

2019 Annual Landfill Inspection Report

Cardinal Plant Fly Ash Reservoir I Landfill



Cardinal Operating Company 306 County Rd. 7E Brilliant,
Ohio 43913

January 2, 2020

Project Number: 60613809





January 2, 2020

Mr. Nick Kasper
Environmental Compliance Specialist
Buckeye Power, Inc.
6677 Busch Blvd.
Columbus, OH 43229

**Subject: 2019 Annual Landfill Inspection Report
Cardinal Plant Fly Ash Reservoir I
Brilliant, Ohio**

Dear Mr. Kasper:

AECOM is pleased to present this report presenting inspection findings for the Cardinal Operating Company Landfill observed during our October 18, 2019 inspection. The report presents AECOM's inspection findings, observations, photographs, conclusions, and recommendations. The report also includes a topographic survey of Cells 1 and 3 completed on October 30, 2019 by Jack A. Hamilton & Associates.

Should you have any questions or require additional information, please do not hesitate to contact the undersigned.

Sincerely,

A handwritten signature in blue ink, appearing to read "Vikram K. Gautam", is positioned above the typed name.

Vikram K. Gautam, P.E.
Geotechnical Practice Leader

VKG/vkg
Enclosure
cc: File 60613809

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1. Introduction

This report was prepared by AECOM Technical Services, Inc. (“AECOM”), to fulfill requirements of 40 CFR 257.84 and to provide Cardinal Operating Company and Buckeye Power, Inc. with an evaluation of the Fly Ash Reservoir I Landfill Facility (the Landfill), located at the Cardinal Power Plant. In accordance with the United States Environmental Protection Agency (USEPA) Final Coal Combustion Residual (CCR) Rule §257.84, annual inspection by a qualified professional engineer is required for each CCR unit, including the Landfill. The CCR Rule requires a visual inspection of each CCR Unit by a licensed civil engineer to ensure that the design, construction, operation and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering standards. At the request of Buckeye Power, Inc., AECOM completed the annual inspection in accordance with the CCR Rule requirements and prepared the following Cardinal Plant CCR Landfill Annual Inspection report.

The Cardinal Power Plant is located at 306 County Road 7 East, Brilliant, OH, 43913, in Jefferson County. Generating Units 2 and 3 are owned by Buckeye Power, Inc.; Unit 1 is owned by American Electric Power. The power plant is managed and operated by Cardinal Operating Company

The annual inspection was previously completed by American Electric Power (AEP) in 2015, 2016, and 2017. The 2018 landfill inspection was completed by AECOM. This 2019 annual inspection was completed by AECOM staff Mr. Vikram Gautam, P.E. and Mr. Thomas George, who were accompanied by Mr. Randy Sims, P.E., of Cardinal Operating Company. The site inspection was performed on October 18, 2019. During the inspection, temperatures reached a high of 55°F, and the sky was partly cloudy to sunny.

This report contains inspection findings, observations, photographs, conclusions, and maintenance recommendations. A field photographic log identifying typical conditions and any items that need correction or requiring additional monitoring is provided in Appendix B.

2. Facility Description

2.1 Permit History

The Cardinal Plant Fly Ash Reservoir I (FAR I) Residual Solid Waste Landfill was constructed over the former Fly Ash Reservoir 1 impoundment under Permit To Install (PTI) No. 06-07993, issued on May 11, 2007 by the Ohio Environmental Protection Agency (Ohio EPA). Its primary purpose is to dispose of flue gas desulfurization (FGD) gypsum material produced as a byproduct of the power plant’s stack scrubber system. A minor amount of power plant water treatment sludge is also disposed of at the landfill.

The agency approved an alteration to the PTI on June 29, 2007 that incorporated several revisions to the Quality Assurance/Quality Control (QA/QC) Plan. A second alteration (Alteration No. 2) was approved on September 2, 2008, addressing re-sequencing plans and revisions to the preloading plans for Cells 3, 4, 5 and 6. In addition to Alterations No. 1 and 2, a modification to PTI No. 06-07993 was approved by Ohio

EPA on August 10, 2011. The modification included revising the approved limits of waste by partially expanding as well as retracting the limits of waste in both the vertical and horizontal directions. The PTI modification also included the retention of the six existing ground water monitoring wells at the facility.

2.2 Landfill Components

The 129.45 acre landfill consists of two phases and six cells. Phase 1 consists of Cells 1 and 2 which overlie the bench area between FAR I and a bedrock highwall that is located around a portion of the facility's perimeter on its north and west sides. Cells 1 and 2 are constructed over bedrock near the highwall interfacing with the minespoil berm holding the fly ash of FAR I. Phase 2 consists of Cells 3, 4, 5, and 6. The Phase 2 cells (except Cell 3) are designed to be developed over the former FAR I fly ash impoundment, as shown in Figure 2 in Appendix A. The 2019 survey of Cells 1 and 3 is shown in Figure 1 of Appendix A; Figure 2 represents the general facility layout.

Cell 1 and Cell 3 (the northernmost cells of the landfill) are the only currently active cells at the facility; Cells 2, 4, 5, and 6 are inactive. Cell 1 is approximately 23 acres in size and bound by two features - the highwall to the south and the minespoil berm/bench to the north. The bench area of Cell 1 was constructed and certified in 2007 and 2008. A portion of the highwall area (approximately 60 ft. in height) was built and certified.

Cell 3 is approximately 21.25 acres in area and is bound by the termination berm and landfill haul road to the north and east, the interphase berm to the west, and the Cell 3/Cell 4 inter-cell berm on the south. Cell 3 is built over a part of the former ash pond with a 10 ft. thick layer of bottom ash and a soil cover layer.

At the time of this inspection Cells 2, 4, 5, and 6 are still in pre-construction conditions. Earthen materials are being stockpiled in these cells to be used in future construction.

