ENGINEERING REPORT FOR INACTIVE CCR UNIT

FORMER PLANT ARKWRIGHT – AP1
MACON-BIBB COUNTY, GEORGIA
FOR

Georgia Power

AUGUST 2025

GEORGIA
REGISTERED
No. PE0447[illegible]1
PROFESSIONAL
ENGINEER
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1. BACKGROUND AND OBJECTIVE

AP1 was issued a Closure Certificate by the Environmental Protection Division (EPD) on July 30, 2010. Although this CCR unit has officially been closed, Georgia Power plans to remove the CCR waste from this CCR unit. After removal of CCR, the area will be regraded and revegetated. This engineering report has been included in the permit application to provide supporting documentation for the updated Closure Plan.

AP1 is defined as a CCR Legacy Surface Impoundment under the USEPA CCR Legacy Rule. The changes to the Federal CCR Rule, which went into effect on November 8, 2024, are currently applicable to AP1. Any Legacy Rule required demonstrations or assessments for Legacy Surface Impoundments as outlined in 40 CFR §257.100(f) will be completed within the timeframes required.

2. LOCATION RESTRICTION DEMONSTRATION

In accordance with the requirements of Georgia Solid Waste Management Rule 391-3-4-.10(9), an Inactive CCR Landfill permit application must include the location restriction demonstration requirements in 40 CFR 257.64 for unstable areas. No unstable areas were identified during the feasibility study for AP1. Local geologic/geomorphologic features and human-made surface features were studied and additional information for the onsite conditions can be found in the Limited Hydrogeological Study. Since the CCR waste is to be removed, long-term stability and differential settling conditions were not evaluated. Any sub-surface human-made features that may be found during excavation of CCR will be evaluated by a professional engineer and changes will be made to the Closure Plan, if necessary.

A certification from a Georgia-Registered Professional Engineer is included in Appendix A.

3. STORMWATER MANAGEMENT DURING EXCAVATION

The run-on and run-off control plan for AP1, which is included in the Closure Plan of this permit application, was prepared to comply with Solid Waste Management Rule 391-3-4-.10. The below documentation has been provided to demonstrate how the run-on and run-off controls were evaluated based on the current conceptual plan for CCR removal. The run-on and run-off control systems will be further evaluated during development of construction drawings and will be modified based on field conditions, if needed.

3.1 GENERAL DESCRIPTION OF STORMWATER MANAGEMENT SYSTEM

Stormwater control during CCR removal from the AP1 has two goals:

1. Prevent the release of stormwater run-off generated from the CCR excavation area, and
2. Minimize the quantity of this stormwater by controlling run-on from the portions of the site outside of the limits of CCR.

During CCR removal, a combination of containment berms, ditches, equalization basin storage, storage tanks, and pumping and piping (to be selected by the contractor as the work proceeds) will be utilized to collect and manage industrial stormwater and industrial wastewater. An equalization basin will be used to store run-off originating from within the CCR excavation area and will be sized to accommodate the run-off (within the CCR excavation area) generated by the 100-year, 24-hour design storm event.

3.2 DESIGN CRITERIA

Preliminary sizing of the equalization basin is based on precipitation values from National Oceanic and Atmospheric Administration Atlas 14 data. Initial required storage sizing assumed no infiltration and that run-on controls would be in place, so that the equalization basin would only need to store the precipitation within the disturbed area. During detailed design, stormwater management analysis will be performed to route rainfall events through the equalization basin and water treatment system to fully size the stormwater management features using SCS TR-55.

Berms and ditches will be necessary to divert the peak discharge from a 100-year, 24-hour storm around the CCR excavation area to an adequately sized outfall so that this surface water does not run-on to the active CCR excavation. The equalization basin has been evaluated for the 100-year runoff generated from within the CCR excavation.

3.3 RUN-ON PREVENTION

Berms and ditches constructed for CCR removal will be utilized to control run-on from flowing into the excavation area. Details of the expected berms and ditches are described below. Calculations and drainage area maps are included in Appendix B.

a) Prior to CCR excavation, the area at north of the site shall be graded to drain to the east around the excavation area.

b) Areas to the east of the site are adjacent to the Ocmulgee River and will not drain into the excavation.

c) The remaining perimeter of the site lies to the west and is adjacent to the existing Norfolk-Southern railroad. This area currently drains to a ditch located along the edge of the railroad right of way. This ditch will continue to convey the stormwater run-off from west of the site to an outfall into Beaverdam Creek, just downstream of the existing railroad bridge.

3.4 WASTEWATER WITHIN EXCAVATION

CCR wastewater run-off for the AP1 will be managed via an equalization basin and/or a series of tanks that will be constructed and maintained during removal of the CCR. The equalization basin will be completely contained within the excavation area and will provide a minimum volume equal to the 100-year runoff generated by the contributing disturbed drainage area. The volume will increase as the work progresses and the basin and tanks will be managed to provide a sufficient volume based on the area draining into the excavation.

As excavation progresses, the site shall be graded such that run-off from disturbed CCR excavation areas drains to the equalization basin or is pumped to the basin from other sumps created in the excavation.

The collected water will be pumped from the equalization basin to an onsite water treatment system and discharged through an approved discharge location.

Calculations for the sizing of the equalization basin are included in Appendix B.1. The equalization basin will provide an adequate storage volume for the 100-year run-off from the controlled excavation area, assuming that the maximum CCR removal area is disturbed when the 100-year, 24-hr storm event occurs. Preliminary sizing assumed no infiltration. This is considered a conservative approach.

4. SITE RESTORATION STORMWATER H&H ANALYSIS

The following section discusses the stormwater hydrologic and hydraulic design conditions for stormwater discharge for the final site restoration conditions.

4.1 PURPOSE OF CALCULATION

AP1 closure will involve restoration of the unit following removal of CCR. Imported soil fill will be utilized to reach the proposed grades. Stormwater will sheet flow to proposed swales which will drain to flumes to the perimeter of the facility, draining eventually to Beaver Dam Creek and the Ocmulgee River. This calculation uses PCSWMM Storm Water Management Model design suite to evaluate the following aspects of the design after CCR removal is complete:

- Ditch geometry (depths, widths, side-slopes);
- Ditch lining;

4.2 SUMMARY OF CONCLUSIONS

The design criteria are met for the final closure condition.

- The Type I and Type II Ditch is designed to convey the 100-year, 24-hour storm with a minimum of 0.5 feet of freeboard
- Velocities and shear stresses calculated using inputs from the PCSWMM model are below the allowable limits for the selected channel lining during the 100-year, 24-hour storm event

Detailed calculations are provided in Appendix B.2.

