Surface Water Quantity Models

Progress Meeting Notes

July 5, 2016 – Teleconference

Attendees: **CDM Smith**: John Boyer, Kirk Westphal, Tim Cox, Nina Caraway
SCDNR: Joe Gellici, Andy Wachob, Scott Harder, Alex Pellet, Bill Clendenin, Kerry Castle
DHEC: Rob Devlin, Leigh Anne Monroe
Clemson: Jeff Allen
Technical Advisory Committee: Eddie Twilley, Ed Bruce, K.C. Price, Eric Kruger, Eric Schmidt (guest from WestRock)

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1. **Upcoming Stakeholder Meetings**
    a. Salkehatchie and Savannah Stakeholder 1st Meetings
    - DNR, DHEC and the TAC agreed that the two Salkehatchie River Basin stakeholder meetings could be combined into a single, three hour meeting, given that there are only a handful of water users in the modeled portion of the basin, and those are exclusively agricultural users. John Boyer confirmed that the draft model could be completed by the end of July, in time for the meeting.
    - Eddie Twilley suggested that the Farm Bureau should be notified of the meeting, to ensure that the agricultural community is represented.
    - Based on CDM Smith, DNR, and DHEC availability, it was agreed that Clemson would investigate dates and venues for the Salkehatchie (combined) meeting and the Savannah first meeting during the week of August 8th. North August was suggested as a central location for the Savannah meeting, and has worked well for the South Carolina Savannah River Basin Advisory Council (SC SRBAC) meetings.
    - Jeff Allen noted that the SC SRBAC was interested in "piggy-backing" their committee meeting with the Savannah stakeholder meeting, if possible.

2. **Broad Model**
    a. Review of updates from 7/1/16
    - John Boyer noted that an update calibration model and workbooks were distributed to DNR and DHEC on Friday, July 1st. Revisions were summarized in an accompanying document. The calibration workbooks were also sent to K.C. Price for review.
    - Scott Harder indicated DNR was still reviewing the updates.

3. **Draft Savannah Framework** (see attached)
- John Boyer provided a cursory review of the proposed Savannah River Basin SWAM framework, focusing on how the Georgia-side inflows and impairments would be represented. The Savannah River can be divided into eight sections, based on the locations where unimpaired flows (UIFs) already developed by ARCADIS on behalf of Georgia EPD were calculated. In the simplest approach, Georgia-side withdrawals, discharges and inflows would be aggregated and represented using one Water User object, one Discharge object, and one implicit Tributary object per section. As needed, Georgia-side tributary inflows to the Savannah River could also be separated with multiple implicit Tributary objects, per section. During model development, the need for one or more Georgia-side Tributary objects per section will be evaluated.
- John Boyer indicated that a data request letter had been sent to DNR, and that DNR should submit it to Dr. Wei Zeng of Georgia EPD. The data request is for the raw data files used to develop and extend the UIFs. EPD had previously provided the extended UIF dataset and associated Draft Report.
- Ed Bruce suggested that the Keowee - Toxaway Water Supply Study data could be used as needed.
- Eric Kruger asked if the model would include the current Drought Protocol (DP) or the new DP that was being developed. John Boyer noted that the baseline model would include the current DP, but that it could be easily updated when the new DP is implemented (which is expected to be after 2016).
- John requested that DNR, DHEC and the TAC review the draft framework and provide any comments within the next two weeks, in anticipation of finalizing the framework before the first Stakeholder meeting tentatively planned for the week of August 8th.

4. **Status of Other Basins**
   - John Boyer noted that DNR has extended the project completion date from August 15, 2016 to December 31, 2016. Over the remaining six months, it will be necessary to finalize the remaining basin models and UIF datasets (discussed below). John noted that the project team will need to reduce and wrap-up the "fine-tuning" of the UIFs and models in the substantially completed basins, in order to focus on model development, calibration, and reporting in the remaining basins.
     a. Catawba – UIF under review
        - Scott Harder noted he had forwarded DNR's comments on the Draft UIFs for the Catawba-Wateree on June 30th (and also resent them during the call).
     b. Salkehatchie – UIFs under review
        - Alex Pellet noted that DNR was finishing comments on the Salkehatchie Draft UIFs and would provide them this week. He noted that the Salkehatchie has similar hydrology to that of the Edisto, and that some decisions need to be made on how best to represent it, especially given the relative lack of gage data.
     c. Saluda – Finalize Report
        - John Boyer indicated a preference to wrap up the baseline model report and baseline model in order to switch focus to the remaining models.
     d. Edisto – Finalize Report and Baseline model
        - John Boyer noted that he is making final updates to the Edisto report and baseline model.
     e. Pee Dee – Finalize Report and Baseline model
        - Alex Pellet suggested that the only remaining DNR comments on the Pee Dee relate to the representation of flows on the Lumber River (relative to flows in the Little Pee Dee) and the Black River at Kingstree. John Boyer indicated they would look further into these, and get back to DNR.
     f. Santee – On hold until Catawba UIFs are final
        - John Boyer indicated that CDM Smith needs to finalize the Catawba and Broad UIFs before developing the Santee UIFs.

Memorandum

To: *South Carolina Department of Natural Resources (DNR)*
South Carolina Department of Health and Environmental Control (DHEC)

From: *CDM Smith*

Date: *July 2016*

Subject: *DRAFT Savannah River Basin SWAM Model Framework*

This memorandum presents the Simplified Water Allocation Model (SWAM) framework for the Savannah River Basin. Several tables and figures are provided to help understand how the tributaries, water users, and discharges are being represented in the SWAM modeling environment. The tables and figures include:

Table 1 **South Carolina permitted and registered water users included in the Savannah River Basin model framework.**

Table 2 **South Carolina NPDES discharges included in the Savannah River Basin model framework.**

Table 3 **South Carolina interbasin transfers included in the Savannah River Basin model framework.**

Figure 1 **Overview Map**
This map consolidates and presents all active permitted and registered water users on the South Carolina side of the river basin which withdraw more than 3 million gallons in any month (Mg/m); significant discharge locations; USGS stream gage locations; the "main stem" consisting of the Savannah River; major reservoirs; and major tributaries. The "higher order tributaries" are not represented explicitly in the model, but their contributions to flow are included in the flows of larger, modeled tributaries. Significant discharge locations generally include NPDES discharges that average over 3 Mg/m. In some instances, discharges which average less than 3 mg/m are included because they are directly associated with a permitted withdrawal.

Figure 2a Model Tributaries and USGS Gages (South Carolina side)

This map presents the Savannah River Basin hydrography. Major branches, primary tributaries and several secondary tributaries on the South Carolina side are shown. The contributions of many of the secondary and higher order tributaries are accounted for in the aggregate flow in the larger tributaries that are modeled explicitly. Both active and inactive USGS streamflow gages are displayed. All streams which have a current or former USGS streamflow gage are explicitly included in the model, except for some secondary tributaries with former USGS gages located at the US Department of Energy Savannah River Site. Gages in the tidally influenced area near Savannah are also excluded.

Figure 2b Model Tributaries and GA EPD UIF Nodes

On the Georgia side of the Savannah River, drainage from both minor and major tributaries will be represented implicitly. Implicit tributaries serve as point inflows to a larger, explicitly simulated reach. Flows from these tributaries, delivered to downstream reaches are important to the overall basin water balance and thus are included as point sources in the models; however, since they are on the Georgia side, they will not be represented explicitly. The figure shows several major tributaries (purple shading). Ultimately, these may be lumped into one implicit tributary per section (see explanation below), or included separately.

This map also shows the eight locations on the Savannah River where unimpaired flows (UIFs) were developed and recently updated by the Georgia Environmental Protection Division (EPD). These eight locations serve to break the Savannah River into sections, for which aggregated Georgia side withdrawals, discharges, and inflows will be applied to the model.

Figure 3 South Carolina Municipal, Industrial and Mining Permitted Surface Water Users

This map presents the location of permitted municipal, industrial, and mining surface water users on the South Carolina side of the Savannah River.

Figure 4 South Carolina Nuclear, Thermoelectric, and Hydroelectric Permitted Surface Water Users

This map presents the location of permitted energy surface water users on the South Carolina side of the Savannah River.

