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CITY OF Lakeland
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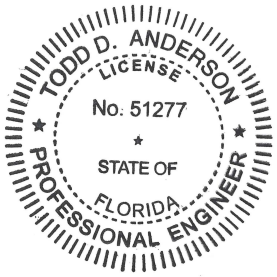
RUN-ON AND RUN-OFF PLAN REPORT BYPRODUCT STORAGE AREA

C.D. MCINTOSH POWER PLANT
Lakeland, Florida



Digitally signed by Todd D. Anderson, P.E.
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Prepared for

Lakeland Electric
501 East Lemon Street
Lakeland, Florida 33801

This document has been electronically signed and sealed by Todd D. Anderson, PE on 29 October 2021 using a digital signature. Printed copies of this document are not considered signed and sealed and the SHA authentication code must be verified on any electronic copies.

Prepared by

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Project FL8003

October 29, 2021

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1. INTRODUCTION

1.1 Statement of Purpose

Lakeland Electric (LE) is evaluating options for permanent regulatory closure of the Byproducts Storage Area (BSA), a coal combustion residual (CCR) storage unit, at the C.D. McIntosh Power Plant (MPP or Site) located in Lakeland, Florida. LE has retained Geosyntec Consultants, Inc. (Geosyntec) to conduct an engineering evaluation of the closure alternatives for the BSA.

This report was prepared by Geosyntec to present the updates to the Run-On and Run-Off Control System (ROROCS) in accordance with the requirements of the federal CCR rule (40 Code of Federal Regulations (CFR) Part 257, Subtitle D). This ROROCS plan documents the changes to the original 2016 plan. Included herein are supporting engineering calculations and modeling analysis. The previous report with original calculations ("Run-On and Run-Off Control System Plan," Golder Associates, Inc., October 2016) can be found in **Appendix A**. The previous report by Golder Associates Inc. (Golder) was used as a basis for this report. The definitions and terminology were continued with this report for consistency.

1.2 Regulatory Background

The federal CCR rule requires that a ROROCS is provided by existing CCR landfill owners or operators in order to document how the run-on and run-off control systems meet the following outlined requirements in §257.81(a):

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

The active portion is defined in §257.53 as the part of the CCR unit that has received CCR or non-CCR waste and has not completed closure in accordance with §257.102. The entire BSA is considered active (Golder, 2016).

1.3 Changes to the Site

The original ROROCS plan is being altered because the final design of the landfill has changed. The final design height will not be reached and instead the landfill will be capped at the current height. The stormwater benches, which are discussed more in depth in the following sections, will not be integrated. This caused changes in design parameters to Basin 1 and Basin 2, which will also be discussed more in depth in the following sections. There were no changes to Basin 3 or Fish Lake Basin.

2. DESIGN METHODOLOGIES

Stormwater discharge and flow routing calculations were performed using the Streamline Technologies Interconnected Channel and Pond Routing, Version 4 (ICPR4). Two separate models were created, the Contact Water (CW) model and the Non-Contact Model (NCW). These Hydrologic & Hydraulic (H&H) models were created in order to determine the peak stages of the

Site and therefore determine whether the ROROCS plan satisfies the federal CCR rule requirements.

The ICPR4 model operates using three key elements that include subbasins, nodes, and links. The subbasins represent the hydrological information for each drainage basin. Stage-area data (or depressional storage areas) within each drainage basin was inputted into nodes. The nodal warning stages correlate to the maximum stage that can be reached within the depressional storage areas before overtopping occurs (e.g. top of bank elevation). The nodal warning stages vary for each drainage basin node. Nodes are interconnected by links and the links represent the existing or proposed culverts/pipes and pumps for flow routing. There are several parameters that are required inputs for the models, which are outlined in the following sections.

It is noted that the original models were created in ICPR3. The models were converted from the outdated Version 3 to Version 4 for ease of use. This conversion created no change to the original model results.

2.1 Design Storm

Per local and federal regulations, the ROROCS plan was designed for the hydraulic capacity of the 25-year, 24-hour design storm event. It was assumed that the site-specific precipitation estimates from the previous calculations did not change for the calculations completed for this report. The precipitation estimates were obtained from the Natural Resource Conservation Service (NRCS) 24-hour rainfall maps and the Soil Conservation Service (SCS) Florida Modified (FLMOD) Type II Rainfall Distribution was used. Approximately 7.5 inches of rainfall is generated from the 25-year, 24-hour storm at the MPP.

2.2 Hydrologic Calculation and Stormwater Routing Methods

NRCS methods were used to complete the hydrology calculations. The calculations from the previous report were re-created and the necessary changes were added at that point.

2.2.1 Time of Concentration

Time of concentration values were calculated for each subbasin by dividing the flow paths into sheet flow and shallow concentration segments. The original time of concentration calculations for the CW and NCW models can be found in **Appendix A**. The time of concentration calculations were updated by adding additional length to the original time of concentration lengths in ArcMap. The additional length was determined by the new area added to Basin 1 and Basin 2. Similar slopes, Manning's n's, velocities, and precipitation from the original calculations were assumed for the updated calculations. The updated time of concentration calculations for the CW and NCW models can be found in **Appendix B** and **Appendix C**, respectively.

2.2.2 Curve Number

Composite curve numbers were calculated for each subbasin within the CW and NCW models. The original calculations can be found in **Appendix A** and the updated calculations for the CW and NCW models can be found in **Appendix B** and **Appendix C**, respectively. CCR material was assumed to perform hydrologically consistent with bare soil conditions. Final cover material was assumed to perform hydrologically consistent with open space with fair vegetative

condition. Hydrologic soil group B was assumed for curve number computations. The change in land cover acreage due to updated subbasin boundaries produced new composite curve numbers.

3. RUN-ON CONTROL

Run-on is defined as stormwater that may flow towards the active portion of the BSA. Based on the topography of the BSA and surrounding topography, run-on potential is low (Golder, 2016). The BSA is topographically higher than surrounding areas and is surrounded by berms and a network of stormwater collection areas. The perimeter berms and stormwater collection areas (ditches, swales, and ponds) would intercept run-on flows. The BSA topography and surrounding area topography can be found in **Appendix A**.

4. RUN-OFF CONTROL

Run-off is defined as stormwater that falls on and flows off of the BSA. This includes run-off from the active ash placement areas and intermediate cover areas. There are two types of stormwater run-off at BSA:

- Contact water (stormwater run-off that has contacted CCR); and
- Non-contact stormwater (run-off that has not contacted CCR).

Contact and non-contact stormwater is separated through the use of diversion berms, swales, and ditches. Contact water run-off and non-contact stormwater run-off are managed separately as addressed in the following sections:

4.1 Contact Water Run-off

Contact water is collected by a series of interconnected ditches and eventually conveyed to the South Sedimentation Pond adjacent to the temporary byproduct staging area. Contact water from the active portion of the BSA is routed to a soil cement lined perimeter ditch where it collects and is discharged via culverts to the South Sedimentation Basin. The South Sedimentation Basin is constructed with a soil cement liner which acts to contain water and facilitate regular clean out by LE. Contact water entering the sedimentation basin is pumped to the existing process water ponds for treatment and ultimately disposal.

4.1.1 Original Contact Water Model

The BSA configuration was analyzed in 2016 for contact water management and modeled in ICPR (see **Appendix A**). The ICPR nodal diagram, model inputs, and results for the contact water configuration can also be found in **Appendix A**.

The results of the original model indicated that the BSA contact water management system has adequate capacity to collect, manage, and route flows from the 25-year, 24-hours return period as warning stages were not exceeded for the basin nodes (no overtopping occurred). The nodal peak staging results and available freeboard for each basin node are summarized in a table in **Appendix A**.

4.1.2 Updated Contact Water Model

The updated basin acreage, composite curve numbers, and time of concentrations were added to the CW model. This produced similar results to the original model, with a decrease in freeboard for the node "South Sed Basin." In the original model, the available freeboard was 0.50 feet for this node, and in the updated model, the freeboard is 0.17 feet. The increased area of Basin 1 and Basin 2 increased the volume of runoff to node "South Sed Basin," which decreased the clearance between the warning stage and maximum stage. The curve number for open space with good vegetative condition was chosen for Basin 1 and Basin 2. See **Table 4-1** for the nodal peak staging results and available freeboard for each basin node. See **Appendix B** for CW Model Input, Calculations, and Reports.

Table 4-1: Updated Contact Water Model Peak Stage and Freeboard Summary

Node Name	Node Type	Max Stage (ft)	Warning Stage (ft)	Freeboard 25-year, 24-hour Storm (ft)
CCR Perimeter Ditch	Stage/Area	134.83	136.00	1.17
CCR Ramp Ditch	Stage/Area	137.44	140.00	2.56
South SB BC	Time/Stage	134.00	134.00	0.00
South Sed Basin	Stage/Area	134.83	135.00	0.17

4.2 Non-Contact Run-Off

Non-contact water is collected via slope drain channel and conveyed to the perimeter ditch system, which was to be graded to convey stormwater to Fish Lake via culverts. Non-contact stormwater would eventually discharge via infiltration to the water table. The final configuration of the BSA was analyzed in 2016 for non-contact water run-off management.

4.2.1 Original Non-Contact Water Model

The original design included 25-foot-wide benches with backwardly included channels to convey stormwater to grout filled fabric revetment lined slope drain channels. The configuration of the BSA was modeled as one drainage basin using the depressional storage of Fish Lake. The ICPR nodal diagram, model inputs, and results for the original NCW model can be found in **Appendix A**.

The results of the original model indicate that Fish Lake has adequate capacity to collect, manage, and route flows from the 25-year, 24-hour return period, as warning stages were not exceeded at any of the basin nodes (no overtopping). The nodal peak staging result and available freeboard are summarized in a table in **Appendix A**.

4.2.2 Updated Non-Contact Water Model

The updated NCW model was kept largely the same as the original NCW model. The only basin, "Fish Lake Basin," kept the same acreage, but changed land cover percentages. The original time of concentration for this basin was unavailable for comparison, however, the updated time of concentration was routed through the ditch along the south side of Fish Lake and was determined to be the hydraulically longest path.

The results of the updated model show similar results to the original. There is no overtopping of the node "Fish Lake." See **Table 4-2** for the nodal peak staging results and available freeboard for each basin node. See **Appendix C** for NCW Model Input, Calculations, and Reports.

Table 4-2: Updated NCW Model Peak Stage and Freeboard Summary

Node Name	Node Type	Max Stage (ft)	Warning Stage (ft)	Freeboard 25-year, 24-hour Storm (ft)
Fish Lake	Stage/Area	133.14	135.00	1.86

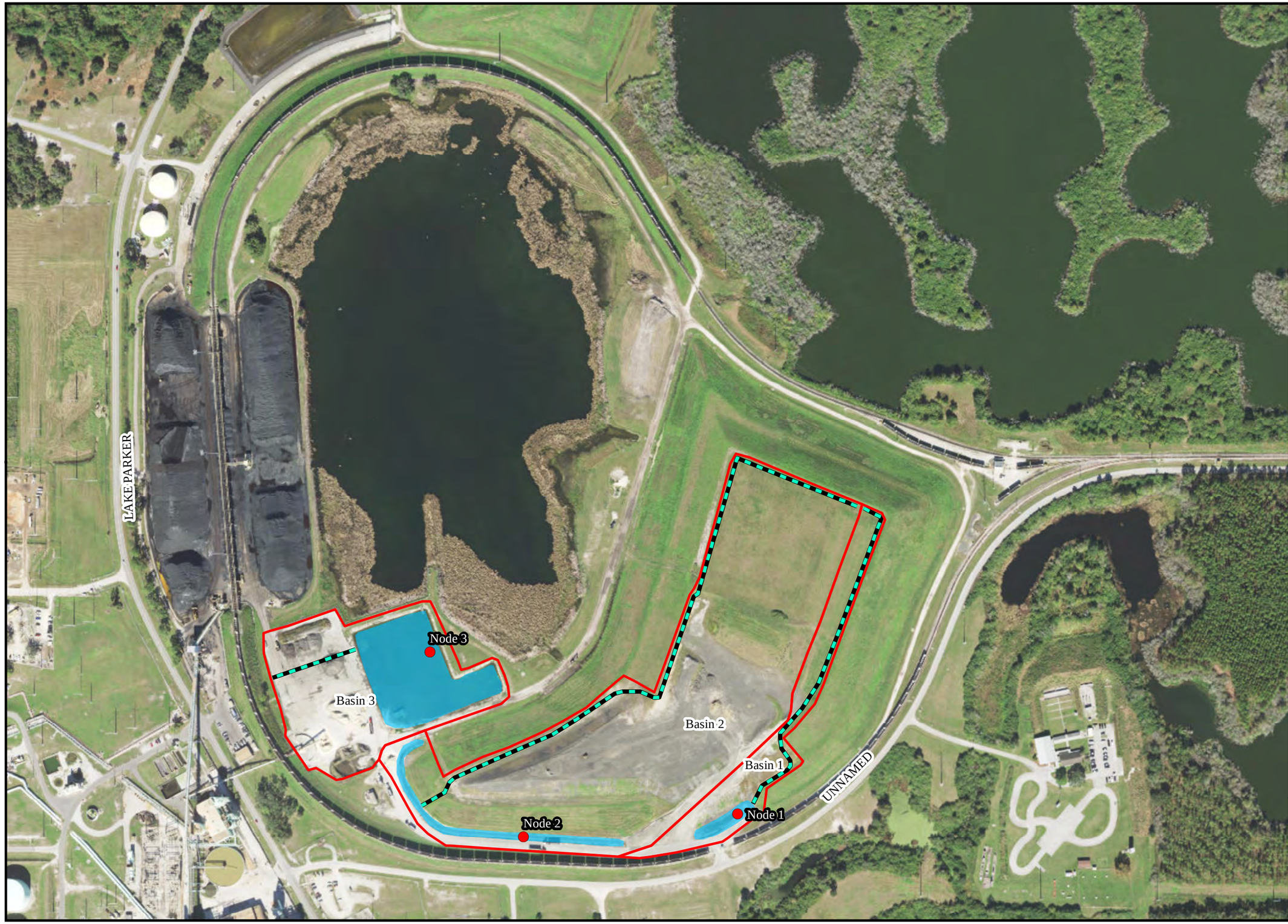
5. CLOSING

As required by §257.81, the updated BSA run-on control system has the capacity to prevent flow onto the active portion of the CCR unit during peak discharge from a 25-year, 24-hour storm, and the run-off control system has the capacity to collect, manage, and route flows resulting from a 25-year, 24-hour storm.

