Addendum 1 – South Carolina State Water Planning Framework

Prepared by the Hydrology Section of the
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Description

This document describes major revisions to the South Carolina State Water Planning Framework since its initial publication in October 2019. Revisions are effective as of July 1st, 2021. To request additional information please contact Scott Harder (harders@dnr.sc.gov).

Summary of Major Revisions

1. Section 2.3.1 was revised to remove language regarding an assumption that all water users will withdrawal their full amount of water allowed under existing permits and registrations when evaluating water availability. This revision was made to make the language of this section consistent with the revisions highlighted in #2 below.
2. Section 4.2 was renamed Planning Scenario and Performance Measures. The term, Baseline Scenario, was removed from the document and replaced with a new term, Planning Scenario, defined as *the set of surface water and groundwater use data for the Planning Horizon that will be used by the RBC to develop its water management strategies*. The High Water-Demand Projection Scenario has been designated as the Planning Scenario for both surface water and groundwater. These revisions serve to shift the focus of evaluating future water availability over the Planning Horizon from the Permitted and Registered Surface Water Use Scenario and the Groundwater Permitted Use Scenario to the High Water-Demand Projection Scenario for both groundwater and surface water.
3. The formal definition for Performance Measures (Section 4.2) has been changed to *a quantitative measure of change in a user-defined condition used to assess the performance of a proposed water management strategy or combination of strategies, or to compare two water-use scenarios*. Performance Measures are no longer evaluated in reference to an established baseline, formerly designated as the Permitted and Registered Surface Water Use Scenario for surface water and the Permitted Groundwater Use Scenario for groundwater.
4. Sections 4.3.1.2 Permitted and Registered Surface Water Use Scenario and Section 4.3.1.3 Water-Demand Projection Scenarios were revised to reflect the removal of the term, Baseline Scenario, and the introduction of a new definition, Planning Scenario, as noted in #2 above. Similarly, language for Sections 4.4.1.3 and 4.4.1.4 regarding groundwater use scenarios was revised.
5. Sections 5.2 and 5.3 were updated to reflect the removal of the term, Baseline Scenario, and the introduction of a new definition, Planning Scenario, as noted in #2 above.

Revisions were specifically made to the outlines and contents of Chapters 5 and 6 of the River Basin Plan.

Full revised language for sections listed above:

Section 2.3.1 River Basin Plan Description

A **River Basin Plan** is *a collection of water management strategies supported by a summary of data and analyses designed to ensure the surface water and groundwater resources of a river basin will be available for all uses for years to come, even under drought conditions*. River Basin Plans will be developed for a 50-year planning horizon (**Planning Horizon**) and updated regularly. A River Basin Plan answers four questions:

1. What is the basin's current available water supply and demand?
2. What are the current permitted and registered water uses within the basin?
3. What will be the water demand in the basin throughout the Planning Horizon and will the available water supply be adequate to meet that demand?
4. What water management strategies will be employed in the basin to ensure the available supply meets or exceeds the projected demand throughout the Planning Horizon?

The first three questions are essentially technical in nature and can be addressed using information and tools available to planners. Answering the fourth question is the heart of the water-planning process and greatly benefits from cooperation and consensus among all stakeholders throughout the basin. A successful and equitable River Basin Plan addresses the effects all water users have on one another and on the resource. The River Basin Plans described in this document are intended to focus on water quantity issues; water quality concerns, however, may be highlighted when appropriate in a River Basin Plan. Water quality considerations will be more fully developed in later iterations of the River Basin Plans.

Section 4.2 Planning Scenario and Performance Measures (formerly Performance Measures)

The **Planning Scenario** is the set of surface water and groundwater use data for the Planning Horizon that will be used by the RBC to develop its water management strategies. The Planning Scenario is designated as the High Water-Demand Projection Scenario for both surface water (Section 4.3.1.3) and groundwater (Section 4.4.1.4).

To help evaluate the effectiveness of potential water management strategies or to compare two or more water use scenarios, **Performance Measures** will be developed by each RBC. A Performance Measure is defined as *a quantitative measure of change in a user-defined condition used to assess the performance of a proposed water management strategy or combination of strategies, or to compare two water-use scenarios*. Performance Measures

establish an objective means with which to compare a water-use scenario with a proposed management strategy to the same water-use scenario without the strategy incorporated. Performance Measures also provide an objective means which to compare two water use scenarios (comparing a scenario based on current water use to a scenario incorporating a projected water use, for example). The RBC may consider establishing a Minimum Increment of Significant Change (MISC) for each Performance Measure to indicate the degree of difference necessary before two management strategies being compared are considered to differ for that Performance Measure. Performance Measures may be applied in the evaluation of both surface and groundwater management strategies.