Figure 5 South Carolina Registered Agricultural and Permitted Golf Course Users

This map presents the location of permitted golf courses and registered agriculture surface water users on the South Carolina side of the Savannah River.

Figure 6 South Carolina Dischargers

This map presents the location of all significant NPDES discharge locations on the South Carolina side of the Savannah River, including several discharges that originate from withdrawals in the Saluda and Edisto river basins. Additionally, there are numerous water users that discharge to the Broad, Saluda, Edisto and Salkehatchie river basins. Significant discharge locations generally include NPDES discharges that average over 3 Mg/m; however, discharges that average less than 3 Mg/m, but with some months greater than 3 Mg/m are also typically included, as are those directly associated with a permitted withdrawal.

Figure 7 Savannah River Basin SWAM Model Framework

This figure represents the SWAM model schematic, including tributaries, water users, and dischargers. Note that water and wastewater discharges can be simulated two ways in SWAM. First, they can be associated with a water user object, each of which may specify five points of discharge anywhere in the river network. These discharges are not represented with visual model objects, but are identified within the dialogue box for the associated Water User object. An example in the Savannah River Basin is the Anderson Joint Regional Water System (ARJWS), which is represented by a water user object (WS: ARJWS) but not separate discharge objects. The discharges are represented within the Water User object. Alternatively, discharges can be specified as a Discharge object. In the Savannah River Basin, some dischargers that do not have associated surface water withdrawals are represented in this manner. Several dischargers have a groundwater withdrawal, and have been represented using a Water User object, even though they do not withdraw from surface water. Representing them as Water User objects provides more flexibility in conducting future management and planning because their discharge can be directly related to changing water demand.

Operating rules (minimum releases, monthly or seasonal rule curves, etc.) associated with the reservoirs and hydropower facilities will be represented by the associated Reservoir object.

Withdrawals and discharges originating on the Georgia side of the basin are available from the Georgia EPD, and were calculated as part of the UIF development and update. The Georgia-side withdrawals and discharges will be represented in the model as aggregated withdrawals (represented by Water User objects) and discharges (represented as Discharge objects), at points in between each GA EPD UIF node. This will allow the user of the model to make adjustments to Georgia side impairments, if so desired.

Similar to the other basins already in development, the guiding principles in determining what elements of the Savannah River Basin to simulate explicitly were:

1. Begin with a simple representation, with the understanding that it is easier to add additional details in the future than to remove unnecessary detail to make the model more efficient.

2. Most tributaries with current uses (permitted or registered withdrawals or significant discharge) will be represented explicitly. This includes most primary tributaries to the Savannah River.

3. Generally, tributaries that are unused are not included explicitly, but the hydrologic contributions from these tributaries is embedded in the unimpaired flows (or reach gains) in downstream locations. As previously noted, several tributaries will be represented implicitly, as point inflows to a larger, explicitly simulated reach.

   As previously noted, the mainstem Savannah River UIFs have already been developed, and recently updated, by ARCADIS under contract to GA EPD. CDM Smith will enhance the existing UIF dataset by adding UIF points and calculating UIFs along significant South Carolina tributaries to the mainstem. Further discussion of this approach will be presented in the UIF methodology memorandum. As tributary UIFs are developed throughout the basin (within South Carolina), some additional tributaries may be added explicitly if warranted as candidates to support future use (or these can be easily added at any time in the future as permit applications are received).

The proposed framework is submitted with the understanding that it is malleable – that is, we may find that additional tributaries are warranted as explicit model objects (to support simulation of future withdrawals or discharges) rather than implicit flow additions, or that further simplifications are possible without compromising model utility.

The proposed model framework is a starting point based on discussions with DNR and DHEC, and on CDM Smith's initial estimate of an appropriate framework for planning and permitting in South Carolina. Feedback from water users, environmental organizations, and other stakeholders within the Savannah River Basin will be important in refining the representation of the river system. The framework will be presented at the first planned stakeholder meeting for the Savannah River Basin, and feedback will be used to refine the framework as appropriate.

Table 1. Permitted and registered surface water users included in the Savannah River Basin model framework.

ID	Type	Facility Name	Withdrawal Tributary	Model Object ID
01PH001S01	PH	Rocky River Hydro	Lake Russell/Rocky River	*NA*
01PH002S01	PH	RB Russell Hydro	Lake Russell/Savannah River	*NA*
01WS002S01	WS	City of Abbeville	Lake Russell/Rocky River	WS: Abbeville
01WS004S01	WS	Mohawk Ind - Rocky River Plant	Lake Russell/Rocky River	WS: Mohawk
02GC007S01	GC	Woodside Plantation	Hollow Creek	GC: Woodside
02GC007S02	GC	Woodside Plantation	Hollow Creek	GC: Woodside
02GC008S01	GC	River Golf Club - North Augusta	Savannah River	GC: River Golf Club
02GC012S01	GC	Sage Valley Golf Club	Horse Creek	GC: Sage Valley
02GC052S01	GC	The Reserve Club	Hollow Creek	GC: The Reserve
02GC052S02	GC	The Reserve Club	Hollow Creek	GC: The Reserve
02IN003S01	IN	Kimberly-Clarke Beech Island Mill	Savannah River	IN: Kimberly-Clarke
02IN008S01	IN	Cytec Industries - Langley Plant	Horse Creek	IN: Cytec
02IN010S01	IN	US DOE - Savannah River Site	Savannah River	IN: US DOE
02IN010S02	IN	US DOE - Savannah River Site	Savannah River	IN: US DOE
02IN010S03	IN	US DOE - Savannah River Site	Savannah River	IN: US DOE
02IR014S01	IR	Mason's Master Turf	Savannah River	IR: Mason's Master Turf
02PT001S01	PT	SCE&G Urquart Station	Savannah River	PT: SCE&G Urquart Station
02WS005S01	WS	Breezy Hill WTP	Little Horse Creek	WS: Breezy Hill
02WS007S01	WS	City of North Augusta WTP	Savannah River	WS: North Augusta
02WS007S02	WS	City of North Augusta WTP	Savannah River	WS: North Augusta
02WS029S01	WS	Graniteville Water Treatment Facility	Horse Creek	WS: Graniteville
02WS030S01	WS	WG Development LLC	Horse Creek	WS: Graniteville
04IN017S01	IN	MT Vernon Mills La France	Three and Twenty Creek	IN: MT Vernon Mills
04MI002S01	MI	Hanson Aggregates - Anderson Facility	Beaver Creek	MI: Hanson Aggregates
04PH003S01	PH	Hartwell Dam Hydro	Lake Hartwell/Savannah River	*NA*
04PT002S01	PT	Santee Cooper Rainey Generating Station	Savannah River	PT: SC Rainey Station
04IN051S01	IN	South Anderson Water Supply Intake	Lake Hartwell/Seneca River	IN: ARJWS
04WS006S01	WS	Anderson Regional JWS	Lake Hartwell/Seneca River	WS: ARJWS
07GC023S01	GC	Old South Golf Links	Coastal*	*NA*
07GC040S01	GC	Haig Point Club	Coastal*	*NA*
07WS005S01	WS	Beaufort Jasper Water & Sewer Authority	Savannah River	WS: BJW&SA
19IR012S01	IR	WG Smith III	Turkey Creek	IR: WG Smith
19IR055S01	IR	Gurosik Farm	Stevens Creek	IR: Gurosik Farm
19IR055S02	IR	Gurosik Farm	Stevens Creek	IR: Gurosik Farm
19IR055S03	IR	Gurosik Farm	Stevens Creek	IR: Gurosik Farm
19IR055S04	IR	Gurosik Farm	Stevens Creek	IR: Gurosik Farm
19PH001S01	PH	Stevens Creek Hydro	Savannah River	*NA*
19WS001S01	WS	Edgefield County W&S Authority	Savannah River	WS: ECW&SA
23GC015S01	GC	Cliffs Club At Keowee Falls	Lake Keowee/Keowee River	GC: Keowee Falls
23WS007S01	WS	Greenville Water System Adkins Treatment Plant	Lake Keowee/Keowee River	WS: Greenville
25IR022S01	IR	Youmans Alex Farm	Savannah River (tributary)	IR: Youmans Farm
25IR022S02	IR	Youmans Alex Farm	Savannah River (tributary)	IR: Youmans Farm
27IR009S01	IR	Nimmer Turf & Tree Farm Nursery	Coastal*	*NA*
35GC003S01	GC	Savannah Lakes Village POA	Lake Thurmond/Savannah River	GC: Savannah Lakes
35GC003S02	GC	Savannah Lakes Village POA	Lake Thurmond/Savannah River	GC: Savannah Lakes
35PH001S01	PH	Strom Thurmond Hydro	Lake Thurmond/Savannah River	*NA*
35WS001S01	WS	McCormick Water Treatment Plant	Lake Thurmond/Savannah River	WS: McCormick
37GC001S01	GC	Keowee Key Golf Club	Lake Keowee/Keowee River	GC: Keowee Key
37IR005S01	IR	Holcombe Farm	Little River	IR: Holcombe Farm
37IR011S02	IR	Head Lee Nursery	Coneross Creek (tributary)	IR: Head Lee Nursery
37IR057S01	IR	Shirley Farm	Tugaloo River	IR: Shirley Farm
37IR058S01	IR	Calyx Farm	Little River	IR: Calyx Farm
37PH001S01	PH	Coneross Hydro	Lake Hartwell/Coneross Creek	*NA*