5. FLOOD PROTECTION

Potential measures to protect removal activities from an overbank flooding event have been evaluated during the permitting design phase. Further evaluations and selection of appropriate measures will be conducted during the detailed design phase and included in contract documents for award to the selected contractor. The following features have been evaluated:

5.1 EXCAVATION SEQUENCING

The excavation is outlined in the Closure Plan but will proceed in the following general sequence:

a) The first stage of excavation will consist of the removal of CCR from elevations above the 100-year flood elevation (approximately 321 ft-NAVD88 from FEMA).
b) Following the first stage, CCR from the interior portion of the original AP1 berm will be removed while maintaining the outer berm up to the 100-year flood elevation level. The outer soil/CCR berm will protect the interior excavation areas from flooding and protect the river from sediment and CCR exposed in the interior excavation.
c) Removal of CCR on the exterior slopes outside the soil berm will be removed in segments. The length of each segment will be selected to minimize the area of soil and CCR potentially exposed to flooding during removal. The removal will likely occur in two phases vertically, with the first phase removed to approximate 10-year flood elevation followed by the final phase. Soil, CCR, and vegetation on the outer slope will be removed by excavating these materials inward to previously excavated areas for transport and disposal. Vegetation will not be stripped from the outer slope surface prior to this removal. When the first segment of CCR has been removed, then a second segment of slope will be selected, and the process repeated. This process will continue until all CCR has been removed from the AP1. River forecasts will be monitored during CCR removal.

5.2 VEGETATION MAINTENANCE

Existing vegetation on the exterior slopes will be maintained for as long as possible, up until the actual moment of excavation and removal. Equipment will not operate on these outer slopes or otherwise disturb the vegetation or soil surface.

5.3 INTERIM BERMS

Interim berms may be periodically constructed across the interior excavation. These berms will protect previously excavated interior areas from flooding when removal of the outer soil/CCR slopes is occurring or to protect previously excavated areas.

5.4 EROSION CONTROL MEASURES

Erosion control measures will be utilized to protect the integrity of the exterior slopes from erosion by floodwaters or rain events. Erosion control measures may consist of, but not be limited to, the following:

a) Soil stockpiles close to slope excavation areas so that exposed CCR can be covered quickly if sufficiently high-water levels are predicted;
b) Erosion control matting deployed on disturbed areas;
c) Geotextiles or temporary geomembranes (rain tarps) deployed on disturbed areas;
d) Temporary seeding or sodding of disturbed areas;
e) Sediment perimeter controls such as compost filter socks or silt fence installed at the toe of the outer slope to filter out sediment before entering the river or creek;
f) Additional rows of sediment perimeter controls installed above the toe of the outer slope but downhill from disturbed areas;
g) Small soil berms constructed at or near the toe of the outer slope to trap sediment; and
h) Monitoring and maintenance of erosion control measures so that trapped sediment is promptly removed, and the full sediment retention capacity of the fence/bale/berm is available.

5.5 POLYMER EMULSIONS

Polymer emulsions may be applied to disturbed areas to reduce erosion.

5.6 CONSTRUCTION SCHEDULE ADJUSTMENT

During construction, the forecast for local weather will be closely monitored. If heavy local rains are predicted, construction activities may be paused or modified to reduce the potential for erosion. Temporary measures described in Sections 5.3 through 5.5 may also be deployed.

Predicted Ocmulgee River water levels will be closely monitored during construction. United States Geological Survey (USGS) monitoring stations are located both upstream and downstream of the project site, and water levels at the project can be predicted by interpolating from predictions at these USGS stations. If predicted water levels rise as high as exposed CCR excavation areas, then construction will be paused and one or more of the temporary measures described in Sections 5.3 through 5.5 may be deployed. Additionally, Georgia Power personnel will maintain close communications with dam operations personnel at upstream Lloyd Shoals Dam so that scheduled flow releases are considered for construction operations.

APPENDIX A. PE CERTIFICATION FOR LOCATION RESTRICTION DEMONSTRATION

LOCATION RESTRICTION DEMONSTRATION

UNSTABLE AREAS

FORMER PLANT ARKWRIGHT – AP1 LANDFILL

GEORGIA POWER COMPANY

Georgia's Solid Waste Management Rule 391-3-4-.10(9) requires that Inactive CCR Landfill solid waste handling permit applications meet requirements of (9)(c)3.(i) – (iv), including the location restriction demonstration requirements in 40 C.F.R. 257.64 for unstable areas.

Per § 257.64 of Subpart D - Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments, the owner or operator must demonstrate that the facility is not located within an unstable area or a demonstration must be made that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted. As defined in § 257.53, an unstable area means a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity, including structural components of some or all of the CCR unit that are responsible for preventing releases from such unit. Unstable areas can include poor foundation conditions, areas susceptible to mass movements, and karst terrains.

The AP1 Landfill is located in Bibb County approximately six miles northwest of Macon, Georgia. A review of the site geology, hydrogeology, and information available of onsite surface and subsurface conditions confirmed that the CCR unit is not located within an unstable area having subsurface soil conditions, onsite geologic or geomorphologic features, and/or on-site human-made features or events (both surface and subsurface) that may result in significant differential settling of the foundation of the CCR unit.

I hereby certify, to the best of my knowledge and based on the information presented in the CCR Unit Solid Waste Handling Permit Application dated November 2018, that for Georgia Power's former Plant Arkwright – AP1 Landfill, the unstable areas location restriction demonstration meets the requirements of 391-3-4-.10(9)(c)3.(i).

11-14-18

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11/14/18

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APPENDIX B. CALCULATIONS

APPENDIX B.1 STORMWATER MANAGEMENT DURING EXCAVATION CALCULATIONS

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Georgia Power **Plant Arkwright** **Macon-Bibb County, Georgia**	**Plant Arkwright** **Closure Project**

Calculation Package Permit Design

Stantec	**Stormwater Management During CCR Removal**

Purpose:

- To evaluate permit designs for construction stormwater management during the Closure Project.

Methods:

- Developed a Stormwater Management Model for the following:
  - AP-1 Equalization Basin to manage the 100-year, 24-hour storm event
  - Evaluate pumps and force mains for stormwater management use in dewatering Equalization Basins for the 100-year, 24-hour storm event

Results:

- Equalization Basin for AP-1 can detain the 100-year, 24-hour storm event without overtopping.
- Commonly available stormwater management pumps can dewater the Equalization Basin during the 100-year, 24-hour storm event.

Calculation Performed by: Stantec Consulting Services, Inc.	
Prepared by: Elizabeth Vanderloo	*Reviewed by:* Sam Lee
Revisions:	

Stantec

Memo

To:	Project Files	From:	Stantec Consulting Services Inc. Lexington, KY
File:	175518230	Date:	November 15, 2024

Reference: Georgia Power Plant Arkwright Closure – Stormwater Management During CCR Removal

PURPOSE

Stantec Consulting Services Inc. (Stantec) has completed conceptual engineering analyses for the Georgia Power Plant Arkwright Closure in Macon, Georgia. The existing CCR unit AP1 is to be excavated onsite and the contact water managed during construction activities. Stantec completed conceptual water management evaluations based on permit design documents with the following completed:

1. Developed a stormwater management model (SWMM) to evaluate the AP-1 Equalization Basin during the 100-year, 24-hour event.
2. Evaluated use of temporary stormwater management pumps and force mains to dewater the Equalization Basin during the 100-year, 24-hour event.

