APPENDIX B

Three-Dimensional Numerical Groundwater Modeling Report

Submitted under separate cover due to size limitations

REPORT

Three-Dimensional Numerical Groundwater Modeling Report

Plant McDonough-Atkinson Ash Pond 3 and Ash Pond 4 (AP-3/4)

Submitted to:

Georgia Power Company

241 Ralph McGill Blvd. Atlanta, Georgia 30341

Submitted by:

WSP USA Inc.

5170 Peachtree Road, Building 100, Suite 300 Atlanta, Georgia 30341

February 2025

Table of Contents

Figures

Appendices

LIST OF ABBREVIATIONS & ACRONYMS

AEM - Advanced Engineering Method

AP - Ash Pond

ARM - Absolute Residual Mean

CCR - Coal Combustion Residuals

CSM - Conceptual Site Model

ft - Feet

ft/d - Feet per day

GA EPD - Georgia Environmental Protection Division

GPC - Georgia Power Company

HAR - Hydrogeologic Assessment Report

Md - Volumetric Balance Discrepancy

PWR - Partially Weathered Rock

RM - Residual Mean

RMSE - Root Mean Square Error

SD - Standard Deviation

SMS – Sparse Matrix Solver

US EPA - United States Environmental Protection Agency

WRCC - Western Regional Climate Center

1.0 INTRODUCTION

This report presents a summary of WSP USA, Inc.'s (WSP) current groundwater modeling activities for the Georgia Power Company (GPC) owned and operated Plant McDonough, located in Cobb County, Georgia (Site; Figure 1-1). As discussed in the Hydrogeological Assessment Report (HAR), Part B Section 1 of the Plant McDonough AP-2,3/4 Solid Waste Handling Permit Application submitted to the Georgia Environmental Protection Division (GA EPD) in December 2024 (WSP, 2024), the AP-2,3/4 closure will include an Advanced Engineering Method (AEM) consisting of an AEM Enhanced Underdrain. Predicted post-closure groundwater flow conditions for AP-2,3/4 were previously simulated using a Closure Model that is documented in the Model Report submitted to GA EPD in 2020 as an Appendix to the HAR (Golder, 2020). Additional modifications to the post-closure model were undertaken, based on closure design changes, and were submitted in HAR Revision 03 in September 2021 (Golder, 2021). WSP performed additional modeling activities, as documented in the Advanced Engineering Methods (AEM) Feasibility Report (WSP, 2023). The AEM Enhanced Underdrain, included in each of these modeling submittals, consistently resulted in a predicted post-closure potentiometric surface below the base of CCR.

In an GA EPD letter dated September 30, 2024 (GA EPD, 2024), GA EPD requested modifications to the groundwater model, resulting in a new model. This report provides an overview of the model construction, calibration, and validation to specifically address the GA EPD comments as well as results of the new model. The modeling results show that, consistent with previous reports submitted between 2020 and 2023, the post-closure potentiometric surface will remain below the base of CCR due to the AEM Enhanced Underdrain being installed below the base of CCR in the deepest portion of AP-3/4. Site-specific hydraulic conductivity data collected in 2024, and prior years has been used to inform and structure the new model to address GA EPD comments to the previously submitted models. The new model incorporates, but is not limited to, the following changes:

- Division of the model into additional layers to represent changes to bedrock permeability with depth, as observed during site-specific aquifer testing (including testing performed in 2024), and to more explicitly represent closure design materials.
- Use of spatially variable hydraulic conductivity values within each layer to reflect observed variability from site-specific aquifer testing (including testing performed in 2024). Hydraulic conductivity zones were converted to matrices, so vertical and horizontal heterogeneity could be simulated within each layer to better represent the Site-specific hydraulic testing data. Pilot points are used throughout the model domain to better represent spatially distributed hydraulic testing data for each model layer.
- Use of a newer model code (MODFLOW-USG)
- Expansion of the model domain to the sub watershed boundary using an unstructured grid with lower resolution away from the Site and higher resolution near the Site where detailed predictions are needed.
- Use of the newer Sparse Matrix Solver (SMS) model solver with MODFLOW-USG
- Calibration to more recent (March 2024) water levels from a larger number of locations

The primary modeling objectives are to simulate March 2024 groundwater flow and predict post-closure conditions near formerly operating Site ash ponds (AP). To meet these objectives, two groundwater flow models were developed to evaluate the following conditions at the Site:

- 2024 Conditions – steady-state approximation of groundwater flow conditions as of March 2024.

- Post-Closure – long-term steady-state groundwater flow conditions following completion of closure.

The Site is about seven miles northwest of Atlanta, GA, surrounded by industrial and residential land use. Coal-fired units were operated until 2012 when they were replaced with three 840-megawatt combined cycle natural gas units.

The property occupies approximately 432 acres (Figure 1-2) and has included the main plant, and four coal combustion residuals (CCR) impoundments designated as Ash Pond 1 (AP-1), Ash Pond 2 (AP-2), Ash Pond 3 (AP-3), and Ash Pond 4 (AP-4). AP-1 and AP-2 were constructed north of the river on the site property, proximal to a low-lying area associated with an unnamed western tributary to the Chattahoochee River (Western Tributary). Combined units AP-3 and AP-4 (AP-3/4) were constructed on the east side of the site over a former topographic high in the middle of the property and extending toward a former low-lying area associated with the unnamed eastern tributary to the Chattahoochee River (Eastern Tributary).

GPC has removed CCR from AP-2 and is currently in the process of closing AP-1 and AP-3/4. The planned closure strategy for each pond is as follows:

- AP-1, inactive since 1968, has a Subtitle D Compliant engineered turf system cover over CCR. The planned closure design includes an AEM fully surrounding subsurface vertical barrier wall from the ground surface to the top of partially weathered rock (PWR).

- AP-2 was closed by removal of CCR. CCR removed from AP-2 was placed within the final limits of AP-1 in September 2016. Additional CCR was removed in 2019 and CCR removal from AP-2 was certified in March 2020. AP-2's footprint has been graded to promote future land use and control stormwater runoff.

- AP-3/4 is currently undergoing closure by a combination of CCR excavation and closure-in-place over a consolidated footprint. AP-3/4 was used for dry ash stacking operation from 1995 until the plant conversion to natural gas was completed in 2012. CCR was removed from a line extending from 50 feet west of the existing stream diversion culvert beneath AP-3/4 to all points east of the culvert within AP-4 and was consolidated in the remaining AP-3/4 footprint. CCR was also removed from the areas in the northwest corner of AP-3 and consolidated in the remaining AP-3/4 footprint. The closure of AP-3/4 also includes an AEM Enhanced Underdrain, which extends below the base of CCR, and Temporary AEM Dewatering Wells. The AEM Enhanced Underdrain was engineered to lower the CCR potentiometric surface below the base of CCR.

Modeled elements of the closure design, including Temporary AEM Dewatering Wells, the Pond 2B sump, closure grading, and closure material types, are displayed in Figure 1-3. The following sections describe the Conceptual Site Model (CSM) and the groundwater flow model construction, calibration, and results, focusing on the vicinity of AP-3/4. Several appendices have been included to provide additional information concerning the model-specific conceptual site model (Appendix A), groundwater model construction and calibration (Appendix B), and empirical data supporting the model conclusions (Appendix C).

2.0 CONCEPTUAL SITE MODEL

Modeling for Plant McDonough consists of two complementary approaches, a CSM and a groundwater flow model. Each has a role in the current understanding and representation of past, current, and future hydrologic processes that comprise the hydrologic system within the site model domain. This report focuses on model efforts and results regarding AP-3/4.

The CSM represents hydrologic processes based on analysis and interpretation of a large hydrogeologic and climate dataset and forms the basis for the construction of the numerical flow model. Numerical model results combined with CSM interpretations are used to develop predictions of future closure design performance. Appendix A includes a summary of the site history, topography and climate, surface water, geology, and hydrogeology at Plant McDonough, which are discussed in greater detail in the HAR (WSP 2024). The information presented in Appendix A forms the basis of the CSM on which the 2024 Conditions (March 2024) steady-state groundwater model is based. Appendix A expands upon information in the HAR to provide justification for model features, model construction, and model parameterization (e.g., boundary conditions, model layering, etc.).

As described in Appendix A, the Site is in the rolling hills and narrow valleys of the Piedmont Physiographic Province of central Georgia. The climate is classified as a humid subtropical climate zone characterized by relatively hot summers and mild winters. The Chattahoochee River is the primary surface water feature in the study area, with multiple gaged tributaries. Near the Site, the eastern unnamed tributary to the Chattahoochee River (Eastern Tributary) drains a small upland catchment, is channelized into a conveyance pipe system underneath the previous footprint of AP-4 and emerges to the south where it flows to the Chattahoochee River. The western unnamed tributary to the Chattahoochee River (Western Tributary) drains a larger upland catchment, and flows around AP-1 to the west and south, before channelization under the Site access road and discharge into the Chattahoochee River.

As summarized in Appendix A and described in more detail in the HAR, site hydrogeology comprises a sequence of unconsolidated and bedrock units. CCR closure areas overlie residuum derived from completely weathered bedrock or alluvial deposits proximal to the Western and Eastern Tributaries. AP-3/4 also contains soil fill in the buttress area, above the AEM Enhanced Underdrain, extending to an elevation below the base of CCR. Partially Weathered Rock (PWR) underlies residuum and overlies bedrock. The upper 30 feet of bedrock exhibit variably enhanced permeability, potentially indicating some degree of localized fracture flow. Bedrock is comprised of Button Schist for most of the southern portion of the site, with Long Island Creek Gneiss present in the northwest area.

3.0 GROUNDWATER FLOW MODEL

Section 3 outlines the integration of the CSM into the construction of the numerical flow model, and a summary of model calibration. The construction, calibration and results of the groundwater flow modeling are described in greater detail in Appendix B.

3.1 Model Construction

A detailed description of the model construction is presented in Appendix B and summarized below. The six hydrogeologic units described in Section 2 (fill, CCR, residuum/alluvium, PWR, upper and lower bedrock) are represented numerically as a six-layer flow model. For the flow model, the study area is divided into a grid that is coarser (640 x 640-foot cells) away from the Site and finer (20 x 20-foot cells) near the Site where more detailed predictions are warranted. The active area (Area of Used Cells as shown on Figure 3-1) of the model extends to the sub watershed boundary. These boundaries also typically represent groundwater divides. Groundwater is not expected to flow across a groundwater divide, so areas outside the sub watershed boundary are not used in calculations. The objective of this approach is also to move the model boundaries far from the Site, so they do not artificially affect model predictions, commonly referred to as edge effects.

The recharge rates use regional climate data from the Western Regional Climate Center's (WRCC) Remote Automatic Weather Stations (RAWS) network. The Chattahoochee River is represented by river boundary conditions, which permit water to enter or leave the model according to a specified stage and conductance (Figure 3-2). Regional ponds are also represented by this type of boundary condition. The AEM Enhanced Underdrain, which extends below the base of CCR, is represented by drain boundary conditions, which permit flow to leave the subsurface if the stage rises above a threshold elevation. Tributary streams and adjoining wetlands are also represented as this type of boundary condition. Temporary AEM Dewatering Wells are added as boundary conditions near AP-3/4 in the 2024 Conditions (March 2024) version of the model to represent the temporary dewatering occurring at that time. A hydraulic flow barrier (HFB) is used to represent the proposed AEM hydraulic barrier wall around AP-1 in the Post-Closure model. As requested by GA EPD, an alternate version of the Post-Closure model is also constructed without the proposed barrier wall around AP-1 for purposes of understanding the effect, if any, on groundwater elevations at AP-2,3/4.

3.2 Model Calibration

Model calibration consists of successive refinement of model input data from initial estimates to improve the fit between observed and model-predicted results. Based on the CCR Permit Application Review Comments in the September 30, 2024, letter from the GA EPD (GA EPD, 2024), the 2024 Conditions model was calibrated in steady state to recent (March 2024) Site water level data.

The 2024 Conditions model calibration process consisted of manual and automated refinement of a variety of parameters, including hydraulic conductivity, boundary conditions, recharge, and drainage. Model calibration details are presented in Attachment B1 to Appendix B.

It should be noted that the selected calibration date of March 2024 represents a time when the AP-3/4 cover installation and water level drawdown below the base of CCR (via the Temporary AEM Dewatering Wells) were substantially complete, but water levels were still decreasing over time as a result of closure construction and on-going operation of the AEM Enhanced Underdrain and Temporary AEM Dewatering Wells. Thus, the calibrated model represents a snapshot in time during closure construction activities. To test the quality of the calibration, the 2024 Conditions model was validated by simulating AP-3/4 Pre-Closure conditions from August 2016 (the same time period the previous model [October 2020 (Golder 2020)] submitted to GA EPD was calibrated to) using calibrated aquifer parameters from the 2024 Conditions model.

The 2024 Conditions model meets industry standard calibration metrics (Anderson, Woessner and Hunt, 2015) for residual mean (RM; RM = -0.91 ft where the industry standard is near 0.0 ft), absolute residual mean (ARM; ARM = 2.94 ft where the industry standard is less than 10% of the observed head range [8.69 ft]), root mean square error (RMSE; RMSE = 3.76 ft where the industry standard is less than 10% of the observed head range [8.69 ft]), standard deviation (SD; SD = 3.66 ft where the industry standard is less than 10% of the observed head range [8.69 ft]), volumetric balance discrepancy (Md; Md = 0.00% where the industry standard is < 1%). These parameters are discussed in more detail in Attachment B1 to Appendix B.

Results of the validation to the August 2016 conditions indicate that the calibrated 2024 Conditions Model provides a reasonable basis for Site-specific predictive modeling. The simulated water levels from the August 2016 Validation Model, generated from the 2024 Conditions Model, closely match the observed August 2016 water levels. The August 2016 validation model meets the same industry standard calibration metrics as are used above to evaluate the 2024 Conditions Model. The validation is discussed in more detail in Attachment B1 to Appendix B.

4.0 GROUNDWATER FLOW MODEL RESULTS

This section summarizes groundwater flow modeling results. The 2024 Conditions model results are presented first, followed by Post-Closure model results. Two Post-Closure model scenarios are simulated per GA EPD comment documented in the CCR Permit Application Review Comments dated September 30, 2024 (GA EPD, 2024). The first Post-Closure simulation assumes an AEM hydraulic barrier wall is constructed at AP-1. The second Post-Closure simulation assumes an AEM hydraulic barrier wall would not be constructed at AP-1. Simulations with and without the AEM hydraulic barrier wall at AP-1 predict that the post-closure potentiometric surface will be below the base of CCR at AP-3/4. A detailed summary of 2024 Conditions and Post-Closure simulations with and without the AEM hydraulic barrier wall at AP-1 is presented in Appendix B.

The 2024 Conditions model focuses on simulation of site conditions from March 2024, with some calibration targets included from January 2024 for more complete data coverage. Simulated water table elevation contours are shown in plan-view on the left inset on Figure 4-1. Groundwater gradients at the Site mimic the general trends of topographic slopes. The overall groundwater flow pattern at the water table near AP-3/4 is from higher elevations toward lower elevations along drainage features. A local groundwater divide occurs within the footprint of AP-3/4, with groundwater predicted to flow towards AP-1, AP-2, and the Western Tributary to the southwest, towards the Eastern Tributary to the southeast, the AEM Enhanced Underdrain to the east, and toward the Chattahoochee River to the southeast (Figure 4-1). Simulated groundwater flow patterns for the 2024 Conditions model are consistent with the current site CSM, as shown in the potentiometric surface map for March 2024 (Attachment A1 to Appendix A).

Vertically downward flow occurs in groundwater recharge areas upgradient of the Site, and upward flow occurs near the Eastern and Western Tributaries and the Chattahoochee River. Flow between recharge and downgradient areas is sub-parallel to hydrostratigraphic unit contacts. The flow patterns are illustrated on a series of cross sections on Figures 4-2 through 4-5.

Predicted Post-Closure water table elevation contours are shown on the center and right insets on Figure 4-1. Groundwater in underlying residuum and PWR (Layers 3 and 4) is predicted to flow below AP-3/4, entering the areal footprint from the northwest and leave along eastern, southern, and southwestern portions of the footprint according to proximity of historical drainages. Some eastward flow is predicted to be captured by the AEM Enhanced Underdrain (756 ft NAVD88).

As with the 2024 Conditions model, vertically downward flow occurs in groundwater recharge areas upgradient of the site and upward flow occurs near Site tributaries and the Chattahoochee River in the Post-Closure Model. Flow between recharge and downgradient areas is sub-parallel to hydrostratigraphic unit contacts. Post Closure Model site-vicinity potentiometric contours are shown on hydrostratigraphic cross sections on Figures 4-2 through 4-5.

As shown in Figure 4-6 (left inset), the maximum simulated thickness of CCR below the potentiometric surface in March 2024 is limited to approximately 2.0 feet near the AEM Enhanced Underdrain and is predicted to decrease to zero thickness in Post-Closure (right inset of Figure 4-6). These predictions are supported by ongoing monitoring results showing water level decreases across AP-3/4, as discussed in the Water Level Drawdown Analysis (Appendix C). The closure design is predicted to lower the potentiometric surface below the bottom of the unit, thereby eliminating all groundwater flow through the unit.

5.0 SUMMARY OF GROUNDWATER MODEL REPORT

Key findings from model results are summarized as follows:

- Simulated groundwater flow patterns for the 2024 Conditions Model are consistent with the current site CSM. Upgradient groundwater follows the topographic divide to AP-3/4, then flows east and southwest to the site tributaries, and southeast toward the Chattahoochee River.
- The closure design is predicted to lower the potentiometric surface below the bottom of the unit, thereby eliminating all groundwater flow through the unit. This result for AP-2,3/4 is consistent with previous modeling results and is expected to be achieved and maintained following closure because the AEM Enhanced Underdrain is deeper than the base of CCR. Water levels measured in vibrating wireline piezometers and monitoring wells across AP-3/4 continue to decrease to below the base of CCR, supporting the model conclusions and the Water Level Drawdown Analysis (Appendix C).
- A fully encompassing barrier wall around AP-1 to the top of the PWR has a negligible effect on the potentiometric surface underneath AP-3/4, with the potentiometric surface still predicted to be below the bottom of the unit.

6.0 REFERENCES

Anderson, Woessner and Hunt, 2015. Applied Groundwater Modeling, 2nd Edition. Academic Press

Georgia Department of Natural Resources, Environmental Protection Division (GA EPD), 2024, Georgia Power Company – Plant McDonough – Atkinson AP -2, 3/4, Cobb County, APL 0338, CCR Permit Application Review Comments, GEOS Submittal 527742. Letter to Jennifer McNelly, Vice President of Environmental Affairs, September 30, 2024.

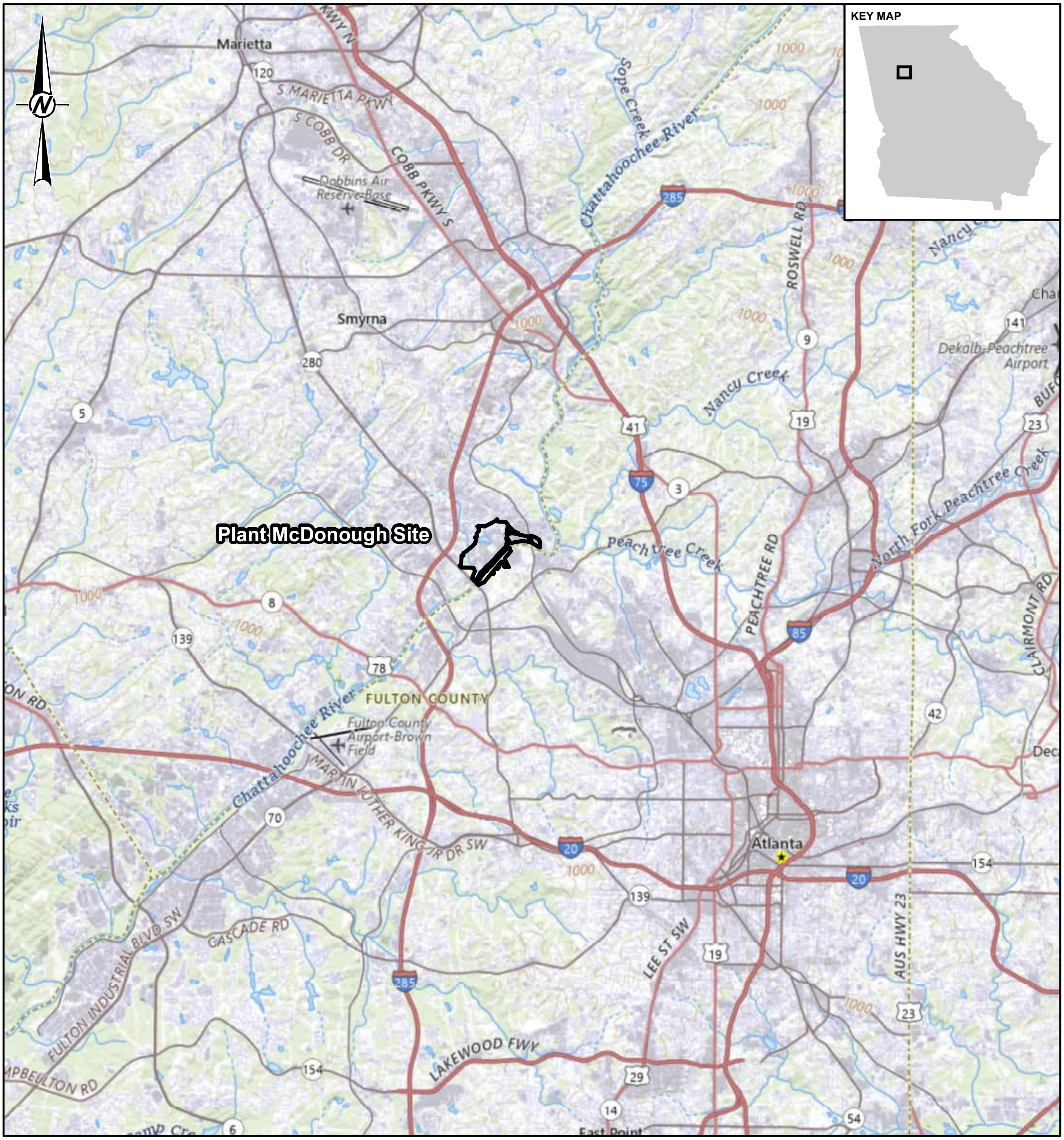
Golder, 2020. Hydrogeologic Assessment Report, Plant McDonough-Atkinson CCR Surface Impoundment (CCR Unit AP-1) Smyrna, Georgia, Part B Section 1 – Hydrogeological Assessment Report, Revision 02 – December 2020.

Golder, 2021. Hydrogeologic Assessment Report, Plant McDonough-Atkinson CCR Surface Impoundment (CCR Unit AP-2 and AP-3/4) Smyrna, Georgia, Part B Section 1 – Hydrogeological Assessment Report, Revision 03, September 2021.

WSP USA, Inc. 2023, Advanced Engineering Methods Feasibility Report, Plant McDonough Ash Pond 3, and Ash Pond 4 (AP-3/4), May 2023.

WSP USA, Inc., 2024, Plant McDonough-Atkinson CCR Surface Impoundment (CCR Unit AP-2 and AP-3/4) Smyrna, Georgia, Part B Section 1 – Hydrogeological Assessment Report, Revision 09 – December 2024.

Figures



LEGEND

Property Boundary

0 3 6

1 " = 3 mi MILES

REFERENCE(S)

1. BASEMAP FROM USGS THE NATIONAL MAP: NATIONAL BOUNDARIES DATASET, 3DEP ELEVATION PROGRAM, GEOGRAPHIC NAMES INFORMATION SYSTEM, NATIONAL HYDROGRAPHY DATASET, NATIONAL LAND COVER DATABASE, NATIONAL STRUCTURES DATASET, AND NATIONAL TRANSPORTATION DATASET; USGS GLOBAL ECOSYSTEMS; U.S. CENSUS BUREAU TIGER/LINE DATA; USFS ROAD DATA; NATURAL EARTH DATA; U.S. DEPARTMENT OF STATE HUMANITARIAN INFORMATION UNIT; AND NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION, U.S. COASTAL RELIEF MODEL. DATA REFRESHED AUGUST, 2021.

CLIENT

GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT

THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE

LOCATION MAP

CONSULTANT

YYYY-MM-DD	2024-12-19
DESIGNED	SJS
PREPARED	VMC
CHECKED	CB
REVIEWED / APPROVED	WG

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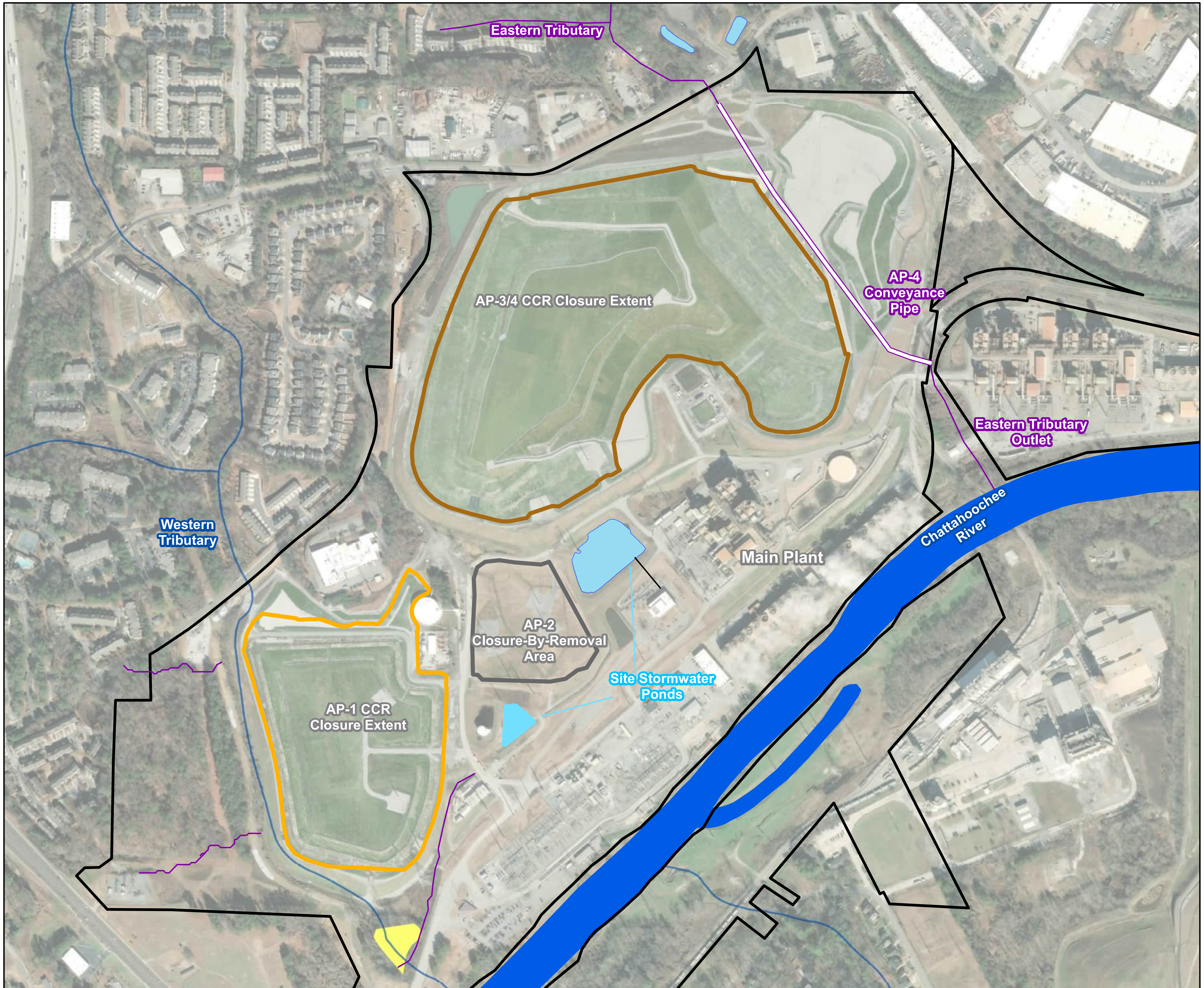

LEGEND

- Digitized Site Tributaries
- AP-4 Conveyance Pipe
- AP-3/4 CCR Closure Extent
- AP-1 CCR Closure Extent
- AP-2 Closure-By-Removal Area
- Property Boundary
- Digitized Water Bodies
- NWI Wetlands
- NHD Major Streams and Rivers
- NHD Lakes and Ponds
- NHD Level-12 Catchment Boundaries
- NHD Minor Streams

NOTE(S)
1. NHD: NATIONAL HYDROGRAPHIC DATASET.
2. NWI: NATIONAL WETLANDS INVENTORY.
3. USGS = UNITED STATES GEOLOGICAL SURVEY
4. CCR = COAL COMBUSTION RESIDUALS

REFERENCE(S)
1. AERIAL IMAGERY: ESRI AERIAL BASEMAP, 2024

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
SITE FEATURES MAP

CONSULTANT

YYYY-MM-DD	2024-12-10
DESIGNED	AFS
PREPARED	VMC
CHECKED	CB
REVIEWED / APPROVED	WG

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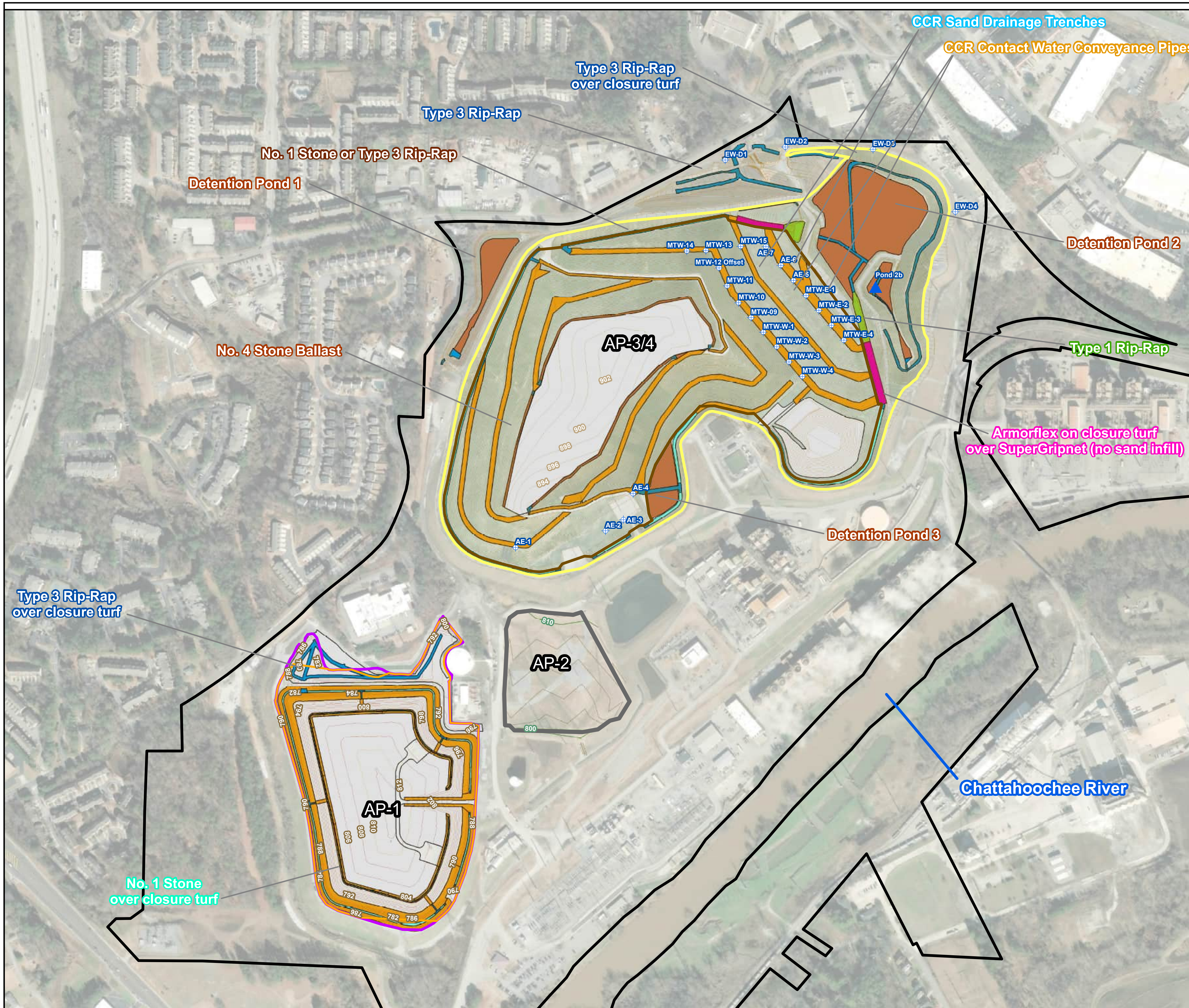

LEGEND

- Temporary Dewatering Wells
- Pond 2B Sump
- AP-2 Closure-By-Removal
- AP-3/4 AEM Enhanced
- Site Boundary
- AP-1 CCR Extent
- AP-1 Limits of the Low Permeability Cap
- AP 3/4 CCR Extent
- AP-3/4 Limits of the Low Permeability Cap

Closure Grading Elevation Contours

- 10 ft NAVD 88
- 2 ft NAVD 88

AP-3/4 Closure Type

- Armorflex on Closure Turf Over Supergripnet
- Closure Turf Over Supergripnet (See Note 1)
- Hydro Turf Over Supergripnet
- NO. 1 Stone or Type 3 Rip-Rap
- NO.4 Stone Ballast
- Type 1 Rip-Rap
- Type 3 Rip-Rap

AP-1 Closure Type

- Closure Turf
- Hydro Turf Over Supergripnet
- NO. 1 Stone Over Closure Turf
- Type 3 Rip Rap Over Closure Turf

N

0 250 500 750 1,000 1,250 1,500 Feet

1 inch = 500 feet

NOTE(S)

1. CCR = COAL COMBUSTION RESIDUALS.
2. NAVD88 = NORTH AMERICAN VERTICAL DATUM OF 1988

REFERENCE(S)

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
POST-CLOSURE MODEL DESIGN FEATURES

CONSULTANT

YYYY-MM-DD	2024-12-18
DESIGNED	SJS
PREPARED	AFS
CHECKED	CB
REVIEWED / APPROVED	WG

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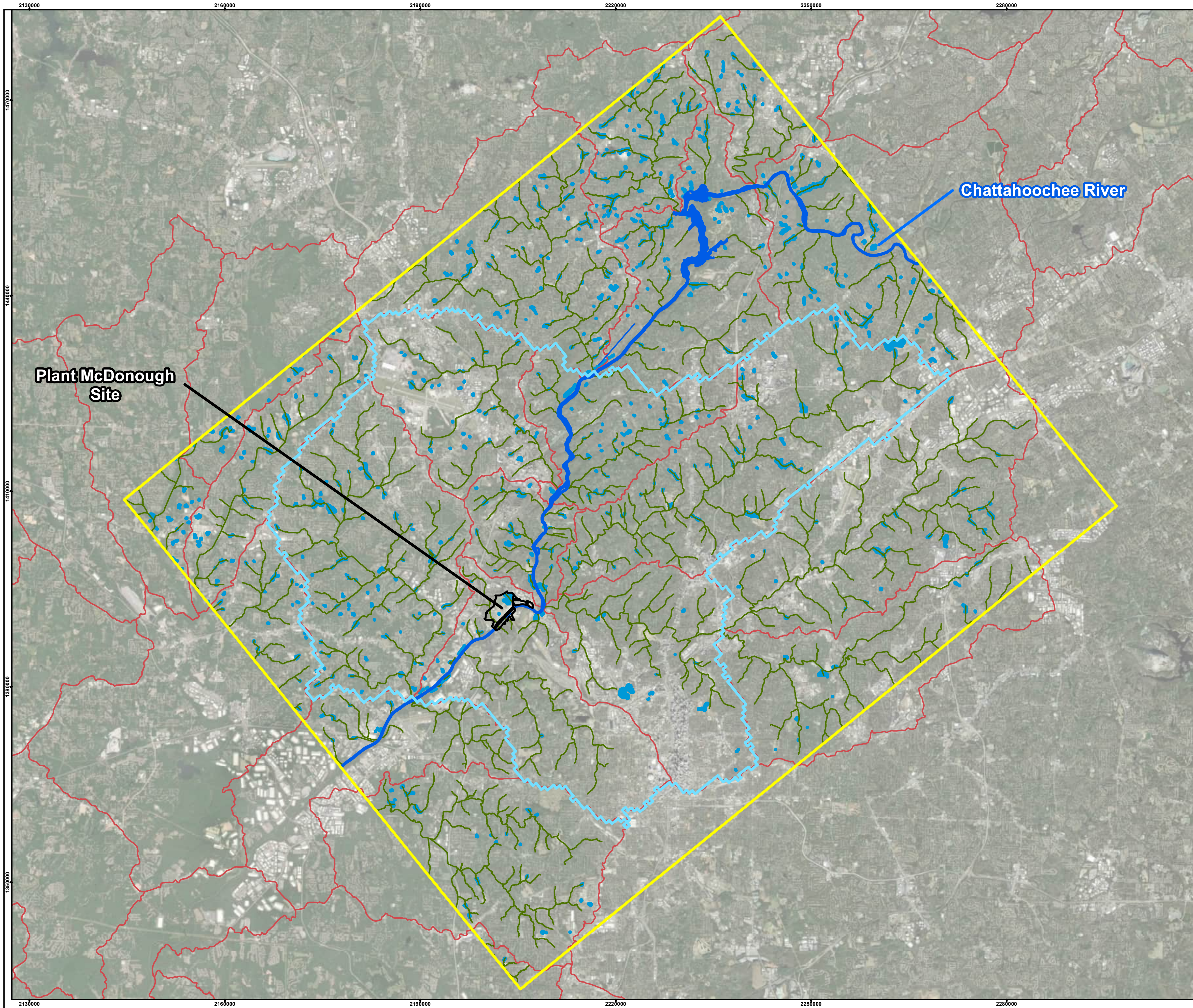

LEGEND

- Property Boundary
- Model Domain
- Area of Used Cells
- NHD Minor Streams
- NHD Major Streams and Rivers
- NHD Lakes and Ponds
- Subwatershed Boundary

N

0 15,000 30,000 45,000 Feet

1 inch = 15,000 feet

NOTE(S)

1. NHD = NATIONAL HYDROGRAPHY DATASET

REFERENCE(S)

1. AERIAL IMAGERY: ESRI AERIAL BASEMAP, 2024

CLIENT

GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT

THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE

MODEL DOMAIN AND REGIONAL HYDROLOGIC FEATURES

CONSULTANT

YYYY-MM-DD	2024-12-09
DESIGNED	AFS
PREPARED	RMO
CHECKED	CB
REVIEWED / APPROVED	WG

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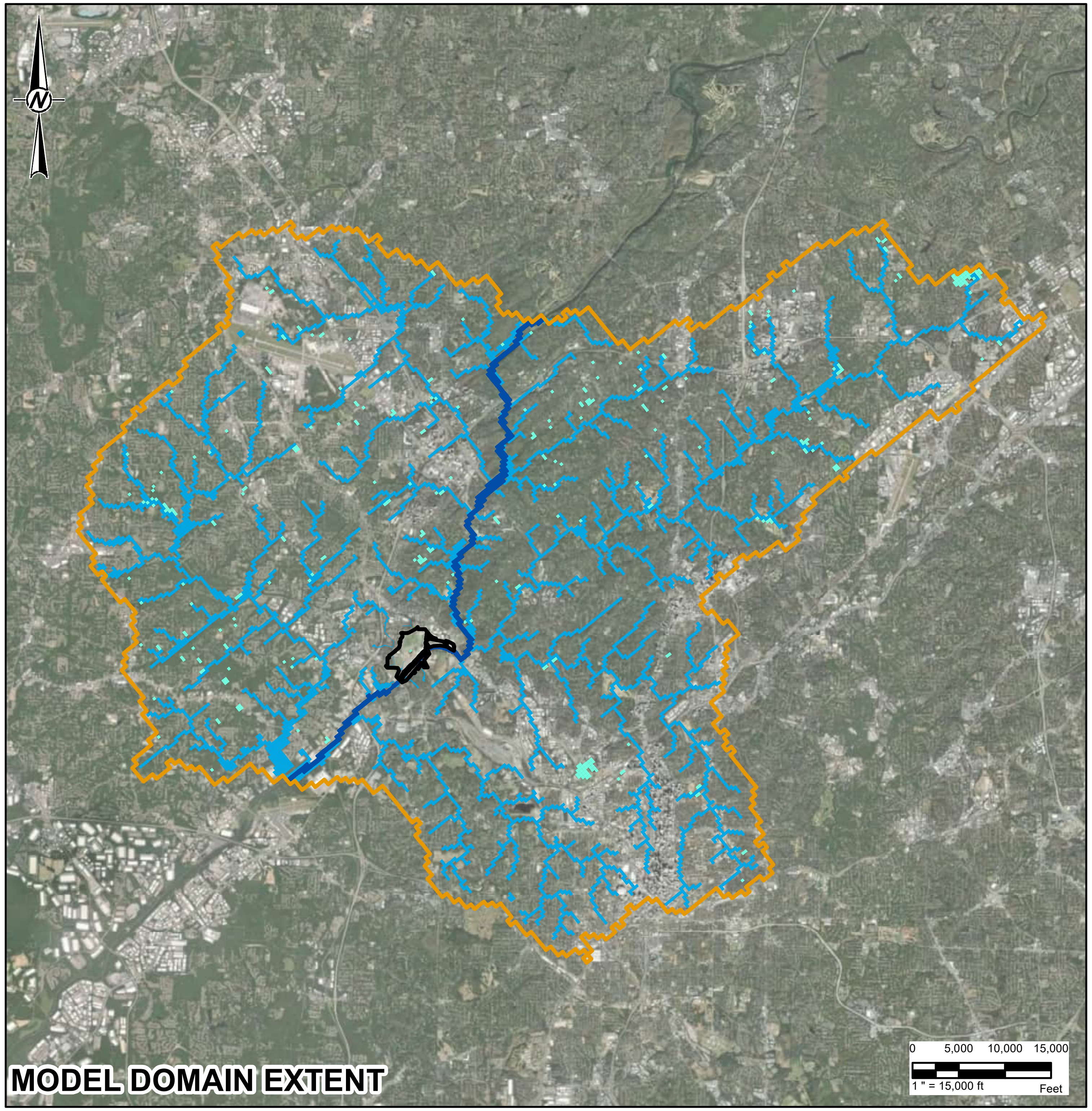

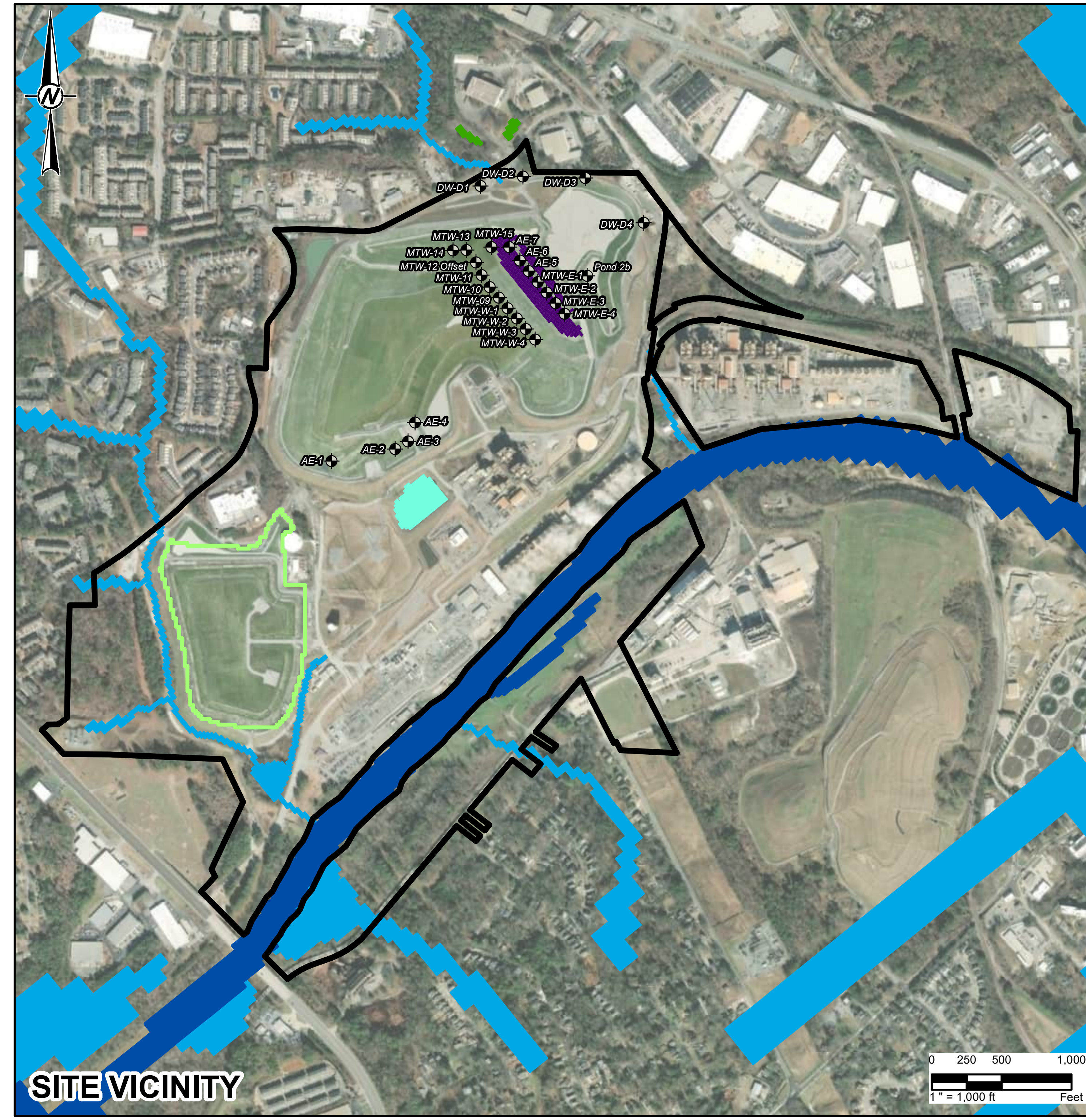

LEGEND

- Temporary AEM Dewatering Well
- AP-1 hydraulic barrier wall (HFB BC)
- Area of Used Cells
- Property Boundary
- AP-3/4 AEM Enhanced Underdrain (drain BC)
- Chattahoochee River (river BC)
- Regional seasonally-present ponds (river BC)
- Tributary streams (drain BC)
- Site-proximal intermittent ponds (drain BC)

NOTE(S)
1. BC = BOUNDARY CONDITION
2. HFB = HYDRAULIC FLOW BARRIER

REFERENCE(S)
1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

CONSULTANT

wsp

YYYY-MM-DD	2024-12-09
DESIGNED	AFS
PREPARED	VMC
REVIEWED	CB
APPROVED	WG

TITLE
MODEL BOUNDARY CONDITIONS

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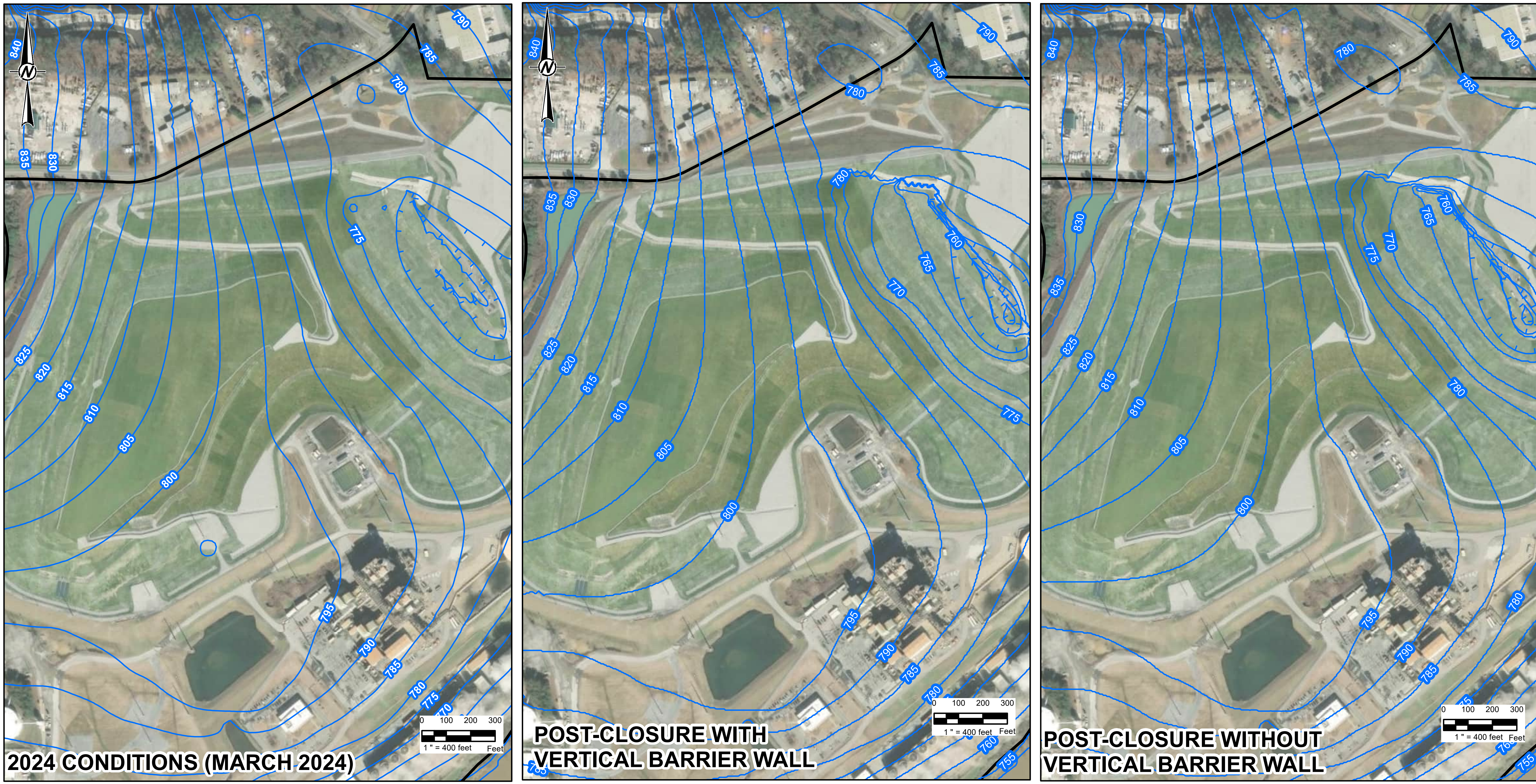

Legend

- Drawdown Hatchures
- Property Boundary
- Simulated Water Table (ft NAVD 88)
- Area of Used Cells

NOTE(S)
1. CONTOUR INTERVALS: 5 FT (REGIONAL EXTENT).
2. FT: FEET.
3. NAVD 88: NORTH AMERICAN VERTICAL DATUM OF 1988.
4. HACHURES INDICATE DEPRESSIONS IN THE POTENTIOMETRIC SURFACE, POINTING IN THE DOWNGRADIENT DIRECTION.

REFERENCE(S)
1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.

CLIENT	GEORGIA POWER COMPANY SOUTHERN COMPANY SERVICES
PROJECT	THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH
CONSULTANT	wsp
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DESIGNED	AFS
PREPARED	VMC
REVIEWED	CB
APPROVED	WG
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PROJECT NO.	US0037149.1670
SCS PROJECT ID.	MCD150170
REV.	0
FIGURE	4-1

LEGEND

- Cross Section Lines
- Property Boundary

0 400 800 1,200 Feet

1 inch = 400 feet

REFERENCE(S)

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.
2. INSET BASEMAP FROM USGS THE NATIONAL MAP: NATIONAL BOUNDARIES DATASET, 3DEP ELEVATION PROGRAM, GEOGRAPHIC NAMES INFORMATION SYSTEM, NATIONAL HYDROGRAPHY DATASET, NATIONAL LAND COVER DATABASE, NATIONAL STRUCTURES DATASET, AND NATIONAL TRANSPORTATION DATASET; USGS GLOBAL ECOSYSTEMS; U.S. CENSUS BUREAU TIGER/LINE DATA; USFS ROAD DATA; NATURAL EARTH DATA; U.S. DEPARTMENT OF STATE HUMANITARIAN INFORMATION UNIT; AND NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION, U.S. COASTAL RELIEF MODEL. DATA REFRESHED AUGUST, 2021.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

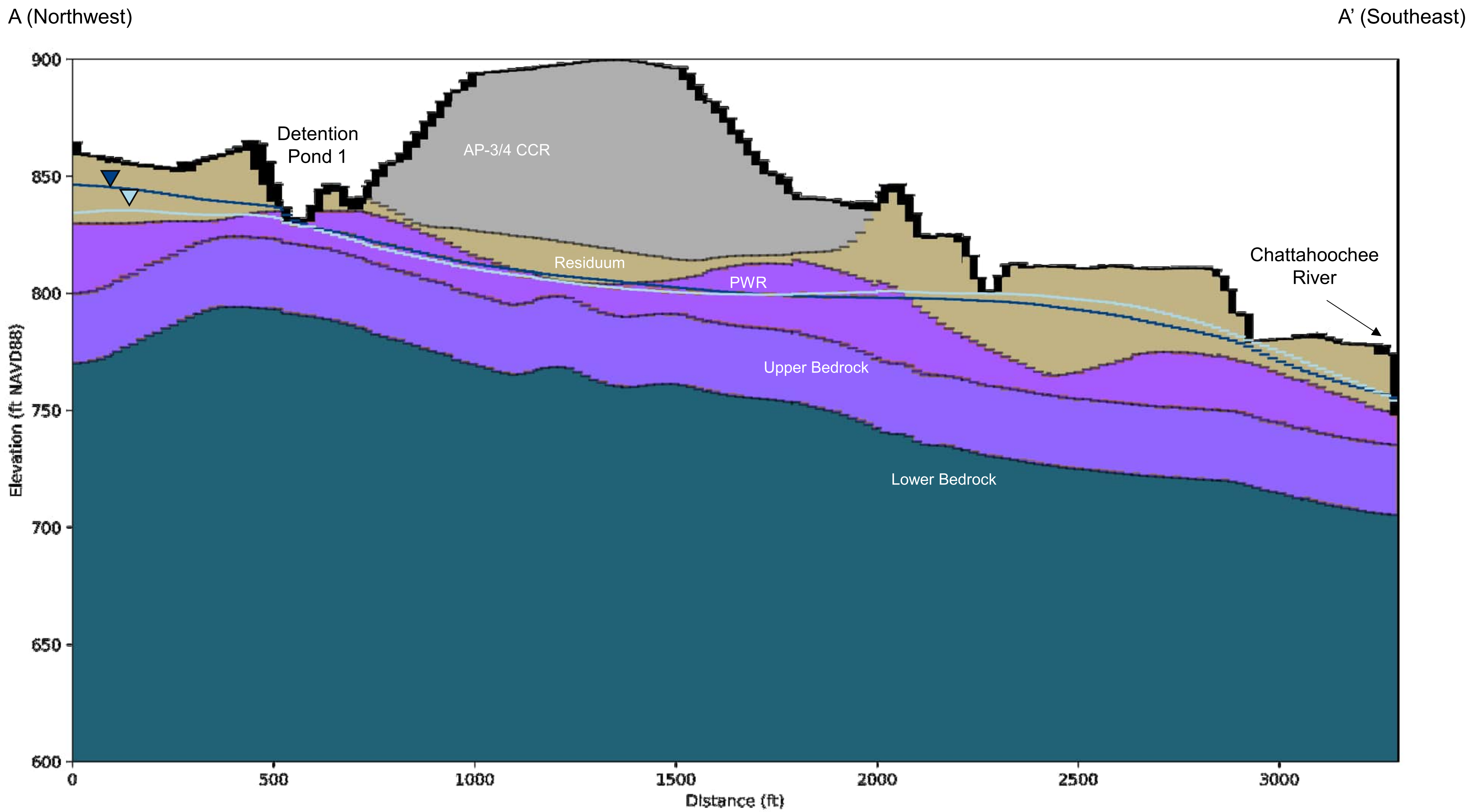
TITLE
MODEL CROSS SECTION LOCATION MAP

CONSULTANT

YYYY-MM-DD	2024-12-18
DESIGNED	SJS
PREPARED	VMC
CHECKED	CB
REVIEWED / APPROVED	WG

PROJECT NO.	SCS PROJECT ID	REV.	FIGURE
US0037149.1670	MCD150170	0	4-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



Key

- Unused Cells
- Layer 1 - Soil buttress over underdrain
- Layer 2 - CCR
- Layer 3 - Residuum
- 2024 Conditions Model water table
- Layer 4 - PWR
- Layer 5 – Upper Bedrock
- Layer 6 – Lower Bedrock
- Post-Closure Model water table

0 ft 500 ft

Note(s)

1. Ft = feet
2. NAVD88 = North American Vertical Datum of 1988.
3. CCR = Coal Combustion Residuals
4. PWR = Partially Weathered Rock

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

CONSULTANT

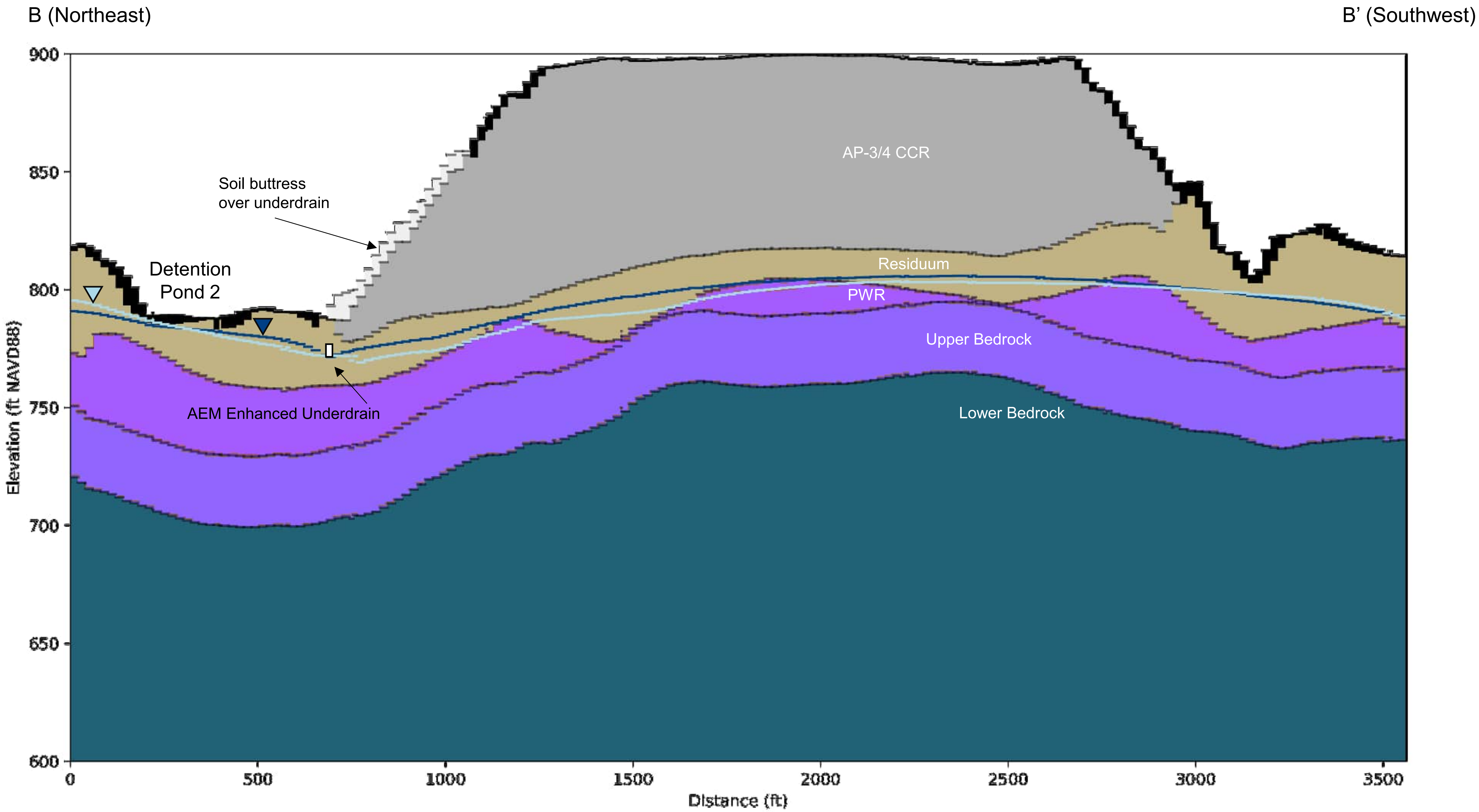
wsp

YYYY-MM-DD	2024-10-22
PREPARED	ITL
DESIGN	ITL
REVIEW	SJS
APPROVED	WG

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
AP-3/4 AREA POST-CLOSURE SIMULATED WATER LEVELS, SECTION A

PROJECT No.	SCS PROJECT ID	Rev	FIGURE
GL20142230	MCD150170	0	4-3



Key

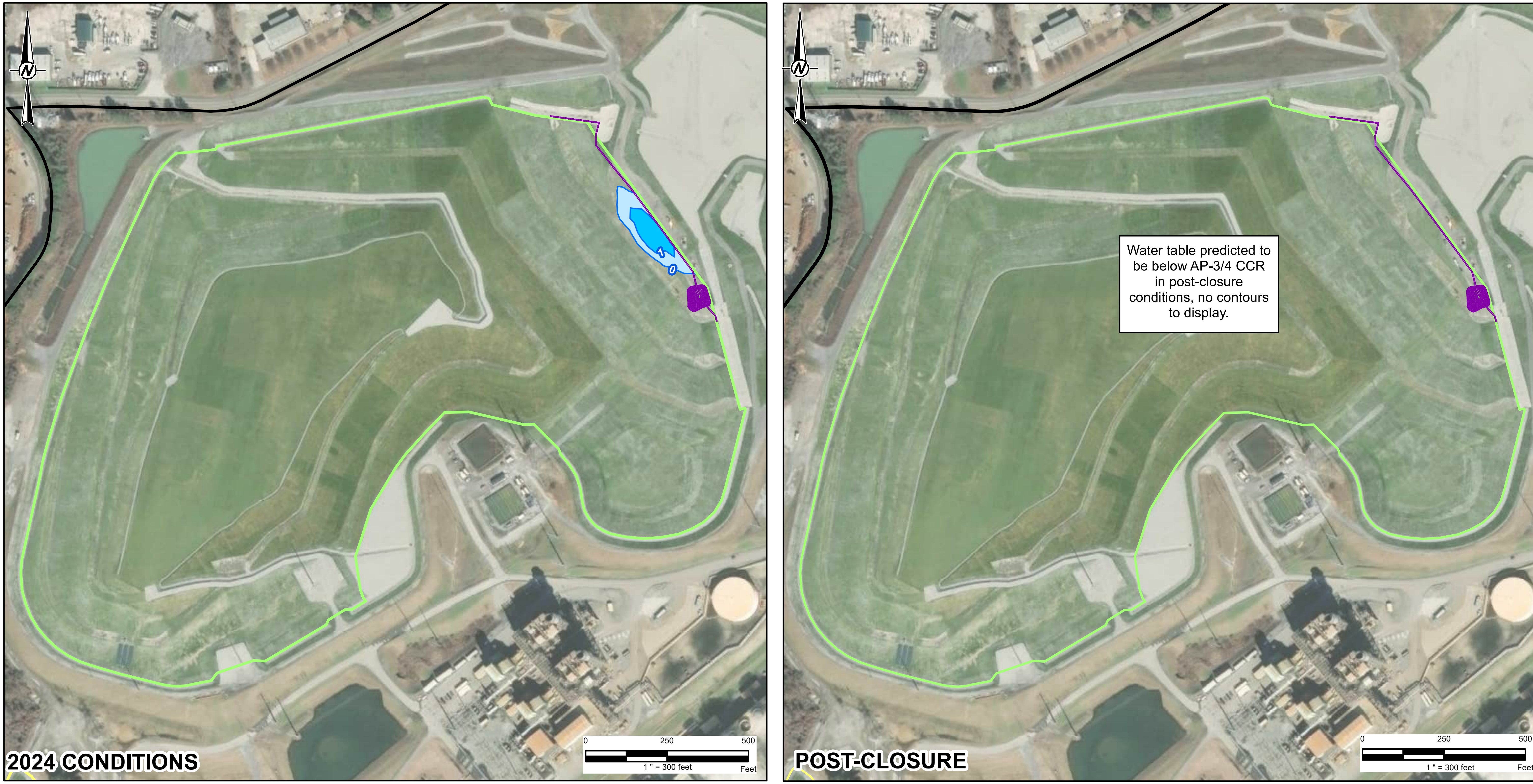
- Unused Cells
- Layer 1 - Soil buttress over underdrain
- Layer 2 - CCR
- Layer 3 - Residuum
- 2024 Conditions Model water table
- AEM Enhanced Underdrain
- Layer 4 - PWR
- Layer 5 – Upper Bedrock
- Layer 6 – Lower Bedrock
- Post-Closure Model water table

0 ft 500 ft

Note(s)

1. Ft = feet
2. NAVD88 = North American Vertical Datum of 1988.
3. CCR = Coal Combustion Residuals
4. PWR = Partially Weathered Rock

CLIENT GEORGIA POWER COMPANY SOUTHERN COMPANY SERVICES		PROJECT **THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH**	
CONSULTANT	YYYY-MM-DD	2024-10-22	TITLE **AP-3/4 AREA POST-CLOSURE SIMULATED WATER LEVELS, SECTION B**
wsp	PREPARED	ITL	
	DESIGN	ITL	
	REVIEW	SJS	
	APPROVED	WG	PROJECT No. GL20142230 · SCS PROJECT ID MCD150170 · Rev 0 · FIGURE 4-4



LEGEND

- Property Boundary
- AP 3/4 CCR Extent
- AP-3/4 AEM Enhanced Underdrain
- Thickness of CCR Below Potentiometric Surface (ft)
- 0 ft
- 1 ft

NOTE(S)
1. CCR = COAL COMBUSTION RESIDUALS
2. CONTOUR INTERVALS = 1 FOOT

REFERENCE(S)
1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

CONSULTANT

wsp

YYYY-MM-DD	2024-12-19
DESIGNED	AFS
PREPARED	VMC
REVIEWED	CB
APPROVED	WG

TITLE
AP-3/4 AREA SIMULATED POTENTIOMETRIC SURFACE BELOW BASE OF CCR

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
US0037149.1670	MCD150170	0	4-5

APPENDIX A

Conceptual Site Model

APPENDIX A

Conceptual Site Model

Plant McDonough-Atkinson Ash Pond 3 and Ash Pond 4 (AP-3/4)

Submitted to:

Georgia Power Company

241 Ralph McGill Blvd., Atlanta, Georgia 30341

Submitted by:

WSP USA Inc.