Table 1. Permitted and registered surface water users included in the Savannah River Basin model framework.

ID	Type	Facility Name	Withdrawal Tributary	Model Object ID
37PN001S01	PN	Oconee Nuclear Station	Lake Keowee/Keowee River	PN: Oconee
37PN001S02	PN	Oconee Nuclear Station	Lake Keowee/Keowee River	PN: Oconee
37PN002S01	PH	Bad Creek Generation	Lake Jocassee/Toxaway River	*NA*
37WS001S01	WS	Pioneer Rural Water - WTP	Lake Hartwell/Tugaloo River	WS: Pioneer
37WS002S01	WS	City of Walhalla WTP	Coneross Creek	WS: Walhalla
37WS002S02	WS	City of Walhalla WTP	Coneross Creek	WS: Walhalla
37WS003S01	WS	City of Westminster WTP	Chauga River	WS: Westminster
37WS004S01	WS	City of Seneca WTP	Lake Keowee/Keowee River	WS: Seneca
39GC007S01	GC	Cliffs Club At Keowee Springs	Lake Keowee/Keowee River	GC: Keowee Springs
39GC008S01	GC	Walker Course at Clemson University	Lake Hartwell/Seneca River	GC: Walker
39GC008S02	GC	Walker Course at Clemson University	Lake Hartwell/Seneca River	GC: Walker
39GC009S01	GC	Cliffs Club At Keowee Vineyards	Lake Keowee/Keowee River	GC: Keowee Vineyards
39GC010S01	GC	The Reserve At Lake Keowee	Lake Keowee/Keowee River	GC: Reserve at Keowee
39IN007S01	IN	Vulcan Contruction Materials	Golden Creek	IN: Vulcan
39IN008S01	IN	Milliken Pendleton Plant	Eighteenmile Creek	IN: Milliken
39IN010S01	IN	Clemson University Central Energy Plant	Lake Hartwell/Seneca River	IN: Clemson Energy
39IN013S01	IN	Shaw Industries Group	Twelvemile Creek	IN: Shaw
39PH001S01	PH	Keowee Hydro	Lake Keowee/Keowee River	*NA*
39PH002S01	PH	Jocassee Generation	Lake Jocassee/Toxaway River	*NA*
39PH002S02	PH	Jocassee Pumped Storage	Lake Jocassee/Toxaway River	*NA*
39WS003S01	WS	Easley Central Water District	Twelvemile Creek	WS: Easley
39WS005S01	WS	City of Pickens WTP	Twelvemile Creek	WS: Pickens
39WS005S02	WS	City of Pickens WTP	Twelvemile Creek	WS: Pickens

Blue and gray shading identifies water users with multiple permitted withdrawal locations. These are represented by one model object.

** In coastal area and will not be modeled*

NA = Not appplicable (no model object necessary)

Table 2. NPDES discharges included in the Savannah River Basin model framework.

NPDES Pipe ID	Facility Name	Discharge Tributary	Associated Surface Water Permit	Associated Groundwater Withdrawal ID	Model Object ID
SC0000353-001	Sage Auto Interiors/Abbeville Plant	Blue Hill Creek	01WS002	*none*	WS: Abbeville
SC0025721-001	Calhoun Falls, Town Of	Sawney Creek	01WS002	*none*	WS: Abbeville
SC0040614-001	Abbeville/Long Cane Creek	Long Cane Creek	01WS002	*none*	WS: Abbeville
SC0000299-001	Mohawk Ind/Rocky River Plant	Lake Russell/Rocky River	01WS004	*none*	WS: Mohawk
SC0000582-001	Kimberly-Clark/Beech Island	Savannah River	02IN003	02IN003G	IN: Kimberely-Clarke
SC0039730-001	Cytec Industries Inc	Horse Creek	02IN008	*none*	IN: Cytec
SC0000175-A01	US DOE/Savannah River Site	Upper Three Runs	02IN010	*none*	IN: US DOE
SC0000175-A11	US DOE/Savannah River Site	Upper Three Runs	02IN010	*none*	IN: US DOE
SC0000175-A1A	US DOE/Savannah River Site	Upper Three Runs	02IN010	*none*	IN: US DOE
SC0000175-F08	US DOE/Savannah River Site	Savannah River	02IN010	*none*	IN: US DOE
SC0000175-G10	US DOE/Savannah River Site	Savannah River	02IN010	*none*	IN: US DOE
SC0000175-H02	US DOE/Savannah River Site	Upper Three Runs	02IN010	*none*	IN: US DOE
SC0000175-H12	US DOE/Savannah River Site	Savannah River	02IN010	*none*	IN: US DOE
SC0000175-K18	US DOE/Savannah River Site	Savannah River	02IN010	*none*	IN: US DOE
SC0000175-L07	US DOE/Savannah River Site	Savannah River	02IN010	*none*	IN: US DOE
SC0000175-M05	US DOE/Savannah River Site	Upper Three Runs	02IN010	*none*	IN: US DOE
SC0000175-TH1	US DOE/Savannah River Site	Upper Three Runs	02IN010	*none*	IN: US DOE
SC0000175-TH2	US DOE/Savannah River Site	Upper Three Runs	02IN010	*none*	IN: US DOE
SC0000175-X08	US DOE/Savannah River Site	Savannah River	02IN010	*none*	IN: US DOE
SC0047431-01C	US DOE/SRS/D-Area Powerhouse	Savannah River	02IN010	*none*	IN: US DOE
SC0047431-01D	US DOE/SRS/D-Area Powerhouse	Savannah River	02IN010	*none*	IN: US DOE
SC0047431-D01	US DOE/SRS/D-Area Powerhouse	Savannah River	02IN010	*none*	IN: US DOE
SC0047431-D06	US DOE/SRS/D-Area Powerhouse	Savannah River	02IN010	*none*	IN: US DOE
SC0049107-G05	Ameresco SRS Biomass Cogeneration Facility	Savannah River	02IN010	*none*	IN: US DOE
SC0000574-001	SCE&G/Urquhart Steam Station	Savannah River	02PT001	*none*	PT: SCE&G Urquart Station
SC0000574-002	SCE&G/Urquhart Steam Station	Savannah River	02PT001	*none*	PT: SCE&G Urquart Station
SC0000485-001	Mount Vernon Mills/LaFrance	Three and Twenty Creek	04IN017	*none*	IN: MT Vernon Mills
SC0049115-001	First Quality Tissue SE LLC	Big Generostee Creek	04IN051	*none*	IN: ARJWS
SCG730222	Hanson Aggregates-Anderson Facility	Beaver Creek	04MI002	*none*	MI: Hanson Aggregates
SC0048135-001	SCPSA/John Rainey Gen Station	Savannah River	04PT002	*none*	PT: Santee Cooper - Rainey
SC0020010-001	Clemson/Cochran Road WWTP	Park Creek	04WS006	*none*	WS: ARJWS
SC0023744-001	Anderson/Rocky River	Rocky River	04WS006	*none*	WS: ARJWS
SC0023752-001	Anderson/Generostee Creek	Big Generostee Creek	04WS006	*none*	WS: ARJWS
SC0024996-001	Pickens CO PSC/Central-North	Twelvemile Creek	04WS006	*none*	WS: ARJWS
SC0034843-001	Clemson University WWTF	Lake Hartwell/Seneca River	04WS006	*none*	WS: ARJWS
SC0035700-001	Pendleton-Clemson Reg. WWTF	Eighteenmile Creek	04WS006	*none*	WS: ARJWS
SC0040193-001	Anderson CO WW Mgmnt/ 6 & 20	Six and Twenty Creek	04WS006	*none*	WS: ARJWS
SC0034584-001	BJW&SA/Hardeeville Church Road	Savannah River	07WS005	*none*	WS: BJW&SA
SC0047279-001	BJW&SA/Cherry Point WWTP	Coastal*	07WS005	*none*	WS: BJW&SA
SC0047279-002	BJW&SA/Cherry Point WWTP	Coastal*	07WS005	*none*	WS: BJW&SA
SC0024457-001	Aiken PSA/Horse Creek WWTF	Savannah River	02WS007	02WS007G	WS: North Augusta
SC0025330-001	ECW&SA/Brooks Street WWTP	Beaverdam Creek	19WS001	*none*	WS: ECW&SA
SCG646049	Witty Adkins WTP	Lake Keowee/Keowee River	23WS007	*none*	WS: Greenville
SCG646029	Town of McCormick WTP	Stevens Creek	35WS001	35WS001G	WS: McCormick
SC0030783-001	McCormick/Rocky Creek WWTF	Stevens Creek	35WS001	35WS001G	WS: McCormick
SC0000396-001	Milliken/McCormick Plant	Stevens Creek	35WS002	35WS001G	WS: McCormick
SC0000515-001	Duke Energy/Oconee Nuclear	Lake Keowee/Keowee River	37PN001	*none*	PN: Oconee
SC0000515-002	Duke Energy/Oconee Nuclear	Lake Keowee/Keowee River	37PN001	*none*	PN: Oconee
SC0000515-004	Duke Energy/Oconee Nuclear	Lake Keowee/Keowee River	37PN001	*none*	PN: Oconee
SCG646068	Lake Hartwell WTP	Lake Hartwell/Tugaloo River	37WS001	*none*	WS: Pioneer
SCG641004	Coneross Creek Water Treatment Facility	Coneross Creek	37WS002	*none*	WS: Walhalla
SC0033553-001	Oconee CO/Coneross Creek WWTF	Coneross Creek	37WS002	*none*	WS: Walhalla
SCG730065	Vulcan Materials Liberty Quarry	Golden Creek	39IN007	*none*	IN: Vulcan
SC0000477-001	Milliken/Pendleton Plant	Eighteenmile Creek	39IN008	*none*	IN: Milliken
SC0022004-001	Clemson Univ/Central Energy	Lake Hartwell/Seneca River	39IN010	*none*	IN: Clemson Energy
SC0000302-001	Shaw Industries Group/Clemson	Twelvemile Creek	39IN013	*none*	IN: Shaw
SC0000302-002	Shaw Industries Group/Clemson	Twelvemile Creek	39IN013	*none*	IN: Shaw
SC0047716-001	Pickens/12 Mile Rv & Wolf Crk	Twelvemile Creek	39WS005	*none*	WS: Pickens
SC0042803-001	Clariant Corp/Martin Plant	Savannah River	*none*	03IN001G	IN: Clariant
SC0042803-01B	Clariant Corp/Martin Plant	Savannah River	*none*	03IN001G	IN: Clariant