6. REFERENCES

Golder Associates, Inc., 2016. Run-On and Run-Off Control System Plan, Lakeland Electric - C.D. McIntosh Power Plant, Byproduct Storage Area, Lakeland Electric, October.

FIGURES



N

0 175 350
Feet

Legend

- Subbasins
- Nodes
- Time of Concentration
- Depressional Storage Areas

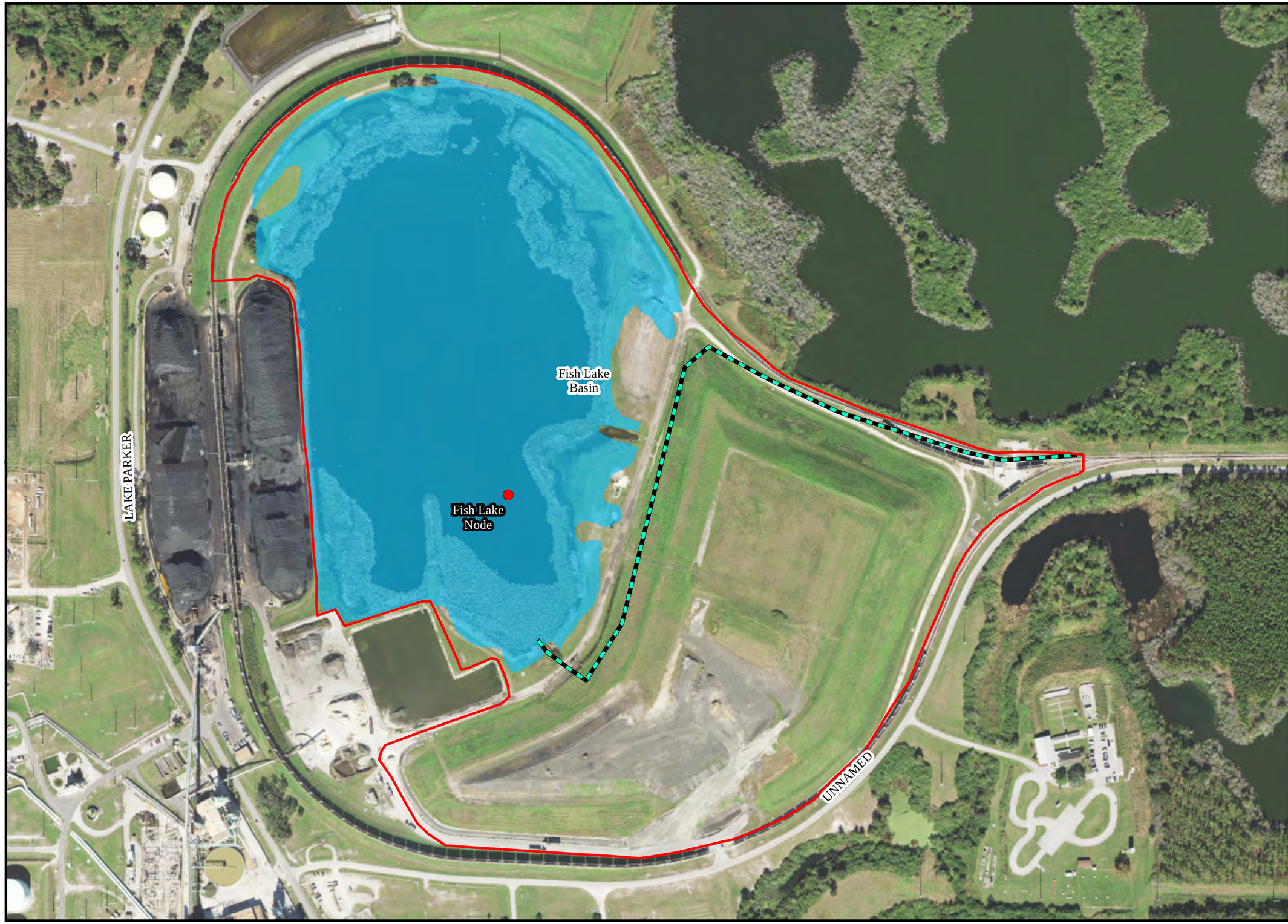
Sources:
Basemap: ESRI, 2021
Roads: Polk County, 2009

Figure
1

Contact Water Model Map

Close-In-Place Evaluation
of Byproduct Storage Area
C.D. McIntosh Power Plant

Geosyntec
consultants



N

0 175 350
Feet

Legend

- Subbasins
- Nodes
- Time of Concentration
- Depressional Storage Areas

Sources:
Basemap: ESRI, 2021
Roads: Polk County, 2009

Figure
2

Non-Contact Water Model Map

Close-In-Place Evaluation
of Byproduct Storage Area
C.D. McIntosh Power Plant

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APPENDICES

Appendix A

Run-On and Run-Off Control System Plan, Golder Associates, Inc., October 2016

RUN-ON/RUN-OFF CONTROL SYSTEM PLAN

A world of capabilities delivered locally

RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN

Lakeland Electric – C.D. McIntosh Power Plant Byproduct Storage Area

Submitted to: Lakeland Electric
C.D. McIntosh Power Plant
3030 East Lake Parker Drive
Lakeland, FL 33805

Submitted by: Golder Associates, Inc.
9428 Baymeadows Road, Suite 400
Jacksonville, FL 32256

October 2016

15-45454.1

Golder Associates

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1.0 INTRODUCTION

This Run-On and Run-Off Control System (ROROCS) Plan was prepared for the Byproduct Storage Area (BSA) at the C.D. McIntosh Power Plant (MPP) owned and operated by Lakeland Electric (LE) in Polk County, Florida, in accordance with the requirements of the federal coal combustion residual (CCR) rule[1]. This ROROCS plan documents how the BSA's run-on and run-off control systems have been designed and constructed to meet the requirements of §257.81 and is supported by appropriate engineering calculations and modeling analysis that is included herein. This Plan will be included in the facility's operating records in accordance with §257.105(g)(3).

2.0 REGULATORY REQUIREMENTS

2.1 Federal CCR Rule

The federal CCR Rule requires that the owner or operator of an existing CCR landfill must prepare an initial ROROCS which documents how the run-on and run-off control systems meet the following requirements as outlined in §257.81(a):

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

The active portion is defined in §257.53 as the part of the CCR unit that has received or is receiving CCR or non-CCR waste and has not completed closure in accordance with §257.102. The entire BSA is considered active.

3.0 DESIGN METHODOLOGIES

3.1 Design Storm

The existing run-on and run-off control systems were designed for hydraulic capacity for at least the 25-year, 24-hour storm event as required by local and federal regulations. Site-specific precipitation estimates were obtained from Natural Resource Conservation Service (NRCS) 24-hour rainfall maps and the Soil Conservation Service (SCS) Florida Modified (FLMOD) Type II Rainfall Distribution was used. The 25-year, 24-hour storm event generates approximately 7.5 inches of precipitation at MPP.

3.2 Hydrologic Calculation and Stormwater Routing Methods

Hydrology calculations were completed using NRCS methods. Time of concentration values were calculated for each basin by dividing the flow paths into sheet flow and shallow concentration segments.

[1] 40 Code of Federal Regulations (CFR) Part 257, Subtitle D

The time of concentration calculations are for the contact water and non-contact water models are presented in Appendix A and B, respectively.

Composite curve numbers were calculated for each basin within the contact and non-contact water models (see Appendix A and B, respectively). CCR material was assumed to perform hydrologically consistent with bare soil conditions. Final cover material was assumed to perform hydrologically consistent with open space with good vegetative condition. Hydrologic soil group B was assumed for curve number computations.

Stormwater discharge and flow routing calculations were performed using the Streamline Technologies Interconnected Pond Routing (ICPR) stormwater modeling software. The ICPR model operates using three key elements that include basins, nodes and links. The basins represent the hydrological information for each drainage basin. Stage-area data (or depressional storage areas) within each drainage basin was input into nodes. The nodal warning stages correlate to the maximum stage that can be reached within the depressional storage areas before overtopping occurs (e.g. top of bank elevation). The nodal warning stages vary for each drainage basin node. Nodes are interconnected by links and the links represent the existing or proposed culverts/pipes and pumps for flow routing.

4.0 RUN-ON CONTROL

Run-on is defined as stormwater that may flow towards the active portion of the BSA. Based on the topography of the BSA and surrounding topography, run-on potential is low. The BSA is topographically higher than surrounding areas and is surrounded by berms and a network of stormwater collection areas. The perimeter berms and stormwater collection areas (ditches, swales, and ponds) would intercept run-on flows. The BSA topography and surrounding area topography are shown on Figure 1.

5.0 RUN-OFF CONTROL

Run-off is defined as stormwater that falls on and flows off of the BSA. This includes run-off from the active ash placement areas and intermediate cover areas. There are two-types of stormwater run-off at BSA:

- Contact water (stormwater run-off that has contacted CCR); and
- Non-contact stormwater (run-off that has not contacted CCR).

Contact and non-contact stormwater is separated through the use of diversion berms, swales, and ditches. Contact water run-off and non-contact stormwater run-off are managed separately as addressed in the following sections:

5.1 Contact Water Run-Off

Contact water is collected by a series of interconnected ditches and eventually conveyed to the South Sedimentation Pond adjacent to the temporary byproduct staging area. Contact water from the active

portion of the BSA is routed to a soil cement lined perimeter ditch where it collects and is discharged via culverts to the south sedimentation basin. The South Sedimentation Basin is constructed with a soil cement liner which acts to contain water and facilitate regular clean out by LE. Contact water entering the sedimentation basin is pumped to the existing process water ponds.

The current configuration of the BSA was analyzed for contact water management (see Figure 2). As the BSA develops further, the area producing contact water run-off will decrease. The current contact water management system for the BSA was modeled in ICPR. The ICPR nodal diagram model inputs and results for the contact water configuration are provided in Appendix A.

The modeling results indicate that the existing BSA contact water management system has adequate capacity to collect, manage and route flows from the 25-year, 24-hour return period as warning stages were not exceeded for the basin nodes (no overtopping occurs). The nodal peak staging results and available freeboard for each basin node are summarized below:

Node	Description	Peak Stage (feet)	Warning Stage (feet)	Freeboard 25-year, 24-hour Storm (feet)
1	Ramp Ditch	137.4	140.0	2.6
2	Perimeter Ditch	135.0	136.0	1.0
3	South Sedimentation Basin	134.5	135.0	0.5

5.2 Non-Contact Stormwater Run-Off

The final cover configuration of the BSA was analyzed for non-contact stormwater run-off management as it would generate the highest volume of stormwater run-off. As the BSA development progresses, the exterior side-slopes will be covered with intermediate soil cover. At 25 to 30-foot (vertical) intervals, 25-foot wide benches with backwardly inclined channels will be constructed to convey stormwater to grout filled fabric revetment lined slope drain channels. The slope drain channel will convey stormwater to the perimeter ditch system which will be graded to convey stormwater to Fish Lake via culverts. Non-contact stormwater will eventually discharge via infiltration to the water table.

The final cover configuration of the BSA was modeled in ICPR as one drainage basin using the depressional storage capacity of Fish Lake. The ICPR nodal diagram, model inputs, and results for the non-contact stormwater run-off configuration are presented in Appendix B.

The modeling results indicate that Fish Lake has adequate capacity to collect, manage and route flows from the 25-year, 24-hour return period as warning stages were not exceeded at any of the basin nodes (no overtopping). The nodal peak staging result and available freeboard are summarized below:

Node	Description	Peak Stage (feet)	Warning Stage (feet)	Freeboard 25-year, 24-hour Storm (feet)
1	Fish Lake	133.1	135.0	1.9

6.0 CLOSING

As required by §257.81, the BSA run-on control system has the capacity to prevent flow onto the active portion of the CCR unit during the peak discharge from a 25-year, 24-hour storm, and the run-off control system has the capacity to collect, manage and route flows resulting from a 25-year, 24-hour storm.

GOLDER ASSOCIATES, INC.

Blake T. Holcomb, PE
Florida Professional Engineer No. 72381
Certificate of Authorization No. 1670

Date

Samuel F. Stafford, PE
Senior Project Engineer

Gregory M. Powell, PE, PhD
Practice Leader and Principal

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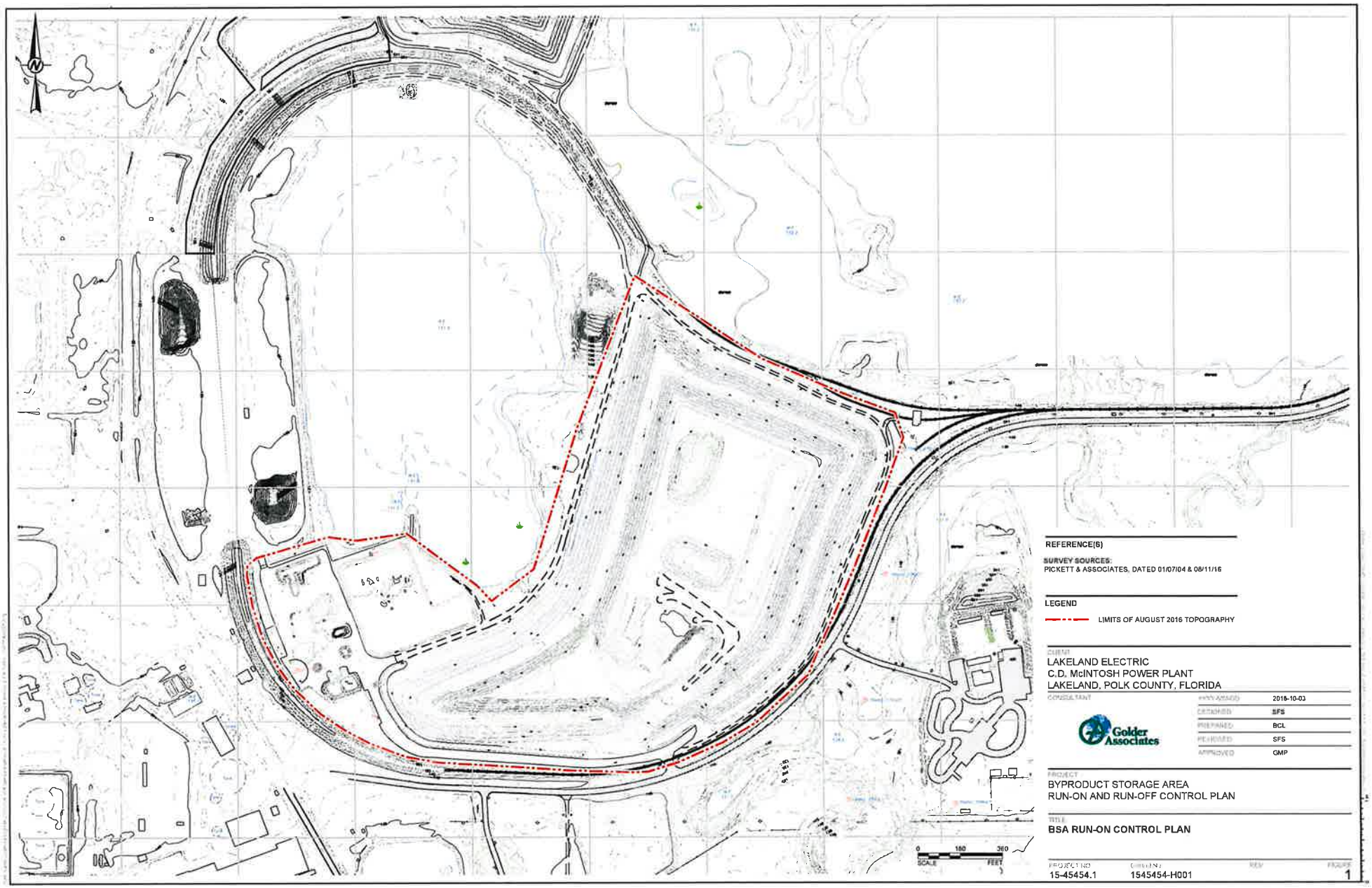
FIGURES