5170 Peachtree Road, Building 100, Suite 300 Atlanta, Georgia 30341

February 2025

Table of Contents

Tables

Figures

1.0 INTRODUCTION

The sections below include brief summaries of the site history, topography and climate, surface water, geology, and hydrogeology at Plant McDonough-Atkinson (Plant McDonough; Site; Figure A-1) and a brief description of MODFLOW's structure and operations to help connect the Conceptual Site Model (CSM) to the MODFLOW simulation. The CSM is discussed in greater detail in the Hydrogeological Assessment Report (HAR) Part B Section 1 (WSP, 2024). The information discussed in these sections form the basis of the CSM on which the 2024 Conditions and post-closure steady-state groundwater models are based. This report also includes rationale for incorporating hydrogeologic data into a numerical groundwater flow model. The groundwater flow model domain is shown on Figure A-1. The model domain area is a grid, fitted to and populated with site properties and boundary conditions.

1.1 Site History

Plant McDonough is owned and operated by the Georgia Power Company. The associated property occupies approximately 390 acres in southeast Cobb County, GA and is bounded to the southeast by the Chattahoochee River (Figure A-1). Coal generated power activities commenced circa 1963[1]. In 2012 Plant McDonough ceased coal-fired electric generating activities[2].

Plant McDonough has had four ash ponds (AP-1, AP-2, AP-3, and AP-4), the latter two of which were historically operated together, and are in the process of being closed together as a combined unit, AP-3/4. AP-1 is in the western limits of the site. AP-2 was east of AP-1 and south of AP-3/4. Most coal combustion residuals (CCR) were removed from AP-2 in 2016, and remnant CCR removal was completed in 2019. AP-3/4 is on a topographic high in the northeast portion of the site.

1.2 Simulating Groundwater Flow Under Plant McDonough

The 2024 Conditions Model presented here simulates *closure construction conditions* as of the March 2024 calibration date. The post-closure simulation includes additional boundary conditions to simulate post-closure, long-term, conditions.

The groundwater model program (a recent version of MODFLOW) is described in this CSM to explain why only pertinent natural systems are presented. This description is a simplification of the model code's complex calculations that rely on the physical findings of the multi-year site investigations. Surface hydrologic processes are also pertinent to the CSM and the groundwater model.

The Plant McDonough three-dimensional groundwater flow models predict aquifer heads, flow directions, and flow rates. An updated version of the United States Geologic Survey's groundwater flow model MODFLOW-USG (Panday, Langevin, Niswonger, Ibaraki, & Hughes, 2013a and b) called USG-Transport (Panday, 2021) was populated with parameters specific to the site and region including soil properties, rock properties, surface water features, and climatic conditions. The model has a 3-dimensional grid that is spatially referenced to the Georgia West State Plane Coordinate System. It has a grid origin (lower left corner of the model) that extends in the positive X, Y and Z directions. The beginning grid is coarsely spaced and populated with site data to allow adjustments before further refinement. Finer grids are then independently inserted into the coarse grid where

[1] History of Construction – Revision 01, 40 C.F.R. Part 257.73(c), CCR Unit Ash Pond 1 (AP-1) Plant McDonough, Georgia Power Company. September 2021.

[2] History of Construction – Revision 02, 40 C.F.R. Part 257.73(c), CCR Unit Ash Pond 3 (AP-3) and Ash Pond 4 (AP-4) Plant McDonough, Georgia Power Company, November 2021.

more detailed predictions are warranted (e.g., near Plant McDonough). The Z direction defines the presence and thickness of a hydrogeologic unit, which is generally assigned to one material type. Areas with the finer grid have this refinement from the uppermost model layer through the bottom layer. If geologic materials pinch out, the cell thickness threshold value for cell pinching is 0.1 foot throughout the model domain.

The MODFLOW family of models uses packages to define physical properties, define hydrogeologic boundaries, and provide a method to solve a set of groundwater flow equations. Earlier versions of this model used MODFLOW-2005 with NWT solver. This updated version uses a more up to date version called MODFLOW-USG by Sorab Panday. The following MODFLOW USG packages are populated with geologic, hydrogeologic, hydrologic and atmospheric data described in this CSM:

Basic (BAS) An indexing package to define the packages used in the model and the associated file number of each package. It also describes the locations of active and unused cells.	**Discretization (DIS)** An indexing package to define the existence of the grid's spatial and temporal arrangement. Steady-state or transient conditions are initialized in this package too. For unstructured grids it also includes a list of cell numbers and associated connections.
Layer Property Flow (LPF) A package that contains physical properties of hydrogeologic materials. Often this is further split into separate property files depending on model size. Properties used include grid cell dimensions and hydraulic conductivity.	**Horizontal-Flow Barrier (HFB)** This package is used only in the Post-Closure model to simulate a potential AP-1 barrier wall design installed in groundwater to control flow. It requires the wall to occur along the edges of model cells. It can appear as a jagged line if the subject wall is curved. Wall thickness, permeability, cell location, and cell wall face(s) are in the package file.
Recharge (RCH) Contains recharge data over a defined period.	**Well (WEL)** The well package is a specified flow boundary condition which is intended for simulating pumping wells. The model's well flow is calculated from the middle of a cell and assumes full penetration for the cell it is located in.
Drain (DRN) A simplified head-dependent boundary that only allows groundwater to flow out of a cell into ephemeral creeks, ditches, and constructed surfaces.	**River (RIV)** A package to invoke a head-dependent flow condition like the interaction of groundwater with a river, stream, creek, etc. Water can move into or out of an aquifer or surface water with this package.

2.0 SITE CHARACTERISTICS

2.1 Topography

Plant McDonough is located within the Piedmont Physiographic Province (Piedmont) of central Georgia, which is characterized by gently rolling hills and narrow valleys, with locally pronounced linear ridges. AP-3/4 is on highest topography on the Site. However, there is higher topography surrounding the Site that is simulated in the model domain. The higher topography affects groundwater flow surrounding the Site and groundwater model simulations of groundwater elevation and flow in the Site vicinity.

Overall, the property slopes gently south towards the Chattahoochee River. The groundwater model domain is shown in Figure A-1. Topographic relief near the site ranges from less than 750 feet referenced to North American Vertical Datum of 1988 (ft NAVD 88) near the tributaries and river to greater than 840 ft NAVD 88 near the center of the property, as shown in Figure A-2.

2.2 Conceptual Model Area Geology

This section presents an overview of features discussed in the HAR (WSP, 2024) and their corresponding representation in the groundwater flow model. Plant McDonough is within the Piedmont Physiographic Province (Piedmont) of the southeastern Appalachian Mountains chain. Piedmont strata are high-grade metamorphic rocks, including gneisses, schists, pegmatites, amphibolites, and mylonite. The general bedrock geology of the domain is shown in Figure A-3. Metamorphic rocks typically form a fracture controlled dendritic drainage pattern. Streams to the north of the Chattahoochee River mainly have rectangular and trellis drainage styles indicating geologic control of the drainage. To the south of the Chattahoochee River, streams form a dendritic drainage pattern indicative the streams developed independently of the underlying geology. The overall depth of weathering in the Piedmont geologic province is variable (Miller 1990, LeGrand 2004), with saprolite thickness reaching up to 150 feet. Alluvial deposits are also present along streams and rivers (Higgins, 1968).

2.2.1 Site Geology and Model Structure

As discussed in the HAR (WSP, 2024), available boring and monitoring well installation logs were reviewed to improve the understanding of subsurface conditions at the site Extensive drilling and hydraulic testing in the project area shows that geologic materials are primarily composed of the following lithologies:

- **Coal Combustion Residual (CCR)** – The CCR (model layer 2) comprises fly ash, bottom ash, and mixed ash of varying thickness and spatial distribution within the footprints of AP-1 and AP-3/4 and overlies residual soil/saprolite material. Pore-pressure dissipation tests conducted in finer-grained materials within the CCR indicate that lower-end estimates of hydraulic conductivity range from 0.0003 to 0.496 ft/day (Figures A-4 and A-5). Based on model calibration, a higher hydraulic conductivity value was used in the model for CCR, which is justified because pore-pressure dissipation testing focused on lower permeability material within the CCR.

- **Residuum** - Residual soils, upper saprolite and lower saprolite (collectively referred to as residuum in this report; model layer 3) overlie partially weathered rock (PWR; model layer 4). The thickness of the residuum encountered in the borings is variable, ranging from a minimum of approximately 14 feet to as much as 67 feet, with an average residuum thickness of about 39 feet. Residuum primarily comprises clayey/sandy silt, sandy silt with clay, and silty sand (increasing with depth), and occurs as a variably thick blanket across most of the site. Slug tests conducted in residuum range from 0.057 to 9.68 ft/day, indicating heterogeneity of the materials (Figures A-4, A-6 and A-7). As described in Appendix B, this hydraulic conductivity range is appropriate for the screened lithologies in slug tested wells.

- **Partially Weathered Rock (PWR)** – PWR (model layer 4) is defined locally by weathered rock conditions with Standard Penetration Test (SPT) blow counts that exceed 50 blows per 6 inches. This blow count criteria in combination with visual observations of samples, the depth of bedrock, and professional judgement were used for identifying the top of the PWR zone as shown on the cross-sections on Sheets GW-3a through GW-3j of the HAR (WSP, 2024). This unit generally retains relict rock fabric patterns from underlying units and represents a transitional weathering zone between residuum and upper bedrock. The thickness of PWR varies from 0.3 to 30 feet in the vicinity of the site. Slug and packer tests place hydraulic conductivity in the range of 0.134 to 2.57 ft/day and 0.007 to 2.24 ft/day, respectively, in a similar range as residuum (Figure A-4 and A-8). As described in Appendix B, this hydraulic conductivity range is appropriate for the screened lithologies in hydraulically tested wells. The elevation of the top of the PWR unit is shown on Figure A-9 and includes data from drilling conducted through May 2023 (WSP, 2024).

- **Igneous and metamorphic bedrock groups** – Bedrock in the vicinity of the site comprises two metamorphic units: the Long Island Creek Gneiss and the Button Schist as shown on Figure A-3. Slug and packer testing in upper bedrock (generally the uppermost 30 feet) indicate variable hydraulic conductivity, with values ranging from 0.010 to 49.95 ft/day and 0.009 to 1.64 ft/day, respectively. Lower bedrock exhibits fewer zones of secondary permeability, with slug test producing values of 0.002 to 0.19 ft/day (Figures A-10 and A-11). As described in Appendix B, this hydraulic conductivity range is appropriate for the screened lithologies in hydraulically tested wells. The interpreted site-vicinity top-of-bedrock surface is shown on Figure A-12, and likewise contains data from recent May 2023 drilling (WSP, 2024).
- **Long Island Creek Gneiss (OZli)**: a medium- to coarse-grained; felsic rock (biotite gneiss) that yields light-colored soil northwest of the faulted contact at the Plant [Sheet GW-4 of the HAR (WSP, 2024)]. Foliation is moderately well-developed and contains an augen texture, locally intruded by granitic pegmatites that are commonly unsheared.
- **Button Schist (with Phyllonite, Mylonite, and Mylonitic Biotite Gneiss) (OZbs)**: Consists of metamorphic rocks interlayered on a scale of inches, feet, and tens of feet. Located at the Plant southeast of the faulted contact.
  - *Button schist* - Fine sericite, muscovite, quartz, and feldspar; with medium- to coarse-grained muscovite forming distinctive “eyes”, and a well-developed shear foliation.
  - *Phyllonite* - Fine recrystallized muscovite along schistose surfaces, formed by dislocation (shearing) metamorphism.
  - *Mylonite* - Sericite, quartz, and feldspar, extremely fine-grained, with a poorly developed foliation.
  - *Mylonitic biotite gneiss* - Biotite, quartz, and feldspar, very fine-grained, with a well-developed shear foliation.

Alluvial deposits were historically mapped near the site as shown on Figure A-13; however, these deposits were not identified in historical geotechnical borings at the Site. These geologic units are discussed in the HAR. The units are conceptualized in the model by assigning each geologic unit to an applicable model layer. A correlation of HAR units and model geologic units is presented in Table A-1.

Project area geology includes a former fault that was a ductile shear zone in bedrock. The fault is one of several regional faults that were formed at significant depth within the crust, enduring intense ductile deformation while forming in a high pressure, low temperature environment.

2.3 Climate

Plant McDonough lies within a humid subtropical climate zone characterized by relatively hot summers and mild winters. To characterize the water balance associated with the local climate in sufficient detail for flow modeling, WSP accessed records compiled by the Western Regional Climate Center (WRCC) for three stations in the vicinity of Atlanta Georgia (Figure A-14). To best align with the numerical flow model conceptualization, climate details were focused on the month of March 2024 and included the WRCC stations at Dallas, Dawsonville, and

Watkinsville, Georgia. Graphs of monthly precipitation and evapotranspiration for all three climate stations are presented on Figure A-15. Each graph contains the monthly values from the preceding year for completeness.

2.3.1 Precipitation

The total March 2024 precipitation at each WRCC station is summarized in Table A-2, and ranges from 6.01 to 7.13 inches (average = 6.54 inches for the month or 0.018 ft/d). These values are also consistent with those observed at the Nancy Creek and Woodall Creek USGS gauges in the conceptual model area, which were 6.67 and 6.75 inches, respectively. Due to the similarity of the values between the WRCC and USGS stations, and the additional inclusion of evapotranspiration estimates in the WRCC database, the precipitation data from the WRCC stations were used in the update of the site numerical flow model. These data were used to calculate a net recharge value for the MODFLOW RCH Package.

2.3.2 Evapotranspiration

The Penman estimate of evapotranspiration was also compiled for each WRCC station and ranged from 3.33 to 4.18 inches in the month of March 2024 (average = 3.87; Table A-2). The average difference between precipitation and the Penman evapotranspiration is 2.67 inches (0.01 ft/day), which typically provides an upper estimate of net recharge in that it does not account for surface runoff. Evapotranspiration rates are expected to vary between different vegetation and land-use types. Subsequent groundwater model calibration refined the net recharge (defined here as precipitation minus runoff and ET) estimates in the conceptual model area.

2.4 Surface Water

Lakes, rivers, ponds, streams, and wetlands are present in the Model Domain Area (Figure A-16) and represent areas of potential groundwater and surface water interaction. These features have been conceptualized in the groundwater flow model as river or drain boundary conditions. Additional detail for feature assignment to MODFLOW boundary conditions are described in the following sections.

2.4.1 Rivers and Streams

The Chattahoochee River (6^{th} order stream, Strahler system) is the primary natural surface water feature in the Domain and generally flows southwestwards with gradient of 2.07 feet per mile (ft/mi), based on the USGS Digital Elevation Model (i.e., 8.9 ft/4.29 mi for Chattahoochee River measured between USGS station gage ID 02336000 and 02336490). The closest active USGS gaging station is 1,000 feet southwest of Plant McDonough (USGS Station ID: 02336490), with an average flow of 4,990 cubic feet per second (CFS) during the month of March 2024. A bathymetric survey was conducted by Alden Research Laboratory, Inc. (ALDEN, 2015) in 2014 for the reach of the Chattahoochee River adjacent to the site, with bedform elevations as low as 730.01 ft; (Figure A-17). Stream bathymetry influences simulated interactions of groundwater with the river in the groundwater flow model. Appendix B includes descriptions on how river boundary conditions are used to simulate the Chattahoochee River.

An unnamed perennial creek (2^{nd} order stream, Strahler system) joins the Chattahoochee River south of AP-1 in the site vicinity (the Western Tributary). The Western Tributary originally flowed through a historical channel in the footprint of the current AP-1 area and was rerouted into an engineered stream channel that now flows parallel and adjacent to the western and southern boundary of AP-1. The Western Tributary is simulated using the MODFLOW drain package because of its influence on groundwater flow on site. Appendix B includes descriptions on how drain boundary conditions are used to simulate the Western Tributary.

A second unnamed creek (2nd order stream, Strahler system; the Eastern Tributary) flows south through a corrugated metal pipe slip lined with a fiberglass reinforced plastic stream diversion culvert in the AP-3/4 area. The diversion inlets north of AP-3/4 and outlets southeast of AP-3/4, then flows towards the Chattahoochee River. This creek was simulated using MODFLOW's drain package to represent the creek influence on groundwater flow in the vicinity of the AP-3/4 area.

Additional streams throughout the Domain are gauged by the USGS and were used in the numerical conceptualization of the flow model, as summarized in Appendix B.

2.4.2 Regional Ponds and Lakes

The USGS inventoried ponds, lakes, and other water bodies throughout the Domain in the National Hydrography Dataset (NHD). Each mapped NHD water body was compared to historical and current aerial imagery, to ascertain the long-term presence of each feature, identify locations where aerial geometries differed from the NHD dataset, and to identify any previously unmapped water bodies. Following this comparison, the dataset was updated accordingly (Figure A-16). Regional ponds and lakes and the on-site stormwater pond near the administration building are simulated using river boundary conditions. Two intermittent stormwater ponds off the northeast corner of the Site are simulated using drain boundary conditions. The surface water stage at these locations was estimated from a high-resolution USGS digital elevation model (USGS, 2024).

2.4.3 Wetlands

The National Wetlands Inventory (NWI; U.S. Fish and Wildlife Service, 2024) was used to identify wetlands in the Domain, with results shown on Figure A-16. Most wetland areas are proximal to tributary streams, and potentially serve as hydrologic sinks for ground and surface water. The wetlands are simulated using the MODFLOW drain package because of their influence on groundwater flow on site. Appendix B includes descriptions on how drain boundary conditions are used to simulate wetlands.

2.4.4 Stormwater Management Ponds

Two unnamed stormwater ponds are located directly to the east of AP-2 in Area & Outfall 47 of the NPDES Industrial Stormwater General Permit (IGP) for Plant McDonough, GAR050000. The northern-most pond is represented with river boundary conditions. The southern-most pond was dry in March 2024 and is not explicitly included in the model as a boundary condition. Appendix B includes descriptions on how river boundary conditions are used to simulate the northern-most stormwater pond.

2.5 Conceptual Model Area Hydrogeology

The hydrogeology of the Domain is influenced by a complex interplay between climate, topography, surface water, and geology. Publicly available data are combined with the site hydrogeologic database to provide the basis for the hydrogeologic conceptualization described in this section.

Overall, within the Domain groundwater flows from upland recharge areas at higher elevations, discharging to ponds and streams at lower elevations. Preferential flow may occur in joints, fractures, and faults. The following sections discuss the major hydrogeologic units identified in the site vicinity.

2.5.1 Uppermost Groundwater

Boring logs and monitoring well/piezometer installation logs were used to evaluate site hydrostratigraphy, with water level data from piezometers used to enhance the understanding of hydraulic gradients and flow directions (Figure A-18). The screened interval for most of the piezometers and monitoring wells (Figure A-19) targets the uppermost aquifer which occurs within the residuum, PWR, and upper bedrock depending on topographic location.

According to water level measurements collected during Q1 2024 from wells and piezometers screened in the residuum, PWR, and upper bedrock, the water table elevation ranges between approximately 830.73 ft NAVD88 at upgradient well DGWA-71 to approximately 743.88 ft NAVD88 at downgradient well B-100 (Table A-3).

The groundwater flow pattern interpreted using the Q1 2024 elevation data is consistent with previous observations. As illustrated on geologic cross-sections A to C (Figures 4-2 through 4-6 of the main modeling report), the water table surface is a subdued reflection of topography at the site, with groundwater generally flowing towards the Chattahoochee River and the eastern and western tributary streams. The top of rock surface also generally follows topography and likely controls groundwater flow direction in the residuum and PWR units.

Closure activities influence the hydraulic gradient in the northeast area of AP-3/4, where flow migrates towards the Temporary AEM Dewatering Wells and the AP-3/4 AEM Enhanced Underdrain.

Multi-year dewatering trends are present in vibrating-wire piezometer (VWP) sensor records for locations P1 through P7 in the AP-3/4 buttress area. Statistical forecasting methods indicate that the potentiometric surface is projected to drop below the base of CCR by mid-2025 (Appendix C).

2.5.2 Bedrock Groundwater System

The bedrock groundwater system is divided into a shallow and deep interval on the basis of boring logs and aquifer testing. The upper 30 feet of bedrock is underlain mostly by less-weathered Button Schist. Boring logs indicate that some areas, in particular topographic highs, correlate with bedrock that is resistant to weathering and massive (i.e., few discontinuities); consequently, flow in lower bedrock is likely not well developed or interconnected in these areas. Preferential groundwater flow is anticipated along structural discontinuities.

Groundwater flow in the fractured bedrock is simulated as an equivalent porous media, where both primary and secondary porosity features of the rock matrix are simulated with a gradient of hydraulic conductivity realizations, as opposed to attempting to simulate groundwater flow through discrete fractures. While groundwater in the bedrock aquifer is generally located within secondary porosity features, the residuum, PWR and upper bedrock at the site are generally uniform from a hydraulic conductivity perspective. Under these circumstances, the equivalent porous media approach provides a commonly applied, practical approach in MODFLOW for simulating hydrostratigraphic units which may contain fractures and/or heterogeneities.

3.0 CONCLUSIONS

Groundwater near Plant McDonough is generally stored and transmitted through residuum, partially weathered rock, and upper bedrock units, and to a lesser degree the lower bedrock. Groundwater generally flows from upland recharge areas toward lower-elevation surface water features, including the two unnamed, onsite tributaries, and the proximal reach of the Chattahoochee River. Water levels are also locally influenced by engineered elements, including the AEM Enhanced Underdrain, Temporary AEM Dewatering Wells, and a low-permeability cover. The engineering elements have reduced the water table in the vicinity of AP-3/4 to near or below the base of CCR.

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APPENDIX A – CONCEPTUAL SITE MODEL

Tables

Table A-1
Model Layer Summary

HAR Stratigraphy	2020 Closure Model and 2021 Closure Addendum Model		2024 Post-Closure Model	
	Steady state model calibrated to August 2016 conditions		Steady state model calibrated to March 2024 conditions	
Layer	*Layer*	*Number*	*Layer*	*Number*
CCR	CCR	**1**	Engineered Fill	**1**
			CCR	**2**
Residuum	Residuum	**2**	Residuum / alluvium	**3**
PWR / TWR	PWR	**3**	PWR	**4**
Upper Bedrock	Bedrock	**4**	Upper Bedrock	**5**
Lower Bedrock			Lower Bedrock	**6**
--	Total layer count = 4		Total layer count = 6	

<u>Note</u>

Created by: WEG 2024-11/27
Checked by: CAB 2024-11/27

Table A-2

Climate Station Summary

Source	Station	Precipitation (in)	Precipitation (ft/day)
WRCC	Dallas	6.14	0.0435
WRCC	Dawsonville	7.13	0.0505
USGS	Nancy Creek	6.67	0.0472
WRCC	Watkinsville	6.01	0.0425
USGS	Woodall Creek	6.75	0.0478

Source	Station	Evapotranspiration (in)	Evapotranspiration (ft/day)
WRCC	Dallas	4.09	0.0280
WRCC	Dawsonville	3.33	0.0228
WRCC	Watkinsville	4.18	0.0286

Note

Evapotranspiration and Precpitation are monthly totals for each station.

Created by:	ITL 2024-10-01
Checked by:	SJS 2024-10-04

Table A-3
First Quarter 2024 Synoptic Water Levels

Name	Easting	Northing	Screen Midpoint Elevation (ft NAVD88)	Location	Water Elevation (ft NAVD88)
B100	2202242.1	1390254.8	735.5	Site	743.9
B101D	2204168.2	1394063.6	751.3	Site	787.1
B102D	2204200.4	1393828.4	741.2	Site	789.3
B103D	2202614.4	1391543.5	728.8	Site	782.3
B104D	2202298.5	1391318.3	730.3	Site	780.8
B105D	2201831.9	1390634.5	711.0	Site	761.3
B106D	2203869.2	1394327.1	749.1	Site	785.2
B107D	2202596.4	1392334.5	740.5	Site	798.7
B108D	2202312.5	1392156.1	744.4	Site	797.4
B109D	2202127.0	1393957.5	753.4	Site	810.1
B110D	2200736.0	1391294.4	706.7	Site	755.6
B111D	2202956.4	1394303.4	709.9	Site	781.1
B112D	2200664.1	1391564.2	716.4	Site	758.7
B113D	2200719.2	1391564.2	679.4	Site	756.5
B115D	2202580.7	1391264.6	712.2	Site	767.0
B116D	2200611.0	1390483.7	721.1	Site	765.2
B117D	2201727.3	1393963.8	791.5	Site	830.1
B118	2200449.7	1391219.3	735.2	Site	756.1
B119D	2200446.6	1391236.4	704.8	Site	759.7
B120D	2202436.4	1394047.2	770.0	Site	800.3
B122D	2202975.4	1390992.8	702.5	Site	746.7
B123D	2202608.4	1391234.4	643.9	Site	768.2
B125D	2202580.7	1394111.6	681.7	Site	797.5
B16	2203315.4	1392595.1	785.2	Site	789.4
B18	2202875.5	1392521.0	796.5	Site	801.9
B24	2201450.0	1392479.9	746.0	Site	798.6
B25	2201502.7	1392813.3	784.1	Site	822.2
B26	2201550.4	1393105.6	806.7	Site	825.8
B28	2201679.2	1391967.4	749.3	Site	785.0
B29	2201422.0	1391890.0	764.4	Site	787.1
B3	2202411.5	1394045.1	803.3	Site	800.3
B31	2200928.5	1392034.3	755.2	Site	763.5
B41	2201751.9	1390920.8	738.0	Site	769.8
B50	2201841.0	1391657.1	779.4	Site	786.1
B51	2200906.5	1390501.2	703.3	Site	753.2
B52	2201314.8	1392308.3	776.4	Site	791.6
B54	2203140.7	1394423.5	753.8	Site	778.6
B55	2204147.9	1394142.6	776.9	Site	798.7
B56	2204187.8	1393957.9	781.4	Site	795.4
B57	2202736.9	1391396.3	741.0	Site	769.1
B58	2202426.5	1391125.7	745.7	Site	769.0
B59	2203001.1	1394349.1	760.3	Site	779.2
B6	2203266.5	1394419.5	756.5	Site	778.6
B60	2202881.6	1391100.7	734.9	Site	750.6

Table A-3
First Quarter 2024 Synoptic Water Levels

Name	Easting	Northing	Screen Midpoint Elevation (ft NAVD88)	Location	Water Elevation (ft NAVD88)
B61	2202505.8	1390957.8	732.5	Site	761.9
B62	2201811.2	1389828.1	725.7	Site	744.2
B63	2202978.1	1390999.1	736.8	Site	747.8
B64	2203031.3	1394381.9	761.1	Site	778.8
B65	2204050.8	1394381.2	782.9	Site	800.9
B66	2204277.5	1393858.2	763.3	Site	797.0
B68	2200714.2	1391298.2	746.0	Site	754.9
B7	2203596.1	1394374.6	786.3	Site	781.5
B72	2200723.9	1391242.2	741.6	Site	755.4
B73	2200697.5	1391352.4	748.5	Site	755.1
B74	2200665.3	1391279.8	745.7	Site	755.2
B76	2202756.9	1390717.4	733.0	Site	744.9
B77	2202942.0	1390948.7	740.1	Site	747.8
B78	2202958.2	1394328.2	763.3	Site	779.5
B79	2203223.0	1394458.6	756.3	Site	779.9
B80	2203533.9	1394372.6	777.3	Site	781.2
B81	2203741.1	1394364.9	773.5	Site	781.6
B82	2204258.1	1393750.0	768.0	Site	794.9
B83	2202695.6	1390735.5	733.5	Site	745.8
B84	2202241.9	1390411.9	732.5	Site	745.7
B85	2203134.5	1394433.4	753.5	Site	778.8
B86	2203206.6	1394480.0	755.5	Site	780.8
B87	2203531.3	1394401.9	763.7	Site	781.4
B88	2203738.3	1394401.1	750.0	Site	780.7
B89	2204049.4	1394398.4	778.1	Site	796.1
B90	2203212.6	1394501.0	755.8	Site	780.9
B91	2203123.9	1394447.1	753.5	Site	778.7
B92	2203026.7	1394392.7	765.7	Site	779.2
B93	2202946.7	1394348.7	765.3	Site	780.7
B94	2203513.7	1394402.0	759.6	Site	781.2
B95	2203167.7	1394518.6	756.3	Site	780.9
B96	2203099.3	1394478.7	757.2	Site	779.2
B97	2203008.3	1394430.0	760.3	Site	781.4
B98	2202934.0	1394392.5	775.8	Site	782.1
B99	2203084.5	1394524.2	772.8	Site	779.2
CHAT_R_I285	2212730.5	1419504.9	777.2	USGS	783.3
CHAT_R_ATL	2209222.9	1403938.5	750.4	USGS	754.9
CHAT_R_GA280	2201317.4	1388769.8	736.6	USGS	743.7
CHAT_R_OAKDALE	2198819.2	1387127.9	740.0	USGS	740.6
DGWA53	2201668.8	1393472.8	818.7	Site	829.9
DGWA70A	2200591.6	1390481.4	751.9	Site	767.0
DGWA71	2201714.8	1393963.3	822.8	Site	830.7
DGWC10	2204201.1	1393818.3	780.9	Site	793.8
DGWC11	2204166.2	1393547.1	754.3	Site	787.3

Table A-3
First Quarter 2024 Synoptic Water Levels

Name	Easting	Northing	Screen Midpoint Elevation (ft NAVD88)	Location	Water Elevation (ft NAVD88)
DGWC12	2204128.3	1393149.4	751.5	Site	765.5
DGWC121	2200849.4	1390739.7	719.8	Site	755.4
DGWC13	2204084.6	1392881.1	752.9	Site	759.6
DGWC14	2204013.3	1392574.2	760.9	Site	771.6
DGWC15	2203679.0	1392544.1	759.8	Site	782.9
DGWC17	2203051.0	1392645.6	795.0	Site	798.5
DGWC19	2202601.0	1392342.6	788.5	Site	798.7
DGWC2	2202119.5	1393958.0	804.6	Site	819.3
DGWC20	2202315.6	1392164.5	785.7	Site	798.8
DGWC21	2202063.5	1392067.5	749.9	Site	796.6
DGWC22	2201791.9	1392126.3	759.0	Site	793.7
DGWC23	2201582.0	1392239.7	760.9	Site	798.3
DGWC37	2200919.8	1390482.2	729.4	Site	752.7
DGWC38	2201148.6	1390362.7	735.0	Site	748.0
DGWC39	2201540.1	1390303.6	741.2	Site	752.9
DGWC4	2202662.4	1394171.5	772.4	Site	789.3
DGWC40	2201825.9	1390625.7	746.7	Site	761.0
DGWC42	2201870.2	1391327.8	757.1	Site	773.9
DGWC47	2202610.5	1391553.8	770.9	Site	780.5
DGWC48	2202290.2	1391314.6	760.6	Site	773.6
DGWC5	2202965.1	1394306.3	764.0	Site	779.7
DGWC67	2200830.7	1390953.8	715.7	Site	756.9
DGWC68A	2200734.9	1391301.2	741.0	Site	755.1
DGWC69	2200657.1	1391585.0	744.7	Site	758.0
DGWC8	2203882.1	1394322.2	780.4	Site	786.5
DGWC9	2204170.0	1394055.9	797.2	Site	790.7
ET1	2203124.5	1394347.0	775.9	Site	771.9
EWD1	2203002.8	1394309.5	751.2	Site	779.3
EWD2	2203307.1	1394375.8	739.3	Site	751.9
EWD3	2203753.5	1394363.7	757.2	Site	781.9
EWD4	2204171.7	1394045.5	765.4	Site	769.6
NANCY_CR_NANCY_CR	2244773.4	1420169.8	856.0	USGS	856.9
NANCY_CR_LAKE_FOREST	2229556.9	1409346.3	820.0	USGS	824.4
NANCY_CR_PLANTATION	2254382.9	1420963.8	900.0	USGS	901.0
NANCY_CR_JOHNSON	2242395.4	1417902.8	837.5	USGS	842.7
NANCY_CR_RANDALL	2218352.3	1404154.2	778.0	USGS	778.8
NANCY_CR_RICKENBACKER	2232166.7	1407521.4	810.3	USGS	811.8
NANCY_CR_WESTWESLEY	2213806.8	1396304.8	753.7	USGS	756.0
NANCY_CR_WIEUCA	2234190.9	1407820.5	845.0	USGS	849.2
NANCY_CR_WOOD	2221355.9	1399863.8	850.0	USGS	852.8
NICKAJACK_CR_COOPER	2185440.6	1397482.3	789.8	USGS	802.4
NICKAJACK_CR_US78	2188830.5	1383685.7	748.2	USGS	749.9
P1_VW1_759ft_Corrected	2203551.4	1393246.2	759.0	Site	770.1
P1_VW2_794ft	2203551.4	1393246.2	794.0	Site	794.0

Table A-3
First Quarter 2024 Synoptic Water Levels

Name	Easting	Northing	Screen Midpoint Elevation (ft NAVD88)	Location	Water Elevation (ft NAVD88)
P1_VW3_779ft	2203551.4	1393246.2	779.0	Site	778.7
P2_VW1_759ft	2203644.9	1393352.6	759.0	Site	768.4
P2_VW2_782ft	2203644.9	1393352.6	782.0	Site	782.0
P3_VW1_803ft	2203339.9	1393495.3	803.0	Site	803.0
P3_VW2_770ft	2203339.9	1393495.3	770.0	Site	778.6
P3_VW3_781ft_corrected	2203339.9	1393495.3	781.0	Site	780.4
P4_VW1_774ft_corrected	2203447.6	1393586.5	774.0	Site	774.0
P4_VW2_751ft	2203447.6	1393586.5	751.0	Site	771.2
P5_VW1_775ft_corrected	2203125.7	1393778.8	775.0	Site	777.4
P5_VW2_785ft_corrected	2203125.7	1393778.8	785.0	Site	785.1
P5_VW3_815ft	2203125.7	1393778.8	815.0	Site	815.6
P6_VW1_763ft_corrected	2203245.0	1393855.9	763.0	Site	771.1
P6_VW2_781ft_corrected	2203245.0	1393855.9	781.0	Site	780.9
P7_VW1_803ft	2202695.0	1393847.3	803.0	Site	803.7
P7_VW2_783ft	2202695.0	1393847.3	783.0	Site	796.1
PEACHTREE_CR_BROOKDALE	2224796.0	1392173.9	800.0	USGS	802.5
PEACHTREE_CR_ATL	2223398.5	1389761.4	764.1	USGS	766.7
PEACHTREE_CR_GA236	2233480.4	1390032.5	810.0	USGS	813.5
PROCTOR_CRFRANCIS	2214140.0	1373741.9	813.8	USGS	829.6
PROCTOR_CR_HORTENSE	2213341.6	1373654.9	816.1	USGS	819.0
PROCTOR_CR_JACKSON	2203157.0	1380415.3	758.8	USGS	762.3
PROCTOR_CR_SPRING_ST	2204767.0	1379794.0	807.1	USGS	816.7
PROCTOR_CR_TRIB3	2216334.1	1373534.1	790.0	USGS	790.0
ROTTONWOOD_CR_INTERSTATE	2208213.2	1416626.6	820.3	USGS	822.7
ROTTONWOOD_CR_FRANKLIN	2197685.7	1428774.3	918.2	USGS	929.4
ROTTONWOOD_CR_I285	2208571.6	1416016.2	820.0	USGS	822.7
VWP01	2200852.0	1391742.3	766.2	Site	766.2
VWP02	2200916.6	1391705.4	767.3	Site	767.3
VWP03	2200965.7	1391820.9	767.9	Site	767.9
VWP04	2200985.7	1391741.5	769.6	Site	769.6
VWP05	2201042.5	1391736.7	771.8	Site	771.8
WOODALL_CR	2213984.8	1390270.1	756.2	USGS	756.9
WT1	2200716.1	1391864.0	758.3	Site	757.4
WT2	2200601.6	1391573.6	755.0	Site	754.6
WT3	2200645.9	1391464.9	753.4	Site	752.1
WT4	2200809.9	1390644.0	750.0	Site	748.8
WT5	2201092.4	1390350.5	747.5	Site	746.7
WT6	2201383.1	1390178.1	745.1	Site	743.4
WT7	2201557.4	1389944.3	744.0	Site	742.7
pond2b	2203765.5	1393666.4	772.0	Site	760.8

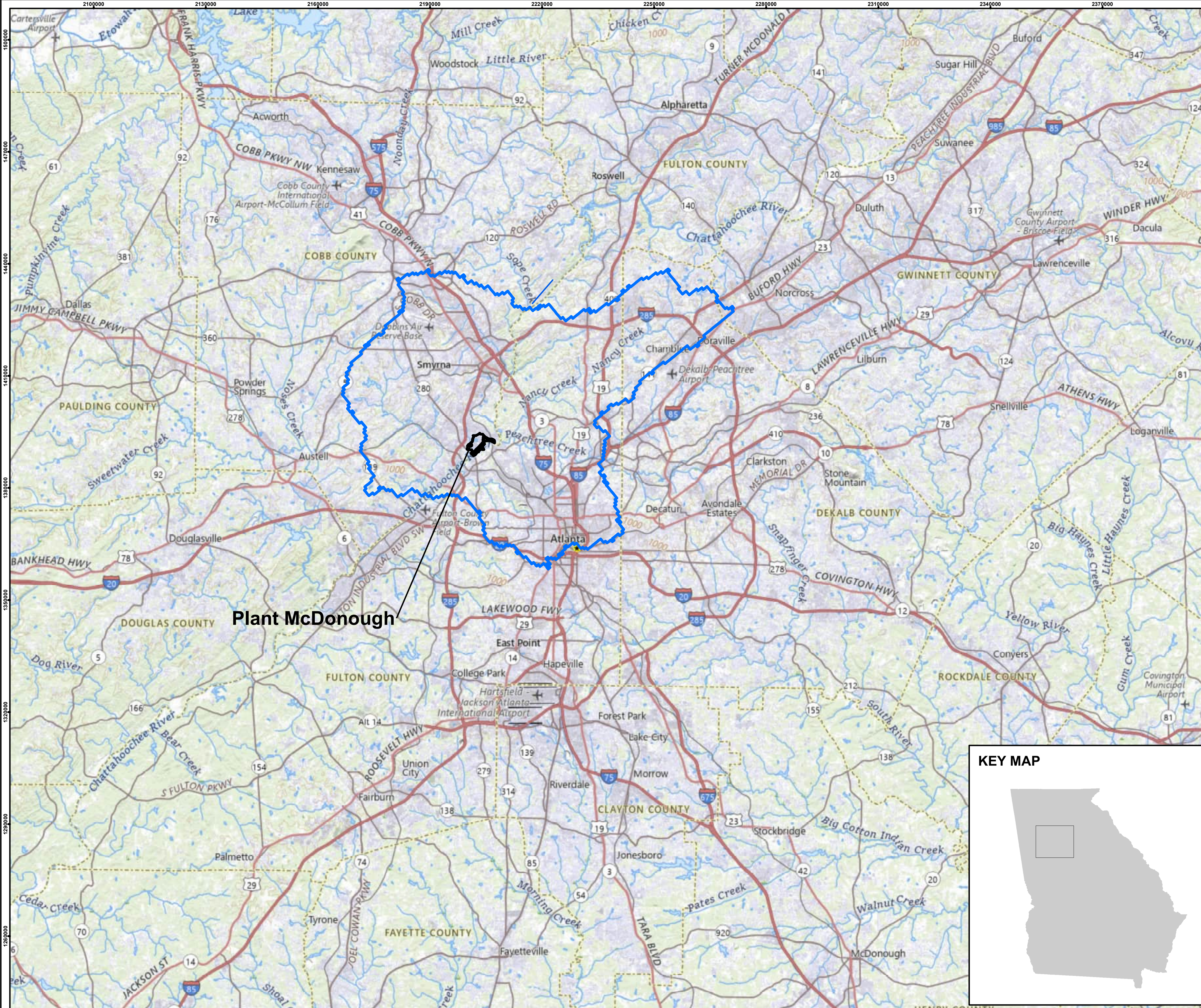
Created by: ITL 2024-10-01
Checked by: SJS 2025-02-14

Notes:

1. USGS = United States Geological Survey staff gauge

APPENDIX A – CONCEPTUAL SITE MODEL

Figures



LEGEND

- Site Boundary
- Study Area

N

0 5 10 15 Miles

1 inch = 5 miles

REFERENCE(S)

1. AERIAL IMAGERY: ESRI AERIAL BASEMAP, 2024
2. INSET BASEMAP FROM USGS THE NATIONAL MAP: NATIONAL BOUNDARIES DATASET, 3DEP ELEVATION PROGRAM, GEOGRAPHIC NAMES INFORMATION SYSTEM, NATIONAL HYDROGRAPHY DATASET, NATIONAL LAND COVER DATABASE, NATIONAL STRUCTURES DATASET, AND NATIONAL TRANSPORTATION DATASET; USGS GLOBAL ECOSYSTEMS; U.S. CENSUS BUREAU TIGER/LINE DATA; USFS ROAD DATA; NATURAL EARTH DATA; U.S. DEPARTMENT OF STATE HUMANITARIAN INFORMATION UNIT; AND NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION, U.S. COASTAL RELIEF MODEL. DATA REFRESHED AUGUST, 2024.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

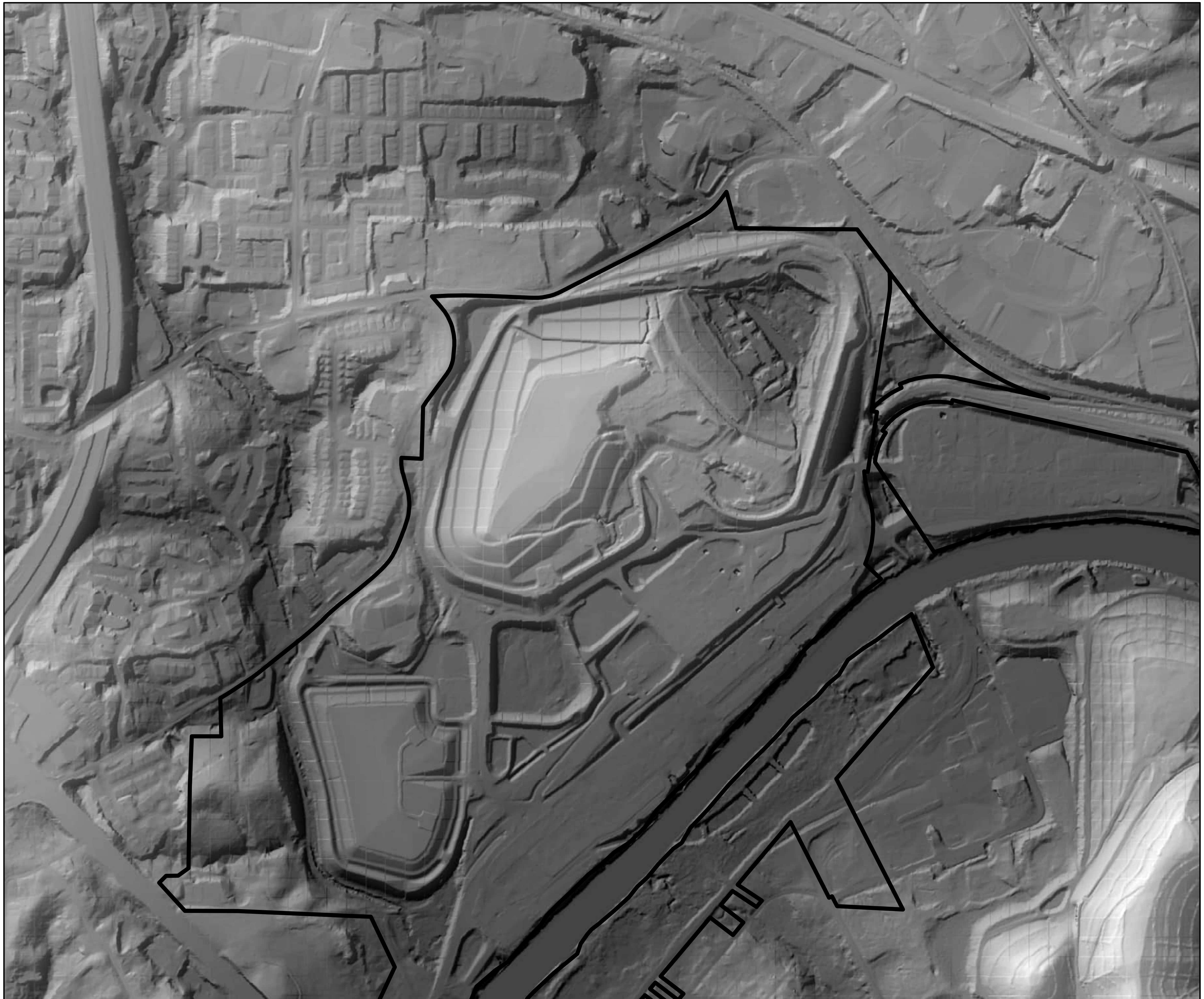
TITLE
LOCATION MAP

CONSULTANT

YYYY-MM-DD	2024-12-09
DESIGNED	AFS
PREPARED	AFS
CHECKED	SJS
REVIEWED / APPROVED	WEG/CB

PROJECT NO.	SCS PROJECT ID	REV.	FIGURE
US0037149.1670	MCD150170	0	A-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



LEGEND

Property Boundary

Topographic Elevation (ft NAVD88)

Value

High : 954.009

Low : 747.312

NOTE(S)

1. FT: FEET
2. NAVD88: NORTH AMERICAN VERTICAL DATUM 1988

REFERENCE(S)

1. AERIAL IMAGERY: ESRI AERIAL BASEMAP, 2024
2. INSET BASEMAP FROM USGS THE NATIONAL MAP: NATIONAL BOUNDARIES DATASET, 3DEP ELEVATION PROGRAM, GEOGRAPHIC NAMES INFORMATION SYSTEM, NATIONAL HYDROGRAPHY DATASET, NATIONAL LAND COVER DATABASE, NATIONAL STRUCTURES DATASET, AND NATIONAL TRANSPORTATION DATASET; USGS GLOBAL ECOSYSTEMS; U.S. CENSUS BUREAU TIGER/LINE DATA; USFS ROAD DATA; NATURAL EARTH DATA; U.S. DEPARTMENT OF STATE HUMANITARIAN INFORMATION UNIT; AND NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION, U.S. COASTAL RELIEF MODEL. DATA REFRESHED AUGUST, 2024.

CLIENT

GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT

THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

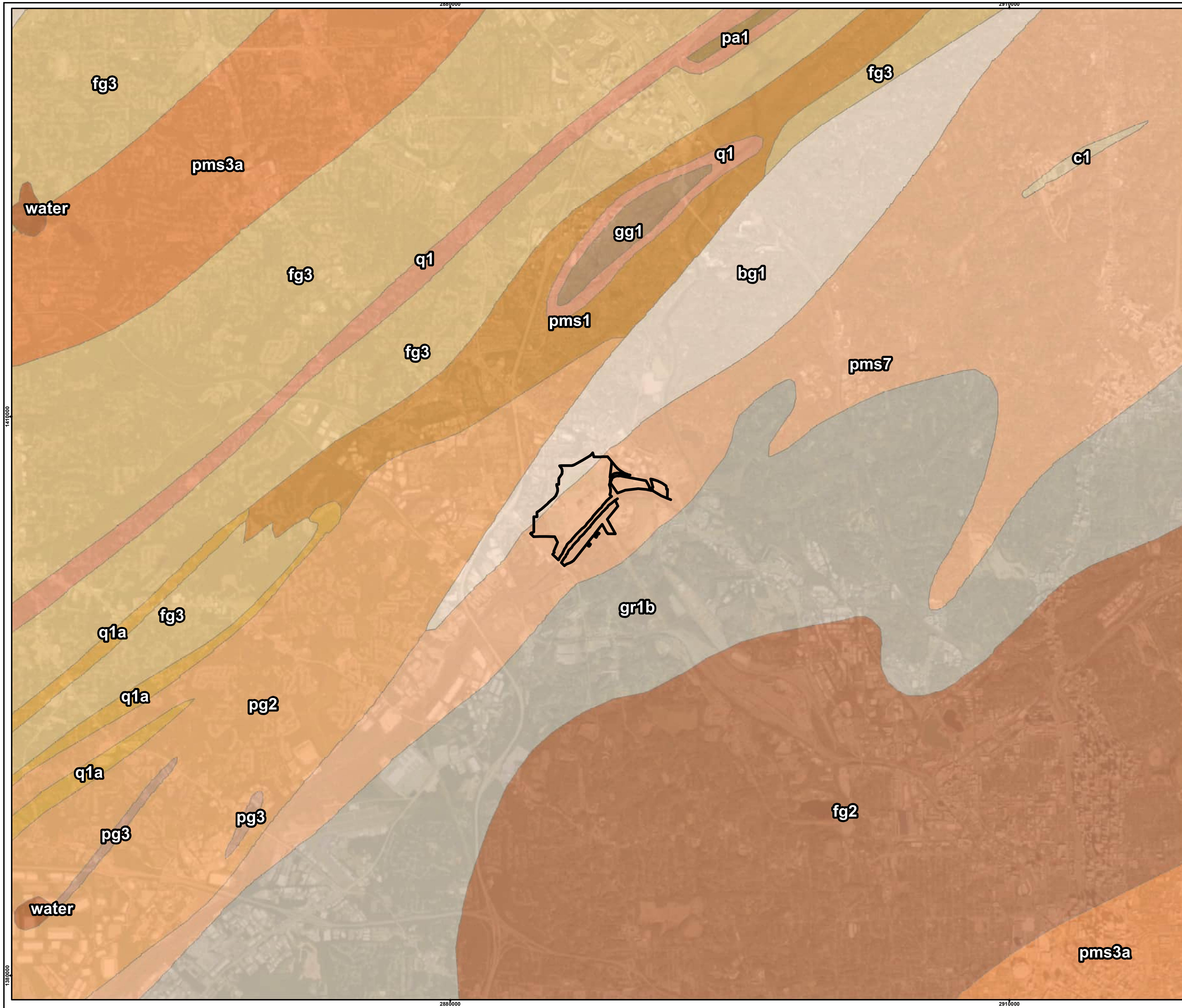
TITLE

SITE VICINITY TOPOGRAPHY

CONSULTANT

YYYY-MM-DD	2024-12-09
DESIGNED	AFS
PREPARED	AFS
CHECKED	SJS
REVIEWED / APPROVED	WEG/CB

PROJECT NO.	SCS PROJECT ID	REV.	FIGURE
US0037149.1670	MCD150170	0	A 2



LEGEND

- Property Boundary
- bg1, biotite gneiss
- c1, mylonite
- fg2, biotite gneiss
- fg3, biotite gneiss
- gg1, granitic gneiss
- gr1b, granite
- pa1, schist
- pg2, mica schist
- pg3, mica schist
- pms1, mica schist
- pms3a, mica schist
- pms7, mica schist
- q1, quartzite
- q1a, quartzite
- water, water

N

0 5,200 10,400 15,600 Feet

1 inch = 5,200 feet

REFERENCE(S)

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.
2. STATE GEOLOGIC MAP OF GEORGIA FROM GEORGIA DEPARTMENT OF NATURAL RESOURCES, REPRINTED IN 1997.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

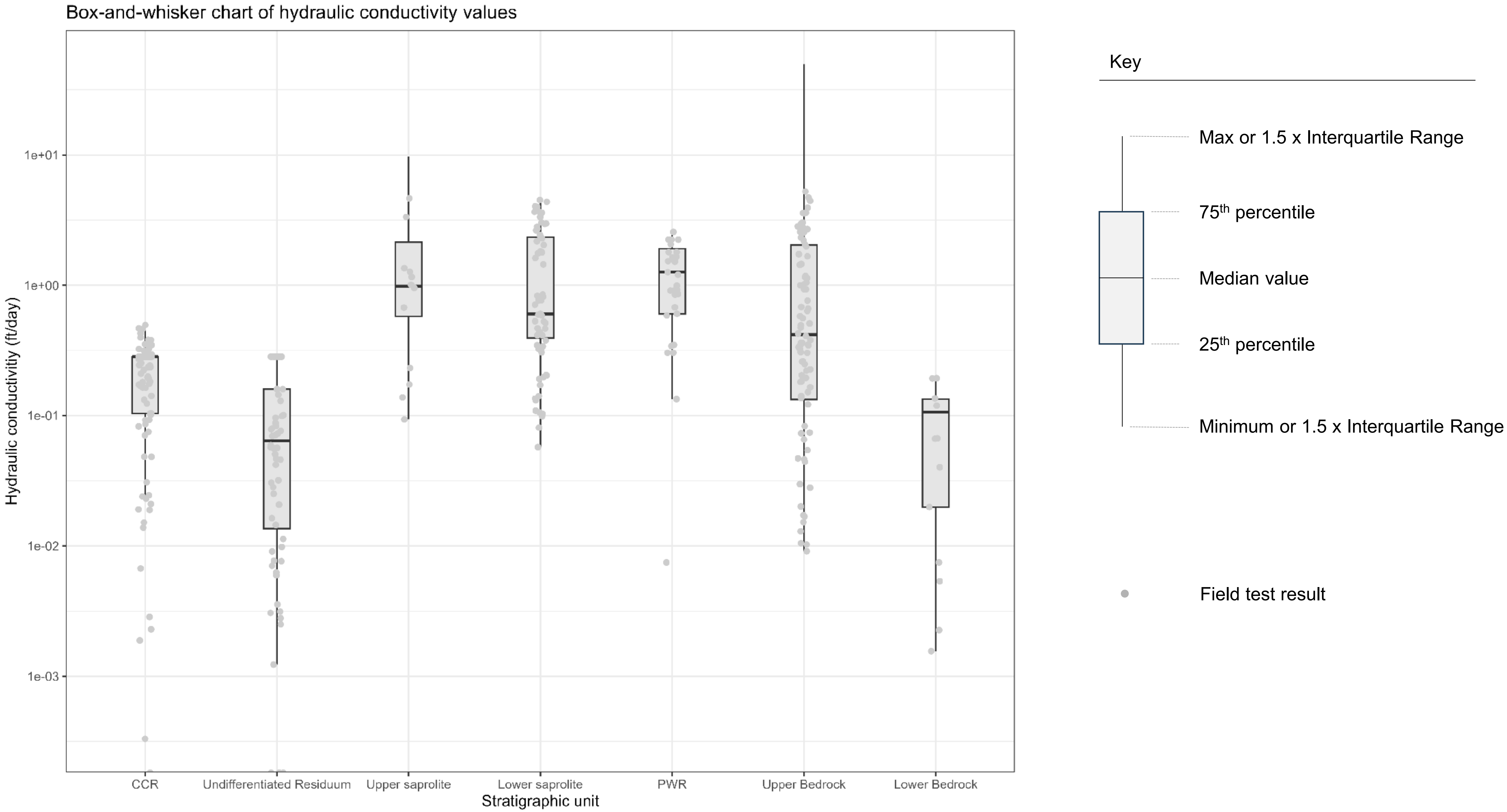
TITLE
CONCEPTUAL MODEL AREA BEDROCK GEOLOGY

CONSULTANT

YYYY-MM-DD	2024-12-18
DESIGNED	AFS
PREPARED	AFS
CHECKED	SJS
REVIEWED / APPROVED	WEG/CB

PROJECT NO.	SCS PROJECT ID	REV.	FIGURE
US0037149.1670	MCD150170	0	A-3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



Notes:

1) PWR = Partially Weathered Rock
2) Ft = feet
3) CCR = Coal Combustion Residuals
4) CCR and Undifferentiated Residuum values derived from CPT dissipation tests. Upper saprolite, Lower saprolite, and PWR values derived from slug tests. Bedrock values derived from slug and packer tests.