The purpose of this Memorandum is to document design calculations performed to develop this conceptual water management strategy, document permit design (pond sizing, pump selection, etc.), and recommend future detailed design goals for stormwater management. An overview of the project area is included in Figure 1 (on the next page).

Reference: **Georgia Power Plant Arkwright Closure – Stormwater Management During CCR Removal**

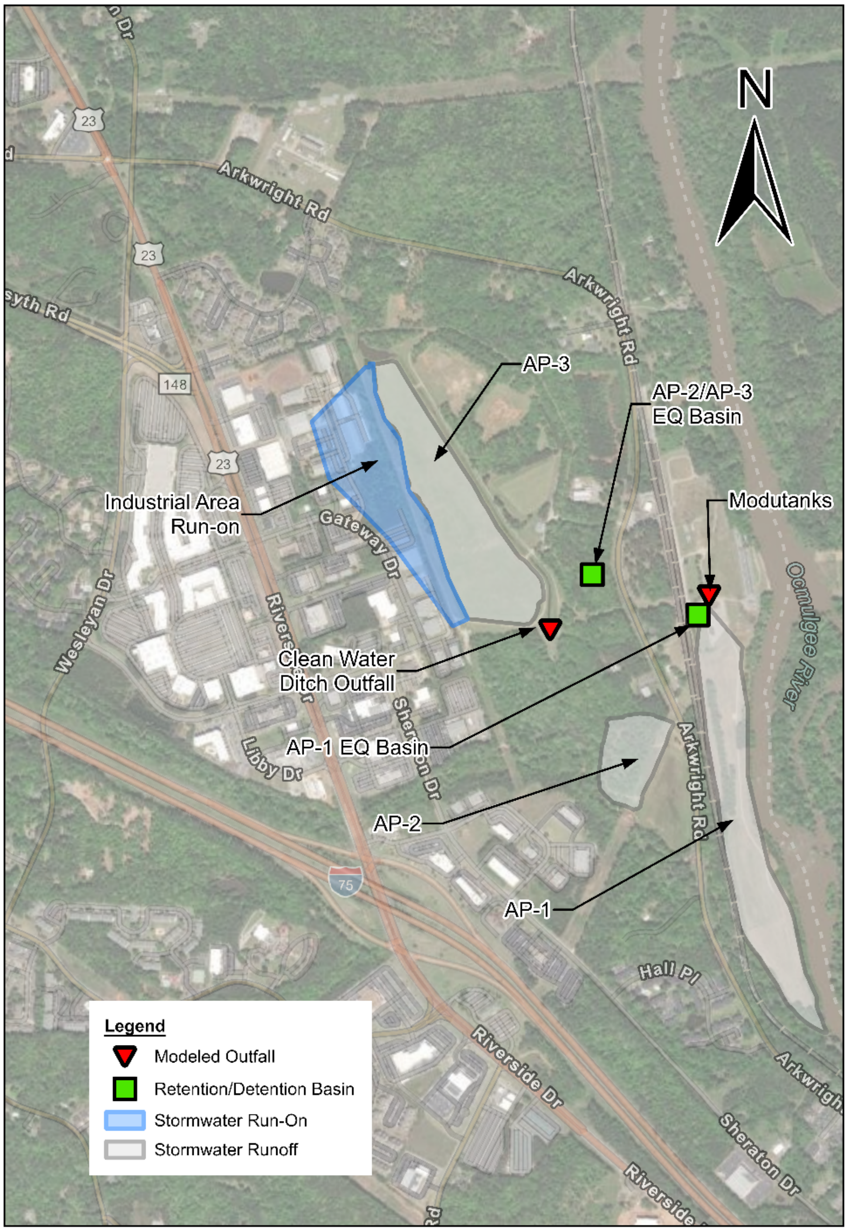


Figure 1: Project Overview (not to scale)

DESIGN STANDARDS AND REFERENCES

Stormwater calculations generally consider peak runoff during the 100-year, 24-hour storm event (8.1 inches at the Project Area). This is an approach recommended to select water management systems for the proposed Arkwright Closure project. Calculation approaches generally followed the Georgia Stormwater Management Manual Design, Volumes 1 & 2 (Atlanta Regional Commission, 2016) with selected design standards and references are summarized in Table 1.

Table 1: Design Standards and References

Parameter	Approach	Design Standard/Method/Source
Storm Rainfall Depths	Select the 100-year, 24-hour rainfall depth for a conservative water management strategy	NOAA Atlas 14 Precipitation Frequency Data Server 100-year, 24-hour rainfall depth = 8.1 inches
Equalization (EQ) Basin Capacity	Size EQ Basin to completely contain rainfall runoff from active closure areas.	Stantec recommended criteria: • 2-feet deep normal pool • 1-feet minimum freeboard during the 100-yr, 24-hour storm event • Maximum combined outflow of 2,500 gallons per minute (existing treatment system capacity)
Conceptual Pump Selection	Utilize temporary pumps common in the stormwater management industry	Review Godwin CD temporary pump curves • Elevation head based on existing ground surface topography • Minor and major friction losses calculated with Hazen Williams Equation • Maximum pump outlet force main diameter = 12-inches
Stormwater Runoff Calculations	Utilize the SCS Curve Number Approach	USDA NRCS “Urban Hydrology for Small Watersheds” (Technical Release 55, June 1986
Stormwater Runoff Modeling Software	Calculate stormwater runoff with the US EPA Stormwater Management Model (SWMM)	Computational Hydraulics Institute, PCSWMM (SWMM Version 5.0.013 - 5.1.015)

STORMWATER MANAGEMENT MODEL

PCSWMM inputs are discussed below. A model layout is included in Attachment A.

DRAINAGE SUBCATCHMENTS

1. Rainfall Depth: 100-yr, 24-hr (8.1 inches) SCS Type II Rainfall Distribution
2. Subcatchment Geometry (Area, Drainage Length, Slope): Delineated in PCSWMM based on existing ground topography.
   - Assumed 2% minimum drainage area slope
   - Drainage subcatchments connected directly to EQ Basin storage nodes
3. SCS Curve Number:
   - CN = 80 for exposed ash at AP1

STORAGE NODE PARAMETERS

EQ Basins were modeled as storage nodes in PCSWMM. EQ Basin geometries are summarized below in Table 2.

