Kickoff Meeting – Yadkin-Pee Dee/Lumber River Basin Hydrologic Model

March 4, 2020

Concept of Basin Hydrologic Model

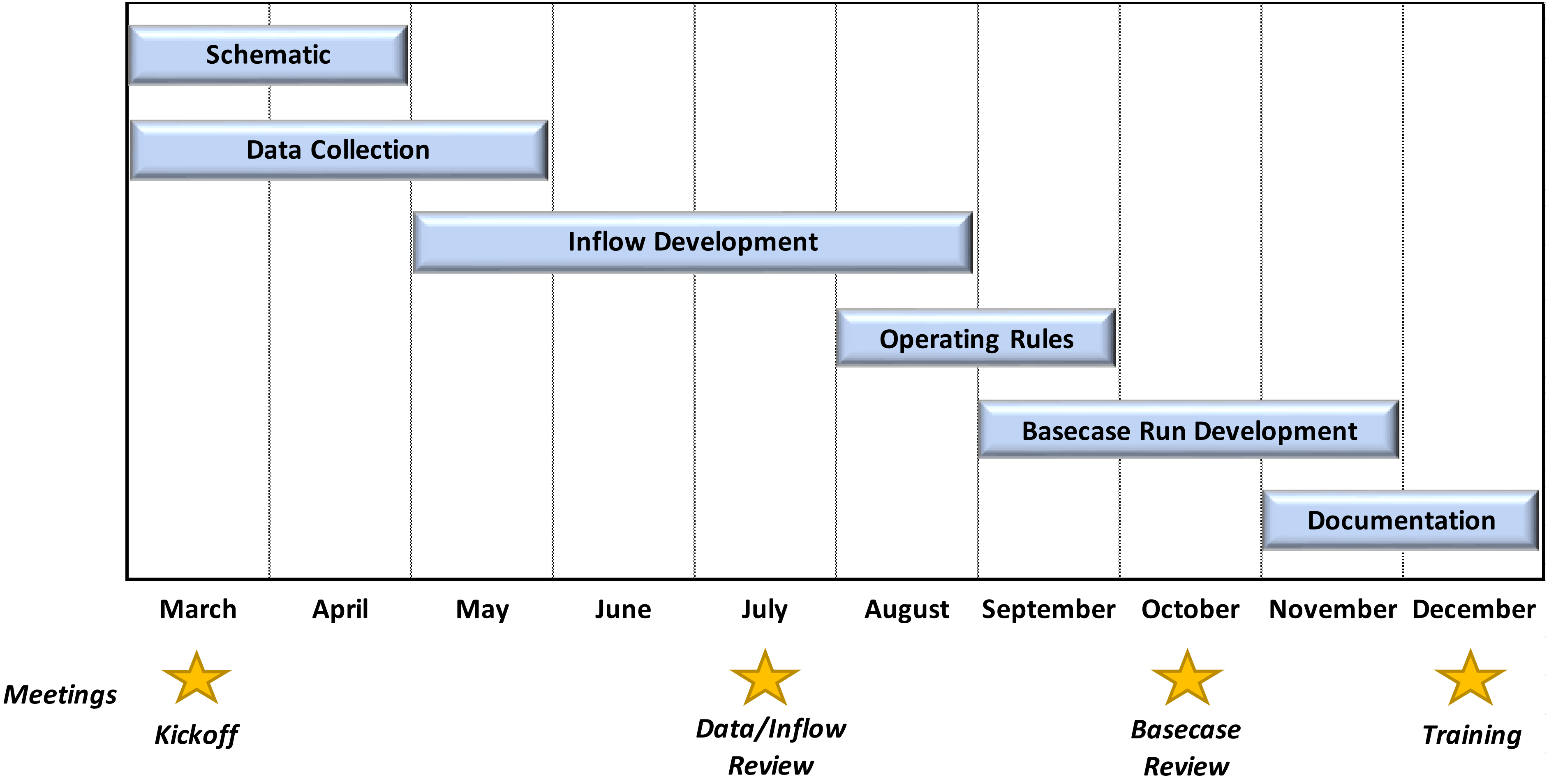
- River basin model at the finest practical geographic resolution and timestep
  - **Nodes for: reservoirs, withdrawals, discharges, USGS gages, minimum instream flows, and other points important to DWR/stakeholders**
  - **Daily timestep**

- Possible Uses
  - **Evaluation of the cumulative effects of municipal water supply plans**
  - **Evaluation of inter-basin transfer permit applications**
  - **Development of individual water supply plans**
    - *Model will be on the DWR server and available to stakeholders and their consultants*
  - **A platform for developing risk-based drought plans**

