RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN

FOR THE:
SOUTHWESTERN ELECTRIC POWER COMPANY
FLINT CREEK POWER PLANT LANDFILL
CLASS 3N LANDFILL
PERMIT 0273-S3N-R2

PREPARED FOR:
SOUTHWESTERN ELECTRIC POWER COMPANY
428 TRAVIS STREET
SHREVEPORT, LOUISIANA 71101

PREPARED BY:
HULL & ASSOCIATES, INC.
3401 GLENDALE AVENUE
SUITE 300
TOLEDO, OHIO 43614

SEPTEMBER 2016

HULL

TABLE OF CONTENTS

PAGE

1.0 INTRODUCTION 1

2.0 RUN-ON CONTROLS 2

2.1 Run-on Controls from Outside the Landfill Footprint 2
2.2 Run-on Controls from Inside the Landfill Footprint 2

3.0 RUN-OFF CONTROLS 4

3.1 Run-off Controls from Landfill's Final Cover System 4
3.2 Run-off Controls for Contact Water Management System 4
3.3 Leachate Collection and Management System 4

4.0 PLAN AMENDMENTS AND REVISIONS 5

5.0 PROFESSIONAL ENGINEER CERTIFICATION 6

LIST OF APPENDICES

Appendix A Figures

Figure 1 General Site Plan
Figure 2 Run-on/Run-off Control Plan

Appendix B Calculations

Appendix C Plan Review Log

1.0 INTRODUCTION

This Run-on and Run-off Control System Plan (Plan) has been prepared for the Flint Creek Power Plant Landfill (Landfill) in Gentry, Arkansas, to comply with the requirements of Federal Regulation Title 40, Subpart §257.81. The Landfill is currently being operated under a Class 3 Non-Commercial Landfill permit modification issued by the Arkansas Department of Environmental Quality (ADEQ) on December 17, 2014 (permit 0273-S3N-R2).

Federal Regulation Title 40, Subpart §257.81 states that the Owner or Operator of an existing or new CCR landfill or any lateral expansion of a CCR landfill must comply with the following:

a. Design, construct, operate, and maintain:

   1. A run-on control system to prevent flow onto the active portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm; and

   2. A run-off control system from the active portion of the CCR unit to collect and control at least the water volume resulting from a 24-hour, 25-year storm.

b. Run-off from the active portion of the CCR unit must be handled in accordance with the surface water requirements under § 257.3-3.

c. Prepare a Run-on and Run-off Control System Plan for existing CCR landfills according to the following timelines:

   1. The initial run-on and run-off control system plan no later than October 17, 2016.

   2. Periodic run-on and run-off control system plans (from the date the initial Plan) are placed in the Landfill's Operating Record every five years.

d. Obtain a certification from a qualified professional engineer stating that the initial and periodic run-on and run-off control system plans meet the requirements of §257.81.

e. Comply with the recordkeeping requirements specified in § 257.105(g), the notification requirements specified in § 257.106(g), and the internet requirements specified in § 257.107(g).

This Plan (dated September 2016) is the initial plan required under §257.81 and is in compliance with the requirements listed above. The design of the run-on and run-off control measures were completed as part of the current permit for the Landfill, which was obtained after submittal of the Intermediate Liner and Leachate Collection System Permit Modification application, dated March 2011 (Permit Modification).

The Landfill has installed and is maintaining many of the stormwater controls discussed within this Plan. Figures 1 and 2 in Appendix A provide additional information related to the controls.

2.0 RUN-ON CONTROLS

The Preamble from Subpart 257 of CFR 40 defines run-on as "any liquid that drains over land onto any part of a CCR landfill or any lateral expansion of a CCR landfill. In surface water hydrology, run-on is a quantity of surface run-off, or excess rain, snowmelt, or other sources of water, which flows from an upstream catchment area onto a specific downstream location." This section of this Plan describes the controls at the Landfill to manage run-on from outside the Landfill footprint and from inside the Landfill footprint, which are designed to manage the peak flow from a 24-hour, 25-year storm event.