SCDNR can provide a set of Performance Measures for each RBC to consider in the comparison of model scenarios. RBCs can propose additional Performance Measures or propose modifications of SCDNR measures to reflect basin-specific or aquifer-specific issues. In developing measures, considerations for recreation, instream flow, low-flow statistics, groundwater level declines, economic factors, and the ability to increase water availability could be considered.

Specific examples for Performance Measures may include but are not limited to:

- Percent change in a monthly minimum flow or 5th percentile flow
- Percent change in Surface Water Supply
- Percent change in magnitude of Surface Water Shortages
- Percent of time a reservoir was in a low inflow protocol
- Percent of time recreational facilities were unavailable on a reservoir (public boat landings or public swimming areas, for example)
- Percent change in lowest reservoir elevation occurring during simulated period of record
- Changes in aquifer levels

Because **Minimum Instream Flow** is defined in the South Carolina Surface Water Withdrawal, Permitting, Use, and Reporting Act, RBCs should consider incorporating the following criterion as a Performance Measure when comparing surface water simulations. This Act defines the Minimum Instream Flow as "*… the flow that provides an adequate supply of water at the surface water withdrawal point to maintain the biological, chemical, and physical integrity of the stream taking into account the needs of downstream users, recreation, and navigation and that flow is set at forty percent of the mean annual daily flow for the months of January, February, March, and April; thirty percent of the mean annual daily flow for the months of May, June, and December; and twenty percent of the mean annual daily flow for the months of July through November for surface water withdrawers as described in Section 49 4 150(A)(1). For surface water withdrawal points located on a surface water segment downstream of and influenced by a*

licensed or otherwise flow controlled impoundment, "minimum instream flow" means the flow that provides an adequate supply of water at the surface water withdrawal point to maintain the biological, chemical, and physical integrity of the stream taking into account the needs of downstream users, recreation, and navigation and that flow is set in Section 49 4 150(A)(3)."

For streams not downstream of, or influenced by, a flow-controlled impoundment, streamflow levels will naturally decrease below the 20%, 30%, and 40% mean annual daily flows. Though in some cases the Minimum Instream Flow should be applied as a condition (see Section 4.3.2), the Minimum Instream Flow may be utilized as a Performance Measure instead using the change in the number and magnitude of excursions below the 20%, 30%, and 40% mean annual daily flows when comparing water management strategies. RBCs also can consider other Performance Measures for instream flows.

Specific Performance Measures used to compare groundwater management strategies may be limited to changes in aquifer levels simulated at existing monitoring wells, hypothetical wells, or as represented on potentiometric maps. Other conditions altered by pumping, such as changes in baseflow, water quality or subsidence, will be difficult to simulate with current models, but those conditions may be available as Performance Measures to the RBCs in the future.

RBCs may choose to designate **Strategic Nodes** to facilitate or simplify the comparison of model scenarios and associated Performance Measures. A Strategic Node is *an RBC-defined location on a surface water body or aquifer designated to evaluate the cumulative impacts of water management strategies for a given model scenario and serving as a primary point of interest from which to evaluate a model scenario's Performance Measures*. For surface water simulations, Strategic Nodes may be designated on a reservoir or a river segment of interest in the SWAM model. For groundwater simulations, a Strategic Node is designated by a monitoring well with which to evaluate groundwater levels in an aquifer.

Section 4.3.1.2 Permitted and Registered Surface Water Use Scenario

The **Permitted and Registered Surface Water Use Scenario** *incorporates the fully permitted or registered water use allowable under existing surface water permits and registrations for all water users*. These surface water simulations will provide information to the RBCs on the potential for Surface Water Shortages that might occur under a repeat of historic droughts in a basin if the maximum legally allowable amounts were withdrawn. The scenario would provide limited information on when such Surface Water Shortages may occur, but valuable information is provided on where Surface Water Shortages are likely to occur and whether surface water is currently over-allocated. The RBCs should compare the permitted and registered surface water use with the high water-demand projections as well as compare

simulation results between the two water-use scenarios. The comparison between these two scenarios may inform the RBC on the reasonableness of existing surface water permit and registration amounts.