Table 2. NPDES discharges included in the Savannah River Basin model framework.

NPDES Pipe ID	Facility Name	Discharge Tributary	Associated Surface Water Permit	Associated Groundwater Withdrawal ID	Model Object ID
SC0026191-001	Pickens CO-Liberty/Roper	Twelvemile Creek	*none*	*none*	Pickens Roper
SC0047856-001	Pickens CO/Middle Reg. WWTF	Eighteenmile Creek	*none*	*none*	Pickens Middle
SC0042994-001	Pickens CO/Eighteen Mile Crk	Eighteenmile Creek	*none*	*none*	Pickens Eighteen
SC0000400-001	Owens Corning Composite Materials/Anderson	Beaverdam Creek	*none*	*none*	Owens Materials
SC0000451-002	SCDNR/Walhalla Fish Hatchery	Chattooga River	*none*	*none*	Walhalla Hatchery
SC0000591-001	WP Prop Clemson/Clemson Fin Pl	Lake Hartwell/Seneca River	*none*	*none*	WP Prop Clemson
SC0022322-001	Keowee Key Utility Systems Inc	Lake Keowee/Little River	*none*	*none*	Key Utility
SC0026701-001	Michelin N America/Sandy Sprgs	Three and Twenty Creek	*none*	*none*	Michelin
SC0027529-001	SC Minerals Inc/N Augusta Mine	Horse Creek	*none*	*none*	SC Minerals
SC0039918-001	Allendale WWTF	Savannah River	*none*	*none*	Allendale
SC0047317-001	US Army/J Strom Thurmond PWRPL	Savannah River	*none*	*none*	US Army
SC0047724-001	South Island PSD RO WTP	Coastal*	*none*	*none*	*NA*
SC0042501-001	South Island PSD WWTP	Coastal*	*none*	*none*	*NA*
SC0042501-002	South Island PSD WWTP	Coastal*	*none*	*none*	*NA*
SC0042501-003	South Island PSD WWTP	Coastal*	*none*	*none*	*NA*
SC0046191-004	Hilton Head No 1 PSD WWTP	Coastal*	*none*	*none*	*NA*
SC0046191-005	Hilton Head No 1 PSD WWTP	Coastal*	*none*	*none*	*NA*
SC0046191-006	Hilton Head No 1 PSD WWTP	Coastal*	*none*	*none*	*NA*

No shading identifies dischargers that have a surface water withdrawal permit and are represented by a Water User object.

Blue shading identifies dischargers that have a public water supply permit or registration to withdraw groundwater, but no surface water permit, and are represented by a Water User object.

Gray shading identifies dischargers that do not have a public water supply permit or registration to withdraw groundwater, and are represented by a Discharge model object.

** In coastal area and will not be modelea*

NA = Not appplicable (no model object necessary)

Table 3. Interbasin transfers included in the Savannah River Basin model framework.

NPDES Pipe ID	NPDES Facility Name	Associated Water Permit	Associated Water Permit Facility	Intake Basin	Discharge Basin	Location of Discharge in Savannah Basin	Model Object ID
SC0024457-001	Aiken PSA/Horse Creek WWTF	02WS002	Shaw's Creek Water Treatment Plant	Edisto	Savannah	Savannah River	Aiken/Newberry/SCWSA Import
SC0024457-001	Aiken PSA/Horse Creek WWTF	36WS001	George Hugh Connelly Water Treatment Plant	Saluda	Savannah	Savannah River	Aiken/Newberry/SCWSA Import
SC0024457-001	Aiken PSA/Horse Creek WWTF	41WS003	Saluda County Water & Sewer Authority	Saluda	Savannah	Savannah River	Aiken/Newberry/SCWSA Import
SC0022403-001	Due West WWTF	04WS005	Belton-Honea Path Water Treatment Plant	Saluda	Savannah	Park Creek	Belton Honea Import
SC0022870-001	Greenwood/West Alexander WWTF	24WS001	Wise Water Treatment Plant	Saluda	Savannah	Hard Labor Creek	Greenwood Import
SC0023035-001	Easley/Golden Creek Lagoon	39WS001	Don L. Moore Water Treatment Plant	Saluda	Savannah	Golden Creek	Easley Import
SC0025691-001	ECW&SA/Johnston #1 Plant	19WS001	ECW&SA WTP	Savannah	Edisto	-	WS: ECW&SA
SC0046841-001	Williamston/Big Crk East	04WS006	Lake Hartwell WTP	Savannah	Saluda	-	WS: ARJWS
SC0041211-001	ReWa/Mauldin Road	23WS007	Witty Adkins WTP	Savannah	Saluda	-	WS: Greenville
SC0002461-001	ReWa/Lower Reedy River	23WS007	Witty Adkins WTP	Savannah	Saluda	-	WS: Greenville
SC0047309-001	ReWa/Georges Creek	23WS007	Witty Adkins WTP	Savannah	Saluda	-	WS: Greenville
SC0040002-001	ReWa/Durbin Creek	23WS007	Witty Adkins WTP	Savannah	Broad	-	WS: Greenville
SC0040525-001	ReWa/Gilder Creek	23WS007	Witty Adkins WTP	Savannah	Broad	-	WS: Greenville
SC0033804-001	ReWa/Pelham WWTF	23WS007	Witty Adkins WTP	Savannah	Broad	-	WS: Greenville
SC0048348-001	BJW&SA/Port Royal Wtr Recl Fac	07WS005	Purrysburg & Chelsea Water Treatment	Savannah	Salkehatchie	-	WS: BJW&SA
SC0000825-001	US Marine Corps Air Station	07WS005	Purrysburg & Chelsea Water Treatment	Savannah	Salkehatchie	-	WS: BJW&SA