Modeling Process

- Develop schematic
- Collect impairment and operating data
- Generate inflows
- Develop performance measures
- Develop “basecase” scenario of current basin conditions
- Provide documentation, set up stakeholder accounts, and train users on model (OASIS)
  - **Stakeholder access promotes use of model**

Project Timeline

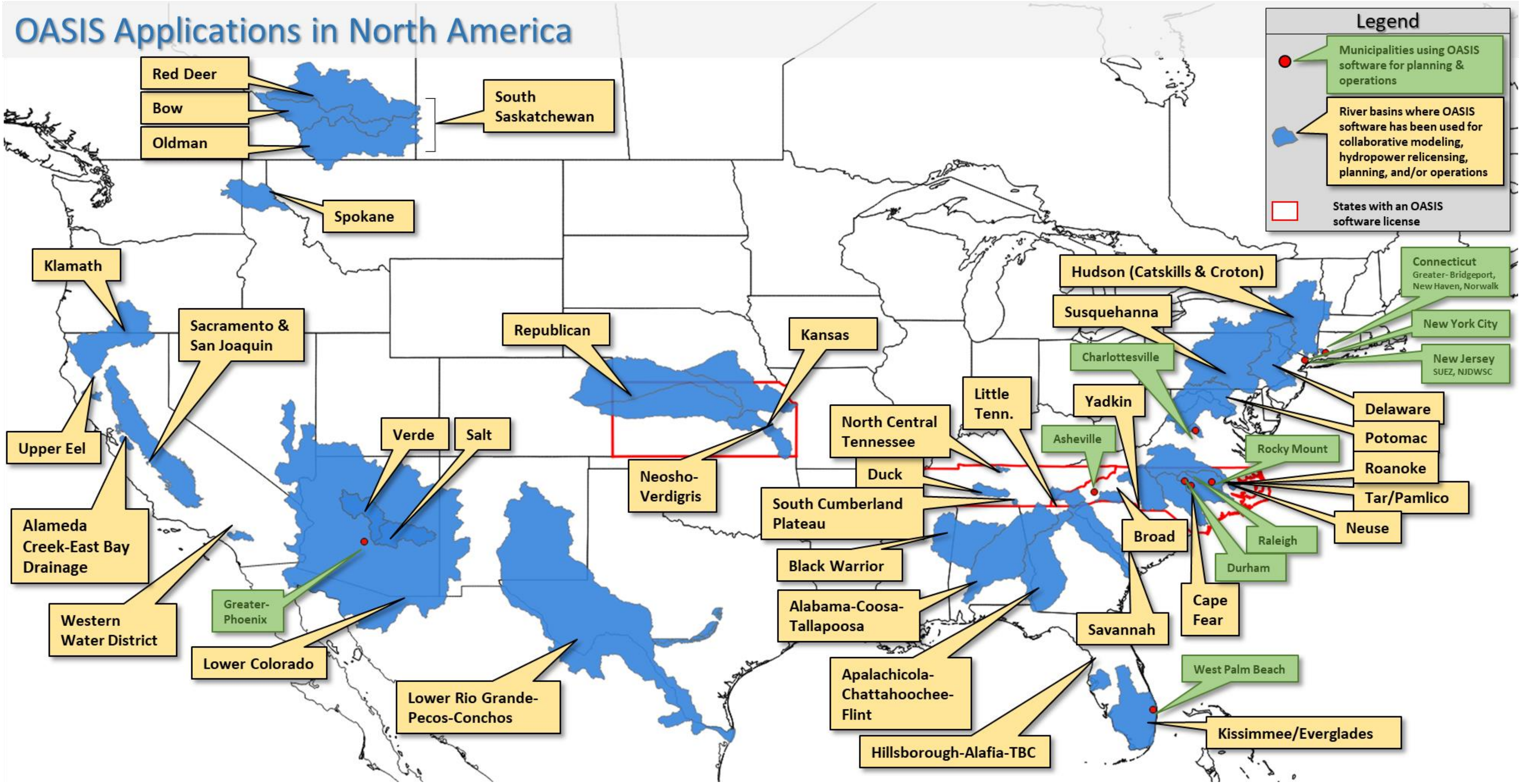


What is OASIS?