CLIENT	GEORGIA POWER COMPANY SOUTHERN COMPANY SERVICES
CONSULTANT	wsp
YYYY-MM-DD	2024-08-06
PREPARED	AFS
DESIGN	SJS
REVIEW	CB
APPROVED	CB
PROJECT	THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH
TITLE	HYDRAULIC TEST RESULTS, STRATIGRAPHIC UNITS: BOX-AND-WHISKER CHART

PROJECT No.	SCS PROJECT ID	Rev	FIGURE
US0037149.1670	MCD150170	0	A-4

LEGEND

- CCR AQUIFER TEST LOCATION
- PROPERTY BOUNDARY
- AP-1 COMPLIANCE BOUNDARY
- AP-2 & 3/4 PERMIT BOUNDARY

NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. AQUIFER TEST RESULTS IN FEET PER DAY
3. CCR = COAL COMBUSTION RESIDUALS

REFERENCE

1. AERIAL IMAGE FOR AP-1, AP-2, AND AP-3/4 DATED JANUARY 2024 PROVIDED BY GPC; AERIAL IMAGE FOR SURROUNDING AREAS DATED 2019 FROM GOOGLE EARTH

2. COORDINATE SYSTEM: NAD 1983 STATE PLANE GEORGIA WEST (U.S. FEET).

3. MONITORING WELL/PIEZOMETER LOCATIONS AND ELEVATIONS SURVEYED BY METRO ENGINEERING AND SURVEYING COMPANY IN AUGUST 2020 WITH ADDITIONAL SURVEY PROVIDED IN JANUARY 2021, MAY 2021, AND MAY

0 300 600

1 IN= 300 FT

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
CCR HYDRAULIC TEST RESULTS

CONSULTANT	YYYY-MM-DD	2024-12-18
WSP	PREPARED	BL
	DESIGN	JDV
	CHECKED	SJS
	REVIEWED/APPROVED	CB

PROJECT No.	SCS PROJECT ID:	Rev.	FIGURE
US0037149.1670	MCD150170	0	A-5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI B

LEGEND

- UPPER SAPROLITE AQUIFER TEST LOCATION
- PROPERTY BOUNDARY
- AP-1 COMPLIANCE BOUNDARY
- AP-2 & 3/4 PERMIT BOUNDARY

NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. AQUIFER TEST RESULTS IN FEET PER DAY

REFERENCE

1. AERIAL IMAGE FOR AP-1, AP-2, AND AP-3/4 DATED JANUARY 2024 PROVIDED BY GPC; AERIAL IMAGE FOR SURROUNDING AREAS DATED 2019 FROM GOOGLE EARTH

2. COORDINATE SYSTEM: NAD 1983 STATE PLANE GEORGIA WEST (U.S. FEET).

3. MONITORING WELL/PIEZOMETER LOCATIONS AND ELEVATIONS SURVEYED BY METRO ENGINEERING AND SURVEYING COMPANY IN AUGUST 2020 WITH ADDITIONAL SURVEY PROVIDED IN JANUARY 2021, MAY 2021, AND MAY

0 400 800

1 IN= 400 FT

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
UPPER SAPROLITE HYDRAULIC TEST RESULTS

CONSULTANT

YYYY-MM-DD	2024-12-18
PREPARED	BL
DESIGN	JDV
CHECKED	SJS
REVIEWED/APPROVED	CB

PROJECT No. US0037149.1670
SCS PROJECT ID: MCD150170
Rev. 0
FIGURE A-6

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI B

LEGEND

- LOWER SAPROLITE AQUIFER TEST LOCATION
- PROPERTY BOUNDARY
- AP-1 COMPLIANCE BOUNDARY
- AP-2 & 3/4 PERMIT BOUNDARY

NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. AQUIFER TEST RESULTS IN FEET PER DAY

REFERENCE

1. AERIAL IMAGE FOR AP-1, AP-2, AND AP-3/4 DATED JANUARY 2024 PROVIDED BY GPC; AERIAL IMAGE FOR SURROUNDING AREAS DATED 2019 FROM GOOGLE EARTH

2. COORDINATE SYSTEM: NAD 1983 STATE PLANE GEORGIA WEST (U.S. FEET).

3. MONITORING WELL/PIEZOMETER LOCATIONS AND ELEVATIONS SURVEYED BY METRO ENGINEERING AND SURVEYING COMPANY IN AUGUST 2020 WITH ADDITIONAL SURVEY PROVIDED IN JANUARY 2021, MAY 2021, AND MAY

0 500 1,000

1 IN= 500 FT

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
LOWER SAPROLITE HYDRAULIC TEST RESULTS

CONSULTANT

wsp

YYYY-MM-DD	2024-12-18
PREPARED	BL
DESIGN	JDV
CHECKED	SJS
REVIEWED/APPROVED	CB

PROJECT No. US0037149.1670 | SCS PROJECT ID: MCD150170 | Rev. 0 | FIGURE A-7

LEGEND

- PWR AQUIFER TEST LOCATION
- PROPERTY BOUNDARY
- AP-1 COMPLIANCE BOUNDARY
- AP-2 & 3/4 PERMIT BOUNDARY

NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. AQUIFER TEST RESULTS IN FEET PER DAY
3. PWR = PARTIALLY WEATHERED ROCK

REFERENCE

1. AERIAL IMAGE FOR AP-1, AP-2, AND AP-3/4 DATED JANUARY 2024 PROVIDED BY GPC; AERIAL IMAGE FOR SURROUNDING AREAS DATED 2019 FROM GOOGLE EARTH

2. COORDINATE SYSTEM: NAD 1983 STATE PLANE GEORGIA WEST (U.S. FEET).

3. MONITORING WELL/PIEZOMETER LOCATIONS AND ELEVATIONS SURVEYED BY METRO ENGINEERING AND SURVEYING COMPANY IN AUGUST 2020 WITH ADDITIONAL SURVEY PROVIDED IN JANUARY 2021, MAY 2021, AND MAY

0 600 1,200

1 IN= 600 FT

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

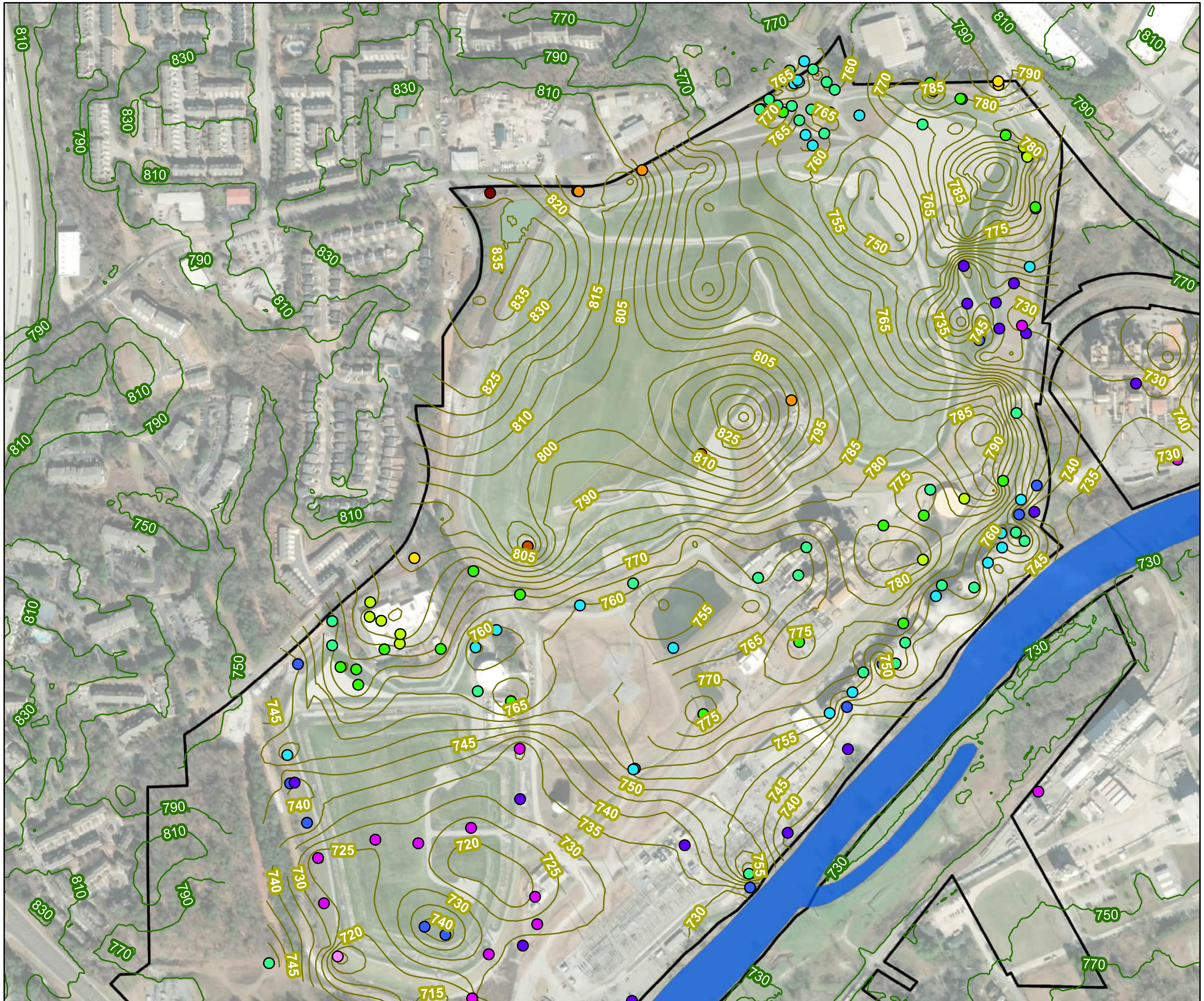
TITLE
PWR HYDRAULIC TEST RESULTS

CONSULTANT

YYYY-MM-DD	2024-12-18
PREPARED	BL
DESIGN	JDV
CHECKED	SJS
REVIEWED/APPROVED	CB

PROJECT No. US0037149.1670 | SCS PROJECT ID: MCD150170 | Rev. 0 | FIGURE A-8

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI B



LEGEND

- Site PWR Contours
- Regional PWR Contours
- Property Boundary
- NHD Water Bodies

Borehole

Top of PWR Elevation (ft NAVD88)

- < 710
- 710 - 720
- 720 - 730
- 730 - 740
- 740 - 750
- 750 - 760
- 760 - 770
- 770 - 780
- 780 - 790
- 790 - 800
- 800 - 810
- 810 - 820
- > 820

N

0 450 900 1,350 Feet

1 inch = 450 feet

NOTE(S)

1. DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988.
2. PWR: PARTIALLY WEATHERED ROCK.
3. Site PWR contour interval = 5 feet.
4. Offsite PWR contour interval = 20 feet.

REFERENCE(S)

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
SITE VICINITY TOP OF PARTIALLY WEATHERED ROCK

CONSULTANT

YYYY-MM-DD	2024-12-18
DESIGNED	AFS
PREPARED	AFS
CHECKED	SJS
REVIEWED / APPROVED	WEG/CB

PROJECT NO.	SCS PROJECT ID	REV.	FIGURE
US0037149.1670	MCD150170	0	A-9

LEGEND

- UPPER BEDROCK AQUIFER TEST LOCATION
- PROPERTY BOUNDARY
- AP-1 COMPLIANCE BOUNDARY
- AP-2 & 3/4 PERMIT BOUNDARY

NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. AQUIFER TEST RESULTS IN FEET PER DAY

REFERENCE

1. AERIAL IMAGE FOR AP-1, AP-2, AND AP-3/4 DATED JANUARY 2024 PROVIDED BY GPC; AERIAL IMAGE FOR SURROUNDING AREAS DATED 2019 FROM GOOGLE EARTH

2. COORDINATE SYSTEM: NAD 1983 STATE PLANE GEORGIA WEST (U.S. FEET).

3. MONITORING WELL/PIEZOMETER LOCATIONS AND ELEVATIONS SURVEYED BY METRO ENGINEERING AND SURVEYING COMPANY IN AUGUST 2020 WITH ADDITIONAL SURVEY PROVIDED IN JANUARY 2021, MAY 2021, AND MAY

0 600 1,200

1 IN= 600 FT

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
UPPER BEDROCK HYDRAULIC TEST RESULTS

CONSULTANT		
wsp	YYYY-MM-DD	2024-12-18
	PREPARED	BL
	DESIGN	JDV
	CHECKED	SJS
	REVIEWED/APPROVED	CB

PROJECT No.	SCS PROJECT ID:	Rev.	FIGURE
US0037149.1670	MCD150170	0	A-10

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI B

LEGEND

- LOWER BEDROCK AQUIFER TEST LOCATION
- PROPERTY BOUNDARY
- AP-1 COMPLIANCE BOUNDARY
- AP-2 & 3/4 PERMIT BOUNDARY

NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. AQUIFER TEST RESULTS IN FEET PER DAY

REFERENCE

1. AERIAL IMAGE FOR AP-1, AP-2, AND AP-3/4 DATED JANUARY 2024 PROVIDED BY GPC; AERIAL IMAGE FOR SURROUNDING AREAS DATED 2019 FROM GOOGLE EARTH

2. COORDINATE SYSTEM: NAD 1983 STATE PLANE GEORGIA WEST (U.S. FEET).

3. MONITORING WELL/PIEZOMETER LOCATIONS AND ELEVATIONS SURVEYED BY METRO ENGINEERING AND SURVEYING COMPANY IN AUGUST 2020 WITH ADDITIONAL SURVEY PROVIDED IN JANUARY 2021, MAY 2021, AND MAY

0 400 800

1 IN= 400 FT

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

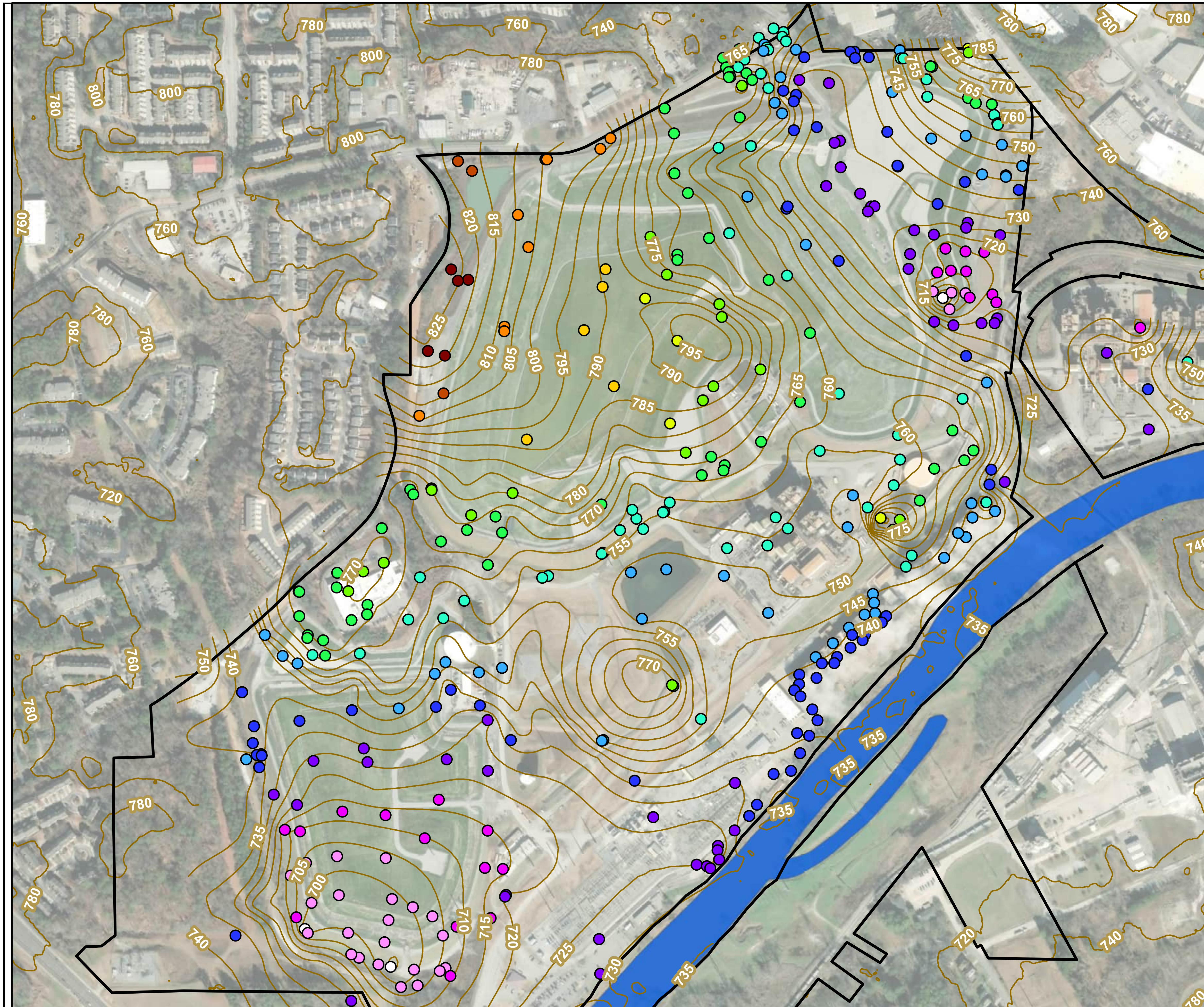
TITLE
LOWER BEDROCK HYDRAULIC TEST RESULTS

CONSULTANT

YYYY-MM-DD	2024-12-18
PREPARED	BL
DESIGN	JDV
CHECKED	SJS
REVIEWED/APPROVED	CB

PROJECT No. US0037149.1670 | SCS PROJECT ID: MCD150170 | Rev. 0 | FIGURE A-11

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI B



LEGEND

- Top of Bedrock Elevation (ft NAVD88)
- Property Boundary
- NHD Water Bodies

Boreholes

Depth to Bedrock

- < 700
- 700 - 710
- 710 - 720
- 720 - 730
- 730 - 740
- 740 - 750
- 750 - 760
- 760 - 770
- 770 - 780
- 780 - 790
- 790 - 800
- 800 - 810
- 810 - 820
- > 820

0 450 900 1,350 Feet

1 inch = 450 feet

NOTE(S)

1. Site contour interval = 5 feet.
2. Offsite contour interval = 20 feet.
3. DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988.
4. NHD: NATIONAL HYDROGRAPHY DATASET.

REFERENCE(S)

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

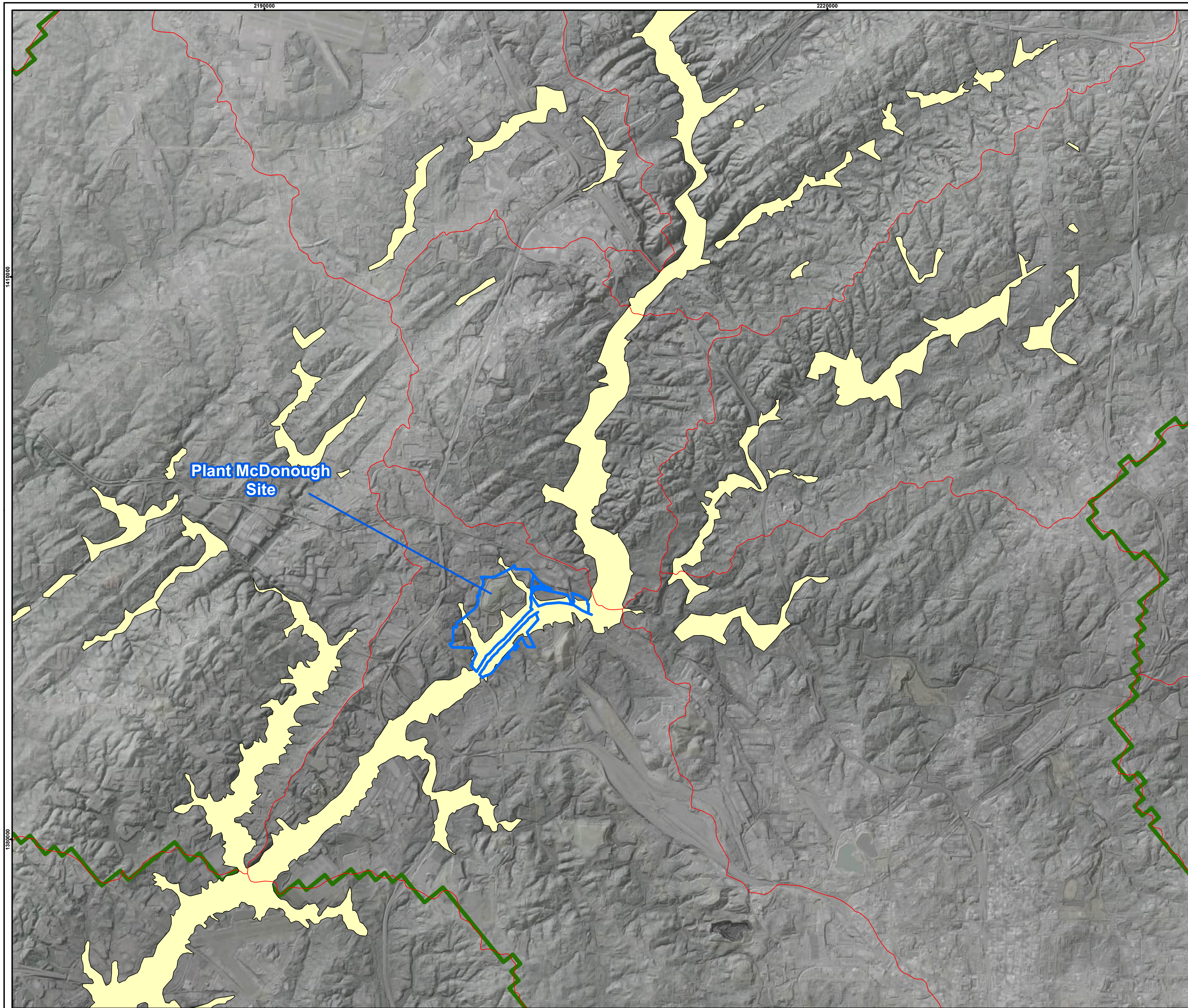
TITLE
SITE VICINITY TOP OF BEDROCK

CONSULTANT

wsp

YYYY-MM-DD	2024-12-18
DESIGNED	AFS
PREPARED	AFS
CHECKED	SJS
REVIEWED / APPROVED	WEG/CB

PROJECT NO.	SCS PROJECT ID	REV.	FIGURE
US0037149.1670	MCD150170	0	A-12



LEGEND

- Mapped Alluvium
- NHD HU12
- Property_Boundary

N

0 5,200 10,400 15,600 Feet

1 inch = 5,200 feet

NOTE(S)

1. NAVD 88: NORTH AMERICAN VERTICAL DATUM OF 1988.
2. HU: HYDROLOGIC UNIT.

REFERENCE(S)

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.
2. MAPPED ALLUVIUM DEPOSITS FROM HIGGINS (1968) GEOLOGIC MAP OF THE BREVARD FAULT ZONE NEAR ATLANTA, GEORGIA.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
CONCEPTUAL MODEL AREA ALLUVIAL DEPOSITS

CONSULTANT

YYYY-MM-DD	2024-12-18
DESIGNED	AFS
PREPARED	AFS
CHECKED	SJS
REVIEWED / APPROVED	WEG/CB

PROJECT NO.	SCS PROJECT ID	REV.	FIGURE
US0037149.1670	MCD150170	0	A-13

1 in
0

LEGEND

Site Boundary

Climate Station Locations

USGS

WRCC

REFERENCE(S)

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.
2. USGS = UNITED STATES GEOLOGICAL SURVEY
3. WRCC = WESTERN REGIONAL CLIMATE CENTER

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

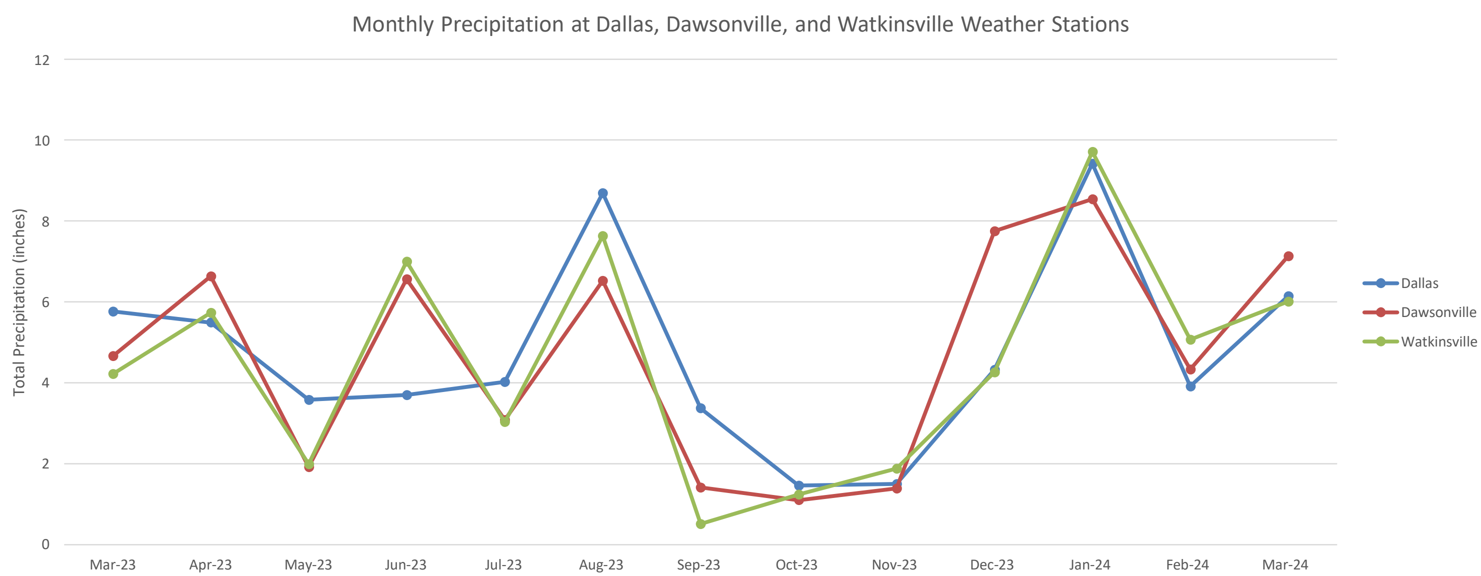
TITLE
CONCEPTUAL MODEL AREA CLIMATE STATION LOCATION MAP

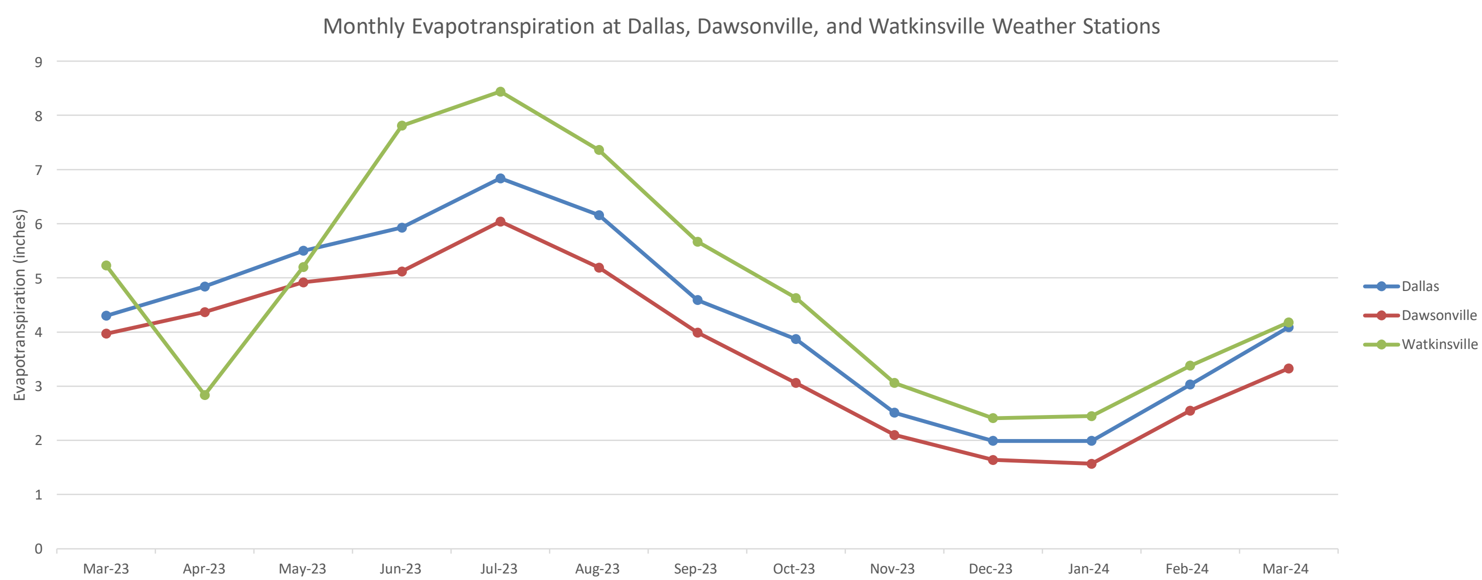
CONSULTANT

YYYY-MM-DD	2024-12-18
DESIGNED	AFS
PREPARED	AFS
CHECKED	SJS
REVIEWED / APPROVED	WEG/CB

PROJECT NO.	SCS PROJECT ID	REV.	FIGURE
US0037149.1670	MCD150170	0	A-14

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B





NOTE(S)
1. USGS = United States Geological Survey
2. WRCC = Western Regional Climate Center.

REFERENCE(S)
1. WRCC precipitation and evapotranspiration data are available at: https://raws.dri.edu/index.html

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

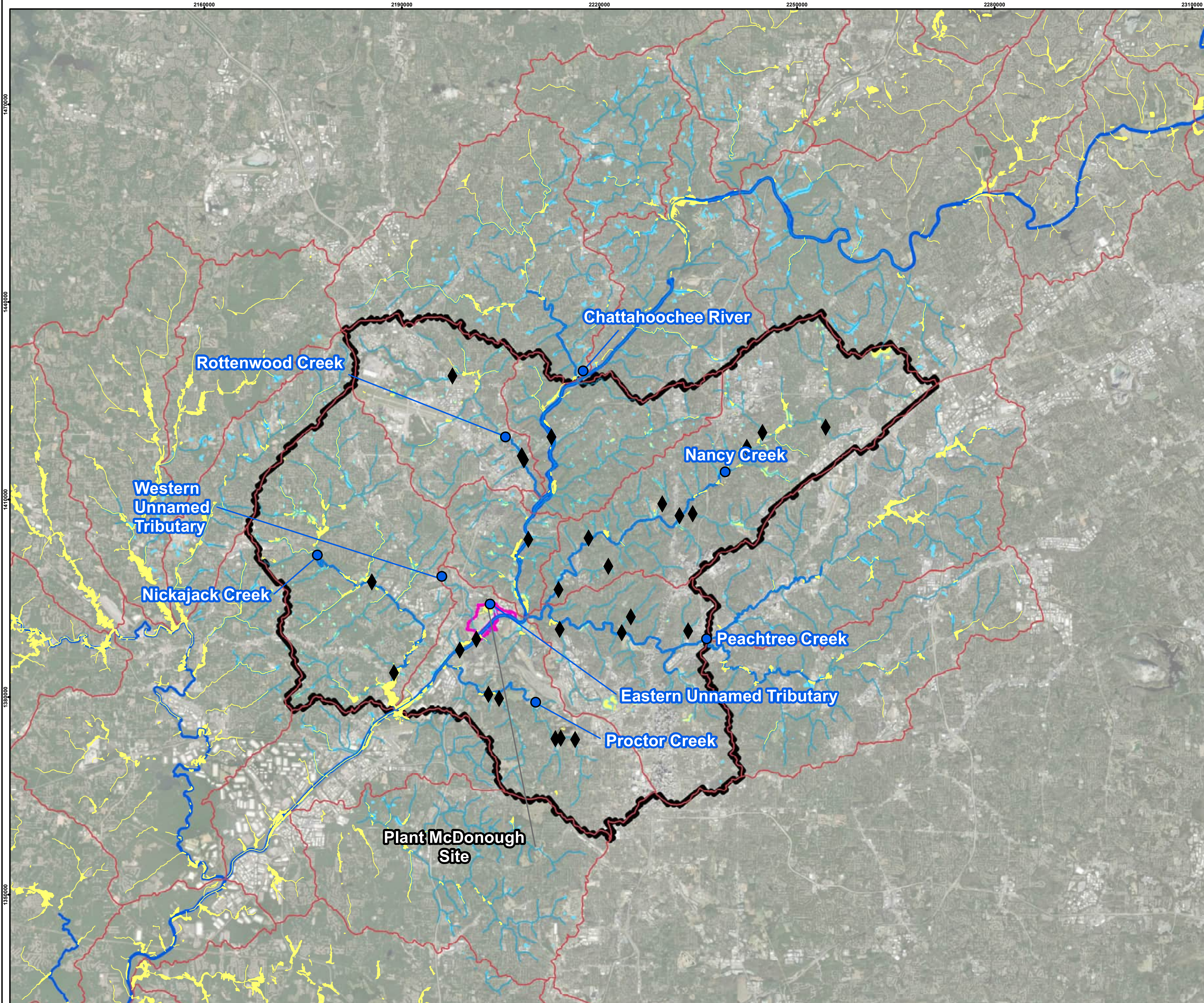
PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
CONCEPTUAL MODEL AREA PRECIPITATION AND EVAPOTRANSPIRATION GRAPHS

CONSULTANT

YYYY-MM-DD	2024-12-13
DESIGNED	RCL
PREPARED	AFS
REVIEWED	WG
APPROVED	WG

PROJECT NO.	SCS PROJECT ID	REV.	FIGURE
US0037149.1670	MCD150170	0	A-15



LEGEND

- Property Boundary
- Study Area
- NHD Minor Streams
- NHD Major Streams and Rivers
- NHD Lakes and Ponds
- NWI Wetlands
- 12th-Level Catchment
- USGS Staff Gauge Location

NOTE(S)

1. NHD: NATIONAL HYDROGRAPHIC DATASET.
2. NAVD88: NORTH AMERICAN VERTICAL DATUM OF 1988.
3. NWI: NATIONAL WETLANDS INVENTORY.
4. USGS = UNITED STATES GEOLOGICAL SURVEY

REFERENCE(S)

1. AERIAL IMAGERY: ESRI AERIAL BASEMAP, 2024

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

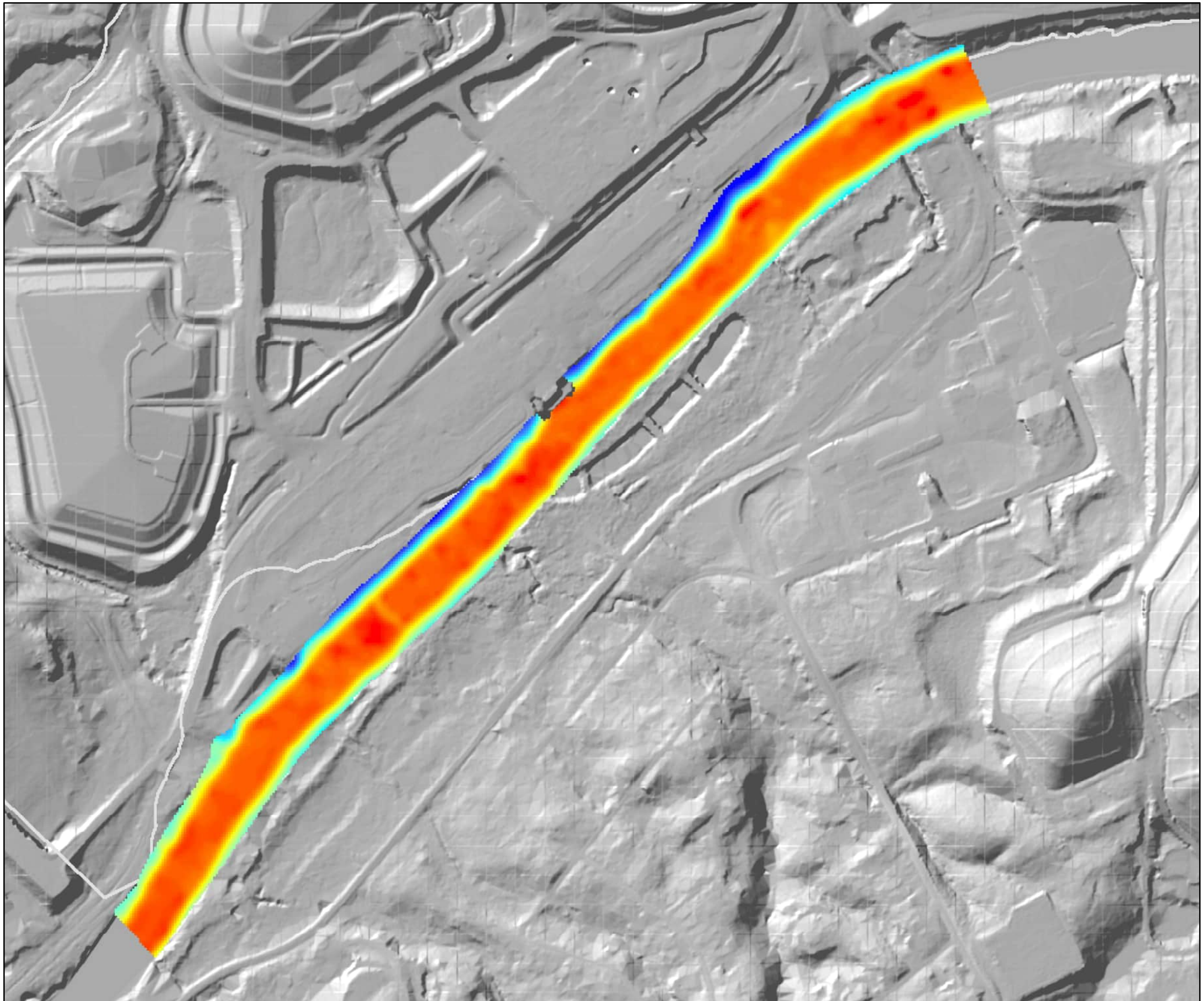
TITLE
CONCEPTUAL MODEL AREA SURFACE WATER FEATURES

CONSULTANT

YYYY-MM-DD	2024-12-09
DESIGNED	AFS
PREPARED	AFS
CHECKED	SJS
REVIEWED / APPROVED	WEG/CB

PROJECT NO.	SCS PROJECT ID	REV.	FIGURE
US0037149.1670	MCD150170	0	A-16

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



LEGEND

Plant McDonough Site Boundary

River Bathymetry Elevation (ft NAVD88)

Value

High : 779.928

Low : 730.013

N

0 400 800 Feet

1 inch = 400 feet

NOTE(S)

1. NAVD 88 = NORTH AMERICAN VERTICAL DATUM OF 1988

REFERENCE(S)

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.

CLIENT

GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT

THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE

SITE VICINITY CHATTAHOOCHEE RIVER BATHYMETRY

CONSULTANT

YYYY-MM-DD	2024-12-18
DESIGNED	AFS
PREPARED	AFS
CHECKED	SJS
REVIEWED / APPROVED	WEG/CB

PROJECT NO.	SCS PROJECT ID	REV.	FIGURE
US0037149.1670	MCD150170	0	A-17

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

LEGEND

- AP-1 MONITORING WELL
- AP-2,3/4 MONITORING WELL
- ASSESSMENT MONITORING WELL
- PIEZOMETER
- STAFF GAUGE
- VIBRATING WIRE PIEZOMETER
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- GROUNDWATER SURFACE CONTOUR (FT-NAVD88)
- SURFACE WATER STREAM
- PERMIT BOUNDARY
- PROPERTY BOUNDARY
- EXISTING TOPOGRAPHY 10-FOOT CONTOUR
- EXISTING TOPOGRAPHY 2-FOOT CONTOUR

NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. GROUNDWATER ELEVATION MEAUSREMENTS OBTAINED IN MARCH 2024 BY WSP.
3. GROUNDWATER ELEVATIONS DISPLAYED IN FEET REFERENCED TO NORTH AMERICAN VERTICAL DATUM (FT NAVD88).

REFERENCE

1. AERIAL IMAGERY DATE FOR AP-1, AP-2, AND AP-3/4 PROVIDED BY GEORGIA POWER, JANUARY 25, 2024; AND SURROUNDING AREAS SOURCED BY PLEXEARTH, DATED SEPTEMBER 28, 2023.
2. COORDINATE SYSTEM: NAD 1983 STATE PLANE GEORGIA WEST (U.S. FEET).
3. MONITORING WELL/PIEZOMETER LOCATIONS AND ELEVATIONS SURVEYED BY METRO ENGINEERING AND SURVEYING COMPANY IN AUGUST 2020 WITH ADDITIONAL SURVEY PROVIDED IN JANUARY 2021, APRIL 2021, MAY 2022, AND MAY 2023.

0 600 1,200

1 IN= 600 FT

CLIENT
GEORGIA POWER COMPANY
PLANT MCDONOUGH

PROJECT
GROUNDWATER MODEL

TITLE
SITE POTENTIOMETRIC MAP – MARCH 2024

CONSULTANT

YYYY-MM-DD	2024-11-21
PREPARED	YCS
DESIGN	SEB
CHECKED	DLP
REVIEWED/APPROVED	RNQ

PROJECT No. US0037149.3190 (GL1777449)   Rev. 0   FIGURE A-18

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI B

LEGEND

NHD Ponds

NHD Water Bodies

Monitoring Locations

N

0 1,000 Feet

1 inch = 532 feet

REFERENCE(S)

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.

NOTE(S)

1. NHD = NATIONAL HYDROGRAPHY DATASET

CLIENT

GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT

THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE

SITE VICINITY MONITORING LOCATIONS

CONSULTANT

YYYY-MM-DD	2024-12-10
DESIGNED	AFS
PREPARED	RMO
CHECKED	SJS
REVIEWED / APPROVED	WEG/CB

PROJECT NO.	SCS PROJECT ID	REV.	FIGURE
US0037149.1670	MCD150170	0	A-19

APPENDIX B

Groundwater Model Construction and Calibration

APPENDIX B

Groundwater Model Construction and Calibration

Plant McDonough-Atkinson Ash Pond 3 and Ash Pond 4 (AP-3/4)

Submitted to:

Georgia Power Company

241 Ralph McGill Blvd., Atlanta, Georgia 30341

Submitted by:

WSP USA Inc.

5170 Peachtree Road, Building 100, Suite 300 Atlanta, Georgia 30341

February 2025

Table of Contents

Tables

Figures

Attachment

1.0 INTRODUCTION

This appendix presents a summary of the construction, calibration, and results of the WSP USA, Inc. (WSP) groundwater model for the Georgia Power Company (GPC) owned and operated Plant McDonough-Atkinson (Plant McDonough; Site) located in Cobb County, Georgia, (Figure B1-1). Four historical ash ponds were present on the site: AP-1, AP-2, and AP-3, and AP-4, the latter two of which are combined into a single closure area (AP-3/4).

The Plant has removed CCR from AP-2 and is currently in the process of closing the other units (AP-1 and AP-3/4). The planned closure strategy for each unit is as follows:

- AP-1, inactive since 1968, has a Subtitle D Compliant engineered turf system cover over CCR. The planned closure design includes an AEM fully surrounding subsurface vertical barrier wall from the ground surface to the top of partially weathered rock (PWR).
- AP-2 was closed by removal of CCR. CCR removed from AP-2 was placed within the final limits of AP-1 in September 2016. Additional CCR was removed in 2019 and CCR removal from AP-2 was certified in March 2020. AP-2's footprint has been graded to promote future land use and control stormwater runoff.
- AP-3/4 is currently undergoing closure by a combination of CCR excavation and closure-in-place over a consolidated footprint. AP-3/4 was used for dry ash stacking operation from 1995 until the plant conversion to natural gas was completed in 2012. CCR was removed from a line extending from 50 feet west of the existing stream diversion culvert beneath AP-3/4 to all points east of the culvert within AP-4 and was consolidated in the remaining AP-3/4 footprint. CCR was also removed from the areas in the northwest corner of AP-3 and consolidated in the remaining AP-3/4 footprint. The closure of AP-3/4 also includes an AEM Enhanced Underdrain, which extends below the base of CCR, and Temporary AEM Dewatering Wells. The AEM Enhanced Underdrain was engineered to lower the potentiometric surface below the base of CCR.

This appendix documents the predicted Post-Closure steady-state groundwater flow conditions based on the closure design. The conceptual site model (CSM), and numerical model construction, calibration, and results were documented elsewhere in the Three-Dimensional Numerical Groundwater Modeling Summary Report Revision 4 (Model Report), included as Appendix B of the HAR (WSP, 2024). The primary objectives of the groundwater modeling are to simulate recent (March 2024) groundwater flow conditions and predict Post-Closure groundwater behavior near AP-3/4. To meet these objectives two groundwater flow models were developed to evaluate the following conditions at the Site:

- **2024 Conditions Model** – Steady-state simulation of groundwater flow conditions from March 2024, with construction features (dewatering wells, underdrains, and a sump) represented in AP-3/4, and substantially complete cover liners over AP-1 and AP-3/4. Since initiating closure construction activities in 2016 groundwater levels have been declining towards predicted post-closure conditions, as discussed in the Water Level Drawdown Analysis included in Appendix C.
- **Post-Closure Model** – Steady-state simulation of Post-Closure flow conditions, using calibrated property values from the 2024 Conditions Model and closure elements from the AP-1, AP-2, and AP-3/4 closure designs, including a proposed fully encapsulating hydraulic barrier wall around AP-1. As discussed below, an additional steady-state simulation without the proposed fully encapsulating hydraulic barrier wall around AP-1 is developed for comparison purposes.

2.0 GROUNDWATER MODEL CONSTRUCTION

The following sections describe the model code, solver settings, model grid and layering, boundary conditions and aquifer properties used for the 2024 Conditions and Post-Closure models.

2.1 Model Code

2024 Conditions and Post-Closure Model input files are created using a combination of Environmental System Research Institute ArcMap 10.8.1, Rockworks20, and the Environmental Simulations Inc. Groundwater Vistas 8 (GV) graphical user interface. A groundwater flow model was developed using the USG-Transport version 1.8.0 model code (Panday, 2021), which is an enhanced version of the MODFLOW-USG finite difference model code (Panday, Langevin, Niswonger, Ibaraki, & Hughes, 2013). MODFLOW-USG is an enhanced version of the MODFLOW code (McDonald & Harbaugh, 1988) and is designed to better solve problems by local nested refinement of the grid resolution in areas of interest.

2.2 Solver Settings

The USG-Transport input/output manual includes a detailed discussion of each parameter in the Sparse Matrix Solver (SMS) solver package. The Groundwater Vistas 8 manual and online FloPy documentation[1] include some recommendations for optimum solver settings. However, the optimum solver settings are specific to each model. Suboptimal solver settings can increase model instability, typically manifested as head oscillation, increased run time and non-convergence. The model is set to solve only active cells (SOLVEACTIVE) and use bottom damping (DAMPBOT) to reduce potential model oscillation.

Solver settings used in the model are summarized below:

- Maximum head change between outer (nonlinear) iterations (HCLOSE) = 0.1 ft
- Maximum head change between inner (linear) iterations (HICLOSE) = 0.01 ft. Typically, an order of magnitude lower than HCLOSE.
- Maximum number of outer iterations (MXITER) = 200 per time step
- Maximum number of inner iterations (ITERI) = 100 per outer iteration

2.3 Model Grid

The planar active model domain area is 166 square miles and consists of a regional-scale grid that has been locally refined in the site vicinity and near surface water features in the model domain (Figure B1-2). The model grid resolution for all Layers is depicted on Figure B2-1.

Model structure comprises an unstructured, nested grid, whose major elements are summarized below

- The primary axis of the model domain is rotated 51 degrees counterclockwise from true North to align with the main stem of the Chattahoochee River and its watershed orientation
- The parent model grid consists of 184 rows, 151 columns, and 6 layers that are subdivided into 319,640 active cells using quadtree refinement.

[1] https://modflowpy.github.io/flopydoc/mfsms.html

- The model cell length and width range from 640 ft x 640 ft for unrefined, parent grid cells to 20 ft x 20 ft for cells near the site (6 levels of quadtree refinement). Cells near rivers and streams (320 ft x 320 ft [1 level of quadtree refinement]) in the model domain are also refined to help simulate steeper hydraulic gradients.

2.4 Model Layers

The model domain has been divided into six model layers based on historical Site-specific borehole logging data and hydraulic conductivity data provided in the HAR (WSP, 2024) and Appendix A, and is supported by regional geologic data. Model cell thickness varies throughout layers 1 through 6 based on multiple site-specific data sets. The MODFLOW-USG simulations allow for the transfer of groundwater between model layers, both horizontally and vertically, throughout the model. Model layer structure has been modified from the model included in November 2021 Groundwater Modeling Summary Report Addendum (Golder 2021), hereafter referred to as the 2021 Closure Addendum Model, based on lithology from additional geotechnical borings and results from additional hydraulic conductivity field measurements. Similarities and differences between the 2021 Closure Addendum Model and the 2024 Conditions Model are described below, where appropriate. Refer to Appendix A Table A-1 for a correlation of model layers described in this sub-section and a correlation of model layers with prior model builds. Layer elevations are summarized in Table B2-1.

- **Layer 1 - Engineered Fill:** Layer 1 in the upper portion of the AP-3/4 buttress is constrained above by the engineered closure grading of AP-3/4 and below by the sand and stone underdrain system. The base of Layer 1 (Engineered Fill) is derived from closure drawing files associated with Sheet 8 of the closure drawings available on the GPC compliance web page[2]. Due to placement above underdrain boundary conditions in the model, Layer 1 (Engineered Fill) will not affect flow simulations but is included for completeness.
- **Layer 2 - CCR:** Layer 2 in both AP-1 and AP-3/4 is bounded above by engineered closure grading (aside from the vicinity of engineered fill in AP-3/4, where it is the base of engineered fill) and below by the base of CCR geometry. CCR extents in Layer 2 (CCR) for the 2024 Conditions and Post-Closure Models are derived from Sheet G-1 of the HAR (WSP, 2024). Layer 2 (CCR) corresponds to layer 1 of the 2021 Closure Addendum Model
- **Layer 3 – Residuum and Alluvium:** Layer 3 is bounded above by the land surface, as specified by the maximum elevation of the digital elevation model (DEM) per model grid cell on hillslopes and upland areas, the DEM minimum in the footprint of stream channels, and river bathymetry (where available) in the footprint of river cells (Figure B2-2). Outside of the Site-proximal bathymetry data, the layer top is assumed to be 13 feet below the digital elevation model surface based on an average water-column height of 13 feet where bathymetry data were present. The base of the residuum is bounded by the logged interface with PWR within the site vicinity, and an average thickness of ~40 feet in the rest of the model domain based on the average thickness of residuum observed in site borings. Alluvium is present in and adjoining the Western and Eastern Tributary stream channels, Layer 3 corresponds to layer 2 of the 2021 Closure Addendum Model.

[2] https://www.georgiapower.com/content/dam/georgia-power/pdfs/company-pdfs/plant-mcdonough/20211109_Closure_Drawings_MCD_AP234.pdf

- **Layer 4 - PWR:** Layer 4 is bounded above by the interpreted top-of-PWR surface, and below by the interface between PWR and bedrock based on standard penetration test (SPT) blow counts and logging observations in the site vicinity (Figure B2-3). Outside of the site vicinity, an average PWR thickness of ~12 feet is used based on the average thickness of PWR in site borings. Layer 4 corresponds to layer 3 of the 2021 Closure Addendum Model.
- **Layer 5 – Upper Bedrock:** Layer 5 is bounded above by the Site vicinity interpreted top-of-rock surface, and below by a 30-foot offset that encompasses the most transmissive upper portion of bedrock, based on the hydraulic conductivity data presented in Appendix A.
- **Layer 6 – Lower Bedrock:** Layer 6 is bounded above by the base of the upper bedrock surface and below by the model base at 369 feet NAVD88. Combined layers 5 and 6 correspond to layer 4 of the historical 2021 Closure Addendum Model.

Model layer tops are also depicted in Figures B2-2 and B2-3.

2.5 Hydraulic Conductivity

Horizontal and vertical hydraulic conductivities are assigned in two phases, initially through a single value per model layer/lithology approach using manual and automated calibration, then through spatially-varying arrays using automated calibration. Initially, hydraulic conductivity in the 2024 Conditions Model was assigned based on historical Site-specific borehole logging data in the HAR (WSP, 2024), and regional geologic data. Hydraulic conductivities in Layer 2 (CCR) in AP-1 and AP-3/4 are initialized as separate zones, but with the same values used in the 2021 Closure Addendum Model (Table B2-2). Residuum in the site vicinity is differentiated from regional residuum in Layer 3 (Residuum) by drawing a zone comprising a 500-foot buffer around site wells with hydraulic test data. Outside of the site-specific residuum zone, an alluvium hydraulic conductivity zone is placed along the Chattahoochee River according to Higgins (1968).

The site-specific zone approach is also used to define proximal vs. distal PWR in Layer 4 (PWR), and proximal vs. distal bedrock in layers 5 (upper bedrock) and 6 (lower bedrock). Outside of the site-specific envelope in layers 5 and 6, the state geologic map is used to define hydraulic conductivity zones, with layer 5 (upper bedrock) representing a more permeable bedrock due to structures and weathering, and layer 6 (lower bedrock) representing less permeable bedrock, according to test data discussed in Appendix A and also in the Hydrogeologic Assessment Report (WSP, 2024). The site-proximal hydraulic conductivity zones were also used during pilot point calibration as discussed in Attachment B-1.

Following initial zone-based model calibration, hydraulic conductivity zones were converted to matrices, so vertical and horizontal heterogeneity could be simulated within each layer to better represent the Site-specific hydraulic testing data. Pilot points are used throughout the model domain to better represent spatially distributed hydraulic testing data for each model layer (Attachment B-1). Most pilot points are assigned near the Site where hydraulic testing data are available. The parameter ranges and preferred values for each point are assigned based on the historical hydraulic testing data, (Appendix A, Attachment B-1). Layer-specific initial (pre-pilot point calibration) and final (post-pilot point calibration) hydraulic conductivity distributions are discussed below:

- **Layer 1 – Engineered Fill:** A representative hydraulic conductivity value of 1.0 foot/day is used to define the hydraulic conductivity of Layer 1 based on published literature estimates for fine/silty sand (Fetter, 2007).

Hydraulic conductivity of Layer 1 (Engineered Fill) was not varied during pilot point-calibration because the March 2024 water level was below the base of the engineered fill layer.

- **Layer 2 - CCR:** CCR hydraulic conductivity values were initially (pre-pilot point calibration) based on pore-pressure dissipation tests which establish a lower range of hydraulic conductivities for CCR stored in AP-1 and AP-3/4 closure areas, as these tests were conducted in low permeability intervals within the CCR. Initial values for the CCR were permitted to vary between the lowest observed hydraulic conductivity from pore-pressure dissipation testing (3.31e-4 ft/day) and 5 ft/day as a conservative upper limit based on an assumed silt to silty sand value (Fetter, 2007). The final, calibrated model horizontal hydraulic conductivity values range from 1.19e-3 ft/day to 3.57e-2 ft/day. As expected, based on the biased-low testing described above, calibrated values are generally higher than pore-pressure dissipation testing.
- **Layer 3 - Residuum and Alluvium:** The initial lateral distribution of hydraulic conductivity zones in Layer 3 (Residuum and Alluvium) outside the pilot point calibration area is based on site-specific borehole logging data and mapped alluvium deposits depicted on the Brevard Fault Zone geologic map (Higgins, 1968). Slug tests are used to derive a range of hydraulic conductivity values for residuum within the pilot point calibration area. The initial range of conductivities spanned the field values of 1.23e-3 ft/day to 9.68 ft/day, with final, calibrated model values ranging from 7.64e-3 ft/day to 5.62 ft/day (Attachment B-1). The Initial alluvium horizontal hydraulic conductivity value is 13.4 ft/day with a two to one vertical anisotropy. This value is within material property ranges for sand as stated in Fetter (2007). There are no hydraulic test values for alluvial material in the model alluvium zone. Final values are based on pilot point calibration.
- **Layer 4 - PWR:** Layer 4 (PWR) is laterally continuous across the model domain, with thickness constraints described in Section 2.4. Field values for the PWR, based on Slug and Lugeon test data, ranged from 7.48e-3 ft/day to 2.57 ft/day, with final, calibrated model values ranging from 7.52e-3 ft/day to 4.36e-1 ft/day (Attachment B-1).
- **Layer 5 - Upper Bedrock:** Hydraulic conductivity zones are based on bedrock units in the state geologic map (Georgia DNR, 1976) and the site-specific geologic map (Petrologic Solutions, 2016). Hydraulic conductivity of the uppermost 30 feet of bedrock is simulated separately from lower bedrock, with field values ranging from 9.12e-3 ft/day to 49.9 ft/day based on historical packer testing. Final, calibrated model values ranged from 9.12e-3 ft/day to 33.4 ft/day (Attachment B-1). The calibrated hydraulic conductivity range is within the range of field values and is reasonable for use when simulating the upper bedrock.
- **Layer 6 - Lower Bedrock:** Hydraulic conductivity zone footprints are based on bedrock units in the state geologic map (Georgia DNR, 1976) and the site-specific geologic map (Petrologic Solutions, 2016). Bedrock more than 30 feet below the top of rock is simulated separately from upper bedrock, with field values ranging from 1.56e-3 ft/day to 1.93e-1 ft/day based on historical packer testing (Appendix A). Final, calibrated model values ranged from 1.56e-3 ft/day to 1.92e-1 ft/day (Attachment B-1).

Figures B2-4 through B2-9 show the horizontal and vertical hydraulic conductivity matrices for each layer for the 2024 Conditions Model, and Table B2-2 includes a general description and the initial and calibrated values for each zone. Initial vertical hydraulic conductivity values are based on values from the 2021 Closure Addendum Model (Golder, 2021). Final vertical hydraulic conductivity values are based on pilot point calibration results.

2.6 Boundary Conditions

The following sections describe the boundary conditions used in the 2024 Conditions and/or Post-Closure Model, including drains, unused cells, rivers, wells, and hydraulic barrier wall boundaries. Model boundary conditions are summarized in Table B2-3 and depicted in Figure B2-10. The boundary conditions are selected to correspond with natural features, as documented in Appendix A.

2.6.1 Unused Cells

The term “unused cell” replaces what is commonly called a no flow cell, which can mislead readers to its function. Unused cells occur in the model to leave these cells out of any calculations. Unused cells that have one cell face in contact with the active grid, however, do form a special case of specified flow boundary condition with a flux of zero across the face. The outermost grid sides, and area below the grid, are not used in any calculations. Inside the grid, another kind of unused cell includes cell pinching.

Cell pinching involves setting a cell thickness threshold value where if a cell thickness is less than the threshold value the model will allow flow calculations between the cells above and below the pinched-out cell while ignoring the pinched-out cell. Cell pinching does not impact the flow between abutting layers. The cell thickness threshold value for cell pinching is 0.1 foot throughout the model domain.

The boundaries of the active model domain for all layers are selected based on National Hydrography Dataset (NHD) sub-watershed (Level 12) polygons; unused cells are assigned outside these polygons. Within the interior of the selected Level 12 sub-watersheds, unused cells are pinched in Layer 1 outside the extent of engineered fill in the upper buttress of AP-3/4. Unused cells are also pinched in layer 2 outside the extent of CCR in both AP-3/4 and AP-1. Cell pinching is not used in model layers 3 through 6.

2.6.2 Drain Boundaries

MODFLOW drain boundaries represent a water transfer function where a volume of groundwater entering a drain boundary condition model cell is removed from the model flow domain if the predicted groundwater head in the drain boundary condition cell is greater than the drain stage. The ability of simulated groundwater to flow into a drain boundary condition and be removed from the model domain is affected by a drain conductance factor which represents a resistance to flow between the aquifer and the drain feature. The primary purpose of drain boundaries is to simulate the flow of groundwater to various features such as streams, wetlands, and engineered sumps and drains. Flow of groundwater to all of these features removes groundwater from the groundwater flow system.

Drain boundaries are used throughout the model domain to represent local creeks, drainage ditches, AP-3/4 toe and blanket drains, and cover surface drains in AP-1 and AP-3/4 (Figure B2-10). Drain stages for creeks are assigned based on the lowest DEM elevations within creek footprints. Creek drain conductance is assigned based on a high (i.e., alluvial) conductivity of 1,000 ft/day and cell geometry to permit free exchange of ground and surface water. The selected value is comparable to the range of values provided in Fetter (2007) for alluvial materials. Surface drains on the cover liner are assigned drain stages based on design drawing, and the conductance of these drain boundaries is based on the liner hydraulic conductivity used in the HELP modeling (~0.028 ft/day; Golder, 2020a).

Drain boundary conditions are also used to simulate the removal of water from the CCR via a sand blanket and stone underdrain system (AEM Enhanced Underdrain) in the buttress of AP-3/4. The sand blanket collects any groundwater entering the buttress and transfers the water to the stone underdrain located at the buttress toe. Drain boundary conditions are assigned to the sand blanket extents to simulate the capture and removal of groundwater from the flow system.

The AEM Enhanced Underdrain is represented by drain boundary conditions in the 2024 Conditions Model and as a high conductivity property zone in the Post-Closure Model. Drains are used to represent the AEM Enhanced Underdrain in the 2024 Conditions Model to facilitate model calibration. The AEM Enhanced Underdrain slopes toward the AP 3/4 sump and terminates at the AP-3/4 sump (elevation 756 ft NAVD88). The bottom sump elevation is 6 feet lower than the lowest base of CCR. The sump is represented by a drain boundary condition with a drain stage of 756 ft NAVD. Any groundwater entering the AEM Enhanced Underdrain flows to the sump where the water is pumped to the plant wastewater treatment system. The flow rate from the AEM Enhanced Underdrain in the March 2024 was approximately 25 to 30 gallons per minute (gpm).