Table 2: Equalization Basin Geometries

EQ Basin	Basin Bottom Elevation (ft)	Basin Footprint (Acres)	Normal Pool Depth (ft)	Top Of Embankment Elevation (ft)	Length: Width Ratio
AP-1	315	1	2	335	1.6:1

Elevation-area data was delineated in AutoCAD Civil3D from existing topographic data.

STORAGE NODE OUTLET PUMPS

Storage nodes were directly connected to PCSWMM pumps to model the conceptual connection of a temporary dewatering pump to the proposed water treatment system. These pumps were modeled with a depth-discharge relationship selected to not exceed the treatment capacity (2,500 GPM). This demonstrated that both EQ Basins may be dewatered during the 100-year, 24-hour storm event without exceeding a maximum flowrate of 2,500 GPM (i.e, 1,250 GPM discharged from each EQ Basin).

SYSTEM OUTFALL

Assumed a “free” outfall at the proposed water treatment system (i.e. no tailwater conditions).

EQ BASIN RESULTS

PCSWMM calculated the following results for the EQ Basins for the Plant Arkwright Closure.

Table 3: Equalization Basin Results (100-year, 24-hour Stormwater Runoff)

EQ Basin	Peak Inflow (CFS)	Peak Outflow (CFS)	Peak Ponded Depth (ft)	Peak Water Surface Elevation (ft)	Freeboard (ft)	Maximum/Total Capacity (%)
AP-1	9.8	2.8 (limited by water treatment system)	16.3	333.3	1.7	84

TEMPORARY PUMPING

Temporary pumps and force mains will be utilized to dewater the detention/retention basins during construction. The following management strategy was considered:

1. Pump contact water from the AP-1 EQ Basin to the treatment system
2. Confirm that temporary pumping can be completed with commonly-available equipment:
   - Godwin Mobile “CD” pumps
   - 12-inch diameter (maximum) HDPE DR-17 force mains

Calculations are discussed in the following.

TEMPORARY PUMPING SYSTEM HEAD

The system head was calculated from the following:

- Static Head: the “elevation” head from the pump suction elevation to discharge elevation
- Friction Losses: losses in the force main due to pipe friction forces
- Minor Losses: losses at bends, valves, and other appurtenances

Results are summarized in the following table.

Table 4: Temporary Pumping System Head

Location	Design Discharge	Force Main Dia.	Total System Head
AP-1 EQ Basin	1,250 GPM • Selected to be ½ of the Modutanks treatment system capacity, 2,500 GPM	12”	26 feet

Reference: **Georgia Power Plant Arkwright Closure – Stormwater Management During CCR Removal**

TEMPORARY STORMWATER MANAGEMENT PUMP FEASIBILITY

Godwin "CD" pumps were considered based on Stantec's experience with construction stormwater management. The design discharges and total system heads (included in Attachment B) were compared to published pump curves as shown below in Figure 2.

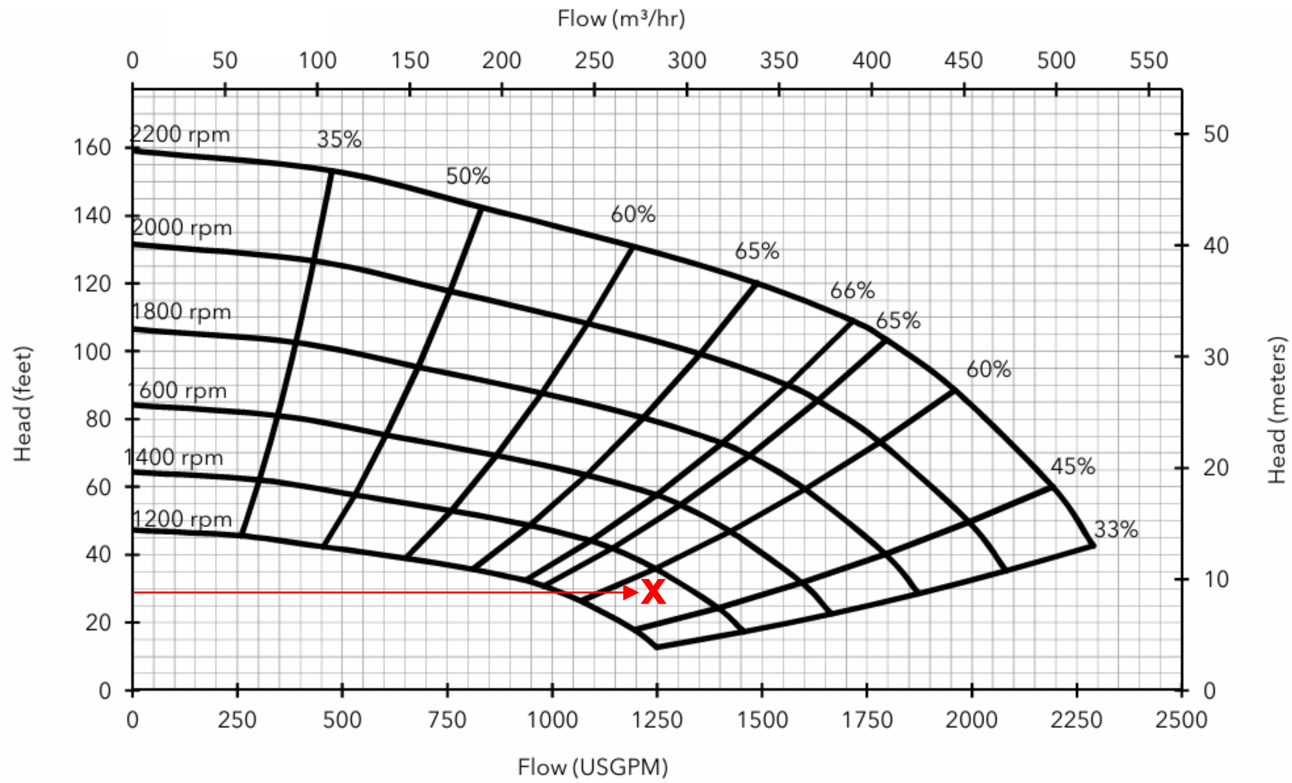


Figure 2: System Operations Conditions (Godwin CD200M Pump Curve)

As shown in Figure 2, commonly available temporary pumps can be utilized to manage stormwater during the Arkwright Closure project. The following conceptual configuration is recommended:

1. Godwin CD200M pumps (or equivalent)
   - Design point: 1250 GPM at approximately 30-feet head
2. Conveyance force mains
   - HDPE DR17 pipe
   - Pipe pressure rating 125 PSI per typical supplier information
   - System force main expected pressure 10 psi – 30 psi

CLOSURE

The following were noted from these calculations:

1. The EQ Basin for AP-1 had been designed to detain the peak 100-year, 24-hour storm event. Conceptual geometries are conservative (i.e., only utilize ±80% storage capacity) and may decrease in size during detailed design. This allows for discharges at the temporary treatment system capacity of 2,500 GPM.
2. Commonly available temporary pumps can dewater the EQ Basins during the 100-year, 24-hour storm event.

