Minutes of the Saluda RBC
August 16, 2023

RBC Members Present: Josie Newton, Rebecca Wade, Michael Waddell, Eddie Owen, KC Price, Larry Nates, Tate Davis, Mark Farris, Rick Huffman, Patrick Jackson, Rett Templeton, Robert Hanley, Katherine Amidon, Thompson Smith, Melanie Ruhlman, Devin Orr, Jeff Boss, Ed Bruce, Jason Davis, Kaleigh Sims, Paul Lewis, Brandon Grooms, Charlie Timmons, Jay Nicholson, & Kevin Miller

RBC Members Absent: Justin McGrady, David Coggins, David Lawrence (David Gobbel, alternate, present)

Planning Team Present: John Boyer, Kirk Westphal, Tom Walker, Jeff Allen, Scott Harder, Andy Wachob, Alexis Modzelesky, Joe Koon, Leigh Anne Monroe, & Hannah Hartley

Total Present: 48

K.C. Price called to order the August 16th, 2023, meeting of the Saluda RBC at 10:00 AM. He introduced the meeting structure and reviewed the meeting objectives, including learning about the methods for evaluating surface water availability and the Saluda River basin water quantity model (SWAM) and visiting the Laurens County Water and Sewer Commission Water Treatment Plant. He requested motions to approve the agenda, minutes, and summary documents from the previous meeting. The Saluda RBC members unanimously approved the RBC meeting agenda – Robert Hanley – 1st and Eddie Owen – 2nd.
The Saluda RBC also unanimously approved the last meeting minutes and summary – Tate Davis – 1st and Michael Waddell – 2nd. The housekeeping items and announcement include the introduction of a new RBC member Kaleigh Sims. Public comment – no public comments received. No agency comments received – Leigh Anne Monroe introduced a new DHEC team member – Alex.

July RBC Meeting Review (John Boyer)

John Boyer briefly recapped the July RBC meeting, including Water Use and Demand by Alex Pellett, SCDNR. We learned about 2022 reported surface water withdrawals (Thermoelectric 39%, Water Supply 48%, Industry 12%, Agr. Irrigation <1%, and Golf Course <1%). Bill Marshall, SCDNR, discussed the Middle and Lower Saluda Scenic Rivers, discussed the Purpose of the S.C Scenic River Act, Approach, and Lower Saluda Resource Protection Interest. We also heard from Elizabeth Miller about FERC Licensing of Hydroelectric Projects, which included SCDNR Interests and objectives in Hydro Project Licensing. The Hydroelectric projects highlighted are Saluda, Buzzards Roost, Ware Shoals, Lower Pelzer, Upper Pelzer, and Piedmont. We further heard from Jeff Boss on Greenville Water Release Criteria, where he talked about Table Rock Reservoir, with a storage volume of 9.52 billion gallons on 9,000 acres, and North Saluda Reservoir, with a storage volume of 25 billion gallons, 18,000 acres. We also heard from Julie Davis, Greenwood Co., who discussed Lake Greenwood Management, and Brandon McCartha, Dominion Energy,

which included County Lake Management Responsibilities. John further stated that a survey will be sent to members sometime next week, and the goal is to ensure members are comfortable with what they have learned so far.

Hydrology 101: Fundamentals of Surface Water Hydrology and Hydrology data (Kirk Westphal, CDM Smith).

Kirk Westphal facilitated this session, highlighting the purpose of this information. For the next 12 months, we will be viewing a lot of hydrologic data in various formats and for many purposes and the RBC will need to understand basic hydrology. The Water Cycle explains how water moves around our planet by the processes that include the water cycle landscapes, transports, and minerals and is essential to most life and ecosystems of the planet. The Hydrologic Cycle includes **Precipitation and Deposition,** which talks about water droplets falling from clouds as drizzle, rain, snow, or ice. **Condensation:** Water vapor rises and condenses as clouds, **Advection:** Wind moves clouds through the atmosphere. Hydrosphere Oceans: The oceans contain 97% of earth's water, **Accumulation, Snowmelt, Meltwater, Sublimation, Desublination/Deposition:** snow and ice accumulate. Later, melting back into liquid water or turns into vapor. **Plant Uptake, Interception, Transpiration:** plants take up water from the ground and later transpire it back into the air, **Surface Runoff, Channel Runoff, Reservoirs:** Water flow above ground as runoff, forming streams, rivers, swamps, pond, and lakes, and **Infiltration, Percolation, Subsurface Flow, Aquifer, Water Table, Seepage Spring, well:** Water is soaked into the ground, flows below it, and seeps back out **enriched** minerals. He explained that USGS provides the service for measuring hydrologic data, such as daily, monthly, and yearly flow measurements. Flow is measured in a river with a pressure transducer, which measures the depth of water. **Displaying Hydrologic Data:** basic streamflow of Hydrograph of Saluda River near Ware Shoals 10 years output from 2012 to 2023. This graph shows the linear scale relationship between the high and low flows. He also made a distinction between the daily vs. monthly flow, visualizing small differences (transformation to log scale, which helps us to understand the order of magnitude, shows us the dynamic and range of flows), Frequency and Magnitude of Shortage tell us whether the shortages are either agricultural or municipal, industrial withdrawals or a shortage in a reach of a river from a target flow level.