2.2.1 Active Placement Areas

The active placement areas during this landfill inspection include Cell 1 and the south portion of Cell 3. Photographic documentation of the inspection of the active areas is included in Appendix B in Photograph Nos. 1, 2, 4, 6, 8, 10, 12, 15, 16 and 19. During the past year, there has been very little CCR waste placement in Cells 1 and 3 due to sales of the gypsum byproduct material, and portions of Cell 3 have actually seen a decrease in disposed volume in the past year (gypsum has been removed from the landfill to be sold). Cell 1 also receives CCR fill although in small quantities. A relatively small quantity of sludge from the Cardinal wastewater treatment plant has been placed within Cell 1.

2.2.2 Closed Areas

Closed areas include a small portion of Cell 1 (approximately one acre) that was closed in 2009, and areas outside the landfill footprint, but above FAR I, mainly to the north of Cell 3. Photographic documentation is included in Appendix B for these closed areas as Photograph Nos. 3, 11, 13 and 14.

2.2.3 Inactive Areas

As mentioned in section 2.2, Cells 2, 4, 5, and 6 are in pre-construction conditions. Earthen materials are being stockpiled in these cells to be used in future construction. The stockpile is graded to promote positive drainage and stormwater is discharged into Fly Ash Reservoir II (FAR II). Photographic documentation of the inspection of the inactive areas is included in Appendix B in Photograph No 5 and 27.

2.2.4 Leachate Collection System

The leachate collection system at FAR I Landfill was constructed in 2007. The system includes leachate collection materials, collection pipes, risers, a pretreatment structure and an outlet pipe. The landfill Leachate Collection System is graded to drain to the east side of the landfill, the leachate is then routed into leachate collection manholes which are connected by a leachate transmission pipe, becoming progressively larger from 24" diameter in the north to 36" diameter at the south end. The Leachate Collection System discharges to FAR II via a 36" nominal diameter HDPE leachate transmission pipe. On the date of the inspection, the discharge pipe was observed to be flowing freely, without obstruction.

2.2.5 Subsurface Drainage Collection System

A subsurface drainage layer (SDL) was incorporated in the landfill design to prevent uplift conditions to the landfill liner. The system consists of a 2-foot thick (minimum) layer of free-draining earthen material (the SDL), a geotextile placed above the SDL as a separator, 6" diameter perforated HDPE subsurface drainage pipes, 6" diameter solid HDPE transmission pipes, and an outfall that discharges to FAR II.

2.3 Constructed and Available Capacity

The constructed storage capacities of Cell 1 and Cell 3 are 2.04 million cubic yards and 2.89 million cubic yards, respectively. The total permitted waste volume of the landfill is 18.95 million cubic yards. The total permitted area of the landfill is approximately 129.45 acres and the currently constructed area of the landfill is approximately 44.28 acres (Cell 1 and Cell 3). There is approximately 15 vertical feet between the as-built limit of waste of Cell 1 and the permitted limited of waste against the highwall. Therefore the as-built volume of Cell 1 is less than the permitted volume. The landfill liner and leachate collection system extend to the highwall.

3. Regulatory Requirements

The Annual inspection report is completed to meet CCR regulatory requirements specified in CCR Rule Section 257.84(b)(1). These requirements include at a minimum:

- (i) A review of available information regarding the status and condition of the CCR unit, including, but not limited to, files available in the operating record (e.g., the results of inspections by a qualified person, and results of previous annual inspections); and

- (ii) A visual inspection of the CCR unit to identify signs of distress or malfunction of the CCR unit.

In addition to the annual inspections, 7-day inspections per CCR Rule Section 257.84(a)(1) are completed by Cardinal Operating Company and are documented in the facility operating record per § 257.105(g)(5) .

Once the annual inspection has been completed, the CCR Rule Section 257.84(b)(2) requires the qualified professional engineer to prepare a report following each inspection that addresses the following:

- (i) Any changes in geometry of the structure since the previous annual inspection;
- (ii) The approximate volume of CCR contained in the unit at the time of the inspection;
- (iii) Any appearances of an actual or potential structural weakness of the CCR unit, in addition to any existing conditions that are disrupting or have the potential to disrupt the operation and safety of the CCR unit; and
- (iv) Any other change(s) which may have affected the stability or operation of the CCR unit since the previous annual inspection.

4. Review of Available Information

257.84(b)(1)(i)

Pursuant to CCR Rule Section 257.84(b)(1)(i), prior to completing the visual inspection, AECOM has reviewed available information regarding the status and condition of the landfill, which includes files available in the operating record, such as design and construction information, previous 7 day inspection reports, and previous annual inspections. This information was referenced prior to and during the inspection (if needed).

Cardinal Operating Company personnel complete an inspection of the landfill facility every 7-days. This includes a visual inspection of the landfill components including the active areas, final cover area, culverts, drainage berms/ditches, leachate collection system, leachate pond, leachate pumps, and haul roads. The inspections are completed to comply with the requirements of § 257.84 of the CCR Rule. AECOM was provided access to and has reviewed the 7-day inspection reports from December 17, 2018 to December 9, 2019. These reports have noted no significant deficiencies or maintenance items.

5. Inspection (257.84(b)(1)(ii))

5.1 Definitions of Visual Observations and Deficiencies

This summary of the visual observations uses terms to describe the general appearance or condition of an observed item, activity or structure. These terms are defined as follows:

<u>Good:</u>	A condition or activity that is generally better than what is minimally expected or anticipated based on design criteria and maintenance performed at the facility.
<u>Fair/Satisfactory:</u>	A condition or activity that generally meets what is minimally expected or anticipated based on design criteria and maintenance performed at the facility.
<u>Poor:</u>	A condition or activity that is generally below what is minimally expected or anticipated based on design criteria and maintenance performed at the facility.
<u>Minor:</u>	An observed deficiency (e.g., erosion, seepage, vegetation, etc.) where the current maintenance condition is below what is minimally expected, but does not currently pose a threat to structural stability.
<u>Significant:</u>	An observed deficiency (e.g. erosion, seepage, vegetation, etc.) where the current maintenance condition is below what is minimally expected, and could pose a threat to structural stability if not addressed.
<u>Excessive:</u>	An observed deficiency (e.g., erosion, seepage, vegetation, etc.) where the current maintenance condition is below what is minimally expected, and which the ability of the observer to properly evaluate the structure or particular area being observed or which poses a threat to structural stability.