REFERENCE(S)

SURVEY SOURCES:
PICKETT & ASSOCIATES, DATED 01/07/04 & 08/11/16

LEGEND

LIMITS OF AUGUST 2016 TOPOGRAPHY

CLIENT
LAKELAND ELECTRIC
C.D. McINTOSH POWER PLANT
LAKELAND, POLK COUNTY, FLORIDA

CONSULTANT

Golder Associates

DATE(YYYY-MM-DD)	2016-10-03
CREATED	SFS
PREPARED	BCL
REVIEWED	SFS
APPROVED	GMP

PROJECT
BYPRODUCT STORAGE AREA
RUN-ON AND RUN-OFF CONTROL PLAN

TITLE
BSA RUN-ON CONTROL PLAN

PROJECT NO	DOCUMENT	REV	FIGURE
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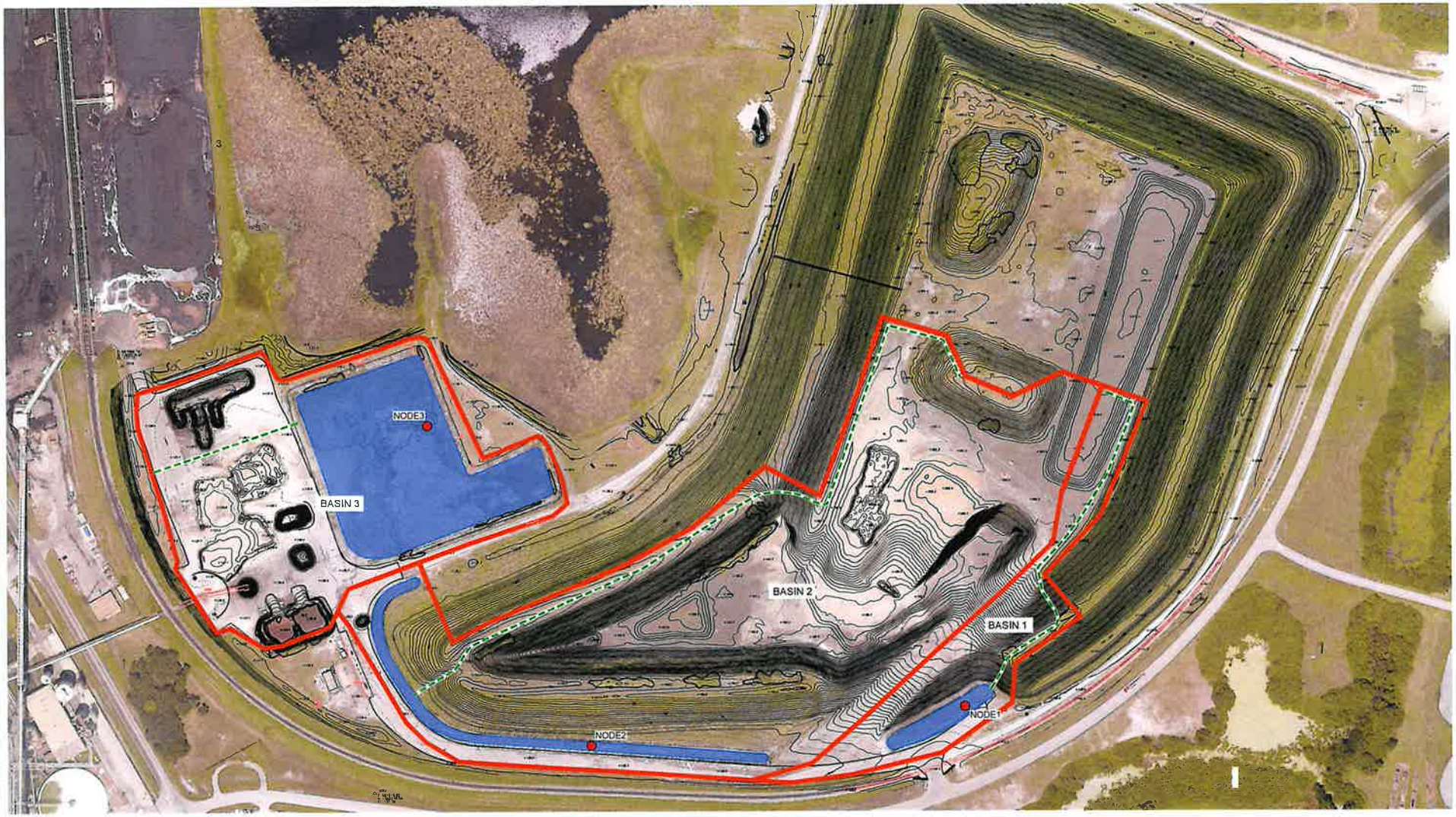

LEGEND

- TIME OF CONCENTRATION
- DEPRESSIONAL STORAGE AREA
- BASIN BOUNDARY

REFERENCE(S)

1. TOPOGRAPHIC SURVEY AND AERIAL PHOTOGRAPH BY PICKETT AND ASSOCIATES DATED 8/11/2016.

0 100 200
SCALE FEET

CLIENT
LAKELAND ELECTRIC
C.D. McINTOSH POWER PLANT
LAKELAND, POLK COUNTY, FLORIDA

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-10-03
DESIGNED	SFS
PREPARED	SCL
REVIEWED	SFS
APPROVED	GMP

PROJECT
BYPRODUCT STORAGE AREA
RUN-ON AND RUN-OFF CONTROL PLAN

TITLE
BSA RUN-OFF CONTROL PLAN
CONTACT STORMWATER

PROJECT NO.	CONTROL NO.	REV.	FIGURE
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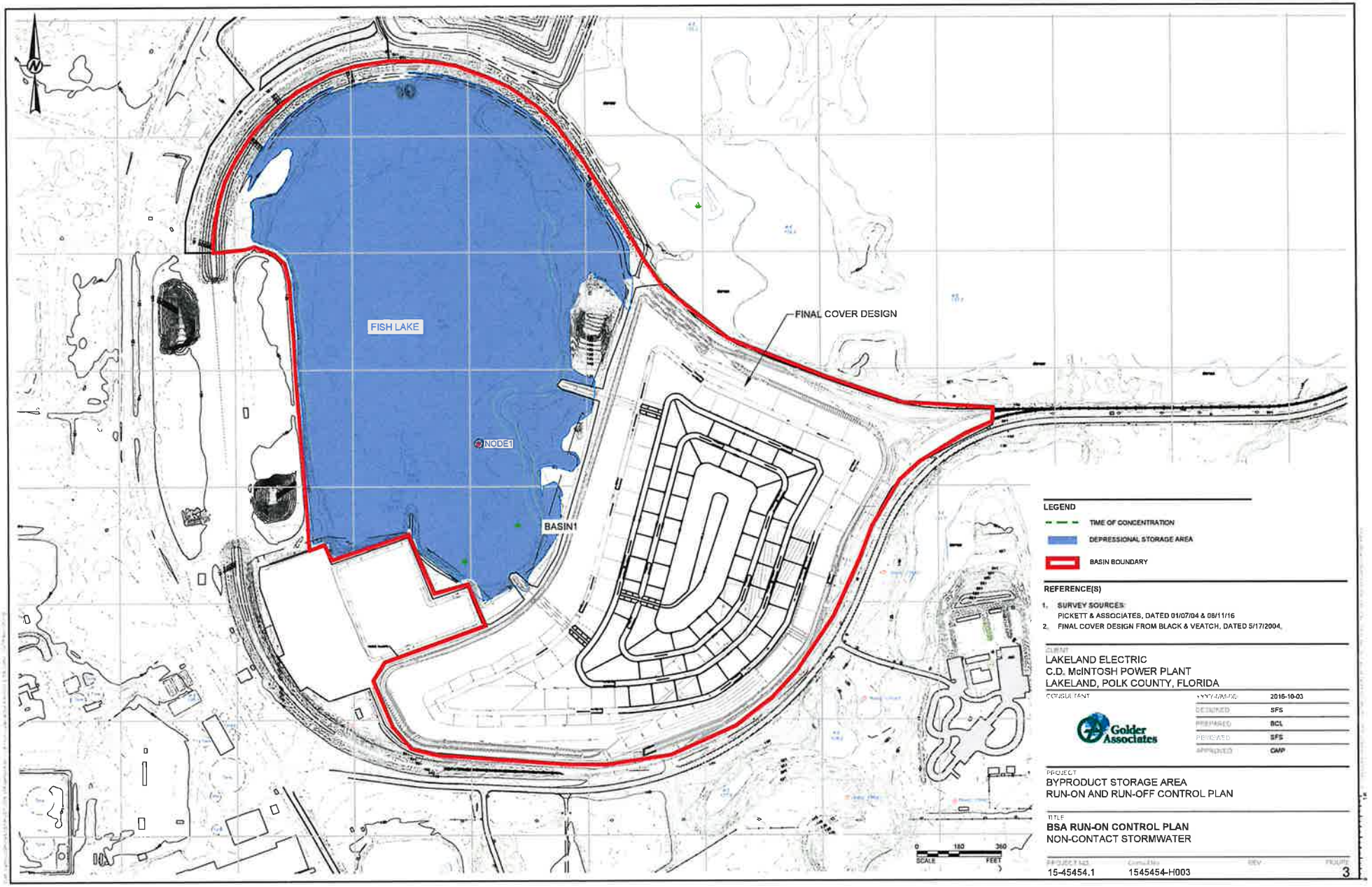


LEGEND

- TIME OF CONCENTRATION
- DEPRESSIONAL STORAGE AREA
- BASIN BOUNDARY

REFERENCE(S)

1. SURVEY SOURCES:
   PICKETT & ASSOCIATES, DATED 01/07/04 & 08/11/16
2. FINAL COVER DESIGN FROM BLACK & VEATCH, DATED 5/17/2004.

CLIENT
LAKELAND ELECTRIC
C.D. McINTOSH POWER PLANT
LAKELAND, POLK COUNTY, FLORIDA

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-10-03
DESIGNED	SFS
PREPARED	BCL
REVIEWED	SFS
APPROVED	CMP

PROJECT
BYPRODUCT STORAGE AREA
RUN-ON AND RUN-OFF CONTROL PLAN

TITLE
BSA RUN-ON CONTROL PLAN
NON-CONTACT STORMWATER

PROJECT NO.	Control	REV.	FIGURE
15-45454.1	1545454-H003		3

APPENDIX A

CONTACT WATER RUN-OFF CALCULATIONS AND MODEL

Time of Concentration Calculations

Hydrology calculations were completed using NRCS methods. Time of concentration values were calculated for each basin by dividing the flow paths into different segments based on overland flow characteristics. The travel times for each flow path were summed to get a time of concentration. The flow paths were divided into the following categories:

Sheet Flow – the maximum sheet flow distance used was 300 feet. The SCS equation for overland flow using Manning's equation was used and is shown below:

$$T_t = \frac{(0.007)(n*L)^{0.8}}{P_2^{0.5}(S)^{0.4}}, \text{ where:}$$

T_t = Travel Time (min.)
n = Manning's n
L = Flow path length (ft.)
P_2 = 2-year, 24-hour rainfall (in.)
S = Flow path slope (ft./ft.)

Shallow Concentrated Flow –concentrated overland flow towards channels. The equation for shallow concentrated flow is shown below:

$$T_t = \frac{L}{V} * \frac{1}{60}, \text{ where:}$$

T_t = Travel Time (min.)
L = Flow path length (ft.)
v = Flow velocity (feet/second)

Time of concentration calculations are presented in Table 1.

Composite Curve Number Calculations

CCR material was assumed to perform hydrologically consistent with bare soil conditions, which correlates to runoff curve number values ranging from 77 to 94 depending on the hydrologic soil group. Final cover material was assumed to perform hydrologically consistent with Open Space, Good Condition (grass cover > 75%), which correlates to runoff curve number values ranging from 39 to 80 depending on the hydrologic soil group. Hydrologic soil group B was assumed for curve number computations.

Composite curve number calculations are presented in Table 1.

TABLE 1
McIntosh Power Plant - Byproduct Storage Area
Run-on and Run-off Control System Plan
CURVE NUMBER & TIME OF CONCENTRATION SUMMARY
CONTACT WATER

Basin Description 1 8.90 ac.