Section 4.3.1.3 Water-Demand Projection Scenarios

Water-demand projections will be incorporated into the surface water simulations for the following scenarios:

1. **Business-as-Usual Water-Demand Projection Scenario** – *surface water simulation using a future water-demand projection based on the assumptions of a normal climate (i.e., average irrigation) and moderate population and economic growth*.
2. **High Water-Demand Projection Scenario** – *surface water simulation using a future water-demand projection based on the assumptions of a hot and dry climate (i.e., increased irrigation) and high population and economic growth*.

The two projection scenarios provide a reasonable lower and upper bound on the expected future surface water demand over the Planning Horizon. SWAM simulations incorporating the business-as-usual and high demand projection scenarios will provide information to the RBCs on when and where future Surface Water Shortages could possibly occur. RBCs are expected to evaluate future water availability over the Planning Horizon, and multiple simulations will be completed for each projection scenario at 5-and 10-year intervals to determine when future shortages, if any, may occur.

The evaluation of water-demand projection scenarios will inform RBC recommendations regarding the need for short- and long-term planning initiatives or Surface Water Management Strategies (Section 4.5.1). As discussed above, the High Water-Demand Projection Scenario is designated as the Planning Scenario and, hence, this scenario should be used as the basis for developing water management strategies to eliminate or mitigate Surface Water Shortages and/or increase Surface Water Supply. However, an RBC may propose additional future water-demand scenarios based on a set of assumptions different from those described above (a projection that incorporates more aggressive economic growth, for example; or a scenario that incorporates a high-demand projection for one category of water use and a low demand-projection for another category). SCDNR, in collaboration with the technical contractors, will be responsible for developing any additional water-demand projection datasets. RBCs will be required to describe the relevance of any additional water-demand projection scenarios. The identification of Surface Water Shortages will be documented for any new water-demand projection scenarios.

Section 4.4.1.3 Permitted Groundwater Use Scenario

The **Permitted Groundwater Use Scenario** *incorporates the fully permitted water use allowable under existing groundwater permits for all groundwater users in Capacity Use Areas*. This scenario also incorporates the maximum annual water use reported to SCDHEC by those groundwater users outside of Capacity Use Areas. This scenario simulates groundwater levels each year through 2070 if the total volume of groundwater that has been permitted in Capacity Use Areas and the maximum reported use outside of Capacity Use Areas is withdrawn every year from 2020 – 2070. This scenario can provide information to the RBCs on the cumulative effects permitted pumping rates will have on groundwater levels. Areas where future groundwater levels diverge significantly from predevelopment levels or from current levels may indicate Groundwater Areas of Concern or Groundwater Shortages that may require the development of Groundwater Management Strategies (Section 4.5.2) by the RBC.

The RBCs should compare the permitted groundwater use with the high water-demand projections as well as compare simulation results between the two water-use scenarios. The comparison between these two scenarios may inform the RBC on the reasonableness of existing groundwater permit amounts.

Section 4.4.1.4 Water-Demand Projection Scenarios

Water-demand projections will be incorporated into the groundwater simulations for the following scenarios:

1. **Business-as-usual Water-Demand Projection Scenario** – *groundwater simulation using a future water-demand projection based on the assumptions of a normal climate (i.e., average irrigation) and moderate population and economic growth*.
2. **High Water-Demand Projection Scenario** – *groundwater simulation using a future water-demand projection based on the assumptions of a hot and dry climate (i.e., increased irrigation) and high population and economic growth*.

The two projection scenarios provide a reasonable lower and upper bound on the expected future groundwater demand over the Planning Horizon. Simulations incorporating the business-as-usual and high demand projection scenarios will provide information to the RBCs on *when* and *where* future Groundwater Areas of Concern or Groundwater Shortages may occur. RBCs are expected to evaluate future water availability over the Planning Horizon and can evaluate groundwater availability in 5-and 10-year intervals to determine when Groundwater Areas of Concern or Groundwater Shortages, if any, may develop.