A “deficiency” is some evidence that a landfill has developed a problem that could impact the structural integrity of the landfill. There are four general categories of deficiencies. These four categories are described below:

1. **Uncontrolled Seepage:** Uncontrolled seepage is seepage that is not behaving as the design engineer has intended. An example of uncontrolled seepage is seepage that comes through or around the embankment and is not picked up and safely carried off by a drain. Seepage that is collected by a drain can still be uncontrolled if it is not safely collected and transported. Seepage that is not clear and is turbid would also be considered as uncontrolled. Seepage that is unable to be measured and/or observe it is considered uncontrolled seepage.

Note: Wet or soft areas are not considered as uncontrolled seepage, but can lead to this type of deficiency. These areas should be monitored more frequently.

2. **Displacement:** Displacement of berms, embankments, or waste masses is large scale movement of part of the structure. Common signs of displacement are cracks, scraps, bulges, depressions, sinkholes and slides.

3. **Blockage of Control Features:** Blockage of Control Features is the restriction of flow at spillways, pipes or pipe outfalls, or drains.
4. **Erosion:** Erosion is the gradual movement of surface material by water, wind or ice. Erosion is considered a deficiency when it is more than a minor routine maintenance item.

Results of the visual inspection performed on December 17, 2018 are summarized below.

5.2 Fly Ash Reservoir I Landfill Inspection Findings

The site inspection began in the closed portion of Cell 3 in the northeast corner of the landfill, progressing into the active Cell 1 area, active Cell 3 area, and then in a clockwise fashion around the inactive/future Cells 4, 6, 5, and 2. A photographic log of the facility site conditions at the time of the October 18, 2019 inspection is included in Appendix B. The overall site layout in plan view is shown in Appendix A.

All areas with protective vegetative cover established such as the closed portion of the landfill and berms had a healthy stand of vegetation that was mowed and well maintained. The northern closed area was in good condition, appeared to be well drained and was free of standing water and/or soft/wet areas on the surface. See Photograph Nos. 3, 11, 13 and 14 in the Photographic log in Appendix B.

The temporary slopes within the active waste placement areas were in good condition, well-graded and showed no signs of instability or displacement (Photos 1, 8, 10, and 16 in Appendix B). The active areas of the landfill also showed no significant erosion and were well maintained to promote drainage to the chimney drains which discharge to the leachate collection system. A majority of the Cell 3 footprint was being actively excavated (material is being removed from that area of the landfill to be sold rather than being disposed of), and the excavation area appeared to be well graded and did not have any significant ponding water or other drainage issues. See Photos 4 and 6 in Appendix B. The riser structures (exposed on account of the excavation activities) were surrounded and protected by a layer of CCR to prevent impact from heavy equipment (Photo 12).

Areas where no activity was taking place were observed to be in good condition and were protected using a polymeric dust suppressant which had been sprayed on the surface. No fugitive dust was observed on the date of the inspection at any location.

The bedrock highwall located along the western perimeter of Cell 1 appeared to be stable and no significant overhangs, rockfall, erosion features, or other signs of instability were observed, and no notable deterioration relative to the previous year's annual inspection was apparent (see Photos 7 and 9). Seepage areas and/or flows from the highwall were very light on the date of the inspection (lighter than the previous year's inspection). No ponding water or uncontrolled seepage flows were observed at the base of the highwall, suggesting that the seepage collection system is functioning as intended.

The inactive slopes, including the interface between Cell 1 and 2 were in good condition, free of displacement and signs of instability, and have a temporary cover soil placed with established vegetation (See Photos 5 and 27 of Appendix B). No major changes within this temporary cover were noted, relative to the previous year's inspection.

Vegetative growth along the downstream slopes of the earthen perimeter berms was in good condition, and the perimeter ditch system along the eastern side of the landfill was free of obstructions and was generally well vegetated and maintained (See Photos 17 thru 25 in Appendix B). Some minor erosion was present over a small area of the perimeter ditch at the southeast corner of Cell 3 (Photos 21 and 23). This is considered to be a minor maintenance concern and Cardinal Operating Company was notified.

The majority of the Cardinal Plant FAR I Landfill area serves as a stockpiling/staging area (Cells, 2, 4, 5, & 6), and is currently undeveloped. Cells 2, 4, and 5 continue to be preloaded using earthen materials that will be used in the future cell construction (See Photo No. 27). This is to control/reduce future settlement of the cells when they are constructed. The stockpiles are well graded to promote drainage.

The junction structures for the leachate collection system and spring drain/SDL were observed to be in good condition (See Photos 28 and 29 in Appendix B) and were freely flowing on the date of the inspection.

5.2.1 Changes in Geometry since Last Inspection 257.84(b)(2)(i)

No significant changes have been made to the FAR I landfill facility since the 2018 inspection. The changes that have occurred are limited to small raising of the landfill grades within Cell 1 as a result of placement of a relatively limited amount of additional CCR and wastewater treatment plant sludge, and a general lowering of the landfill grades in Cell 3 as a result of excavation and sale of gypsum. Additionally, the landfill was maintained during operations by placing dust suppressant, mowing the vegetative cover, and other maintenance requirements as necessary. The landfill has a maximum permitted elevation of approximately 1,180 feet above mean sea level (MSL), and the current maximum landfill elevation is approximately 1,111 feet above MSL.

Based on our review of the landfill survey data, areas which received additional waste increased in elevation by up to 7 ft, relative to 2018. As stated previously, areas of Cell 3 were actively excavated in 2019, and experienced a lowering of the top of waste elevation. This lowering was up to a maximum of about 20 ft and averaged about 11 ft.