Operational Analysis and Simulation of Integrated Systems

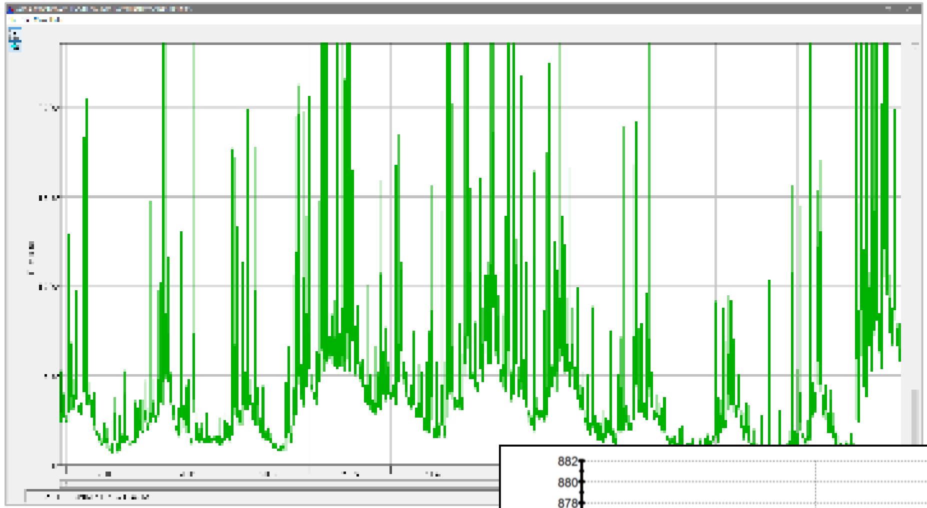
- A patented, mass balance, water resources simulation/optimization model
- Purposes:
  - **Alternatives evaluation (planning)**
  - **Real-time operations**
- Used in:
  - **Water allocation/conflict resolution (drought management)**
  - **Water supply planning and operations**

Modeling Experience

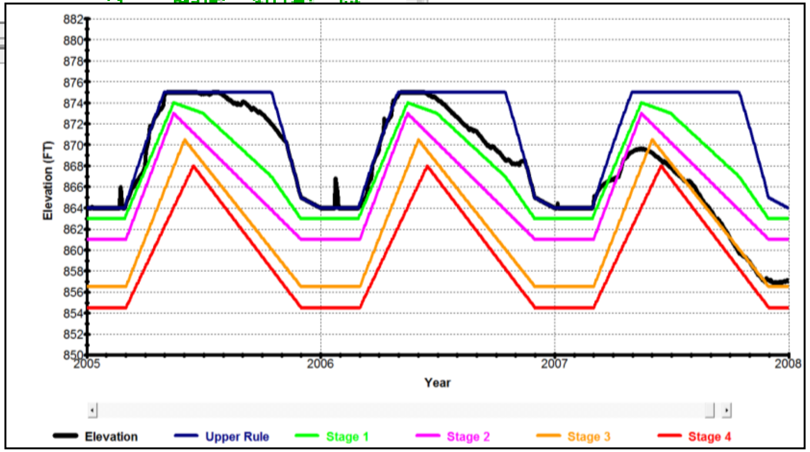


Model Input

- Time series data
  - Unregulated inflows
  - Evaporation
  - Precipitation



- Static data
  - Physical data
    - *Reservoir SAE, turbine characteristics, channel capacities, etc.*
  - Withdrawals, discharges, demands