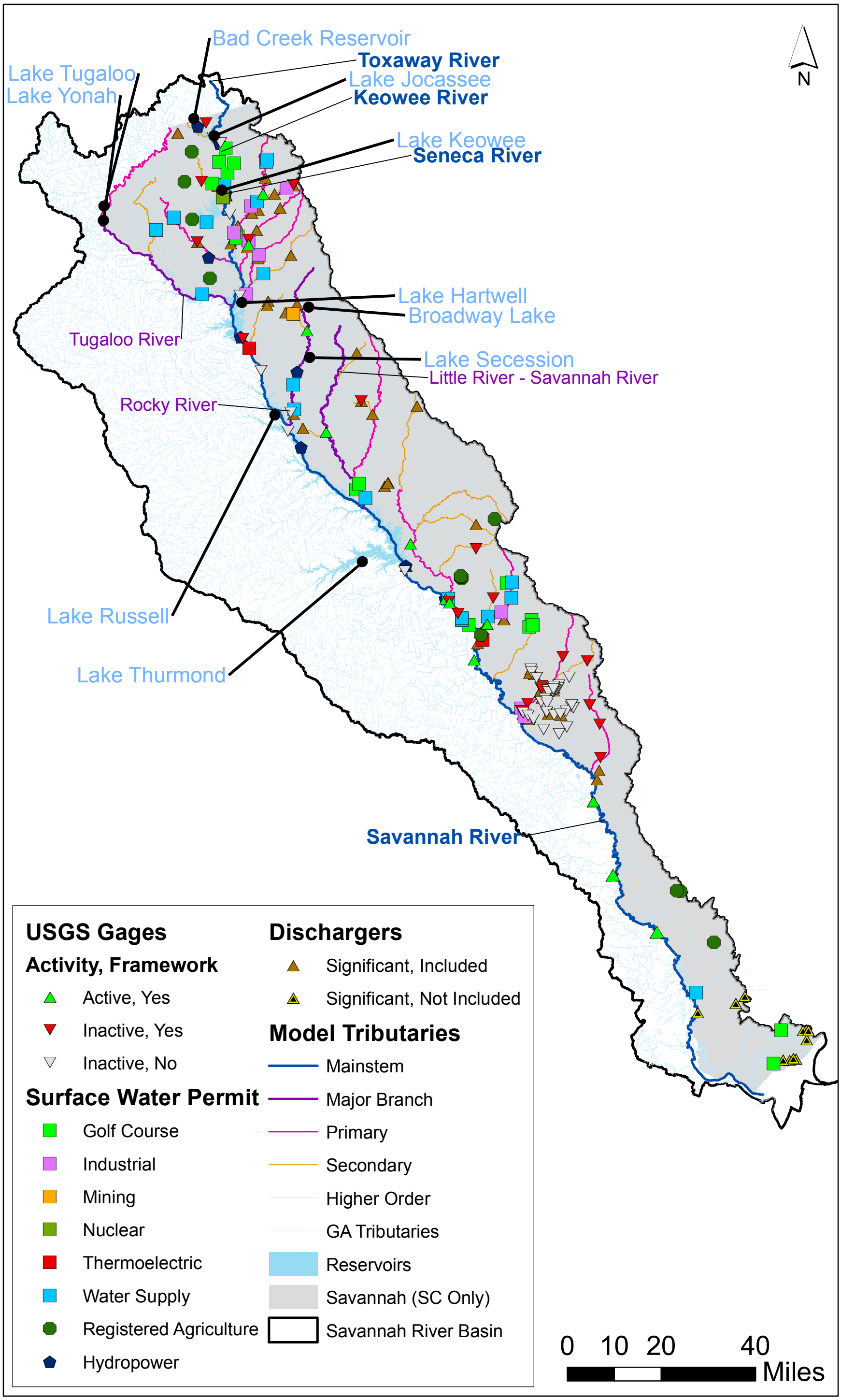

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Figure 1: Overview Map

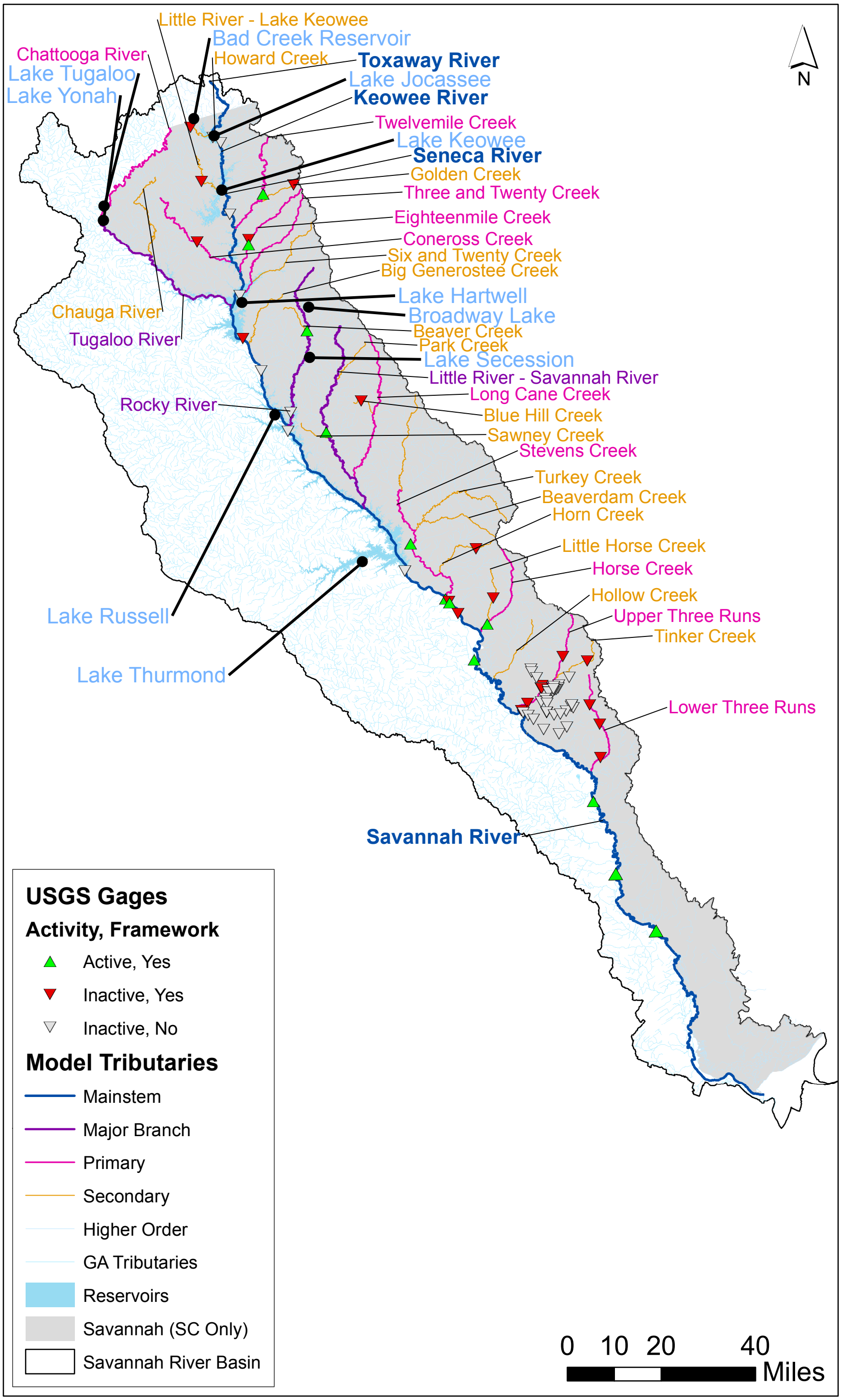

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Figure 2a: Model Tributaries and USGS Streamflow Gages (South Carolina side)