5.2.2 CCR Landfill Volume 257.84(b)(2)(ii)

The FAR I landfill was not frequently used in the past year, and received small amounts of additional CCR or other solid waste in 2019. The gypsum produced at the plant is currently sold for beneficial reuse and therefore is typically not disposed of in the landfill facility.

Overall, the volume of waste contained in the landfill decreased by approximately 8% in 2019 relative to the prior year. The total volume of waste material contained in the Cardinal Plant CCR Landfill is estimated to be 2.00 million cubic yards. The year to date placement in the landfill as of November 19, 2019 includes 12,900 cubic yards of wastewater treatment plant sludge. The estimated net volume of gypsum removed from the landfill as of November 2019 is approximately 263,000 tons (approximately 168,000 CY).

5.2.3 Changes That Affect Stability or Operation 257.84(b)(2)(iii)

No appearances of actual or potential structural weakness of the CCR unit were identified during the 2019 inspection. No existing conditions were identified that were or had the potential to disrupt the operation and safety of the FAR I landfill. No deficiencies or disrupting conditions that would require immediate measures to remedy were identified in the inspection. The inspection findings consisted of a very limited number of maintenance items that were not observed to be signs or potential signs of significant structural weakness.

5.2.4 CCR Landfill Changes 257.84(b)(2)(iv)

It was noted when reviewing the 2018 aerial survey elevations that 1 point of 189 on the south side of Cell 1 where temporary cover is established, was approximately 4 inches above the permitted design elevation at that location. The discrepancy was pointed out to Cardinal Operating Company, which took action to regrade and lower the grade in the area. A resurvey performed in early 2019, which verified that the grade had been lowered.

The current survey indicates that all areas of active placement within Cells 1 and 3 have surface elevation that lies below the permitted top of waste grade.

6. Conclusions

Based on AECOM's visual inspection, the landfill's earthen berms, and open, closed, and inactive areas appear to be in good condition. The active disposal area of the landfill was in good condition with no evidence of significant erosion or water ponding. The vegetative growth along the downstream slopes of the earthen berms was in good condition. The closed areas of the landfill appeared to be stable and well maintained. The discharge structures and pipes were in good condition.

7. Recommendations – General Maintenance and Monitoring Conditions

7.1 Overall

1. Continue to mow all vegetated berms on a regular basis to prevent the growth of excess woody plants and brush.
2. Continue to complete regular maintenance of minor erosion rills and use the polymer as needed for erosion control and fugitive dust control.

3. Continue to complete weekly inspections and submit inspection reports to the operating record as required by 40 CFR 257.83.

7.2 Open Areas

1. Revegetate or armor the perimeter ditch at the southeast corner of Cell 3, where minor erosion was observed (as shown in Photo Nos. 21 and 23 of Appendix B).
2. Continue to monitor water dripping off the highwall and the highwall seepage collection system. Monitor the water for signs of turbidity or increases in flow rate and monitor the condition of the highwall at the locations where the water is observed for signs of instability, weathering, or erosion.
3. Continue to monitor the leachate collection system and spring drain collection system for unobstructed flow.
4. Continue all current maintenance and fill placement practices.

7.3 Closed Areas

1. Continue current maintenance practices including but not limited to continuing to maintain the vegetative cover height at 6 inches or less and continue the 7-day inspections of the area.