The Important Hydrologic Statistics:

7Q10: low flow metric, the lowest 7-day average flow that occurs once every 10 years.
Medium Monthly Flow: median value of all monthly average flows for a given month. The median flow is stationary.
Mean Monthly Flow: Average value of all monthly average flows for a given month. This flow goes upward.
Water Availability: Water is limited to the flow in the stream at any point in time. The "Safe Yield" is the amount of water that can be continuously withdrawn from a reservoir through the period of record without depletion. Generally higher than river withdrawal because storage buffers low flows. And by depletion, we mean accessible water was exhausted.

Kirk Westphal – Hydrology 101 Discussion
Q: How many USGS gages are there in the Saluda basin?

A: Low 30s to the confluence of the Broad River.
Q: How often are the gages calibrated?
A: Toby from the USGS site visits the gages throughout the year working on rating curves.
C: Once a month on the lower Saluda.

Methodologies For Evaluating Water Availability (Scott Harder, SCDNR):

Scott Harder facilitated this session, where he discussed the methods for evaluating water availability using a formal approach described in the planning framework in section 4, methodologies used in Texas for evaluating water availability and providing consistency (designates a common set of definitions and processes to use across the state). The Big Picture – gap analysis: The RBC will determine where and when demand exceeds supply under varying demand scenarios, deciding how to manage water to close the gaps.

Physically Available Surface Water Supply: This is the maximum amount of water occurring 100% of the time at a location on a surface water body, with no defined conditions applied on the surface water body.

Surface Water Conditions (20 cfs): Conditions that physically limit the amount of water that can be withdrawn from a surface water source and are independent of water demand.

Surface Water Supply (26 cfs): maximum amount of water available for withdrawal 100% of the time at a location on a surface water body without violating any applied surface water conditions on the surface water source and considering upstream demands.

Increased Demand Reduces Physically Available Surface Water Supply: 50-year water demand projection Scenario: a new period of record low flow (26 cfs).

Surface Water Shortage: This occurs when the water demand exceeds the surface water supply for any water user in the basin. Surface water condition is (20 cfs) and Surface water shortage (4 cfs). The new period of record low flow is (16 cfs).

Reach of Interest: A specific stream reach with no identified surface water shortage but experiences undesired environmental or otherwise impacts determined from current or future water demand scenarios or proposed water management strategies. We have Surface water condition of (20 cfs), and a new period of record of (21 cfs).

Reservoir Safe Yield is “the Surface Water Supply for a reservoir or system of reservoirs over the simulated hydrologic period of record.” Reservoir Safe Yield should be estimated for Lake Greenwood and Lake Murray- estimates for smaller reservoirs may considered as well but will depend on available streamflow gage data.

Discussion:

Q: Where would the surface water condition come from?
A: The RBC could come up with it, it could be related to various reasons to have the condition.
Q: Are those all reservoirs?
A: Yes, we have several in the SWAM figure.
Q: Lake Greenwood and Lake Murray have no safe yield studies?
A: Lake Greenwood , no. Lake Murray has some estimates.
A: Safe yield calculation will be impacted by inflows.
Q: Can you talk about safe yield in the rivers? How does it relate to safe yield in the lakes?
C: Not based on science but was a political decision. It is not safe.
Q: What is the difference?
A: Streams are looking at flows. Reservoirs (if they are FERC reservoirs) have specific license requirements and rules, etc. If not FERC, we look at the dead pool and inflow and outflow.
A: On a river the choice of the term safe yield was poorly chosen and is actually better defined as legally available water which is a more appropriate description. For planning it is not as much of concern.
C: It seems like it would be important for rivers since the water isn't there.
C: Safe yield wasn't based on science.
C: For our water demand projections we aren't seeing an issue at this point.
Q: How many intakes for drinking water are there on the Saluda river versus on a reservoir?
A: There are a few on the mainstem Saluda.
Q: Is there a map of all intakes?
A: The DHEC watershed atlas.
Q: How many are under FERC license?
A: We went over this last time – like 6 or 7.

Performance Measures: To facilitate analyses, RBC may also:

- Develop Performance Measures- quantitative measures of change in user-defined conditions used to assess the performance of a proposed water management strategy or condition of strategies or to compare two water use scenarios. For example, % change in monthly minimum flow, % change in surface water supply, % change in number and/ or magnitude of surface water shortages, and impacts on regulatory minimum instream flow(20-30-40% MDF).

Performance Measures- 20/30/40: SCDNR Instream Policy:
Based on studies completed in the 1980s by the Water Resources Commission and updated by SCDNR in 2009, **Coastal Plain:** 20% mean daily flow (MDF) between July- November, 40% MDF- May, June, December, and 60% MDF January- April. **Piedmont:** 20% mean daily flow (MDF): July- November, 30% MDF: May, June, and December, and 40% MDF: January -April.

- Minimum instream flow defined as the 20-30-40 MDF in surface water withdrawal, permitting, Use and Reporting Act (applies statewide).

Strategic Nodes: a location on a surface water body or aquifer designated to evaluate the cumulative impacts of water management strategies for a given model scenario and serves as a

primary point of interest from which to evaluate a model scenario's performance measures. Examples: USGS streamflow gage locations, outlets of tributaries of interest.

Discussion:
Q: For the nodes are we concerned with land use management? Water Quality?
A: You could put nodes that way and look forward.
C: You can always add nodes later.
C: The nodes are to present model output.
Q: What would be a good number of nodes?
A: 7-17 is the range in other basins which are in addition to gages we have.
Q: For high demand projections what are the assumptions? Growth in population? Economic growth?
A: Some of the slides from the last meeting discussed this such as high population growth with economic growth – bumped it up 10%.
Q; What is an example of a new supply?
A: A new reservoir.
C: Would like some future consideration and discussion on reaches of interest.
Q: Slide on reservoir safe yield wasn't in our packet, can you send? – Slide set is posted on the Saluda RBC meeting website.

Surface Water-Demand Scenarios:

- Planning Framework requires 4 scenarios to be reviewed by each RBC:
  1. Current Surface Water Use
  2. Permitted and Registered Water Use Scenario
  3. Moderate Water-Demand Projection
  4. High Water-Demand Projection.
- Optional scenario- simulation of unimpaired surface water hydrology
- Scenarios focus on "water demand" side as opposed to "water supply" side
- RBC can recommend additional water demand scenarios based on different assumptions used in existing projections.

Current Surface Water Use Scenario:

- Demand-based on Current water use is defined as the recent 10-year average (2010-2019) of reported water use.
- Simulates surface water supply and shortage resulting from a repeat of the historic drought of record under current withdrawal
- Shortages would highlight the need for short-term planning.

Permitted and Registered Water Use Scenario:

- Surface water supply estimated under this scenario denotes unallocated available water.
- Addresses whether surface water source is currently over-allocated.

- Water demand based on maximum legally allowable water use for surface water permits and registrations.

Water-demand Projections Scenarios:

- Provide information on when and where shortages are likely to occur. (50-year planning horizon and simulations completed in 5-10 year intervals).
- Two Scenarios: moderate water demand projection scenario based on a projection of water use assuming normal climate and moderate population and economic growth, and high water demand projection scenario based on projections of water use assuming drier conditions and high population and economic growth.

Process for Evaluating Surface Water Availability:

For each future water use scenario, CDM Smith runs the SWAM model, develops surface water management strategies, and uses the SWAM model to evaluate each strategy or combination of strategies. Surface water management strategy includes any proposed water management strategy to eliminate a surface water shortage, reduce water shortage, or increase surface water supply—examples: conservation measures, new supplies, conjunctive use, etc. River Basin Plan will document Surface Water Supply, shortages, Reaches of interest, and recommended surface water management strategy.