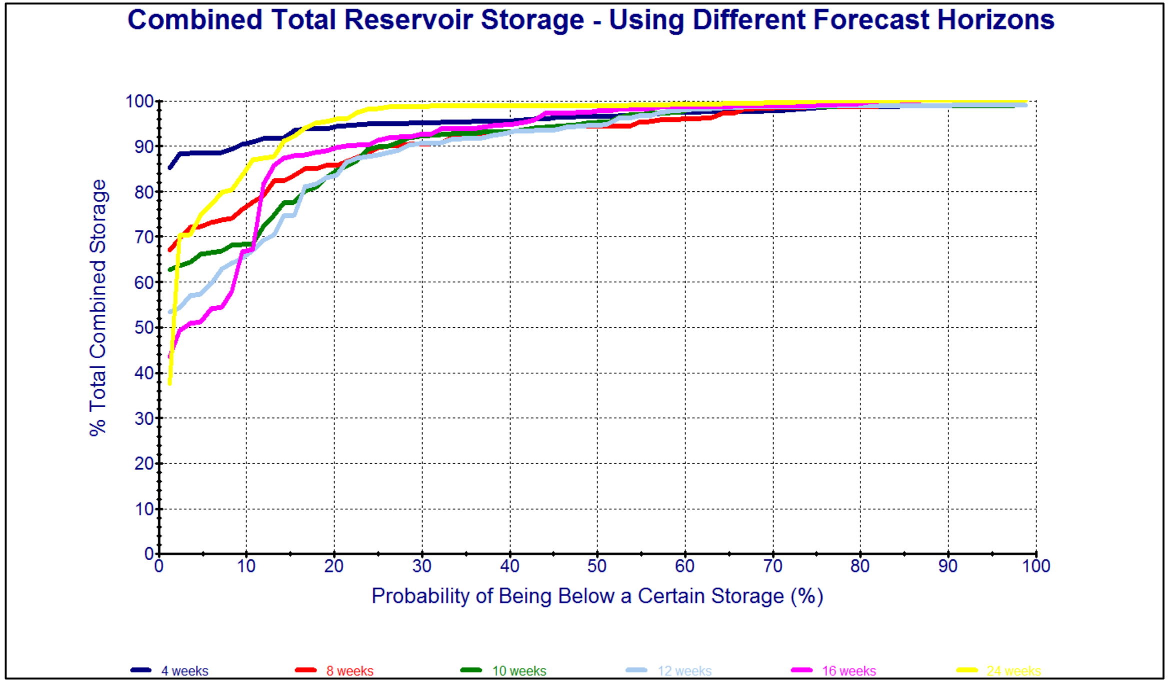
- Operating Data, e.g.
  - Rule curves
  - Minimum releases/environmental flows
  - Drought and flood management policies

Model Output

- Tables and graphs of
  - Flow
  - Storage, and
  - *Derived attributes*, e.g. habitat availability, energy, revenue, water supply shortages, recreation days, etc.