2.6.3 River Boundaries

MODFLOW River boundaries are implemented in the model to simulate a variety of surface water body features. The term "River Boundary" is used for a head dependent boundary condition that applies to two adjoining water features such as a river and an aquifer. The simulated flow of water between the two features is a function of the difference in water elevation between the features and the conductance of material that forms the boundary between the features. In practical terms, river boundaries add or remove groundwater from a groundwater flow system or model domain depending on whether the river boundary stage is higher or lower than the adjoining groundwater elevation.

River boundaries are assigned to represent the following features in the model domain:

- **Ponds and Lakes** – River cells in model layer 3 are assigned to ponds and lakes categorized as NHD Area features in the National Hydrographic Dataset, with stages set to the minimum elevation of the DEM. River cell bottom elevations were assigned or based on an assumed bottom elevation that is 13 feet below water surface. Ponds or lake sediment conductance ranges from 400 to 102,400 ft^2/day depending on cell size and proportion of a cell that is occupied by the pond or lake. Pond bottom sediments are assumed to be a mix of clay to sand sized particles and hydraulic conductivity values presented in Fetter (2007) are one of the terms used to develop conductance ranges. The pond or lake stage (a head), conductance, and iterative groundwater head are used for computing the steady state groundwater head and volume of water flowing into or out of the river boundary cell.

- **The Chattahoochee River** – River boundary conditions are used in model layer 3 to simulate the trunk channel of the Chattahoochee River – as extracted from the NHD areas. Surface water elevations were initially assigned based on the minimum elevation of the DEM within each cell and were then shifted downward by four feet based on observed March 2024 river-water levels at site and USGS staff gauges, which are discussed in more detail in section 3.0. River cell bottom elevations were assigned based on bathymetry data where available or based on an assumed bottom elevation that is 13 feet below water surface. River sediment conductance ranges from 400 to 102,400 ft^2/day depending on cell size and proportion of a cell that is occupied by the river. River sediments are assumed to be predominantly sand and gravel sized particles and hydraulic conductivity values presented in Fetter (2007) are one of the terms used to develop conductance ranges. The river stage (a head), conductance, and iterative groundwater head are used for computing the steady state groundwater head and volume of water flowing into or out of the river.

2.6.4 Wall Boundaries

The closure design for AP-1 includes a fully encompassing hydraulic barrier wall from the ground surface to the top of PWR, as shown on Sheet GW-3a of the HAR (WSP, 2024). The barrier wall is simulated in the Post-Closure Model in model layer 3 using MODFLOW's horizontal flow barrier (HFB) boundary conditions that cover the entire vertical extent of the assigned cell along one or more cell faces. Wall thickness in the model is set to 2 feet as stated in the AP-1 Closure Plan (WSP, 2023), with a hydraulic conductivity of 1.415e-3 ft/day, consistent with the expected wall construction.

2.6.5 Well Boundaries

MODFLOW's original well boundary conditions represent water removed or added to a model cell. The boundary condition can be applied to features such as pumping and injection wells, streams, karst, large fractures, artificial vertical or horizontal drains, and/or processes such as inflow or outflow along the edge of a model domain, or evapotranspiration.

Twenty-seven (27) well boundary conditions are in the 2024 Conditions groundwater flow model. Each boundary condition represents an individual pumping well. The pumping wells include Temporary AEM Dewatering Wells in the buttress area, Temporary AEM Dewatering Wells at AP-3, temporary Pond 2 (not AP-2) dewatering sump in the closure by removal area, and four Temporary AEM Dewatering Wells north and east of the closure by removal area. The range of assigned well pumping rates is approximately zero to 3.6 gpm based on recorded flow data or estimates of flow from operational data.

The Post-Closure groundwater flow model does not include any well boundary conditions for the Temporary AEM Dewatering Wells at the Site because the AEM wells are temporary construction phase features.

2.7 Recharge Zones

Recharge zone areas are assigned according to land use, as shown in Figure B2-11. Recharge is a flux value applied to the highest active layer of the model. Recharge values represent net recharge defined here as precipitation minus runoff and evapotranspiration. Where Layer 1 and 2 are pinched out and unused, as described in Section 2.5.1, recharge is applied to the next highest active layer in the model.

Assigned recharge within low permeability cover areas for AP-1 and AP-3/4 in the 2024 Conditions Model is a constant 0.00689 inches per year (1.5753e-6 ft/d) which is modified from HELP model results presented in the Engineering Report (Golder, 2020a). The modification is needed to represent moisture conditions within the CCR footprint that are currently equilibrating to the recent cover liner installation. Model domain climate conditions and a discussion of local weather stations is included in Appendix A to the groundwater model report. Recharge rates are included in Table B2-4.

Recharge in the area impacted by closure activities is adjusted from 2024 conditions in the Post-Closure Model. Recharge in areas beyond the property boundary are determined following the same logic and approach as in the 2024 Conditions Model. Recharge to the cover area assumes the estimate from a modeling effort using HELP is representative of long-term conditions. The HELP model estimate of recharge through the cover is 0.0000479 inches per year.

3.0 GROUNDWATER MODEL CALIBRATION

Model calibration consists of successive refinement of model input data from initial assumptions/estimates to improve the fit between observed and model-predicted results. The 2024 Conditions Model calibration consisted of manual and automated refinement of a variety of parameters, including hydraulic conductivity, recharge and drainage. Results from 2,830 model runs (three-hundred realizations from each of ten optimization runs, minus abandoned runs) were used to assess the model's sensitivity to changes in aquifer parameters, AEM Enhanced Underdrain conductance and recharge. Model calibration details are presented in Attachment B1.

The 2024 Conditions Model meets industry standard calibration metrics for residual mean (RM), absolute residual mean (ARM), root mean square error (RMSE), standard deviation (SD), volumetric balance discrepancy (Md), and spatial distribution.

The quality of the calibration is also evaluated using the same calibration metrics as above but focused on targets in the area of interest (AP-3/4). Results of the focused calibration evaluation indicate that the flow model provides a reasonable representation of March 2024 conditions in the AP-3/4 area. The focused calibration evaluation is discussed in more detail in Attachment B1.

The 2024 Conditions Model calibration is validated by simulating the August 2016 AP-3/4 Pre-Closure conditions. The August 2016 data was used in the previously submitted October 2020 model (Golder 2020b) Validation results indicate the calibrated 2024 Conditions Model provides a reasonable basis for Site-specific predictive modeling. The simulated water levels from the August 2016 Validation Model, generated from the 2024 Conditions Model aquifer parameters, closely match the observed August 2016 water levels. The August 2016 Validation Model meets the same industry standard calibration metrics as are used above to evaluate the 2024 Conditions Model. The validation is discussed in more detail in Attachment B1.

4.0 GROUNDWATER FLOW MODEL RESULTS

The following sections summarize groundwater flow modeling results. 2024 Conditions Model results are presented first, followed by Post-Closure Model results with and without an AEM hydraulic barrier wall around AP-1.

4.1 2024 Conditions Model

The 2024 Conditions Model focuses on simulation of site conditions from March 2024, with some calibration targets included from earlier in the first quarter of 2024 for more complete data coverage. Simulated water table elevation contours are shown in plan-view for the regional model domain on Figure B4-1. Contours for model layers 2 to 6 are shown on Figures B4-2 and B4-3.

- Simulated groundwater table elevations in the model domain vary from highest elevations of about 1,228 feet NAVD88 in the northern corner, to lowest elevations occurring around 741.3 feet along the planform of the Chattahoochee River in the southwest corner. Groundwater gradients mimic the general trends of topographic slopes.
- The overall groundwater flow pattern at the water table is from higher elevations toward local and regional lower elevations along drainage features, including Nancy Creek, Peachtree Creek, Proctor Creek, Nickajack Creek, Rottenwood Creek, an unnamed tributary to the Chattahoochee River located to the west of AP-1

(Western Tributary), an unnamed tributary to the Chattahoochee River located to the east of AP-3/4, and the Chattahoochee River.

- A local groundwater divide occurs within the footprint of AP-3/4, with groundwater predicted to flow towards AP-1, AP-2, and the Western Tributary to the southwest, towards an unnamed tributary to the Chattahoochee River located on the eastern side of AP-3/4 (Eastern Tributary) to the southeast, and to the onsite construction-related topographic low to the east.
- Flow gradients are predicted to be steeper in areas adjacent to the Western and Eastern Tributaries and the Chattahoochee River.
- The simulated 2024 Conditions potentiometric surface is below the base of CCR, except for isolated areas near the underdrain where the potentiometric surface is simulated to be between 0 and 2 feet above the base of CCR; Figure B4-4 (left inset). These isolated areas represent the late stages of water table decline within the aerial footprint of AP-3/4 as water levels within the CCR footprint are continuing to decline in response to Temporary AEM Well pumping, groundwater flowing into and being removed from the AEM Enhanced Underdrain, and the installation of a cover liner to limit direct precipitation recharge. The potentiometric surface in the isolated areas where it is above the CCR in the 2024 Conditions Model is predicted to fall below the base of CCR by about mid-2025 based on the empirical analysis of buttress water levels provide in Appendix C.

At the model domain scale almost 94% of the model outflow reports to minor tributaries and wetlands represented by drain boundary conditions. The Chattahoochee River accommodates about 6% of model outflow. Approximately 97% of model inflows are due to recharge; while river cells represented by the Chattahoochee River and regionally distributed ponds account for the remaining 3% of model inflow. The model cumulative percent mass balance error of 0% is smaller than the industry standard of 1 percent (absolute).

4.2 Post-Closure Model – Wall around AP-1

The Post-Closure Model simulates a long-term steady-state representation of the model domain following installation of the AP-3/4 AEM Enhanced Underdrain and sump system, installation of a low-permeable cover over AP-3/4, cessation of pumping from AP-3/4 dewatering wells and proposed installation of a hydraulic barrier wall around AP-1. The Post-Closure model incorporates several elements of the closure design at varying levels of detail. These elements include:

- Installation of a fully encompassing hydraulic barrier wall around AP-1 to the top of PWR. The top of PWR occurs at a variable depth below ground surface according to the elevation of the top of PWR.
- Facilitate free flow of groundwater through the AEM Enhanced Underdrain.
- Reduction of liner recharge to long-term closure conditions within AP-1 and AP-3/4. The reduction in recharge is needed because a higher recharge is needed in the 2024 Condition Model to approximate moisture conditions in the CCR in the time frame between liner installation and March 2024. The moisture conditions had not yet reached long-term equilibrium with liner recharge and there is currently more moisture in the CCR compared to long term Post-Closure conditions. Recharge through the cover is simulated using the Hydrologic Evaluation of Landfill Performance (HELP) model approach, as detailed in Golder, 2020a. The

HELP model recharge prediction represents long-term recharge conditions extending through the post closure period.

- Installation of surface water drains on liner surfaces.
- Construction of stormwater channels and other water conveyance features within AP-1 and AP-3/4.

These design elements are shown in Figure B4-5.

Post Closure Model simulation results demonstrate that the closure design will lower the CCR potentiometric ground water surface below the base of CCR. This is based on numerical model outputs confirming that the simulated CCR potentiometric surface is below the bottom of every AP-3/4 CCR model cell.

Post-Closure water table elevation contours are shown in Figure B4-1. Groundwater in underlying residuum and PWR (Layers 3 and 4) enter AP-3/4 from the northwest and leaves along eastern, southern, and southwestern portions of the footprint according to historical drainages (Figure B4-6). Some eastward flow is captured by the AEM Enhanced Underdrain. Potentiometric contours in bedrock layers 5 & 6 display similar flow direction patterns (Figure B4-7).

At the model domain scale about 94% of the model outflow reports to minor tributaries, site surface drainage features, and the AP-3/4 sump as represented by drain boundary conditions. Like the 2024 Conditions Model, the remaining outflows report to the Chattahoochee River. The model cumulative percent mass balance error of 0.00% is below the industry standard of 1 percent (absolute).

4.3 Post-Closure Model – No wall around AP-1

A sensitivity analysis was conducted to assess the effect of removing the proposed fully encompassing barrier wall from AP-1 on water levels in the surrounding areas. All other features of this model realization are left identical to that of the Post-Closure with wall scenario. The results, discussed in more detail in Attachment B1, show little to no difference in the potentiometric surface underlying AP-3/4, and mass-balance details remained the same as the Post-Closure scenario with the fully encompassing barrier wall (Attachment B1, Figure B1-9). Based on this post-closure simulation, the inclusion or exclusion of the AP-1 hydraulic barrier is not predicted to impact groundwater conditions at AP-3/4. In each case, the post-closure potentiometric surface remains below the base of CCR.

5.0 SUMMARY

Key findings from model results are summarized as follows:

- Simulated groundwater flow patterns for the 2024 Conditions Model are consistent with the current site CSM. Upgradient groundwater follows the topographic divide to AP-3/4, then flows east and southwest to the site tributaries, and southeast to the Chattahoochee River.

The closure measures are predicted to lower the CCR potentiometric surface to below the base of CCR within the AP-3/4 footprint. This is true whether a fully encompassing barrier wall around AP-1 to the top of PWR is included in the modeling.

6.0 REFERENCES

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APPENDIX B - GROUNDWATER MODEL CONSTRUCTION AND CALIBRATION

Tables

Table B2-1
Model Layer Summary

Number	Thickness	MODFLOW Layer Type	Conceptual Designation	Top Elevation Data Source(s)	Bottom Elevation Data Source(s)
Layer 1	Variable	1 - Unconfined (Layer 1)	Engineered Fill	AP-1 and AP-3/4 cells represent the maximum elevation of the closure design grading. Elsewhere in the model domain the max of USGS National Elevation Dataset (NED) 1/9 Arc Second DEM (~ 3 m; NED19 DEM), aside from river and drain boundary-condition locations, where the elevation is the minimum of the DEM + 0.02	AP-3/4 buttress area has a base of fill from the design drawing. Elsewhere in the model domain the bottom elevation of Layer 1 was set at the top elevation of minus 0.01 ft.
Layer 2	Variable	3 – Unconfined (T Varies)	CCR	Base of Layer 1	AP-1 and AP-3/4 cells have a base of CCR from the design drawing. Elsewhere in model domain the bottom elevation of Layer 1 was set at the base elevation of minus 0.02 ft.
Layer 3	Variable	3 – Unconfined (T Varies)	Residuum	Base of Layer 2	Onsite the bottom elevation of the base of the residuum from the HAR. Elsewhere the bottom elevation was set at 39.59 ft below ground surface away from the site, which is the average residuum thickness based on borehole logs.
Layer 4	Variable	3 – Unconfined (T Varies)	PWR	Base of Layer 3	Onsite the bottom elevation of the base of PWR from the HAR. Elsewhere the bottom elevation was set at 12.08 ft below ground surface away from site, which is the average PWR thickness based on borehole logs.

Number	Thickness	MODFLOW Layer Type	Conceptual Designation	Top Elevation Data Source(s)	Bottom Elevation Data Source(s)
Layer 5	30 feet	3 – Unconfined (T Varies)	Upper Bedrock	Base of Layer 4	The bottom elevation of Layer 4 is 30 ft below top of rock, based on hydraulic testing data.
Layer 6	Variable	3 – Unconfined (T Varies)	Lower Bedrock	Base of Layer 5	369 ft NAVD 88 elevation (300 feet below the lowest point of layer 5 base), which captures deep conditions to remove any edge effects on flow conditions.

Notes:
T: Transmissivity
CCR: Coal Combustion Residuals
PWR: Partially Weathered Rock
BC: Boundary Condition
HAR: Hydrogeological Assessment Report.
NAVD: North American Vertical Datum
DEM: Digital Elevation Model
ft: feet

Created by: SJS 2024-09-28
Checked by: CAB 2024-11-29

Table B2-2
Model Hydraulic Conductivity Zone Summary

Zone	Name	Geometric mean horizontal hydraulic conductivity (ft/day)[1]	Calibrated horizontal hydraulic conductivity (ft/day)	Calibrated vertical hydraulic conductivity (ft/day)	Horizontal : Vertical hydraulic conductivity ratio (H/V)
1	Unused	--	1.00E+03	8.08E+04	1.24E-02
2	Coal Combustion Residuals - AP-1	1.42E-01	5.00E+00	1.16E-01	4.32E+01
3	Coal Combustion Residuals - AP-3/4	1.42E-01	8.99E-02	5.50E-02	1.63E+00
4	Pilot Point Area Residuum	2.84E-01	3.25E-01	4.10E-03	7.92E+01
5	Regional Alluvium	2.84E-01	3.25E-02	3.14E-02	1.03E+00
6	Regional Residuum	2.84E-01	1.23E-03	1.12E+00	1.10E-03
7	Pilot Point Area Partially Weathered Rock	8.93E-01	7.48E-03	9.12E-03	8.20E-01
8	Regional Partially Weathered Rock	8.93E-01	2.55E+00	7.48E-02	3.41E+01
9	Upper Bedrock Pilot Point Area	4.48E-01	9.12E-03	5.21E-01	1.75E-02
10	Upper Regional Sedimentary Siliciclastic Bedrock	4.48E-01	1.77E+00	2.18E-01	8.10E+00
11	Upper Regional Mylonite Bedrock	4.48E-01	4.17E-02	5.95E-02	7.01E-01
12	Upper Regional Metamorphic Schist Bedrock	4.48E-01	2.14E-02	4.19E-02	5.11E-01
13	Upper Regional Metamorphic Gneiss & Orthogneiss Bedrock	4.48E-01	3.25E-01	2.32E-02	1.40E+01
14	Upper Regional Metamorphic Gneiss Bedrock	4.48E-01	1.15E+00	5.90E-02	1.96E+01
15	Upper Regional Metamorphic Amphibolite Bedrock	4.48E-01	1.89E+00	7.44E-01	2.54E+00
16	Upper Regional Igneous Intrusive Felsic Bedrock	4.48E-01	1.83E-01	9.12E-03	2.00E+01
17	Lower Bedrock Pilot Point Area	4.39E-02	1.56E-03	1.93E-01	8.08E-03
18	Lower Regional Sedimentary Siliciclastic Bedrock	4.39E-02	2.18E-02	1.93E-01	1.13E-01
19	Lower Regional Mylonite Bedrock	4.39E-02	2.31E-02	6.57E-02	3.52E-01
20	Lower Regional Metamorphic Schist Bedrock	4.39E-02	1.18E-01	1.50E-01	7.89E-01
21	Lower Regional Metamorphic Gneiss & Orthogneiss Bedrock	4.39E-02	2.43E-02	1.93E-01	1.26E-01
22	Lower Regional Metamorphic Gneiss Bedrock	4.39E-02	1.93E-01	2.55E-02	7.57E+00
23	Lower Regional Metamorphic Amphibolite Bedrock	4.39E-02	3.23E-02	8.48E-03	3.81E+00
24	Lower Regional Igneous Intrusive Felsic Bedrock	4.39E-02	1.83E-02	1.48E-02	1.24E+00

Notes:

1. Geometric mean hydraulic conductivity based on field tests performed at the site. All upper and lower bedrock units in the model domain are initially represented with the geometric means of onsite upper and lower bedrock tests.

Created by: SJS 2024-10-24
Checked by: CAB 2024-11-29

Table B2-3
Model Boundary Conditions Summary

Number	Type	Conceptual Designation	Elevation Data Source(s)	Conductivity / Rate Data Source(s)
Layer 2	Drain Cells	Surface drainage features - Liner Vicinity	AP-3/4 liner grading: AP-3/4 Final Cover Armoring Delineation Plan (Sheet 7), Plant McDonough Ash Pond 3 and Ash Pond 4 (AP-3/4) Closure & Ash Pond 2 (AP-2) Closure Report AP-1 liner grading: Cover System & Cap Improvements (Sheet S13), Plant McDonough CCR Unit AP-1 Advanced Engineering Methodologies & stormawater improvements report.	Liner conductivity: HELP Model Summary
Layer 2	Drain Cells	AP-3/4 AEM Enhanced Underdrain	Underdrain grading: Under Slope Drainage & Geotechnical Instrumentation Details (Sheet C31), Plant McDonough Ash Pond 3 and Ash Pond 4 (AP-3/4) Closure & Ash Pond 2 (AP-2) Closure Report	Underdrain material types: Under Slope Drainage & Geotechnical Instrumentation Details (Sheet C31), Plant McDonough Ash Pond 3 and Ash Pond 4 (AP-3/4) Closure & Ash Pond 2 (AP-2) Closure Report
Layer 3	Drain Cells	Surface drainage features - Pond 2 Vicinity	AP-3/4 liner grading: AP-3/4 Final Cover Armoring Delineation Plan (Sheet 7), Plant McDonough Ash Pond 3 and Ash Pond 4 (AP-3/4) Closure & Ash Pond 2 (AP-2) Closure Report AP-1 liner grading: Cover System & Cap Improvements (Sheet S13), Plant McDonough CCR Unit AP-1 Advanced Engineering Methodologies & stormawater improvements report.	Liner conductivity: HELP Model Summary
Layer 3	Drain Cells	Intermittent Ponds	United States Geological Survey 1-meter Digital Elevation Model (The National Map)	Fetter (2007)
Layer 3	Drain Cells	Tributary stream channels	United States Geological Survey 1-meter Digital Elevation Model (The National Map)	Fetter (2007)
Layer 3	River Cells	Ponds and Lakes	United States Geological Survey National Hydrography Dataset (NHD)	Fetter (2007)
Layer 3	River Cells	Chattahoochee River	United States Geological Survey National Hydrography Dataset (NHD)	Fetter (2007)

Layer 3	Hydraulic Flow Barrier Elements	AP-1 Barrier Wall	Advanced Engineering Methods Feasibility Study and Construction Review: Plant McDonough Ash Pond 1 (AP-1): Submitted January 2024.	Advanced Engineering Methods Feasibility Study and Construction Review: Plant McDonough Ash Pond 1 (AP-1): Submitted January 2024.
Layers 3-5	Pumping Wells	AP-3/4 Temporary AEM Dewatering Wells	Hydrogeologic Assessment Report Revision 07, April 2024, 791 p.	WSP USA O&M synoptic data - unpublished.
All Layers	Unused	Hydrologic Unit level 12 watershed boundary	United States Geological Survey National Hydrography Dataset (NHD)	Zero (Cells outside of HU Level 12 perimeter not used in modeling).

Created by: SJS 2024-10-24

Checked by: CAB 2024-11-29

Table B2-4
Model Recharge Zone Summary

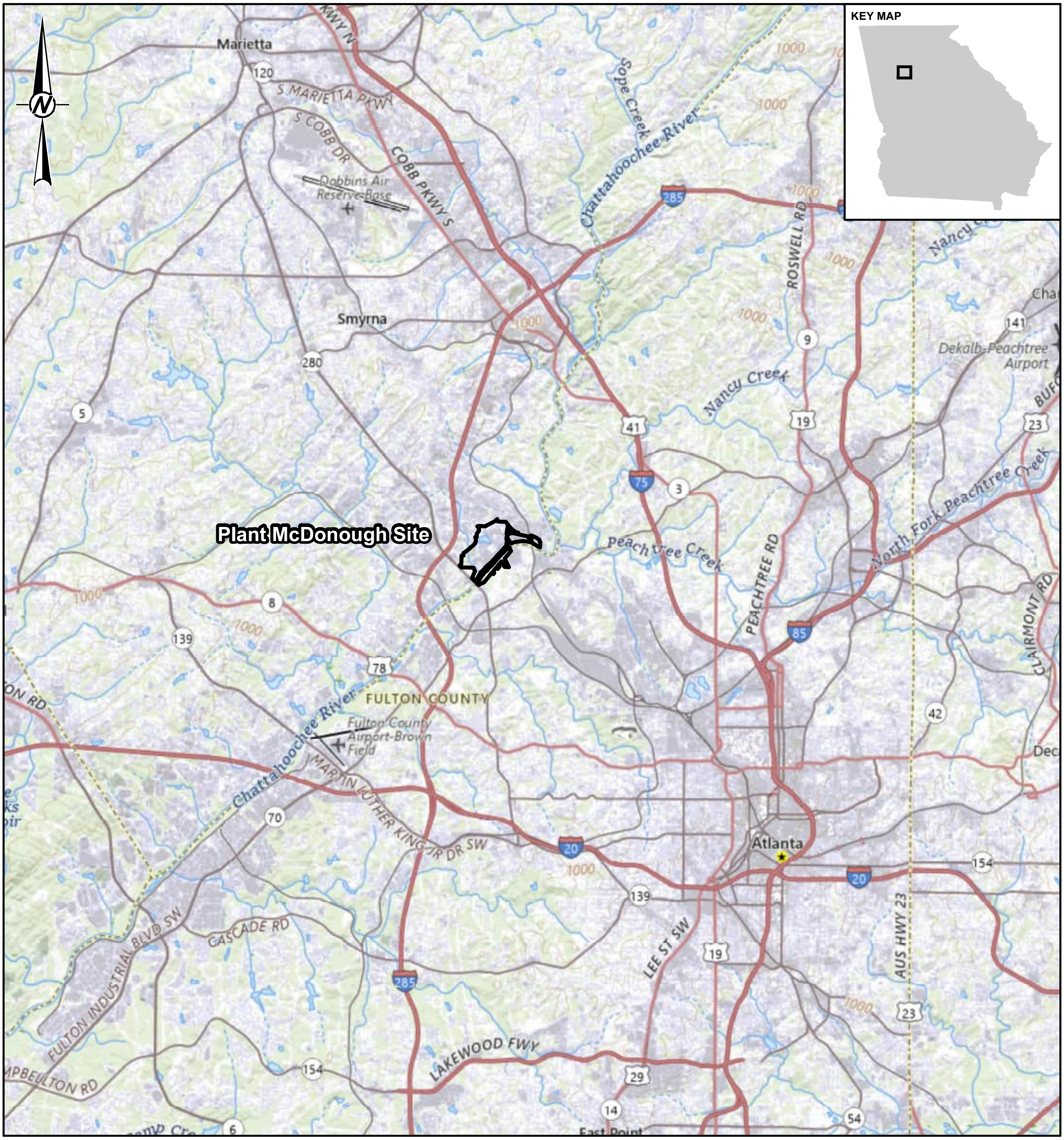
Zone	MRLC Land Cover Class	Type	Recharge (ft/day)	Recharge (in/mo)
1	11	OPEN WATER	1.73E-02	6.43
2	21	DEVELOPED, OPEN SPACE	1.64E-03	0.61
3	22	DEVELOPED, LOW INTENSITY	1.98E-04	0.07
4	23	DEVELOPED, MEDIUM INTENSITY	2.03E-03	0.75
5	24	DEVELOPED, HIGH INTENSITY	3.03E-05	0.01
6	31	BARREN LAND	1.25E-04	0.05
7	41	DECIDUOUS FOREST	3.39E-05	0.01
8	42	EVERGREEN FOREST	3.25E-04	0.12
9	43	MIXED FOREST	6.85E-05	0.03
10	52	SHRUB/SCRUB	1.42E-03	0.53
11	71	HERBACEUOUS	7.02E-03	2.61
12	81	HAY/PASTURE	2.05E-04	0.08
13	90	WOODY WETLANDS	7.47E-03	2.78
14	95	EMERGENT HERBACEUOUS WETLANDS	2.47E-03	0.92
15	-	AP-1 liner	1.66E-06	6.18E-04
16	-	AP-3/4 liner	1.58E-06	5.88E-04

Notes:
Recharge converted to in/mo is specific to March 2024

Created by: SJS 2024-09-24
Checked by: ITL 2024-10-02

APPENDIX B – GROUNDWATER CONSTRUCTION AND CALIBRATION

Figures



LEGEND

Property Boundary

REFERENCE(S)

1. BASEMAP FROM USGS THE NATIONAL MAP: NATIONAL BOUNDARIES DATASET, 3DEP ELEVATION PROGRAM, GEOGRAPHIC NAMES INFORMATION SYSTEM, NATIONAL HYDROGRAPHY DATASET, NATIONAL LAND COVER DATABASE, NATIONAL STRUCTURES DATASET, AND NATIONAL TRANSPORTATION DATASET; USGS GLOBAL ECOSYSTEMS; U.S. CENSUS BUREAU TIGER/LINE DATA; USFS ROAD DATA; NATURAL EARTH DATA; U.S. DEPARTMENT OF STATE HUMANITARIAN INFORMATION UNIT; AND NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION, U.S. COASTAL RELIEF MODEL. DATA REFRESHED AUGUST, 2021.

0 3 6

1 " = 3 mi MILES

CLIENT

GEORGIA POWER COMPANY
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PROJECT

THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE

LOCATION MAP

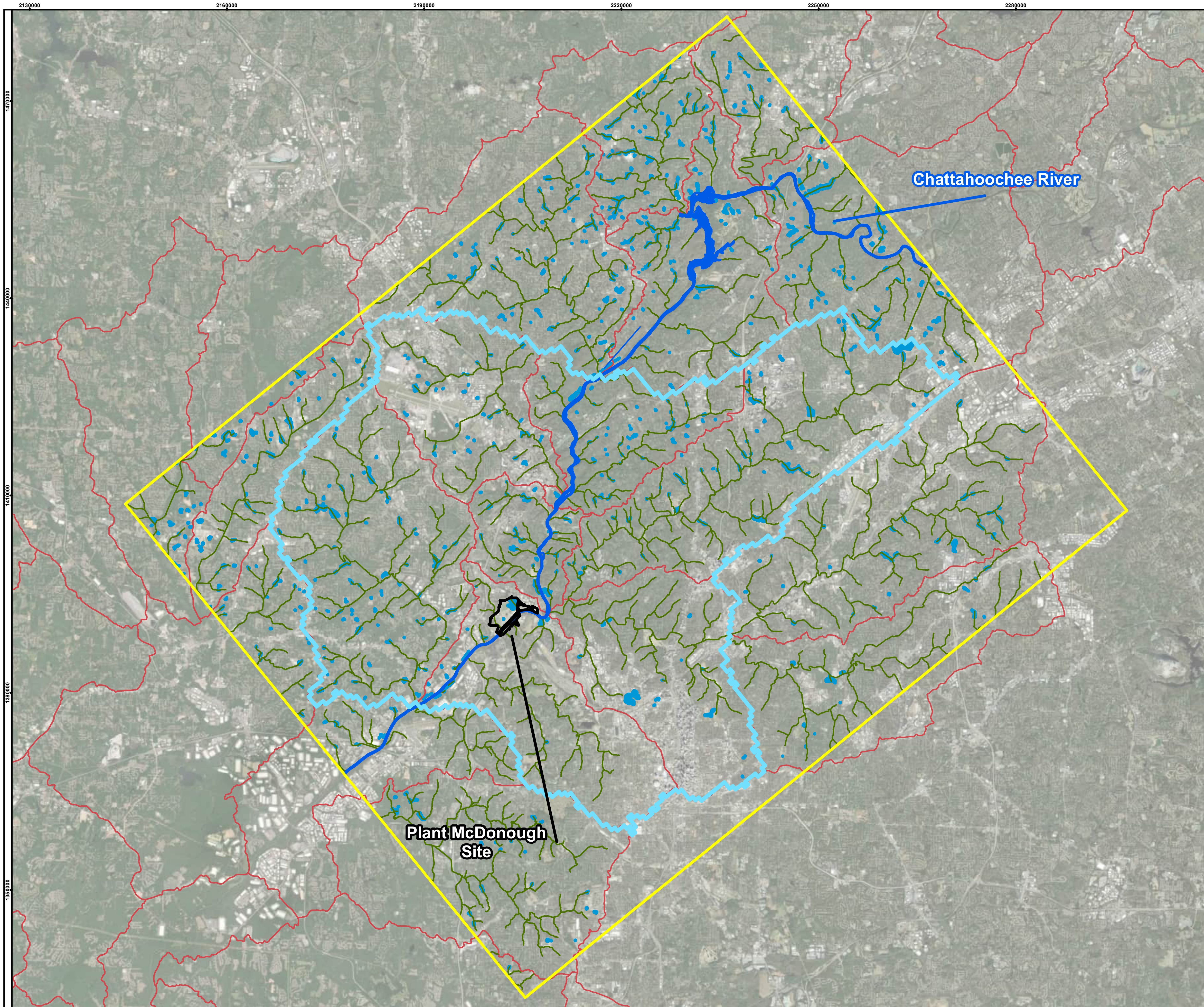
CONSULTANT

YYYY-MM-DD	2024-12-10
DESIGNED	SJS
PREPARED	AFS
CHECKED	SJS
REVIEWED / APPROVED	CB

PROJECT NO.	SCS PROJECT ID	REV.	FIGURE
US0037149.1670	MCD150170	0	B1-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

0 1 in



LEGEND

- Property Boundary
- Model Domain
- Area of Used Cells
- NHD Minor Streams
- NHD Major Streams and Rivers
- NHD Lakes and Ponds
- 12th-Level Catchment

N

0 15,000 30,000 45,000 Feet

1 inch = 15,000 feet

NOTE(S)

1. NHD = NATIONAL HYDROGRAPHIC DATASET

REFERENCE(S)

1. AERIAL IMAGERY: ESRI AERIAL BASEMAP, 2024

CLIENT

GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT

THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE

MODEL DOMAIN AND REGIONAL HYDROLOGIC FEATURES

CONSULTANT

YYYY-MM-DD	2024-12-10
DESIGNED	AFS
PREPARED	RMO
CHECKED	SJS
REVIEWED / APPROVED	CB

PROJECT NO.	SCS PROJECT ID	REV.	FIGURE
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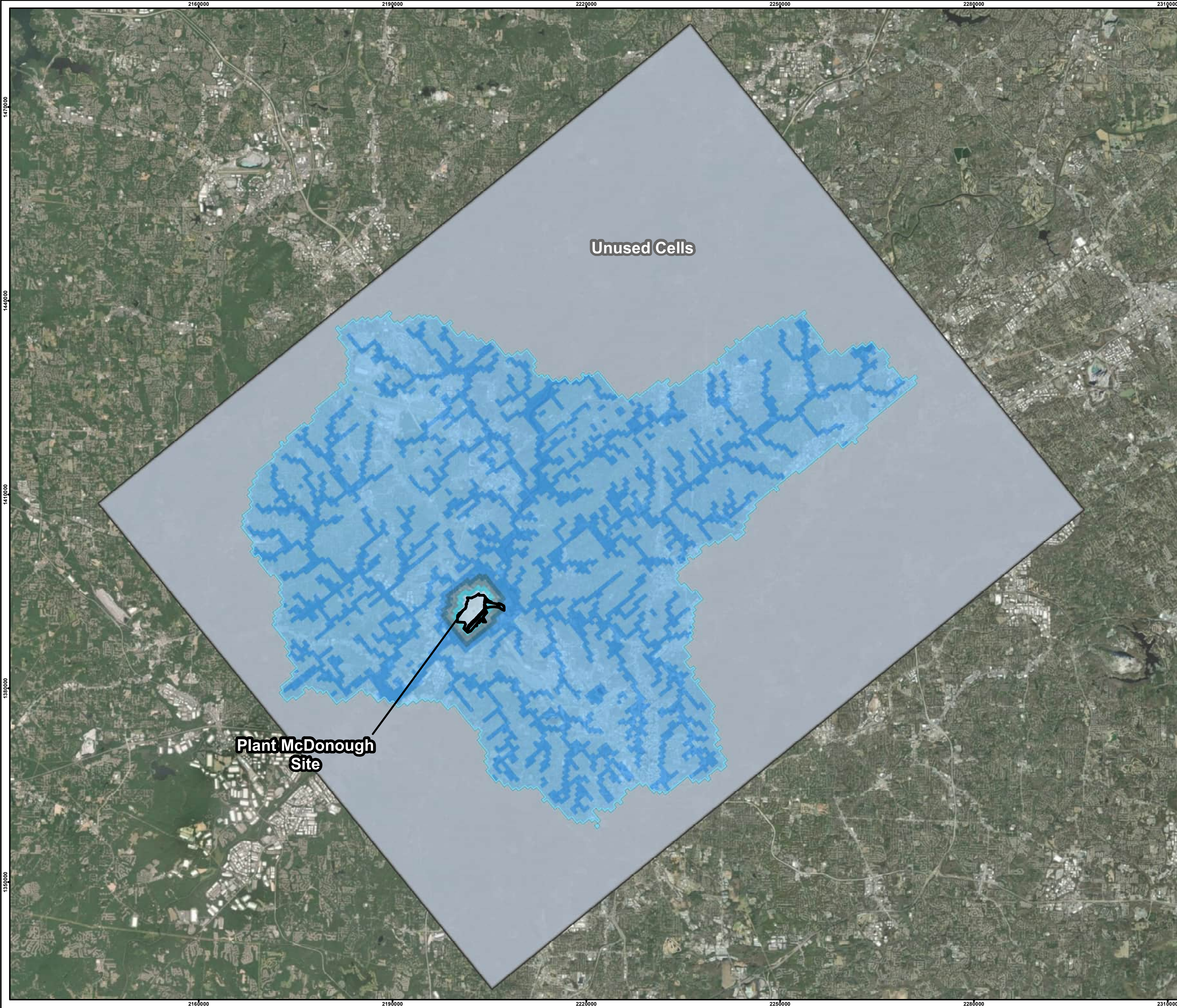

Model Domain
Area of Used Cells
Unused Cells

Model Grid Horizontal Cell Size (ft)

20 x 20 ft
40 x 40
80 x 80 ft
160 x 160 ft
320 x 320 ft
640 x 640 ft

N

0 7,500 15,000 30,000 45,000 Feet

1 inch = 15,000 feet

NOTE(S)
1. FT: FEET.

REFERENCE(S)
1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH

CLIENT
GEORGIA POWER COMPANY
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PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
MODEL GRID - FULL MODEL DOMAIN

CONSULTANT

YYYY-MM-DD	2024-12-11
DESIGNED	SJS
PREPARED	AFS
CHECKED	JML
REVIEWED / APPROVED	CB/WG

PROJECT NO.	SCS PROJECT ID	REV.	FIGURE
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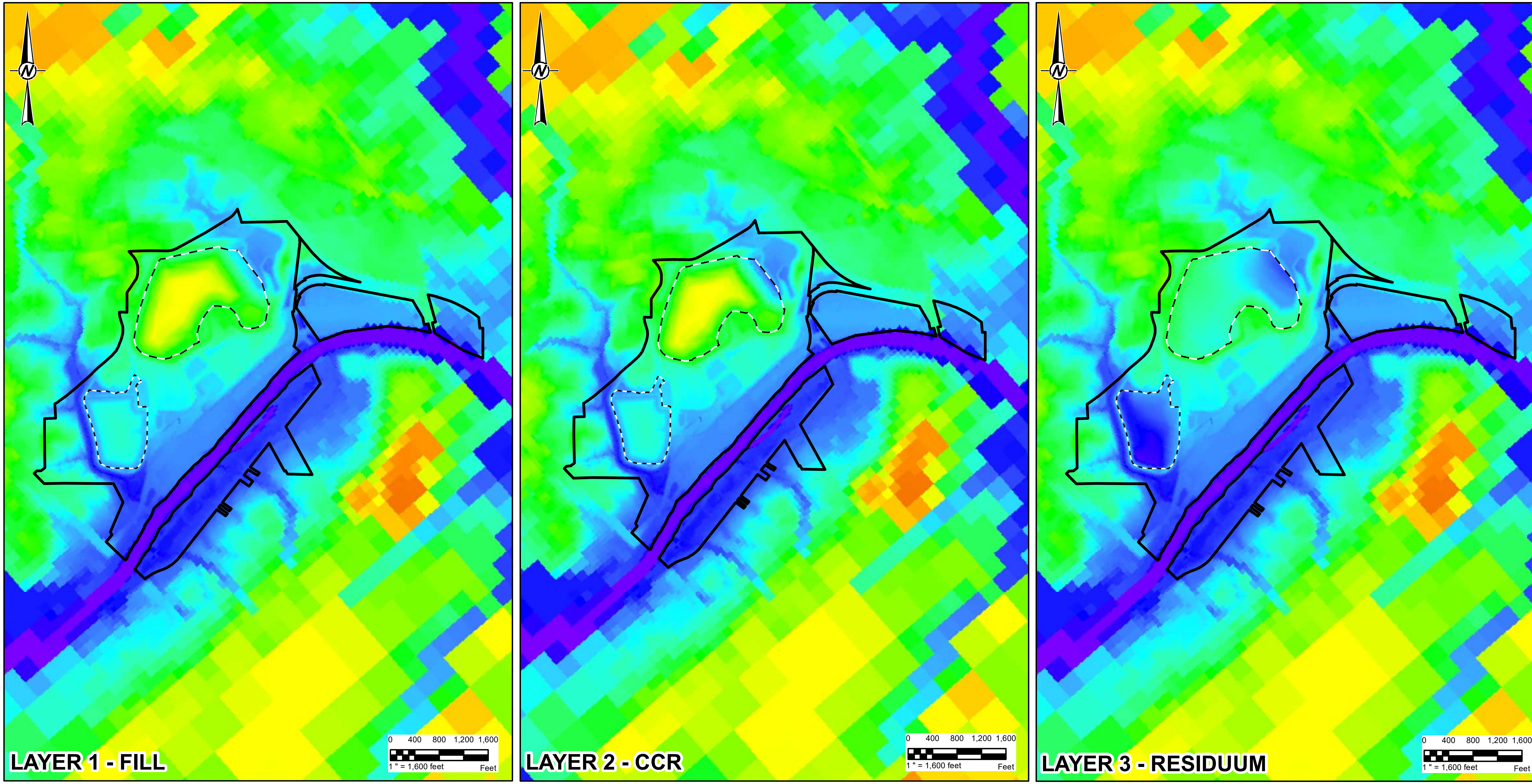

LEGEND

Property Boundary

AP-1 CCR Extent

AP-34 CCR Extent

Model Layer Top Elevation (ft NAVD 88)

650 1000

REFERENCE(S)

NOTE(S)
1. CCR: COAL COMBUSTION RESIDUALS.
2. NAVD 88: NORTH AMERICAN VERTICAL DATUM OF 1988.
3. FT: FEET.

CLIENT
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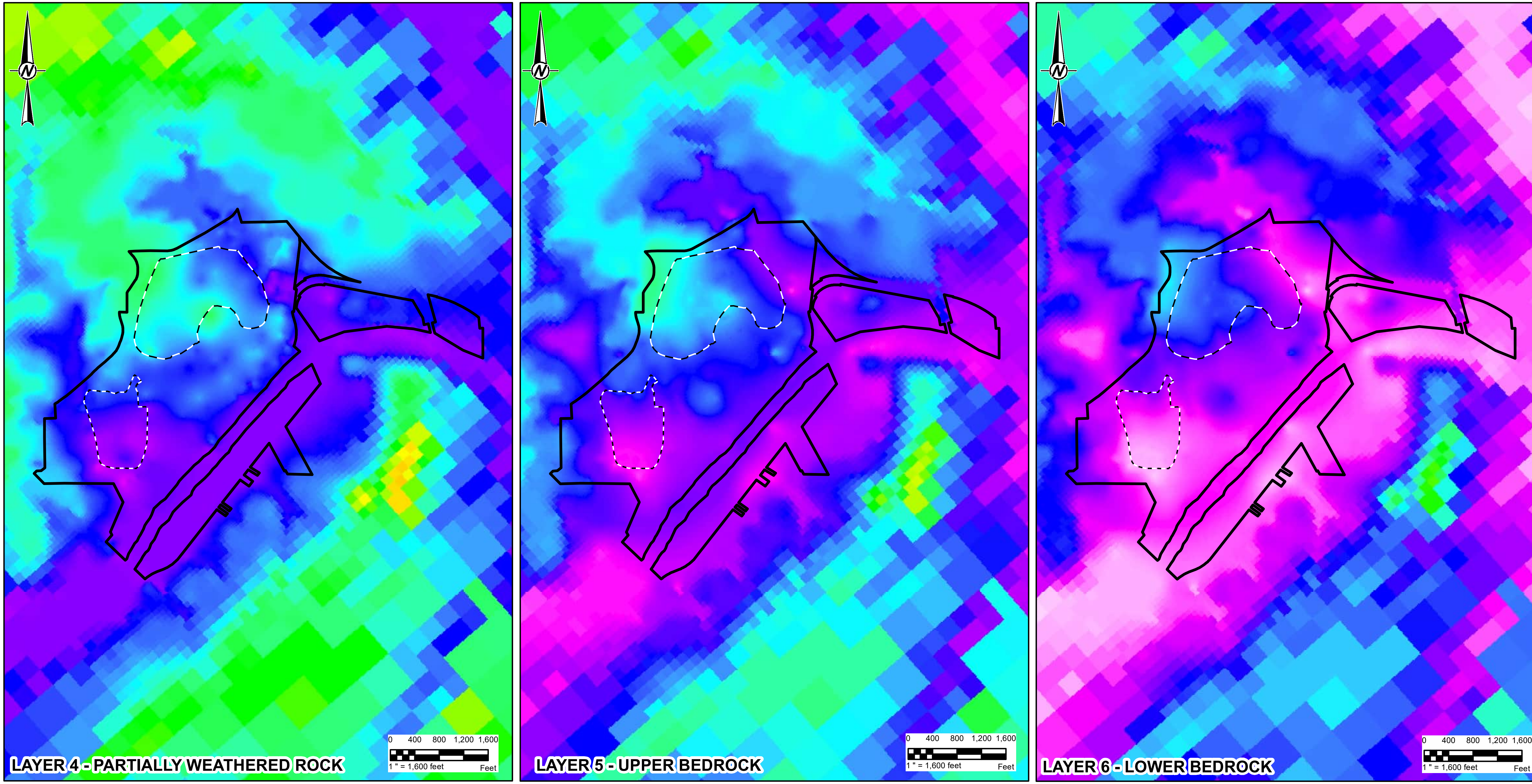
PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

CONSULTANT

YYYY-MM-DD	2024-12-10
DESIGNED	AKM
PREPARED	AFS
REVIEWED	CB
APPROVED	WG

TITLE
LAYER TOP ELEVATIONS: SITE VICINITY, LAYERS 1-3

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
US0037149.1670	MCD150170	0	B2-2



LEGEND

- Property Boundary
- AP-1 CCR Extent
- AP-3/4 CCR Extent

Model Layer Top Elevation (ft NAVD 88)

650 — 1000

REFERENCE(S)

NOTE(S)
1. NAVD 88: NORTH AMERICAN VERTICAL DATUM OF 1988.
2. FT: FEET.

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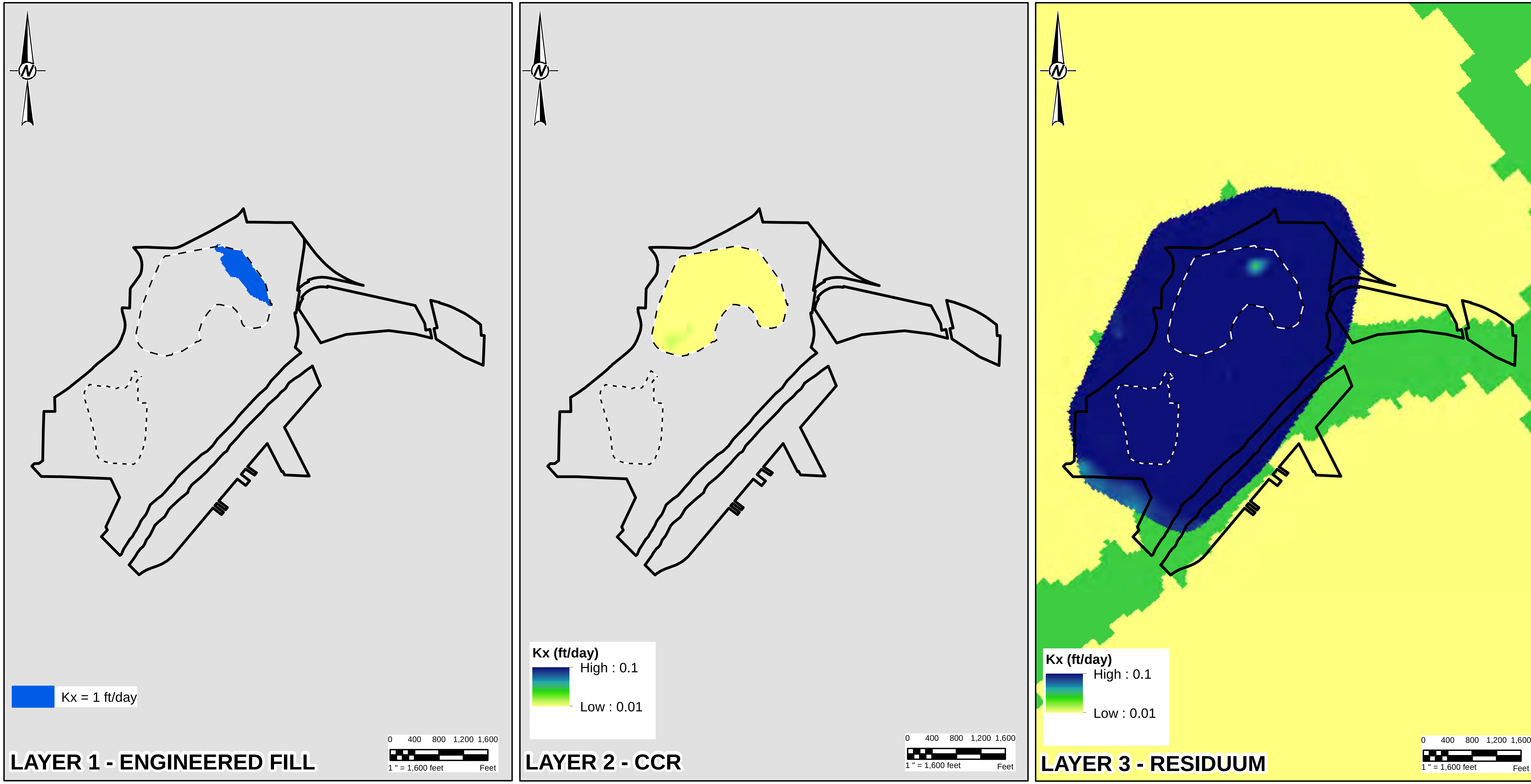
PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

CONSULTANT
wsp

YYYY-MM-DD	2024-12-10
DESIGNED	AKM
PREPARED	AFS
REVIEWED	CB
APPROVED	WG

TITLE
LAYER TOP ELEVATIONS: SITE VICINITY, LAYERS 4-6

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
US0037149.1670	MCD150170	0	B2-3



LEGEND

- Property Boundary
- Unused Cells
- AP - 1 CCR Extent
- AP - 3/4 CCR Extent

NOTE(S)
1. CCR: COAL COMBUSTION RESIDUALS.
2. NAVD 88: NORTH AMERICAN VERTICAL DATUM OF 1988.
3. FT: FEET.
4. KX = HORIZONTAL HYDRAULIC CONDUCTIVITY
5. COLOR BARS ARE LOG SCALED

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wsp

YYYY-MM-DD	2024-12-19
DESIGNED	AFS
PREPARED	AFS
REVIEWED	CB
APPROVED	WG

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
HORIZONTAL HYDRAULIC CONDUCTIVITY - LAYER 1-3: SITE VICINITY

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
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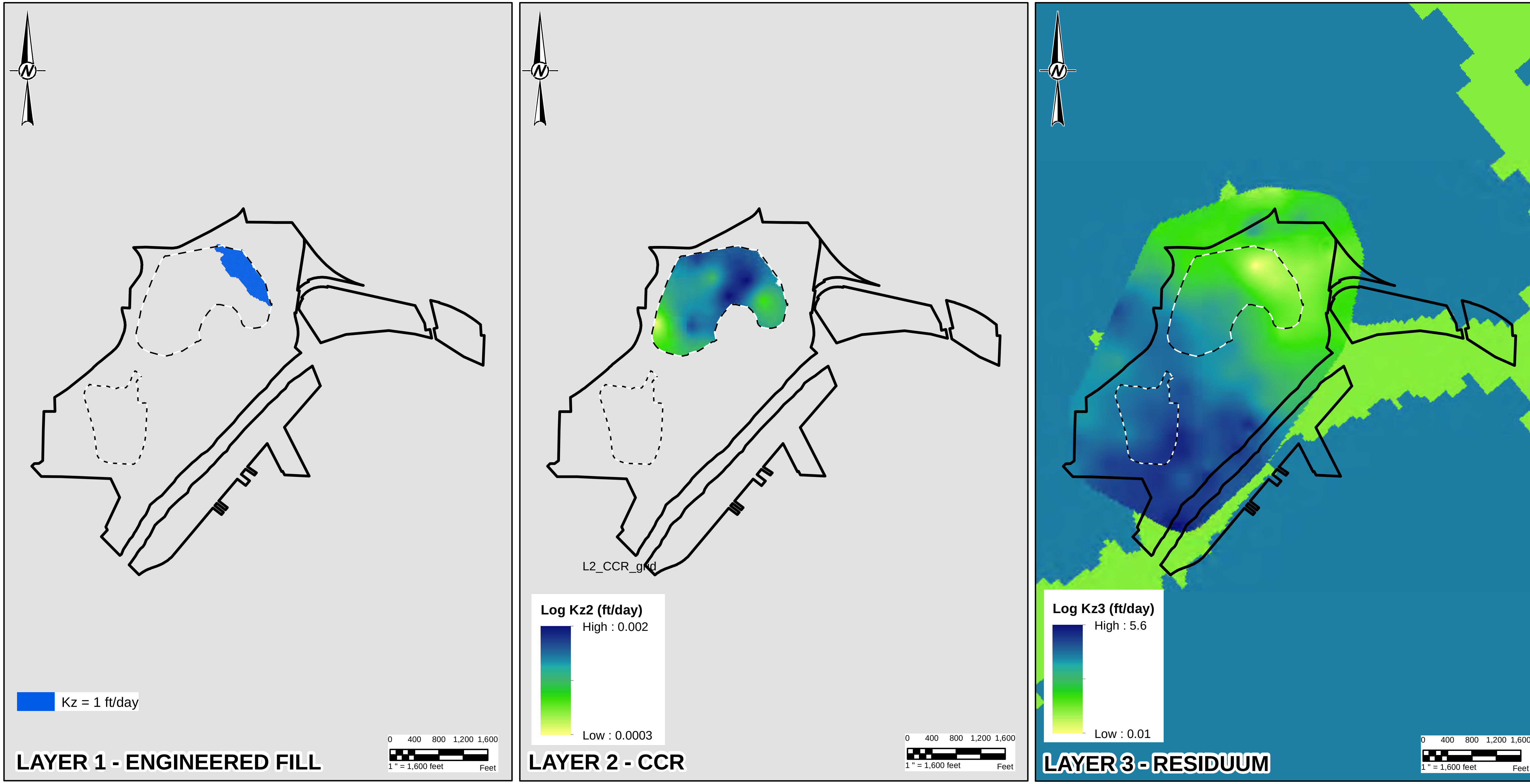

LEGEND

- Property Boundary
- AP - 1 CCR Extent
- AP - 3/4 CCR Extent

REFERENCE(S)

NOTE(S)

1. CCR: COAL COMBUSTION RESIDUALS.
2. NAVD: NORTH AMERICAN VERTICAL DATUM.
3. FT: FEET.
4. KZ: VERTICAL HYDRAULIC CONDUCTIVITY.
5. COLOR BARS ARE LOG SCALED

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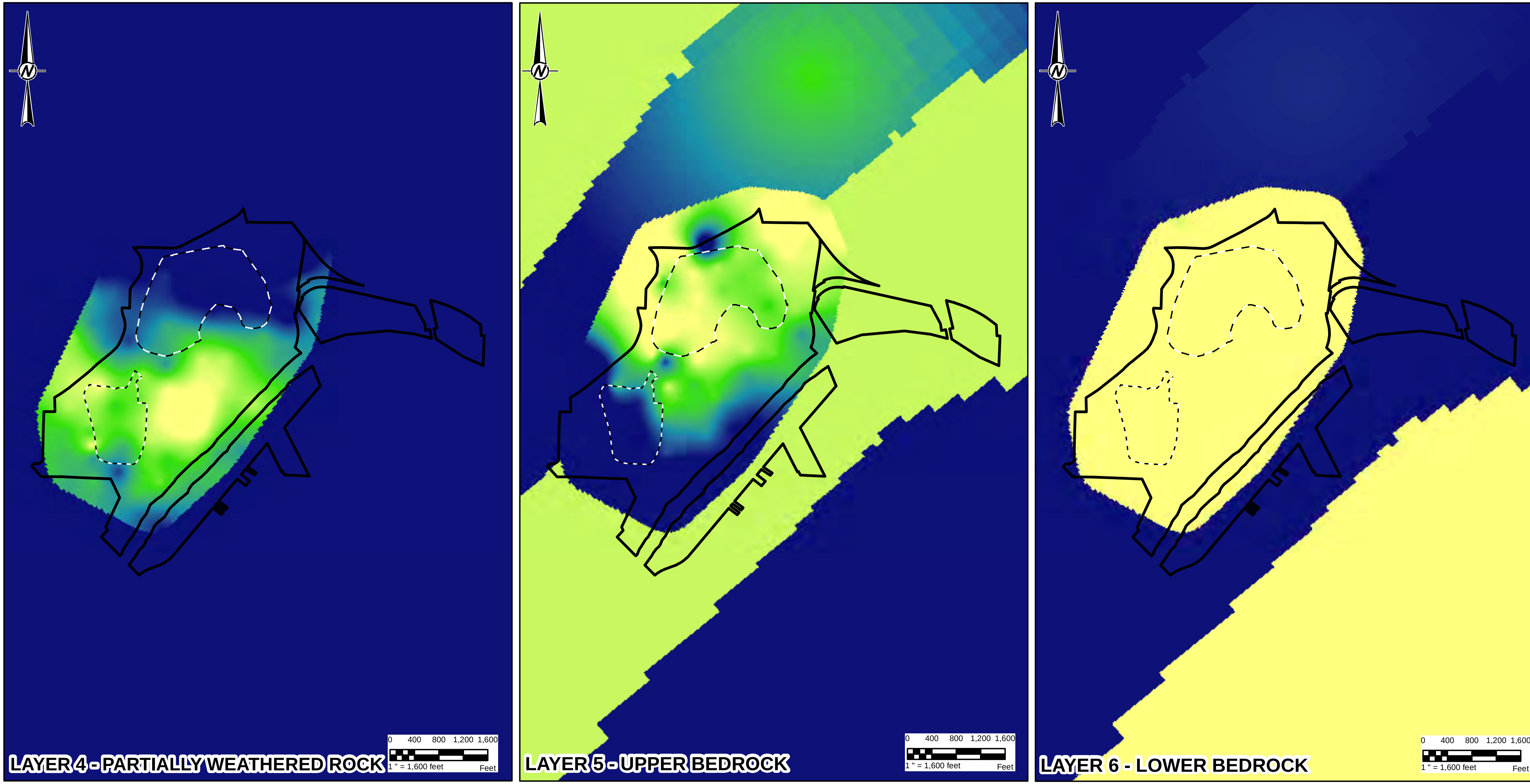
YYYY-MM-DD	2024-12-19
DESIGNED	AFS
PREPARED	AFS
REVIEWED	CB
APPROVED	WG

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
VERTICAL HYDRAULIC CONDUCTIVITY - LAYER 1-3: SITE VICINITY

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
US31406440.006	MCD150170	0	B2-5



LEGEND

Property Boundary

AP - 1 CCR Extent

AP - 3/4 CCR Extent

Kx (ft/day)

High : 0.1

Low : 0.01

NOTE(S)

1. CCR: COAL COMBUSTION RESIDUALS.
2. FT: FEET.
3. KX = HORIZONTAL HYDRAULIC CONDUCTIVITY
4. COLOR SCALE IS LOGARITHMIC (BASE 10).