2.1 Run-on Controls from Outside the Landfill Footprint

The Landfill is located in an area with gentle slopes that generally drain from northeast to southwest. Figure 1 in Appendix A shows the layout of the Landfill, nearby existing topography and the run-on controls.

Perimeter ditches are located along the north and west sides of the Landfill to collect run-on and keep it away from the Landfill. Run-on that is collected by these ditches (north ditch and upstream portion of west ditch) is conveyed to either the West Sediment Basin or to stormwater culverts under Swepco Road at the southwest corner of the Landfill, which ultimately discharge to the Primary Ash Pond located southwest of the Landfill. Design calculations for the perimeter ditches are provided in the Permit Modification.

An existing intermittent stream located east of the Landfill collects run-on from the east and conveys it to stormwater culverts under Swepco Road at the southeast corner of the Landfill, which ultimately discharge to the Primary Ash Pond. The portion between the east side of the Landfill and the perennial stream, as well as the south side of the Landfill, slope away from the Landfill, thus not generating run-on to the Landfill.

2.2 Run-on Controls from Inside the Landfill Footprint

The Landfill, since obtaining approval from ADEQ for the Permit Modification in December 2014, is being developed in phases. The first phase began immediately after gaining the permit modification approval and is nearly complete. It consisted of regrading the Landfill to improve surface water drainage and to prepare to completely cover the entire Landfill with either a Final Cover System (on the outer landfill 4:1 slopes that have reached final permitted grades) or with an Intermediate Liner System (on the remainder of the Landfill, which is the center area that will receive waste during the remainder of the Landfill's life). Details for the Final Cover and Intermediate Liner systems are provided in the Permit Modification. Other components being constructed in this first phase are a leachate collection pond, a leachate treatment system (under a wastewater permit that is separate from the Permit Modification), a contact water management pond and conveyance pipe, and surface water management structures (sediment basins, erosion control

terraces, letdowns, etc.). Figure 2 depicts the general layout of the Landfill at the end of this first phase of construction. The status of the first phase of construction is as follows:

1. The Final Cover System on the outer slopes is near completion and a certification report will be submitted to ADEQ in late 2016 or early 2017. This portion of the Landfill does not generate run-on to the Landfill.

2. The Intermediate Liner System is also near completion. The first active filling area (Area 1), which includes a leachate collection system (LCS) per the approved permit modification, has been constructed and certified to ADEQ. The remainder of the Intermediate Liner System area (Areas 2, 3, and 4) are currently under construction and will not have a LCS installed until the previous filling area is nearly full (e.g., Area 2 will only have a LCS installed when Area 1 is filled to capacity based on achievable waste grades per the certified limits and operational needs, and so forth). Prior to installing the LCS over a new area, the surface of Areas 2, 3, and 4 will consist of an exposed 60 mil HDPE geomembrane and will generate run-on to Area 1. To keep stormwater (run-on) away from the active filling area, a cell separation berm was constructed along the upstream side of Area 1, which will convey stormwater to the west perimeter ditch and, thus, minimize leachate and contact water generation. Cell separation berms will also be constructed at the final development of Areas 2 and 3 (i.e., installation of a LCS to receive waste) to control run-on away from the active filling area. Details for the cell separation berm are provided in the Permit Modification. Calculations were performed to verify that the cell separation berm would manage the peak flow from a 24-hour, 25-year storm event and are provided in Appendix B.

3.0 RUN-OFF CONTROLS

The Preamble from Subpart 257 of CFR 40 defines run-off as "any liquid that drains over land from any part of the CCR landfill." This section of this Plan describes the controls at the Landfill to manage run-off from the Landfill's Final Cover System and from the active filling area, which are designed to manage the peak flow from a 24-hour, 25-year storm event. Details for the run-off controls discussed below are provided in the Permit Modification and are shown on Figure 2.