8. Recommendations – Remedial Actions/Repairs

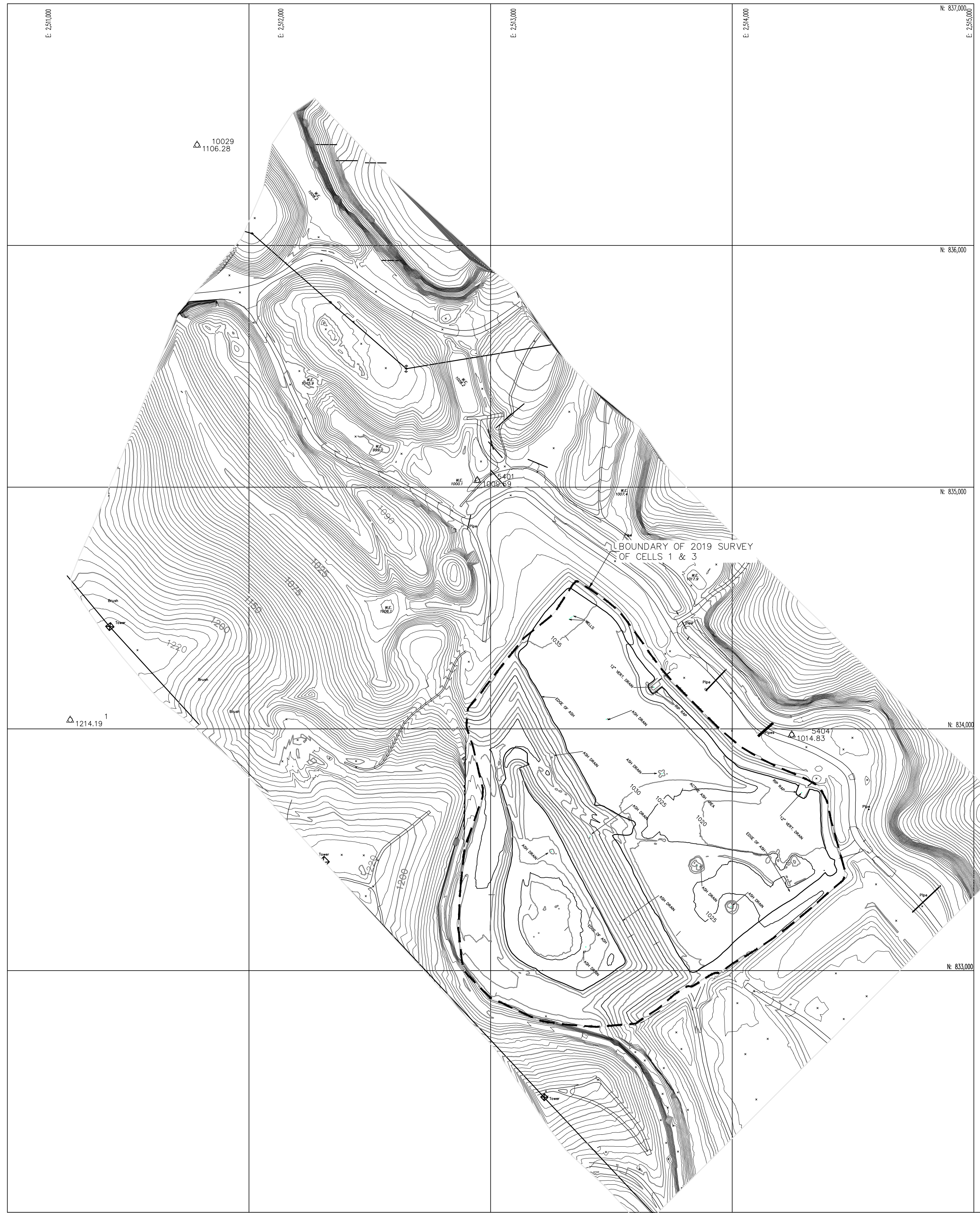
8.1 Open Areas

1. There were no deficiencies, signs of structural weakness, or signs of disruptive conditions observed at the time of the inspection that would require additional investigation or remedial action.

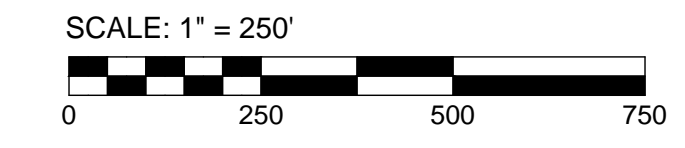
8.2 Closed Areas

1. There were no deficiencies, signs of structural weakness, or signs of disruptive conditions observed at the time of the inspection that would require additional investigation or remedial action.

Appendix A : Aerial Survey



- LEGEND**
- 980 ——— EXISTING SURFACE CONTOUR (INDEX)
 - EXISTING SURFACE CONTOUR (INTERMEDIATE)
 - 987.0 ——— EXISTING SURFACE SPOT ELEVATION
 - ⊙ WELL
 - |— SILT FENCE
 - |— EDGE OF LINER
 - · · · · EDGE OF ASH
 - - - - - MAPPING UPDATE PERIMETER
 - + CULVERT
 - ⊠ TRANSMISSION TOWER
 - ⊙ HORIZONTAL AND VERTICAL CONTROL
 - TREE LINE
 - 740 ——— MAJOR CONTOUR
 - MINOR CONTOUR
 - x SPOT ELEVATION
 - 739.6 ——— SPOT TEXT
 - · - · - WATER LINE
 - · - · - RIP RAP



- MAPPING NOTES**
- AERIAL SURVEY FOR CELLS 1 AND 3 COMPLETED BY JACK A. HAMILTON AND ASSOCIATES ON OCTOBER 30, 2019.
 - DRAWING IS IN US SURVEY FEET.
 - DATE OF ORIGINAL MAPPING PHOTOGRAPHY: 12-07-2014.
 - CONTOURS INSIDE TREE LINES SHOULD BE CONSIDERED AS GROUND OBSCURED.
 - THIS MAP UPDATED FROM A FIELD SURVEY BY THE JOHN E. DOLAN CIVIL LAB SECTION DATED DECEMBER 4, 2017.

HORIZONTAL DATUM: NAD27 OHIO SOUTH
 VERTICAL DATUM: NGVD29

AECOM
 277 West Nationwide Boulevard
 Columbus, OH 43215
 614-464-4500 (phone)
 614-464-0588 (fax)

BUCKEYE POWER
 6677 Busch Boulevard
 Columbus, OH 43229
 614-846-5757 (phone)