REFERENCE(S)

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

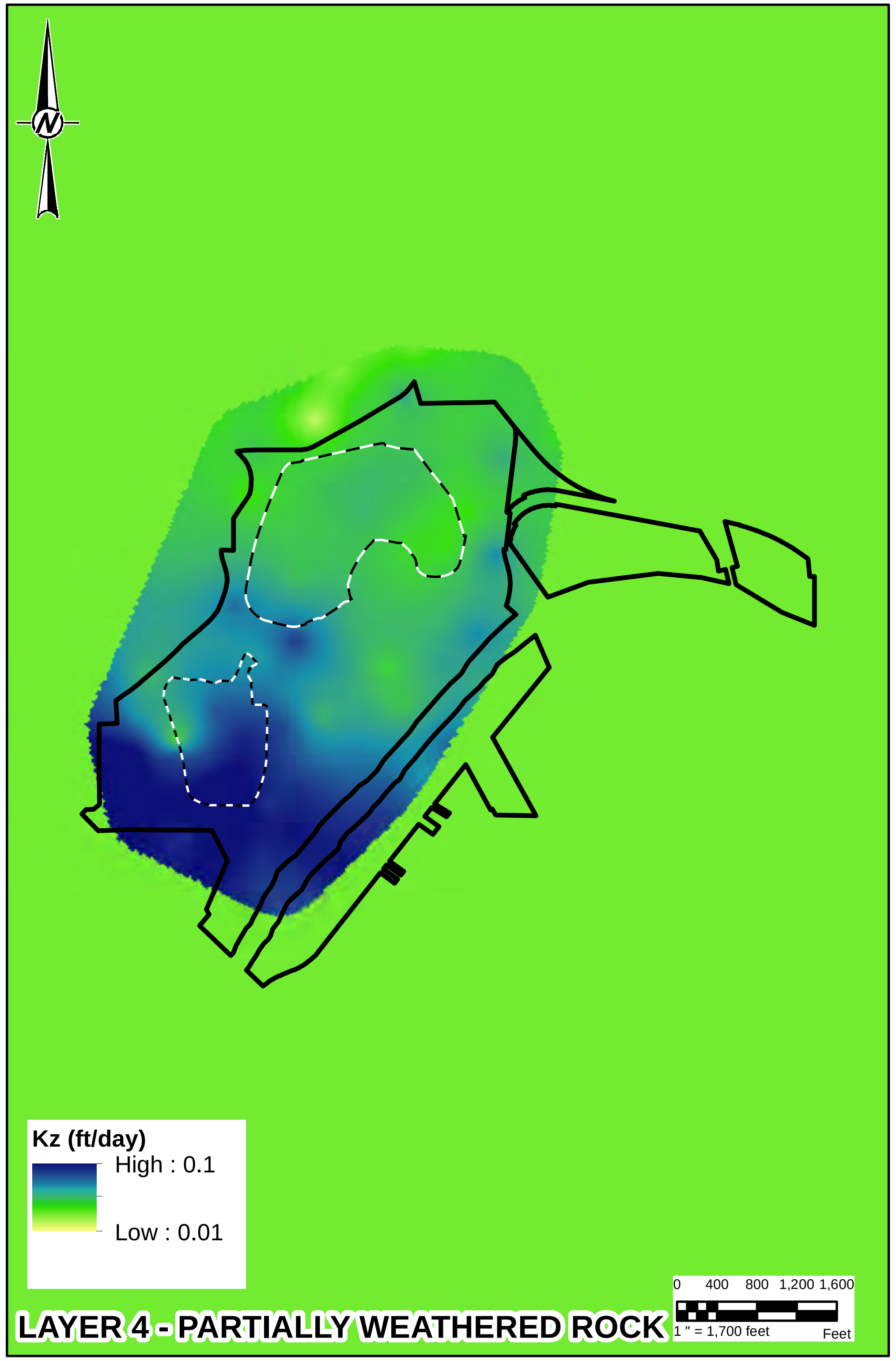
CONSULTANT

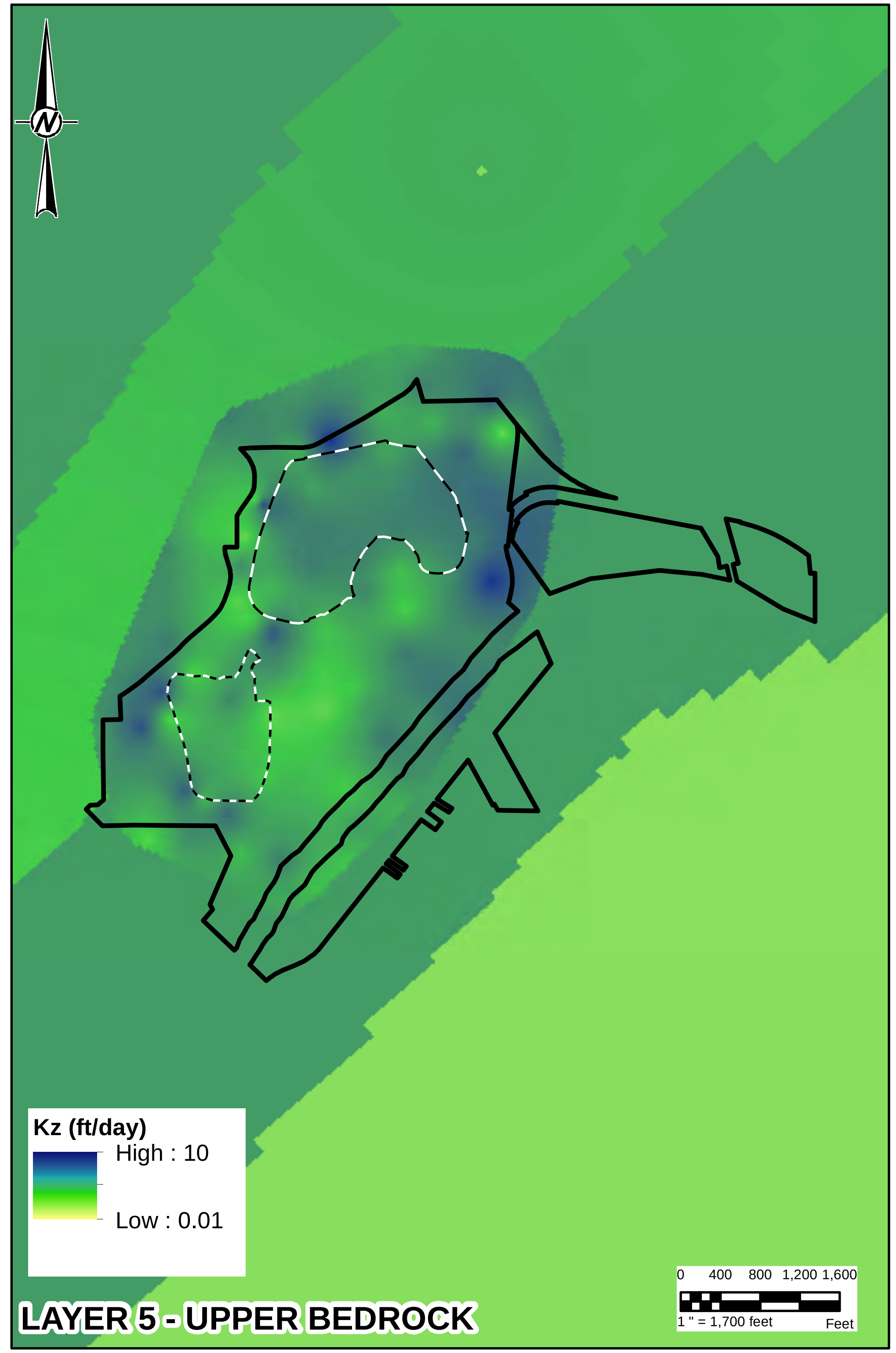
YYYY-MM-DD	2024-12-10
DESIGNED	AFS
PREPARED	AFS
REVIEWED	CB
APPROVED	WG

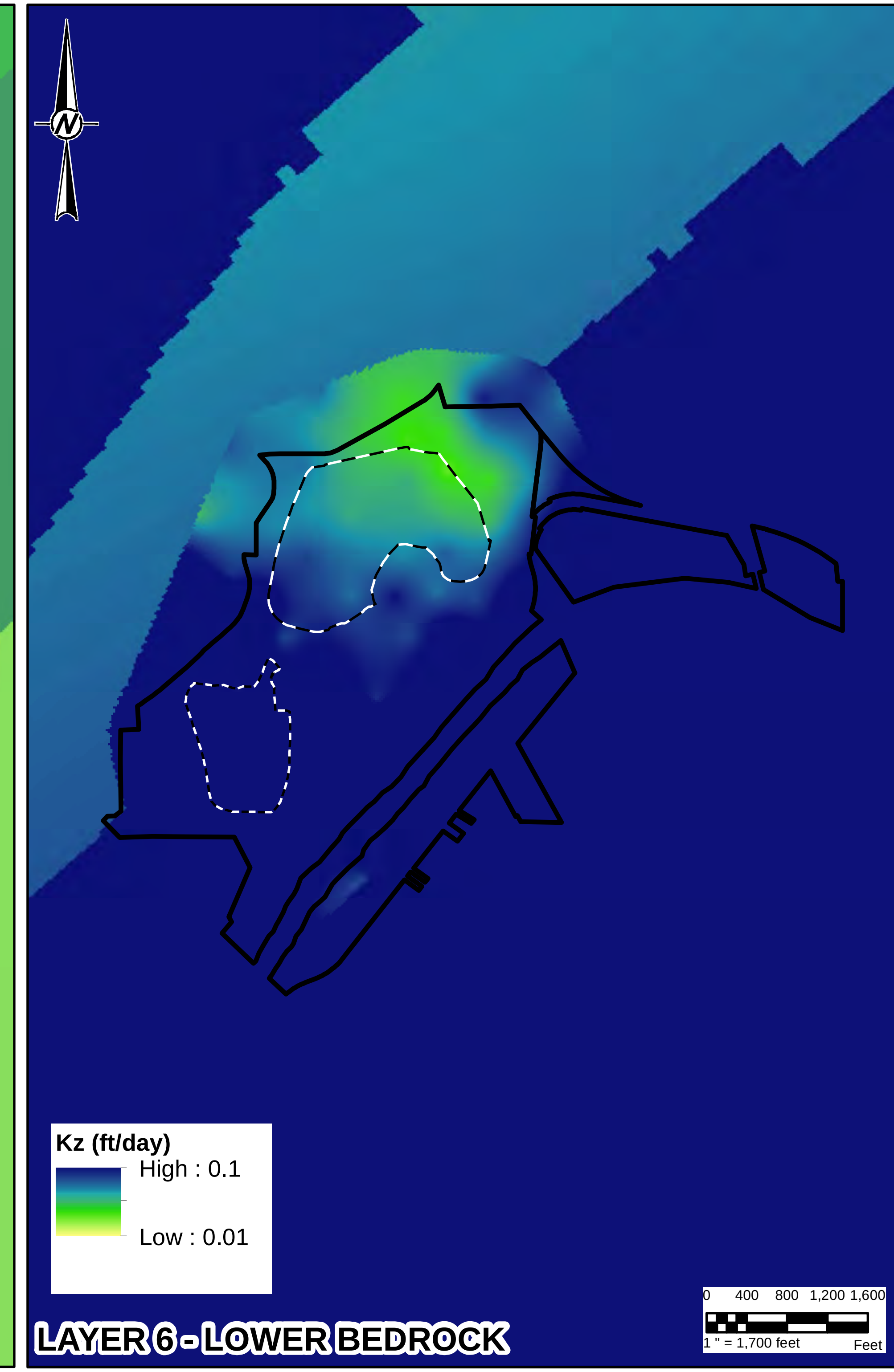
TITLE
HORIZONTAL HYDRAULIC CONDUCTIVITY - LAYER 4-6: SITE VICINITY

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
US0037149.1670	MCD150170	0	B2-6

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B







LEGEND

- Property Boundary
- AP - 1 CCR Extent
- AP - 3/4 CCR Extent

NOTE(S)

1. CCR: COAL COMBUSTION RESIDUALS.
2. FT: FEET.
3. KZ = VERTICAL HORIZONTAL CONDUCTIVITY
4. COLOR SCALE IS LOGARITHMIC (BASE 10).

REFERENCE(S)

CLIENT
GEORGIA POWER COMPANY
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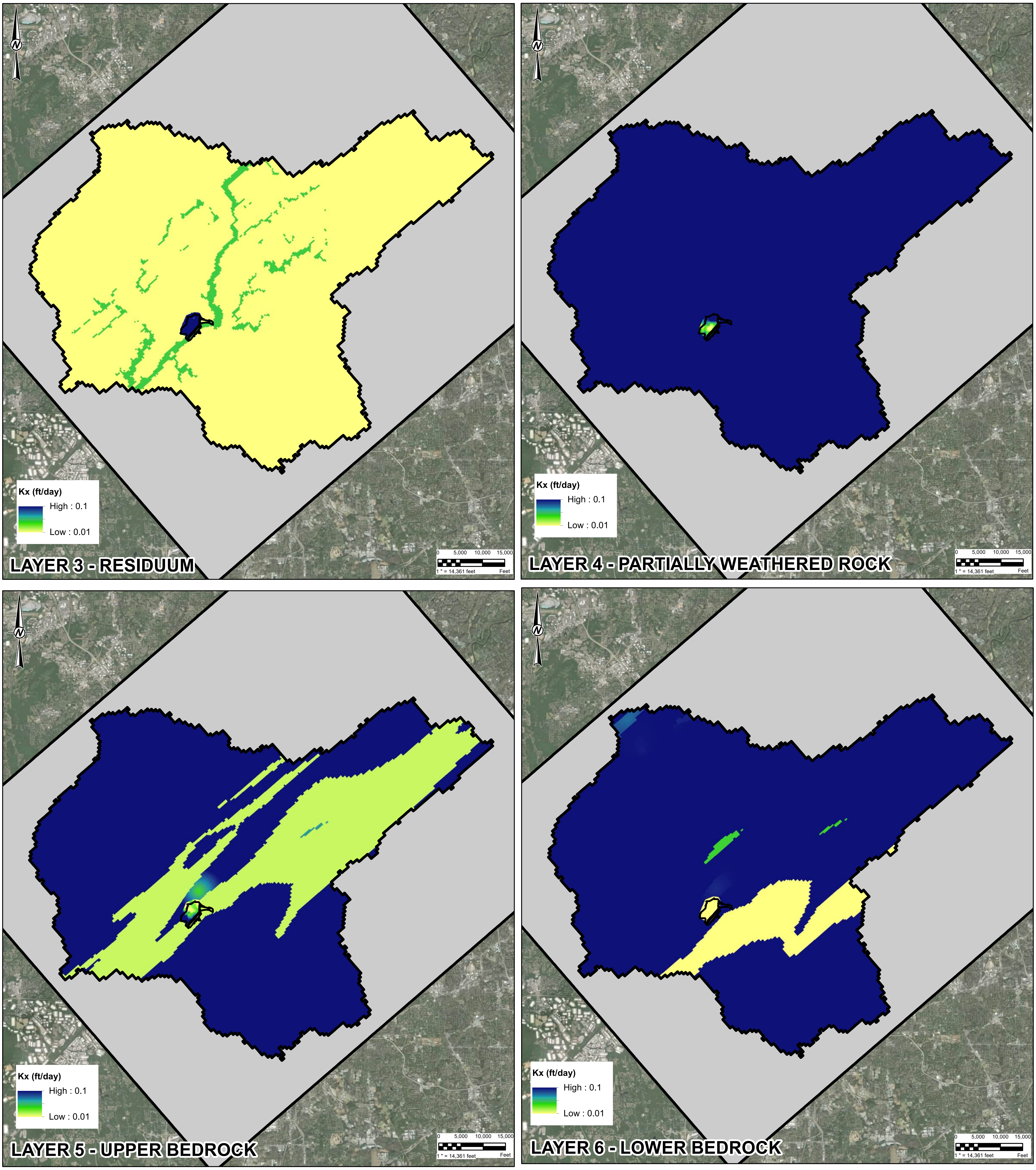
CONSULTANT

YYYY-MM-DD	2024-12-10
DESIGNED	AFS
PREPARED	AFS
REVIEWED	CB
APPROVED	WG

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
VERTICAL HYDRAULIC CONDUCTIVITY - LAYER 4-6: SITE VICINITY

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
US0037149.1670	MCD150170	0	B2-7



Legend

Property Boundary

Unused Cells

NOTE(S)

1. KZ = VERTICAL HYDRAULIC CONDUCTIVITY.
2. COLOR SCALE IS LOGARITHMIC (BASE 10).

REFERENCE(S)

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.

2. INSET BASEMAP FROM USGS THE NATIONAL MAP: NATIONAL BOUNDARIES DATASET, 3DEP ELEVATION PROGRAM,GEOGRAPHIC NAMES INFORMATION SYSTEM, NATIONAL HYDROGRAPHY DATASET, NATIONAL LAND COVER DATABASE, NATIONAL STRUCTURES DATASET, AND NATIONAL TRANSPORTATION DATASET; USGS GLOBAL ECOSYSTEMS; U.S. CENSUS BUREAU TIGER/LINE DATA; USFS ROAD DATA; NATURAL EARTH DATA; U.S. DEPARTMENT OF STATE HUMANITARIAN INFORMATION UNIT; AND NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION, U.S. COASTAL RELIEF MODEL.

DATA REFRESHED AUGUST, 2021.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

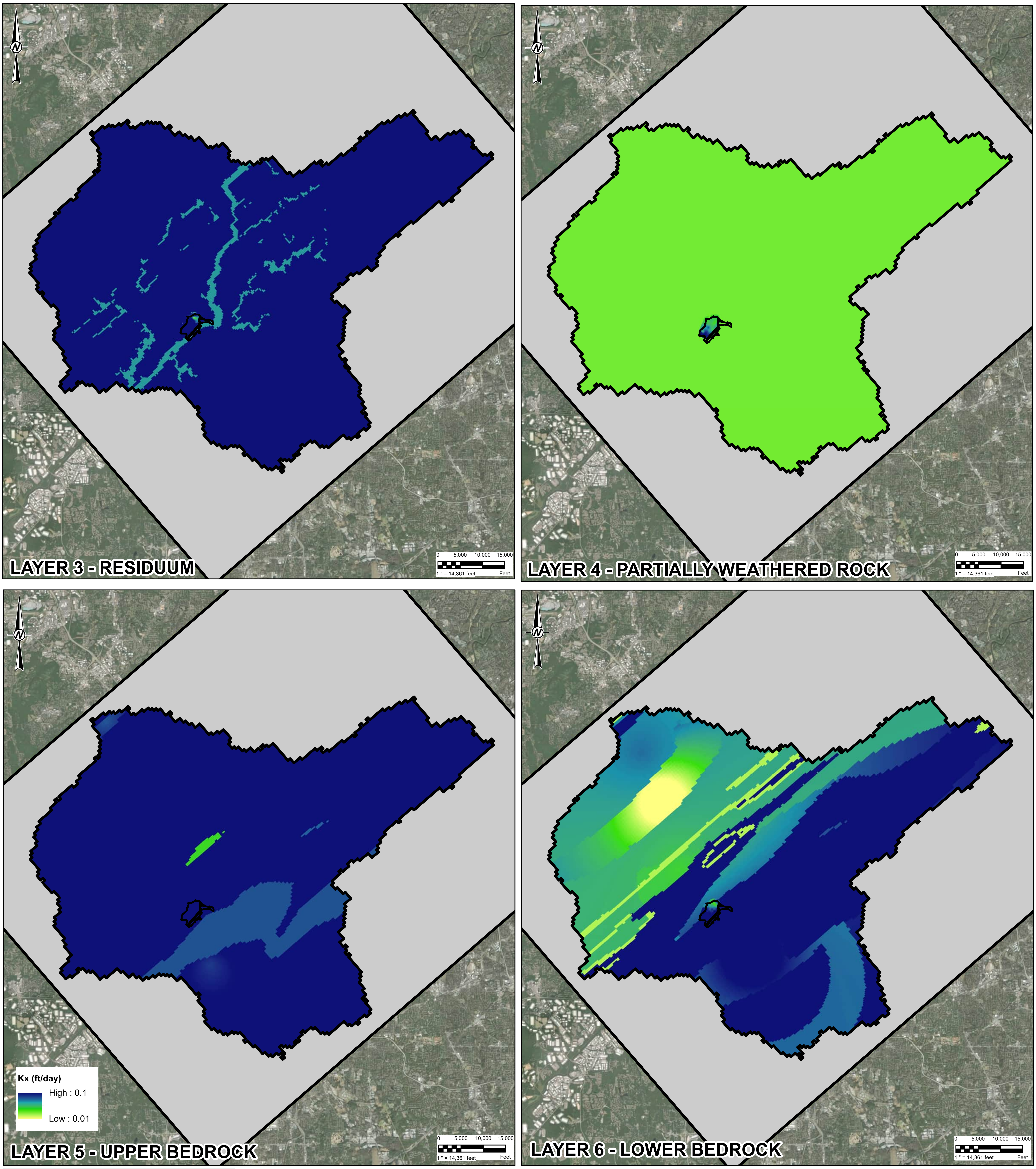
TITLE
HORIZONTAL HYDRAULIC CONDUCTIVITY - LAYERS 3-6: FULL MODEL DOMAIN

CONSULTANT

YYYY-MM-DD	2024-12-19
DESIGNED	BL
PREPARED	BL
REVIEWED	CB
APPROVED	WG

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
US0037149.1670	MCD150170	0	B2-8

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI C
1 in
0



Legend

- Property Boundary
- Unused Cells

NOTE(S)

1. KZ = VERTICAL HYDRAULIC CONDUCTIVITY.
2. COLOR SCALE IS LOGARITHMIC (BASE 10).

REFERENCE(S)

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.

2. INSET BASEMAP FROM USGS THE NATIONAL MAP: NATIONAL BOUNDARIES DATASET, 3DEP ELEVATION PROGRAM,GEOGRAPHIC NAMES INFORMATION SYSTEM, NATIONAL HYDROGRAPHY DATASET, NATIONAL LAND COVER DATABASE, NATIONAL STRUCTURES DATASET, AND NATIONAL TRANSPORTATION DATASET; USGS GLOBAL

CLIENT
GEORGIA POWER COMPANY
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PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

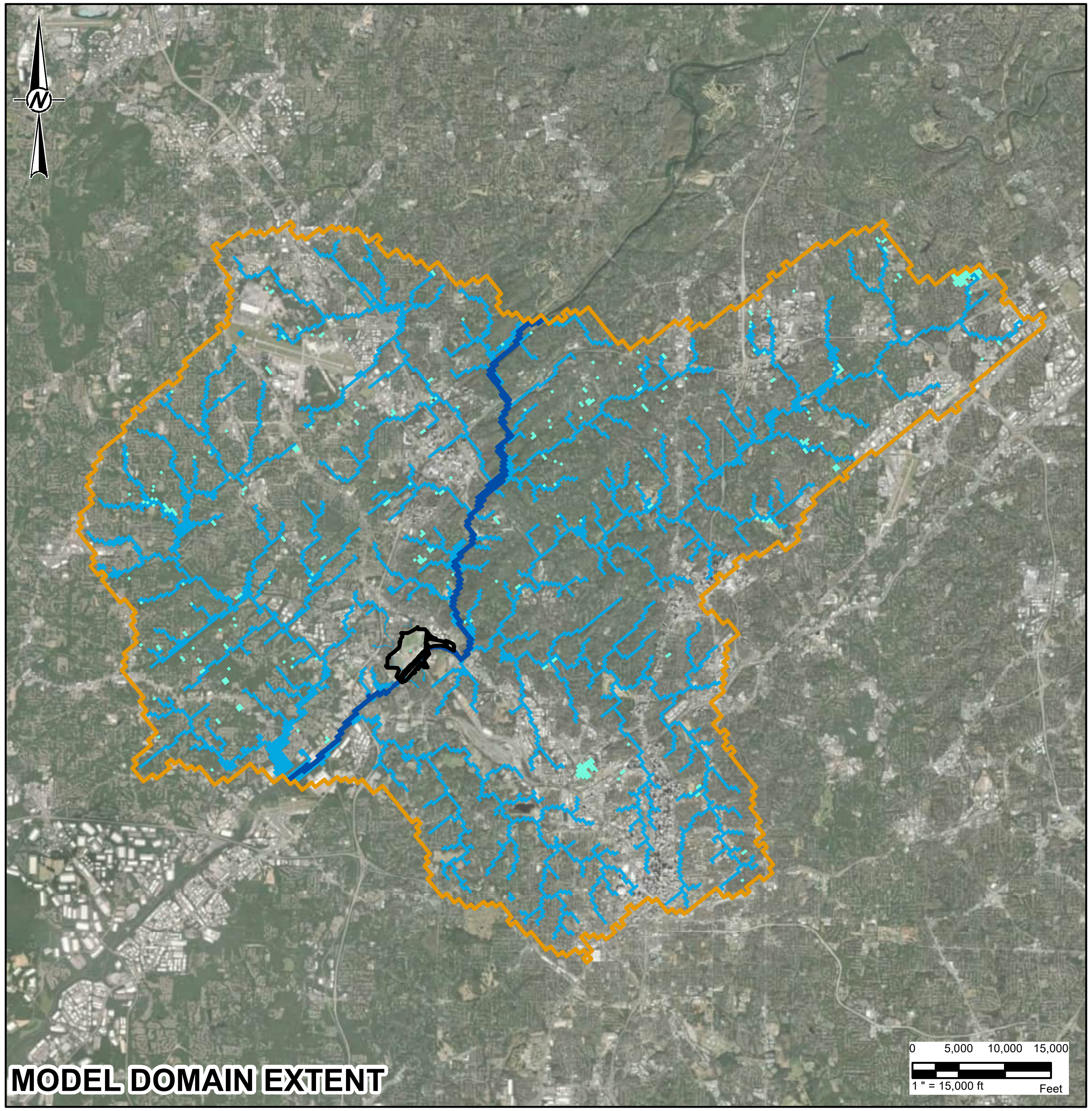
TITLE
HORIZONTAL HYDRAULIC CONDUCTIVITY - LAYERS 3-6: FULL MODEL DOMAIN

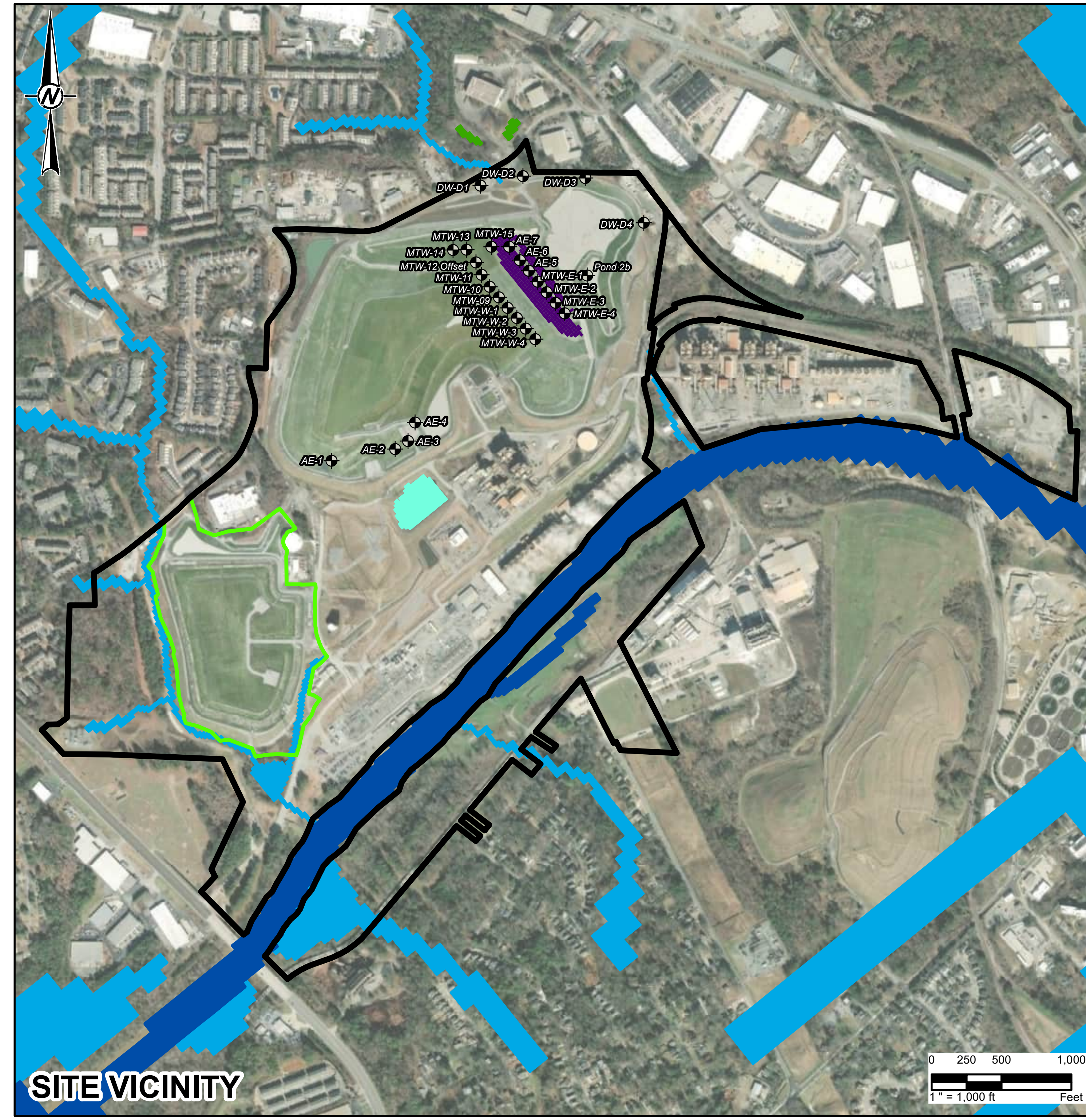
CONSULTANT

wsp

YYYY-MM-DD	2024-12-18
DESIGNED	BL
PREPARED	BL
REVIEWED	CB
APPROVED	WG

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
US0037149.1670	MCD150170	0	B2-9





LEGEND

- Area of Used Cells
- Property Boundary
- Temporary AEM Dewatering Wells (Well BCs)
- Barrier Wall (Hydraulic Flow Barrier BCs)
- AEM Enhanced Underdrain System (Drain BCs)
- Chattahoochee River (River BCs)
- Ponds (River BCs)
- Tributary Streams (Drain BCs)
- Intermittent Ponds (Drain BCs)

NOTE(S)
1. BC = BOUNDARY CONDITION

REFERENCE(S)
1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

CONSULTANT

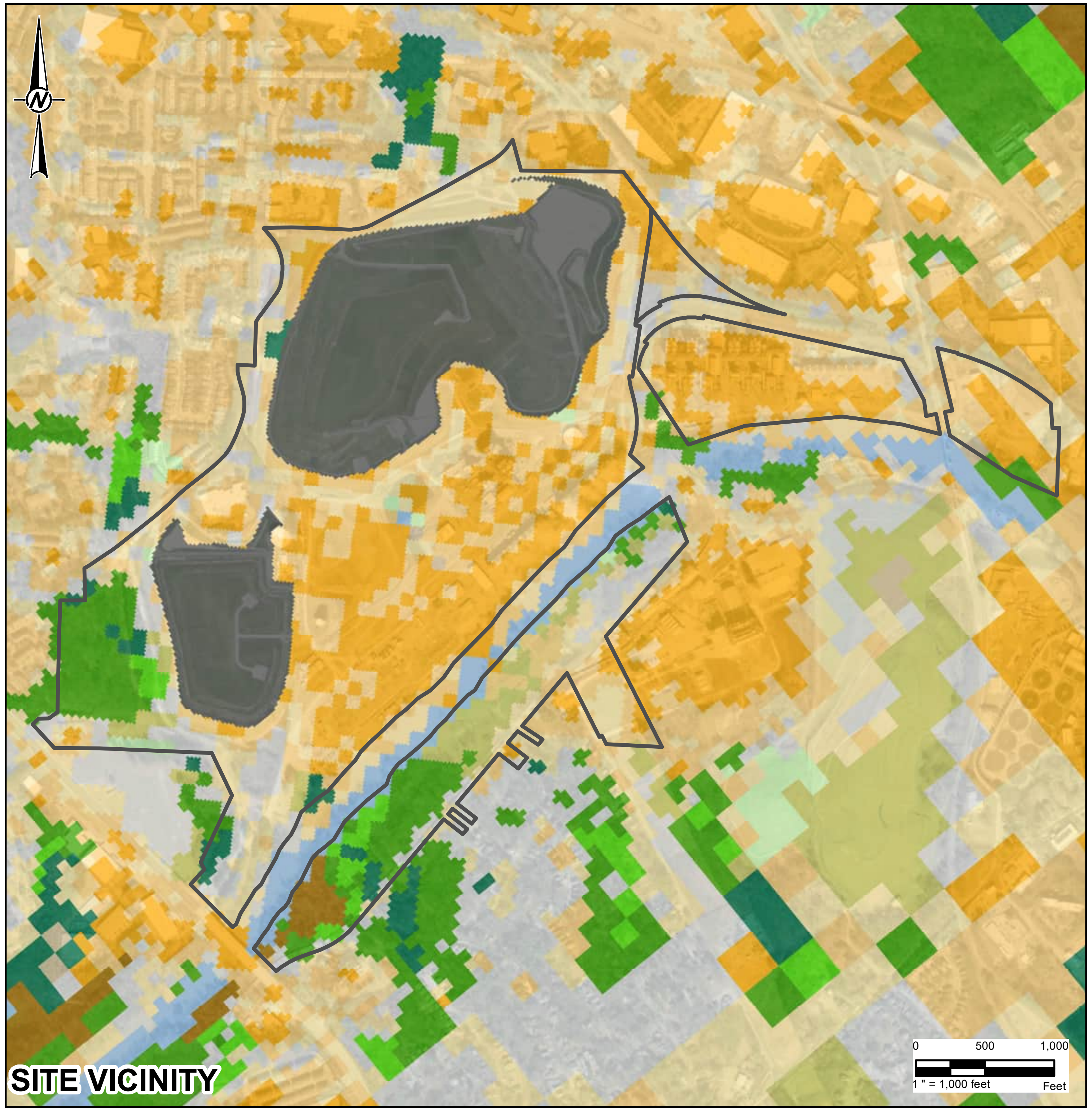
wsp

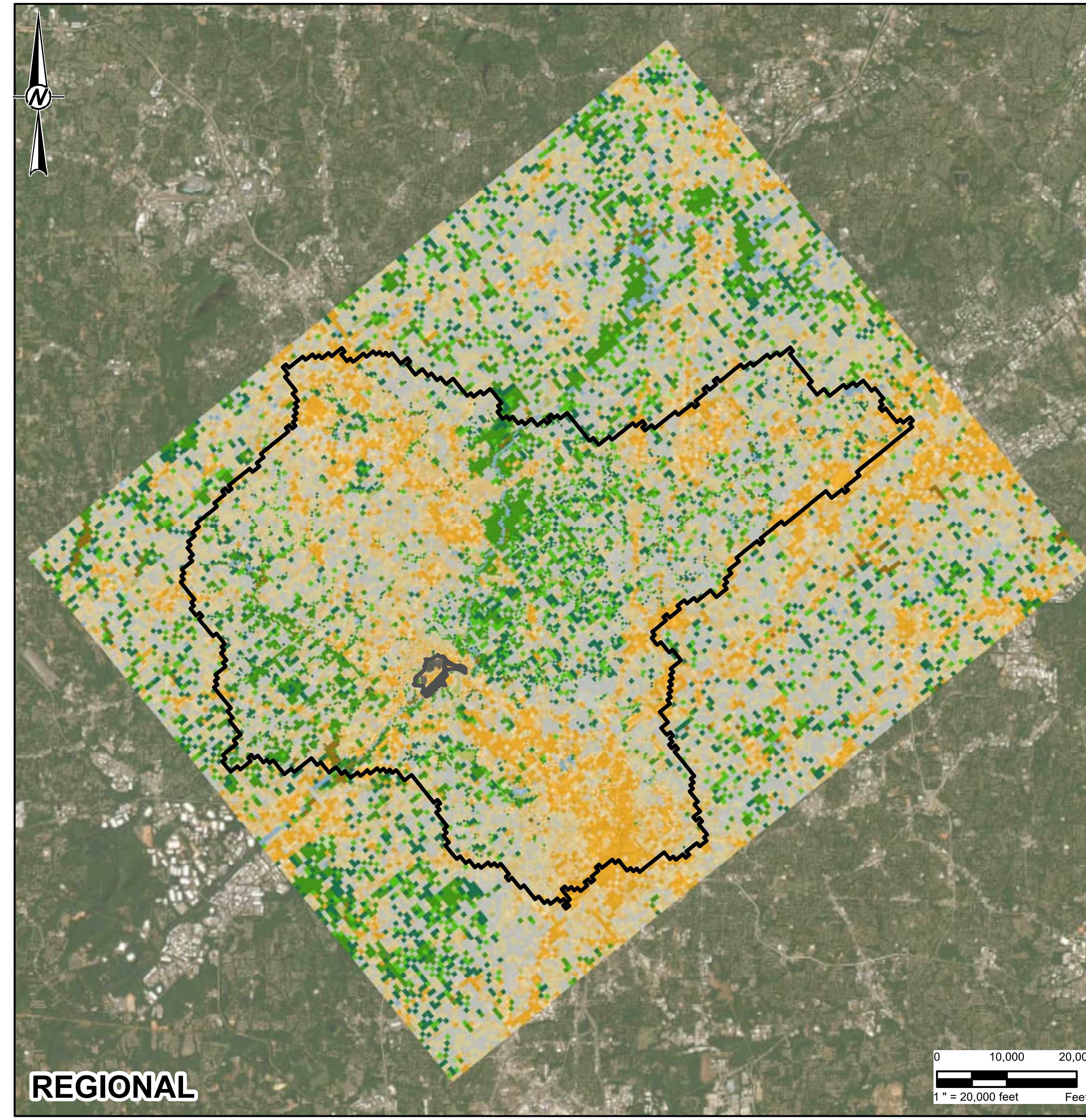
YYYY-MM-DD	2024-12-10
DESIGNED	AFS
PREPARED	AFS
REVIEWED	CB
APPROVED	WG

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
BOUNDARY CONDITIONS

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
US0037149.1670	MCD150170	0	B2-10





LEGEND

- Property Boundary
- Area of Used Cells

Model Zone

- 1: Open Water
- 2: Developed, Open Space
- 3: Developed, Low Intensity
- 4: Developed, Medium Intensity
- 5: Developed, High Intensity
- 6: Barren Land
- 7: Deciduous Forest
- 8: Evergreen Forest
- 9: Mixed Forest
- 10: Shrub/Scrub
- 11: Herbaceous
- 12: Hay/Pasture
- 13: Woody Wetlands
- 14: Emergent Herbaceous Wetlands
- 15: Covers

REFERENCE(S)
1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

CONSULTANT

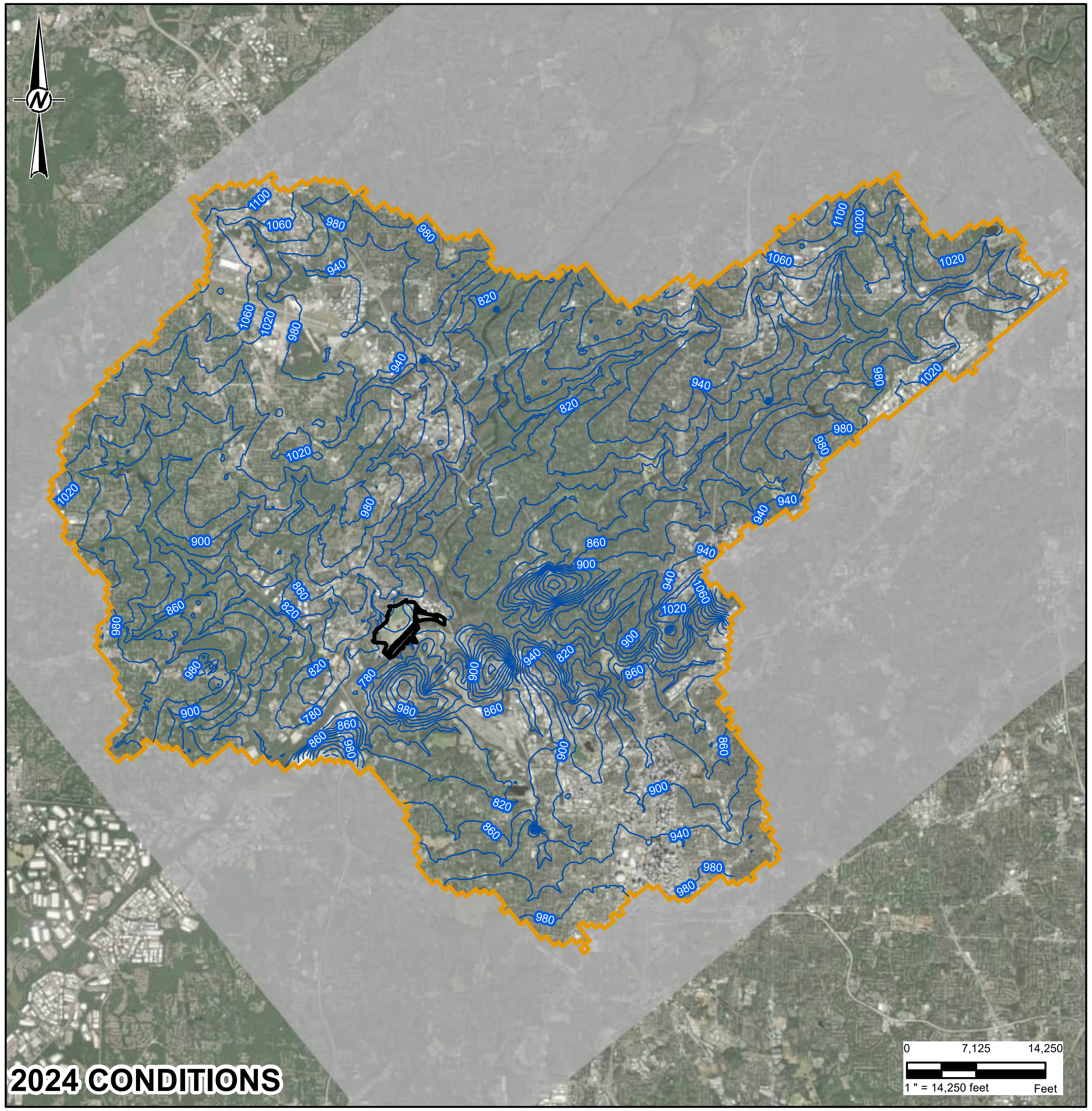
wsp

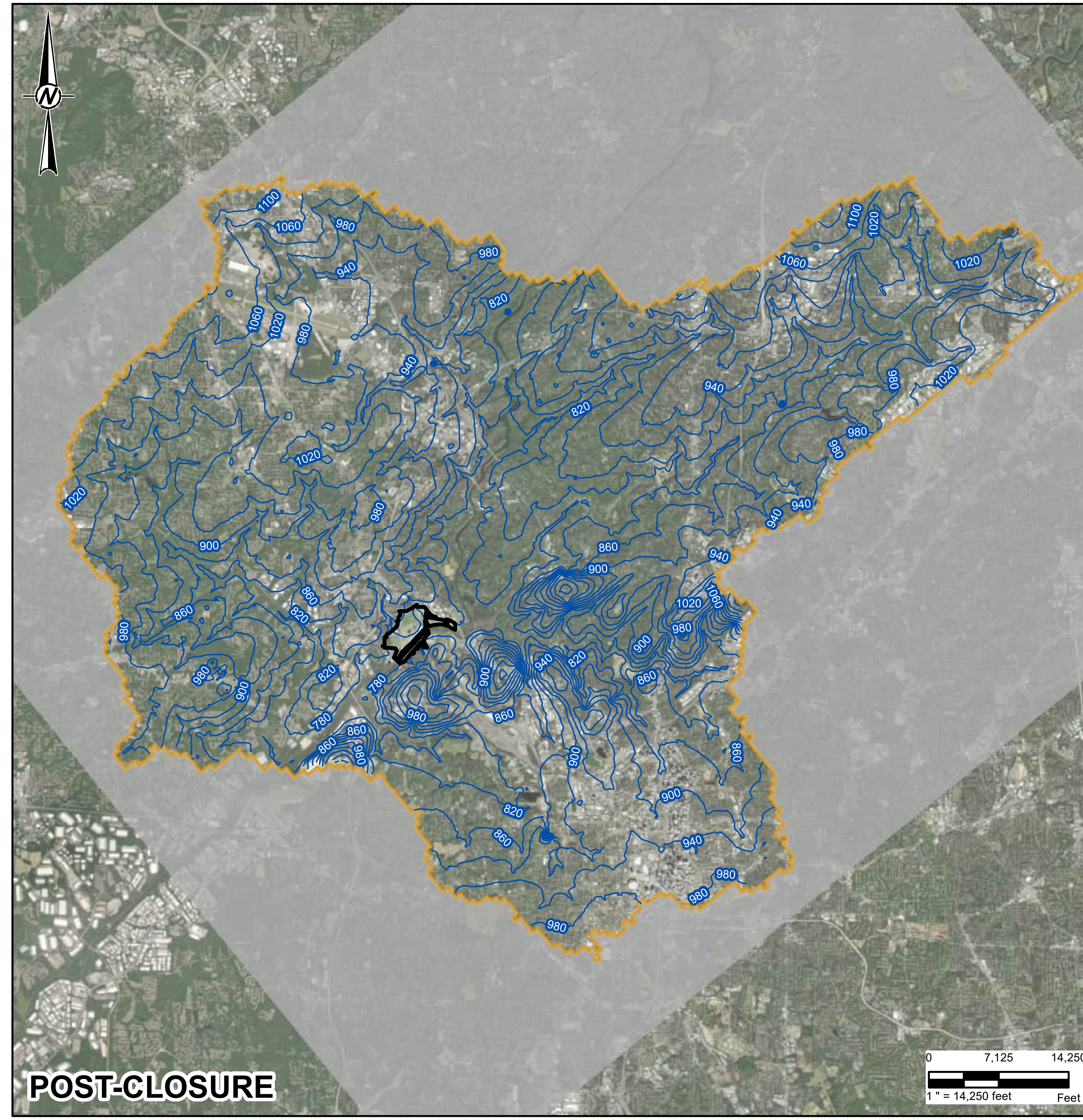
YYYY-MM-DD	2024-12-10
DESIGNED	AFS
PREPARED	AFS
REVIEWED	CB
APPROVED	WG

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
RECHARGE ZONES BY GROUNDCOVER TYPE

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
US0037149.1670	MCD150170	0	B2-11





Legend

- Property Boundary
- Simulated Water Table (ft NAVD 88)
- Area of Used Cells
- Unused Cells

REFERENCE(S)
1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10

NOTE(S)
1. CONTOUR INTERVALS: 40 FT (REGIONAL EXTENT).
2. FT: FEET.
3. NAVD 88: NORTH AMERICAN VERTICAL DATUM OF 1988.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

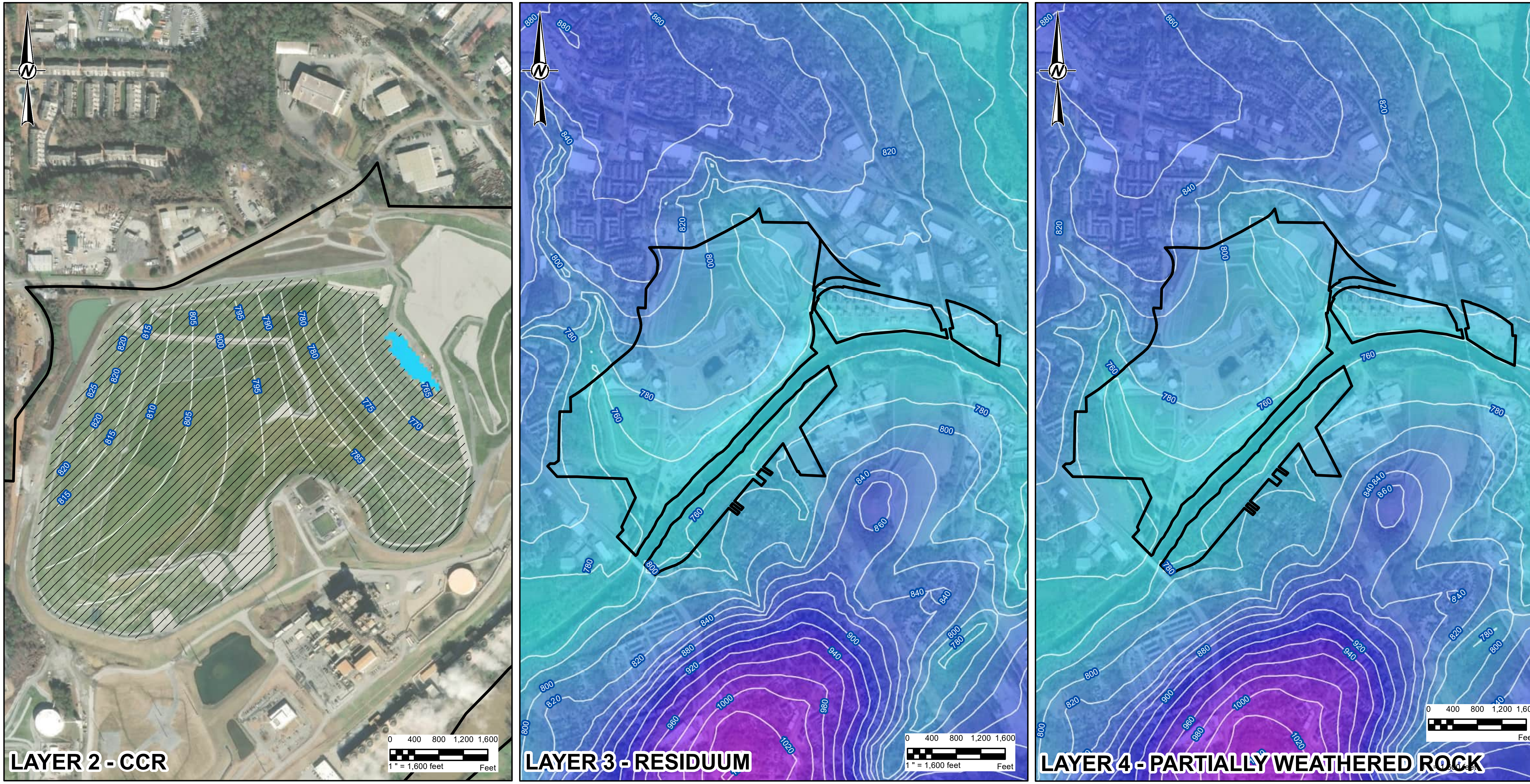
PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

CONSULTANT

YYYY-MM-DD	2024-12-10
DESIGNED	AFS
PREPARED	AFS
REVIEWED	CB
APPROVED	WG

TITLE
SIMULATED WATER TABLE - 2024 CONDITIONS MODEL AND POST CLOSURE MODEL, FULL MODEL DOMAIN

PROJECT NO.	SCS PROJECT ID.	REV	FIGURE
US0037149.1670	MCD150170	0	B4-1



LEGEND

Property Boundary

Simulated Potentiometric Surface Elevation (ft NAVD 88)

High : 1100

Low : 740

Potentiometric Surface Below Base of CCR

NOTE(S)
1. CCR: COAL COMBUSTION RESIDUALS.
2. NAVD 88: NORTH AMERICAN VERTICAL DATUM OF 1988.
3. FT: FEET.
4. CONTOUR INTERVAL: LAYER 2 = 5 FT, LAYERS 3 & 4 - 20 FT

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

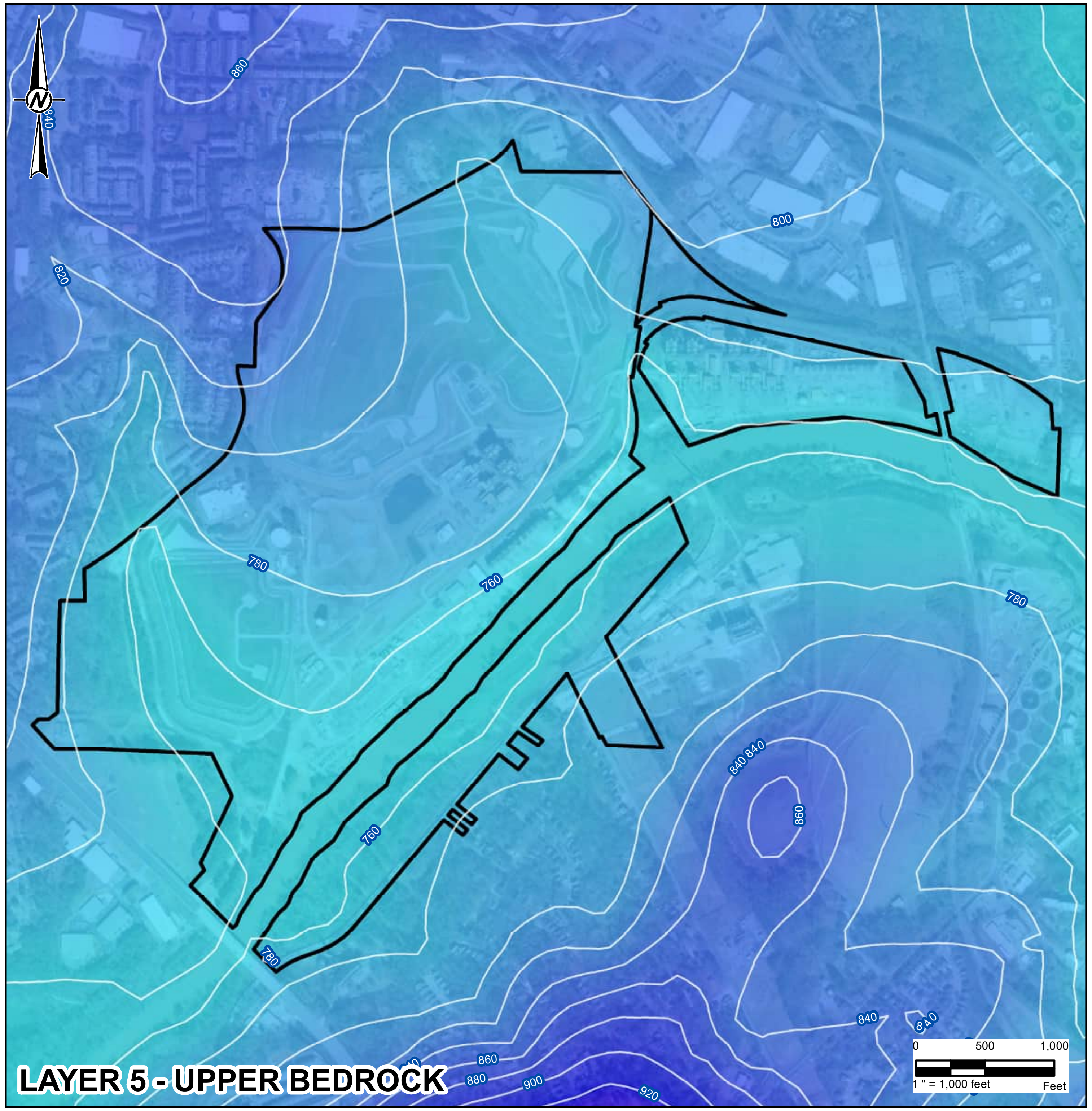
CONSULTANT

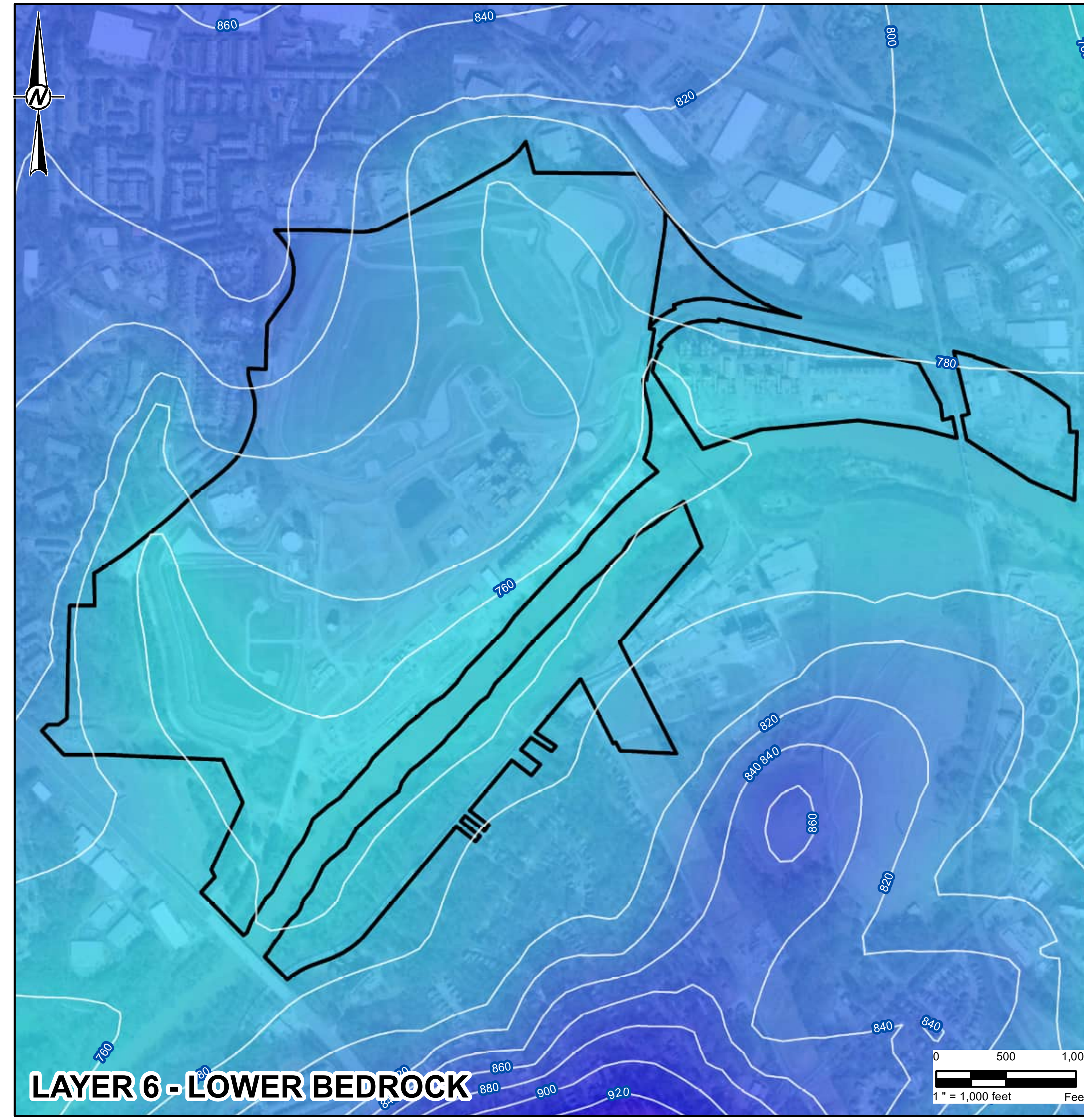
wsp

YYYY-MM-DD	2024-12-20
DESIGNED	AFS
PREPARED	AFS
REVIEWED	CB
APPROVED	WG

TITLE
SIMULATED POTENTIOMETRIC SURFACE - LAYERS 2-4 - 2024 CONDITIONS MODEL, SITE VICINITY

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
US0037149.1670	MCD150170	0	B4-2





LEGEND

Simulated Potentiometric Surface Elevation (ft NAVD 88)

Property Boundary

High : 1100

Low : 740

NOTE(S)

1. NAVD 88: NORTH AMERICAN VERTICAL DATUM OF 1988.
2. FT: FEET
3. CONTOUR INTERVAL: 20 FT

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

CONSULTANT

YYYY-MM-DD	2024-12-18
DESIGNED	AFS
PREPARED	AFS
REVIEWED	CB
APPROVED	WG

TITLE
SIMULATED POTENTIOMETRIC SURFACE - LAYERS 5 & 6 - 2024 CONDITIONS MODEL, SITE VICINITY

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
US0037149.1670	MCD150170	0	B4-3

LEGEND

- AP-3/4 AEM Enhanced Underdrain
- Property Boundary
- AP 3/4 CCR Extent
- Thickness of CCR Below Potentiometric Surface (ft)
- 0 ft
- 1 ft

NOTE(S)
1. CCR = COAL COMBUSTION RESIDUALS
2. CONTOUR INTERVALS = 1 FOOT

REFERENCE(S)
1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

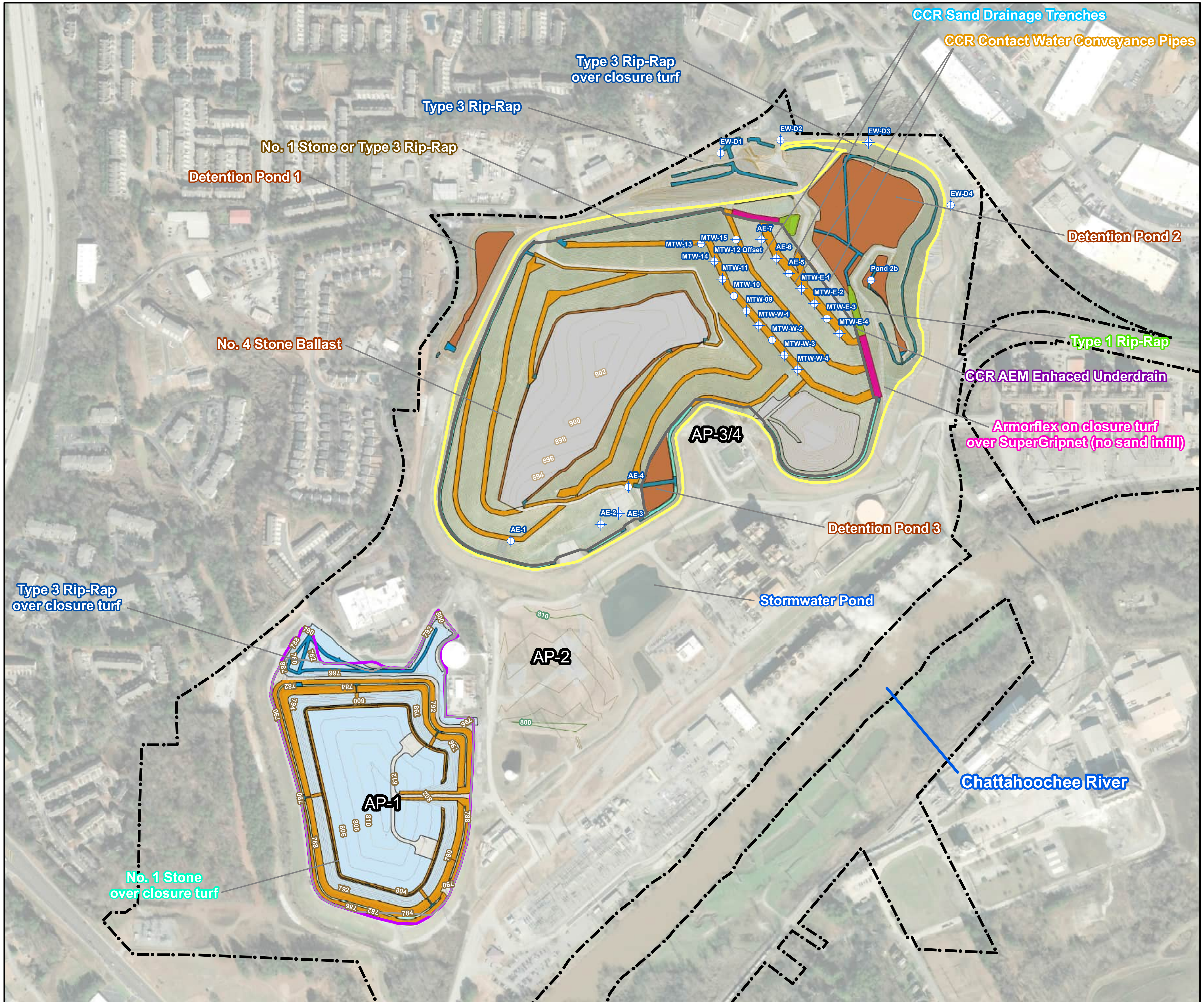
PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