CN:

Ac.	Land Cover	Soil Type	SCS CN	%	Weight %
8.15	Impervious	B	98	91.5%	90
0.76	Grass	B	69	8.5%	6
0.00	CCR (Bare Soil)	B	86	0.0%	0

Total: 8.90 **OK** Weighted SCS CN = 96

Tc:

*First Time of Concentration segment less than 300-ft was calculated using the TR-55 formula for sheet flow (cultivated soils - residue cover ≤ 20%)
*The remaining segments were calculated using the TR-55 velocity vs. slope criteria for shallow concentrated flow or pipe flow (if applicable)
*Pipe flow travel times were negligible and not included in the Tc computations

Mannings n	$P_{2\text{-yr},24\text{-hr}}$ (in.)	Slope (ft./ft.)
0.06	5	0.02

Segment	Dist. (ft)		Slope	Vel. (fps)	Time (min.)
1	300	Sheet Flow	2%		9.1
2	100	Shallow concentrated flow	2%	3.00	0.6
Total:	400				

Time of Concentration = 9.6 min.

Basin Description 2 17.75 ac.

CN:

Ac.	Land Cover	Soil Type	SCS CN	%	Weight %
1.81	Impervious	B	98	10.2%	10
6.58	Grass	B	69	37.1%	26
9.36	CCR (Bare Soil)	B	86	52.8%	45

Total: 17.75 **OK** Weighted SCS CN = 81

Tc:

*First Time of Concentration segment less than 300-ft was calculated using the TR-55 formula for sheet flow (cultivated soils - residue cover ≤ 20%)
*The remaining segments were calculated using the TR-55 velocity vs. slope criteria for shallow concentrated flow or pipe flow (if applicable)
*Pipe flow travel times were negligible and not included in the Tc computations

Mannings n	$P_{2\text{-yr},24\text{-hr}}$ (in.)	Slope (ft./ft.)
0.06	5	0.02

Segment	Dist. (ft)		Slope	Vel. (fps)	Time (min.)
1	225	Sheet Flow	2%		7.2
2	100	Shallow concentrated flow	3H:1V	9.25	0.2
3	1135	Shallow concentrated flow	0.50%	1.15	16.4
4	120	Shallow concentrated flow	3H:1V	9.25	0.2
Total:	1580				

Time of Concentration = 24.1 min.

TABLE 1
McIntosh Power Plant - Byproduct Storage Area
Run-on and Run-off Control System Plan
CURVE NUMBER & TIME OF CONCENTRATION SUMMARY
CONTACT WATER

Basin Description 3 3.10 ac.

CN:

Ac.	Land Cover	Soil Type	SCS CN	%	Weight %
0.54	Impervious	B	98	17.6%	17
0.97	Grass	B	69	31.2%	22
1.59	CCR (Bare Soil)	B	86	51.2%	44
Total: 3.10	**OK**		Weighted SCS CN =		83

Tc:

*First Time of Concentration segment less than 300-ft was calculated using the TR-55 formula for sheet flow (cultivated soils - residue cover ≤ 20%)
*The remaining segments were calculated using the TR-55 velocity vs. slope criteria for shallow concentrated flow or pipe flow (if applicable)
*Pipe flow travel times were neglible and not included in the Tc computations

Mannings n	$P_{2\text{-yr},24\text{-hr}}$ (in.)	Slope (ft./ft.)
0.06	5	0.1

Segment	Dist. (ft)		Slope	Vel. (fps)	Time (min.)
1	300	Sheet Flow	10%		4.8
2	150	Shallow concentrated flow	10%	5.00	0.5
3	100	Shallow concentrated flow	3H:1V	9.25	0.2
Total:	550				
				Time of Concentration =	5.4 min.

*The minimum TR-55 Time of Concentration of 0.1 hours (6 minutes) was used for this basin.

CONTACT WATER ICPR MODEL INPUT

```
================================================================================
==== Basins ====================================================================
================================================================================

        Name: Basin 1                 Node: South Sed Basin        Status: Onsite
       Group: 25-24                   Type: SCS Unit Hydrograph CN

  Unit Hydrograph: Uh256                      Peaking Factor: 256.0
    Rainfall File: Flmod               Storm Duration(hrs): 24.00
Rainfall Amount(in): 7.500               Time of Conc(min): 9.60
       Area(ac): 8.900                     Time Shift(hrs): 0.00
   Curve Number: 96.00                 Max Allowable Q(cfs): 999999.000
        DCIA(%): 0.00

--------------------------------------------------------------------------------
        Name: Basin 2                 Node: CCR Perim Ditch        Status: Onsite
       Group: 25-24                   Type: SCS Unit Hydrograph CN

  Unit Hydrograph: Uh256                      Peaking Factor: 256.0
    Rainfall File: Flmod               Storm Duration(hrs): 24.00
Rainfall Amount(in): 7.500               Time of Conc(min): 24.10
       Area(ac): 17.750                    Time Shift(hrs): 0.00
   Curve Number: 81.00                 Max Allowable Q(cfs): 999999.000
        DCIA(%): 0.00

--------------------------------------------------------------------------------
        Name: Basin 3                 Node: CCR Ramp Ditch         Status: Onsite
       Group: 25-24                   Type: SCS Unit Hydrograph CN

  Unit Hydrograph: Uh256                      Peaking Factor: 256.0
    Rainfall File: Flmod               Storm Duration(hrs): 24.00
Rainfall Amount(in): 7.500               Time of Conc(min): 6.00
       Area(ac): 3.100                     Time Shift(hrs): 0.00
   Curve Number: 83.00                 Max Allowable Q(cfs): 999999.000
        DCIA(%): 0.00

================================================================================
==== Nodes =====================================================================
================================================================================

      Name: CCR Perim Ditch     Base Flow(cfs): 0.000          Init Stage(ft): 133.000
     Group: 25-24                                            Warn Stage(ft): 136.000
      Type: Stage/Area

      Stage(ft)        Area(ac)
--------------- ---------------
        133.000          0.0300
        134.000          0.3000
        135.000          0.5000
        136.000          0.7000

--------------------------------------------------------------------------------
      Name: CCR Ramp Ditch      Base Flow(cfs): 0.000          Init Stage(ft): 136.000
     Group: 25-24                                            Warn Stage(ft): 140.000
      Type: Stage/Area

      Stage(ft)        Area(ac)
--------------- ---------------
        136.000          0.0100
        137.000          0.1000
        138.000          0.1000
        139.000          0.2000
        140.000          0.2400
```

Name: South SB BC Base Flow(cfs): 0.000 Init Stage(ft): 134.000
Group: 25-24 Warn Stage(ft): 134.000
Type: Time/Stage

Time(hrs)	Stage(ft)
0.00	134.000
30.00	134.000

Name: South Sed Basin Base Flow(cfs): 0.000 Init Stage(ft): 130.000
Group: 25-24 Warn Stage(ft): 135.000
Type: Stage/Area

Stage(ft)	Area(ac)
130.000	1.0000
131.000	3.2000
132.000	3.3000
133.000	3.5000
134.000	3.6000
135.000	3.8000

Cross Sections

Name: Weir SSB-BC Group: 25-24
Encroachment: No

Station(ft)	Elevation(ft)	Manning's N
0.000	135.000	0.060000
100.000	135.000	0.060000

Operating Tables

Name: SSB Pump Group: 25-24
Type: Rating Curve
Function: US Stage vs. Discharge

US Stage(ft)	Discharge(cfs)
130.000	1.78
131.000	1.78
132.000	1.78
133.000	1.78
134.000	1.78
135.000	1.78

Pipes

Name: CCR PD Culvert From Node: CCR Perim Ditch Length(ft): 50.00
Group: 25-24 To Node: South Sed Basin Count: 3
Friction Equation: Automatic
Solution Algorithm: Most Restrictive
Flow: Both
Entrance Loss Coef: 0.00
Exit Loss Coef: 1.00
Bend Loss Coef: 0.00
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dc
Stabilizer Option: None

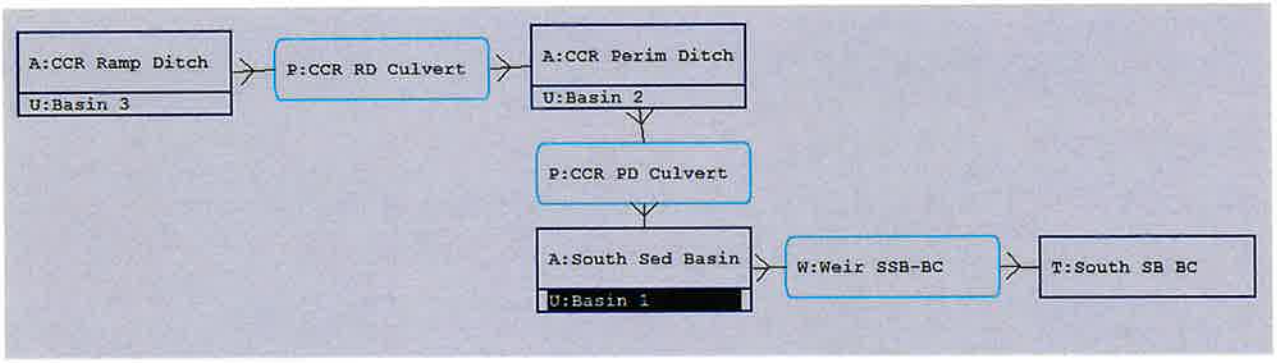
	UPSTREAM	DOWNSTREAM
Geometry:	Circular	Circular
Span(in):	30.00	30.00
Rise(in):	30.00	30.00
Invert(ft):	133.000	130.700
Manning's N:	0.012000	0.012000
Top Clip(in):	0.000	0.000
Bot Clip(in):	0.000	0.000

Upstream FHWA Inlet Edge Description:
Circular Concrete: Groove end projecting

Downstream FHWA Inlet Edge Description:
Circular Concrete: Groove end projecting

```
---------------------------------------------------------------------------------------------------
        Name: CCR RD Culvert      From Node: CCR Ramp Ditch     Length(ft): 280.00
       Group: 25-24                 To Node: CCR Perim Ditch         Count: 1
                                                  Friction Equation: Automatic
              UPSTREAM       DOWNSTREAM       Solution Algorithm: Most Restrictive
    Geometry: Circular       Circular                       Flow: Both
    Span(in): 36.00          36.00                Entrance Loss Coef: 0.00
    Rise(in): 36.00          36.00                    Exit Loss Coef: 1.00
  Invert(ft): 135.900        133.900                  Bend Loss Coef: 0.00
Manning's N: 0.012000        0.012000               Outlet Ctrl Spec: Use dc or tw
Top Clip(in): 0.000          0.000                    Inlet Ctrl Spec: Use dc
Bot Clip(in): 0.000          0.000                 Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Groove end projecting

Downstream FHWA Inlet Edge Description:
Circular Concrete: Groove end projecting

===================================================================================================
==== Weirs ========================================================================================
===================================================================================================

        Name: Weir SSB-BC         From Node: South Sed Basin
       Group: 25-24                 To Node: South SB BC
        Flow: Both                    Count: 1
        Type: Vertical: Fread      Geometry: Irregular

                      XSec: Weir SSB-BC
                Invert(ft): 135.000
      Control Elevation(ft): 135.000
     Struct Opening Dim(ft): 9999.00
                                      TABLE
           Bottom Clip(ft): 0.000
              Top Clip(ft): 0.000
         Weir Discharge Coef: 3.200
     Orifice Discharge Coef: 0.600

===================================================================================================
==== Hydrology Simulations ========================================================================
===================================================================================================

        Name: 25-24
    Filename: G:\Projects\15-\15-45454.1\Calculations\Initial Draft\25-24.R32

     Override Defaults: Yes
   Storm Duration(hrs): 24.00
         Rainfall File: Flmod
   Rainfall Amount(in): 7.50

Time(hrs)       Print Inc(min)
--------------- ---------------
30.000          5.00

===================================================================================================
==== Routing Simulations ==========================================================================
===================================================================================================
        Name: 25-24               Hydrology Sim: 25-24
    Filename: G:\Projects\15-\15-45454.1\Calculations\Initial Draft\25-24.I32
     Execute: Yes         Restart: No            Patch: No     Alternative: No

       Max Delta Z(ft): 1.00                    Delta Z Factor: 0.00500
   Time Step Optimizer: 10.000
      Start Time(hrs): 0.000                     End Time(hrs): 30.00
    Min Calc Time(sec): 0.5000               Max Calc Time(sec): 60.0000
       Boundary Stages:                          Boundary Flows:

Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
25-24           Yes
```

CONTACT WATER ICPR MODEL NODAL DIAGRAM



CONTACT WATER ICPR MODEL MAXIMUM CONDITIONS REPORT

Name	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
CCR Perim Ditch	25-24	12.32	134.94	136.00	0.0050	21796	12.17	54.61	12.31	50.27
CCR Ramp Ditch	25-24	12.06	137.42	140.00	0.0049	4767	12.00	13.71	12.06	12.13
South SB BC	25-24	0.00	134.00	134.00	0.0000	0	0.00	0.00	0.00	0.00
South Sed Basin	25-24	26.92	134.48	135.00	0.0045	161090	12.12	79.26	0.00	0.00