3.1 Run-off Controls from Landfill's Final Cover System

The Landfill's Final Cover System has been designed to minimize stormwater infiltration into the Landfill, thus minimizing leachate generation. The surface of the Final Cover System consists of a vegetated cover to minimize erosion of the final cover soils. A subsurface drainage system (i.e., a double-sided geocomposite drainage net) is also part of the design to collect and convey stormwater that infiltrates through the final cover soils. Stormwater from the Final Cover System flows away from the active filling area and discharges to perimeter ditches and diversion berms via erosion control terraces and letdowns. The majority of the run-off from the Final Cover System is conveyed to either the North or West Sediment Basins. The small portions that are not conveyed to the Sediment Basins are conveyed directly to the stormwater culverts under Swepco Road on the southwest and southeast corners of the Landfill. All stormwater run-off from the Final Cover System is eventually discharged to the Primary Ash Pond. The design calculations for the run-off controls are provided in the Permit Modification.

3.2 Run-off Controls for Contact Water Management System

Run-off generated within the active filling area will be managed as contact water and conveyed to the Contact Water Pond located southwest of the Landfill. As waste is placed in the active filling area, the outer 4:1 slopes will be covered in accordance with the permit to minimize contact water generation. Filling operations will occur in such way that the inner grades of the Landfill will be sloped for contact water to gravity-drain towards the Contact Water Pond inlet channels located on the southwest corner of the Landfill, and will ultimately discharge to the Contact Water Pond. The design calculations for the run-off controls are provided in the Permit Modification.

3.3 Leachate Collection and Management System

Leachate from the Landfill is collected via a 1.5-foot (minimum thickness) bottom ash drainage layer and perforated collection pipes, which all drain to the southwest corner of the Landfill, at which point the leachate pipe becomes solid and conveys leachate from the Landfill to the Leachate Pond. An on-site treatment system has been constructed (under a wastewater permit that is separate from the Permit Modification) to treat the Landfill's leachate prior to discharging it into the Contact Water Pond.

4.0 PLAN AMENDMENTS AND REVISIONS

In accordance with §257.81(c)(2), this Plan may be amended at any time, if desired by the owner or operator of the Landfill or if there is a change in conditions that substantially affect the written plan in effect (e.g., changes in the Landfill design, construction, operation, and/or maintenance). In such cases, amendments shall be made to the written plan and placed in the Landfill's operating record.

In accordance with §257.81(c)(4), the owner or operator must prepare periodic run-on and run-off control system plans every five years, at a minimum. This Plan serves as the initial plan required by §257.81 (c)(3) and may be evaluated and revised (if needed) every five years, from the date when the plan in effect was placed in the Landfill's operating record.

All amendments resulting from changes in in the Landfill design, construction, operation, and/or maintenance shall be reviewed and certified by a qualified professional engineer in accordance with Section 5.0 of this Plan. All scheduled reviews and amended plans shall be recorded in the Plan Review Log provided in Appendix C. The five-year reviews shall be recorded even if no changes are made to the Plan as a result of the review.

5.0 PROFESSIONAL ENGINEER CERTIFICATION

The original plan and all reviews and amended plans must obtain certification from a qualified professional engineer stating that the initial and periodic run-on and run-off control system plans meet the requirements of §257.

The undersigned licensed Professional Engineer (P.E.) certifies that this Run-on and Run-off Control Plan has been prepared, reviewed, and/or revised in accordance with the current requirements of Federal Regulation Title 40, Subpart §257.81, including consideration of good engineering practice and industry standards. This certification in no way relieves the owner or operator of the Landfill of his/her duty to fully implement this Plan.