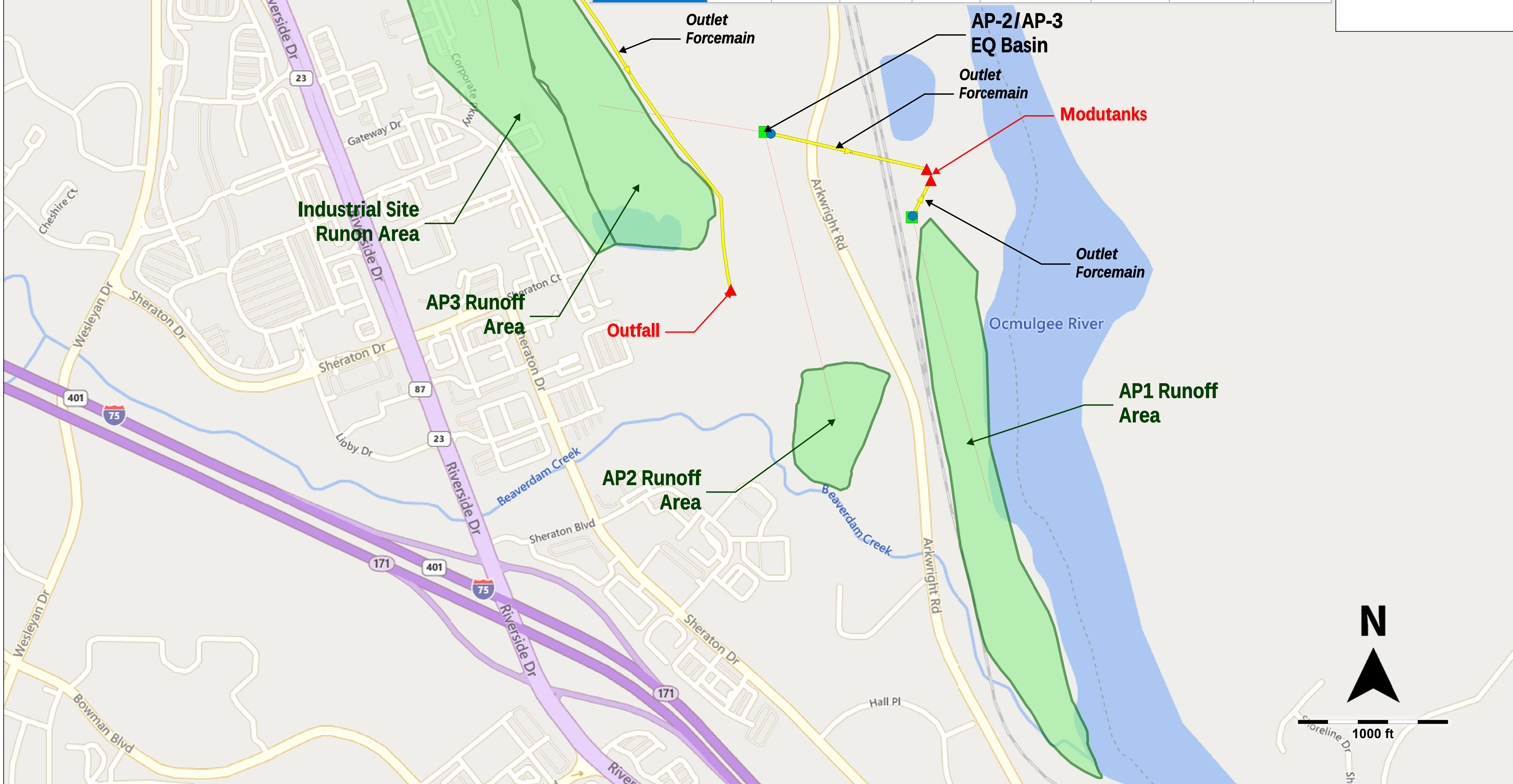
LIST OF ATTACHMENTS:

Attachment A: PCSWMM Overview Figure

ATTACHMENT A:
PCSWMM OVERVIEW FIGURE

Drainage Area Subcatchments 100-yr, 24-hr Event Summary

Name	Outlet	Area (ac)	Flow Length (ft)	Slope (%)	Time of Concentration (min)	SCS Curve Number	Runoff Volume (MG)	Peak Runoff (cfs)
AP3	CWP1	27.826	1300	2	27.716	80	1.863	60.269
AP2	CWP1	8.576	430	2	11.438	80	0.569	26.131
AP1	CWP2	29.303	2000	2	39.12	80	1.962	51.944
Industrial_Area_Runon	Duck_Pond	22.876	625	2	15.427	80	1.517	61.912



APPENDIX B.2 SITE RESTORATION STORMWATER CALCULATIONS

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Georgia Power Plant Arkwright Macon, Bibb County, Georgia	**Plant Arkwright Closure**

Calculation Package Permit Design

Stantec

Final Site Restoration Stormwater Management

Purpose:

- Evaluate proposed closure grades after removal of CCR to manage stormwater during the 100-year, 24-hour storm event.

Methods:

- Utilize the Georgia Stormwater Management Manual to size drainage ditches, culverts, and flumes
    - Perform hydrologic modeling using CHI PCSWMM
    - Evaluate hydraulic capacity of ditches, culverts, and flumes
    - Select appropriate channel lining material for ditches and flumes

Results:

- Stormwater management features presented in the permit design drawings are sufficiently sized to convey the 100-year, 24-hour storm event.

Calculation Performed by: Stantec Consulting Services, Inc.

Prepared by: Elizabeth Vanderloo, EIT	*Reviewed by:* Sam Lee, PE

Revisions:

Attachment A: SWMM Summary

Design Standards and References

Calculations conducted in accordance with the Georgia Stormwater Management Manual.

Design Standards and References

Parameter	Design Standard/Method/Source
Stormwater Design Storm Return Interval	100-yr, 24-hour NOAA Atlas 14 Precipitation Frequency Data Server
Stormwater Runoff Calculations	SCS Curve Number Approach USDA NRCS "Urban Hydrology for Small Watersheds" (Technical Release 55, June 1986)
Stormwater Modeling Software	Computational Hydraulics Institute, PCSWMM (SWMM Version 5.0.013 - 5.1.015)

Inputs and Assumptions

PCSWMM inputs are discussed below. Model layouts are included in Attachment B.