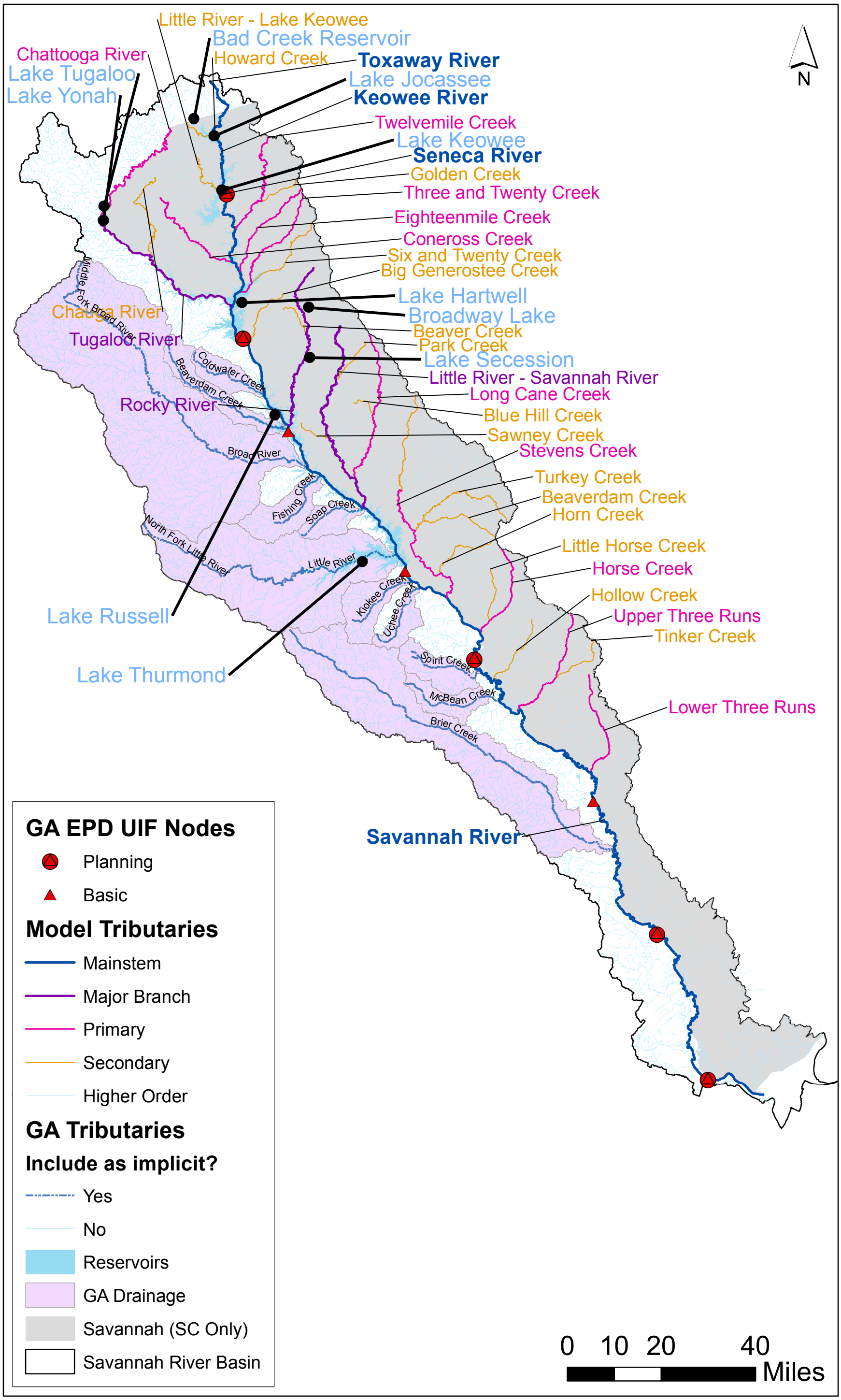

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Figure 2b: Model Tributaries and GA EPD UIF Nodes

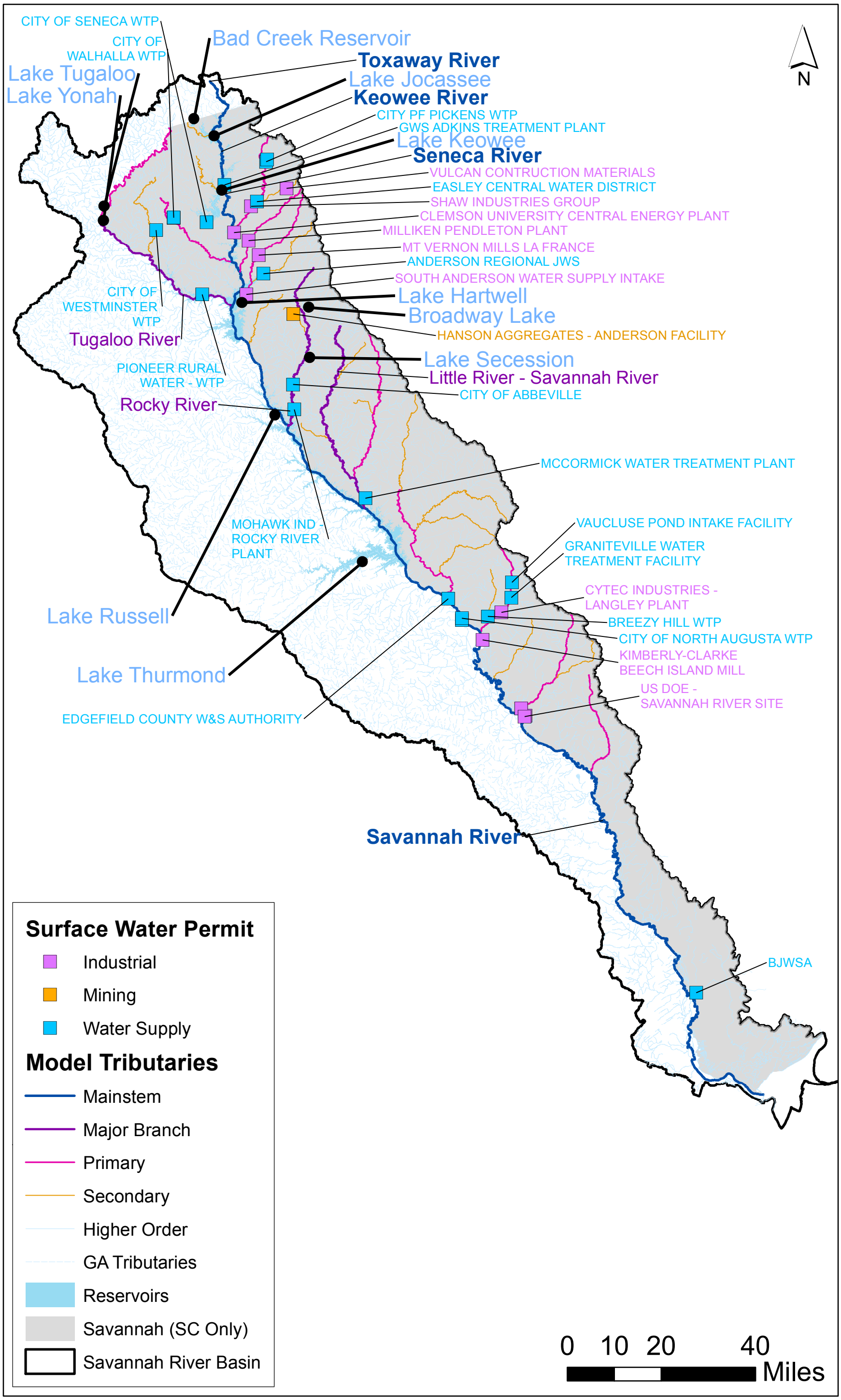

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Figure 3: Municipal, Industrial, and Mining Permitted Surface Water Users