The evaluation of groundwater-demand projection scenarios will inform RBC recommendations regarding the need for short- and long-term planning initiatives or Groundwater Management Strategies (Section 4.5.2). As discussed above, the High Water-

Demand Projection Scenario is designated as the Planning Scenario and, hence, this scenario should be used as the basis for developing water management strategies to eliminate or mitigate Groundwater Shortages and/or increase Groundwater Supply. However, RBCs may propose additional water-demand projection scenarios based on a set of assumptions different from those described above (a projection incorporating more aggressive economic growth, for example). SCDNR, in collaboration with the technical contractors, will be responsible for developing any additional water-demand projection datasets. RBCs will be required to describe the relevance of any additional water-demand projection scenarios.

Section 5.2 Outline (Chapter 5 of River Basin Plan only)

CHAPTER 5. Comparison of Water Resource Availability and Water Demand

5.1 Methodology
- Surface water
- Groundwater

5.2 Performance Measures

5.3 Scenario Descriptions and Surface Water Simulation Results
- Planning Scenario (High Water-Demand Projection Scenario)
- Current Surface Water Use Scenario
- Permitted and Registered Surface Water Use Scenario
- Business-as-Usual Water-Demand Projection Scenario
- Other scenarios developed by RBC
- Reservoir Safe Yield analyses

5.4 Scenario Descriptions and Groundwater Simulation Results
- Planning Scenario (High Water-Demand Projection Scenario)
- Current Groundwater Use Scenario
- Permitted Groundwater Use Scenario
- Business-as-Usual Water-Demand Projection Scenario
- Other scenarios developed by RBC

5.5 Summary of Water Availability Assessments
- Surface water
- Groundwater

Section 5.3 Guidance Documentation (Chapters 5 and 6 of River Basin Plan only)

Chapter 5. Comparison of Water Resource Availability and Water Demand

This chapter, using Section 4 of the Planning Framework as a formal guide, will document the methods used to assess surface water and groundwater supply; will describe any Performance Measures used to evaluate scenarios; will describe the Planning Scenario as well as other scenarios used to inform planning; and will present the results of model simulations for each scenario, including the identification of any Surface or Groundwater Shortages, Reaches of Interest and Groundwater Areas of Concern.

5.1 Methodology – An overview of the methodologies, as outlined in Section 4 of the Planning Framework, for assessing Surface Water and Groundwater Supply, identifying shortages, and designating any Reaches of Interest or Groundwater Areas of Concern will be described. Definitions of key terms will be provided.

5.2 Performance Measures – Any Performance Measures and associated MISCs developed and applied by the RBC for the evaluation of simulated scenarios will be described along with the locations of any Strategic Nodes used in the analysis.

5.3 Scenario Descriptions and Surface Water Simulation Results – The Planning Scenario used to evaluate Surface Water Supply and any anticipated Surface Water Shortages, as well as the other scenarios described in Sections 4.3.1.1–4.3.1.3 used to inform planning, will be described. Simulation results for each scenario will be presented. At a minimum, this section will include the descriptions and simulation results for the four scenarios described in Section 4.3.1 of the Planning Framework. For each scenario, the following information will be provided:

- Detailed description
- Justification and description of any applied Surface Water Conditions on a stream that impact Surface Water Supply
- Locations and magnitudes of Surface Water Shortages
- Designation of any Reaches of Interest and associated justification

For any additional water-demand scenarios not explicitly described in Section 4.3.1 of the Planning Framework, the justification or motivation for why the scenario was evaluated by the RBC will be provided.

Any Reservoir Safe Yield determinations will be documented and will include information on the Surface Water Conditions applied on the reservoir or system of reservoirs and any other

assumptions made in the determination. Section 4 of the Planning Framework will be used as a guide for Reservoir Safe Yield determinations.

5.4 Scenario Descriptions and Groundwater Simulation Results – The Planning Scenario used to evaluate Groundwater Supply and any anticipated Groundwater Shortages, as well as the other scenarios described in Sections 4.3.1.1–4.3.1.3 used to inform planning should be presented. At a minimum, this section should include the descriptions and simulation results for the five scenarios described in Section 4.4.1 of the Planning Framework. For each scenario, the following information will be provided:

- Detailed description
- Justification and description of any applied Groundwater Conditions on an aquifer that impacts groundwater supply
- Locations and magnitudes of Ground Water Shortages
- Designation of any Groundwater Areas of Concern and associated justification

For any additional water-demand scenarios not explicitly described in Section 4.4.1 of the Planning Framework, the justification or motivation for why the scenario was evaluated by the RBC will be provided.