for every time step

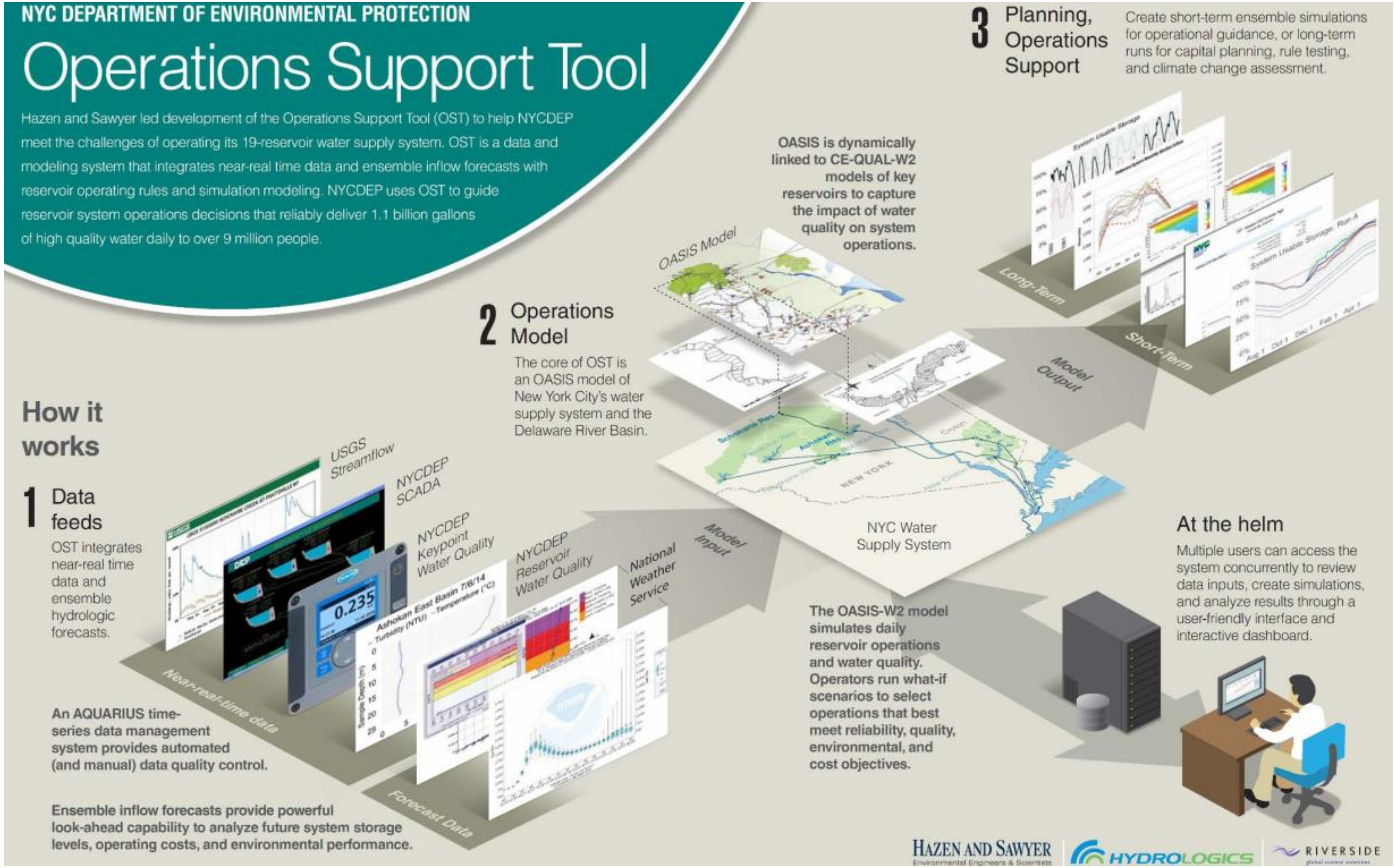
at every point in the system



Examples

- Yadkin – Pee Dee
  - Alcoa (APGI) relicensing
  - Coordinated with Progress Energy and DTA (CHEOPS)
- Broad
  - Coordinated with Duke Energy and HDR (CHEOPS)
- Roanoke
  - Dominion Energy
  - Corps of Engineers
  - American Electric Power

Examples:
New York City



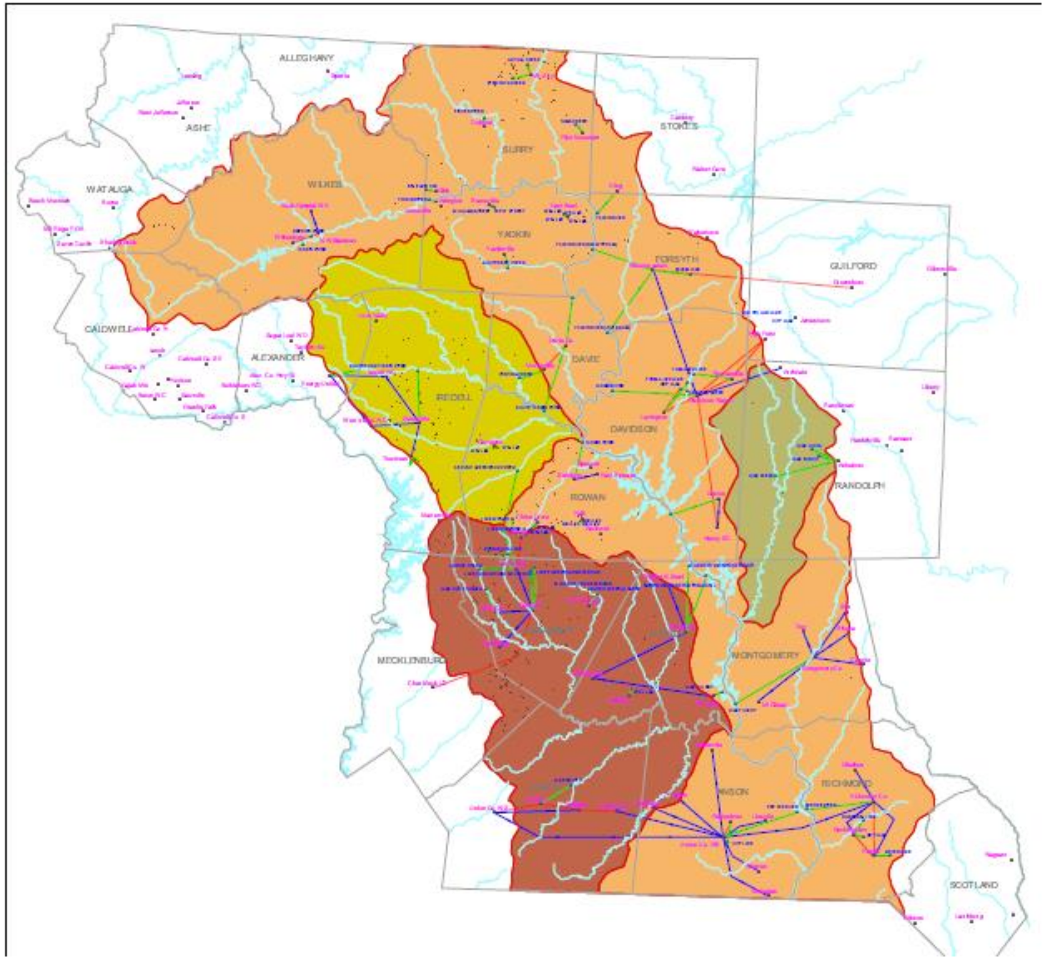
Demonstration of OASIS (Using Classic)