CONSULTANT

YYYY-MM-DD	2024-12-19
DESIGNED	AFS
PREPARED	VMC
REVIEWED	CB
APPROVED	WG

TITLE
AP-3/4 AREA SIMULATED THICKNESS OF CCR BELOW POTENTIOMETRIC SURFACE

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
US0037149.1670	MCD150170	0	B4-4



LEGEND

- Temporary AEM Dewatering
- Site Boundary
- AP-3/4 Limits of the Low Permeability Cap
- AP-1 Ash Extent
- AP 3/4 Ash Extent
- AP-1 Limits of the Low Permeability Cap

Closure Topographic Gradient Contours

- 10 ft NAVD 88
- 2 ft NAVD 88

AP-1 Closure Types

- Closure Turf
- Hydro Turf Over Supergripnet
- NO. 1 Stone Over Closure Turf
- Type 3 Rip Rap Over Closure Turf

AP-3/4 Closure Types

- Armorflex on Closure Turf Over Supergripnet
- Closure Turf Over Supergripnet (See Note 1)
- Hydro Turf Over Supergripnet
- NO. 1 Stone or Type 3 Rip-Rap
- NO.4 Stone Ballast
- Type 1 Rip-Rap
- Type 3 Rip-Rap

0 250 500 750 1,000 1,250 1,500 Feet

1 inch = 500 feet

NOTE(S)

1. CCR = COAL COMBUSTION RESIDUALS.
2. NAD88 = NORTH AMERICAN VERTICAL DATUM OF 1988

REFERENCE(S)

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

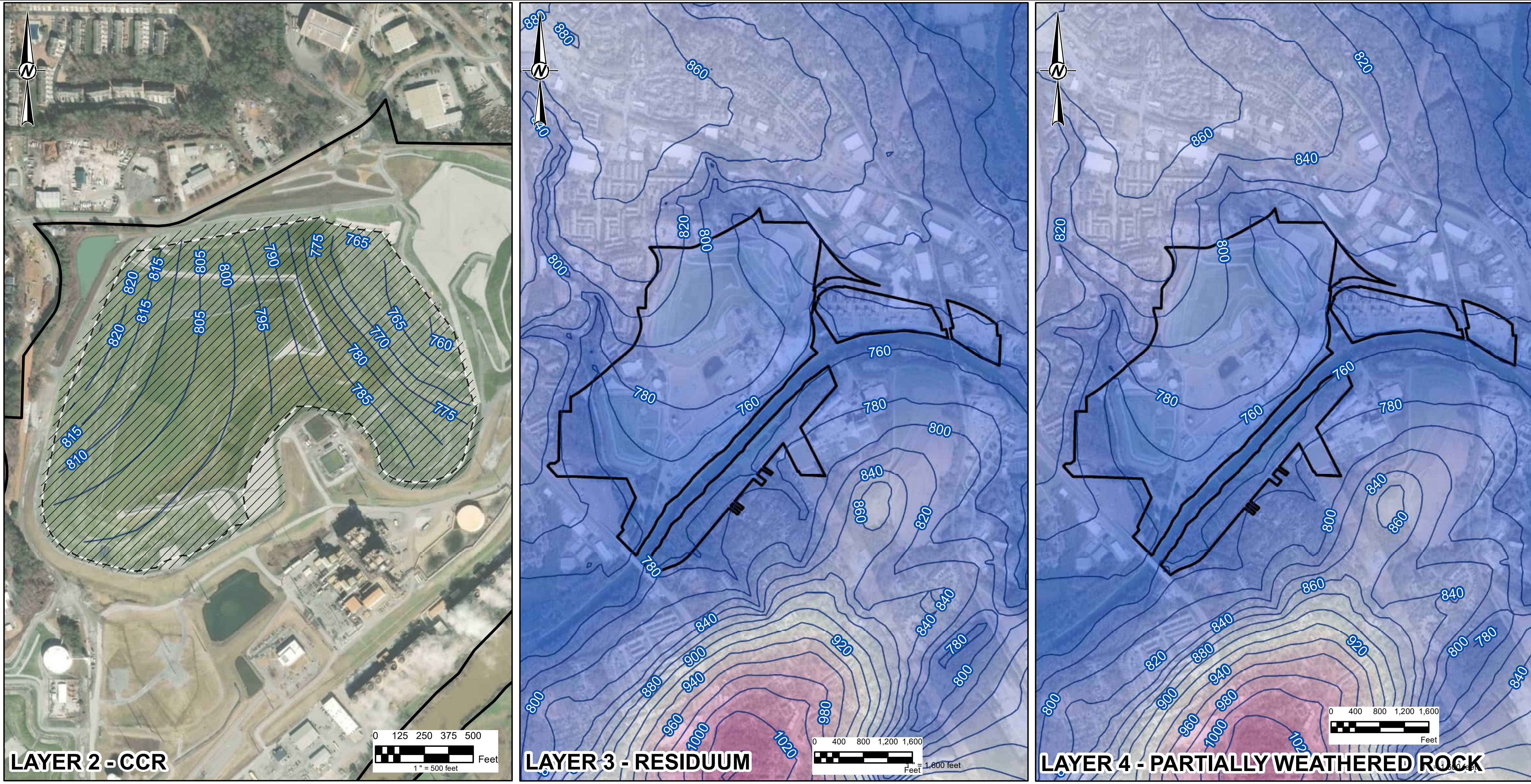
PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
POST-CLOSURE MODEL DESIGN FEATURES

CONSULTANT

YYYY-MM-DD	2024-12-18
DESIGNED	SJS
PREPARED	AFS
CHECKED	CB
REVIEWED / APPROVED	CB

PROJECT NO.	SCS PROJECT ID	REV.	FIGURE
US0037149.1670	MCD150170	0	B4-5



LEGEND

- Property Boundary
- Simulated Potentiometric Surface Elevation (ft NAVD88)
- High : 1100
- Low : 740
- Potentiometric surface below layer bottom

REFERENCE(S)

NOTE(S)
1. LAYER 2 CONTOUR INTERVAL IS 5 FEET, LAYERS 3 AND 4 INTERVALS ARE 20 FEET.
2. NAVD 88: NORTH AMERICAN VERTICAL DATUM OF 1988.
3. FT: FEET.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

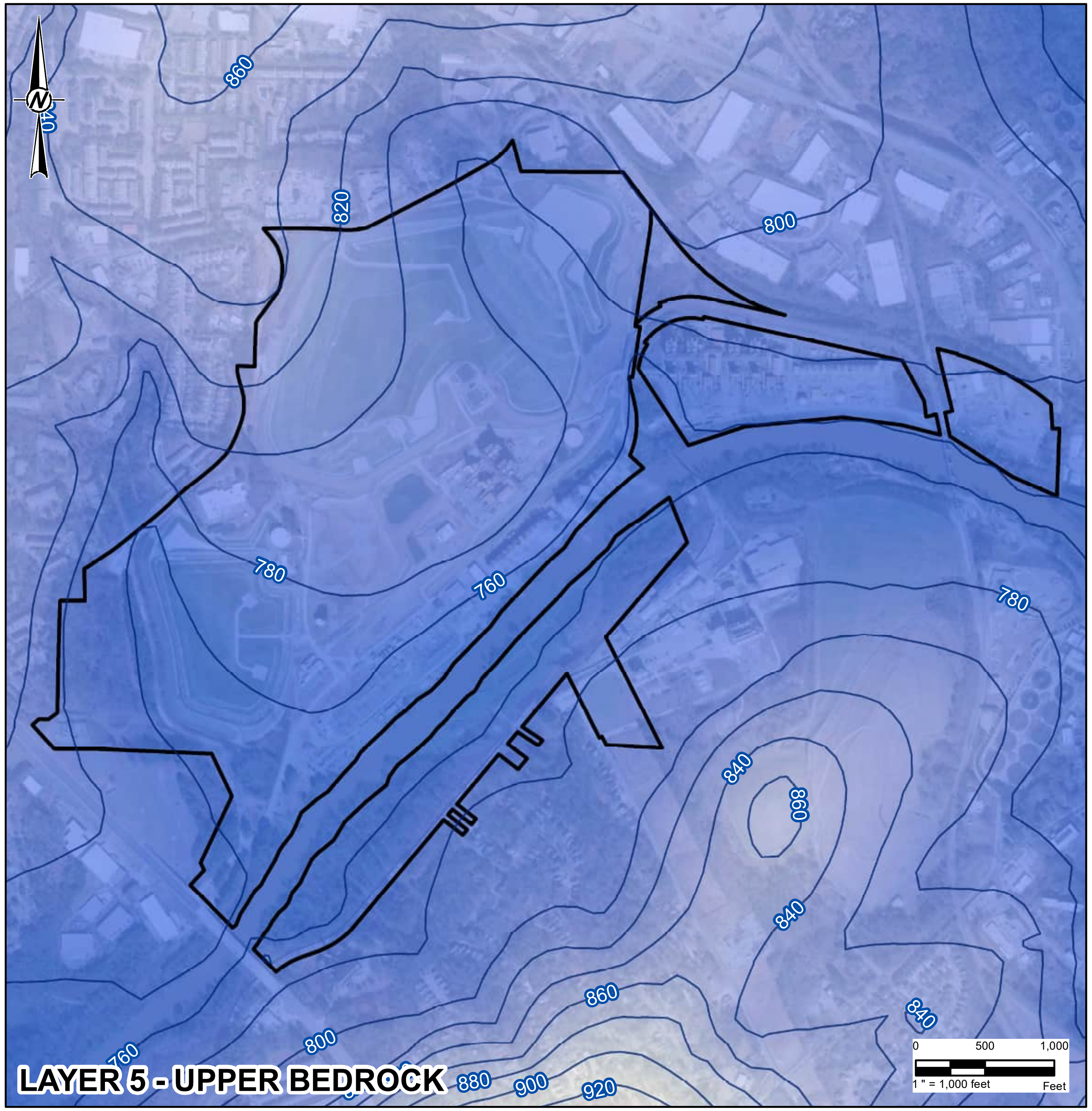
PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

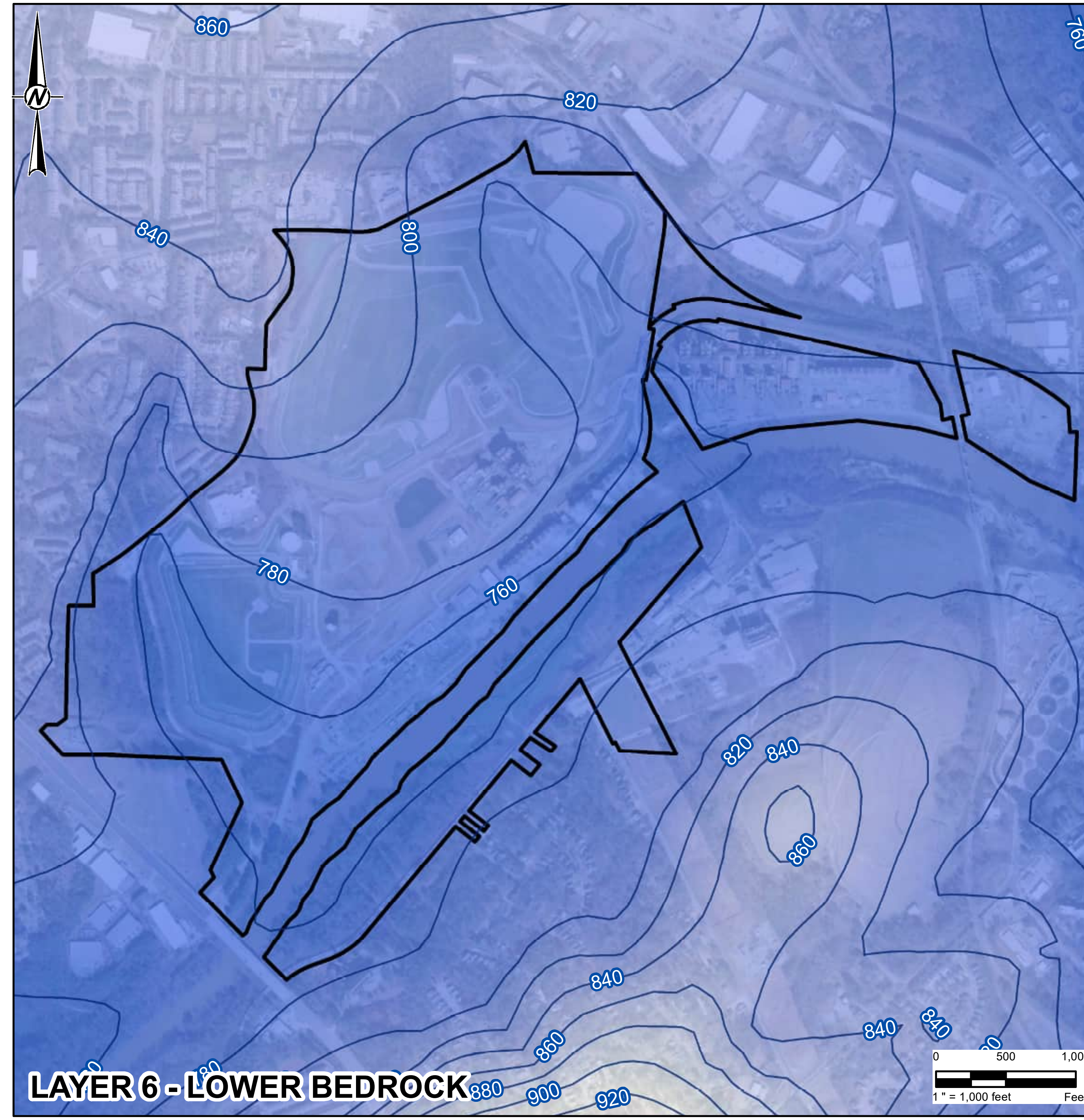
CONSULTANT

YYYY-MM-DD	2024-12-20
DESIGNED	AFS
PREPARED	AFS
REVIEWED	CB
APPROVED	WG

TITLE
SIMULATED POTENTIOMETRIC SURFACE - LAYERS 2-4 - POST-CLOSURE MODEL, SITE VICINITY

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
US0037149.1670	MCD150170	0	B4-6





LEGEND

Property Boundary

Simulated Potentiometric Surface Elevation (ft NAVD88)

High : 1100

Low : 740

NOTE(S)
1. ELEVATIONS ARE IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
2. CONTOUR INTERVAL IS 20 FEET.

REFERENCE(S)
1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.

CLIENT GEORGIA POWER COMPANY SOUTHERN COMPANY SERVICES		PROJECT THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH	
CONSULTANT wsp	YYYY-MM-DD	2024-12-13	TITLE **SIMULATED POTENTIOMETRIC SURFACE - LAYERS 5 & 6-POST-CLOSURE MODEL, SITE VICINITY**
	DESIGNED	AFS	
	PREPARED	AFS	
	REVIEWED	CB	PROJECT NO. US0037149.1670 · SCS PROJECT ID. MCD150170 · REV. 0 · FIGURE B4-7
	APPROVED	WG	

ATTACHMENT B1

Model Calibration Summary

ATTACHMENT B1

Model Calibration Summary

Plant McDonough-Atkinson Ash Pond 3 and Ash Pond 4 (AP-3/4)

Submitted to:

Georgia Power Company

241 Ralph McGill Blvd., Atlanta, Georgia 30341

Submitted by:

WSP USA Inc.

5170 Peachtree Road, Building 100, Suite 300 Atlanta, Georgia 30341

February 2025

Table of Contents

Tables

Figures

1.0 INTRODUCTION

This attachment presents a summary of calibration techniques used for the current groundwater model for the Plant McDonough-Atkinson site (Site), owned and operated by Georgia Power Company. The entire site was included in model calibration, with a focus on Ash Pond 1 (AP-1), and the combined closure area of Ash Ponds 3 and 4 (AP-3/4).

The objective of the calibration efforts was to simulate recent (March 2024) (2024 Conditions Model) groundwater flow conditions at the Site based on comments from the Georgia Environmental Protection Division (GA EPD) in a letter dated September 30, 2024. The March 2024 time represents the most recent, comprehensive, Site-wide groundwater and surface-water level data set available that could be reasonably used for model calibration purposes. As of March 2024, key closure design features, such as the AP-3/4 cover and buttress drainage system and sump (the AEM Enhanced Underdrain), and Temporary AEM Dewatering Wells in and around AP-3/4 were present and operating. The presence of these features results in predicted potentiometric heads that more closely approximate long-term, post-closure conditions than pre-construction closure conditions from 2016.

To enable the steady-state 2024 Conditions Model to approximate the first-quarter 2024 conditions of the Site, the hydraulic properties of the AEM Enhanced Underdrain system and estimated recharge through the low-permeability cover were included as calibration parameters. Water levels in coal combustion residuals (CCR) were declining in March 2024 as a result of the ongoing closure construction activities, including installation of the AEM Enhanced Underdrain system and completion of the cover liner over AP-3/4. These features are included in the 2024 Conditions Model because they were physically present at the Site during calibration time, but the continued water level decline in the CCR after the March 2024 time is not representative of long-term equilibrium with the recently completed closure design features. Therefore, the properties of these features were modified, within reasonable ranges, during calibration to facilitate history matching to an approximation of these conditions with a steady state model. The hydraulic conductivity from the 2024 Conditions Model were then used as a base model for a separate validation, or historical check, simulation to August 2016 conditions (prior to construction at AP-3/4) to demonstrate that the calibration was reasonable.

Calibration methods are discussed in Section 2.0, calibration results are discussed in Section 3.0, and conclusions are discussed in Section 4.0.

2.0 CALIBRATION METHODOLOGY

This section documents the methodology used to calibrate the 2024 Conditions (March 2024) groundwater flow model. The methodology consists of calibration target development, calibration parameter assignment, model calibration using calibration techniques, calibration sensitivity analysis, and model validation.

2.1 Calibration Targets

167 groundwater and surface water hydraulic head readings were used as calibration targets to constrain model parameters to better match the physical system (Table B1-1). From the site, 114 groundwater monitoring locations were selected, with readings from the first quarter of 2024 (Figure B1-1). These locations excluded Temporary AEM Dewatering Wells and represented head conditions throughout the defined hydrostratigraphic units onsite (residuum, partially weathered rock (PWR), upper/lower bedrock). The calibration point elevations were assigned to the model row, column, and layer corresponding to the well location and midpoint of the saturated filter pack or screen interval for comparison to model groundwater level elevations.

Readings from five site staff gauges indicate conditions in the unnamed western tributary to the Chattahoochee River (Western Tributary) along and south of AP-1 (WT-2 through WT-5 and WT-7), one staff gauge (ET1) on the unnamed eastern tributary to the Chattahoochee River (Eastern Tributary) south of AP-3/4 (Figure B1-1). Twelve USGS gauge locations along the Chattahoochee River and major creeks were also used to represent regional surface water stages in the regional domain (Figure B1-2).

Finally, 35 locations on hillslopes across the model domain were selected based on historical aerial imagery review as representative locations seasonally devoid of groundwater discharge features, like seeps or springs. Ground surface calibration targets were only optimized with PEST if the simulated water level was predicted to be above the ground surface.

2.2 Calibration Parameters

Parameter calibration focused on both horizontal and vertical hydraulic conductivity, regional recharge rates, recharge rate through the cover liner (to approximate enhanced recharge under the liner due to storage drain-down), and the conductance of drain cells (e.g., the AEM Enhanced Underdrain), as summarized below.

- **Hydraulic Conductivity**: Initial hydraulic conductivity data were obtained from historical Site slug tests, a pumping test, packer (Lugeon) tests, and CPT pore-pressure dissipation (PPD) tests to define spatial variability and overall ranges per unit. Hydraulic conductivity values for the initial calibration of the model were represented as zones which are assigned to contiguous areas with similar hydraulic properties. Initial values for hydraulic conductivity zones are listed in Table B1-2. These data are also summarized in Appendix A of the Model Report (Appendix B to the HAR), with the minimum and maximum observed values for the different units used to constrain model calibration.

- **Recharge**: Initial net recharge values were derived from regional (RAWS) precipitation and evapotranspiration data (Western Regional Climate Center, 2024). Recharge rates for areas outside the AP-1 and AP-3/4 boundaries were constrained by precipitation and evapotranspiration data from the Western Regional Climate Center (WRCC) Remote Automated Weather Station (RAWS) network (WRCC, 2024). Recharge rates for zones representing the low-permeability cover areas of AP-1 and AP-3/4 were also adjusted during model calibration. Recharge rates in AP-3/4 were initially based on the HELP model values but were increased during calibration to approximate the release of groundwater from storage that occurs following completion of the cover system over AP-3/4. Initial and calibrated recharge rates are listed in Table B1-3.

- **Drain Conductance:** The conductance of drain cells representing the AEM Enhanced Underdrain in AP-3/4 was decreased during calibration to limit simulated inflows to the underdrain system to allow the model to match March 2024 water levels near the buttress without artificially imposing long-term closure conditions. As conductance is commensurate with flow rates out of the sump, this approach permits a flow balance with calibrated recharge through the low-permeability cover and approximate March 2024 conditions with a steady-state model.

2.3 Calibration Techniques

The model was calibrated using the following techniques:

- Manual adjustment of model parameter values within site-specific data ranges.
- Automated zone-based calibration using ensembles of model realizations.

- Automated pilot-point calibration using arrays for hydraulic conductivity terms.

Model calibration consisted of successive refinement of hydraulic properties (horizontal and vertical hydraulic conductivity zones and arrays, recharge zones and drain conductances) until the simulated water levels closely matched observed March 2024 water levels.

Automated calibrations were completed with the PEST++ software suite (White et. al., 2020) by running iterations of the model using an ensemble of different realizations to estimate the optimal values of each parameter. The goal of PEST is minimization of a mathematical objective function, typically the residual sum of squares (RSS; phi in PEST terms), to achieve a close fit between observed and model-calculated groundwater levels while maintaining reasonable values for model parameters. Lower values of phi represent a better match between the model and target observations. The initial zone-based automated calibration (Section 2.3.1) included hydraulic conductivity and recharge properties as discrete, contiguous zones, and calibrated values represented bulk property values for each zone. A refined pilot-point calibration (Section 2.3.2) treated hydraulic conductivity as a spatially variable array of values, governed by kriged interpolations of the pilot points themselves. Updated hydraulic conductivity values for the pilot point calibration represent spatially varying arrays of values within each zone from the zone-based calibration. Recharge in the pilot point calibration remained based on MRLC zones.

2.3.1 Initial Zone-Based Calibration

Initial automated zone-based calibration was performed for the following major lithologic units[1]:

- (CCR) in AP-1 and AP-3/4.
- Residuum, with localized alluvium around the Chattahoochee River based on the Wiggins (1968) map, and a site-vicinity area comprising of a 500-foot buffer around wells with hydraulic testing data.
- The same site-vicinity zone in (PWR), and a regional zone outside of that area.
- The same site-vicinity zone in upper and lower bedrock layers, and zones derived from the state geologic map (Tanner and others, 1997) outside of that area.

The PESTPP-Iterative Ensemble Smoothing (IES) algorithm, a tool within the PEST++ software suite, was used to calibrate the model based on 300 unique realizations of model parameters. The values estimated by the zone-based calibration are summarized in Tables B1-2 and B1-3 and were used as initial values in refined pilot point calibration.

2.3.2 Pilot Point Calibration

Once initial zone-based calibrations were completed, pilot point calibration was performed to further accommodate subsurface nuances of the Site and improve the predictive accuracy of the model. Pilot points were placed at historical on-Site, hydraulic testing locations and at a general grid spacing of 400 feet in CCR, residuum, PWR, upper bedrock, and lower bedrock (layers 2-6) to leverage Site-specific hydraulic conductivity data within a 500-foot buffer around the Site-specific data envelope (Figure B1-3). Pilot points were placed outside the 500-foot buffer at a frequency of one point for each hydraulic conductivity zone for each layer.

The Site-specific hydraulic testing data were also used to provide realistic constraints on Site-vicinity material properties for PEST. PEST calibrates the horizontal and vertical hydraulic conductivity at each pilot point and uses

[1] Hydraulic conductivity of the structural fill (Layer 1) in the AP-3/4 buttress was not included in the calibration effort because the March 2024 water table was below the base of the fill unit.

kriging to generate a spatially variable parameter field within an area of interest. A 500-foot buffer was generated around Site-vicinity hydraulic test locations to provide a localized kriging area. Outside of this area, layer 3 is represented by two property zones (residuum and alluvium) each represented by a single pilot point to generate a uniform, regional hydraulic conductivity field. Layer 4 was represented by a single pilot point outside of the site-vicinity area to represent the general, regional PWR properties. Layers 5 and 6 were represented with a single pilot point value per mapped bedrock geologic unit outside of the Site vicinity.

The Site-specific aquifer testing results and range of final kriged hydraulic conductivity values are summarized in Section 3. As with the zone-based calibration, the automated calibration was based on 300 unique realizations of model parameters (now including pilot points) using PESTPP-IES.

2.4 Calibration Sensitivity Analysis

Model sensitivity analysis was performed to evaluate how calibrated model parameters may affect model behavior. Because groundwater models are fundamentally nonunique, where multiple reasonable models may result in a good fit to observed data, decision makers often require a single “best” model to inform decisions. A sensitivity analysis is often used to evaluate what the “best” model is to meet project objectives. Sensitivity analysis can be performed manually by evaluating one parameter at a time or by using automated techniques like PEST.

Parameter sensitivity analysis using PEST typically involves generating a Jacobian, or sensitivity, matrix, which is a two-dimensional array of sensitivity coefficients for each observation. The sensitivity coefficients are calculated based on the change in the simulated value of an observation that results from a change in a parameter value. Traditional PEST methods (e.g., PEST, BeoPEST or PEST_HP) can be used to generate a Jacobian matrix and perform a detailed sensitivity analysis; however, PESTPP-IES (White and others, 2020), while more efficient at model calibration in many cases, does not generate a Jacobian matrix. Therefore, alternate sensitivity analysis methods are necessary.

Calibration sensitivity analysis for the 2024 Conditions Model was performed using explainable Artificial Intelligence (XAI), which comprises a variety of algorithms for clarifying model structure as it pertains to overall parameters (here, hydraulic conductivity, recharge, or drain conductance) or individual observations (i.e., a water level). Following the calibration process, two surrogate metrics were computed to identify influential parameters to which the model is sensitive: permutation feature importance (PFI) and accumulated local effects (ALE; Biecek and Burzykowski, 2020). This sensitivity analysis was performed by fitting a machine-learning model (random forest) to act as a proxy for the model structure and running PFI and ALE methods in the Interpretable Machine Learning (IML) package (Molnar, 2024). A log10-transformed version of phi was set as the target variable for both methods, and two random forest methods (standard and regularized) were used to link model parameters to the target.

Random forests fit many tree-like branching structures through the data, learning nonlinear pathways that link input parameters to the target output. PFI randomly and iteratively shuffles the rows of an input parameter and re-fits the random-forest links to the target, tracking the goodness-of-fit for each permutation. Randomized shuffling of key parameters worsens the fit, and in this way their importance is identified. The theory behind ALE is similar, although instead of randomly shuffling values within a single parameter, observations are systematically permuted higher or lower, to see the effect on the prediction. The effects of these permutations highlight the sensitivity of the model to each parameter.

2.5 Validation Analysis

The 2024 Conditions model calibration was validated by simulating AP-3/4 Pre-Closure conditions from August 2016 (the same time the previous model [October 2020; Golder 2020] submitted to GA EPD was calibrated to) using calibrated aquifer parameters and modified model layer structure from the 2024 Conditions model.

Results of the validation indicate the calibrated 2024 Conditions Model provides a reasonable basis for Site-specific predictive modeling. The simulated water levels from the August 2016 Validation Model, generated from the 2024 Conditions Model, closely match the observed August 2016 water levels. The August 2016 validation model meets the same industry standard calibration metrics as are used above to evaluate the 2024 Conditions Model.

3.0 RESULTS

3.1 Comparison of Observed and Predicted Heads

Observed March 2024 hydraulic head elevations were compared to simulated hydraulic head elevations (Tables B1-1 and B1-4). Given the variability of hydraulic heads over short distances (e.g., 10’s of feet or less), the groundwater flow model was considered calibrated when the criteria in Table B1-4 were met. A small residual mean head error of less than one foot (-0.823 ft) indicates that the model closely simulates steady-state heads, and that residuals are evenly distributed. These characteristics are also apparent when inspecting the observed vs. simulated and observed vs. residual scatter plots (Figure B1-4). The absolute residual mean (2.87 ft), root mean square error (3.68 ft) and standard deviation (3.60 ft) are all minor compared to the range of head observations (86.9 ft), likewise indicating that modeled conditions provide a reasonable match to field data. Corresponding scatter plots for targets in the AP-3/4 area (Figure B1-5) and calibration statistics for targets in the AP-3/4 area (Table B1-5) also indicate that modeled conditions provide a reasonable match to field data in the AP-3/4 area.

Model residual bubble plots for site-vicinity targets in layers 3 to 6 are depicted in Figures B1-6, with regional targets displayed on Figure B1-7. The bubble plots depict the distribution and magnitude of positive (simulated value is less than observed value) and negative (simulated value is greater than observed value) residuals. In each layer, the spatial distribution of positive and negative residuals is random, aside from targets proximal to the Temporary AEM Dewatering Wells. In these locations, larger residuals (difference of 8 to 14 feet) are due to the treatment of transient stresses as steady-state boundary conditions.

The overall model mass balance error for the steady-state 2024 Conditions model is -6.03e-7 (error/average inflow & outflow) indicating the model converges well.

3.2 Comparison of Model Parameters

Hydraulic conductivity values varied from initial values based on field hydraulic tests and are compared in this section with corresponding material ranges (Freeze and Cherry, 1979). Initial zone-based geometric mean horizontal hydraulic conductivities ranged from 4.39e-2 ft/day (i.e., comparable to literature values for fractured metamorphic rock; Freeze and Cherry, 1979) in lower bedrock to 8.93e-1 ft/day (i.e., comparable to literature values from silt/silty sand) in partially weathered rock. Over the course of zone-based model calibration, the lowest hydraulic conductivity decreased to 1.23e-3 ft/day (i.e., comparable to clays-silt) in regional residuum and increased to ~5 ft/day (i.e., comparable to silty sand) in AP-1 CCR. Pilot-point calibration reduced horizontal hydraulic conductivity to 1.19e-3 ft/day (i.e., comparable to clays-silt) in AP-3/4 CCR, and increased the shallow regional siliciclastic schist to 24.8 ft/day (i.e., permeable fractured rocks). A layer-by-layer summary is presented below:

- Layer 2 (CCR) – CCR is composed of fly ash, bottom ash, and mixed ash, which range from clay to sand consistency in composition, placing a general literature range of 1e-10 to 1 cm/sec (2.8e-7 to 2,800 ft/day) according to Freeze and Cherry (1979). Field pore-pressure dissipation tests represent the lower range of site-specific CCR hydraulic conductivity and ranged from 3e-4 to 4.96e-1 ft/day (Appendix A). Final pilot-point calibrated values range from 1.19e-3 to 3.57e-2, within the range of the field data (Table B1-2).
- Layer 3 (Residuum) – Residuum materials at the site range from clay to gravel, placing a range of hydraulic conductivities at 1e-10 to 100 cm/sec (2.8e-7 to 2.8e5 ft/day; Freeze and Cherry, 1979). Slug tests conducted within residuum varied from 5.7e-2 to 9.68 ft/day, representing the site-specific range of hydraulic conductivity values (Appendix A). Pilot-point calibrated hydraulic conductivity ranged from 7.64e-3 ft/day in the regional domain (2.56e-2 ft/day near the site) to 5.62 ft/day near the site, similar to the field data (Table B1-2).
- Layer 4 (PWR) – PWR conductivity falls in the range of fractured rock, which ranges from 1e-8 to 1e-2 cm/sec (2.8e-5 to 28 ft/day; Freeze and Cherry, 1979). Slug tests and packer tests within the PWR ranged from 7e-3 to 2.24 ft/day (Appendix A). Hydraulic conductivity calibrated as pilot points ranged from 7.52e-3 to 4.36e-1 ft/day near the site (Table B1-2), within the range of field data. The lower maxima when compared to field testing is likely due to the pilot point representation of bulk hydraulic conductivity, rather than discrete values measured at individual wells.
- Layer 5 (Upper Bedrock) - Upper bedrock may be conceptualized also as variably fractured rock, falling within the same range as PWR (1e-8 to 1e-2 cm/sec; 2.8e-5 to 28 ft/day; Freeze and Cherry, 1979). Slug and packer tests within the upper bedrock onsite produced hydraulic conductivity values ranging from 9e-3 to 49.95 ft/day (Appendix A). Pilot point hydraulic conductivity ranged from 9.12e-3 ft/day near the site to 24.8 ft/day in the regional domain, within the range of field data (Table B1-2).
- Layer 6 (Lower Bedrock) – Lower bedrock conceptually should have lower hydraulic conductivity, and falls within the range of 1e-11 to 1e-8 cm/sec (2.8e-8 to 2.8e-5 ft/day; Freeze and Cherry, 1979). Slug tests in the lower bedrock onsite ranged from 2e-3 to 1.9e-1 ft/day (Appendix A). Pilot point hydraulic conductivity values ranged from 1.56e-3 ft/day near the site to 1.92e-1 ft/day in the regional domain, similar to field data (Table B1-2).

These values are summarized in Table B1-2 and displayed alongside empirical field data on Figure B1-8.

As discussed in Appendix A, the average difference between precipitation and the Penman evapotranspiration in the region is 2.78 inches for the month of March 2024 (2.00e-2 ft/day), which provides an upper estimate of groundwater recharge in that it does not account for surface runoff. Regional groundwater recharge rates for average dry and wet years are expected to range from 4.7 to 8.8 inches per year (in/yr; Clarke and Peck, 1991).

Recharge to surface water features (e.g., creeks, rivers, lakes, wetlands, etc.) is expected to be higher than recharge to the aquifer.

Initial recharge values were set to 1.00e-3 ft/day in most zones, aside from developed land which was scaled proportional to level of stated development (Table B1-3). The HELP model (Golder 2020) is used to derive an estimated 1.58e-6 ft/day of recharge through the low-permeability covers over AP-1 and AP-3/4. Over the course of the zone-based calibration, recharge decreased to 1.00e-5 ft/day over high-intensity developed land and increased to 4.95e-3 ft/day in developed open space. The pilot-point calibration (in which zones were still retained for recharge) lowered recharge to a minimum of 3.03e-5 ft/day (0.01 inches per month [in/mo] for March 2024) in high-intensity developed land and increased the maximum recharge to 7.47e-3 ft/day (2.78 in/mo for March 2024) in woody wetlands.

Taken together, the calibrated model values for recharge and horizontal hydraulic conductivity varied within reasonable ranges of their initial starting conditions, and within relative constraints established by empirical data.

3.3 Calibration Sensitivity Analysis

PESTPP-IES results from 2,830 model runs (three-hundred realizations from each of ten optimization runs, minus abandoned runs) were used to assess the model's sensitivity to changes in aquifer parameters, AEM Enhanced Underdrain conductance, and recharge. Sensitivity analysis was performed using multiple machine-learning algorithms, including random forest (Brieman, 2001), regularized random forest (Deng and Runger, 2012) and accumulated local effects (ALE; Apley and Zhu, 2020). The following model parameters were included in the sensitivity analysis:

- Horizontal and vertical hydraulic conductivity (K) for all pilot points in layers 2-6.
- Recharge rates for all recharge zones.
- Drain conductance for AEM Enhanced Underdrain simulated in the buttress area of the CCR in AP-3/4.

Results of the sensitivity analysis indicate:

- The model is sensitive to recharge rates above 13.9 inches per year (0.0032 ft/d) over developed open space (recharge zone 2), which was among the most sensitive parameters included in the sensitivity analysis.
- Horizontal hydraulic conductivity was sensitive in upper bedrock near the unlined pond northwest of AP-3/4, in lower schist bedrock outside the site-specific data envelope, and in PWR near the unlined pond at the site administration building.

Overall, the sensitivity analysis results suggest that the calibration is reasonable and not overly sensitive to minor modifications of the calibrated parameter values. Sensitivity analysis reveals that the most sensitive parameters are either located distal to the site, or near known site features that have not yet reached hydraulic equilibrium.

3.4 Validation Analysis

A validation analysis is performed to test the ability of the 2024 Conditions model to simulate results based on data that was different from data used during the calibration process. The analysis consists of the application of relevant calibrated hydraulic property values and recharge zones from the 2024 Conditions model to the August 2016 conditions simulated in the 2016 Conditions Model (Golder, 2021). The analysis shows that the 2024 Conditions model provides a reasonable representation of site hydrogeology that can be applied to simulations of historical, current, and future conditions. This conclusion is based on August 2016 model calibration statistics in Tables B1-6 and B1-7 and model simulation and statistics results on Figures B1-9 to B1-11 showing 2016 model condition statistics that are comparable to the 2024 Conditions model.

Table B1-6 shows that calibration criteria for model-wide statistics are met by the August 2016 calibration model. Table B1-7 shows that most calibration criteria are met for target data in the AP-3/4 areas. The simulated Site water table for August 2016 conditions is shown on Figure B1-9 along with simulated water tables interpreted from March 2024 and Post-Closure. The changing water tables over time shown Figure B1-9 document the progression of water table levels and geometry over time as a response to closure construction and final closure construction represented by the Post-Closure simulation period.

4.0 CONCLUSIONS

The manual and automated model calibration process improved the accuracy of the Plant McDonough steady-state groundwater model, and met the following criteria:

- Calibration statistics adhered to general industry practices.
- Recharge and horizontal hydraulic conductivity parameters are calibrated within reasonable ranges of their initial values, which are based on field data.
- A model validation analysis shows that the model provides reasonable simulation results when applied to August 2016 data which are different from data used during the calibration process. The results provide additional confidence in the simulation of future Post-Closure conditions.
- Anomalies in calibrated head residuals correspond to areas with Temporary AEM Dewatering Wells where steady-state conditions do not yet prevail (Temporary AEM Dewatering Wells are not used as head calibration targets)
- Sensitivity analysis reveals that the most sensitive parameters are either located distal to the site, or near known site features that have not yet reached hydraulic equilibrium.

5.0 REFERENCES

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APPENDIX B - GROUNDWATER MODEL CONSTRUCTION AND CALIBRATION

ATTACHMENT B1 – CALIBRATION SUMMARY

TABLES

Table B1-1
Model Head Calibration Targets

Name	Type	X	Y	Layer	Date	Observed	Computed	Weight	Group	Location	Residual
B100	Monitoring Well	2202242	1390255	3	1/29/2024	743.9	750.2	1	2	Site	-6.3
B101D	Monitoring Well	2204168	1394064	5	1/29/2024	787.1	796.3	1	2	AP-3/4	-9.2
B102D	Monitoring Well	2204200	1393828	5	1/29/2024	789.3	792.4	1	2	AP-3/4	-3.1
B103D	Monitoring Well	2202614	1391543	6	1/29/2024	782.3	782.1	1	2	Site	0.2
B104D	Monitoring Well	2202298	1391318	5	1/29/2024	780.8	778.6	1	2	Site	2.2
B105D	Monitoring Well	2201832	1390635	5	1/29/2024	761.3	762.6	1	2	AP-1	-1.3
B106D	Monitoring Well	2203869	1394327	5	1/29/2024	785.2	793.3	1	2	AP-3/4	-8.1
B107D	Monitoring Well	2202596	1392334	5	1/29/2024	798.7	797.1	1	2	AP-3/4	1.6
B108D	Monitoring Well	2202313	1392156	5	1/29/2024	797.4	797.6	1	2	AP-3/4	-0.2
B109D	Monitoring Well	2202127	1393958	6	1/29/2024	810.1	817.0	1	2	AP-3/4	-6.9
B110D	Monitoring Well	2200736	1391294	5	3/20/2024	755.6	754.2	1	1	AP-1	1.4
B111D	Monitoring Well	2202956	1394303	6	1/29/2024	781.1	781.4	1	2	AP-3/4	-0.3
B112D	Monitoring Well	2200664	1391564	5	3/20/2024	758.7	756.2	1	1	AP-1	2.5
B113D	Monitoring Well	2200719	1391564	6	3/20/2024	756.5	756.6	1	1	AP-1	-0.1
B115D	Monitoring Well	2202581	1391265	6	1/29/2024	767.0	770.6	1	2	Site	-3.6
B116D	Monitoring Well	2200611	1390484	5	1/29/2024	765.2	763.5	1	2	Site	1.7
B117D	Monitoring Well	2201727	1393964	5	1/29/2024	830.1	836.4	1	2	AP-3/4	-6.3
B118	Monitoring Well	2200450	1391219	5	1/29/2024	756.1	764.8	1	2	Site	-8.7
B119D	Monitoring Well	2200447	1391236	6	1/29/2024	759.7	764.8	1	2	Site	-5.1
B120D	Monitoring Well	2202436	1394047	5	1/29/2024	800.3	801.1	1	2	AP-3/4	-0.8
B122D	Monitoring Well	2202975	1390993	5	1/29/2024	746.7	752.8	1	2	Site	-6.1
B123D	Monitoring Well	2202608	1391234	6	1/29/2024	768.2	768.4	1	2	Site	-0.2
B125D	Monitoring Well	2202581	1394112	6	1/29/2024	797.5	795.1	1	2	AP-3/4	2.4
B16	Monitoring Well	2203315	1392595	3	1/29/2024	789.4	790.1	1	2	AP-3/4	-0.7
B18	Monitoring Well	2202875	1392521	3	1/29/2024	801.9	796.2	1	2	AP-3/4	5.7
B24	Monitoring Well	2201450	1392480	5	1/29/2024	798.6	803.2	1	2	AP-3/4	-4.6
B25	Monitoring Well	2201503	1392813	5	1/29/2024	822.2	817.1	1	2	AP-3/4	5.1
B26	Monitoring Well	2201550	1393106	5	1/29/2024	825.8	825.9	1	2	AP-3/4	-0.1
B28	Monitoring Well	2201679	1391967	5	1/29/2024	785.0	790.8	1	2	AP-1	-5.8
B29	Monitoring Well	2201422	1391890	4	1/29/2024	787.1	787.8	1	2	AP-1	-0.7
B3	Monitoring Well	2202412	1394045	4	1/29/2024	800.3	802.2	1	2	AP-3/4	-1.9
B41	Monitoring Well	2201752	1390921	3	1/29/2024	769.8	767.0	1	2	AP-1	2.8

Table B1-1
Model Head Calibration Targets

Name	Type	X	Y	Layer	Date	Observed	Computed	Weight	Group	Location	Residual
B50	Monitoring Well	2201841	1391657	3	1/29/2024	786.1	784.7	1	2	AP-1	1.4
B51	Monitoring Well	2200906	1390501	4	3/20/2024	753.2	750.6	1	1	AP-1	2.6
B52	Monitoring Well	2201315	1392308	4	1/29/2024	791.6	797.2	1	2	AP-3/4	-5.6
B54	Monitoring Well	2203141	1394424	3	1/29/2024	778.6	777.3	1	2	AP-3/4	1.3
B55	Monitoring Well	2204148	1394143	3	3/20/2024	798.7	798.1	1	1	AP-3/4	0.6
B56	Monitoring Well	2204188	1393958	3	3/15/2024	795.4	796.2	1	1	AP-3/4	-0.8
B57	Monitoring Well	2202737	1391396	5	1/29/2024	769.1	771.2	1	2	Site	-2.1
B58	Monitoring Well	2202426	1391126	3	3/15/2024	769.0	767.9	1	1	Site	1.1
B59	Monitoring Well	2203001	1394349	4	3/20/2024	779.2	778.1	1	1	AP-3/4	1.1
B6	Monitoring Well	2203267	1394419	4	3/20/2024	778.6	780.6	1	1	AP-3/4	-2.0
B60	Monitoring Well	2202882	1391101	4	1/29/2024	750.6	756.4	1	2	Site	-5.8
B61	Monitoring Well	2202506	1390958	4	1/29/2024	761.9	759.6	1	2	Site	2.3
B62	Monitoring Well	2201811	1389828	5	1/29/2024	744.2	748.5	1	2	Site	-4.3
B63	Monitoring Well	2202978	1390999	3	1/29/2024	747.8	752.8	1	2	Site	-5.0
B64	Monitoring Well	2203031	1394382	3	1/29/2024	778.8	777.2	1	2	AP-3/4	1.6
B65	Monitoring Well	2204051	1394381	4	1/29/2024	800.9	798.4	1	2	AP-3/4	2.5
B66	Monitoring Well	2204277	1393858	3	1/29/2024	797.0	795.8	1	2	AP-3/4	1.2
B68	Monitoring Well	2200714	1391298	3	3/20/2024	754.9	753.5	1	1	AP-1	1.4
B7	Monitoring Well	2203596	1394375	3	3/20/2024	781.5	787.5	1	1	AP-3/4	-6.0
B72	Monitoring Well	2200724	1391242	3	3/20/2024	755.4	753.6	1	1	AP-1	1.8
B73	Monitoring Well	2200697	1391352	3	3/20/2024	755.1	753.0	1	1	AP-1	2.1
B76	Monitoring Well	2202757	1390717	3	1/29/2024	744.9	749.4	1	2	Site	-4.5
B77	Monitoring Well	2202942	1390949	3	1/29/2024	747.8	753.1	1	2	Site	-5.3
B78	Monitoring Well	2202958	1394328	5	3/20/2024	779.5	779.2	1	1	AP-3/4	0.3
B79	Monitoring Well	2203223	1394459	4	3/20/2024	779.9	780.5	1	1	AP-3/4	-0.6
B80	Monitoring Well	2203534	1394373	3	1/29/2024	781.2	786.0	1	2	AP-3/4	-4.8
B81	Monitoring Well	2203741	1394365	4	1/29/2024	781.6	789.9	1	2	AP-3/4	-8.3
B82	Monitoring Well	2204258	1393750	3	1/29/2024	794.9	793.2	1	2	AP-3/4	1.7
B83	Monitoring Well	2202696	1390736	3	1/29/2024	745.8	750.5	1	2	Site	-4.7
B85	Monitoring Well	2203135	1394433	3	1/29/2024	778.8	777.6	1	2	AP-3/4	1.2
B86	Monitoring Well	2203207	1394480	4	3/20/2024	780.8	780.6	1	1	AP-3/4	0.2
B87	Monitoring Well	2203531	1394402	4	1/29/2024	781.4	786.1	1	2	AP-3/4	-4.7

Table B1-1
Model Head Calibration Targets

Name	Type	X	Y	Layer	Date	Observed	Computed	Weight	Group	Location	Residual
B88	Monitoring Well	2203738	1394401	4	1/29/2024	780.7	790.6	1	2	AP-3/4	-9.9
B89	Monitoring Well	2204049	1394398	5	1/29/2024	796.1	798.5	1	2	AP-3/4	-2.4
B90	Monitoring Well	2203213	1394501	3	3/20/2024	780.9	781.3	1	1	AP-3/4	-0.4
B91	Monitoring Well	2203124	1394447	4	1/29/2024	778.7	778.2	1	2	AP-3/4	0.5
B92	Monitoring Well	2203027	1394393	3	1/29/2024	779.2	777.3	1	2	AP-3/4	1.9
B93	Monitoring Well	2202947	1394349	4	1/29/2024	780.7	779.2	1	2	AP-3/4	1.5
B94	Monitoring Well	2203514	1394402	4	1/29/2024	781.2	785.8	1	2	AP-3/4	-4.6
B95	Monitoring Well	2203168	1394519	3	1/29/2024	780.9	781.0	1	2	AP-3/4	-0.1
B96	Monitoring Well	2203099	1394479	4	1/29/2024	779.2	779.3	1	2	AP-3/4	-0.1
B97	Monitoring Well	2203008	1394430	5	1/29/2024	781.4	777.9	1	2	AP-3/4	3.5
B98	Monitoring Well	2202934	1394393	3	1/29/2024	782.1	779.0	1	2	AP-3/4	3.1
B99	Monitoring Well	2203084	1394524	3	1/29/2024	779.2	780.0	1	2	AP-3/4	-0.8
CHAT_R_I285	USGS staff gauge	2212731	1419505	3	2/23/2024	783.3	783.1	1	4	USGS	0.2
CHAT_R_ATL	USGS staff gauge	2209223	1403939	3	2/21/2024	754.9	756.6	1	4	USGS	-1.7
CHAT_R_GA280	USGS staff gauge	2201317	1388770	3	2/21/2024	743.7	747.1	1	4	USGS	-3.4
DGWA53	Monitoring Well	2201669	1393473	5	1/29/2024	829.9	835.0	1	2	AP-3/4	-5.1
DGWA70A	Monitoring Well	2200592	1390481	4	1/29/2024	767.0	764.1	1	2	Site	2.9
DGWA71	Monitoring Well	2201715	1393963	4	1/29/2024	830.7	837.0	1	2	AP-3/4	-6.3
DGWC10	Monitoring Well	2204201	1393818	3	1/29/2024	793.8	792.9	1	2	AP-3/4	0.9
DGWC11	Monitoring Well	2204166	1393547	3	1/29/2024	787.3	785.1	1	2	AP-3/4	2.2
DGWC12	Monitoring Well	2204128	1393149	3	1/29/2024	765.5	767.6	1	2	AP-3/4	-2.1
DGWC121	Monitoring Well	2200849	1390740	4	3/20/2024	755.4	753.9	1	1	AP-1	1.5
DGWC13	Monitoring Well	2204085	1392881	4	1/29/2024	759.6	764.7	1	2	AP-3/4	-5.1
DGWC14	Monitoring Well	2204013	1392574	5	1/29/2024	771.6	767.3	1	2	AP-3/4	4.3
DGWC15	Monitoring Well	2203679	1392544	4	1/29/2024	782.9	781.1	1	2	AP-3/4	1.8
DGWC17	Monitoring Well	2203051	1392646	3	1/29/2024	798.5	793.4	1	2	AP-3/4	5.1
DGWC19	Monitoring Well	2202601	1392343	3	1/29/2024	798.7	797.1	1	2	AP-3/4	1.6
DGWC2	Monitoring Well	2202120	1393958	4	1/29/2024	819.3	817.6	1	2	AP-3/4	1.7
DGWC20	Monitoring Well	2202316	1392165	3	3/15/2024	798.8	797.6	1	1	AP-3/4	1.2
DGWC21	Monitoring Well	2202063	1392067	5	1/29/2024	796.6	795.0	1	2	AP-3/4	1.6
DGWC22	Monitoring Well	2201792	1392126	5	1/29/2024	793.7	794.2	1	2	AP-3/4	-0.5
DGWC23	Monitoring Well	2201582	1392240	5	1/29/2024	798.3	796.5	1	2	AP-3/4	1.8

Table B1-1
Model Head Calibration Targets

Name	Type	X	Y	Layer	Date	Observed	Computed	Weight	Group	Location	Residual
DGWC37	Monitoring Well	2200920	1390482	3	3/20/2024	752.7	749.8	1	1	AP-1	2.9
DGWC38	Monitoring Well	2201149	1390363	3	3/20/2024	748.0	746.8	1	1	AP-1	1.2
DGWC39	Monitoring Well	2201540	1390304	3	3/20/2024	752.9	751.7	1	1	AP-1	1.2
DGWC4	Monitoring Well	2202662	1394171	3	1/29/2024	789.3	790.0	1	2	AP-3/4	-0.7
DGWC40	Monitoring Well	2201826	1390626	3	1/29/2024	761.0	762.5	1	2	AP-1	-1.5
DGWC42	Monitoring Well	2201870	1391328	3	1/29/2024	773.9	778.2	1	2	AP-1	-4.3
DGWC47	Monitoring Well	2202610	1391554	4	3/15/2024	780.5	783.5	1	1	Site	-3.0
DGWC48	Monitoring Well	2202290	1391315	3	3/15/2024	773.6	778.6	1	1	Site	-5.0
DGWC5	Monitoring Well	2202965	1394306	5	1/29/2024	779.7	779.2	1	2	AP-3/4	0.5
DGWC67	Monitoring Well	2200831	1390954	4	3/20/2024	756.9	754.3	1	1	AP-1	2.6
DGWC68A	Monitoring Well	2200735	1391301	3	3/20/2024	755.1	754.1	1	1	AP-1	1.0
DGWC69	Monitoring Well	2200657	1391585	3	3/20/2024	758.0	755.5	1	1	AP-1	2.5
DGWC8	Monitoring Well	2203882	1394322	3	1/29/2024	786.5	794.1	1	2	AP-3/4	-7.6
DGWC9	Monitoring Well	2204170	1394056	3	1/29/2024	790.7	797.4	1	2	AP-3/4	-6.7
ET1	Site staff gauge	2203125	1394347	3	1/29/2024	771.9	773.0	1	2	AP-3/4	-1.1
Hill0	Regional hillslope	2221646	1362835	3	-	1061.9	1061.9	1	1	Censored	0.0
Hill1	Regional hillslope	2210701	1371266	3	-	962.0	962.0	1	1	Censored	0.0
Hill2	Regional hillslope	2204376	1376026	3	-	967.9	967.9	1	1	Censored	0.0
Hill3	Regional hillslope	2224463	1376645	3	-	975.6	975.6	1	1	Censored	0.0
Hill4	Regional hillslope	2231853	1377688	3	-	953.0	953.0	1	1	Censored	0.0
Hill5	Regional hillslope	2238652	1377429	3	-	1026.3	1026.3	1	1	Censored	0.0
Hill6	Regional hillslope	2213329	1383275	3	-	911.5	911.5	1	1	Censored	0.0
Hill7	Regional hillslope	2233605	1385695	3	-	938.2	938.2	1	1	Censored	0.0
Hill8	Regional hillslope	2228015	1384462	3	-	928.1	928.1	1	1	Censored	0.0
Hill9	Regional hillslope	2174315	1388741	3	-	1065.0	1065.0	1	1	Censored	0.0
Hill10	Regional hillslope	2184808	1389003	3	-	1071.1	1071.1	1	1	Censored	0.0
Hill11	Regional hillslope	2174052	1399235	3	-	1045.8	1045.8	1	1	Censored	0.0
Hill12	Regional hillslope	2175972	1395848	3	-	1036.9	1036.9	1	1	Censored	0.0
Hill13	Regional hillslope	2172014	1405819	3	-	1054.4	1054.4	1	1	Censored	0.0
Hill14	Regional hillslope	2187506	1406011	3	-	1022.7	1022.7	1	1	Censored	0.0
Hill15	Regional hillslope	2205533	1400021	3	-	856.7	856.7	1	1	Censored	0.0
Hill16	Regional hillslope	2241893	1403935	3	-	1014.3	1014.3	1	1	Censored	0.0

Table B1-1
Model Head Calibration Targets

Name	Type	X	Y	Layer	Date	Observed	Computed	Weight	Group	Location	Residual
Hill17	Regional hillslope	2192480	1410039	3	-	1054.3	1054.3	1	1	Censored	0.0
Hill18	Regional hillslope	2200462	1412385	3	-	1038.1	1038.1	1	1	Censored	0.0
Hill19	Regional hillslope	2215386	1407176	3	-	981.8	981.8	1	1	Censored	0.0
Hill20	Regional hillslope	2223249	1412721	3	-	1030.8	1030.8	1	1	Censored	0.0
Hill21	Regional hillslope	2248548	1410972	3	-	1033.2	1033.2	1	1	Censored	0.0
Hill22	Regional hillslope	2183359	1414183	3	-	996.7	996.7	1	1	Censored	0.0
Hill23	Regional hillslope	2235305	1419189	3	-	1074.6	1074.6	1	1	Censored	0.0
Hill24	Regional hillslope	2253900	1418600	3	-	1034.0	1034.0	1	1	Censored	0.0
Hill25	Regional hillslope	2199916	1420178	3	-	1049.7	1049.7	1	1	Censored	0.0
Hill26	Regional hillslope	2235565	1425987	3	-	1091.0	1091.0	1	1	Censored	0.0
Hill27	Regional hillslope	2245158	1426344	3	-	1009.0	1009.0	1	1	Censored	0.0
Hill28	Regional hillslope	2261171	1422841	3	-	1052.6	1052.6	1	1	Censored	0.0
Hill29	Regional hillslope	2187573	1428301	3	-	1094.1	1094.1	1	1	Censored	0.0
Hill30	Regional hillslope	2208158	1429323	3	-	1057.1	1057.1	1	1	Censored	0.0
Hill31	Regional hillslope	2222560	1427809	3	-	1021.1	1021.1	1	1	Censored	0.0
Hill32	Regional hillslope	2251245	1427980	3	-	1056.6	1056.6	1	1	Censored	0.0
Hill33	Regional hillslope	2260933	1429237	3	-	1033.2	1033.2	1	1	Censored	0.0
Hill34	Regional hillslope	2198137	1433562	3	-	1040.2	1040.2	1	1	Censored	0.0
NANCY_CR_JOHNSON	USGS staff gauge	2242395	1417903	3	2/23/2024	842.7	839.1	1	4	USGS	3.6
NANCY_CR_RICKENBACKER	USGS staff gauge	2232167	1407521	3	2/8/2024	811.8	815.7	1	4	USGS	-3.9
NANCY_CR_WESTWESLEY	USGS staff gauge	2213807	1396305	3	2/27/2024	756.0	756.5	1	4	USGS	-0.5
NICKAJACK_CR_US78	USGS staff gauge	2188830	1383686	3	2/22/2024	749.9	748.2	1	4	USGS	1.7
P1_VW1_759ft	Vibrating Wire Piezometer	2203551	1393246	4	3/15/2024	770.1	771.7	1	1	AP-3/4	-1.6
P2_VW1_759ft	Vibrating Wire Piezometer	2203645	1393353	3	3/15/2024	768.4	764.1	1	1	AP-3/4	4.3
P3_VW2_770ft	Vibrating Wire Piezometer	2203340	1393495	3	3/15/2024	778.6	770.9	1	1	AP-3/4	7.7
P4_VW2_751ft	Vibrating Wire Piezometer	2203448	1393586	4	3/15/2024	771.2	765.8	1	1	AP-3/4	5.4
P5_VW1_775ft	Vibrating Wire Piezometer	2203126	1393779	3	3/15/2024	777.4	774.1	1	1	AP-3/4	3.3
P6_VW1_763ft	Vibrating Wire Piezometer	2203245	1393856	3	3/15/2024	771.1	770.3	1	1	AP-3/4	0.8
P7_VW2_783ft	Vibrating Wire Piezometer	2202695	1393847	3	3/15/2024	796.1	792.0	1	1	AP-3/4	4.1

Table B1-1
Model Head Calibration Targets

Name	Type	X	Y	Layer	Date	Observed	Computed	Weight	Group	Location	Residual
PEACHTREE_CR_ATL	USGS staff gauge	2223398	1389761	3	2/6/2024	766.7	774.7	1	4	USGS	-8.0
PROCTOR_CR_HORTENSE	USGS staff gauge	2213342	1373655	3	3/1/2024	819.0	817.1	1	4	USGS	1.9
PROCTOR_CR_JACKSON	USGS staff gauge	2203157	1380415	3	3/19/2024	762.3	759.8	1	4	USGS	2.5
ROTTONWOOD_CR_INTERSTATE	USGS staff gauge	2208213	1416627	3	2/21/2024	822.7	826.6	1	4	USGS	-3.9
WOODALL_CR	USGS staff gauge	2213985	1390270	3	3/7/2024	756.9	757.7	1	4	USGS	-0.8
WT2	Site staff gauge	2200602	1391574	3	3/20/2024	754.6	754.5	1	1	AP-1	0.1
WT3	Site staff gauge	2200646	1391465	3	3/20/2024	752.1	755.0	1	1	AP-1	-2.9
WT4	Site staff gauge	2200810	1390644	3	3/20/2024	748.8	750.9	1	1	AP-1	-2.1
WT5	Site staff gauge	2201092	1390351	3	3/20/2024	746.7	745.8	1	1	AP-1	0.9
WT7	Site staff gauge	2201557	1389944	3	3/20/2024	742.7	745.8	1	1	AP-1	-3.1

Notes:
1. Group 1 = March 2024 site data, Group 2 = January 2024 site data, Group 4 = USGS (United States Geological Survey) data
2. Regional hillslope = ground surface calibration targets to constrain regional potentiometric surface.