Drainage Subcatchments

1. Rainfall Depth: 100-yr, 24-hr: 8.1 inches SCS Type II Rainfall Distribution
2. Subcatchment Geometry (Area, Drainage Length, Slope): Delineated in PCSWMM based on permit design plans topography.
    - Drainage area slope referenced from permit design plans
3. SCS Curve Number:
    - CN = 78 for grass

Conduit Parameters

1. Roughness:
    - Grass: 0.027 referenced from "Open Channel Hydraulics" by Ven Te Chow
    - AP1 Flume: 0.078
    - V-ditch: 0.027
    - Drivable Crossing: 0.013

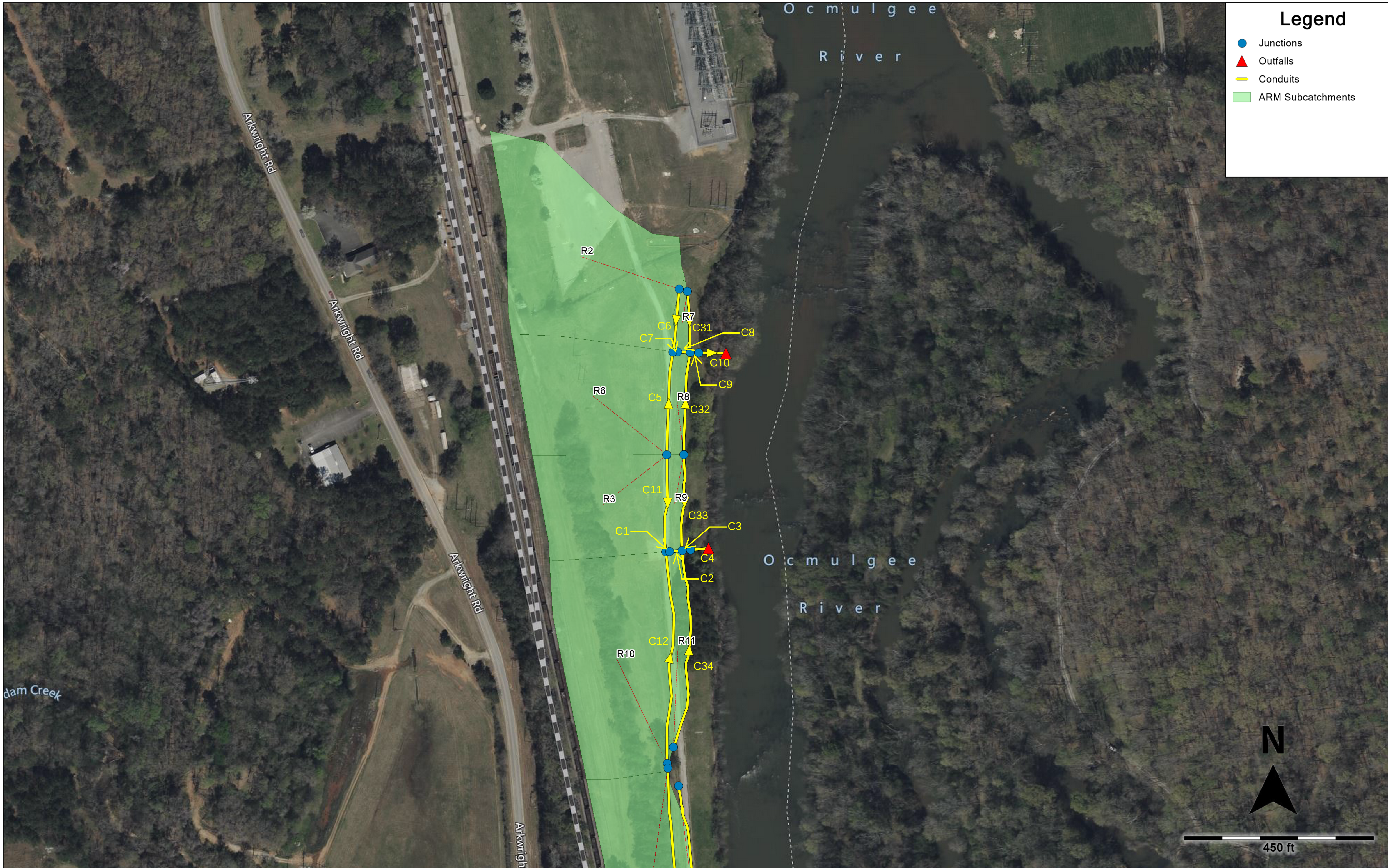
System Outfall

Assumed a "free" outfall (i.e. no tailwater conditions).