Data Collection

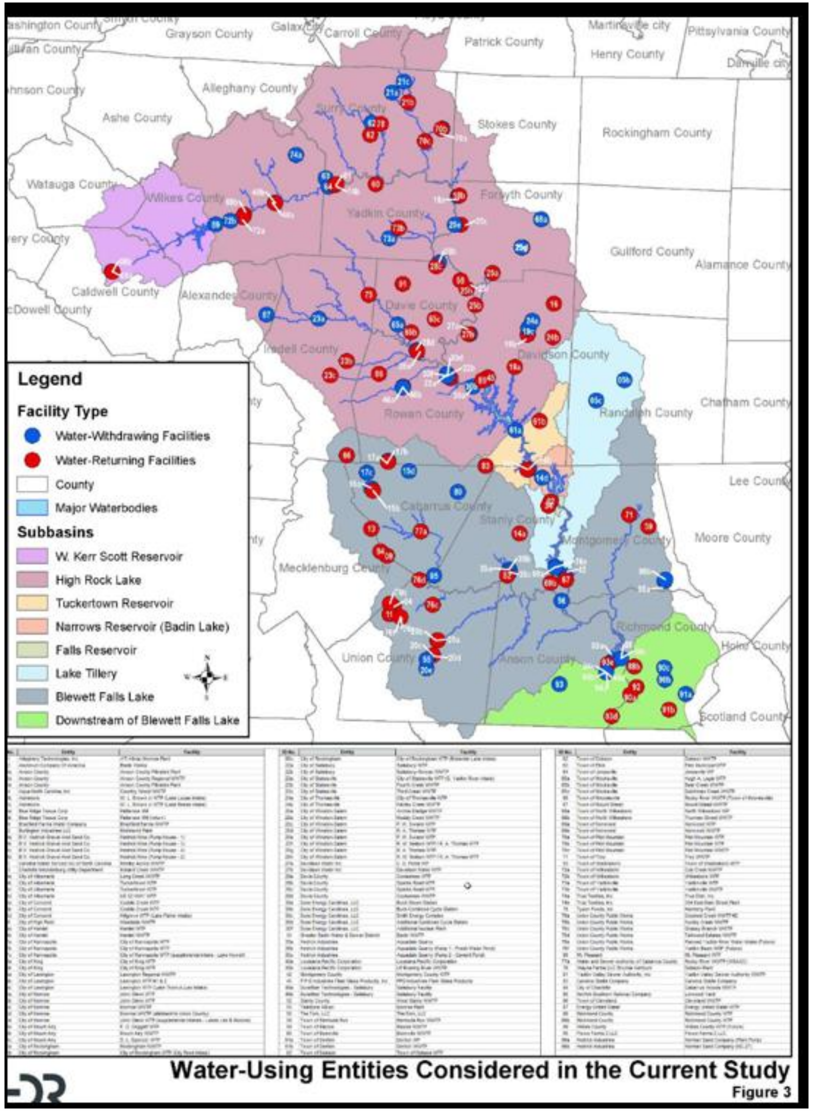
- Use to develop daily inflow record extending from 1930 to 2019
- Geographic scope from headwaters to state line (or the nearest gage)

Water withdrawal and wastewater returns

- Water withdrawals for municipal and industrial (over 100,000 gpd)
  - DWR databases for Water Withdrawals and Transfers and Local Water Supply Plans
  - Water withdrawals are net of any groundwater use
  - Contact facilities for additional data
- Wastewater returns for municipal and industrial (over 100,000 gpd)
  - Include those users that rely on groundwater for water supply
  - NPDES databases
  - Contact facilities for additional data
- Agricultural use: surface water irrigation based on acreage, net of rainfall, and livestock counts, both net of groundwater use
  - Ag extension agencies; USGS and others
- Extrapolate back in time (factoring in facility starts)
  - Based on population, economic, and power generation data (municipal and industrial)
  - Based on historic acreage, livestock, and climate (agricultural)
- Coordinate with YRBWMG in terms of data collected