Signature _____

Name Angela M. Gerdeman

Registration Number 14070

State Arkansas

Date 9-8-16

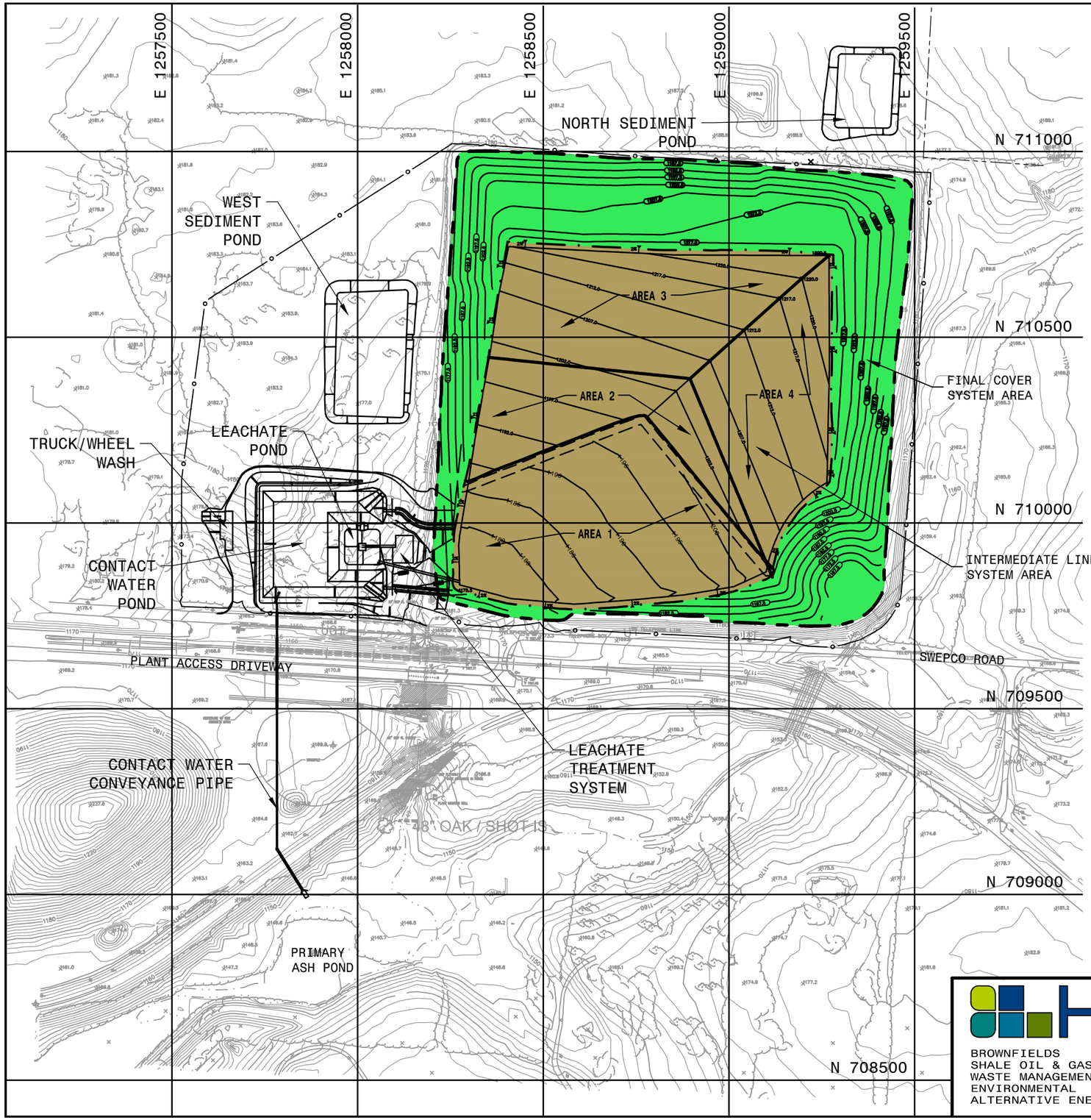
Seal

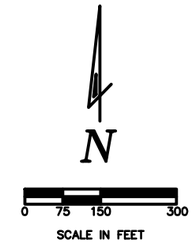


9-8-16

APPENDIX A

Figures





LEGEND

- PROPERTY BOUNDARY
- INDEX CONTOUR (1200)
- INTERMEDIATE CONTOUR
- TREE LINE
- CULVERT
- RAILROAD TRACKS
- APPROXIMATE LIMIT OF FINAL COVER SYSTEM
- APPROXIMATE LIMIT OF INTERMEDIATE LINER SYSTEM
- APPROXIMATE LIMIT OF THE INTERMEDIATE LINER CONSTRUCTION AREA
- APPROXIMATE LIMIT OF THE FINAL COVER SYSTEM CONSTRUCTION AREA
- CHAIN LINK FENCE
- GATE

NOTES:

1. THE TOPOGRAPHY WAS OBTAINED FROM A MARCH 31, 2010 SURVEY PERFORMED BY HENDERSON AERIAL SURVEYS INC. AND BY THE CIVIL LAB SECTION ON APRIL 25, 2013, BY CRAFTON TULL & ASSOCIATES, INC. ON JANUARY 19, 2015, BY MORRISON SHIPLEY ON FEBRUARY 2, 2015 AND LOCATION OF POWER POLES AND TELEPHONE PEDESTAL SOUTH OF THE PONDS WERE LOCATED IN THE FIELD BY CHARAH, INC. HORIZONTAL DATUM: NAD27 ARN. VERTICAL DATUM: NGVD29
2. CHAIN LINK FENCE AND GATES SHOWN ARE FROM DESIGN DRAWINGS AS THEY WERE BEING INSTALLED DURING PREPARATION OF THIS PLAN AND, AS SUCH, AS-BUILT INFORMATION WAS NOT AVAILABLE AT THE TIME.