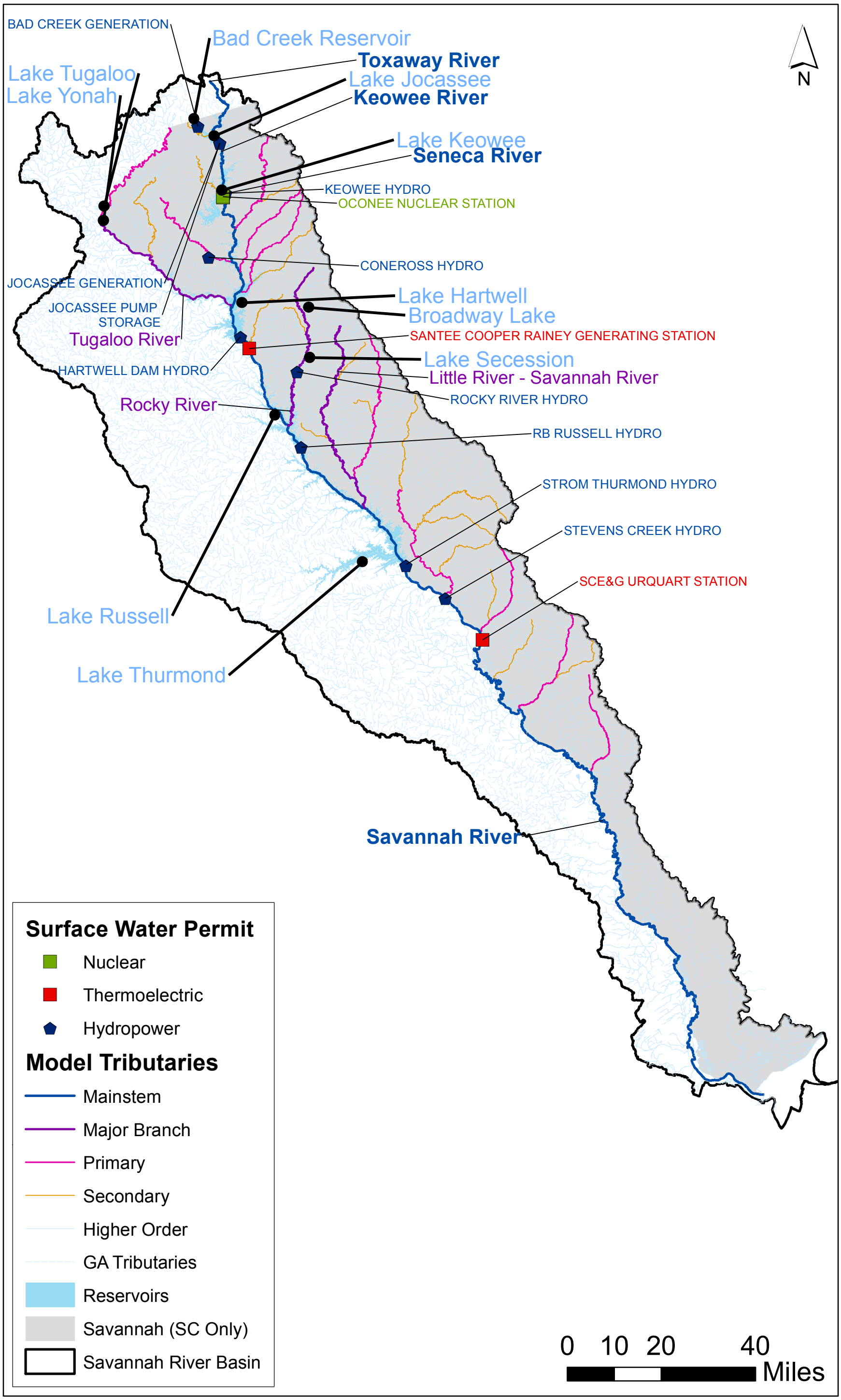

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Figure 4: Nuclear, Thermoelectric, and Hydroelectric Permitted Surface Water Users

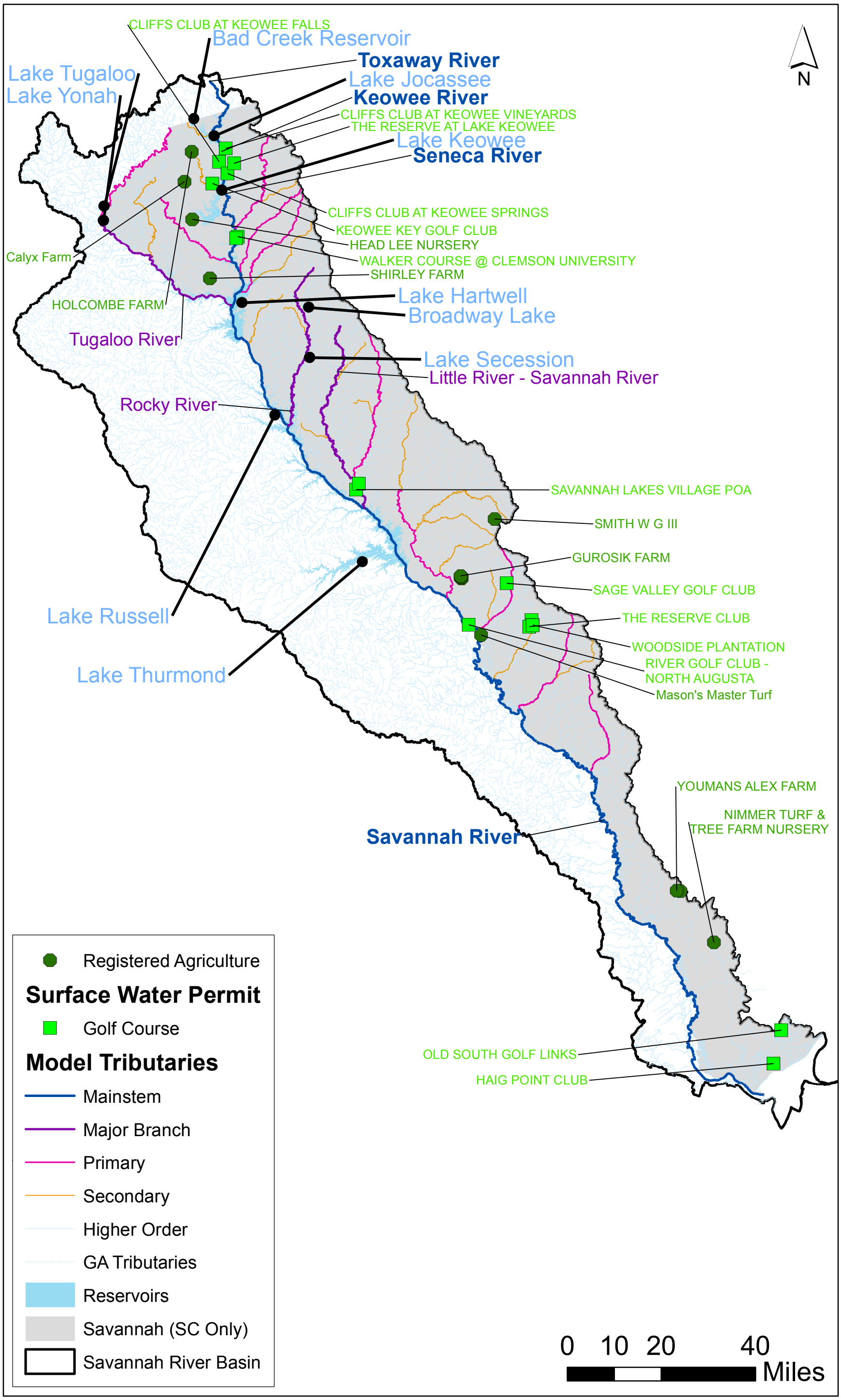

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Figure 5: Registered Agricultural Users and Golf Courses