Lumber not included yet

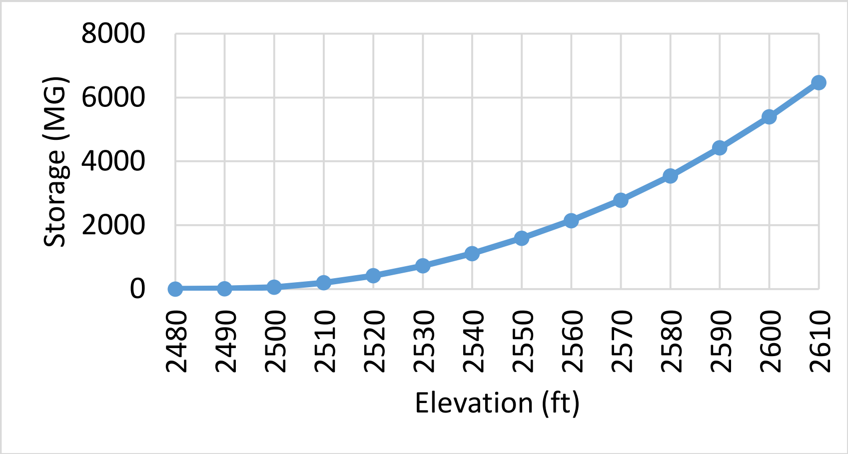


Operating Protocols

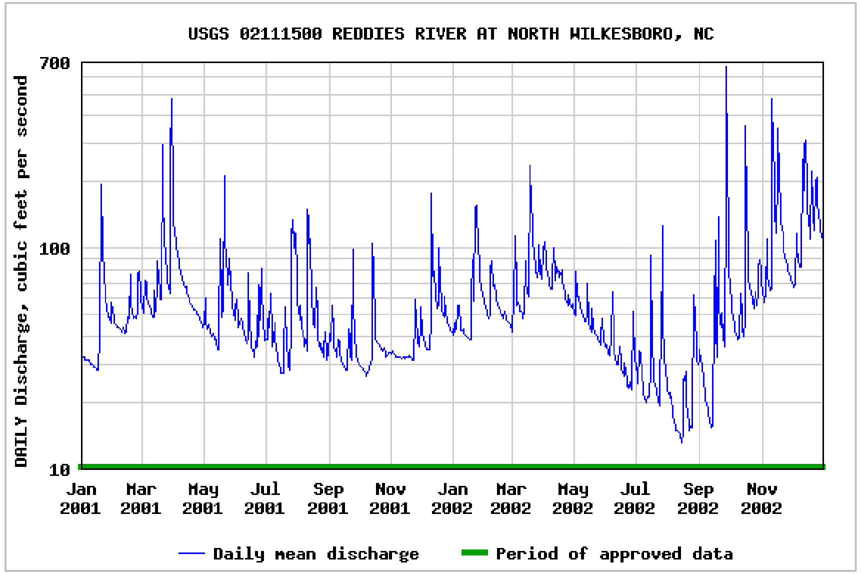
- FERC license agreements, including minimum releases and drought response plans
  - **Coordinate with HDR on hydropower operations in CHEOPS model**
- Utility drought plans (Water Shortage Response Plans)
- Facility operations, including hydro facilities (e.g., rule curves)
- Annual average and monthly patterns for municipal and industrial demands and discharges
- Additional system information from Local Water Supply Plans

Other

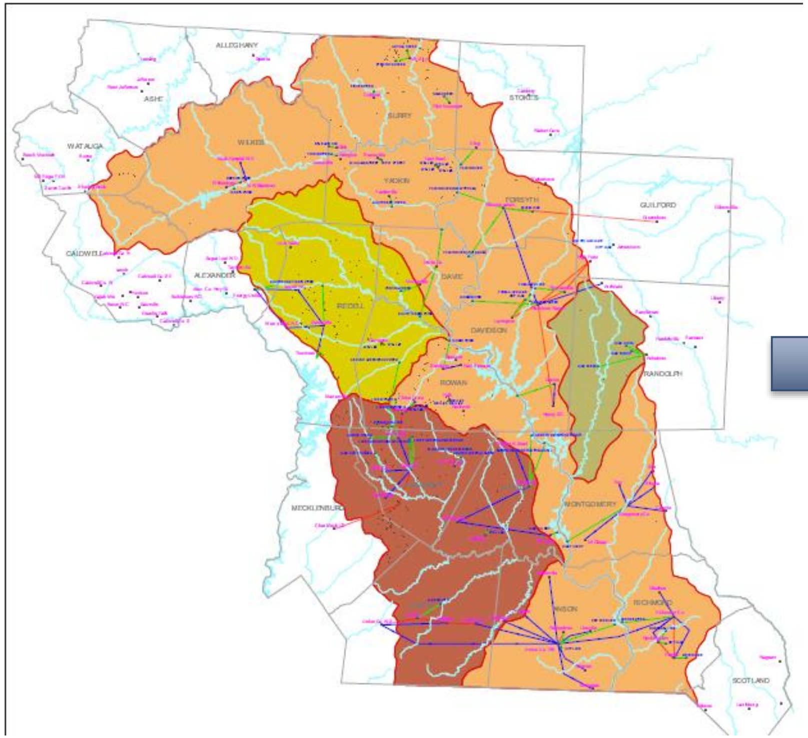
- "Static"
  - Storage, area, elevation curves for reservoirs
  - Maximum pumping and treatment capacity
  - Turbine curves