**CARDINAL PLANT
 BRILLIANT, OH**
 CARDINAL FAR I RESIDUAL
 WASTE LANDFILL FACILITY
 ANNUAL AS-BUILT GRADES

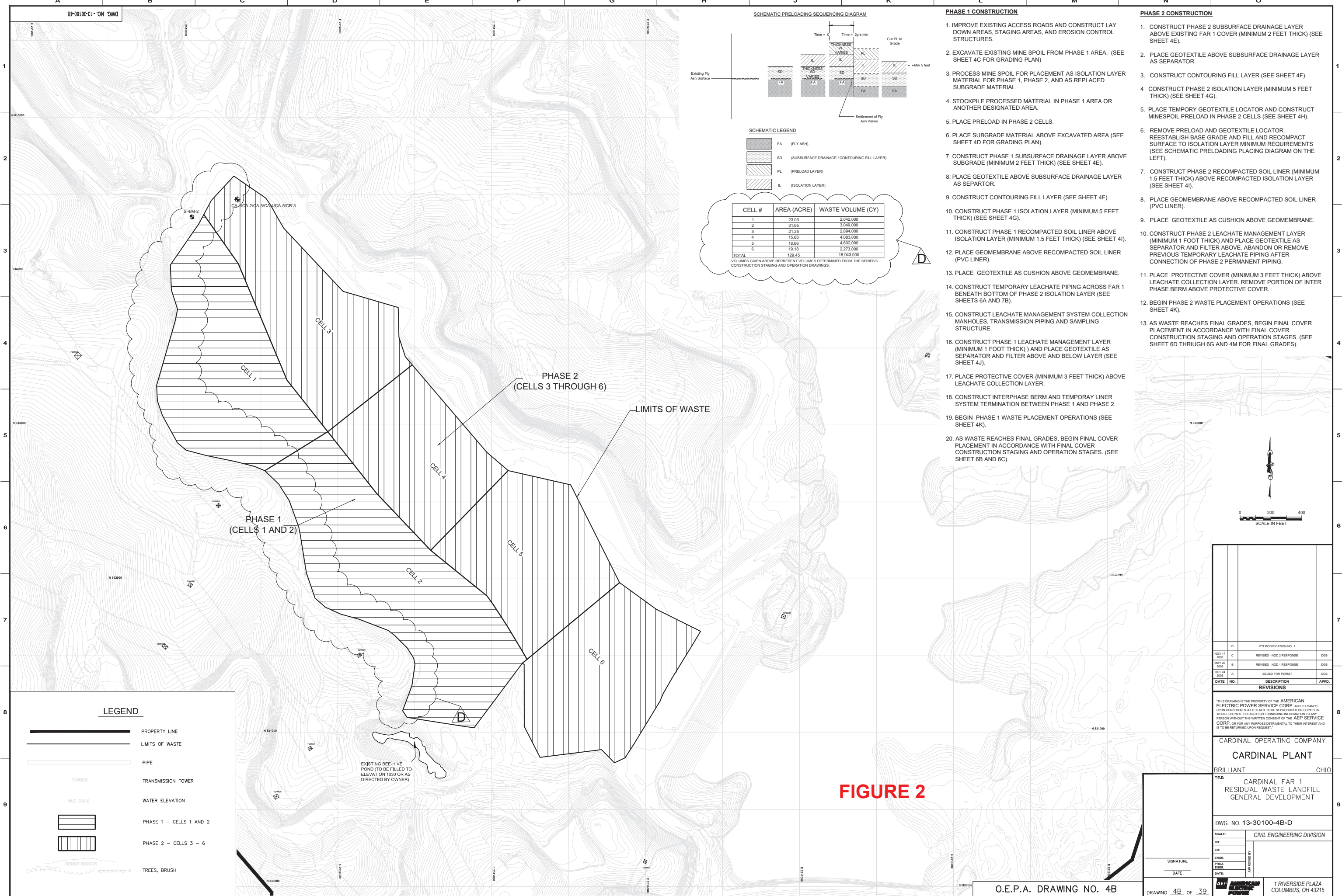
**ISSUED FOR
 CERTIFICATION**

ISSUED FOR BIDDING	DATE	BY
ISSUED FOR CONSTRUCTION	DATE	BY

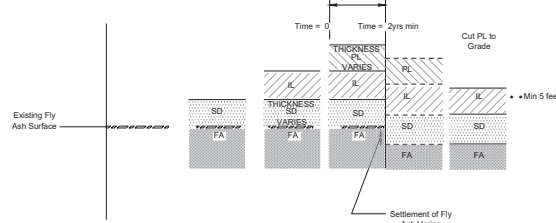
REVISIONS		
NO.	DESCRIPTION	DATE
△		
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△		
△		
△		

AECOM PROJECT NO:	60583548
DRAWN BY:	
DESIGNED BY:	
CHECKED BY:	
DATE CREATED:	
PLOT DATE:	12/19/2019
SCALE:	
ACAD VER:	2018
SHEET TITLE	

FIGURE 1



SCHEMATIC PRELOADING SEQUENCING DIAGRAM



SCHEMATIC LEGEND

- FA (FLY ASH)
- SD (SUBSURFACE DRAINAGE / CONTOURING FILL LAYER)
- PL (PRELOAD LAYER)
- IL (ISOLATION LAYER)

CELL #	AREA (ACRE)	WASTE VOLUME (CY)
1	23.03	2,042,000
2	31.65	3,049,000
3	21.25	2,884,000
4	15.68	4,083,000
5	18.66	4,602,000
6	19.18	2,273,000
TOTAL	129.45	19,943,000

VOLUMES GIVEN ABOVE REPRESENT VOLUMES DETERMINED FROM THE SERIES 6 CONSTRUCTION STAGING AND OPERATION DRAWINGS.

PHASE 1 CONSTRUCTION

1. IMPROVE EXISTING ACCESS ROADS AND CONSTRUCT LAY DOWN AREAS, STAGING AREAS, AND EROSION CONTROL STRUCTURES.
2. EXCAVATE EXISTING MINE SPOIL FROM PHASE 1 AREA. (SEE SHEET 4C FOR GRADING PLAN)
3. PROCESS MINE SPOIL FOR PLACEMENT AS ISOLATION LAYER MATERIAL FOR PHASE 1, PHASE 2, AND AS REPLACED SUBGRADE MATERIAL.
4. STOCKPILE PROCESSED MATERIAL IN PHASE 1 AREA OR ANOTHER DESIGNATED AREA.
5. PLACE PRELOAD IN PHASE 2 CELLS.
6. PLACE SUBGRADE MATERIAL ABOVE EXCAVATED AREA (SEE SHEET 4D FOR GRADING PLAN).
7. CONSTRUCT PHASE 1 SUBSURFACE DRAINAGE LAYER ABOVE SUBGRADE (MINIMUM 2 FEET THICK) (SEE SHEET 4E).
8. PLACE GEOTEXTILE ABOVE SUBSURFACE DRAINAGE LAYER AS SEPARATOR.
9. CONSTRUCT CONTOURING FILL LAYER (SEE SHEET 4F).
10. CONSTRUCT PHASE 1 ISOLATION LAYER (MINIMUM 5 FEET THICK) (SEE SHEET 4G).
11. CONSTRUCT PHASE 1 RECOMPACTED SOIL LINER ABOVE ISOLATION LAYER (MINIMUM 1.5 FEET THICK) (SEE SHEET 4I).
12. PLACE GEOMEMBRANE ABOVE RECOMPACTED SOIL LINER (PVC LINER).
13. PLACE GEOTEXTILE AS CUSHION ABOVE GEOMEMBRANE.
14. CONSTRUCT TEMPORARY LEACHATE PIPING ACROSS FAR 1 BENEATH BOTTOM OF PHASE 2 ISOLATION LAYER (SEE SHEETS 6A AND 7B).
15. CONSTRUCT LEACHATE MANAGEMENT SYSTEM COLLECTION MANHOLES, TRANSMISSION PIPING AND SAMPLING STRUCTURE.
16. CONSTRUCT PHASE 1 LEACHATE MANAGEMENT LAYER (MINIMUM 1 FOOT THICK)) AND PLACE GEOTEXTILE AS SEPARATOR AND FILTER ABOVE AND BELOW LAYER (SEE SHEET 4J).
17. PLACE PROTECTIVE COVER (MINIMUM 3 FEET THICK) ABOVE LEACHATE COLLECTION LAYER.
18. CONSTRUCT INTERPHASE BERM AND TEMPORARY LINER SYSTEM TERMINATION BETWEEN PHASE 1 AND PHASE 2.
19. BEGIN PHASE 1 WASTE PLACEMENT OPERATIONS (SEE SHEET 4K).
20. AS WASTE REACHES FINAL GRADES, BEGIN FINAL COVER PLACEMENT IN ACCORDANCE WITH FINAL COVER CONSTRUCTION STAGING AND OPERATION STAGES. (SEE SHEET 6B AND 6C).