CONTACT WATER ICPR MODEL MB REPORT

SIMULATION	TIME HRS	INFLOW VOLUME FT3	OUTFLOW VOLUME FT3	CHANGE IN SYS STORAGE FT3	DIFFERENCE FT3	ERROR %
25-24	0.00	0.0	0.0	0.0	0.0	0.00
25-24	0.26	0.0	0.0	-0.0	0.0	9999.99
25-24	0.51	0.0	0.0	-0.0	0.0	9999.99
25-24	0.76	0.0	0.0	-0.0	0.0	9999.99
25-24	1.01	0.2	0.0	0.2	0.0	0.00
25-24	1.26	18.6	0.0	18.6	0.0	0.00
25-24	1.51	92.9	0.0	92.9	0.0	0.00
25-24	1.76	232.8	0.0	232.8	0.0	0.00
25-24	2.01	435.3	0.0	435.3	0.0	0.00
25-24	2.26	699.4	0.0	699.4	0.0	0.00
25-24	2.51	1023.3	0.0	1023.3	0.0	0.00
25-24	2.76	1396.2	0.0	1396.2	0.0	0.00
25-24	3.01	1810.8	0.0	1810.8	-0.0	-0.00
25-24	3.26	2273.9	0.0	2273.9	-0.0	-0.00
25-24	3.51	2790.6	0.0	2790.6	-0.0	-0.00
25-24	3.76	3346.0	0.0	3346.0	-0.0	-0.00
25-24	4.01	3932.4	0.0	3932.4	-0.0	-0.00
25-24	4.26	4570.5	0.0	4570.5	-0.0	-0.00
25-24	4.51	5277.2	0.0	5277.2	0.0	0.00
25-24	4.76	6032.3	0.0	6032.3	0.0	0.00
25-24	5.01	6836.0	0.0	6836.0	0.0	0.00
25-24	5.26	7713.5	0.0	7713.5	0.0	0.00
25-24	5.51	8681.3	0.0	8681.3	0.0	0.00
25-24	5.76	9729.2	0.0	9729.2	-0.0	-0.00
25-24	6.01	10852.9	0.0	10852.9	-0.0	-0.00
25-24	6.26	12108.4	0.0	12108.4	-0.0	-0.00
25-24	6.51	13534.3	0.0	13534.3	-0.0	-0.00
25-24	6.76	15081.9	0.0	15081.9	0.0	0.00
25-24	7.01	16729.0	0.0	16729.0	0.0	0.00
25-24	7.26	18530.7	0.0	18530.7	0.0	0.00
25-24	7.51	20531.1	0.0	20531.1	0.0	0.00
25-24	7.76	22671.5	0.0	22671.5	0.0	0.00
25-24	8.01	24923.0	0.0	24923.0	0.0	0.00
25-24	8.26	27368.2	0.0	27368.2	0.0	0.00
25-24	8.51	30073.9	0.0	30073.9	0.0	0.00
25-24	8.76	33058.7	0.0	33058.7	0.0	0.00
25-24	9.01	36358.8	0.0	36358.8	0.0	0.00
25-24	9.26	39920.3	0.0	39920.3	0.0	0.00
25-24	9.51	43735.1	0.0	43735.1	0.0	0.00
25-24	9.76	47900.1	0.0	47900.1	0.0	0.00
25-24	10.01	52513.2	0.0	52513.2	0.0	0.00
25-24	10.26	57709.1	0.0	57709.1	0.0	0.00
25-24	10.51	63640.9	0.0	63640.9	0.0	0.00
25-24	10.76	70450.0	0.0	70450.0	0.0	0.00
25-24	11.01	78342.7	0.0	78342.7	0.0	0.00
25-24	11.26	87027.6	0.0	87027.6	0.0	0.00
25-24	11.50	98114.5	0.0	98114.5	0.0	0.00
25-24	11.75	124134.9	0.0	124134.9	0.0	0.00
25-24	12.00	183012.4	0.0	183012.4	0.0	0.00
25-24	12.25	261053.3	0.0	261053.3	-0.0	-0.00
25-24	12.50	321983.0	0.0	321983.0	-0.0	-0.00
25-24	12.75	363896.0	0.0	363896.0	0.0	0.00
25-24	13.00	393221.9	0.0	393221.9	0.0	0.00
25-24	13.25	415800.5	0.0	415800.5	0.0	0.00
25-24	13.50	434259.3	0.0	434259.3	0.0	0.00
25-24	13.75	449250.5	0.0	449250.5	0.0	0.00
25-24	14.01	461469.6	0.0	461469.6	-0.0	-0.00
25-24	14.26	471530.5	0.0	471530.5	0.0	0.00
25-24	14.50	479803.7	0.0	479803.7	0.0	0.00
25-24	14.75	487556.3	0.0	487556.3	0.0	0.00
25-24	15.01	494575.1	0.0	494575.1	0.0	0.00
25-24	15.26	501055.5	0.0	501055.5	0.0	0.00
25-24	15.51	507202.2	0.0	507202.2	0.0	0.00
25-24	15.76	513018.4	0.0	513018.4	0.0	0.00
25-24	16.01	518453.7	0.0	518453.7	0.0	0.00
25-24	16.26	523608.2	0.0	523608.2	0.0	0.00
25-24	16.51	528514.8	0.0	528514.8	0.0	0.00
25-24	16.76	533214.5	0.0	533214.5	0.0	0.00
25-24	17.01	537701.3	0.0	537701.3	0.0	0.00
25-24	17.26	542071.5	0.0	542071.5	-0.0	-0.00
25-24	17.51	546377.1	0.0	546377.1	0.0	0.00
25-24	17.76	550497.3	0.0	550497.3	0.0	0.00
25-24	18.01	554317.1	0.0	554317.1	-0.0	-0.00
25-24	18.26	558050.8	0.0	558050.8	-0.0	-0.00
25-24	18.51	561842.5	0.0	561842.5	-0.0	-0.00
25-24	18.76	565515.5	0.0	565515.5	-0.0	-0.00
25-24	19.01	568918.2	0.0	568918.2	-0.0	-0.00
25-24	19.26	572247.2	0.0	572247.2	-0.0	-0.00

25-24	19.51	575643.5	0.0	575643.5	-0.0	-0.00
25-24	19.76	579003.8	0.0	579003.8	-0.0	-0.00
25-24	20.01	582237.9	0.0	582237.9	-0.0	-0.00
25-24	20.26	585325.2	0.0	585325.2	-0.0	-0.00
25-24	20.51	588237.6	0.0	588237.6	-0.0	-0.00
25-24	20.76	591058.8	0.0	591058.8	0.0	0.00
25-24	21.01	593832.8	0.0	593832.8	-0.0	-0.00
25-24	21.26	596580.3	0.0	596580.3	-0.0	-0.00
25-24	21.51	599309.4	0.0	599309.4	-0.0	-0.00
25-24	21.76	602025.4	0.0	602025.4	-0.0	-0.00
25-24	22.01	604733.9	0.0	604733.9	-0.0	-0.00
25-24	22.26	607439.6	0.0	607439.6	-0.0	-0.00
25-24	22.51	610144.9	0.0	610144.9	-0.0	-0.00
25-24	22.76	612776.1	0.0	612776.1	0.0	0.00
25-24	23.01	615268.3	0.0	615268.3	0.0	0.00
25-24	23.26	617684.8	0.0	617684.8	-0.0	-0.00
25-24	23.51	620061.1	0.0	620061.1	-0.0	-0.00
25-24	23.76	622341.3	0.0	622341.3	-0.0	-0.00
25-24	24.01	624466.9	0.0	624466.9	-0.0	-0.00
25-24	24.26	626137.1	0.0	626137.1	-0.0	-0.00
25-24	24.50	627008.7	0.0	627008.7	-0.0	-0.00
25-24	24.75	627519.1	0.0	627519.1	0.0	0.00
25-24	25.00	627822.5	0.0	627822.5	0.0	0.00
25-24	25.25	628013.8	0.0	628013.8	0.0	0.00
25-24	25.50	628126.4	0.0	628126.4	0.0	0.00
25-24	25.75	628184.3	0.0	628184.3	0.0	0.00
25-24	26.00	628208.8	0.0	628208.8	0.0	0.00
25-24	26.25	628216.0	0.0	628216.0	0.0	0.00
25-24	26.50	628216.4	0.0	628216.4	0.0	0.00
25-24	26.75	628216.4	0.0	628216.4	0.0	0.00
25-24	27.00	628216.4	0.0	628216.4	0.0	0.00
25-24	27.25	628216.4	0.0	628216.4	0.0	0.00
25-24	27.50	628216.4	0.0	628216.4	0.0	0.00
25-24	27.75	628216.4	0.0	628216.4	0.0	0.00
25-24	28.00	628216.4	0.0	628216.4	0.0	0.00
25-24	28.25	628216.4	0.0	628216.4	0.0	0.00
25-24	28.50	628216.4	0.0	628216.4	0.0	0.00
25-24	28.75	628216.4	0.0	628216.4	0.0	0.00
25-24	29.00	628216.4	0.0	628216.4	0.0	0.00
25-24	29.26	628216.4	0.0	628216.4	0.0	0.00
25-24	29.50	628216.4	0.0	628216.4	0.0	0.00
25-24	29.75	628216.4	0.0	628216.4	0.0	0.00
25-24	30.00	628216.4	0.0	628216.4	0.0	0.00
25-24	30.01	628216.4	0.0	628216.4	0.0	0.00

APPENDIX B

NON-CONTACT WATER RUN-OFF CALCULATIONS AND MODEL

Time of Concentration Calculations

Hydrology calculations were completed using NRCS methods. Time of concentration values were calculated for each basin by dividing the flow paths into different segments based on overland flow characteristics. The travel times for each flow path were summed to get a time of concentration. The flow paths were divided into the following categories:

Sheet Flow – the maximum sheet flow distance used was 300 feet. The SCS equation for overland flow using Manning's equation was used and is shown below:

$$T_t = \frac{(0.007)(n*L)^{0.8}}{P_2^{0.5}(S)^{0.4}}, \text{ where:}$$

T_t = Travel Time (min.)
n = Manning's n
L = Flow path length (ft.)
P_2 = 2-year, 24-hour rainfall (in.)
S = Flow path slope (ft./ft.)

Shallow Concentrated Flow –concentrated overland flow towards channels. The equation for shallow concentrated flow is shown below:

$$T_t = \frac{L}{V} * \frac{1}{60}, \text{ where:}$$

T_t = Travel Time (min.)
L = Flow path length (ft.)
v = Flow velocity (feet/second)

Time of concentration calculations are presented in Table 2.

Composite Curve Number Calculations

CCR material was assumed to perform hydrologically consistent with bare soil conditions, which correlates to runoff curve number values ranging from 77 to 94 depending on the hydrologic soil group. Final cover material was assumed to perform hydrologically consistent with Open Space, Good Condition (grass cover > 75%), which correlates to runoff curve number values ranging from 39 to 80 depending on the hydrologic soil group. Hydrologic soil group B was assumed for curve number computations.

Composite curve number calculations are presented in Table 2.

TABLE 2
McIntosh Power Plant - Byproduct Storage Area
Run-on and Run-off Control System Plan
CURVE NUMBER & TIME OF CONCENTRATION SUMMARY
NON-CONTACT WATER

Basin Description 1 124.30 ac.

CN:

Ac.	Land Cover	Soil Type	SCS CN	%	Weight %
5.10	Impervious	B	98	4.1%	4
73.40	Grass	B	69	59.1%	41
45.80	Pond	B	98	36.8%	36
Total: 124.30	**OK**		Weighted SCS CN =		81

Tc:

*First Time of Concentration segment less than 300-ft was calculated using the TR-55 formula for sheet flow (gravel)
*The remaining segments were calculated using the TR-55 velocity vs. slope criteria for shallow concentrated flow or pipe flow (if applicable)
*Pipe flow travel times were negligible and not included in the Tc computations

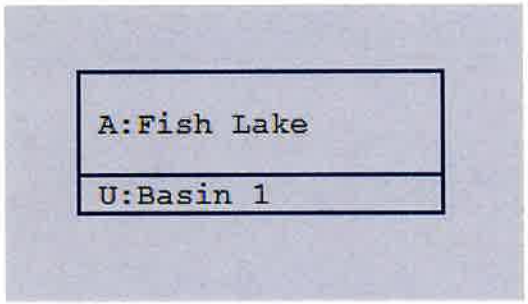
Mannings n	$P_{2\text{-yr},24\text{-hr}}$ (in.)	Slope (ft./ft.)
0.011	5	0.33

Segment	Dist. (ft)		Slope	Vel. (fps)	Time (min.)
1	100	Sheet Flow	2%		0.3
2	2500	Shallow concentrated flow	0.2%	2.20	18.9
Total:	2600				
				Time of Concentration =	19.3 min.

NON-CONTACT WATER ICPR MODEL INPUT

```
================================================================================
==== Basins ====================================================================
================================================================================

        Name: Basin 1                 Node: Fish Lake              Status: Onsite
       Group: 25-24                   Type: SCS Unit Hydrograph CN

      Unit Hydrograph: Uh256                    Peaking Factor: 256.0
        Rainfall File: Flmod              Storm Duration(hrs): 24.00
  Rainfall Amount(in): 7.500                Time of Conc(min): 19.30
            Area(ac): 124.300                  Time Shift(hrs): 0.00
        Curve Number: 81.00               Max Allowable Q(cfs): 999999.000
             DCIA(%): 0.00

================================================================================
==== Nodes =====================================================================
================================================================================

      Name: Fish Lake           Base Flow(cfs): 0.000          Init Stage(ft): 132.000
     Group: 25-24                                            Warn Stage(ft): 135.000
      Type: Stage/Area

      Stage(ft)        Area(ac)
--------------- ---------------
        124.700          0.3000
        125.000         15.6000
        131.600         44.1000
        132.000         45.8000
        133.000         50.5000
        134.000         54.0000
        135.000         57.1000

================================================================================
==== Hydrology Simulations =====================================================
================================================================================

        Name: 25-24
    Filename: G:\Projects\15-\15-45454.1\Calculations\Initial Draft\25-24.R32

     Override Defaults: Yes
   Storm Duration(hrs): 24.00
         Rainfall File: Flmod
   Rainfall Amount(in): 7.50

Time(hrs)       Print Inc(min)
--------------- ---------------
30.000          5.00

================================================================================
==== Routing Simulations =======================================================
================================================================================

        Name: 25-24              Hydrology Sim: 25-24
    Filename: G:\Projects\15-\15-45454.1\Calculations\Initial Draft\25-24.I32

     Execute: Yes         Restart: No            Patch: No
 Alternative: No

       Max Delta Z(ft): 1.00                    Delta Z Factor: 0.00500
   Time Step Optimizer: 10.000
       Start Time(hrs): 0.000                    End Time(hrs): 30.00
    Min Calc Time(sec): 0.5000              Max Calc Time(sec): 60.0000
      Boundary Stages:                          Boundary Flows:

Time(hrs)       Print Inc(min)
--------------- ---------------
999.000         15.000

Group           Run
--------------- -----
25-24           Yes
```

NON-CONTACT WATER ICPR MODEL NODAL DIAGRAM



NON-CONTACT WATER ICPR MODEL MAXIMUM CONDITIONS REPORT

Name	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
Fish Lake	25-24	25.92	133.13	135.00	0.0050	2219075	12.16	339.95	0.00	0.00