Created by: TPK 2025-02-03
Checked by: SJS 2025-02-26

Table B1-2

Hydraulic Conductivity Values

Zone	Type	Geometric mean Kxy (ft/day)	Zone-calibrated Kxy (ft/day)	Zone-calibrated Kz (ft/day)	Zone-calibrated Kz/Kxy ratio	Pilot-point calibrated Minimum Kx (ft/day)	Pilot-point calibrated Maximum Kx (ft/day)	Pilot-point calibrated Minimum Kz (ft/day)	Pilot-point calibrated Maximum Kz (ft/day)	Pilot-point calibrated Minimum kx/kz ratio	Pilot-point calibrated Maximum kz/kx ratio
1	Unused	--	1.00E+03	8.08E+04	8.08E+01	1.00E+03	1.00E+03	1.00E+03	8.08E+04	1.24E-02	1.0E+00
2	Coal Combustion Residuals - AP-1	1.42E-01	5.00E+00	1.16E-01	2.31E-02	6.99E-03	3.57E-02	3.31E-04	3.31E-04	2.11E+01	1.1E+02
3	Coal Combustion Residuals - AP-3/4	1.42E-01	8.99E-02	5.50E-02	6.12E-01	1.19E-03	1.25E-02	3.42E-04	1.96E-03	6.79E-01	2.7E+01
4	Pilot Point Area Residuum	2.84E-01	3.25E-01	4.10E-03	1.26E-02	2.56E-02	5.62E+00	1.05E-02	5.56E+00	0.00E+00	6.5E+01
5	Regional Alluvium	2.84E-01	3.25E-02	3.14E-02	9.66E-01	2.63E-02	2.63E-02	4.24E-02	4.24E-02	6.21E-01	6.2E-01
6	Regional Residuum	2.84E-01	1.23E-03	1.12E+00	9.14E+02	7.64E-03	7.64E-03	9.23E-01	9.23E-01	8.27E-03	8.3E-03
7	Pilot Point Area Partially Weathered Rock	8.93E-01	7.48E-03	9.12E-03	1.22E+00	7.52E-03	4.36E-01	1.27E-02	1.77E-01	0.00E+00	2.1E+01
8	Regional Partially Weathered Rock	8.93E-01	2.55E+00	7.48E-02	2.93E-02	1.27E-01	1.27E-01	1.77E-02	1.77E-02	7.18E+00	7.2E+00
9	Shallow Bedrock Pilot Point Area	4.48E-01	9.12E-03	5.21E-01	5.71E+01	9.12E-03	2.83E+00	1.08E-01	4.86E+00	0.00E+00	2.1E+01
10	Shallow Regional Sedimentary Siliciclastic Bedrock	4.48E-01	1.77E+00	2.18E-01	1.24E-01	2.48E+01	2.48E+01	1.80E-01	1.80E-01	1.38E+02	1.4E+02
11	Shallow Regional Mylonite Bedrock	4.48E-01	4.17E-02	5.95E-02	1.43E+00	4.17E-02	4.17E-02	5.95E-02	5.95E-02	7.01E-01	7.0E-01
12	Shallow Regional Metamorphic Schist Bedrock	4.48E-01	2.14E-02	4.19E-02	1.96E+00	1.25E-02	1.25E-02	4.69E-01	4.69E-01	2.66E-02	2.7E-02
13	Shallow Regional Metamorphic Gneiss & Orthogneiss Bedrock	4.48E-01	3.25E-01	2.32E-02	7.14E-02	3.25E-01	3.25E-01	2.32E-02	2.32E-02	1.40E+01	1.4E+01
14	Shallow Regional Metamorphic Gneiss Bedrock	4.48E-01	1.15E+00	5.90E-02	5.11E-02	2.10E-02	3.34E+01	6.86E-02	3.36E-01	6.28E-02	1.6E+02

Table B1-2
Hydraulic Conductivity Values

Zone	Type	Geometric mean Kxy (ft/day)	Zone-calibrated Kxy (ft/day)	Zone-calibrated Kz (ft/day)	Zone-calibrated Kz/Kxy ratio	Pilot-point calibrated Minimum Kx (ft/day)	Pilot-point calibrated Maximum Kx (ft/day)	Pilot-point calibrated Minimum Kz (ft/day)	Pilot-point calibrated Maximum Kz (ft/day)	Pilot-point calibrated Minimum kx/kz ratio	Pilot-point calibrated Maximum kz/kx ratio
15	Shallow Regional Metamorphic Amphibolite Bedrock	4.48E-01	1.89E+00	7.44E-01	3.94E-01	2.93E-01	1.10E+00	4.19E+00	4.62E+00	6.56E-02	2.6E-01
16	Shallow Regional Igneous Intrusive Felsic Bedrock	4.48E-01	1.83E-01	9.12E-03	4.99E-02	1.66E-01	1.66E-01	6.50E-02	6.50E-02	2.56E+00	2.6E+00
17	Deep Bedrock Pilot Point Area	4.39E-02	1.56E-03	1.93E-01	1.24E+02	1.56E-03	1.19E-02	1.88E-02	1.94E-01	0.00E+00	2.9E-01
18	Deep Regional Sedimentary Siliciclastic Bedrock	4.39E-02	2.18E-02	1.93E-01	8.86E+00	1.63E-01	1.63E-01	1.36E-02	1.36E-02	1.20E+01	1.2E+01
19	Deep Regional Mylonite Bedrock	4.39E-02	2.31E-02	6.57E-02	2.84E+00	2.31E-02	2.31E-02	6.57E-02	6.57E-02	3.52E-01	3.5E-01
20	Deep Regional Metamorphic Schist Bedrock	4.39E-02	1.18E-01	1.50E-01	1.27E+00	1.23E-01	1.23E-01	1.93E-01	1.93E-01	6.39E-01	6.4E-01
21	Deep Regional Metamorphic Gneiss & Orthogneiss Bedrock	4.39E-02	2.43E-02	1.93E-01	7.96E+00	2.43E-02	2.43E-02	1.93E-01	1.93E-01	1.26E-01	1.3E-01
22	Deep Regional Metamorphic Gneiss Bedrock	4.39E-02	1.93E-01	2.55E-02	1.32E-01	6.07E-02	1.92E-01	4.20E-03	1.55E-01	3.92E-01	4.6E+01
23	Deep Regional Metamorphic Amphibolite Bedrock	4.39E-02	3.23E-02	8.48E-03	2.62E-01	9.41E-02	1.82E-01	2.45E-02	5.58E-02	1.69E+00	5.5E+00
24	Deep Regional Igneous Intrusive Felsic Bedrock	4.39E-02	1.83E-02	1.48E-02	8.09E-01	4.47E-03	4.47E-03	1.93E-01	1.93E-01	2.32E-02	2.3E-02
25	Engineered Fill	--	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
-	Minimum	4.39E-02	1.23E-03	4.10E-03	1.26E-02	1.19E-03	4.47E-03	3.31E-04	3.31E-04	0.00E+00	8.27E-03
-	Maximum	8.93E-01	5.00E+00	1.12E+00	9.14E+02	2.48E+01	3.34E+01	4.19E+00	5.56E+00	1.38E+02	1.60E+02

Created by: SJS 2024-10-24
Checked by: SJS 2024-10-24

Table B1-3
Recharge Values

Zone	Type	Initial value (ft/day)	Initial value (in/mo)	Initial calibration (ft/day)	Initial calibration (in/mo)	Pilot-point calibration (ft/day)	Pilot-point calibration (in/mo)
1	OPEN WATER	1.00E-03	0.37	4.10E-04	0.15	1.73E-02	6.43
2	DEVELOPED, OPEN SPACE	9.00E-04	0.33	4.95E-03	1.84	1.64E-03	0.61
3	DEVELOPED, LOW INTENSITY	8.00E-04	0.30	1.88E-04	0.07	1.98E-04	0.07
4	DEVELOPED, MEDIUM INTENSITY	5.00E-04	0.19	1.24E-03	0.46	2.03E-03	0.75
5	DEVELOPED, HIGH INTENSITY	3.00E-04	0.11	1.00E-05	0.004	3.03E-05	0.01
6	BARREN LAND	1.00E-03	0.37	1.52E-04	0.06	1.25E-04	0.05
7	DECIDUOUS FOREST	1.00E-03	0.37	2.00E-05	0.01	3.39E-05	0.01
8	EVERGREEN FOREST	1.00E-03	0.37	4.74E-04	0.18	3.25E-04	0.12
9	MIXED FOREST	1.00E-03	0.37	1.81E-04	0.07	6.85E-05	0.03
10	SHRUB/SCRUB	1.00E-03	0.37	2.12E-03	0.79	1.42E-03	0.53
11	HERBACEUOUS	1.00E-03	0.37	4.32E-03	1.61	7.02E-03	2.61
12	HAY/PASTURE	1.00E-03	0.37	3.90E-05	0.01	2.05E-04	0.08
13	WOODY WETLANDS	1.00E-03	0.37	1.68E-03	0.62	7.47E-03	2.78
14	EMERGENT HERBACEUOUS WETLANDS	1.00E-03	0.37	2.93E-03	1.09	2.47E-03	0.92
15	AP-1 liner	1.58E-06	5.86E-04	1.98E-06	7.37E-04	1.66E-06	6.16E-04
16	AP-3/4 liner	1.58E-06	5.86E-04	1.58E-06	5.86E-04	1.58E-06	5.86E-04
--	Minimum (non liner)	3.00E-04	0.11	1.00E-05	0.004	3.03E-05	0.01
--	Maximum (non liner)	1.00E-03	0.37	4.95E-03	1.8	7.47E-03	2.8

Note:
Month represented is March 2024.

Table B1-4
March 2024 Conditions Model Calibration Statistics

Parameter	Explanation	Target Value	Model Result
Residual Mean	Mean of the value of target residuals	0.0 ft (or near zero)	-0.823
Absolute Residual Mean	Mean of the absolute value of target residuals	10 (< 10% of observed head range)	2.87
Root Mean Square Error	Square root of the mean of the squared value of target residuals	10 (< 10% of observed head range)	3.68
Standard Deviation	Standard deviation of the target residuals	10 (< 10% of observed head range)	3.60
Mass Balance Discrepancy	Cumulative model error	< 1%	0.00
Spatial Distribution	Spatial Distributon of Model Residuals	Randomly distributed	Mostly random distribution, some focus near areas of known transient stress.

Created by: TPK 2025-02-04
Checked by: SJS 2025-01-18

Note:
Hillslope targets represent elevations where the water level is censored below the ground surface, and were not used to calculate summary statistics.

Table B1-5

March 2024 Conditions Model AP-3/4 Area Calibration Statistics

Parameter	Explanation	Target Value	Model Result
Residual Mean	Mean of the value of target residuals	0 ft	-0.62
Absolute Residual Mean	Mean of the absolute value of target residuals	7.11 (< 10% of observed head range)	2.95
Root Mean Square Error	Square root of the mean of the squared value of target residuals	7.11 (< 10% of observed head range)	3.89
Standard Deviation	Standard deviation of the target residuals	7.11 (< 10% of observed head range)	3.87
Mass Balance Discrepancy	Cumulative model error	< 1%	0.00
Spatial Distribution	Spatial Distributon of Model Residuals	Randomly distributed	Mild spatial patterns in the vicinity of AP 3/4

Created by: TPK 2025-01-15
Checked by: SJS 2025-01-18

Table B1-6

August 2016 Conditions Model Statistics

Parameter	Explanation	Target Value	Model Result
Residual Mean	Mean of the value of target residuals	0.0 ft (or near zero)	-0.59
Absolute Residual Mean	Mean of the absolute value of target residuals	7.79 (< 10% of observed head range)	5.71
Root Mean Square Error	Square root of the mean of the squared value of target residuals	7.79 (< 10% of observed head range)	7.34
Standard Deviation	Standard deviation of the target residuals	7.79 (< 10% of observed head range)	7.42
Mass Balance Discrepancy	Cumulative model error	< 1%	0.00
Spatial Distribution	Spatial Distributon of Model Residuals	Randomly distributed	Mild spatial patterns in the vicinity of AP 3/4

Table B1-7

August 2016 Conditions Model AP-3/4 Area Statistics

Parameter	Explanation	Target Value	Model Result
Residual Mean	Mean of the value of target residuals	0.0 ft (or near zero)	-1.24
Absolute Residual Mean	Mean of the absolute value of target residuals	6.89 (< 10% of observed head range)	6.68
Root Mean Square Error	Square root of the mean of the squared value of target residuals	6.89 (< 10% of observed head range)	8.30
Standard Deviation	Standard deviation of the target residuals	6.89 (< 10% of observed head range)	8.37
Mass Balance Discrepancy	Cumulative model error	< 1%	0.00
Spatial Distribution	Spatial Distributon of Model Residuals	Randomly distributed	Mild spatial patterns in the vicinity of AP 3/4

APPENDIX B – GROUNDWATER MODEL CONSTRUATION AND CALIBRATION

ATTACHMENT B1 – CALIBRATION SUMMARY

Figures

LEGEND

Monitoring Well

Staff Gauge

Vibrating Wire Piezometer

Property Boundary

NOTE(S)

1. FIGURE B1-1 ONLY SHOWS TARGETS LOCATED WITHIN SITE VICINITY; FIGURE B1-2 FEATURES TARGETS OUTSIDE THE SITE BOUNDARY.

0 350 700

1 " = 350 ft Feet

REFERENCE(S)

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.

CLIENT

GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT

THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE

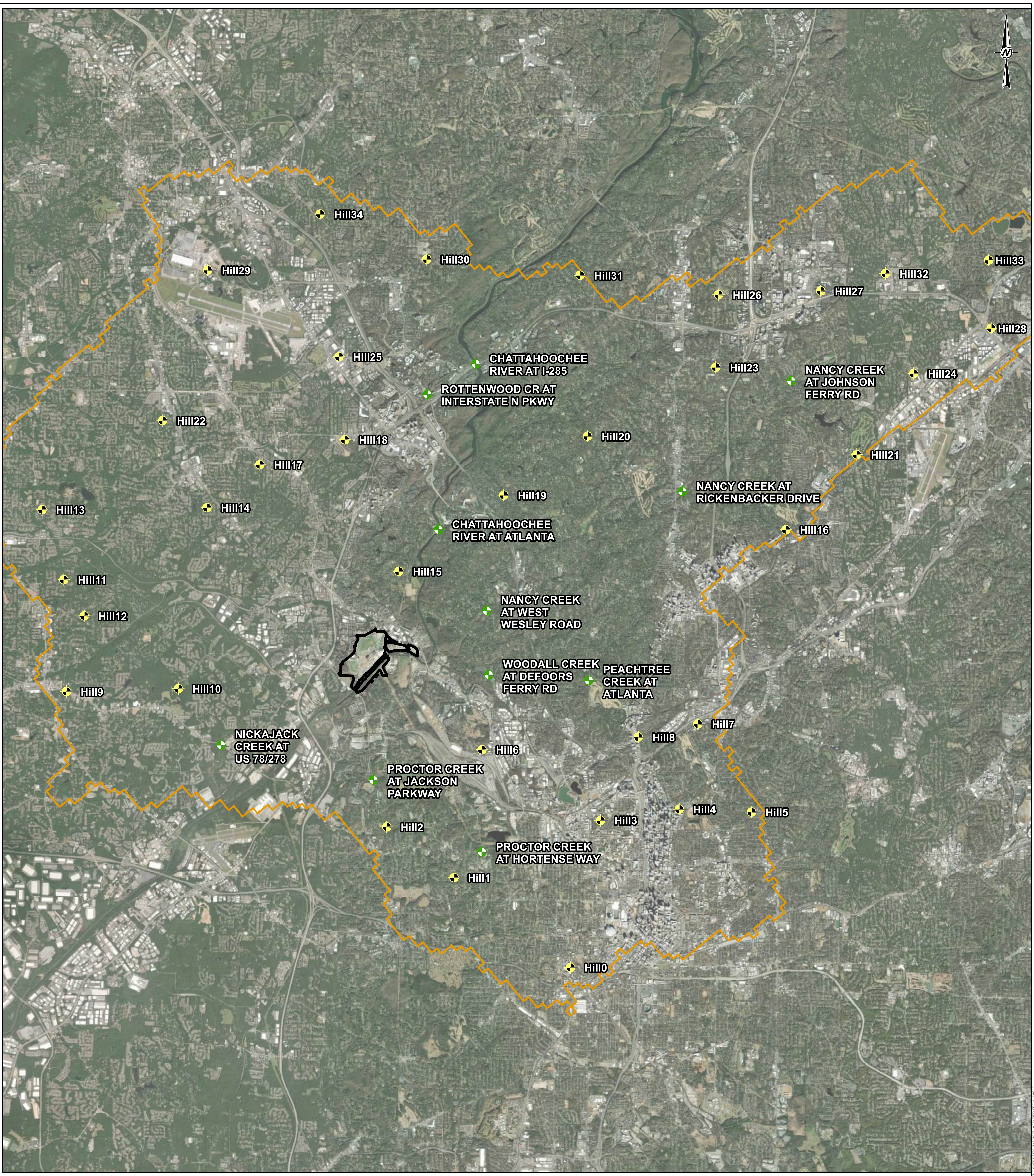
HEAD TARGET LOCATIONS - SITE VICINITY

CONSULTANT

YYYY-MM-DD	2024-12-10
DESIGNED	AFS
PREPARED	EMR
REVIEWED	CB
APPROVED	WG

wsp

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
US0037149.1670	MCD150170	0	B1-1



LEGEND

- Regional Hillslope Target
- USGS Staff Gauge
- Area of Used Cells
- Property Boundary

REFERENCE(S)

1. FIGURE B1-2 DISPLAYS TARGETS LOCATED OUTSIDE SITE VICINITY. FIGURE B1-1 SHOWS TARGETS LOCATED WITHIN SITE VICINITY.

0 6,000 12,000
1 " = 6,000 ft Feet

REFERENCE(S)

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
HEAD TARGET LOCATIONS - REGIONAL

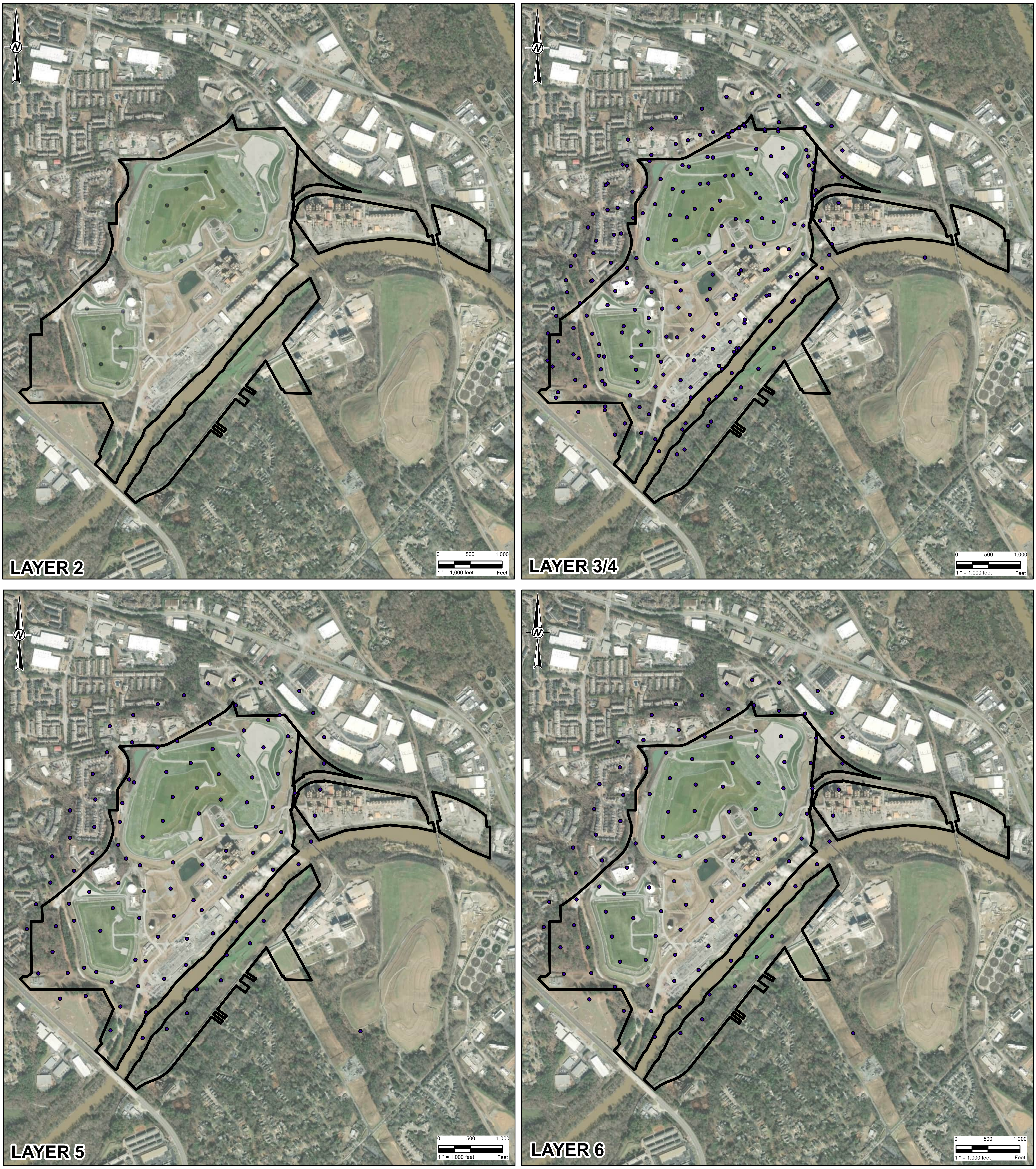
CONSULTANT

YYYY-MM-DD	2024-12-10
DESIGNED	AFS
PREPARED	EMR
REVIEWED	CB
APPROVED	WG

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
US0037149.1670	MCD150170	0	B1-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FR

1 in
0



LEGEND

- Property Boundary
- Pilot Point Locations

NOTE(S)

REFERENCE(S)
1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
PILOT POINT LOCATIONS – SITE VICINITY

CONSULTANT

YYYY-MM-DD	2024-12-10
DESIGNED	AFS
PREPARED	EMR
REVIEWED	CB
APPROVED	WG

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
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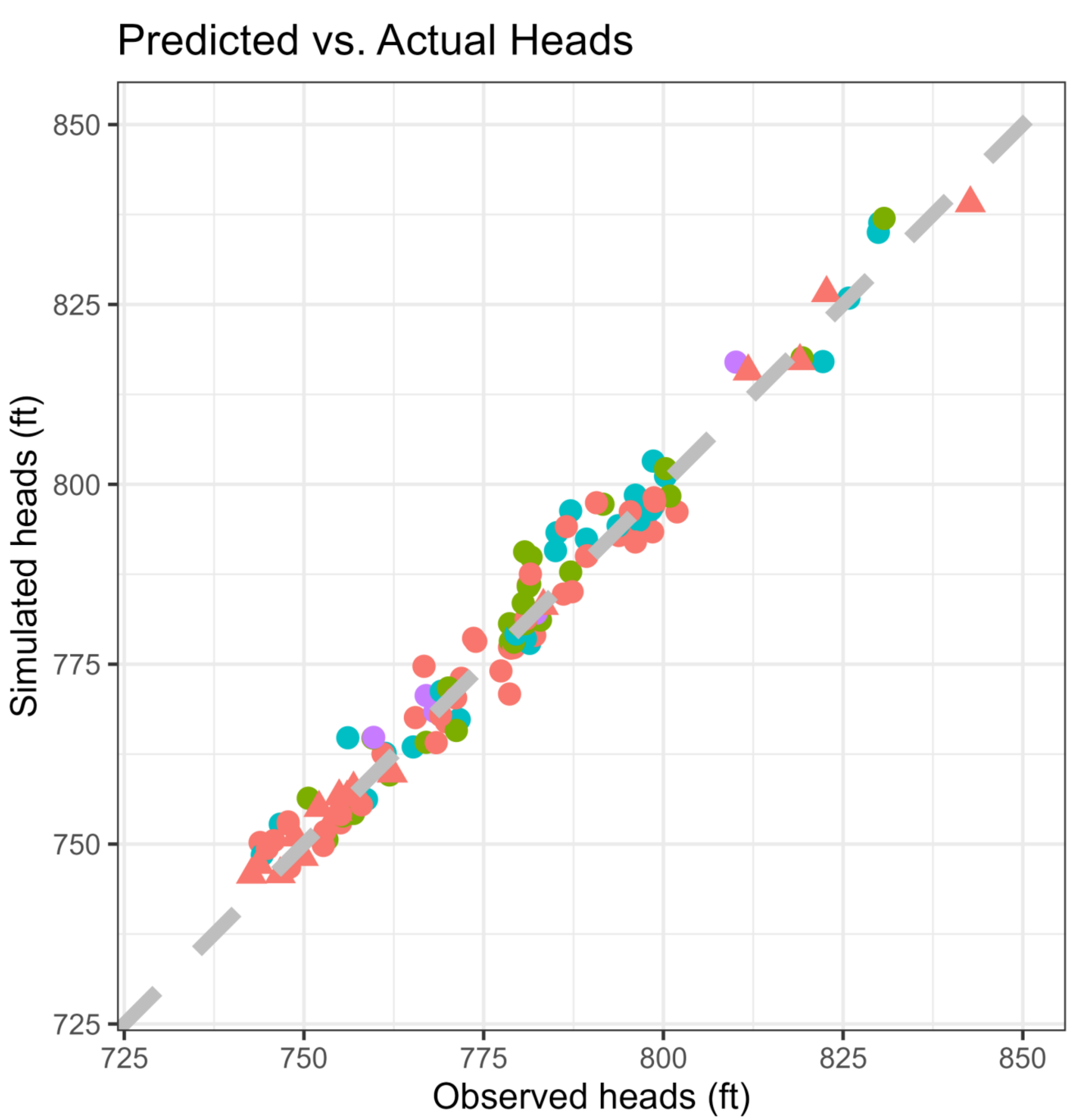
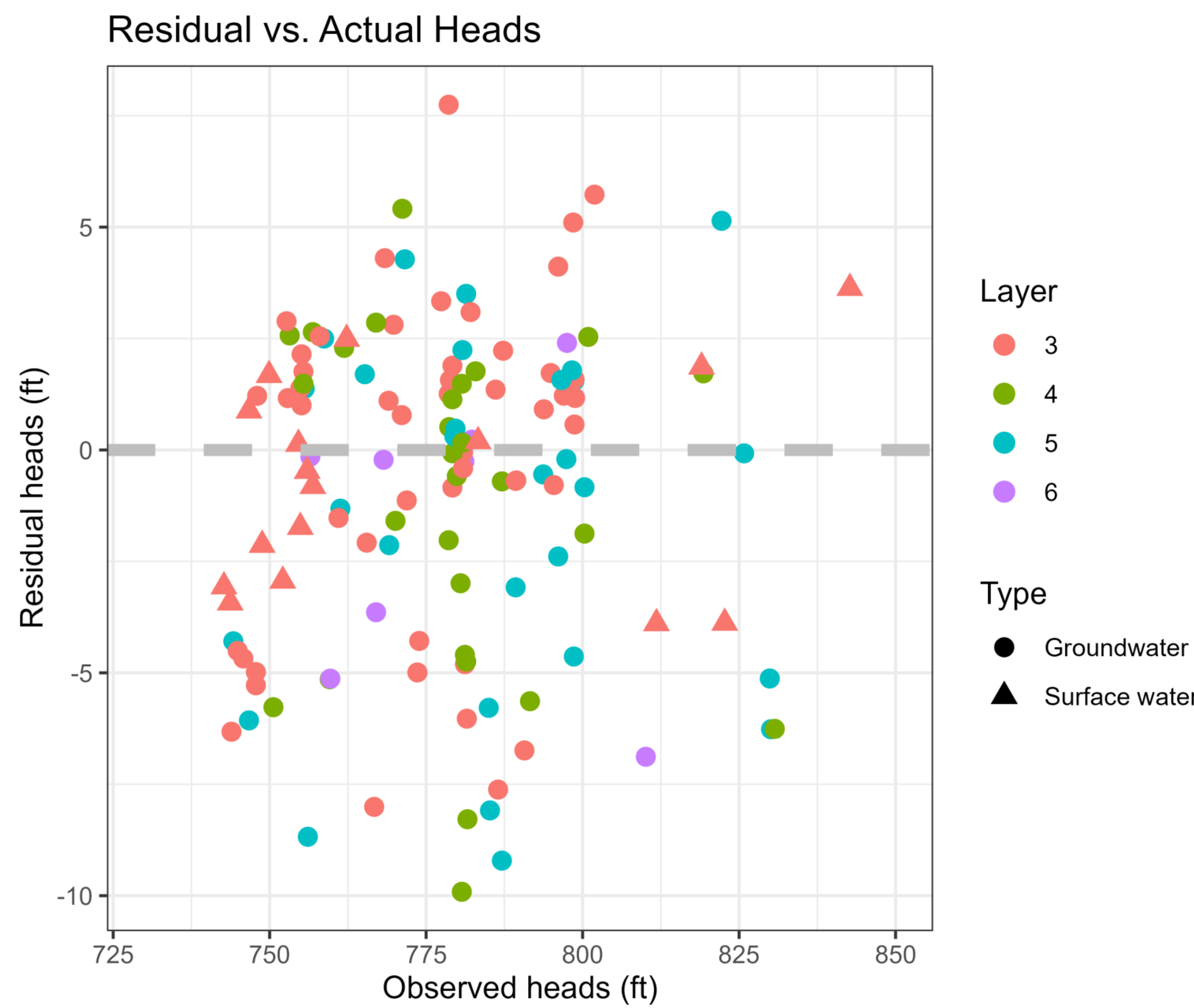
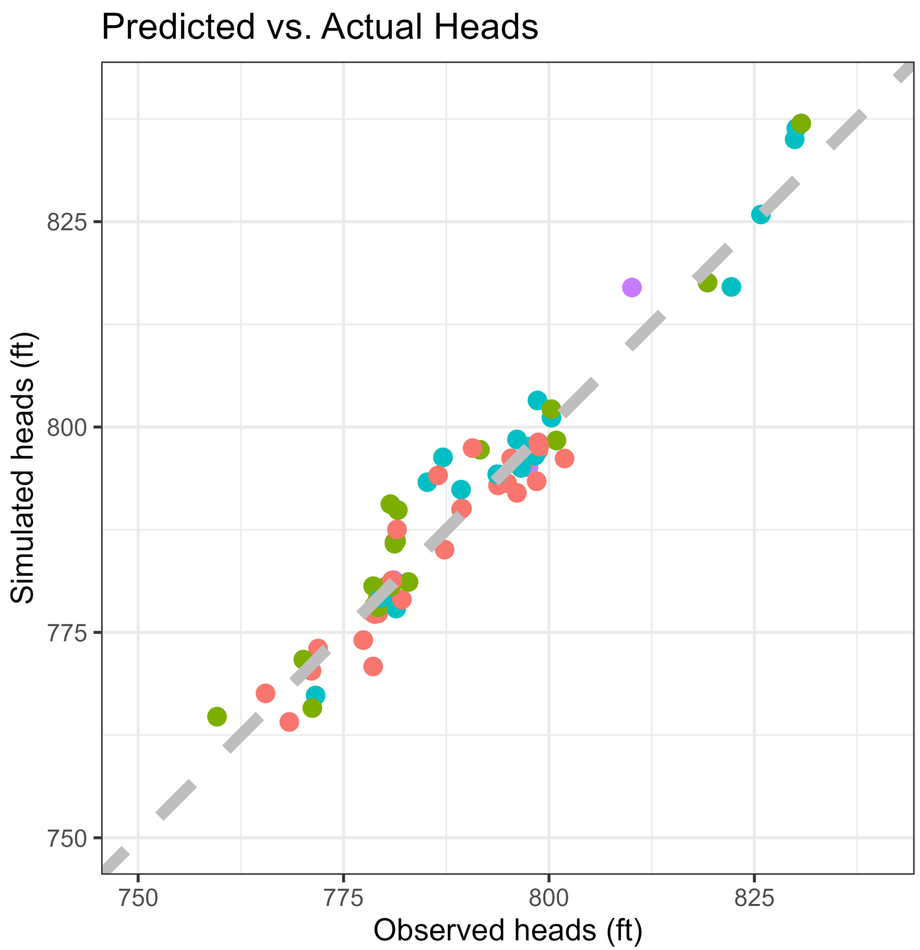
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI C

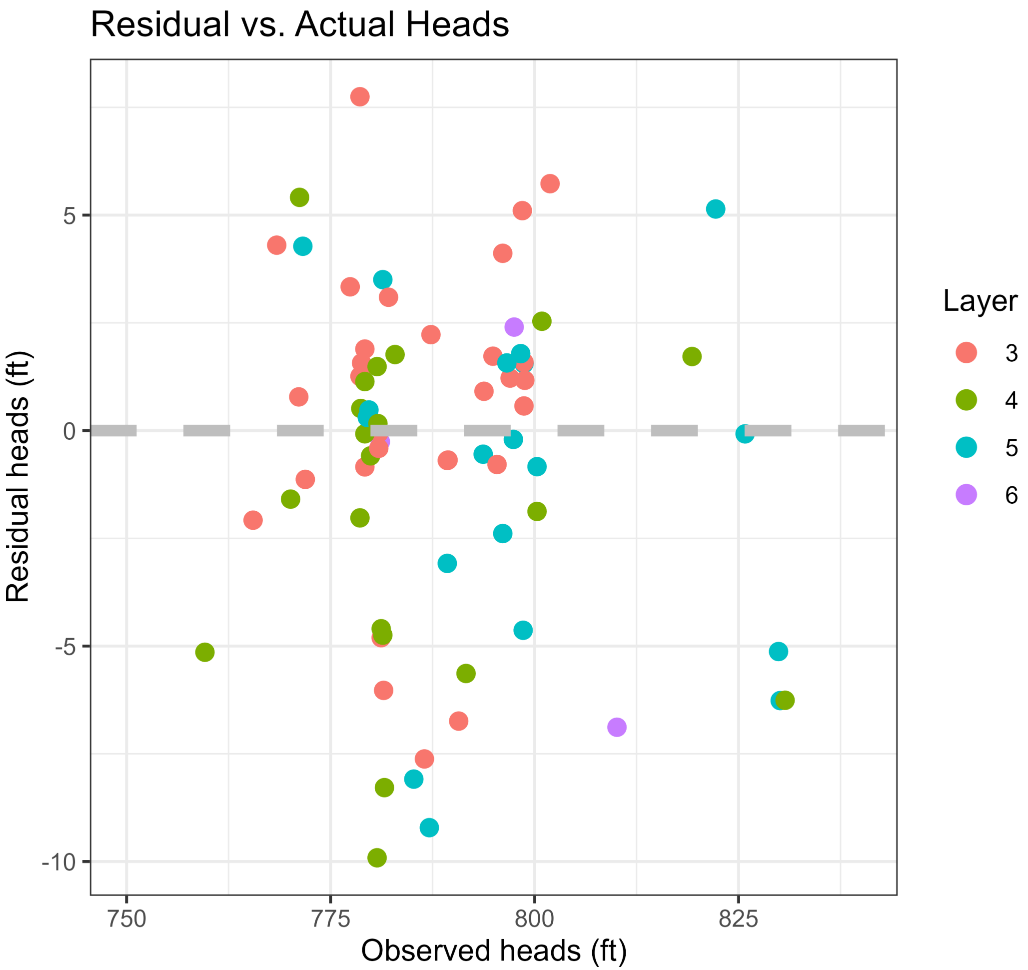
0 1 in





CLIENT GEORGIA POWER COMPANY SOUTHERN COMPANY SERVICES	PROJECT THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH
CONSULTANT WSP YYYY-MM-DD 2025-02-04 PREPARED TPK DESIGN SJS REVIEW CB APPROVED WG	TITLE **SIMULATED VS. OBSERVED HEADS – 2024 CALIBRATION MODEL** PROJECT No. US0037149.1670 SCS PROJECT ID MCD150170 REV. C FIGURE B1-4





CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

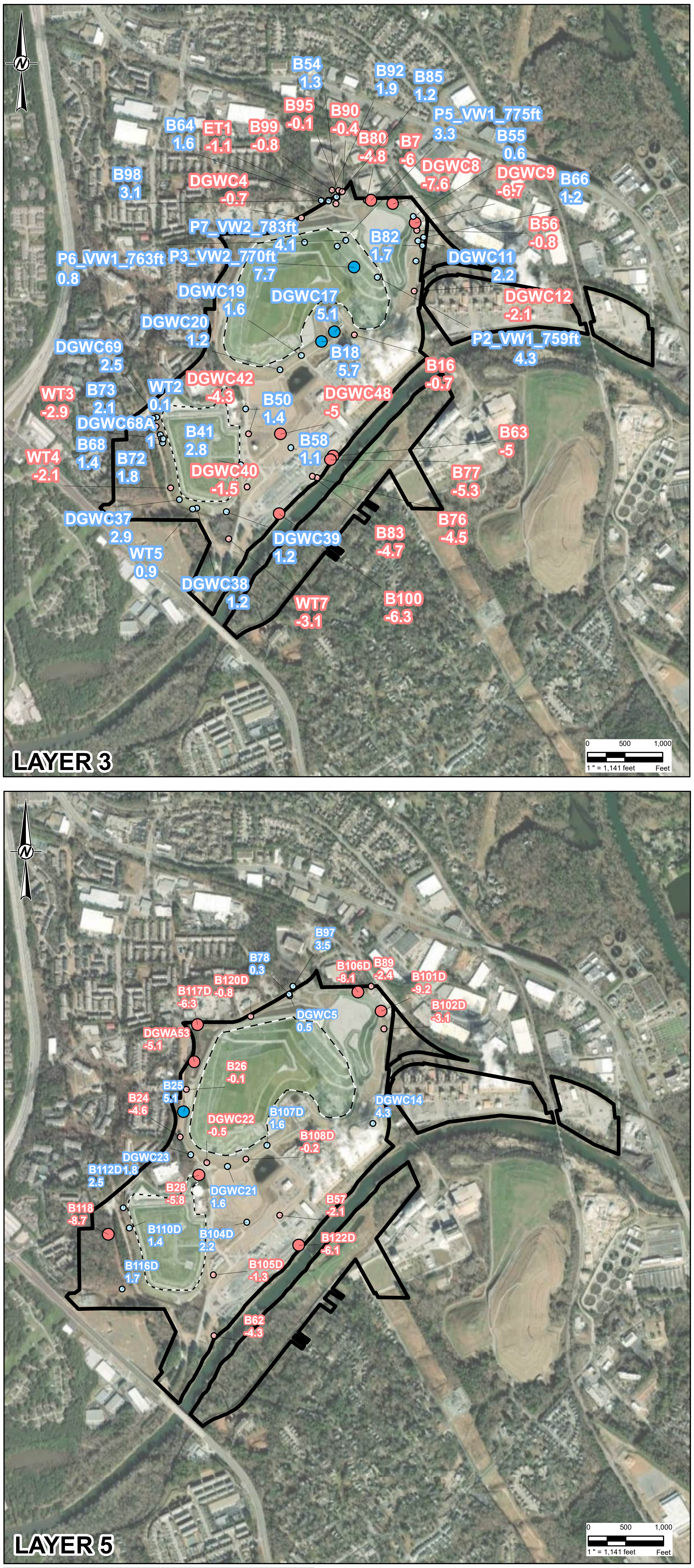
PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

CONSULTANT
wsp

YYYY-MM-DD	2025-02-04
PREPARED	TPK
DESIGN	SJS
REVIEW	CB
APPROVED	WG

TITLE
SIMULATED VS. OBSERVED HEADS – 2024 CALIBRATION MODEL, AP-3/4 AREA

PROJECT No.	SCS PROJECT ID	REV.	FIGURE
US0037149.1670	MCD150170	C	B1-5



LEGEND

AP - 1 CCR Extent

AP - 3/4 CCR Extent

Property Boundary

Positive Residuals

(ft)

0 to 5

5 to 10

Negative Residuals

(ft)

-5 to 0

-10 to -5

NOTE(S)
1. RESIDUAL DIFFERENCES ARE COMPUTED AS OBSERVED HEADS - SIMULATED HEADS.

REFERENCE(S)
1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

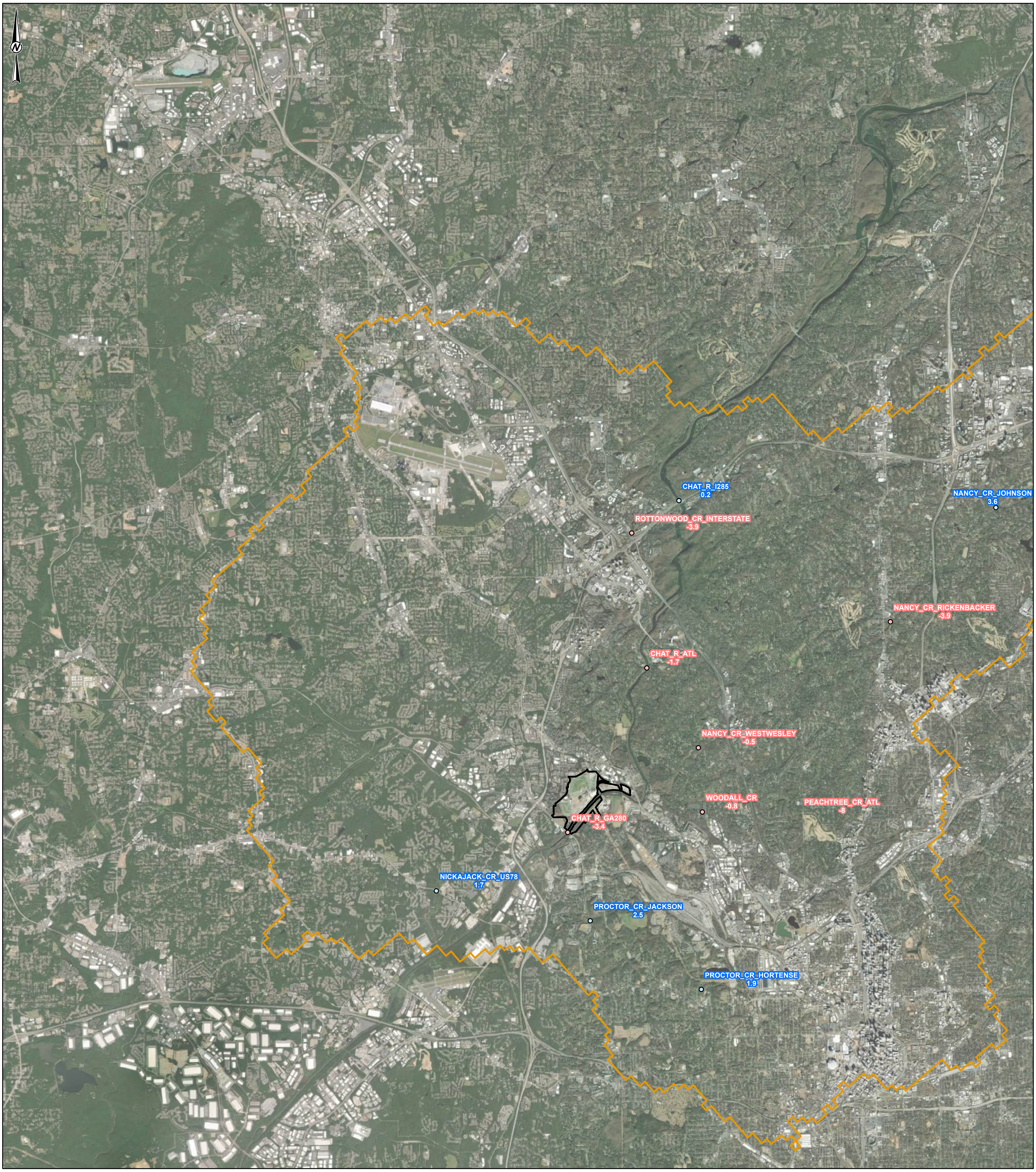
PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
RESIDUAL HEAD DIFFERENCE - LAYERS 3-6: MARCH 2024 MODEL

CONSULTANT: wsp

YYYY-MM-DD	2025-02-22
DESIGNED	AFS
PREPARED	EMR
REVIEWED	CB
APPROVED	WG

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
US0037149.1670	MCD150170	0	B1-6



0 3,000 6,000

1 " = 6,000 ft Feet

LEGEND

Residual

- 0 to 5
- 5 to 10

Residual

- -5 to 0
- -10 to -5
- Property Boundary
- Area of Used Cells

NOTE(S)

1. NHD HU = NATIONAL HYDROGRAPHY DATASET HYDROLOGIC UNIT
2. RESIDUAL DIFFERENCES ARE COMPUTED AS OBSERVED HEADS - SIMULATED HEADS.

REFERENCE(S)

1. AERIAL IMAGERY FROM NAIP DATASET, DATED 2019-09-10 THROUGH 2019-10-04.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
REGIONAL RESIDUAL HEAD DIFFERENCE, MARCH 2024

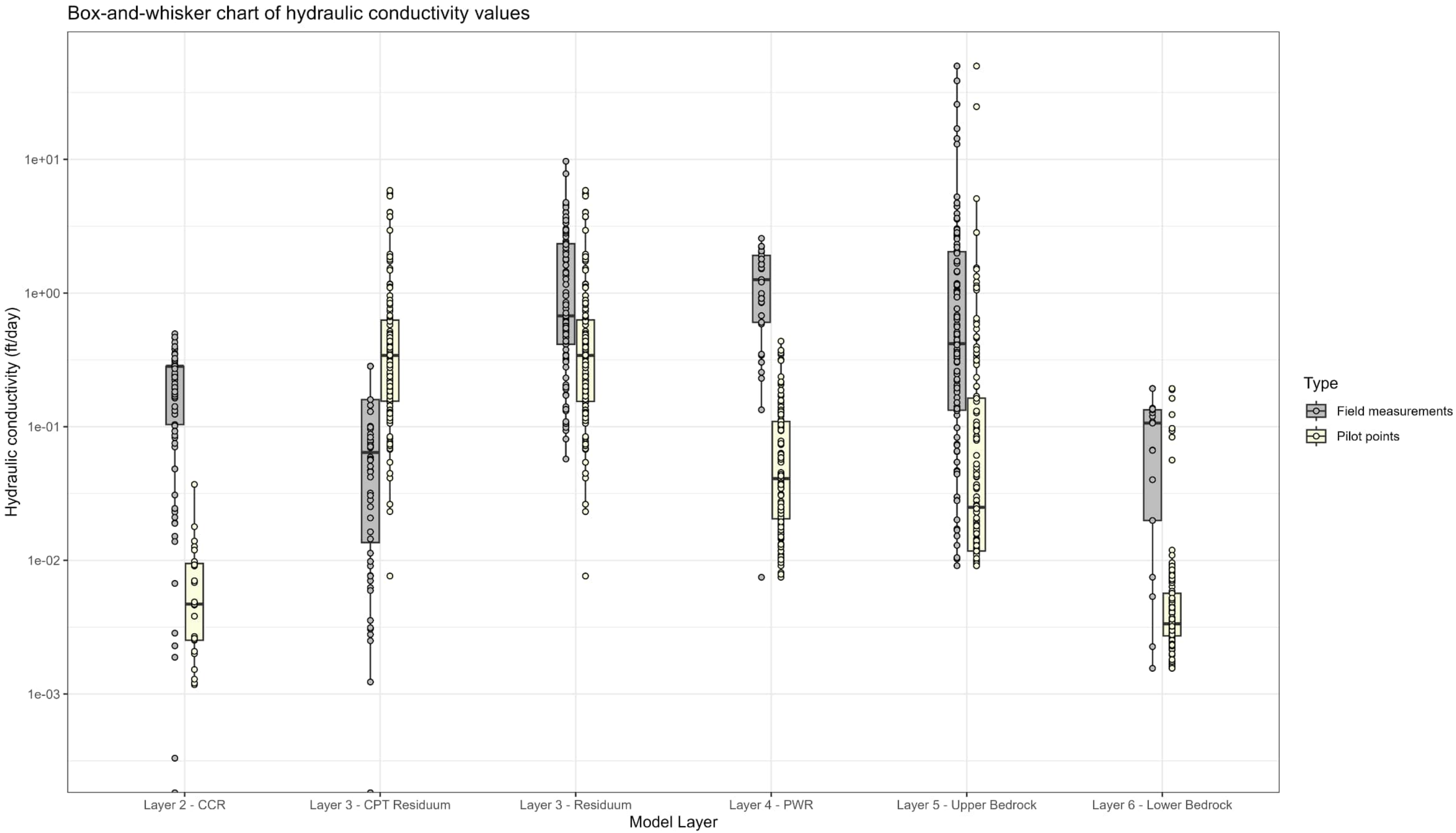
CONSULTANT

YYYY-MM-DD	2025-02-24
DESIGNED	AFS
PREPARED	EMR
REVIEWED	CB
APPROVED	WG

PROJECT NO.	SCS PROJECT ID.	REV.	FIGURE
US0037149.1670	MCD150170	0	B1-7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI C

0 1 in

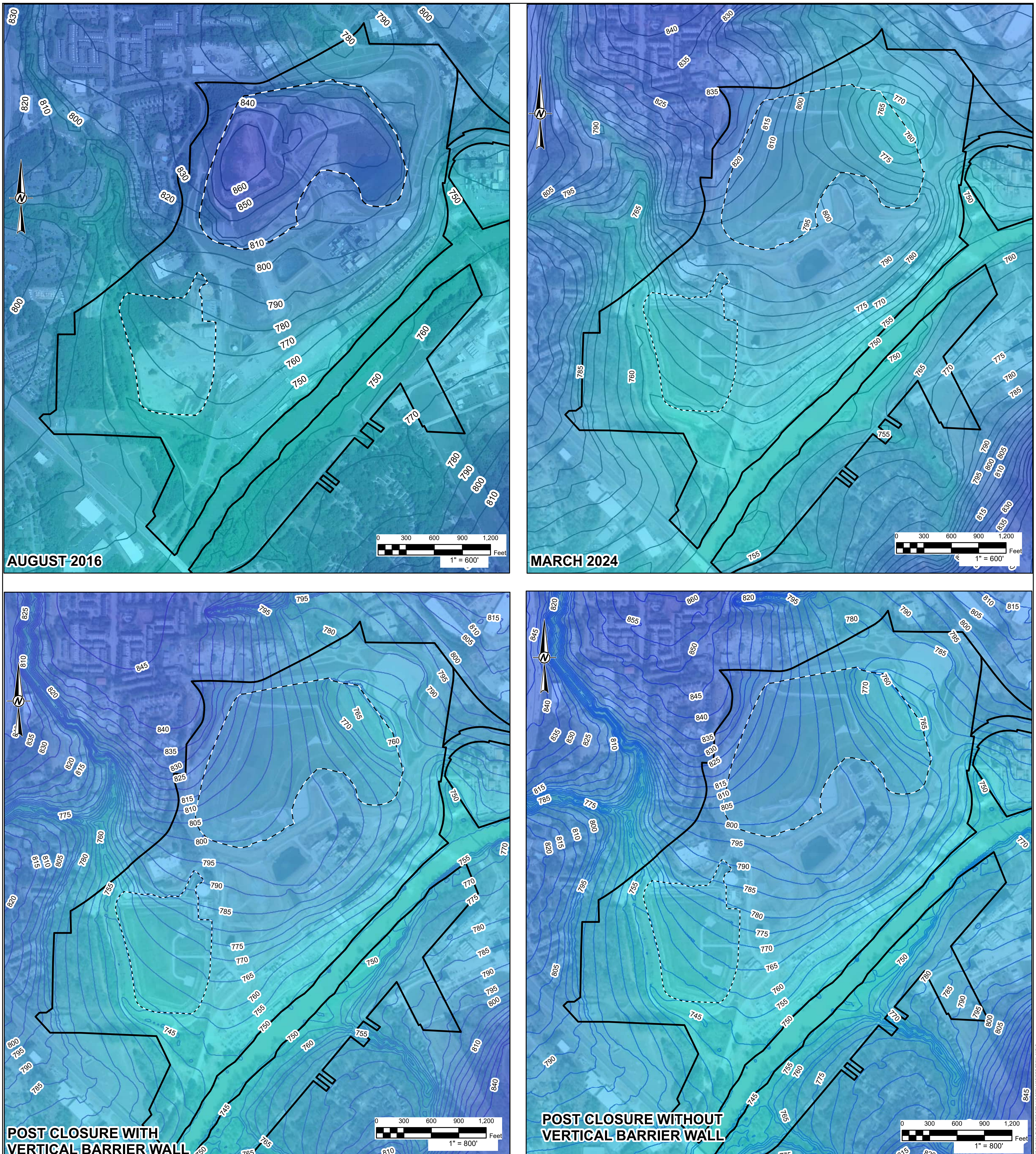


Notes:

1) PWR = Partially Weathered Rock
2) Ft = feet
3) CCR = Coal Combustion Residuals
4) CCR and CPT Residuum values derived from CPT dissipation tests. Residuum and PWR values derived from slug tests. Bedrock values derived from slug and packer tests.

CLIENT	GEORGIA POWER COMPANY SOUTHERN COMPANY SERVICES
CONSULTANT	wsp
YYYY-MM-DD	2024-12-10
PREPARED	BL
DESIGN	SJS
REVIEW	CB
APPROVED	WG
PROJECT	THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH
TITLE	**HYDRAULIC TEST RESULTS: BOX-AND-WHISKER CHARTS**

PROJECT No.	SCS PROJECT ID	Rev	FIGURE
US31406440.006	MCD150170	0	B1-8



LEGEND

Property Boundary

High : 1100

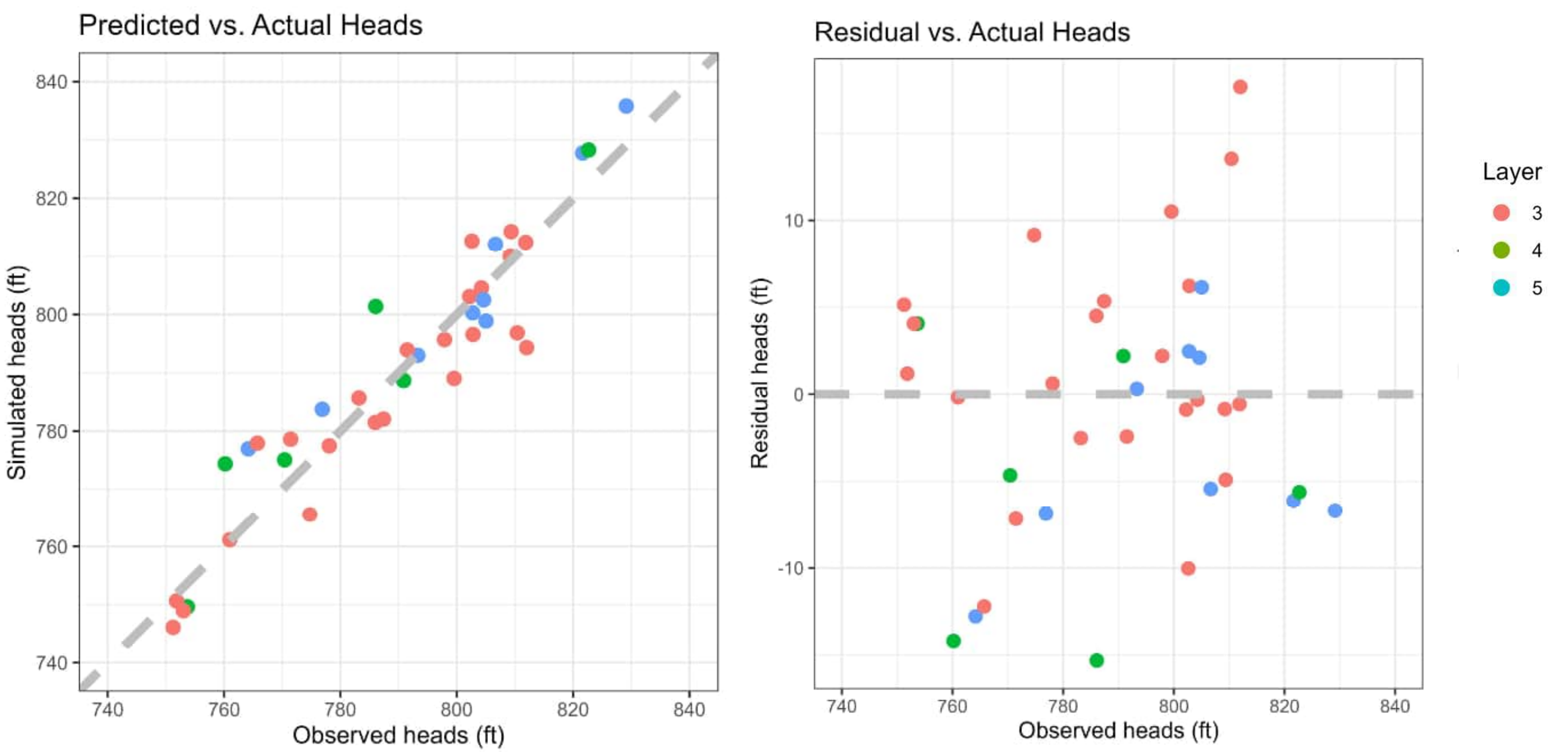
Low : 740

REFERENCE(S)

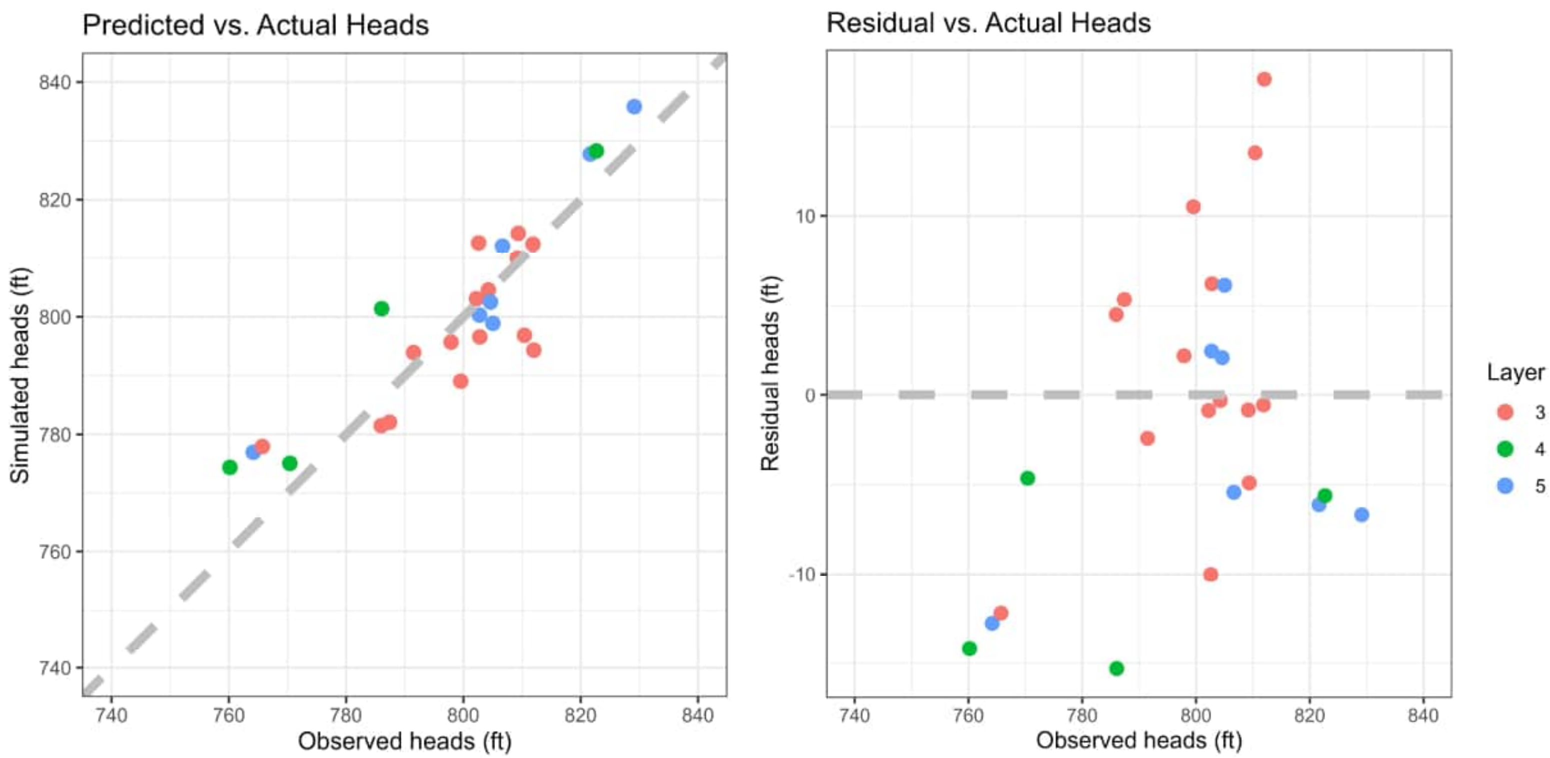
NOTE(S)
1. ALL CONTOUR INTERVALS ARE 10 FEET.
2. NAVD 88: NORTH AMERICAN VERTICAL DATUM OF 1988.
3. FT: FEET.