PHASE 2 CONSTRUCTION

1. CONSTRUCT PHASE 2 SUBSURFACE DRAINAGE LAYER ABOVE EXISTING FAR 1 COVER (MINIMUM 2 FEET THICK) (SEE SHEET 4E).
2. PLACE GEOTEXTILE ABOVE SUBSURFACE DRAINAGE LAYER AS SEPARATOR.
3. CONSTRUCT CONTOURING FILL LAYER (SEE SHEET 4F).
4. CONSTRUCT PHASE 2 ISOLATION LAYER (MINIMUM 5 FEET THICK) (SEE SHEET 4G).
5. PLACE TEMPORARY GEOTEXTILE LOCATOR AND CONSTRUCT MINESPOIL PRELOAD IN PHASE 2 CELLS (SEE SHEET 4H).
6. REMOVE PRELOAD AND GEOTEXTILE LOCATOR. REESTABLISH BASE GRADE AND FILL AND RECOMPACT SURFACE TO ISOLATION LAYER MINIMUM REQUIREMENTS (SEE SCHEMATIC PRELOADING PLACING DIAGRAM ON THE LEFT).
7. CONSTRUCT PHASE 2 RECOMPACTED SOIL LINER (MINIMUM 1.5 FEET THICK) ABOVE RECOMPACTED ISOLATION LAYER (SEE SHEET 4I).
8. PLACE GEOMEMBRANE ABOVE RECOMPACTED SOIL LINER (PVC LINER).
9. PLACE GEOTEXTILE AS CUSHION ABOVE GEOMEMBRANE.
10. CONSTRUCT PHASE 2 LEACHATE MANAGEMENT LAYER (MINIMUM 1 FOOT THICK) AND PLACE GEOTEXTILE AS SEPARATOR AND FILTER ABOVE. ABANDON OR REMOVE PREVIOUS TEMPORARY LEACHATE PIPING AFTER CONNECTION OF PHASE 2 PERMANENT PIPING.
11. PLACE PROTECTIVE COVER (MINIMUM 3 FEET THICK) ABOVE LEACHATE COLLECTION LAYER. REMOVE PORTION OF INTER PHASE BERM ABOVE PROTECTIVE COVER.
12. BEGIN PHASE 2 WASTE PLACEMENT OPERATIONS (SEE SHEET 4K).
13. AS WASTE REACHES FINAL GRADES, BEGIN FINAL COVER PLACEMENT IN ACCORDANCE WITH FINAL COVER CONSTRUCTION STAGING AND OPERATION STAGES. (SEE SHEET 6D THROUGH 6G AND 4M FOR FINAL GRADES).

LEGEND

- PROPERTY LINE
- LIMITS OF WASTE
- PIPE
- TOWER
- W.E. 836.6
- WATER ELEVATION
- PHASE 1 - CELLS 1 AND 2
- PHASE 2 - CELLS 3 - 6
- DENSE WOODS
- TREES, BRUSH

FIGURE 2

DATE	NO.	DESCRIPTION	APPRO.
	D	PI1 MODIFICATION NO. 1	
NOV 17 2008	C	REVISED - NOD 2 RESPONSE	DGB
MAY 25 2008	B	REVISED - NOD 1 RESPONSE	DGB
FEB 24 2008	A	ISSUED FOR PERMIT	DGB

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CARDINAL OPERATING COMPANY
CARDINAL PLANT
 BRILLIANT OHIO

TITLE: **CARDINAL FAR 1 RESIDUAL WASTE LANDFILL GENERAL DEVELOPMENT**

DWG. NO. 13-30100-4B-D

SCALE: **CIVIL ENGINEERING DIVISION**

SIGNATURE: _____
 DATE: _____

O.E.P.A. DRAWING NO. 4B

DRAWING 4B OF 39

1 RIVERSIDE PLAZA
 COLUMBUS, OH 43215

Appendix B : Landfill Inspection Photographs

Facility Name: Cardinal FAR 1 Landfill	Site Location: 306 County Road 7 East, Brilliant, OH, 43913	Project No.: 60613809
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Photo No. 1	Date: 10/18/19	
Direction Photo Taken: South		
Description: Cell 1/3 internal slope conditions. Polymer dust suppressant has been applied.		

Photo No. 2	Date: 10/18/19	
Direction Photo Taken: North		
Description: Active portion of Cell 1. Overview of general conditions.		

Facility Name: Cardinal FAR 1 Landfill	Site Location: 306 County Road 7 East, Brilliant, OH, 43913	Project No.: 60613809
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Photo No. 3	Date: 10/18/19	
Direction Photo Taken: West		
Description: View of closed areas of the landfill, standing near NE corner of Cell 3, looking west.		

Photo No. 4	Date: 10/18/19	
Direction Photo Taken: East/Northeast		
Description: Active placement area in Cell 3. Excavation of gypsum is taking place. Internal slope between Cell 1 and 3 is in good condition.		


Facility Name: Cardinal FAR 1 Landfill	Site Location: 306 County Road 7 East, Brilliant, OH, 43913	Project No.: 60613809
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Photo No. 5	Date: 10/18/19	
Direction Photo Taken: South/Southeast		
Description: Cell 1 southwest corner line. Cell 1&2 berm and temporary cover.		