NON-CONTACT WATER ICPR MODEL MB REPORT

SIMULATION	TIME HRS	INFLOW VOLUME FT3	OUTFLOW VOLUME FT3	CHANGE IN SYS STORAGE FT3	DIFFERENCE FT3	ERROR %
25-24	0.00	0.0	0.0	0.0	0.0	0.00
25-24	0.26	0.0	0.0	0.0	0.0	0.00
25-24	0.50	0.0	0.0	0.0	0.0	0.00
25-24	0.77	0.0	0.0	0.0	0.0	0.00
25-24	1.02	0.0	0.0	0.0	0.0	0.00
25-24	1.27	0.0	0.0	0.0	0.0	0.00
25-24	1.52	0.0	0.0	0.0	0.0	0.00
25-24	1.77	0.0	0.0	0.0	0.0	0.00
25-24	2.02	0.0	0.0	0.0	0.0	0.00
25-24	2.27	0.0	0.0	0.0	0.0	0.00
25-24	2.52	0.0	0.0	0.0	0.0	0.00
25-24	2.77	0.0	0.0	0.0	0.0	0.00
25-24	3.02	0.0	0.0	0.0	0.0	0.00
25-24	3.27	0.0	0.0	0.0	0.0	0.00
25-24	3.52	0.0	0.0	0.0	0.0	0.00
25-24	3.77	0.0	0.0	0.0	0.0	0.00
25-24	4.02	0.0	0.0	0.0	0.0	0.00
25-24	4.27	0.0	0.0	0.0	0.0	0.00
25-24	4.52	0.0	0.0	0.0	-0.0	-0.00
25-24	4.77	14.7	0.0	14.7	-0.0	-0.00
25-24	5.02	149.3	0.0	149.3	-0.0	-0.00
25-24	5.27	521.1	0.0	521.1	-0.0	-0.00
25-24	5.52	1205.7	0.0	1205.7	0.0	0.00
25-24	5.77	2235.1	0.0	2235.1	0.0	0.00
25-24	6.02	3623.1	0.0	3623.1	0.0	0.00
25-24	6.27	5427.5	0.0	5427.5	0.0	0.00
25-24	6.52	7761.6	0.0	7761.6	0.0	0.00
25-24	6.77	10593.4	0.0	10593.4	0.0	0.00
25-24	7.02	13888.2	0.0	13888.2	0.0	0.00
25-24	7.27	17710.7	0.0	17710.7	0.0	0.00
25-24	7.52	22217.4	0.0	22217.4	-0.0	-0.00
25-24	7.77	27329.6	0.0	27329.6	0.0	0.00
25-24	8.02	32980.0	0.0	32980.0	0.0	0.00
25-24	8.27	39284.9	0.0	39284.9	0.0	0.00
25-24	8.52	46509.9	0.0	46509.9	0.0	0.00
25-24	8.77	54683.6	0.0	54683.6	0.0	0.00
25-24	9.02	64023.4	0.0	64023.4	-0.0	-0.00
25-24	9.27	74419.8	0.0	74419.8	-0.0	-0.00
25-24	9.52	85904.1	0.0	85904.1	-0.0	-0.00
25-24	9.77	98624.7	0.0	98624.7	0.0	0.00
25-24	10.02	113049.1	0.0	113049.1	-0.0	-0.00
25-24	10.27	129403.1	0.0	129403.1	-0.0	-0.00
25-24	10.52	148522.7	0.0	148522.7	-0.0	-0.00
25-24	10.77	170646.6	0.0	170646.6	-0.0	-0.00
25-24	11.02	196965.6	0.0	196965.6	0.0	0.00
25-24	11.27	226714.2	0.0	226714.2	0.0	0.00
25-24	11.52	264468.2	0.0	264468.2	0.0	0.00
25-24	11.77	344061.3	0.0	344061.3	0.0	0.00
25-24	12.00	524313.8	0.0	524313.8	0.0	0.00
25-24	12.25	820290.5	0.0	820290.5	0.0	0.00
25-24	12.51	1081310.6	0.0	1081310.6	0.0	0.00
25-24	12.76	1273179.9	0.0	1273179.9	0.0	0.00
25-24	13.01	1411709.9	0.0	1411709.9	0.0	0.00
25-24	13.25	1515263.1	0.0	1515263.1	0.0	0.00
25-24	13.50	1593425.3	0.0	1593425.3	0.0	0.00
25-24	13.75	1651947.2	0.0	1651947.2	0.0	0.00
25-24	14.00	1696606.3	0.0	1696606.3	0.0	0.00
25-24	14.25	1734559.7	0.0	1734559.7	0.0	0.00
25-24	14.50	1768375.7	0.0	1768375.7	0.0	0.00
25-24	14.75	1799509.6	0.0	1799509.6	0.0	0.00
25-24	15.00	1827846.1	0.0	1827846.1	0.0	0.00
25-24	15.25	1854360.3	0.0	1854360.3	0.0	0.00
25-24	15.50	1879429.8	0.0	1879429.8	0.0	0.00
25-24	15.75	1903310.4	0.0	1903310.4	0.0	0.00
25-24	16.00	1925608.4	0.0	1925608.4	0.0	0.00
25-24	16.25	1946786.3	0.0	1946786.3	0.0	0.00
25-24	16.50	1966902.8	0.0	1966902.8	0.0	0.00
25-24	16.75	1986209.1	0.0	1986209.1	0.0	0.00
25-24	17.00	2004596.4	0.0	2004596.4	0.0	0.00
25-24	17.25	2022430.9	0.0	2022430.9	0.0	0.00
25-24	17.50	2039966.1	0.0	2039966.1	0.0	0.00
25-24	17.75	2056987.5	0.0	2056987.5	0.0	0.00
25-24	18.00	2072790.0	0.0	2072790.0	0.0	0.00
25-24	18.25	2088026.6	0.0	2088026.6	0.0	0.00
25-24	18.50	2103428.2	0.0	2103428.2	0.0	0.00
25-24	18.75	2118583.6	0.0	2118583.6	0.0	0.00
25-24	19.00	2132647.4	0.0	2132647.4	0.0	0.00
25-24	19.25	2146220.2	0.0	2146220.2	0.0	0.00

25-24	19.50	2160027.4	0.0	2160027.4	0.0	0.00
25-24	19.75	2173809.2	0.0	2173809.2	0.0	0.00
25-24	20.00	2187080.9	0.0	2187080.9	0.0	0.00
25-24	20.25	2199858.7	0.0	2199858.7	0.0	0.00
25-24	20.50	2211924.9	0.0	2211924.9	0.0	0.00
25-24	20.75	2223550.8	0.0	2223550.8	0.0	0.00
25-24	21.00	2234920.5	0.0	2234920.5	0.0	0.00
25-24	21.25	2246128.9	0.0	2246128.9	0.0	0.00
25-24	21.50	2257242.8	0.0	2257242.8	0.0	0.00
25-24	21.75	2268316.3	0.0	2268316.3	0.0	0.00
25-24	22.00	2279375.8	0.0	2279375.8	0.0	0.00
25-24	22.25	2290437.6	0.0	2290437.6	0.0	0.00
25-24	22.50	2301504.4	0.0	2301504.4	0.0	0.00
25-24	22.75	2312395.1	0.0	2312395.1	0.0	0.00
25-24	23.00	2322726.5	0.0	2322726.5	0.0	0.00
25-24	23.25	2332699.5	0.0	2332699.5	0.0	0.00
25-24	23.50	2342468.0	0.0	2342468.0	0.0	0.00
25-24	23.75	2351928.9	0.0	2351928.9	0.0	0.00
25-24	24.00	2360730.2	0.0	2360730.2	0.0	0.00
25-24	24.25	2367975.1	0.0	2367975.1	0.0	0.00
25-24	24.50	2372152.7	0.0	2372152.7	0.0	0.00
25-24	24.75	2374511.3	0.0	2374511.3	0.0	0.00
25-24	25.00	2375851.4	0.0	2375851.4	0.0	0.00
25-24	25.25	2376541.1	0.0	2376541.1	0.0	0.00
25-24	25.50	2376821.0	0.0	2376821.0	0.0	0.00
25-24	25.75	2376900.1	0.0	2376900.1	0.0	0.00
25-24	26.00	2376905.2	0.0	2376905.2	0.0	0.00
25-24	26.25	2376905.2	0.0	2376905.2	0.0	0.00
25-24	26.50	2376905.2	0.0	2376905.2	0.0	0.00
25-24	26.75	2376905.2	0.0	2376905.2	0.0	0.00
25-24	27.00	2376905.2	0.0	2376905.2	0.0	0.00
25-24	27.25	2376905.2	0.0	2376905.2	0.0	0.00
25-24	27.50	2376905.2	0.0	2376905.2	0.0	0.00
25-24	27.75	2376905.2	0.0	2376905.2	0.0	0.00
25-24	28.00	2376905.2	0.0	2376905.2	0.0	0.00
25-24	28.25	2376905.2	0.0	2376905.2	0.0	0.00
25-24	28.50	2376905.2	0.0	2376905.2	0.0	0.00
25-24	28.75	2376905.2	0.0	2376905.2	0.0	0.00
25-24	29.00	2376905.2	0.0	2376905.2	0.0	0.00
25-24	29.25	2376905.2	0.0	2376905.2	0.0	0.00
25-24	29.50	2376905.2	0.0	2376905.2	0.0	0.00
25-24	29.75	2376905.2	0.0	2376905.2	0.0	0.00
25-24	30.00	2376905.2	0.0	2376905.2	0.0	0.00
25-24	30.01	2376905.2	0.0	2376905.2	0.0	0.00

Appendix B
Contact Water Model Input, Calculations, and Results

Excerpt from "Run-On and Run-Off Control System Plan," Golder Associates, Inc., October 2016

Time of Concentration Calculations

Hydrology calculations were completed using NRCS methods. Time of concentration values were calculated for each basin by dividing the flow paths into different segments based on overland flow characteristics. The travel times for each flow path were summed to get a time of concentration. The flow paths were divided into the following categories:

Sheet Flow – the maximum sheet flow distance used was 300 feet. The SCS equation for overland flow using Manning's equation was used and is shown below:

$$T_t = \frac{(0.007)(n*L)^{0.8}}{P_2^{0.5}(S)^{0.4}}, \text{ where:}$$

T_t = Travel Time (min.)
n = Manning's n
L = Flow path length (ft.)
P_2 = 2-year, 24-hour rainfall (in.)
S = Flow path slope (ft./ft.)

Shallow Concentrated Flow –concentrated overland flow towards channels. The equation for shallow concentrated flow is shown below:

$$T_t = \frac{L}{v} * \frac{1}{60}, \text{ where:}$$

T_t = Travel Time (min.)
L = Flow path length (ft.)
v = Flow velocity (feet/second)

Time of concentration calculations are presented in Table 1.

Composite Curve Number Calculations

CCR material was assumed to perform hydrologically consistent with bare soil conditions, which correlates to runoff curve number values ranging from 77 to 94 depending on the hydrologic soil group. Final cover material was assumed to perform hydrologically consistent with Open Space, Good Condition (grass cover > 75%), which correlates to runoff curve number values ranging from 39 to 80 depending on the hydrologic soil group. Hydrologic soil group B was assumed for curve number computations.

Composite curve number calculations are presented in Table 1.

McIntosh Power Plant - Byproduct Storage Area
Run-on and Run-off Control System Plan
Curve Number & Time of Concentration Summary
Contact Water Model
Updated Calculations, Geosyntec, October 2021

Basin 1 — 10.21 ac.

CN:

Ac.	Land Cover	Soil Type	SCS CN	%	Weight %
8.15	Impervious	B	98	79.8	78.2
2.06	Grass	B	61	20.2	12.3
0	Bare Soil	B	86	0.0	0.0

Total: 10.21 — Weighted SCS CN = 90.5

Tc:

Mannings n	P (2-yr, 24-hr) (in.)	Slope (ft./ft.)
0.06	5	0.02

Segment	Dist. (ft.)		Slope (%)	Vel. (fps)	Time (min.)
1	300	Sheet Flow	2%		9.07
2	100	Shallow Concentrated Flow	2%	3	0.56
3	650	Sheet Flow	2%		18.89

Total: 1050 — Time of Concentration = 28.51 min

Basin 2 — 24.68 ac.

CN:

Ac.	Land Cover	Soil Type	SCS CN	%	Weight %
1.81	Impervious	B	98	7.3	7.2
13.51	Grass	B	61	54.7	33.4
9.36	Bare Soil	B	86	37.9	32.6

Total: 24.68 — Weighted SCS CN = 73.2

Tc:

Mannings n	P (2-yr, 24-hr) (in.)	Slope (ft./ft.)
0.06	5	0.02

Segment	Dist. (ft.)		Slope	Vel. (fps)	Time (min.)
1	225	Sheet Flow	2%		7.20
2	100	Shallow Concentrated Flow	3H:1V	9.25	0.18
3	1135	Shallow Concentrated Flow	0.50%	1.15	16.45
4	120	Shallow Concentrated Flow	3H:1V	9.25	0.22
5	1100	Sheet Flow	1%		25.64

Total: 2680 — Time of Concentration = 49.69 min

Note: Basin 3 had no change from the original model

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Simple Basin: Basin 1

Scenario:	Icpr3
Node:	South Sed Basin
Hydrograph Method:	NRCS Unit Hydrograph
Infiltration Method:	Curve Number
Time of Concentration:	29.0000 min
Max Allowable Q:	999999.00 cfs
Time Shift:	0.0000 hr
Unit Hydrograph:	Uh256
Peaking Factor:	256.0
Area:	10.2100 ac
Curve Number:	90.5
% Impervious:	0.00
% DCIA:	0.00
% Direct:	0.00
Rainfall Name:	Flmod

Comment:

Simple Basin: Basin 2

Scenario:	Icpr3
Node:	CCR Perim Ditch
Hydrograph Method:	NRCS Unit Hydrograph
Infiltration Method:	Curve Number
Time of Concentration:	50.0000 min
Max Allowable Q:	999999.00 cfs
Time Shift:	0.0000 hr
Unit Hydrograph:	Uh256
Peaking Factor:	256.0
Area:	24.6800 ac
Curve Number:	73.2
% Impervious:	0.00
% DCIA:	0.00
% Direct:	0.00
Rainfall Name:	Flmod

Comment:

Simple Basin: Basin 3

Scenario:	Icpr3
Node:	CCR Ramp Ditch
Hydrograph Method:	NRCS Unit Hydrograph
Infiltration Method:	Curve Number
Time of Concentration:	6.0000 min
Max Allowable Q:	999999.00 cfs
Time Shift:	0.0000 hr
Unit Hydrograph:	Uh256

Peaking Factor: 256.0
Area: 3.1000 ac
Curve Number: 83.0
% Impervious: 0.00
% DCIA: 0.00
% Direct: 0.00
Rainfall Name: Flmod

Comment:

Node: CCR Perim Ditch

Scenario: Icpr3
Type: Stage/Area
Base Flow: 0.00 cfs
Initial Stage: 133.00 ft
Warning Stage: 136.00 ft

Stage [ft]	Area [ac]	Area [ft2]
133.00	0.0300	1307
134.00	0.3000	13068
135.00	0.5000	21780
136.00	0.7000	30492