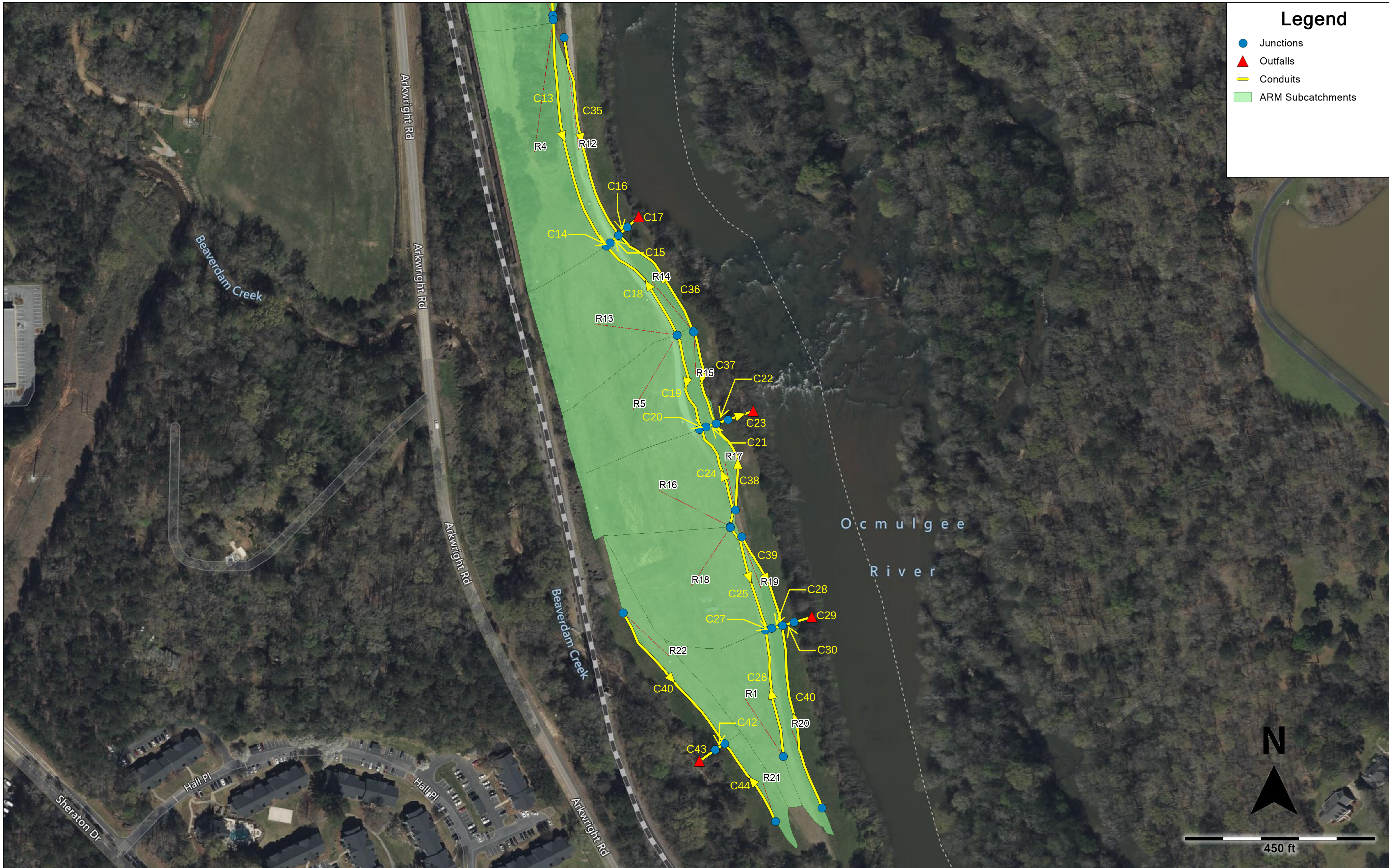
Results

PCSWMM results can be found in the tables in Attachment C. Channel lining material was determined using Equation 5.4.13 in the Georgia Stormwater Management Manual. Calculated D_{30} using Equation 5.4.13 was used to determine D_{50} and channel type.

Attachment B: SWMM Model Layouts



Legend
Junctions
Outfalls
Conduits
ARM Subcatchments
Ocmulgee River
Ocmulgee River
Arkwright Rd
Arkwright Rd
Arkwright Rd
Arkwright
R2
R7
C6
C31
C8
C7
C10
C9
R6
C5
R8
C32
C11
R9
R3
C33
C1
C3
C4
C2
C12
R11
R10
C34
N
450 ft



Legend
Junctions
Outfalls
Conduits
ARM Subcatchments
C13
C35
R4
R12
C16
C17
C14
C15
R14
C36
C18
R13
C37
R15
C22
C19
R5
C20
C23
C21
R17
C24
C38
R16
C39
R19
R18
C25
C28
C29
C27
C30
R22
C26
C40
R1
C40
C42
R20
C43
R21
C44
Ocmulgee River
Beaverdam Creek
Beaverdam Creek
Arkwright Rd
Arkwright Rd
Arkwright Rd
Arkwright Rd
Hall Pl
Hall Pl
Sheraton Dr
N
450 ft

Attachment C: Tables

Table 1: AP1 Subcatchments

Name	Area (ac)	Flow Length (ft)	Slope (%)	Time of Concentration (min)	SCS Curve Number	Peak Runoff (cfs)
R1	1.0	110	3	6	78	8.7
R2	3.5	440	3	10	78	26.0
R3	1.6	280	3	7	78	12.9
R4	2.3	170	3	6	78	20.0
R5	1.4	310	3	8	78	10.8
R6	2.1	380	3	9	78	16.3
R7	0.1	40	33	6	78	1.1
R8	0.2	40	33	6	78	1.9
R9	0.2	40	33	6	78	1.9
R10	3.0	260	3	7	78	24.0
R11	0.4	40	33	6	78	3.6
R12	0.4	40	33	6	78	3.7
R13	1.7	300	3	7	78	13.6
R14	0.3	40	33	6	78	2.3
R15	0.2	40	33	6	78	1.9
R16	1.5	335	3	8	78	11.6
R17	0.2	40	33	6	78	1.4
R18	1.7	280	3	7	78	13.8
R19	0.2	40	33	6	78	1.5
R20	0.4	40	33	6	78	3.9
R21	0.3	40	33	6	78	2.3
R22	0.5	40	33	6	78	4.5

Table 2: AP1 Open Channels

Name	Channel Type	Length (ft)	Roughness	Slope (ft/ft)	Max Flow (cfs)	Max Velocity (ft/s)	Max/Full Depth (%)
C10	AP1 Flume	65	0.078	0.10	43.6	4.7	44%
C11	Grass-lined	230	0.027	0.03	12.9	1.8	69%
C12	Grass-lined	503	0.027	0.02	23.7	2.8	80%
C13	Grass-lined	557	0.027	0.01	19.5	2.3	78%
C15	AP1 Flume	27	0.078	0.19	26.5	5.5	26%
C16	Drivable crossing	17	0.013	0.02	30.2	4.0	28%
C17	AP1 Flume	38	0.078	0.14	30.1	4.7	32%
C18	Grass-lined	273	0.027	0.02	13.6	1.9	71%
C19	Grass-lined	223	0.027	0.02	10.8	1.6	68%
C2	AP1 Flume	29	0.078	0.15	29.6	4.0	36%
C21	AP1 Flume	26	0.078	0.16	20.2	4.8	23%
C22	Drivable crossing	17	0.013	0.01	22.3	4.3	28%
C23	AP1 Flume	64	0.078	0.27	22.3	5.3	23%
C24	Grass-lined	251	0.027	0.02	11.6	1.7	69%
C25	Grass-lined	260	0.027	0.02	13.8	1.9	71%
C26	Grass-lined	302	0.027	0.02	8.6	1.3	66%
C28	AP1 Flume	27	0.078	0.19	19.3	4.5	23%
C29	AP1 Flume	44	0.078	0.22	23.2	5.0	25%
C3	Drivable crossing	20	0.013	0.01	31.9	3.1	36%
C30	Drivable crossing	17	0.013	0.01	23.2	3.7	32%
C31	V-ditch	144	0.027	0.07	1.1	2.4	61%
C32	V-ditch	241	0.027	0.02	1.9	2.6	69%
C33	V-ditch	227	0.027	0.02	1.9	2.9	61%
C34	V-ditch	473	0.027	0.03	3.7	4.1	66%
C35	V-ditch	491	0.027	0.02	3.7	5.0	51%
C36	V-ditch	293	0.027	0.02	2.3	3.9	47%
C37	V-ditch	205	0.027	0.02	1.9	3.9	42%
C38	V-ditch	220	0.027	0.03	1.4	3.9	37%
C39	V-ditch	232	0.027	0.04	1.5	3.5	40%
C4	AP1 Flume	43	0.078	0.17	31.9	5.0	32%
C40	V-ditch	445	0.027	0.02	4.0	4.4	56%
C41	Grass-lined	473	0.027	0.03	4.4	3.2	19%
C42	Drivable crossing	27	0.013	0.01	6.6	3.1	21%
C43	AP1 Flume	46	0.078	0.22	6.6	3.2	12%
C44	Grass-lined	257	0.027	0.03	2.3	2.0	17%
C5	Grass-lined	242	0.027	0.03	16.2	2.2	72%
C6	Grass-lined	150	0.027	0.04	26.0	3.3	75%
C8	AP1 Flume	30	0.078	0.15	41.7	4.6	43%
C9	Drivable crossing	20	0.013	0.01	43.6	2.8	46%