Photo No. 6	Date: 10/18/19	
Direction Photo Taken: East		
Description: Cell 1 southwest corner line and Cell 3 waste boundary.		

Facility Name: Cardinal FAR 1 Landfill	Site Location: 306 County Road 7 East, Brilliant, OH, 43913	Project No.: 60613809
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Photo No. 7	Date: 10/18/19	
Direction Photo Taken: West		
Description: Cell 1 west boundary highwall conditions.		

Photo No. 8	Date: 10/18/19	
Direction Photo Taken: North		
Description: Cell 1 west line waste internal slope conditions. Polymer dust suppressant has been sprayed on slope and crest surfaces. Note WWTP waste in photo.		

Facility Name: Cardinal FAR 1 Landfill	Site Location: 306 County Road 7 East, Brilliant, OH, 43913	Project No.: 60613809
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Photo No.: 9	Date: 10/18/19	
Direction Photo Taken: Southwest		
Description: Cell 1 west highwall conditions.		

Photo No.: 10	Date: 10/18/19	
Direction Photo Taken: East/Southeast		
Description: Cell 1 slopes, southwest corner.		

Facility Name: Cardinal FAR 1 Landfill	Site Location: 306 County Road 7 East, Brilliant, OH, 43913	Project No.: 60613809
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Photo No. 11	Date: 10/18/19	
Direction Photo Taken: Southwest		
Description: Cell 1&3 boundary with closed area.		

Photo No. 12	Date: 10/18/19	
Direction Photo Taken: N/A		
Description: Cell 3 chimney drain. Drain protected by gypsum within active excavation area.		

Facility Name: Cardinal FAR 1 Landfill	Site Location: 306 County Road 7 East, Brilliant, OH, 43913	Project No.: 60613809
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Photo No.: 13	Date: 10/18/19	
Direction Photo Taken: East/Northeast		
Description: Closed area conditions.		

Photo No.: 14	Date: 10/18/19	
Direction Photo Taken: South		
Description: Cell 3 northeast perimeter (berm and closed area) conditions.		

Facility Name: Cardinal FAR 1 Landfill	Site Location: 306 County Road 7 East, Brilliant, OH, 43913	Project No.: 60613809
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Photo No. 15	Date: 10/18/19	
Direction Photo Taken: Southwest		
Description: Cell 3 north crest. Cell 3 north active area conditions, including raised monitoring wells.		

Photo No. 16	Date: 10/18/19	
Direction Photo Taken: North		
Description: Cell 1/3 internal slope.		

Facility Name: Cardinal FAR 1 Landfill	Site Location: 306 County Road 7 East, Brilliant, OH, 43913	Project No.: 60613809
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Photo No. 17	Date: 10/18/19	
Direction Photo Taken: South		
Description: Northern Cell 3 berm crest conditions.		

Photo No. 18	Date: 10/18/19	
Direction Photo Taken: North		
Description: Southern Cell 3 berm (near southeast corner of cell) conditions Cell 3 active area placement conditions.		

Facility Name: Cardinal FAR 1 Landfill	Site Location: 306 County Road 7 East, Brilliant, OH, 43913	Project No.: 60613809
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Photo No. 19	Date: 10/18/19	
Direction Photo Taken: West/Southwest		
Description: Cell 3 central, active area conditions and stormwater inlet.		

Photo No. 20	Date: 10/18/19	
Direction Photo Taken: Northeast		
Description: Cell 3 southeastern berm perimeter ditch conditions.		

Facility Name: Cardinal FAR 1 Landfill	Site Location: 306 County Road 7 East, Brilliant, OH, 43913	Project No.: 60613809
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Photo No. 21	Date: 10/18/19	
Direction Photo Taken: Northwest		
Description: Minor erosion noted at Cell 3 perimeter ditch (southeast corner of cell)		

Photo No. 22	Date: 10/18/19	
Direction Photo Taken: South		
Description: Cell 3 berm and ditch, southeast conditions. Eastern slope of CCR placement area is no longer present due to excavations.		

Facility Name: Cardinal FAR 1 Landfill	Site Location: 306 County Road 7 East, Brilliant, OH, 43913	Project No.: 60613809
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Photo No.: 23	Date: 10/18/19	
Direction Photo Taken: East		
Description: Minor erosion noted at Cell 3 perimeter ditch		

Photo No.: 24	Date: 10/18/19	
Direction Photo Taken: South		
Description: Cell 3 east swale line conditions.		

Facility Name: Cardinal FAR 1 Landfill	Site Location: 306 County Road 7 East, Brilliant, OH, 43913	Project No.: 60613809
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Photo No.: 25	Date: 10/18/19	
Direction Photo Taken: North		
Description: Cell 3 east berm and swale line.		

Photo No.: 26	Date: 10/18/19	
Direction Photo Taken: Northwest		
Description: Cell 3 south swale line. Manhole #2 conditions.		

Facility Name: Cardinal FAR 1 Landfill	Site Location: 306 County Road 7 East, Brilliant, OH, 43913	Project No.: 60613809
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Photo No. 27	Date: 10/18/19
Direction Photo Taken: Southeast	
Description: Standing at Cell 1 southern perimeter, view of Cells 2/4/5 inactive/future area. Earthen stockpiles seen in view (stockpiles in cells 2 and 4 have temporary vegetative cover).	



Photo No. 28	Date: 10/18/19
Direction Photo Taken: East	
Description: Subsurface Drainage Layer outfall in Cell 6. Outfall was flowing freely on date of inspection.	



Facility Name: Cardinal FAR 1 Landfill	Site Location: 306 County Road 7 East, Brilliant, OH, 43913	Project No.: 60613809
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Photo No. 29	Date: 10/18/19	
Direction Photo Taken: East		
Description: Leachate Pretreatment Structure.		

Photo No.	Date:	
Direction Photo Taken:		
Description:		