Comment:

Water Quality

Apply WQ: False

Node: CCR Ramp Ditch

Scenario: Icpr3
Type: Stage/Area
Base Flow: 0.00 cfs
Initial Stage: 136.00 ft
Warning Stage: 140.00 ft

Stage [ft]	Area [ac]	Area [ft2]
136.00	0.0100	436
137.00	0.1000	4356
138.00	0.1000	4356
139.00	0.2000	8712
140.00	0.2400	10454

Comment:

Water Quality

Apply WQ: False

Node: South SB BC

Scenario: Icpr3
Type: Time/Stage
Base Flow: 0.00 cfs
Initial Stage: 134.00 ft
Warning Stage: 134.00 ft
Boundary Stage:

Year	Month	Day	Hour	Stage [ft]
0	0	0	0.0000	134.00
0	0	0	30.0000	134.00

Comment:

Water Quality

Apply WQ: False

Node: South Sed Basin

Scenario: Icpr3
Type: Stage/Area
Base Flow: 0.00 cfs
Initial Stage: 130.00 ft
Warning Stage: 135.00 ft

Stage [ft]	Area [ac]	Area [ft2]
130.00	1.0000	43560
131.00	3.2000	139392
132.00	3.3000	143748
133.00	3.5000	152460
134.00	3.6000	156816
135.00	3.8000	165528

Comment:

Water Quality

Apply WQ: False

Pipe Link: CCR PD Culvert

Scenario: Icpr3
From Node: CCR Perim Ditch
To Node: South Sed Basin
Link Count: 3
Flow Direction: Both
Damping: 0.0000 ft
Length: 50.00 ft
FHWA Code: 3
Entr Loss Coef: 0.00

Upstream		Downstream	
Invert:	133.00 ft	Invert:	130.70 ft
Manning's N:	0.0120	Manning's N:	0.0120
Geometry: Circular		Geometry: Circular	
Max Depth:	2.50 ft	Max Depth:	2.50 ft
Bottom Clip			
Default:	0.00 ft	Default:	0.00 ft
Op Table:		Op Table:	
Ref Node:		Ref Node:	
Manning's N:	0.0120	Manning's N:	0.0120

Exit Loss Coef:	1.00	Top Clip			
Bend Loss Coef:	0.00	Default:	0.00 ft	Default:	0.00 ft
Bend Location:	0.00 dec	Op Table:		Op Table:	
Energy Switch:	Energy	Ref Node:		Ref Node:	
		Manning's N:	0.0120	Manning's N:	0.0120

Comment:

Water Quality

Apply WQ: False

Pipe Link: CCR RD Culvert		Upstream		Downstream	
Scenario:	Icpr3	Invert:	135.90 ft	Invert:	133.90 ft
From Node:	CCR Ramp Ditch	Manning's N:	0.0120	Manning's N:	0.0120
To Node:	CCR Perim Ditch	Geometry: Circular		Geometry: Circular	
Link Count:	1	Max Depth:	3.00 ft	Max Depth:	3.00 ft
Flow Direction:	Both	Bottom Clip			
Damping:	0.0000 ft	Default:	0.00 ft	Default:	0.00 ft
Length:	280.00 ft	Op Table:		Op Table:	
FHWA Code:	3	Ref Node:		Ref Node:	
Entr Loss Coef:	0.00	Manning's N:	0.0120	Manning's N:	0.0120
Exit Loss Coef:	1.00	Top Clip			
Bend Loss Coef:	0.00	Default:	0.00 ft	Default:	0.00 ft
Bend Location:	0.00 dec	Op Table:		Op Table:	
Energy Switch:	Energy	Ref Node:		Ref Node:	
		Manning's N:	0.0120	Manning's N:	0.0120

Comment:

Water Quality

Apply WQ: False

Weir Link: Weir SSB-BC			
Scenario:	Icpr3	Bottom Clip	
From Node:	South Sed Basin	Default:	0.00 ft
To Node:	South SB BC	Op Table:	
Link Count:	1	Ref Node:	
Flow Direction:	Both	Top Clip	
Damping:	0.0000 ft	Default:	0.00 ft
Weir Type:	Broad Crested Vertical	Op Table:	
Geometry Type:	Irregular	Ref Node:	
Invert:	135.00 ft	Discharge Coefficients	
Control Elevation:	135.00 ft	Weir Default:	3.200
Cross Section:	Weir SSB-BC-W	Weir Table:	
		Orifice Default:	0.600
		Orifice Table:	

Comment:

Water Quality

Apply WQ: False

Simulation: 25-24

Scenario: Icpr3
Run Date/Time: 10/27/2021 1:26:01 PM
Program Version: ICPR4 4.07.38

General

Run Mode: Normal

	Year	Month	Day	Hour [hr]
Start Time:	0	0	0	0.0000
End Time:	0	0	0	30.0000

	Hydrology [sec]	Surface Hydraulics [sec]	Groundwater [sec]
Min Calculation Time:	60.0000	0.1000	900.0000
Max Calculation Time:		60.0000	

Output Time Increments

Hydrology

Year	Month	Day	Hour [hr]	Time Increment [min]
0	0	0	0.0000	5.0000

Surface Hydraulics

Year	Month	Day	Hour [hr]	Time Increment [min]
0	0	0	0.0000	15.0000

Groundwater

Year	Month	Day	Hour [hr]	Time Increment [min]
0	0	0	0.0000	360.0000

Restart File

Save Restart: False

Resources & Lookup Tables

Resources

Rainfall Folder: ICPR3
Reference ET Folder:
Unit Hydrograph Folder: ICPR3

Lookup Tables

Boundary Stage Set:
Extern Hydrograph Set:
Curve Number Set:
Green-Ampt Set:
Vertical Layers Set:
Impervious Set:
Roughness Set:
Crop Coef Set:
Fillable Porosity Set:
Conductivity Set:

Leakage Set:	
EMC Constituent Set:	

Tolerances & Options

Time Marching:	SAOR	IA Recovery Time:	24.0000 hr
Max Iterations:	6	ET for Manual Basins:	False
Over-Relax Weight Fact:	0.5 dec	Ia/S:	0.20 dec
dZ Tolerance:	0.0010 ft		
Max dZ:	1.0000 ft	Smp/Man Basin Rain Opt:	Global
Link Optimizer Tol:	0.0001 ft	OF Region Rain Opt:	Global
		Rainfall Name:	Flmod
Edge Length Option:	Automatic	Rainfall Amount:	7.50 in
		Storm Duration:	24.0000 hr
Dflt Damping (2D):	0.0050 ft	Dflt Damping (1D):	0.0050 ft
Min Node Srf Area (2D):	1 ft2	Min Node Srf Area (1D):	113 ft2
Energy Switch (2D):	Energy	Energy Switch (1D):	Energy

Comment:

Contact Water ICPR Model Maximum Conditions Report

Sim	Node Name	Warning Stage [ft]	Maximum Stage [ft]	Time to Maximum Stage [hrs]	Maximum Total Inflow Rate [cfs]	Time to Maximum Total Inflow Rate [hrs]	Maximum Total Outflow Rate [cfs]	Time to Maximum Total Outflow Rate [hrs]	Min/Max Change in Stage [ft]	Maximum Surface Area [ft2]
25-24	CCR Perim Ditch	136	134.83	28.1613	38.61	12.4331	37.49	12.5965	0.001	20632
25-24	CCR Ramp Ditch	140	137.44	12.0627	13.78	12.0163	12.41	12.0617	0.001	4772
25-24	South SB BC	134	134	0	0	0	0	0	0	0
25-24	South Sed Basin	135	134.83	29.0613	61.05	12.4478	0	29.0613	0.001	164053

Sim	Relative Time [hrs]	Stored Volume (Flow Based) [ft3]	Total Inflow Volume [ft3]	Total Outflow Volume [ft3]	% Error (By Inflow) [%]
25-24	0.0000	0	0	0	0.00
25-24	0.2511	0	0	0	0.00
25-24	0.5050	0	0	0	0.00
25-24	0.7556	0	0	0	0.00
25-24	1.0021	0	0	0	0.00
25-24	1.2546	0	0	0	0.00
25-24	1.5105	0	0	0	0.00
25-24	1.7605	0	0	0	0.00
25-24	2.0105	0	0	0	0.00
25-24	2.2605	0	0	0	0.00
25-24	2.5105	1	1	0	0.00
25-24	2.7605	10	10	0	0.00
25-24	3.0105	39	39	0	0.00
25-24	3.2605	96	96	0	0.00
25-24	3.5105	186	186	0	0.00
25-24	3.7605	314	314	0	0.00
25-24	4.0105	479	479	0	0.00
25-24	4.2507	676	676	0	0.00
25-24	4.5048	940	940	0	0.00
25-24	4.7550	1258	1258	0	0.00
25-24	5.0131	1644	1644	0	0.00
25-24	5.2548	2058	2058	0	0.00
25-24	5.5048	2541	2541	0	0.00
25-24	5.7548	3079	3079	0	0.00
25-24	6.0048	3667	3667	0	0.00
25-24	6.2631	4334	4334	0	0.00
25-24	6.5025	5026	5026	0	0.00
25-24	6.7537	5823	5823	0	0.00
25-24	7.0087	6702	6702	0	0.00

Sim	Relative Time [hrs]	Stored Volume (Flow Based) [ft3]	Total Inflow Volume [ft3]	Total Outflow Volume [ft3]	% Error (By Inflow) [%]
25-24	7.2506	7617	7617	0	-0.03
25-24	7.5051	8704	8704	0	-0.03
25-24	7.7562	9903	9903	0	-0.03
25-24	8.0077	11227	11227	0	-0.03
25-24	8.2531	12658	12658	0	-0.03
25-24	8.5087	14338	14338	0	-0.03
25-24	8.7502	16131	16131	0	-0.03
25-24	9.0049	18271	18271	0	-0.03
25-24	9.2542	20623	20623	0	-0.03
25-24	9.5005	23196	23196	0	-0.03
25-24	9.7517	26112	26112	0	-0.03
25-24	10.0005	29353	29353	0	-0.03
25-24	10.2527	33077	33077	0	-0.03
25-24	10.5006	37283	37283	0	-0.03
25-24	10.7509	42193	42193	0	-0.03
25-24	11.0006	47916	47916	0	-0.03
25-24	11.2522	54531	54531	0	-0.03
25-24	11.5014	62539	62539	0	-0.02
25-24	11.7504	76539	76539	0	-0.02
25-24	12.0001	106845	106845	0	-0.02
25-24	12.2506	155970	155970	0	-0.01
25-24	12.5001	211438	211438	0	-0.01
25-24	12.7503	262722	262722	0	-0.01
25-24	13.0005	306249	306249	0	-0.01
25-24	13.2502	342535	342535	0	-0.01
25-24	13.5000	373520	373520	0	-0.01
25-24	13.7503	400314	400314	0	-0.01
25-24	14.0005	423414	423414	0	-0.01
25-24	14.2516	443517	443517	0	-0.01

Sim	Relative Time [hrs]	Stored Volume (Flow Based) [ft3]	Total Inflow Volume [ft3]	Total Outflow Volume [ft3]	% Error (By Inflow) [%]
25-24	14.5014	461182	461182	0	-0.01
25-24	14.7508	476916	476916	0	-0.01
25-24	15.0020	491107	491107	0	0.00
25-24	15.2518	503870	503870	0	0.00
25-24	15.5026	515498	515498	0	0.00
25-24	15.7519	525956	525956	0	0.00
25-24	16.0020	535430	535430	0	0.00
25-24	16.2508	543993	543993	0	0.00
25-24	16.5026	551890	551890	0	0.00
25-24	16.7501	558951	558951	0	0.00
25-24	17.0020	565510	565510	0	0.00
25-24	17.2564	571691	571691	0	0.00
25-24	17.5055	577472	577472	0	0.00
25-24	17.7528	582980	582980	0	0.00
25-24	18.0023	588261	588261	0	0.00
25-24	18.2512	593295	593295	0	0.00
25-24	18.5086	598362	598362	0	0.00
25-24	18.7574	603132	603132	0	0.00
25-24	19.0076	607738	607738	0	0.00
25-24	19.2558	612130	612130	0	0.00
25-24	19.5015	616392	616392	0	0.00
25-24	19.7546	620718	620718	0	0.00
25-24	20.0053	624908	624908	0	0.00
25-24	20.2536	628929	628929	0	0.00
25-24	20.5029	632809	632809	0	0.00
25-24	20.7503	636519	636519	0	0.00
25-24	21.0005	640160	640160	0	0.00
25-24	21.2564	643797	643797	0	0.00
25-24	21.5020	647226	647226	0	0.00

Sim	Relative Time [hrs]	Stored Volume (Flow Based) [ft3]	Total Inflow Volume [ft3]	Total Outflow Volume [ft3]	% Error (By Inflow) [%]
25-24	21.7528	650680	650680	0	0.00
25-24	22.0025	654081	654081	0	0.00
25-24	22.2513	657440	657440	0	0.00
25-24	22.5014	660797	660797	0	0.00
25-24	22.7547	664151	664151	0	0.00
25-24	23.0028	667353	667353	0	0.00
25-24	23.2507	670459	670459	0	0.00
25-24	23.5052	673570	673570	0	0.00
25-24	23.7587	676584	676584	0	0.00
25-24	24.0095	679449	679449	0	0.00
25-24	24.2514	681968	681968	0	0.00
25-24	24.5019	684121	684121	0	0.00
25-24	24.7510	685777	685777	0	0.00
25-24	25.0044	687067	687067	0	0.00
25-24	25.2519	688041	688041	0	0.00
25-24	25.5006	688809	688809	0	0.00
25-24	25.7613	689435	689435	0	0.00
25-24	26.0113	689899	689899	0	0.00
25-24	26.2613	690260	690260	0	0.00
25-24	26.5113	690541	690541	0	0.00
25-24	26.7613	690757	690757	0	0.00
25-24	27.0113	690920	690920	0	0.00
25-24	27.2613	691040	691040	0	0.00
25-24	27.5113	691125	691125	0	0.00
25-24	27.7613	691182	691182	0	0.00
25-24	28.0113	691220	691220	0	0.00
25-24	28.2613	691242	691242	0	0.00
25-24	28.5113	691254	691254	0	0.00
25-24	28.7613	691259	691259	0	0.00

Sim	Relative Time [hrs]	Stored Volume (Flow Based) [ft3]	Total Inflow Volume [ft3]	Total Outflow Volume [ft3]	% Error (By Inflow) [%]
25-24	29.0113	691259	691259	0	0.00
25-24	29.2613	691259	691259	0	0.00
25-24	29.5113	691259	691259	0	0.00
25-24	29.7613	691259	691259	0	0.00
25-24	30.0113	691259	691259	0	0.00

Appendix C
Non-Contact Water Model Input, Calculations, and Results

Excerpt from "Run-On and Run-Off Control System Plan," Golder Associates, Inc., October 2016

Time of Concentration Calculations

Hydrology calculations were completed using NRCS methods. Time of concentration values were calculated for each basin by dividing the flow paths into different segments based on overland flow characteristics. The travel times for each flow path were summed to get a time of concentration. The flow paths were divided into the following categories:

Sheet Flow – the maximum sheet flow distance used was 300 feet. The SCS equation for overland flow using Manning's equation was used and is shown below:

$$T_t = \frac{(0.007)(n*L)^{0.8}}{P_2^{0.5}(S)^{0.4}}, \text{ where:}$$

T_t = Travel Time (min.)
n = Manning's n
L = Flow path length (ft.)
P_2 = 2-year, 24-hour rainfall (in.)
S = Flow path slope (ft./ft.)