HULL

BROWNFIELDS
SHALE OIL & GAS
WASTE MANAGEMENT
ENVIRONMENTAL
ALTERNATIVE ENERGY

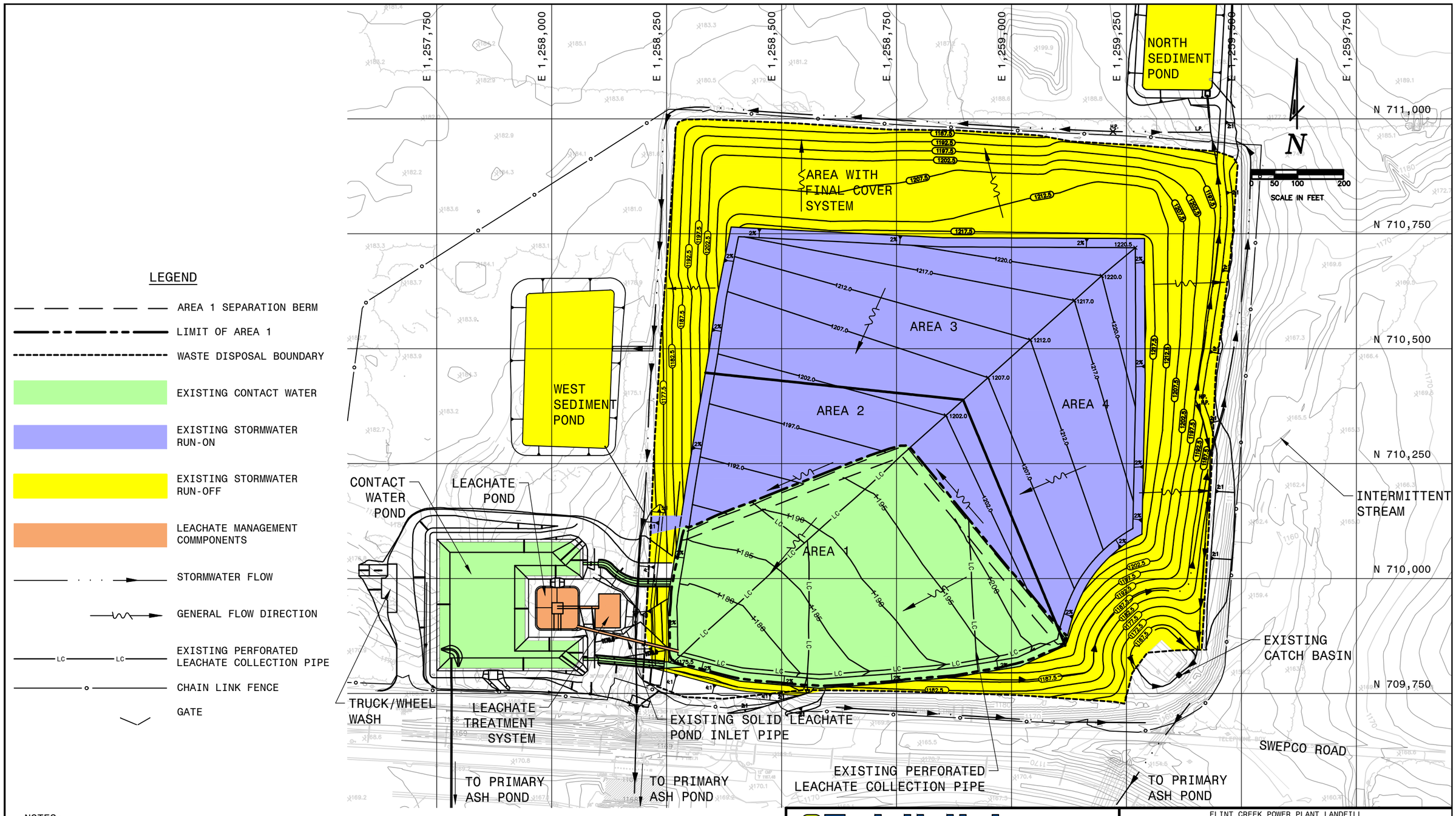
© 2016 Hull & Associates, Inc.
3401 Glendale Ave.
Suite 300
Toledo, Ohio 43614
Phone: (419) 385-2018
Fax: (419) 385-5487
www.hullinc.com

FLINT CREEK POWER PLANT LANDFILL
RUN-ON AND RUN-OFF CONTROL PLAN

FIGURE 1
GENERAL SITE PLAN

GENTRY, ARKANSAS

PROJECT NO.: AP0075	SUBMITTAL DATE: SEPTEMBER 2016
CAD DWG FILE: AP0075.100.0002 SAH	PLOT DATE: 9/8/16



NOTES:

1. THE TOPOGRAPHY WAS OBTAINED FROM A MARCH 31, 2010 SURVEY PERFORMED BY HENDERSON AERIAL SURVEYS INC. AND BY THE CIVIL LAB SECTION ON APRIL 25, 2013, BY CRAFTON TULL & ASSOCIATES, INC. ON JANUARY 19, 2015, BY MORRISON SHIPLEY ON FEBRUARY 2, 2015 AND LOCATION OF POWER POLES AND TELEPHONE PEDESTAL SOUTH OF THE PONDS WERE LOCATED IN THE FIELD BY CHARAH, INC. HORIZONTAL DATUM: NAD27 ARN. VERTICAL DATUM: NGVD29
2. CHAIN LINK FENCE AND GATES SHOWN ARE FROM DESIGN DRAWINGS AS THEY WERE BEING INSTALLED DURING PREPARATION OF THIS PLAN AND, AS SUCH, AS-BUILT INFORMATION WAS NOT AVAILABLE AT THE TIME.