Attachment D: Channel Lining

Georgia Power
Plant Arkwright Closure 60% Design
AP-1 Final Grade Riprap Sizing

Governing Geometry Equations

$$W = b + 2dz$$

$$A = bd + zd^2$$

$$W_P = b + 2d\sqrt{z^2 + 1}$$

Open Channel Equations

$$Q = \frac{1.49}{n} A R^{\frac{2}{3}} S_o^{\frac{1}{2}} \qquad R = \frac{A}{W_p}$$

$$\tau_d = \gamma d S \qquad V = \frac{Q}{A}$$

Riprap Sizing

$$D_{30} = D * 0.193 * Fr^{2.5}$$

$$D_{50} = D_{30} * 2^{1/3}$$

Channel ID	n	S	Q	b	z	d	W	A	Wp	R	V	Shear Stress	Hydraulic Depth	Froude	GA D30 (inches)	D50	Channel Type
C8	0.078	0.15	41.7	8	3	0.8	12.6	7.9	12.8	0.6	5.3	7.0	0.6	1.2	2.68	3.4	AP1 Flume
C15	0.078	0.19	26.3	8	3	0.5	11.3	5.3	11.5	0.5	4.9	6.4	0.5	1.3	2.33	2.9	AP1 Flume
C2	0.078	0.15	29.6	8	3	0.6	11.8	6.3	12.0	0.5	4.7	5.8	0.5	1.1	2.05	2.6	AP1 Flume
C21	0.078	0.16	20.5	8	3	0.5	11.0	4.7	11.1	0.4	4.3	5.0	0.4	1.2	1.70	2.1	AP1 Flume
C28	0.078	0.19	19.6	8	3	0.5	10.8	4.3	10.9	0.4	4.5	5.6	0.4	1.3	1.90	2.4	AP1 Flume
C23	0.078	0.27	22.7	8	3	0.5	10.7	4.3	10.9	0.4	5.3	7.7	0.4	1.5	2.86	3.6	AP1 Flume
C29	0.078	0.22	23.5	8	3	0.5	11.0	4.7	11.1	0.4	5.0	6.8	0.4	1.4	2.45	3.1	AP1 Flume
C4	0.078	0.17	31.9	8	3	0.6	11.8	6.3	12.0	0.5	5.1	6.6	0.5	1.2	2.45	3.1	AP1 Flume
C10	0.078	0.10	43.6	8	3	0.9	13.2	9.2	13.5	0.7	4.7	5.5	0.7	1.0	1.99	2.5	AP1 Flume
C17	0.078	0.14	30.2	8	3	0.6	11.9	6.4	12.1	0.5	4.7	5.7	0.5	1.1	2.04	2.6	AP1 Flume
C39	0.027	0.04	1.5	0	3	0.4	2.2	0.4	2.3	0.2	3.3	0.9	0.2	1.4	1.89	2.4	Grass-lined
C38	0.027	0.03	1.4	0	3	0.3	2.1	0.4	2.2	0.2	3.0	0.7	0.2	1.3	1.45	1.8	Grass-lined
C31	0.022	0.07	1.1	0	3	0.3	1.8	0.3	1.9	0.1	4.7	1.2	0.1	2.2	4.69	5.9	Grass-lined
C35	0.027	0.02	3.7	0	3	0.6	3.5	1.0	3.7	0.3	3.7	0.9	0.3	1.2	2.10	2.6	Grass-lined
C34	0.027	0.03	3.7	0	3	0.6	3.5	1.0	3.7	0.3	3.8	0.9	0.3	1.2	2.26	2.9	Grass-lined
C43	0.078	0.22	6.6	8	3	0.2	9.4	2.0	9.5	0.2	3.2	3.3	0.2	1.2	0.90	1.1	Grass-lined
C5	0.027	0.03	16.2	6	6	0.4	11.3	3.8	11.4	0.3	4.2	0.7	0.3	1.3	1.91	2.4	Grass-lined
C25	0.027	0.02	13.8	6	6	0.4	11.1	3.7	11.2	0.3	3.7	0.5	0.3	1.2	1.41	1.8	Grass-lined
C12	0.027	0.02	23.7	6	6	0.6	13.1	5.7	13.2	0.4	4.2	0.7	0.4	1.1	1.84	2.3	Grass-lined
C24	0.027	0.02	11.6	6	6	0.4	10.6	3.2	10.7	0.3	3.6	0.5	0.3	1.2	1.31	1.6	Grass-lined
C13	0.027	0.01	19.5	6	6	0.6	12.8	5.3	12.9	0.4	3.7	0.5	0.4	1.0	1.31	1.7	Grass-lined
C41	0.027	0.03	4.4	6	6	0.2	8.4	1.4	8.4	0.2	3.1	0.4	0.2	1.3	0.94	1.2	Grass-lined
C18	0.027	0.02	13.6	6	6	0.4	11.0	3.6	11.1	0.3	3.8	0.6	0.3	1.2	1.46	1.8	Grass-lined
C19	0.027	0.02	10.8	6	6	0.4	10.3	2.9	10.4	0.3	3.7	0.5	0.3	1.2	1.38	1.7	Grass-lined
C40	0.027	0.02	4.0	0	3	0.6	3.8	1.2	4.0	0.3	3.3	0.7	0.3	1.0	1.54	1.9	Grass-lined
C37	0.027	0.02	1.9	0	3	0.5	2.8	0.7	3.0	0.2	2.9	0.6	0.2	1.0	1.21	1.5	Grass-lined
C11	0.027	0.03	12.9	6	6	0.4	10.6	3.2	10.7	0.3	4.0	0.6	0.3	1.3	1.72	2.2	Grass-lined
C44	0.027	0.03	2.3	6	6	0.1	7.7	1.0	7.7	0.1	2.3	0.2	0.1	1.1	0.43	0.5	Grass-lined
C36	0.027	0.02	2.3	0	3	0.5	3.1	0.8	3.2	0.2	2.9	0.6	0.3	1.0	1.27	1.6	Grass-lined
C33	0.027	0.02	1.9	0	3	0.5	2.8	0.7	3.0	0.2	3.0	0.6	0.2	1.1	1.36	1.7	Grass-lined
C32	0.027	0.02	1.9	0	3	0.5	2.8	0.7	3.0	0.2	2.9	0.6	0.2	1.1	1.27	1.6	Grass-lined
C26	0.027	0.02	8.6	6	6	0.3	9.9	2.6	10.0	0.3	3.3	0.4	0.3	1.1	1.05	1.3	Grass-lined