Discussion:
Q: Develop scenarios for performance measures?
A: Generally yes.
John Boyer: The RBC can decide if you want to apply performance measures – we will dive into the results in 2 – 3 meetings.

Introduction to the Saluda River Basin Surface Water Quantity Model (John Boyer):

John Boyer facilitated this session by defining what a Model is. A numerical model is a representation of a real-world system that can be solved with computation methods. Numerical models allow us to explore and consider possible futures. And most importantly, models should be as simple as possible and as complex as needed. The model we are using is called the "Simplified Water Allocation Model." It is relatively easy to learn and has an easy interface and built-in Microsoft Excel.

Saluda River Basin Surface Water Model Overview:

Water Allocation Modeling is water balance calculations of physical flow, water rights calculations of legally available flow, accounting of water demands, withdrawals, and return flows, accounting of reservoir storage and loss to evaporation, a representation of stream networks, multiple "nodes," and data intensive.
Water Allocation Modeling is not rainfall run-off calculations, hydrologic routing calculations, ground hydrology modeling, and water quality modeling.

Simplified Water Allocation Model (SWAM):

SWAM calculates physically and legally available water, diversions, storage, consumption, and return flows at user-defined nodes. From 2014 to 2017, all eight South Carolina surface water quantity models were built in the SWAM platform. Model updates were performed in 2021. In support of Saluda River Planning, the Model will be used to assess current availability and shortages across a range of hydrologic conditions (1925 through 2019-94 years), compare managed flows to natural flows, evaluate drought management plans, and test, evaluate and help prioritize water management strategies.

Model Inputs and Supporting Information:

- Model Inputs: USGS daily records, historical operational data, reservoir characteristics, and operating rules.
- Supporting Information: subbasin characteristics and drainage area land use and slope.

Discussion:
Q: Greenville county maintains gages throughout the county – any of that data useful for this model?
A: We haven't used but they might be useful if we have a gap in our model – could be useful for modeling.
C: The calculate discharge.
A: Might be worth considering – Woolpert has some data – last 10 years.
Q: This model is daily?
A: Monthly or daily but nothing finer than daily.
Q: North Saluda flows into the South Saluda in the map?
A: The schematic is a rough depiction.
Q: No rainfall/runoff model in SWAM right?
A: Correct, no rainfall/runoff.
Q: Could you try and quantify the uncertainty?
A: We haven't and it is difficult to do for this type of model.
C: Do you include mobile home parks?
A: If its small its probably not in there – small mobile home parks.
John Boyer: Does everyone want to see the unimpaired flow scenario?
R: Yes.
Q: In the current use scenario I saw an export to the Broad basin and export to the Savannah basin, are these included in the model?
A: Yes and also imports into the Saluda basin.
C: ARJWS imports/sells to Williamston from the Savannah.
C: From a recreation perspective that may be what we want to discuss.
C: That would probably be outside the scope of this work.

He further highlighted the Modeled Rivers and Streams, which explains how we are trying to model the major discharges throughout the basin. Permitted Surface Water Users show the reservoirs. We have 6 reservoirs demonstrated in the model.

Saluda River Basin Surface Water Model Framework:
SWAM Calculation: Supply

Physically available flow is a function of:

- Upstream tributary inflows
- Reach gains and losses
- Upstream diversions, withdrawals, returns, and storage.

Legally available flow is a function of :

- Permit limits/water rights
- Storage rights
- Minimum instream flow requirements
- Downstream priority water uses

SWAM Calculations: demand (Easley)

User Object: Node-based withdrawal and returns.

SWAM Calculations : Reservoirs:

Reservoir object: Dynamic water balance, water supply pool, customized operating rules. For example, Lake Murray Normal Operating Storage Curve.

Model Calibration:

- Calibration performed for multiple sites across a wide range of hydrologic conditions.
- Key calibration parameters= reach gain/loss factors (hydrology).

Some calibration examples discussed are the comparison of mean daily and Monthly Gaged and Modeled Flows and the Comparison of Measured and Modeled Lake Levels. Calibrations enable us to ascertain confidence in the model.

2021 Surface Water Model Updates:

Extended baseline hydrological through 2019 (added 6 years), updated monthly mean water demands based on recent water use data, updated permit, and intake location information, removed inactive permittees, and added new registration and software updates.