HULL
BROWNFIELDS
SHALE OIL & GAS
WASTE MANAGEMENT
ENVIRONMENTAL
ALTERNATIVE ENERGY

© 2016 Hull & Associates, Inc.

3401 Glendale Ave. Suite 300 Toledo, Ohio 43614
Phone: (419) 385-2018 Fax: (419) 385-5487 www.hullinc.com

FLINT CREEK POWER PLANT LANDFILL
RUN-ON AND RUN-OFF CONTROL PLAN

FIGURE 2
RUN-ON AND RUN-OFF CONTROL PLAN

GENTRY, ARKANSAS

PROJECT NO.: AP0075	SUBMITTAL DATE: SEPTEMBER 2016
CAD DWG FILE: AP0075.100.0001 SAH	PLOT DATE: 9/8/16

APPENDIX B

Calculations

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

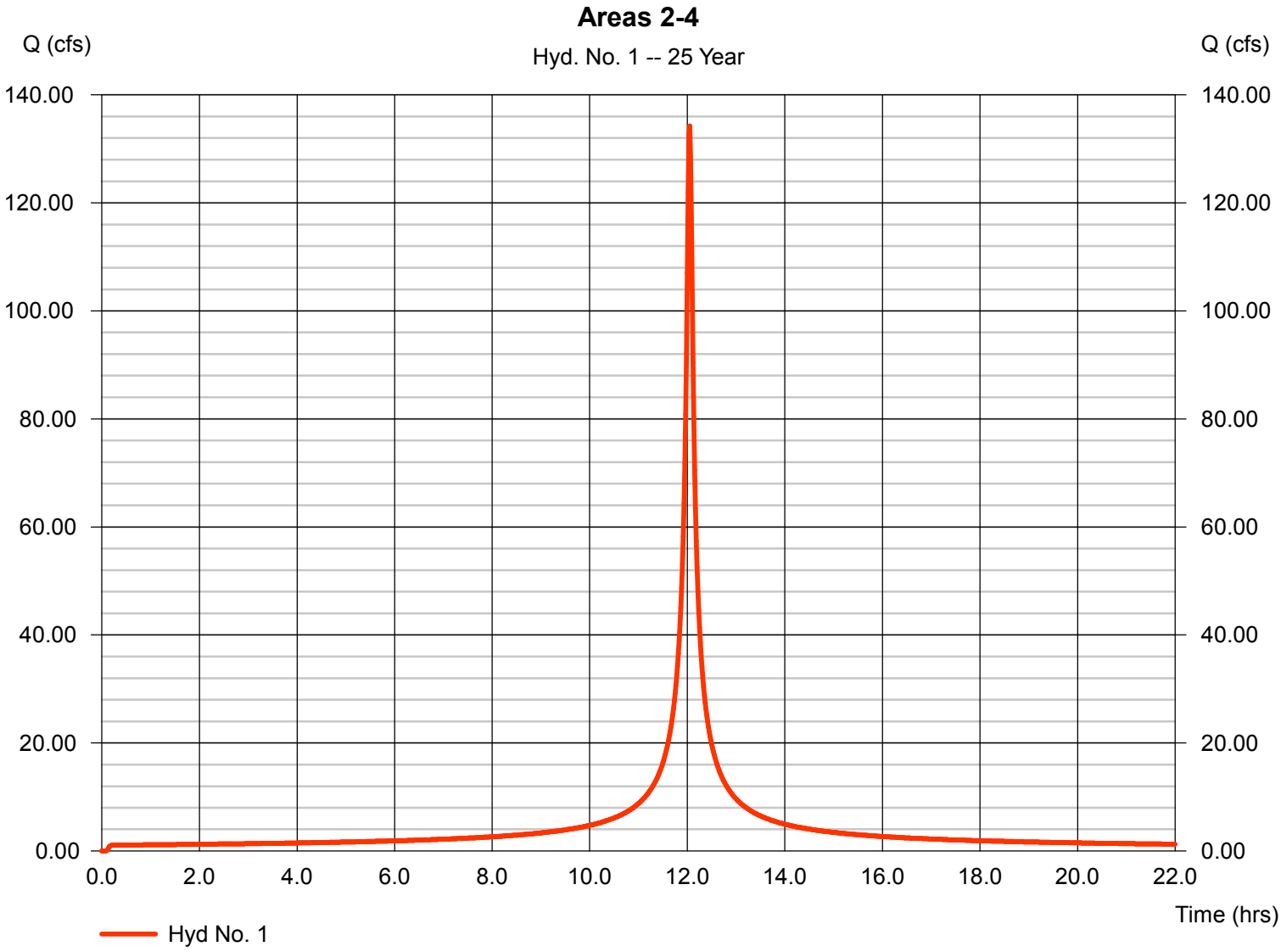
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	134.22	1	723	405,850	----	------	------	Areas 2-4

