 63044

Daily Field Summary Report

Client:	Bridgeton Landfill	**Job No.:**	BT-146
Project:	LCS-5B Installation	**Task No.:**	-
Location:	Bridgeton, MO	**Date:**	2/24/2017
Contractor(s):	Frontz Drilling	**Report No.:**	
Weather:	Partly cloudy		
Temperature:	65 °F		

Description of field activities (include labor, equipment, site conditions, sampling, etc.)

0638 – FEI and Frontz on-site, rig up tremie pipe to clear bridge in backfill rock

0828 – Tremie having limited success; switch to flushing water through the well pipe to dislodge bridge in backfill, but water eventually discharges out the top of the well pipe (path of least resistance)

1020 - FEI suggest modifying the spare 10-in half-nipple to allow watertight connection between the rig and the well pipe; RSI takes half-nipple to welder for modification

1238 – Modified half-nipple connected to well pipe, allows efficient flushing of annulus and use of oscillator to vibrate the bridge loose; blockage successfully dislodged, waste floated out of annulus

1302 – Resume backfilling annulus with river rock

1431 – Top of backfill rock at 60 ft bgs; using shovels to add an additional 15-20 ft of rock

1502 – Annulus backfilled to 43 ft bgs; emplace 6-8 bags of filter sand on top of rock; crane prepping to extract 24-in surface casing

1537 – Surface casing removed; emplacing bentonite chips and soil in annulus

1620 – Backfill complete, safety cage installed around well casing

1624 – FEI and Frontz off-site

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FEI Representative: William J Abernathy, RG

Feezor Engineering, Inc.
3377 Hollenberg Drive
Bridgeton, MO 63044

Daily Field Summary Report

Client:	Bridgeton Landfill	**Job No.:**	BT-146
Project:	LCS-5B Installation	**Task No.:**	-
Location:	Bridgeton, MO	**Date:**	2/25/2017
Contractor(s):	Frontz Drilling, Sharp Services	**Report No.:**	
Weather:	Sunny		
Temperature:	40°F		

Description of field activities (include labor, equipment, site conditions, sampling, etc.)

0700 – Frontz is onsite with 3 workers. Equipment onsite is: a Komatsu WA270, a CAT330C LME, a Bobcat, 2 Mud Technology Mud Plants, and a Versasonic Drill Rig with 2 support trucks. Frontz sets up the drill rig and pumps and begins well development of LCS-5B by pumping water to the bottom of the well.

1230 – Lunch

1300 – Frontz resumes development of LCS-5B.

1630 – Frontz stops development for the day and begins cleanup.

1700 – Frontz leaves the site for the day.

Copies to: Dan Feezor

FEI Representative: Arron Weber

Feezor Engineering, Inc.
3377 Hollenberg Drive
Bridgeton, MO 63044

Daily Field Summary Report

Client:	Bridgeton Landfill	**Job No.:**	BT-146
Project:	LCS-5B Installation	**Task No.:**	-
Location:	Bridgeton, MO	**Date:**	2/26/2017
Contractor(s):	Frontz Drilling, Sharp Services	**Report No.:**	
Weather:	Sunny		
Temperature:	50°F		

Description of field activities (include labor, equipment, site conditions, sampling, etc.)

0700 – Frontz is onsite with 3 workers. Equipment onsite is: a Komatsu WA270, a CAT330C LME, a Bobcat, 2 Mud Technology Mud Plants, and a Versasonic Drill Rig with 2 support trucks. Frontz sets up the drill rig and pumps and begins well development of LCS-5B by pumping water to 50' from the bottom of the well.

1230 – Lunch

1300 – Frontz resumes development of LCS-5B.

1630 – Frontz stops development for the day and begins cleanup.

1700 – Frontz leaves the site for the day.