Shallow Concentrated Flow –concentrated overland flow towards channels. The equation for shallow concentrated flow is shown below:

$$T_t = \frac{L}{v} * \frac{1}{60}, \text{ where:}$$

T_t = Travel Time (min.)
L = Flow path length (ft.)
v = Flow velocity (feet/second)

Time of concentration calculations are presented in Table 1.

Composite Curve Number Calculations

CCR material was assumed to perform hydrologically consistent with bare soil conditions, which correlates to runoff curve number values ranging from 77 to 94 depending on the hydrologic soil group. Final cover material was assumed to perform hydrologically consistent with Open Space, Good Condition (grass cover > 75%), which correlates to runoff curve number values ranging from 39 to 80 depending on the hydrologic soil group. Hydrologic soil group B was assumed for curve number computations.

Composite curve number calculations are presented in Table 1.

McIntosh Power Plant - Byproduct Storage Area
Run-on and Run-off Control System Plan
Curve Number & Time of Concentration Summary
Non-Contact Water Model
Updated Calculations, Geosyntec, Oct. 2021

Basin 1 "Fish Lake Basin" 124.3 ac.

CN:

Ac.	Land Cover	Soil Type	SCS CN	%	Weight %
5.1	Impervious	B	98	4.1	4.0
69.835	Grass	B	69	56.2	38.8
3.565	Bare Soil	B	86	2.9	2.5
45.8	Pond	B	98	36.8	36.1

Total: 124.3 Weighted SCS CN = 81.4

Tc:

Mannings n	P (2-yr, 24-hr) (in.)	Slope (ft./ft.)
0.011	5	0.33

Segment	Dist. (ft.)		Slope (%)	Vel. (fps)	Time (min.)
1	100	Sheet Flow	2%		0.32
2	3000	Shallow Concentrated Flow	2.0%	2.2	22.73

Total: 3100 Time of Concentration = 23.04 min

Geosyntec consultants
engineers | scientists | innovators

Simple Basin: Basin 1

Scenario:	Icpr3
Node:	Fish Lake
Hydrograph Method:	NRCS Unit Hydrograph
Infiltration Method:	Curve Number
Time of Concentration:	23.0000 min
Max Allowable Q:	999999.00 cfs
Time Shift:	0.0000 hr
Unit Hydrograph:	Uh256
Peaking Factor:	256.0
Area:	124.3000 ac
Curve Number:	81.4
% Impervious:	0.00
% DCIA:	0.00
% Direct:	0.00
Rainfall Name:	Flmod

Comment:

Node: Fish Lake

Scenario:	Icpr3
Type:	Stage/Area
Base Flow:	0.00 cfs
Initial Stage:	132.00 ft
Warning Stage:	135.00 ft

Stage [ft]	Area [ac]	Area [ft2]
124.70	0.3000	13068
125.00	15.6000	679536
131.60	44.1000	1920996
132.00	45.8000	1995048
133.00	50.5000	2199780
134.00	54.0000	2352240
135.00	57.1000	2487276

Comment:

Water Quality

Apply WQ: False

Simulation: 25-24

Scenario:	Icpr3
Run Date/Time:	10/15/2021 5:05:17 PM
Program Version:	ICPR4 4.07.38

General

Run Mode: Normal

	Year	Month	Day	Hour [hr]
Start Time:	0	0	0	0.0000
End Time:	0	0	0	30.0000

	Hydrology [sec]	Surface Hydraulics [sec]	Groundwater [sec]
Min Calculation Time:	60.0000	0.1000	900.0000
Max Calculation Time:		60.0000	

Output Time Increments

Hydrology

Year	Month	Day	Hour [hr]	Time Increment [min]
0	0	0	0.0000	5.0000

Surface Hydraulics

Year	Month	Day	Hour [hr]	Time Increment [min]
0	0	0	0.0000	15.0000

Groundwater

Year	Month	Day	Hour [hr]	Time Increment [min]
0	0	0	0.0000	360.0000

Restart File

Save Restart: False

Resources & Lookup Tables

Resources

Rainfall Folder: ICPR3
Reference ET Folder:
Unit Hydrograph Folder: ICPR3

Lookup Tables

Boundary Stage Set:
Extern Hydrograph Set:
Curve Number Set:
Green-Ampt Set:
Vertical Layers Set:
Impervious Set:
Roughness Set:
Crop Coef Set:
Fillable Porosity Set:
Conductivity Set:
Leakage Set:
EMC Constituent Set:

Tolerances & Options

Time Marching: SAOR
Max Iterations: 6
Over-Relax Weight Fact: 0.5 dec
dZ Tolerance: 0.0010 ft
Max dZ: 1.0000 ft
Link Optimizer Tol: 0.0001 ft

IA Recovery Time: 24.0000 hr
ET for Manual Basins: False
Ia/S: 0.20 dec
Smp/Man Basin Rain Opt: Global
OF Region Rain Opt: Global
Rainfall Name: Flmod

Edge Length Option:	Automatic	Rainfall Amount:	7.50 in
		Storm Duration:	24.0000 hr
Dflt Damping (2D):	0.0050 ft	Dflt Damping (1D):	0.0050 ft
Min Node Srf Area (2D):	1 ft2	Min Node Srf Area (1D):	113 ft2
Energy Switch (2D):	Energy	Energy Switch (1D):	Energy

Comment:

Non-Contact Water ICPR Model Maximum Conditions Report

Sim	Node Name	Warning Stage [ft]	Maximum Stage [ft]	Time to Maximum Stage [hrs]	Maximum Total Inflow Rate [cfs]	Time to Maximum Total Inflow Rate [hrs]	Maximum Total Outflow Rate [cfs]	Time to Maximum Total Outflow Rate [hrs]	Min/Max Change in Stage [ft]	Maximum Surface Area [ft2]
25-24	Fish Lake	135	133.14	26.2932	316.22	12.2	0	0	0.001	2220526

Sim	Relative Time [hrs]	Stored Volume (Flow Based) [ft3]	Total Inflow Volume [ft3]	Total Outflow Volume [ft3]	% Error (By Inflow) [%]
25-24	0.0000	0	0	0	0.00
25-24	0.2511	0	0	0	0.00
25-24	0.5050	0	0	0	0.00
25-24	0.7556	0	0	0	0.00
25-24	1.0021	0	0	0	0.00
25-24	1.2546	0	0	0	0.00
25-24	1.5105	0	0	0	0.00
25-24	1.7605	0	0	0	0.00
25-24	2.0105	0	0	0	0.00
25-24	2.2605	0	0	0	0.00
25-24	2.5105	0	0	0	0.00
25-24	2.7605	0	0	0	0.00
25-24	3.0105	0	0	0	0.00
25-24	3.2605	0	0	0	0.00
25-24	3.5105	0	0	0	0.00
25-24	3.7605	0	0	0	0.00
25-24	4.0105	0	0	0	0.00
25-24	4.2605	0	0	0	0.00
25-24	4.5105	0	0	0	0.00
25-24	4.7605	25	25	0	0.00
25-24	5.0105	184	184	0	0.00
25-24	5.2605	577	577	0	0.00
25-24	5.5105	1274	1274	0	0.00
25-24	5.7605	2309	2309	0	0.00
25-24	6.0105	3698	3698	0	0.00
25-24	6.2605	5477	5477	0	0.00
25-24	6.5105	7770	7770	0	0.00
25-24	6.7605	10571	10571	0	0.00
25-24	7.0105	13845	13845	0	0.00

Sim	Relative Time [hrs]	Stored Volume (Flow Based) [ft3]	Total Inflow Volume [ft3]	Total Outflow Volume [ft3]	% Error (By Inflow) [%]
25-24	7.2605	17618	17618	0	0.00
25-24	7.5105	22055	22055	0	0.00
25-24	7.7605	27118	27118	0	0.00
25-24	8.0105	32739	32739	0	0.00
25-24	8.2605	38961	38961	0	0.00
25-24	8.5105	46065	46065	0	0.00
25-24	8.7605	54075	54075	0	0.00
25-24	9.0105	63223	63223	0	0.00
25-24	9.2605	73425	73425	0	0.00
25-24	9.5105	84718	84718	0	0.00
25-24	9.7605	97148	97148	0	0.00
25-24	10.0105	111219	111219	0	0.00
25-24	10.2605	127043	127043	0	0.00
25-24	10.5105	145494	145494	0	0.00
25-24	10.7605	166668	166668	0	0.00
25-24	11.0105	191833	191833	0	0.00
25-24	11.2605	220459	220459	0	0.00
25-24	11.5018	253546	253546	0	0.00
25-24	11.7531	315434	315434	0	0.00
25-24	12.0013	466880	466880	0	0.00
25-24	12.2505	732719	732719	0	0.00
25-24	12.5010	992532	992532	0	0.00
25-24	12.7509	1193511	1193511	0	0.00
25-24	13.0006	1344646	1344646	0	0.00
25-24	13.2531	1464508	1464508	0	0.00
25-24	13.5045	1558865	1558865	0	0.00
25-24	13.7527	1632040	1632040	0	0.00
25-24	14.0077	1689668	1689668	0	0.00
25-24	14.2539	1733306	1733306	0	0.00

Sim	Relative Time [hrs]	Stored Volume (Flow Based) [ft3]	Total Inflow Volume [ft3]	Total Outflow Volume [ft3]	% Error (By Inflow) [%]
25-24	14.5100	1770999	1770999	0	0.00
25-24	14.7598	1803867	1803867	0	0.00
25-24	15.0098	1833590	1833590	0	0.00
25-24	15.2598	1861172	1861172	0	0.00
25-24	15.5098	1887096	1887096	0	0.00
25-24	15.7598	1911729	1911729	0	0.00
25-24	16.0098	1934746	1934746	0	0.00
25-24	16.2598	1956532	1956532	0	0.00
25-24	16.5098	1977182	1977182	0	0.00
25-24	16.7598	1996968	1996968	0	0.00
25-24	17.0098	2015809	2015809	0	0.00
25-24	17.2598	2034001	2034001	0	0.00
25-24	17.5098	2051803	2051803	0	0.00
25-24	17.7598	2069144	2069144	0	0.00
25-24	18.0098	2085360	2085360	0	0.00
25-24	18.2598	2100868	2100868	0	0.00
25-24	18.5098	2116398	2116398	0	0.00
25-24	18.7598	2131789	2131789	0	0.00
25-24	19.0098	2146212	2146212	0	0.00
25-24	19.2598	2160006	2160006	0	0.00
25-24	19.5098	2173887	2173887	0	0.00
25-24	19.7598	2187791	2187791	0	0.00
25-24	20.0098	2201256	2201256	0	0.00
25-24	20.2598	2214256	2214256	0	0.00
25-24	20.5098	2226567	2226567	0	0.00
25-24	20.7598	2238399	2238399	0	0.00
25-24	21.0098	2249948	2249948	0	0.00
25-24	21.2598	2261316	2261316	0	0.00
25-24	21.5098	2272554	2272554	0	0.00

Sim	Relative Time [hrs]	Stored Volume (Flow Based) [ft3]	Total Inflow Volume [ft3]	Total Outflow Volume [ft3]	% Error (By Inflow) [%]
25-24	21.7598	2283708	2283708	0	0.00
25-24	22.0098	2294819	2294819	0	0.00
25-24	22.2598	2305913	2305913	0	0.00
25-24	22.5098	2317008	2317008	0	0.00
25-24	22.7598	2327993	2327993	0	0.00
25-24	23.0098	2338487	2338487	0	0.00
25-24	23.2598	2348608	2348608	0	0.00
25-24	23.5098	2358504	2358504	0	0.00
25-24	23.7598	2368144	2368144	0	0.00
25-24	24.0098	2377189	2377189	0	0.00
25-24	24.2598	2385209	2385209	0	0.00
25-24	24.5098	2390468	2390468	0	0.00
25-24	24.7598	2393681	2393681	0	0.00
25-24	25.0098	2395683	2395683	0	0.00
25-24	25.2598	2396925	2396925	0	0.00
25-24	25.5098	2397628	2397628	0	0.00
25-24	25.7598	2397962	2397962	0	0.00
25-24	26.0098	2398089	2398089	0	0.00
25-24	26.2598	2398115	2398115	0	0.00
25-24	26.5098	2398115	2398115	0	0.00
25-24	26.7598	2398115	2398115	0	0.00
25-24	27.0098	2398115	2398115	0	0.00
25-24	27.2598	2398115	2398115	0	0.00
25-24	27.5098	2398115	2398115	0	0.00
25-24	27.7598	2398115	2398115	0	0.00
25-24	28.0098	2398115	2398115	0	0.00
25-24	28.2598	2398115	2398115	0	0.00
25-24	28.5098	2398115	2398115	0	0.00
25-24	28.7598	2398115	2398115	0	0.00

Sim	Relative Time [hrs]	Stored Volume (Flow Based) [ft3]	Total Inflow Volume [ft3]	Total Outflow Volume [ft3]	% Error (By Inflow) [%]
25-24	29.0098	2398115	2398115	0	0.00
25-24	29.2598	2398115	2398115	0	0.00
25-24	29.5098	2398115	2398115	0	0.00
25-24	29.7598	2398115	2398115	0	0.00
25-24	30.0098	2398115	2398115	0	0.00