Hydrograph Report

Hyd. No. 1

Areas 2-4

Hydrograph type	=	SCS Runoff	Peak discharge	=	134.22 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.05 hrs
Time interval	=	1 min	Hyd. volume	=	405,850 cuft
Drainage area	=	15.840 ac	Curve number	=	100
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	4.70 min
Total precip.	=	7.06 in	Distribution	=	Synthetic
Storm duration	=	24.00 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 1

Areas 2-4

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 1.75		0.00		0.00		
Land slope (%)	= 4.00		0.00		0.00		
Travel Time (min)	**= 2.99**	**+**	**0.00**	**+**	**0.00**	**=**	**2.99**
Shallow Concentrated Flow							
Flow length (ft)	= 420.00		0.00		0.00		
Watercourse slope (%)	= 4.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	= 4.07		0.00		0.00		
Travel Time (min)	**= 1.72**	**+**	**0.00**	**+**	**0.00**	**=**	**1.72**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.026		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 4.70 min

Area 1 Cell Separation Berm

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01000	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	25.00	ft/ft (H:V)
Discharge	134.22	ft³/s

Results

Normal Depth	1.03	ft
Flow Area	14.19	ft²
Wetted Perimeter	27.95	ft
Hydraulic Radius	0.51	ft
Top Width	27.68	ft
Critical Depth	1.44	ft
Critical Slope	0.00165	ft/ft
Velocity	9.46	ft/s
Velocity Head	1.39	ft
Specific Energy	2.42	ft
Froude Number	2.33	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.03	ft
Critical Depth	1.44	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00165	ft/ft



FROM PERMIT DRAWING AP0033.100.0144 - PLATE 1 CONTACT WATER AREAS PER PHASE, APPENDIX H-I.

SCALE 1" = 120'

DISCLAIMER: AMERICAN ELECTRIC POWER SERVICE CORPORATION (AEPSC) AND SOUTHWESTERN ELECTRIC POWER COMPANY (SWEPCO) ARE FULLY AWARE THAT AN PORTION OF THE PERMIT MODIFICATION APPLICATION FOR THE INTERMEDIATE LINER AND LEACHATE COLLECTION SYSTEM AT FLINT CREEK POWER PLANT LANDFILL PERI APPLICATION IS AVAILABLE TO THE PUBLIC FOR REVIEW AND REPRODUCTION. AS SUCH, THIS DISCLAIMER CAN BE CONSIDERED AN OFFICIAL ACKNOWLEDGEMENT OF THIS REQUIREMENT AND INSTRUCTION TO DISREGARD ANY CONFIDENTIALITY STATEMENT CONTAINED THROUGHOUT THIS PERMIT APPLICATION.

APPENDIX C

Plan Review Log

Run-On and Run-Off Plan Amendment Log

By	Date	Amendment Description	PE Certification Required?	PE Name	Licensing State: Registration No.
Hull & Associates, Inc.	9/8/2016	Initial Plan	Yes	Angela M. Gerdeman	AR 14070