Aaron Weber

Copies to: Dan Feezor

FEI Representative: Arron Weber

Feezor Engineering, Inc.
3377 Hollenberg Drive
Bridgeton, MO 63044

Daily Field Summary Report

Client:	Bridgeton Landfill	**Job No.:**	BT-146
Project:	LCS-5B Installation	**Task No.:**	-
Location:	Bridgeton, MO	**Date:**	2/27/2017
Contractor(s):	Frontz Drilling	**Report No.:**	
Weather:	Sunny		
Temperature:	43 °F		

Description of field activities (include labor, equipment, site conditions, sampling, etc.)

0700 – FEI and Frontz on-site, resume well development activities

1034 – Tag bottom of well to check progress; about 12 inches of fine sediment in bottom of well, re-installing 4-in drill pipe to bottom of well to flush sediment out

1458 – LCS-5B well development completed; extracting 4-in drill pipe from well

1545 – FEI off-site

Copies to: Dan Feezor

FEI Representative: William J Abernathy, RG

Feezor Engineering, Inc.
3377 Hollenberg Drive
Bridgeton, MO 63044

Daily Field Summary Report

Client:	Bridgeton Landfill	**Job No.:**	BT-146
Project:	LCS-5B Installation	**Task No.:**	-
Location:	Bridgeton, MO	**Date:**	2/28/2017
Contractor(s):	Frontz Drilling	**Report No.:**	
Weather:	Cloudy		
Temperature:	58 °F		

Description of field activities (include labor, equipment, site conditions, sampling, etc.)

0720 – FEI and Frontz on-site, begin equipment decontamination activities

1055 – Decon activities complete, stowing equipment/materials for demob

1141 – FEI off-site

Copies to: Dan Feezor

FEI Representative: William J Abernathy, RG

Appendix E
Photographs

Photo #1

Photographer: WJA Date: 2/27/2017

Description: Mud rotary drilling of LCS-5B wellbore; thimble & mud tubs

Photo #2

Photographer: WJA Date: 2/22/2017

Description: 20-inch mud rotary bit being extracted from LCS-5B wellbore

Photo #3

Photographer: WJA Date: 2/15/2017

Description: Half-nipples, centralizers, O-rings, & lubricant for well pipe

Photo #4

Photographer: WJA Date: 2/15/2017

Description: 10-in diameter 316L stainless steel well pipe sections

Photo #5

Photographer: WJA Date: 2/22/2017

Description: Single-clamp well pipe suspension jig; centralizers on pipe

Photo #6

Photographer: WJA Date: 2/23/2017

Description: Double-clamp jig; prepping to connect next pipe section

Photo #7

Photographer: WJA Date: 2/22/2017

Description: Threaded ends of LCS-5B well pipe

Photo #8

Photographer: WJA Date: 2/22/2017

Description: Threading well pipe sections together

Photo #9

Photographer: WJA Date: 2/18/2017

Description: 0.125-in x 0.25-in washed river gravel (annular backfill)

Photo #10

Photographer: JH Date: 2/24/2017

Description: LCS-5B backfilled to surface, safety cage in place

Photo #11

Photographer: WJA Date: 2/27/2017

Description: LCS-5B well development activities using clean water

Photo #12

Photographer: WJA Date: 3/2/2017

Description: LCS-5B installation completed, lifting cap in place

Appendix F
Leachate Collection Sump LCS-5B As-Built Drawing

STATE OF MISSOURI
DANIEL RICHARD FEEZOR
NUMBER PE-030292
PROFESSIONAL ENGINEER
7-28-17

NOT TO SCALE

BRIDGETON LANDFILL, LLC. 13570 ST. CHARLES ROCK ROAD BRIDGETON, MO 63044	BRIDGETON LANDFILL LCS-5B INSTALLATION RECORD DRAWING	Engineering for a Better World FEEZOR ENGINEERING, INC.	MARCH 2017 DRAWN BY: BJV APPROVED BY: DRF	APPENDIX F
LCS-5B			BJV 7/27/2017	
PROJECT NUMBER: BT-146	FILE PATH: D:\Bridgeton Landfill\LCS-5B.dwg		REVISION DATE	