CLIENT	GEORGIA POWER COMPANY SOUTHERN COMPANY SERVICES
PROJECT	THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH
CONSULTANT	WSP
YYYY-MM-DD	2024-12-18
DESIGNED	AFS
PREPARED	GSD
REVIEWED	CB
APPROVED	WG
TITLE	**SIMULATED WATER TABLE - SITE VICINITY**
PROJECT NO.	US0037149.1670
SCS PROJECT ID.	MCD150170
REV.	0
FIGURE	B1-9

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI C



CLIENT GEORGIA POWER COMPANY SOUTHERN COMPANY SERVICES	PROJECT THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH
CONSULTANT wsp YYYY-MM-DD 2024-12-10 PREPARED EMR DESIGN SJS REVIEW CB APPROVED WG	TITLE **SIMULATED VS. OBSERVED HEADS – AUGUST 2016 CONDITIONS MODEL** PROJECT No. US0037149.1670 · SCS PROJECT ID MCD150170 · REV. 0 · FIGURE B1-10



CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

CONSULTANT
wsp

YYYY-MM-DD	2024-12-10
PREPARED	EMR
DESIGN	SJS
REVIEW	CB
APPROVED	WG

TITLE
SIMULATED VS. OBSERVED HEADS – AUGUST 2016 CONDITIONS MODEL, AP-3/4 AREA

PROJECT No.	SCS PROJECT ID	REV.	FIGURE
US0037149.1670	MCD150170	0	B1-11

APPENDIX C

Water Level Drawdown Analysis

APPENDIX C

Water Level Drawdown Analysis

Plant McDonough-Atkinson Ash Pond 3 and Ash Pond 4 (AP-3/4)

Submitted to:

Georgia Power Company

241 Ralph McGill Blvd., Atlanta, Georgia 30341

Submitted by:

WSP USA Inc.

5170 Peachtree Road, Building 100, Suite 300 Atlanta, Georgia 30341

February 2025

Table of Contents

Tables

Figures

1.0 INTRODUCTION

1.1 Overview

This appendix presents a summary of current groundwater elevations relative to the coal combustion residuals (CCR) in and around Ash Pond 3/4 (AP-3/4) for the Georgia Power Company (GPC) owned and operated Plant McDonough-Atkinson (Plant McDonough; Site) located in southeast Cobb County, GA (Figure C-1).

The current steady-state groundwater model (Appendix B) simulates post-closure groundwater elevations. The model includes natural hydrologic features as well as elements of the AP-1, AP-2, and AP-3/4 closure (i.e., cover and closure turf, a perimeter barrier wall installed around AP-1, closure by removal of AP-2, and an AEM [Advanced Engineering Method] Enhanced Underdrain in AP-3/4). The AEM Enhanced Underdrain receives flows from a combination of on-slope and toe drainage systems on the eastern side of AP-3/4 and from nearby Temporary AEM Dewatering Wells. The closure measures, summarized below, are predicted to lower the CCR potentiometric surface to below the base of CCR.

- **AEM Enhanced Underdrain** – Operational data from 2024 indicate nominal flows collected and removed by the AEM Enhanced Underdrain have reduced from 30 to below 25 gallons per minute (gpm) in 2024. Results from the Post-Closure Model indicate the AEM Enhanced Underdrain flows are predicted to decrease to approximately 7 gpm once long-term, steady-state conditions are reached during post closure.
- **Temporary AEM Dewatering Wells** – This system consists of the following as shown on Figure C-2
    - 4 wells in AP-3 (AE-1 to AE-4)
    - 19 wells near the AEM Enhanced Underdrain in the east of AP-4 (AE-5 to AE-7 and the MTW series), and
    - 4 wells along the perimeter of AP-4 (EW-D1 through EW-D4)
    - The AEM wells were initially installed for construction dewatering purposes and are currently being used as an AEM to accelerate lowering of the groundwater table.
    - AEM operational data for 2024 indicate an average flow rate of approximately 0 to 3.6 gpm per well.
    - The Temporary AEM wells will operate through the completion of closure and during the beginning of post-closure care, as discussed and documented in the Post-Closure Care Plan (WSP, 2024).

Seven multi-level vibrating wire piezometers (VWP), each containing 2-3 sensors at various elevations (Table C-1; Figure C-2), were installed in the buttress area on the east side of AP-3/4 to monitor water levels in the AP-3/4 buttress area. As provided under the Post-Closure Care Plan (WSP, 2024b), the site instrumentation will remain operational and be routinely inspected and maintained until groundwater elevations reach steady state during post-closure care. Details related to the VWPs are presented in the Post-Closure Care Plan, including location, final cover elevation, CCR bottom elevation, and instrument elevation for each VWP.

1.2 Water Level Drawdown Analysis Objectives

The purpose of this analysis is to assess and compare recent and forecasted VWP groundwater elevations to the predicted steady-state water table. As of the date of this report, VWPs P1, P2, P3, P5, P6, and P7 have measured water levels below the base of CCR. This comparison is intended to evaluate progress to date towards long-term steady-state conditions and to predict an estimated time for the water table to recede below the base of the CCR at VWP P4, where measured water levels in the lower sensor installed in residuum are above the base of CCR. Water levels at P3 have been below the base of CCR since March 2024.

2.0 METHODOLOGY

2.1 Data Collection

Transducers are at multiple depths for each VWP location in the AP-3/4 buttress area. Groundwater measurements from these locations are collected hourly, with a general monitoring period spanning from late 2016 to early September 2024. The recorded data were downloaded and exported for subsequent analysis, forming the basis for the trends presented within this appendix (Figures C-3 to C-9).

Hydrographs of synoptic water levels from six wells to the northwest and southwest of AP-3 were also evaluated for overall water level trends to represent conditions on the west side of AP-3/4. These manual water level measurements began in 2016, with the most recent data collection in early 2024. Time series trends for these locations are presented in Figures C-10 and C-11.

2.2 Temporal Trend Analysis

To gain a clearer understanding of the underlying patterns within the dataset, a time series decomposition analysis was performed. This technique allowed for the separation of the observed groundwater elevation time-series into three distinct components: trend, seasonality, and irregular fluctuations (hydrologic noise) (Hyndman et al., 2023). Each component provides insights into the long-term behavior of groundwater elevations at each location.

The trend component captures the long-term movement in groundwater elevations, independent of seasonal fluctuations or effects. It provides insight into the general trend of water levels over the monitoring period.

The seasonal component represents reoccurring patterns within the dataset, typically driven by regular climate variability. This provides insight into the oscillation of groundwater elevations at, around, or below the CCR and what fluctuations may continue to occur in the future.

The residual component explains irregular fluctuations that are not the result of seasonality or an overall trend in the data. This component helps identify any unexpected deviations in the data related to site-specific activities (e.g., CCR closure construction) or external environmental factors (e.g., significant precipitation events).

The hourly water level data were averaged over a monthly time period for each location’s bottom sensor to highlight seasonal oscillations. This approach allows for smoothing of short-term fluctuations while preserving key seasonal and long-term trends. These monthly averages were then used to compute the trends summarized in Table C-2. Trend analysis includes the following sequential steps:

1. Data aggregation
2. Temporal trend analysis
3. Seasonality analysis
4. Irregularity analysis
5. Related error or significance analyses
6. Forecasting

2.3 Empirical Trend Forecasting

2.3.1 ETS and ARIMA Models

Supplemental trend and forecasting analyses were used to predict future CCR dewatering times for the lowermost sensors at VWP locations P4 (P4-VW2-751 FT), where recent (February 2024) water levels were above the base of CCR.

Two common and complementary forecasting approaches based on different statistical methods were used to create a robust forecast of when the decreasing water table will be below the base of CCR at P4. The forecasting methods used include.

- Autoregressive Integrated Moving Average (ARIMA) - predicts future values by correlating with linear combinations of recent values, known as autocorrelation, and moving averages (Hyndman and Athanasopoulos, 2021). This approach leverages the dependence of subsequent values on previous values to identify temporal patterns (e.g., seasonality).

- Error, Trend, Seasonal (ETS) - is used to predict future water levels by decomposing the time-series data into components consisting of a longer-term trend, seasonal fluctuations, and residual error (i.e., irregular hydraulic fluctuations; Hyndman and Athanasopoulos, 2021). The longer-term trend (if any) and shorter-term seasonality are retained from this decomposition and used to project future values.

ARIMA and ETS trend matching for P4 focused on the first 90% of the observed monthly average water level data (through mid-2023). The most recent 10% of each data set (mid 2023 to August 2024) was then used to verify the accuracy of trend matching. After verification, the monthly datasets (Table C-2) were then projected forward in time with ARIMA and ETS using the fpp3 statistics computer package (Hyndman et al., 2023). The forecasting results for P4-Bottom are shown on Figure C-12.

3.0 RESULTS

3.1 AP-3/4 Buttress Water Levels

Hydrographs indicate that water levels at six of the seven VWP locations (P1 to P3, P5 to P7) are below the base of CCR as of September 2024, and the remaining location (P4) shows current water levels within two feet above the base of CCR. The hydrographs for each location are shown in Figures C-3 to C-9.

3.2 Time Series Trends

Temporal water level trends at P1 to P7 are used to further evaluate Post-Closure Model predictions discussed in Appendix B. The trends provide further insight into the potential timing of when steady state conditions may have occurred near the end of construction.

3.2.1 P1 Water Level Trends

Location P1 has three VWP sensors, with two sensors in the CCR and the third sensor within soils about 20 feet below the base of CCR (Figure C-3). The two CCR sensors in P1 are now inactive because water levels are below the CCR sensors. The steady-state model head in the CCR above P1 is 765.9 feet, which is 3.3 feet below the most recent measured P1 water level in residuum (769.3 ft), indicating that heads at the P1 location continue to decrease and are making progress toward reaching the model levels. Figure C-3 shows the most recently measured water level is lower than the base of CCR at P1.

3.2.2 P2 Water Level Trends

Location P2 has two VWP sensors, with one in the CCR and one in natural soil about 12 feet below the base of CCR (Figure C-4). A continuous data record is available from this location from October 2016 to July 2019 and again from October 2021 to September 2024. Data recordings from this location are unavailable between July 2019 and October 2021 due to a data overwrite error. The water table has been below the upper sensor since 2019. The September 2024 measured groundwater elevation is at 768.12 feet in P2's lower sensor, indicating that the piezometric surface is currently below the base of CCR (770.6 feet). P2 is near the AP-3/4 AEM Enhanced Underdrain, which underwent maintenance and winter weatherization upgrades towards the latter half of 2023, and shows response to its operation. Following the 2023 maintenance activities, the water table continued to decline during 2024. This September 2024 groundwater elevation is 9.1 feet higher than the model-computed steady-state head in CCR above this location (758.9 feet), indicating continuing progress toward the long-term conditions predicted by the model.

3.2.3 P3 Water Level Trends

P3 has three VWP sensors, with the upper two VWPs within the CCR and the bottom sensor installed about 6 feet below the base of CCR (Figure C-5). The water table has been below the upper two sensors in CCR for at least a year. The lowermost sensor had a September 2024 groundwater elevation of 775.2 feet that is 1.2 feet below the base of CCR (776.4 feet). It is also 9.2 feet above the model water level in CCR (765.9 feet). Water levels are continuing to decline at P3, trending towards the model values.

3.2.4 P4 Water Level Trends

Location P4 has two VWP sensors, with upper sensor in the CCR and the lower sensor about 9 feet below the base of CCR (Figure C-6). The water table has been below the upper sensor since 2022. The lower sensor's September 2024 groundwater elevation is 770.5, nominally 1.5 feet above the base of CCR (769 feet) and 8.0 feet above the model-computed steady-state water level in CCR (762.5 feet). Water levels continue to decline over time at P4, trending towards the predicted model values.

3.2.5 P5 Water Level Trends

Location P5 has three VWP sensors. The upper sensor at 815 feet is within the CCR, the second and third sensors at elevations 785 feet and 775 feet, about 0 and 10 feet, respectively, below the base of CCR (Figure C-7). The water table has been below the upper two sensors and base of CCR at least since 2022. The September 2024 groundwater level (776.82 feet) is 8.4 feet below the base of CCR (near the lowermost sensor elevation) and trending toward the model water level of 768.9 ft.

3.2.6 P6 Water Level Trends

Location P6 has two VWP sensors. The upper sensor is within the CCR and the lower sensor about 12 feet below the base of CCR (Figure C-8). The water table has been below the upper sensor since 2018. The lower sensor's September 2024 groundwater elevation, 770.9 feet, is below the base of CCR and has been since 2022. The September 2024 measured groundwater elevation is also about 6.2 foot above the modelled steady-state water level (764.7 feet). Water levels continue to decline over time at P6, trending towards the model value.

3.2.7 P7 Water Level Trends

Location P7 has two VWP sensors. The upper sensor is at elevation 803 feet within the CCR, and the lower sensor is at elevation 783 feet, about 13 feet below the base of CCR (Figure C-9). The September groundwater elevation (794.5 feet) at this location is below the upper sensor and the base of CCR (796.5 feet) and is 1.0 feet above the model-computed steady-state water level (793.5 feet). Water levels continue to decline over time at P7, trending towards the model value.

3.3 Western AP-3/4 Water Level Trends

Water levels at DGWC-21, DGWC-22, DGWC-23 to the southwest of AP-3/4 have decreased approximately 6 feet (DGWC-21) to over 11 feet (DGWC-22) since 2016 (Figure C-10; Table C-3). Water levels to the northwest of AP-3/4 at DGWC-2, DGWC-53, and DGWC-71 (Figure C-11; Table C-3) are proximal to unlined stormwater Detention Pond 1 and exhibited higher levels while the stormwater pond held non-CCR contact construction support water. Since the pond is no longer artificially full, elevations in this area are decreasing and are expected to continue to decrease. This is also consistent with reduced flow to the Temporary AEM Dewatering Wells located in AP-3 (AE-1 to AE-4), which currently pump at a combined rate of approximately 1.0 gpm or less.

Based on the evaluation of these locations and their proximity to the AP-3/4 area, groundwater elevations are consistently decreasing over the monitoring period. When compared to the VWPs in the AP-3/4 area, water level trends across all locations indicate continued and consistent declines toward stable conditions.

3.4 P4 Forecasts

According to the forecasts, P4 exhibits a dewatering trend of ~ 3.4 ft/year. Considering seasonal fluctuations and noise, the piezometric levels at P4 are estimated to be below the CCR by mid to late 2025 based on predicted dewatering trends (Figure C-12). The predicted dewatering trends were confirmed to be credible by comparing the forecast results with the most recent 10% of the dataset. The prediction verification analysis indicates that the ARIMA and ETS statistical forecasting provides reasonable, short-term dewatering forecasts. Uncertainty of the dewatering prediction was evaluated using an 80% and 95% confidence band. Predictions from piezometric levels at P4 are consistent with previously provided estimates indicating that the potentiometric surface will be below the base of CCR by mid to late 2025 based on the predicted dewatering trends.

4.0 CONCLUSIONS

The comprehensive trend and time series forecasting analyses conducted for the seven VWP locations within the AP-3/4 buttress area demonstrate continued progress towards achieving long term steady-state conditions with the potentiometric surface below the base of CCR.

A review of the hydrographs from the VWP sensor data at CCR unit AP-3/4 indicates that the water level as of early September 2024 is consistently below the base of the CCR at six of seven VWP locations (P1, P2, P3, P5, P6 and P7) and is near the base of the CCR at the remaining VWP location (P4). Water levels at P3 have recently dropped below the base of the CCR; while water levels at P4 are within 2 feet of the base of the CCR as of September 2024. The declining water levels and reduced seasonal and residual fluctuation observed at all the VWP locations indicate conditions are trending towards the modeled heads and predicted long-term water table below the base of the CCR, independent of external factors.

Forecasting model results are consistent with previously provided estimates indicating that piezometric levels at P4 will be below the base of the CCR by mid to late 2025, with a well-defined downward trend. Considering this forecast and groundwater elevations observed at other VWP locations where elevations are below the base of CCR, the water table is expected to be below the base of the CCR in the entirety of the AP-3/4 footprint by mid-late 2025. The Post-Closure Model (Appendix B) predicts that the declining water levels will result in reduced flows to the AEM Enhanced Underdrain over time, with a long-term, steady-state flow rate of approximately 7 gpm (without any additional pumping from the Temporary AEM Dewatering Wells).

The flows collected and pumped from the AEM Enhanced Underdrain have steadily decreased since the start of operations, with flows under 25 gpm on average as of September 2024. These flows are well within the capacity of the Enhanced Underdrain System as outlined in Appendix F of the Engineer Report (Permit Part B). The Temporary AEM Wells within the vicinity of the Enhanced Underdrain are currently collecting and pumping on the order of 5 gpm, a significant decrease from the more than 40 gpm collected from this system during the early stages of construction dewatering. The total flows observed within the vicinity of the Enhanced Underdrain support the capacity of the Enhanced Underdrain to adequately handle the long-term dewatering of AP-4 once the Temporary AEM wells are decommissioned.

5.0 REFERENCES

Hyndman, RJ and Athanasopoulos, G, 2021, Forecasting: principles and practice, 3rd edition, OTexts: Melbourne, Australia. Otexts.com/fpp3.

Hyndman, RJ, Athanasopoulos, G, and O'Hara-Wild, M, 2023, Package 'fpp3': Data for "Forecasting: Principles and Practice" (3rd Edition).

WSP USA Inc., 2024a, Plant McDonough- Atkinson CCR Surface Impoundment (CCR Unit AP-2 and 3/4), Cobb County, Georgia, Part A Section 7, Closure Plan, December 2024

WSP USA, Inc., 2024b, Plant McDonough-Atkinson CCR Impoundments (CCR Unit AP-2 and 3/4), Cobb County, Georgia, Part A Section 8, Post-Closure Care Plan, December 2024.

APPENDIX C – WATER LEVEL DRAWDOWN ANALYSIS

Tables

Table C-1
Vibrating Wire Piezometer Summary Table

Location	Easting (ft)[2]	Northing (ft)	Sensor[5]	Position	Monitoring Interval	Sensor Elevation (ft)	Base Of CCR[1] Elevation (ft)	Sensor vertical distance below Base of CCR (ft)	Most Recent Groundwater Elevation(ft)	Most Recent Groundwater Elevation Compared to CCR
P1	2203551.4	1393246.2	P1-VW1-759ft	Bottom	Below CCR	759.0	778.6	19.6	769.27	Water Level Below CCR
			P1-VW3-779ft	Middle	Lower CCR	779.0		-	Dry	
			P1-VW2-794ft	Top	Middle CCR	794.0		-	Dry	
P2	2203644.9	1393352.6	P2-VW1-759ft	Bottom	Below CCR	759.1	770.6	11.5	768.12	Water Level Below CCR
			P2-VW2-782ft	Top	Middle CCR	782.0		-	Dry	
P3	2203339.9	1393495.3	P3-VW2-770ft*	Bottom	Below CCR	769.6	776.4	6.8	775.15	Water Level Below CCR
			P3-VW3-781ft	Middle	Lower CCR	780.6		-	Dry	
			P3-VW1-803ft	Top	Middle CCR	803.0		-	Dry	
P4	2203447.6	1393586.5	P4-VW2-751ft*	Bottom	Below CCR	751.0	769	18.0	770.75	Water Level < 2 ft Above CCR
			P4-VW1-774ft	Top	Middle CCR	774.0		-	Dry	
P5	2203125.7	1393778.8	P5-VW1-775ft	Bottom	Below CCR	775.4	785.2	9.8	776.82	Water Level Below CCR
			P5-VW2-785ft	Middle	Lower CCR	785.4		-	Dry	
			P5-VW3-815ft	Top	Middle CCR	815.4		-	Dry	
P6	2203245.0	1393855.9	P6-VW1-763ft	Bottom	Below CCR	763.0	775.1	12.1	770.3	Water Level Below CCR
			P6-VW2-781ft	Top	Middle CCR	781.0		-	Dry	
P7	2202695.0	1393847.3	P7-VW2-783ft	Bottom	Below CCR	783.0	796.5	13.5	794.52	Water Level Below CCR
			P7-VW1-803ft	Top	Middle CCR	803.5		-	Dry	

1. CCR = Coal Combustion Residuals
2. ft = feet
3. * = indicates sensor used for time-series forecasting
4. Most recent transducer download represents a data date of September 9, 2024
5. VWP = Vibrating Wire Piezometer
6. Base of CCR elevation calculated from AP-2,3/4 permit document, Sheet 4: Estimated Bottom of CCR Plan.

Monthly Average Groundwater Elevations for Vibrating Wire Piezometer Sensors P1 to P7

Month-Year	P-1 Bottom	P-2 Bottom	P-3 Bottom	P-4 Bottom	P-5 Bottom	P-6 Bottom	P-7 Bottom
October-16	NA	797.10	NA	804.15	NA	803.67	NA
November-16	NA	796.23	NA	802.51	NA	801.55	NA
December-16	NA	797.44	NA	803.09	NA	801.90	826.01
January-17	NA	800.04	NA	806.41	NA	802.74	825.79
February-17	NA	800.33	NA	804.34	NA	801.75	825.82
March-17	NA	798.41	NA	801.20	NA	797.16	821.61
April-17	NA	797.55	NA	802.23	NA	798.23	819.91
May-17	NA	797.93	NA	801.60	NA	798.18	819.18
June-17	NA	800.16	NA	802.70	NA	798.74	817.71
July-17	NA	799.97	NA	803.50	NA	798.79	816.73
August-17	NA	796.18	NA	801.80	NA	797.73	816.69
September-17	NA	794.67	NA	799.35	NA	796.88	818.19
October-17	NA	791.75	NA	795.58	NA	795.26	816.94
November-17	NA	791.45	NA	792.73	NA	792.12	815.36
December-17	NA	790.45	NA	790.19	NA	788.03	814.06
January-18	NA	790.01	NA	790.07	NA	788.44	811.81
February-18	NA	789.36	NA	788.87	NA	786.79	810.57
March-18	NA	785.87	NA	786.68	NA	785.95	810.22
April-18	NA	787.83	NA	786.71	NA	785.87	811.28
May-18	NA	786.02	NA	786.43	NA	785.24	811.13
June-18	NA	784.89	NA	785.36	NA	785.83	810.91
July-18	NA	785.10	NA	784.13	NA	785.27	810.76
August-18	NA	785.65	NA	785.46	NA	786.03	810.28
September-18	NA	782.18	NA	783.08	NA	784.15	809.95
October-18	NA	781.73	NA	782.46	NA	783.50	809.40
November-18	NA	782.95	NA	783.44	NA	784.23	809.41
December-18	NA	784.26	NA	785.45	NA	785.59	808.71
January-19	789.29	789.53	795.82	792.77	794.46	788.59	808.50
February-19	788.79	788.57	794.57	790.16	794.24	787.31	808.78
March-19	787.38	786.74	792.56	786.53	793.61	786.04	808.36
April-19	785.13	783.97	790.46	783.91	792.22	783.44	807.15
May-19	783.35	781.50	788.11	780.72	790.26	779.55	805.97
June-19	782.70	780.85	787.65	780.17	790.03	779.95	806.03
July-19	781.66	779.36	787.72	782.17	789.78	779.93	806.24
August-19	781.55	NA	788.33	782.88	789.53	779.52	805.82
September-19	780.86	NA	787.72	782.09	789.41	779.21	805.78
October-19	781.59	NA	787.77	782.40	789.18	779.54	805.48
November-19	781.27	NA	788.04	782.71	789.42	780.22	805.55
December-19	781.43	NA	788.14	783.24	788.86	780.00	805.04
January-20	782.76	NA	789.12	784.89	789.02	780.43	804.08
February-20	783.86	NA	790.14	786.70	789.08	781.56	803.83
March-20	784.87	NA	791.00	787.99	789.60	782.53	803.85
April-20	783.60	NA	789.76	786.15	788.78	781.72	803.43
May-20	782.34	NA	788.75	784.85	788.62	781.26	803.45
June-20	780.73	NA	787.41	782.78	788.33	780.31	803.93
July-20	779.68	NA	786.77	782.14	787.87	779.69	803.32
August-20	779.51	NA	785.81	781.00	786.91	777.48	803.14
September-20	779.62	NA	784.59	778.28	786.54	775.58	803.05
October-20	779.74	NA	784.60	778.62	786.44	776.98	802.76
November-20	777.79	NA	782.98	775.76	786.13	NA	802.41
December-20	778.98	NA	784.47	779.49	786.62	NA	802.17
January-21	779.64	NA	785.33	780.94	787.29	778.45	802.96
February-21	781.02	NA	786.91	783.91	787.97	780.74	802.96
March-21	780.78	NA	786.85	783.80	788.00	780.37	802.82
April-21	779.60	NA	785.69	781.98	787.35	779.00	802.74
May-21	779.30	NA	785.29	781.58	787.19	779.46	802.84
June-21	779.13	NA	785.31	781.87	787.23	NA	802.72
July-21	780.02	NA	786.30	783.73	787.66	NA	803.02
August-21	780.03	NA	786.30	783.59	787.57	NA	803.14
September-21	779.59	NA	785.87	782.92	787.46	NA	803.51
October-21	778.91	770.72	785.21	782.06	787.29	NA	803.60
November-21	778.71	768.96	785.12	782.05	787.27	NA	803.75
December-21	778.99	769.53	785.40	782.80	786.84	NA	803.13
January-22	776.88	769.93	783.16	778.28	785.74	NA	802.60
February-22	778.10	NA	784.19	781.15	785.91	NA	802.36
March-22	777.41	NA	783.52	779.55	785.16	NA	801.59

Table C-2
Monthly Average Groundwater Elevations for Vibrating Wire Piezometer Sensors P1 to P7

Month-Year	P-1 Bottom	P-2 Bottom	P-3 Bottom	P-4 Bottom	P-5 Bottom	P-6 Bottom	P-7 Bottom
April-22	775.04	NA	780.96	775.38	784.19	NA	801.14
May-22	774.34	NA	780.27	774.74	783.64	774.55	800.36
June-22	775.42	NA	781.33	777.23	784.22	775.70	801.65
July-22	773.98	NA	780.03	774.80	783.70	774.49	801.82
August-22	773.92	NA	779.93	775.01	782.11	774.29	800.28
September-22	773.82	769.89	779.89	775.21	782.65	774.19	799.18
October-22	773.46	769.42	779.57	774.72	782.68	773.94	799.29
November-22	773.33	769.42	779.51	774.67	782.73	774.14	800.54
December-22	774.10	770.44	780.16	776.25	781.32	774.06	799.63
January-23	774.29	770.27	780.64	776.12	780.09	773.47	798.27
February-23	773.34	769.92	779.38	774.61	780.16	773.30	797.76
March-23	773.05	769.90	779.18	774.45	780.23	772.95	797.18
April-23	772.87	769.38	779.02	774.32	780.28	772.54	796.76
May-23	772.59	769.42	778.77	773.94	779.52	772.25	796.18
June-23	772.01	768.71	778.23	773.28	779.20	771.98	796.20
July-23	772.46	770.37	778.68	774.37	779.18	772.19	795.43
August-23	772.36	770.15	778.61	774.29	779.00	772.21	795.28
September-23	771.79	768.99	777.97	773.14	778.44	771.68	795.05
October-23	771.16	769.79	778.00	773.07	778.39	772.03	794.93
November-23	770.87	768.80	777.72	772.47	778.20	771.61	795.44
December-23	770.98	769.72	777.76	772.93	777.98	771.70	795.88
January-24	771.02	769.81	777.86	773.11	777.81	771.89	795.95
May-24	769.74	768.55	775.80	771.08	777.10	770.87	795.27
June-24	769.56	768.21	775.57	770.87	776.96	NA	795.29
July-24	769.42	768.10	775.34	770.61	776.87	770.30	795.26
August-24	769.43	768.38	775.28	770.81	776.86	770.30	795.07

1.) ft-NAVD88 = Feet North American Vertical Datum 1988
2.) NA = Not Applicable

Table C-3
Manual Water Levels for Monitoring Wells

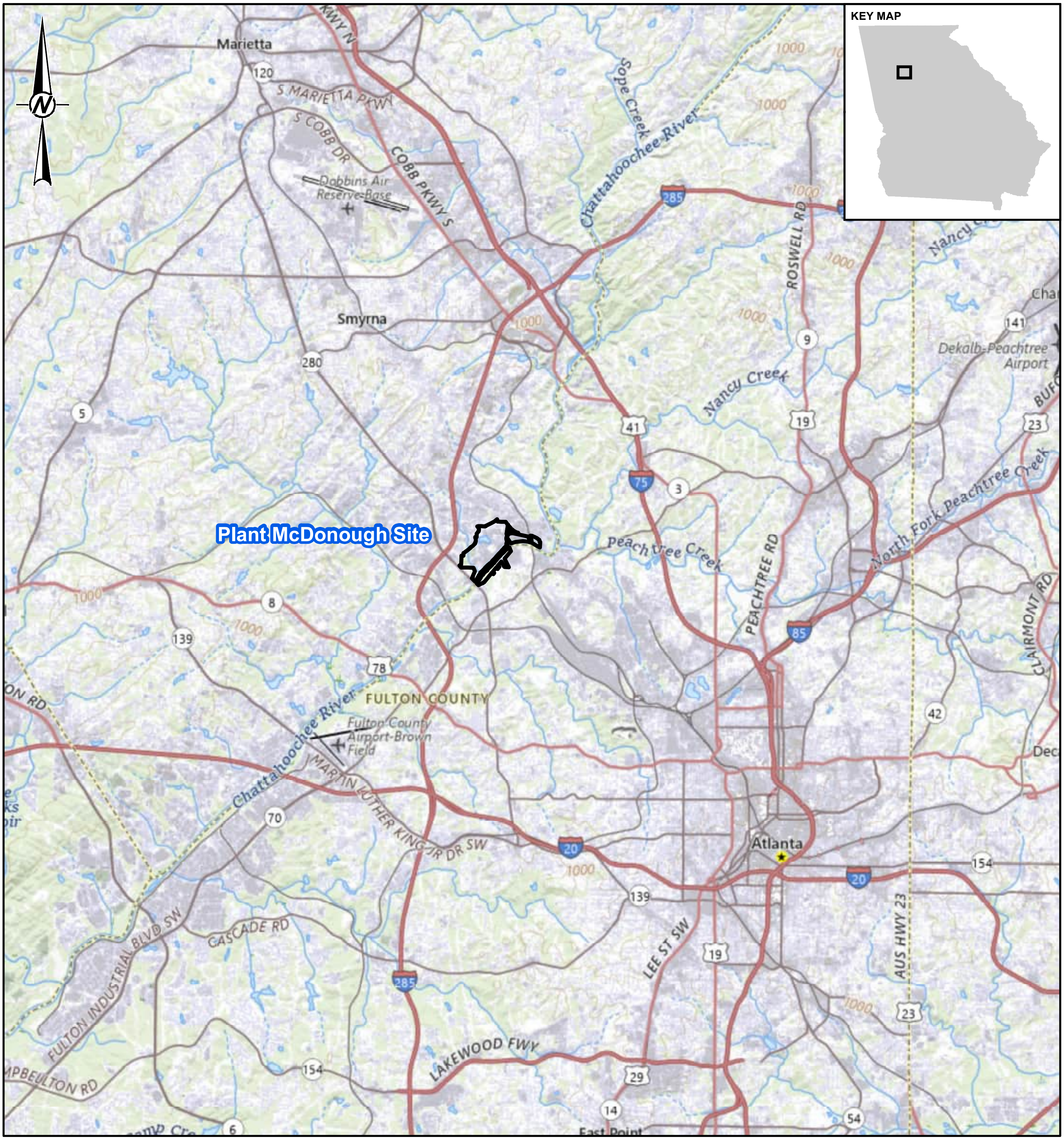
Measurement Date	DGWA-53 (FT NAVD88)	DGWA-71 (FT NAVD88)	DGWC-2 (FT NAVD88)	DGWC-21 (FT NAVD88)	DGWC-22 (FT NAVD88)	DGWC-23 (FT NAVD88)
2016-08-29	-	-	822.66	802.74	805.02	804.61
2016-12-05	840.16	-	821.27	801.41	803.20	804.84
2017-03-27	841.21	834.80	820.00	800.77	802.84	804.88
2017-07-10	844.59	835.84	822.53	800.50	801.71	803.89
2017-10-23	840.73	835.32	821.22	799.79	799.88	802.66
2018-02-26	842.64	835.56	820.39	799.85	800.84	804.02
2018-07-09	842.00	835.70	820.73	799.03	799.69	801.83
2018-11-05	828.02	834.78	819.05	798.47	798.25	800.61
2019-03-11	831.04	837.74	822.11	799.09	800.74	803.75
2019-08-26	834.88	835.40	820.06	798.22	797.05	798.64
2019-10-14	835.51	834.53	819.89	796.96	796.36	797.77
2019-12-20	830.10	-	820.13	797.08	796.97	799.76
2020-01-13	830.74	835.49	-	-	-	802.29
2020-01-14	-	-	819.84	797.51	798.09	-
2020-08-10	829.41	-	820.86	796.96	796.03	797.89
2020-08-11	-	835.74	-	-	-	-
2020-09-21	830.68	835.26	820.53	798.78	796.29	798.92
2020-11-03	830.87	835.91	820.83	800.10	797.34	799.67
2021-02-25	830.64	836.52	820.80	800.73	797.81	800.82
2021-09-07	830.73	836.31	821.57	800.93	796.46	798.00
2021-10-27	829.75	835.19	820.66	799.93	795.57	795.74
2022-01-18	833.41	835.49	821.71	799.38	795.80	799.31
2022-09-06	830.21	834.48	820.72	797.85	794.02	795.43
2022-11-28	831.62	833.64	820.63	796.80	793.06	795.33
2023-01-30	833.17	-	821.79	797.98	795.31	800.18
2023-01-31	-	834.26	-	-	-	-
2023-09-05	831.05	832.52	821.65	797.24	794.04	796.20
2023-11-06	826.82	831.83	819.60	796.74	793.10	794.75
2024-01-29	829.91	830.73	819.29	796.57	793.65	798.28

1. FT = Feet
2. Water levels reported in the North American Vertical Datum of 1988 (NAVD88).
3. - indicates no water level collected

Created by: OAZ 2024-12-03
Checked by: SJS 2024-12-03

APPENDIX C – WATER LEVEL DRAWDOWN ANALYSIS

Figures



LEGEND

Property Boundary

0 3 6

1 " = 3 mi MILES

REFERENCE(S)

1. BASEMAP FROM USGS THE NATIONAL MAP: NATIONAL BOUNDARIES DATASET, 3DEP ELEVATION PROGRAM, GEOGRAPHIC NAMES INFORMATION SYSTEM, NATIONAL HYDROGRAPHY DATASET, NATIONAL LAND COVER DATABASE, NATIONAL STRUCTURES DATASET, AND NATIONAL TRANSPORTATION DATASET; USGS GLOBAL ECOSYSTEMS; U.S. CENSUS BUREAU TIGER/LINE DATA; USFS ROAD DATA; NATURAL EARTH DATA; U.S. DEPARTMENT OF STATE HUMANITARIAN INFORMATION UNIT; AND NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION, U.S. COASTAL RELIEF MODEL. DATA REFRESHED AUGUST, 2021.

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
LOCATION MAP

CONSULTANT

YYYY-MM-DD	2024-12-14
DESIGNED	SJS
PREPARED	AFS
CHECKED	SJS
REVIEWED / APPROVED	WG

PROJECT NO.	SCS PROJECT ID	REV.	FIGURE
US0037149.1670	MCD150170	0	C-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

LEGEND

- Temporary Pumping Location
- VWP Location
- AEM Enhanced Underdrain
- PROPERTY BOUNDARY
- AP-2 & 3/4 PERMIT BOUNDARY

NOTES

1. VWP = VIBRATING WIRE PIEZOMETER

REFERENCE

1. AERIAL IMAGE FOR AP-1, AP-2, AND AP-3/4 DATED JANUARY 2024 PROVIDED BY GPC; AND SURROUNDING AREAS DATED JANUARY 2023 PROVIDED BY GPC.

2. COORDINATE SYSTEM: NAD 1983 STATE PLANE GEORGIA WEST (U.S. FEET).

3. PIEZOMETER LOCATIONS AND ELEVATIONS SURVEYED BY METRO ENGINEERING AND SURVEYING COMPANY IN AUGUST 2020 WITH ADDITIONAL SURVEY PROVIDED IN JANUARY 2021, MAY 2021, AND MAY 2023.

0 250 500

1 IN= 250 FT

CLIENT
GEORGIA POWER COMPANY
PLANT MCDONOUGH-ATKINSON

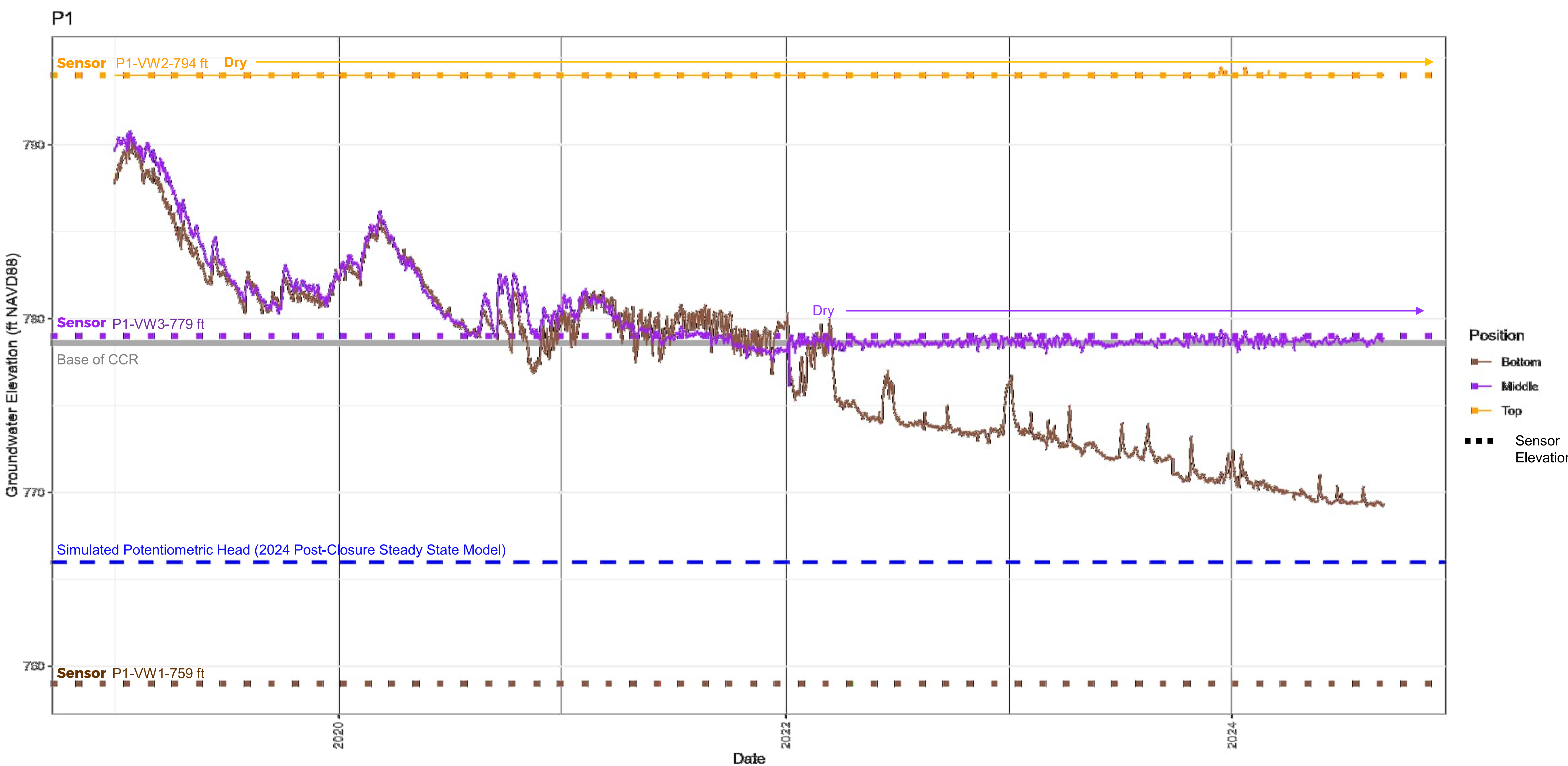
PROJECT
THREE-DIMENSIONAL NUMERICAL GROUNDWATER MODELING SUMMARY REPORT - PLANT MCDONOUGH

TITLE
SELECTED MONITORING LOCATIONS

CONSULTANT		
	YYYY-MM-DD	2024-12-18
	PREPARED	BL
	DESIGN	JDV
	CHECKED	SJS
	REVIEWED/APPROVED	CB

PROJECT No.	SCS PROJECT ID:	Rev.	FIGURE
US0037149.1670	MCD150170	0	C-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI B



Notes:

1) VWP = Vibrating Wire Piezometer
2) Ft-NAVD88 = Feet North American Vertical Datum 1988
3) CCR = Coal Combustion Residuals

CLIENT GEORGIA POWER COMPANY SOUTHERN COMPANY SERVICES		PROJECT EMPIRICAL DEWATERING ANALYSIS	
CONSULTANT	YYYY-MM-DD: 2024-12-10 PREPARED: JDV DESIGN: JDV REVIEW: SJS APPROVED: CB	TITLE **HYDROGRAPHS FOR VIBRATING WIRE PIEZOMETER P1**	
		PROJECT No. US0037149.1670 SCS PROJECT ID MCD150170	Rev 0 FIGURE C-3

Notes:

1) VWP = Vibrating Wire Piezometer
2) Ft-NAVD88 = Feet North American Vertical Datum 1988
3) CCR = Coal Combustion Residuals

CLIENT	GEORGIA POWER COMPANY SOUTHERN COMPANY SERVICES
PROJECT	EMPIRICAL DEWATERING ANALYSIS
CONSULTANT	wsp
YYYY-MM-DD	2024-12-10
PREPARED	JDV
DESIGN	JDV
REVIEW	SJS
APPROVED	CB
TITLE	HYDROGRAPHS FOR VIBRATING WIRE PIEZOMETER P2
PROJECT No.	US0037149.1670
SCS PROJECT ID	MCD150170
Rev	0
FIGURE	C-4

Notes:

1) VWP = Vibrating Wire Piezometer
2) Ft-NAVD88 = Feet North American Vertical Datum 1988
3) CCR = Coal Combustion Residuals

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

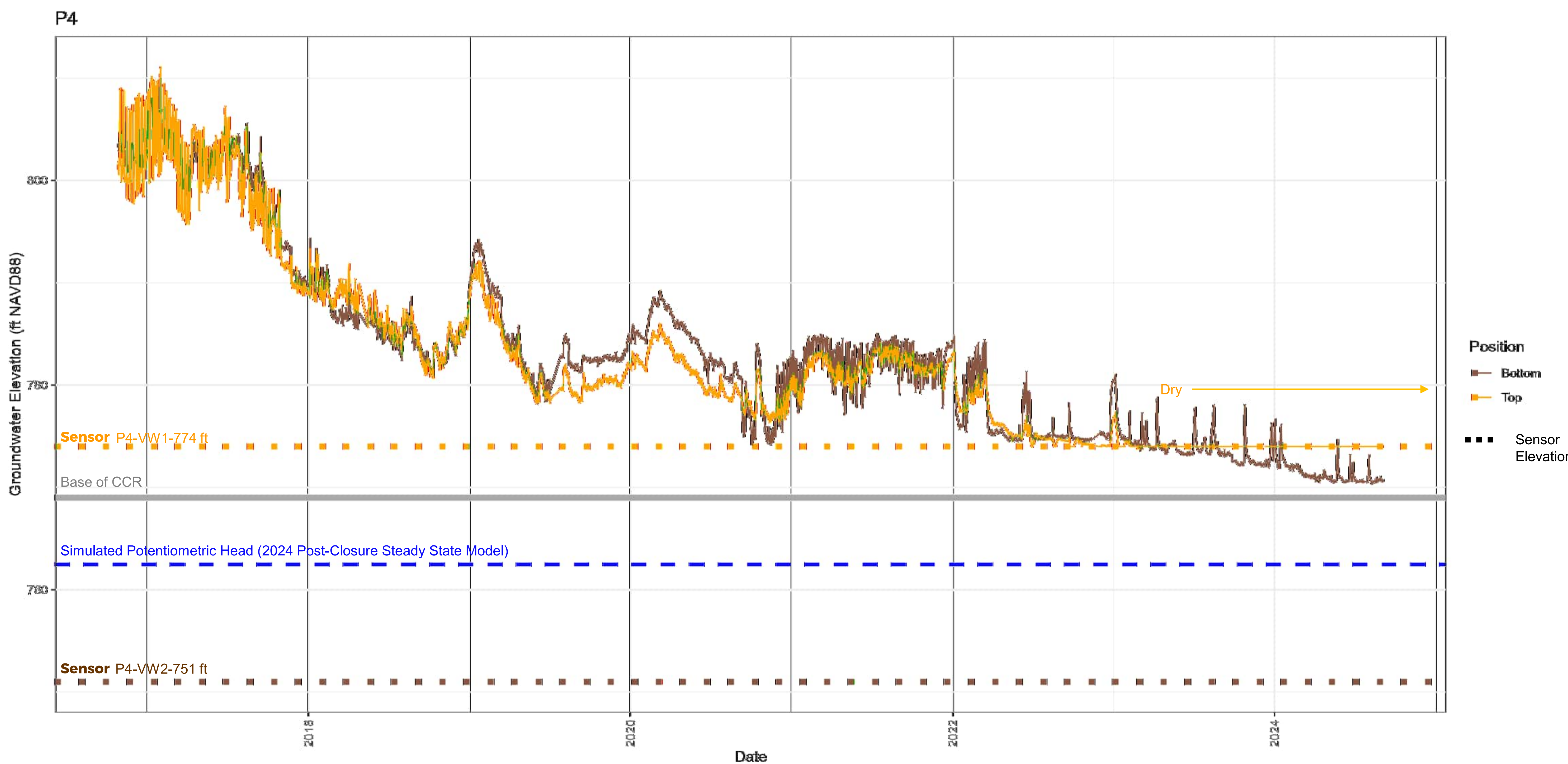
CONSULTANT

YYYY-MM-DD	2024-12-10
PREPARED	JDV
DESIGN	JDV
REVIEW	SJS
APPROVED	CB

PROJECT
EMPIRICAL DEWATERING ANALYSIS

TITLE
HYDROGRAPHS FOR VIBRATING WIRE PIEZOMETER P3

PROJECT No.	SCS PROJECT ID	Rev	FIGURE
US0037149.1670	MCD150170	0	C-5



Notes:

1) VWP = Vibrating Wire Piezometer
2) Ft-NAVD88 = Feet North American Vertical Datum 1988
3) CCR = Coal Combustion Residuals

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

CONSULTANT

YYYY-MM-DD	2024-12-10
PREPARED	JDV
DESIGN	JDV
REVIEW	SJS
APPROVED	CB

PROJECT
EMPIRICAL DEWATERING ANALYSIS

TITLE
HYDROGRAPHS FOR VIBRATING WIRE PIEZOMETER P4

PROJECT No.	SCS PROJECT ID	Rev	FIGURE
US0037149.1670	MCD150170	0	C-6

Notes:

1) VWP = Vibrating Wire Piezometer
2) Ft-NAVD88 = Feet North American Vertical Datum 1988
3) CCR = Coal Combustion Residuals

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

PROJECT
EMPIRICAL DEWATERING ANALYSIS

CONSULTANT
wsp

YYYY-MM-DD	2024-12-10
PREPARED	JDV
DESIGN	JDV
REVIEW	SJS
APPROVED	CB

TITLE
HYDROGRAPHS FOR VIBRATING WIRE PIEZOMETER P5

PROJECT No.	SCS PROJECT ID	Rev	FIGURE
US0037149.1670	MCD150170	0	C-7

Notes:

1) VWP = Vibrating Wire Piezometer
2) Ft-NAVD88 = Feet North American Vertical Datum 1988
3) CCR = Coal Combustion Residuals

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

CONSULTANT

YYYY-MM-DD	2024-12-10
PREPARED	JDV
DESIGN	JDV
REVIEW	SJS
APPROVED	CB

PROJECT
EMPIRICAL DEWATERING ANALYSIS

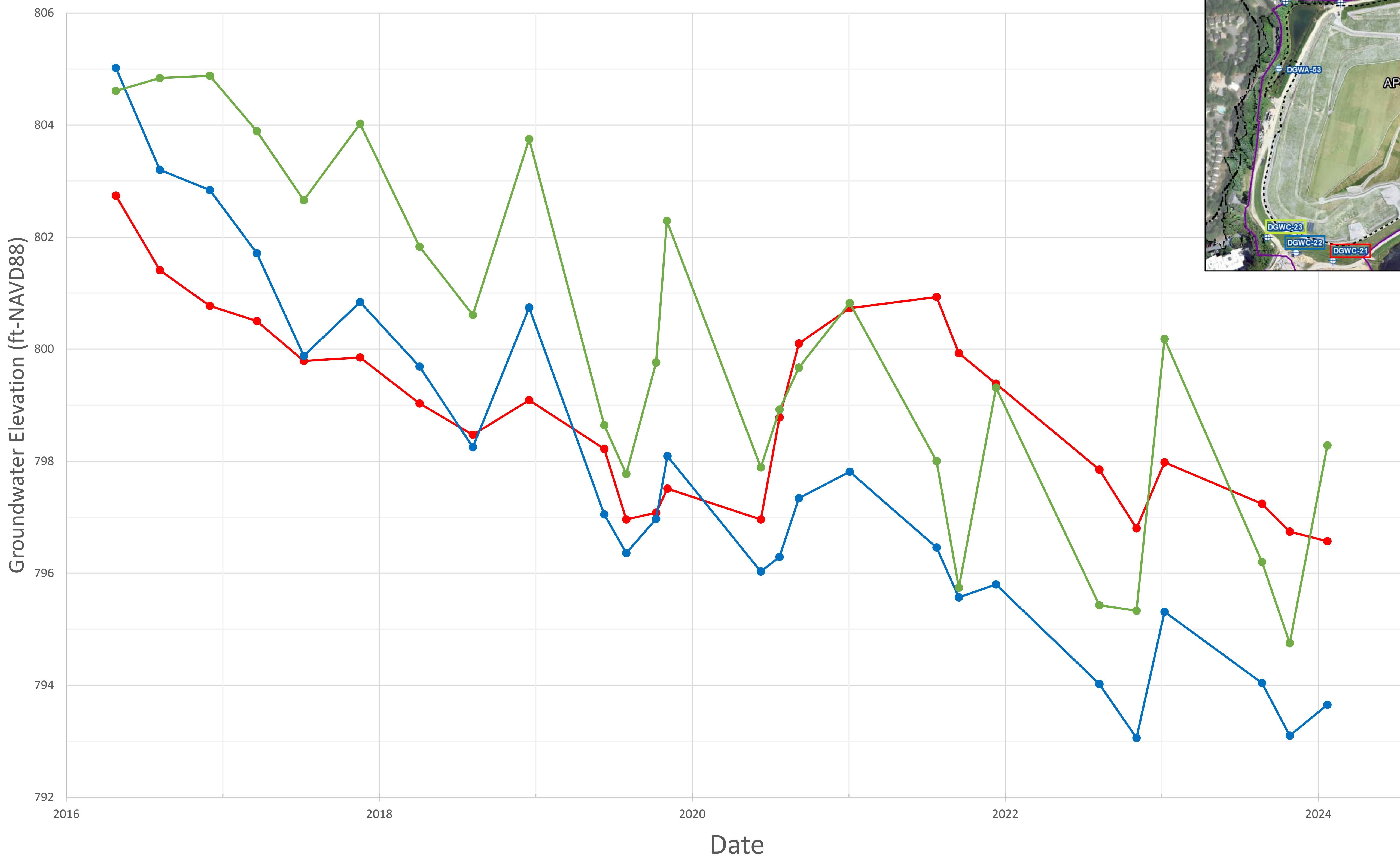
TITLE
HYDROGRAPHS FOR VIBRATING WIRE PIEZOMETER P6

PROJECT No.	SCS PROJECT ID	Rev	FIGURE
US0037149.1670	MCD150170	0	C-8

Notes:

1) VWP = Vibrating Wire Piezometer
2) Ft-NAVD88 = Feet North American Vertical Datum 1988
3) CCR = Coal Combustion Residuals

CLIENT	GEORGIA POWER COMPANY SOUTHERN COMPANY SERVICES	PROJECT	EMPIRICAL DEWATERING ANALYSIS
CONSULTANT	YYYY-MM-DD: 2024-12-10 PREPARED: JDV DESIGN: JDV REVIEW: SJS APPROVED: CB	TITLE	HYDROGRAPHS FOR VIBRATING WIRE PIEZOMETER P7
PROJECT No. US0037149.1670	SCS PROJECT ID MCD150170	Rev 0	FIGURE C-9



Notes:

1) Ft-NAVD88 = feet North American Vertical Datum 1988

CLIENT

GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

CONSULTANT

wsp

YYYY-MM-DD	2024-12-10
PREPARED	JDV
DESIGN	JDV
REVIEW	SJS
APPROVED	CB

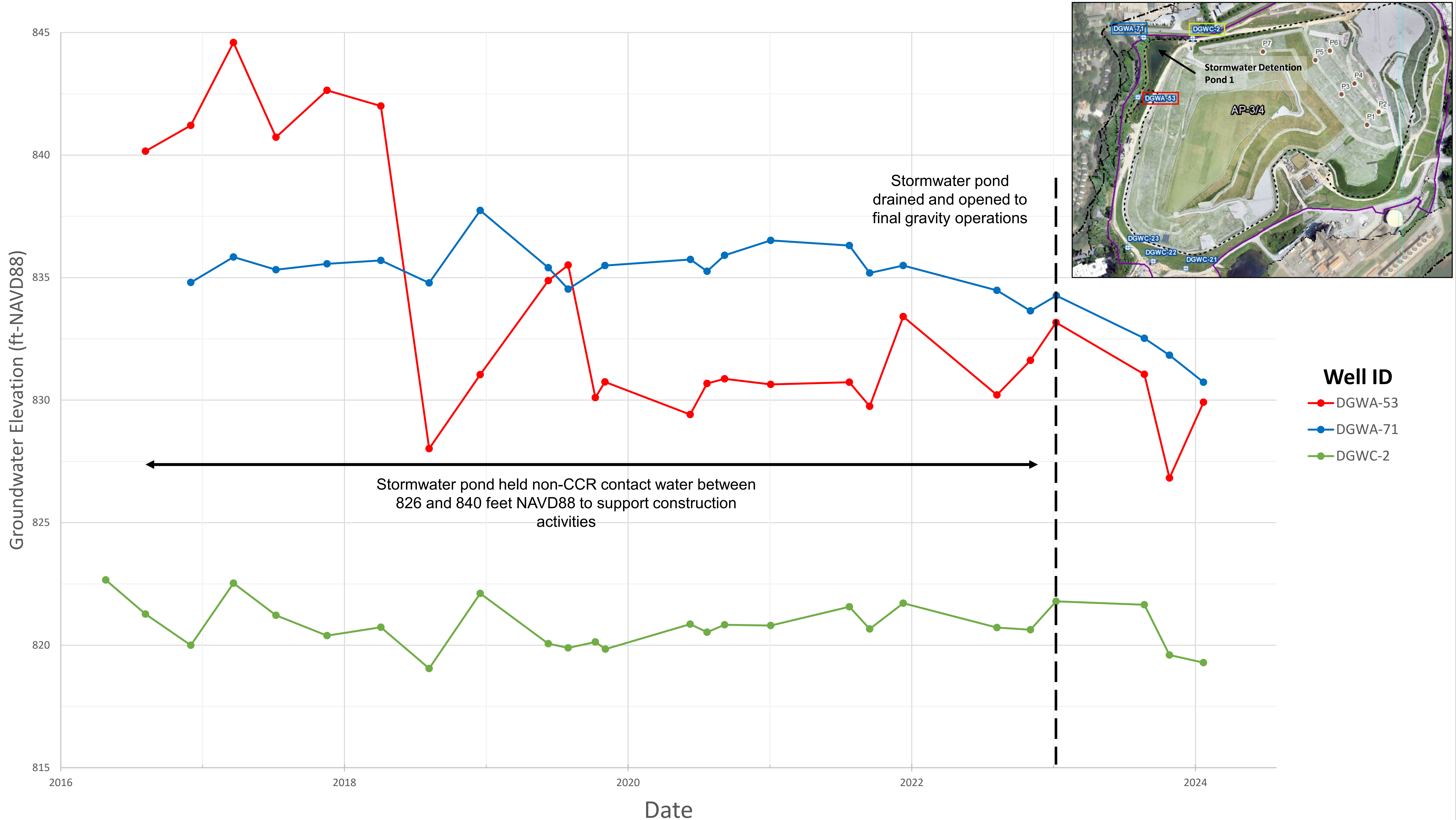
PROJECT

EMPIRICAL DEWATERING ANALYSIS

TITLE

HYDROGRAPHS FOR WELLS DGWC-21, DGWC-22, DGWC-23

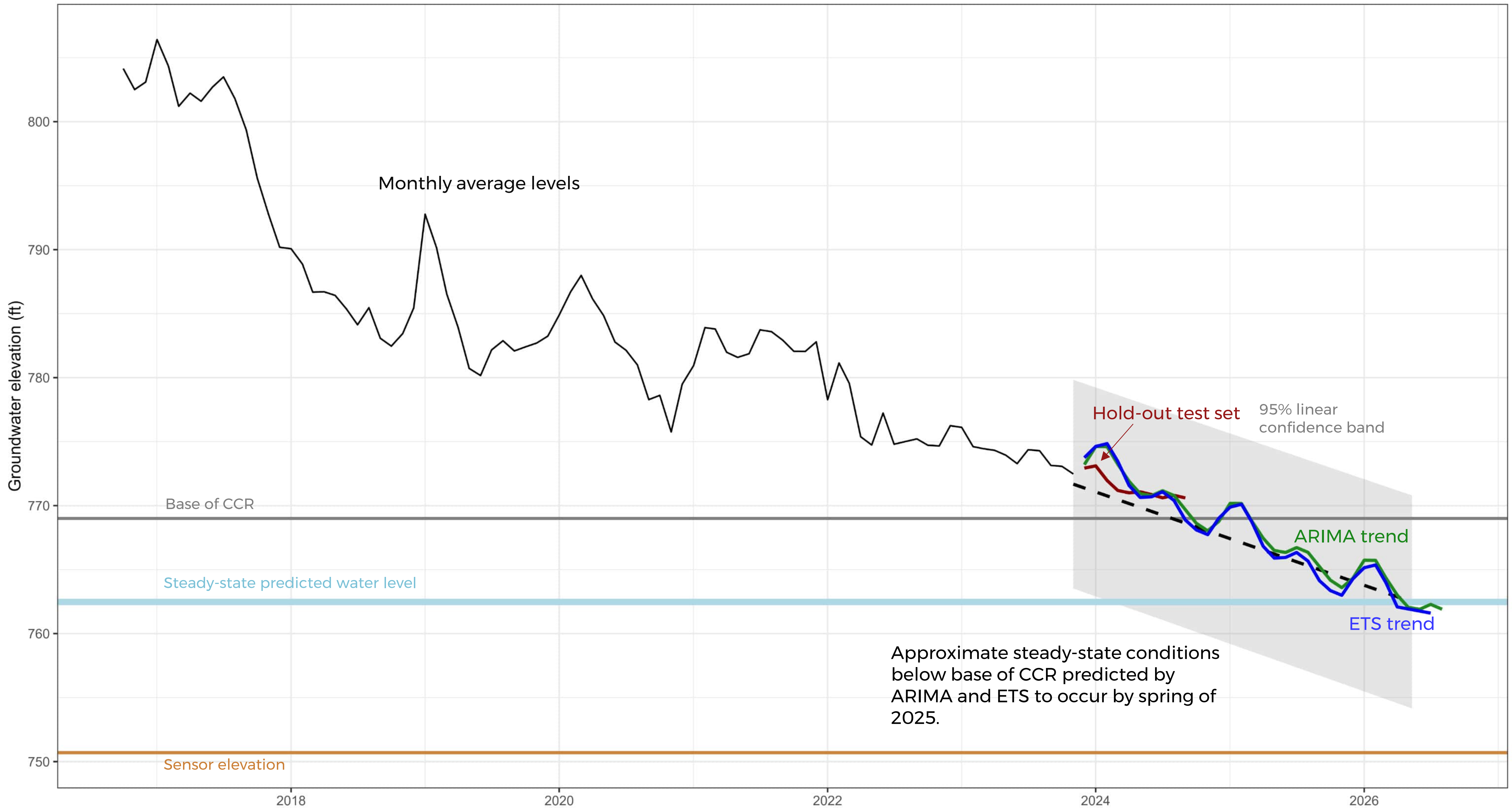
PROJECT No.	SCS PROJECT ID	Rev	FIGURE
US0037149.1670	MCD150170	0	C-10



Notes:

1) Ft-NAVD88 = feet North American Vertical Datum 1988

CLIENT	GEORGIA POWER COMPANY SOUTHERN COMPANY SERVICES
PROJECT	EMPIRICAL DEWATERING ANALYSIS
CONSULTANT	wsp
YYYY-MM-DD	2024-12-10
PREPARED	JDV
DESIGN	JDV
REVIEW	SJS
APPROVED	CB
TITLE	HYDROGRAPHS FOR WELLS DGWC-2, DGWA-71, DGWA-53
PROJECT No.	US0037149.1670
SCS PROJECT ID	MCD150170
Rev	0
FIGURE	C-11



Notes:

1) VWP = Vibrating Wire Piezometer
2) Ft-NAVD88 = Feet North American Vertical Datum 1988
3) CCR = Coal Combustion Residuals
4) ARIMA = Auto-Regressive Integrated Moving Average
5) ETS = Error, Trend, Seasonal

CLIENT
GEORGIA POWER COMPANY
SOUTHERN COMPANY SERVICES

CONSULTANT

YYYY-MM-DD	2024-12-10
PREPARED	JDV
DESIGN	JDV
REVIEW	SJS
APPROVED	CB

PROJECT
EMPIRICAL DEWATERING ANALYSIS

TITLE
STATISTICAL FORECAST FOR VIBRATING WIRE PIEZOMETER SENSOR P4-VW2-751 FT

PROJECT No.	SCS PROJECT ID	Rev	FIGURE
US0037149.1670	MCD150170	0	C-12

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