Model Limitations:

- Greater uncertainty in predictions for ungaged reaches compared to gaged.
- Model not designated for reach routing of flow changes at a sub-daily time step.
- Greater uncertainty in supply availability and shortage predictions is associated with small stream withdrawal compared to larger river and reservoir withdrawal.

Surface Water Scenarios: Base Scenarios:

- Current Surface Water Use Scenario
- Permitted and Registered Surface Water Use Scenario
- Moderate Water Demand Projection Scenario
- High Water Demand Projection Scenario

Evaluating Projected demands: (90+ years of Hydrologic Records), 2070 demand projections are applied to the entire period of hydrologic record.

Performance Measures: Assessment of simulation results will focus on quantifying key performance measures for strategic nodes and reaches of interest across the basin.

Reaches of Interest: Specific stream reaches that may have no identified Surface Water Shortage but experience undesired impacts, environment or otherwise, determined from current or future water-demand scenarios or proposed water management strategies.

Saluda Water Quantity Model Training: Training for interested RBC members will occur on Tuesday, October 3, beginning at 10 a.m. in Columbia (Wells Fargo Building, 1441 Main Street). A laptop will be provided, lunch, and exercises to work through.
Discussion:
C: That's the week of the WEFTEC conference in Chicago.
C: Any chance you can have the training up in Greenville?
C: Would people prefer having the training in the upstate? – Almost all prefer near Columbia? Fred Castles (PPAC member) is also interested in the SWAM training.

Demand Projections Update (Alex Pellett, SCDNR)
As requested by the RBC member, here is a write-up of my comments at the Saluda RBC meeting today.

Projection Scenarios
Moderate:

I like to think of this as "Moderate Growth" because almost all water users in the major sectors are projected to increase withdrawals in this scenario. The exception is some rural counties where the Office of Revenue and Fiscal Affairs projects a decline in population, I go with those projections out to 2035, and then I flat-line them.

High:

For surface water, I think of this as "High Demand X High Growth". Whereas the Moderate scenario is based on the median withdrawal for each water user for each calendar month, the High scenario is based on the maximum withdrawal for each water user for each calendar month. So, that's an assumption that every single water user is using the most they've used historically (over the calibration period). And then, the projections of high growth are applied to that.

Sectors
Golf – no projected change.
Agriculture – projected growth of roughly 0.7% compounded annually, a bit less for moderate scenario (0.65%), a bit more for the high scenario (0.73%).
Industry – projected according to US Energy Information Agency projections of economic growth. Industrial water use has actually been declining as we get more efficient, and water use per dollar of output has declined as we produce higher value goods. Therefore, this projection is rather conservative in terms of planning for water availability.
Thermo-electric – water demand will be projected according to the long-term plans developed by the utility companies.
Public Supply – There were some comments at the last meeting regarding my numbers for per capita water use. My numbers represent "system-wide" withdrawals and populations served. Per capita water use is an industry term reserved for domestic water use, so I need to adjust my terminology to avoid confusion. There is additional information forthcoming regarding

wholesale volumes and water supply service areas. I am not sure whether I'll be able to incorporate that information in to revised projection methods, but I'll try.
Question:
Q: Can we get a written summary of your talking points?
A: Yes

Upcoming Meeting Schedule and Topics (John Boyer):
Saluda RBC Meeting #7- Wednesday, September 20, 2023- Dominion Energy Facility, Lake Murray.
Q: Can the public come to the meeting?
A: Yes.
Information Topic (Tentative):
SWAM Model Results, Current Use,
Recommendations for Flow-Ecology Relationships
Discussion and other items: Look for the Phase 1 survey, including an invitation to RSVP for SWAM Training on October 3.
Meeting conclusion: Jason Davis – 1st and Jeff Boss 2nd
12:42 pm.

Minutes: Iffy Ogbekene and Tom Walker
Approved: 9/20/23

RBC Chat:
11:26:21 From Thomas Walker To Everyone:
9 minute break 11:35 return.
12:27:10 From Fred Castles To Everyone:
John, I would be interested in attending as a PPAC member.
12:29:03 From Thomas Walker To Everyone:
thanks fred, i mentioned it to him
12:42:36 From Thomas Walker To Everyone:
meeting adjourned