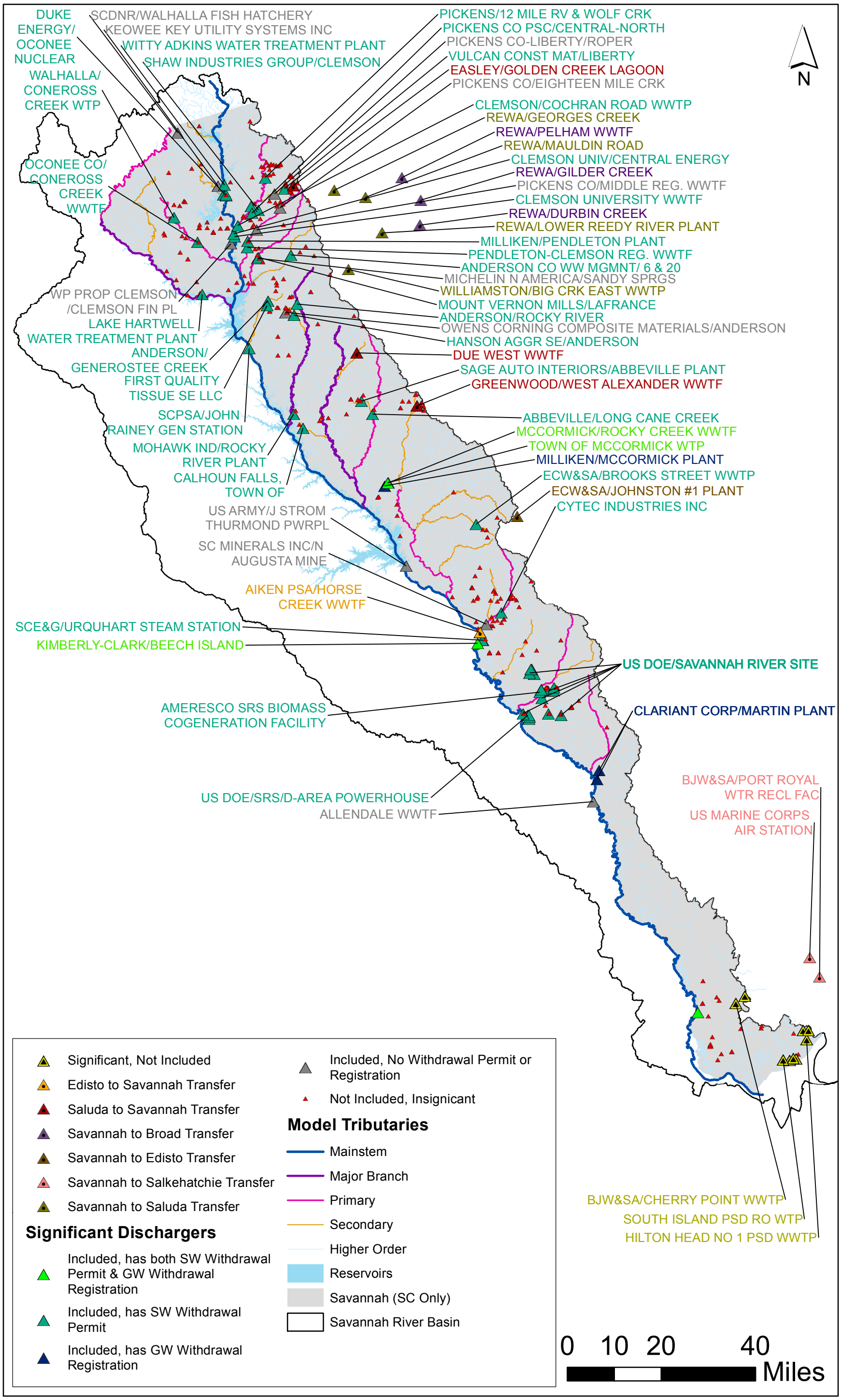

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Figure 6: Dischargers

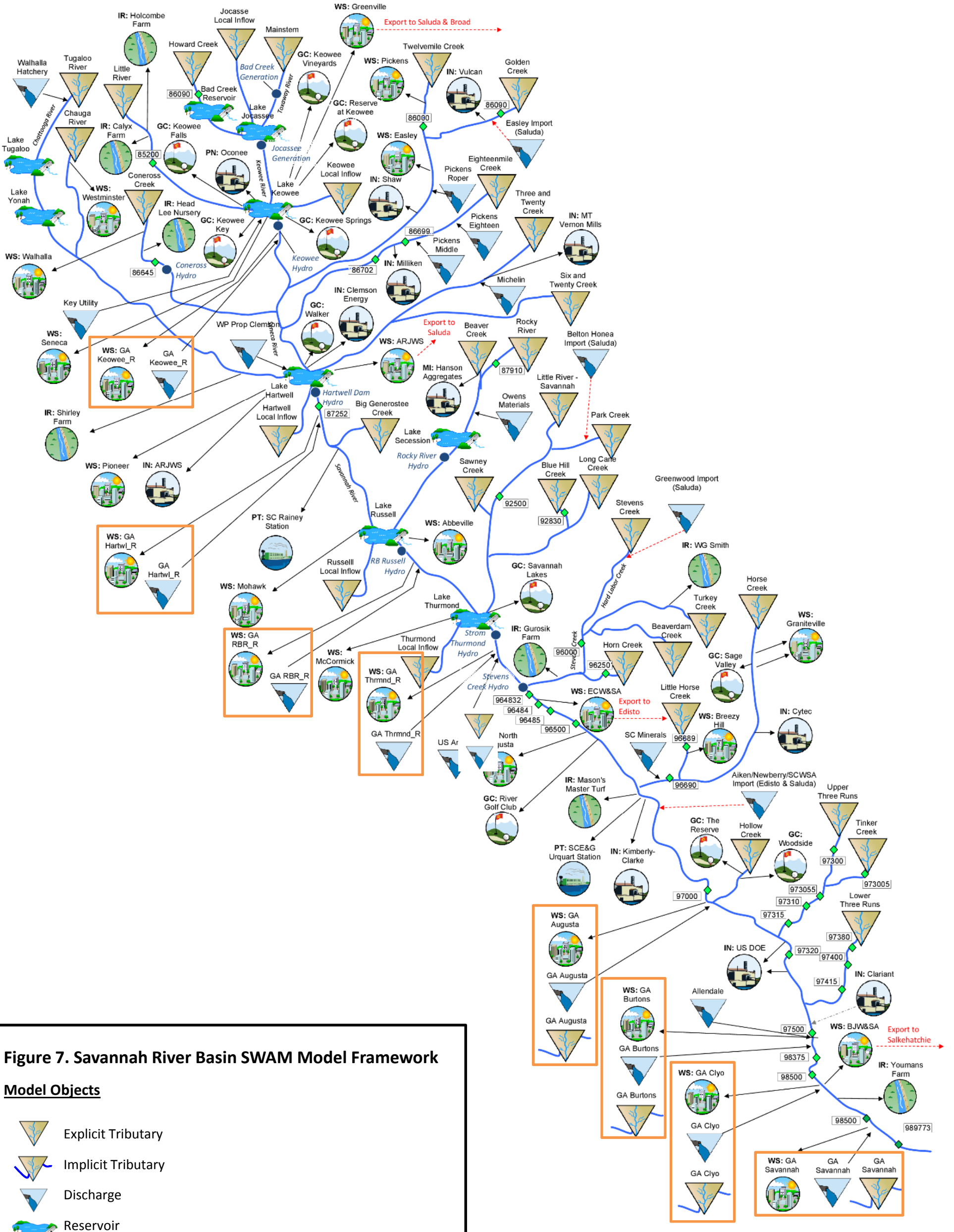

Figure 7. Savannah River Basin SWAM Model Framework

Model Objects

- Explicit Tributary
- Implicit Tributary
- Discharge
- Reservoir
- Current or Former USGS Stream Gage *(with last 5 to 6 digits of Gage ID)*

Water User Objects

- Municipal
- Agriculture (Irrigation)
- Thermoelectric or Nuclear
- Industrial or Mining
- Golf Course (Irrigation)
- Hydropower (not an object)

Aggregated Georgia Withdrawals, Discharges and Inflows

- Import or Export (Interbasin Transfer)
- Discharge from a Groundwater User*

** The associated Water User Object does not have a Surface Water Withdrawal.*

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