5.5 Summary of Water Availability Assessments – The key conclusions resulting from the assessments of water supply for both the surface and groundwater resources will be summarized with particular attention given to the Surface Water and Groundwater Shortages identified under the Planning Scenario. RBCs may prioritize the importance of Surface Water Shortages, Groundwater Shortages or Groundwater Areas of Concern if multiple shortages or areas of concern are identified. Similarly, RBCs may prioritize any designated Reaches of Interest if multiple reaches are identified. The summary also will provide sufficient detail to serve as the justification for the water management strategies proposed and evaluated in Chapter 6 of the River Basin Plan.

Chapter 6. Water Management Strategies

Chapter 6 describes proposed strategies developed by each RBC to address shortages or increase water supply identified or estimated from Planning Scenario simulations and documents the effectiveness and feasibility of each water management strategy or combination of strategies.

6.1 Surface Water Management Strategies – Each Surface Water Management Strategy proposed by the RBC to eliminate or reduce a Surface Water Shortage or increase Surface Water Supply as

estimated from the Planning Scenario will be described and evaluated. The section will be divided into four parts:

- A detailed description of each strategy, including a detailed description of how the strategy was incorporated into the surface or groundwater model will be given.
- Results from a technical evaluation, using the surface water model(s) to the extent possible, are presented and will include detailed documentation of the effectiveness of each strategy as outlined in Section 4.5.1 of the Planning Framework. Any Performance Measures used to evaluate the effectiveness of Surface Water Management Strategies will be summarized. Any shortages remaining after each Surface Water Management Strategy or combination of strategies is applied will be documented. Any impacts of the strategy on Reaches of Interest will be included as determined from established Performance Measures. The effectiveness of each proposed strategy will be documented in sufficient detail to provide justification for the final selection of recommended strategies. Though strategies are developed based on the simulations of the Planning Scenario, the effectiveness of the strategies in addressing shortages or increasing Surface Water Supply for other water-use scenarios described in Sections 4.3.1.1–4.3.1.3 should be documented as well.
- A description of the feasibility of each strategy as outlined in Section 4.5.1 of the Planning Framework will be given. Planning Level Costs (economic viability), environmental and socioeconomic impacts, legal constraints, and impacts on other River Basin Plans and other states will be included. Performance Measures may be applied to evaluate the feasibility of each strategy. Sufficient detail on the feasibility of each proposed strategy will be documented to provide justification for the final selection of recommended strategies.
- A cost-benefit analysis of each strategy to determine those strategies that provide a net benefit will be given. The cost-benefit analysis will consider both the effectiveness and feasibility of each strategy. The cost-benefit analysis also may be used to prioritize strategies.

6.2 Groundwater Management Strategies – Each Groundwater Management Strategy proposed by the RBC to address a Groundwater Shortage or Groundwater Area of Concern identified using the Planning Scenario will be described. The section should be divided into three parts:

- A detailed description of each strategy, including a detailed description of how the strategy was incorporated into the surface or groundwater model.

- Results from a technical evaluation, using the groundwater model(s) and/or surface water model(s) to the extent possible, are presented and will include detailed documentation of the effectiveness of each strategy as outlined in Section 4.5.2 of the Planning Framework. Any Performance Measures used to evaluate the effectiveness of Groundwater Management Strategies will be summarized by quantifying reductions in groundwater level declines. The effectiveness of each proposed strategy will be documented in sufficient detail to provide justification for the final selection of recommended strategies. Though strategies are developed based on the simulations of the Planning Scenario, the effectiveness of the strategies in reducing Groundwater Shortages or increasing Groundwater Supply for other water-use scenarios described in Sections 4.4.1.2–4.4.1.4 should be documented as well.
- A description of the feasibility of each strategy. Planning Level Costs (economic viability), environmental and socioeconomic impacts, legal constraints, and impacts on other River Basin Plans and other states will be considered. Performance Measures may be applied to evaluate the feasibility of each strategy. Sufficient detail on the feasibility of each proposed strategy will be documented to provide justification for the final selection of recommended strategies.
- A cost-benefit analysis of each strategy to determine those strategies that provide a net benefit. The cost-benefit analysis will consider both the effectiveness and feasibility of each strategy. The cost-benefit analysis also may be used to prioritize strategies.