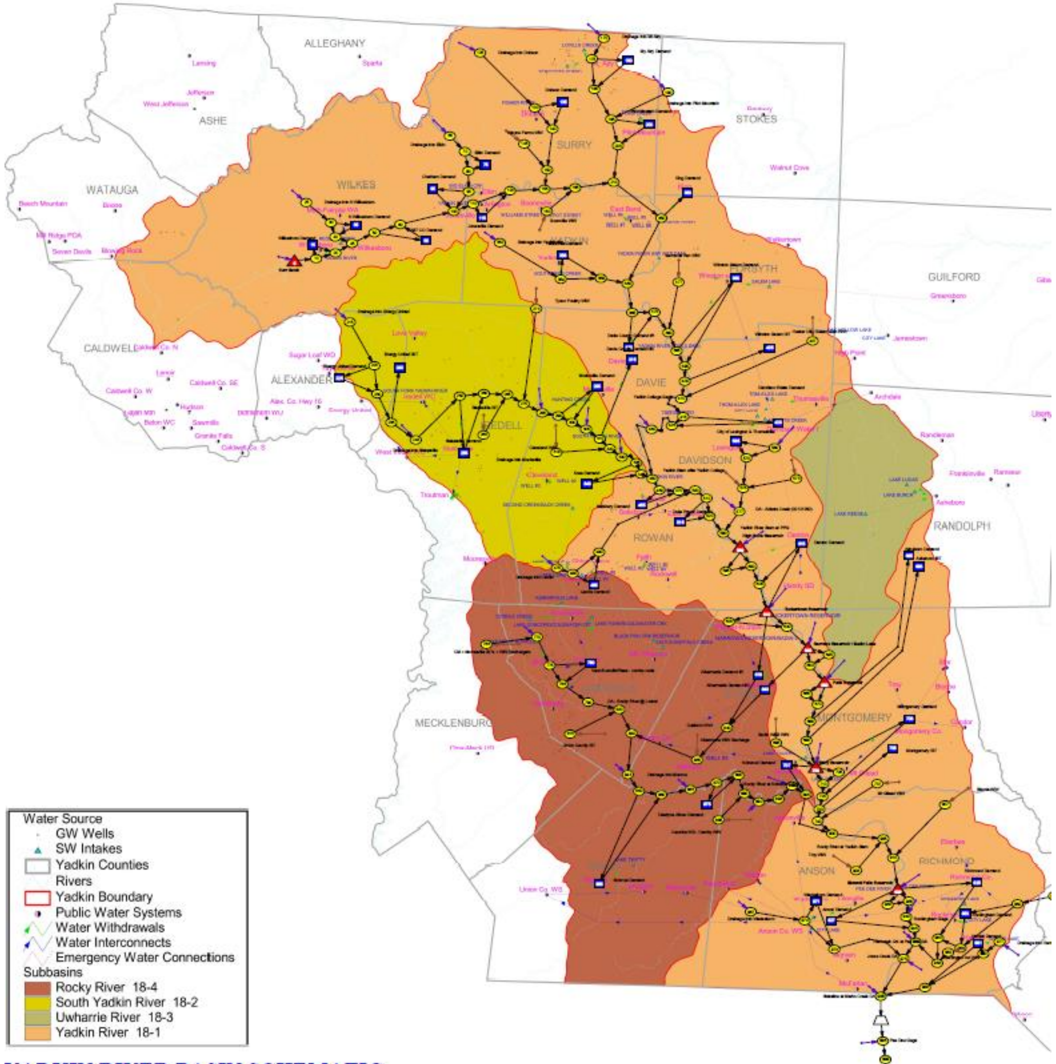


- Timeseries
  - Precipitation and evaporation
  - Gaging data
  - Historic reservoir storage/elevation and outflows



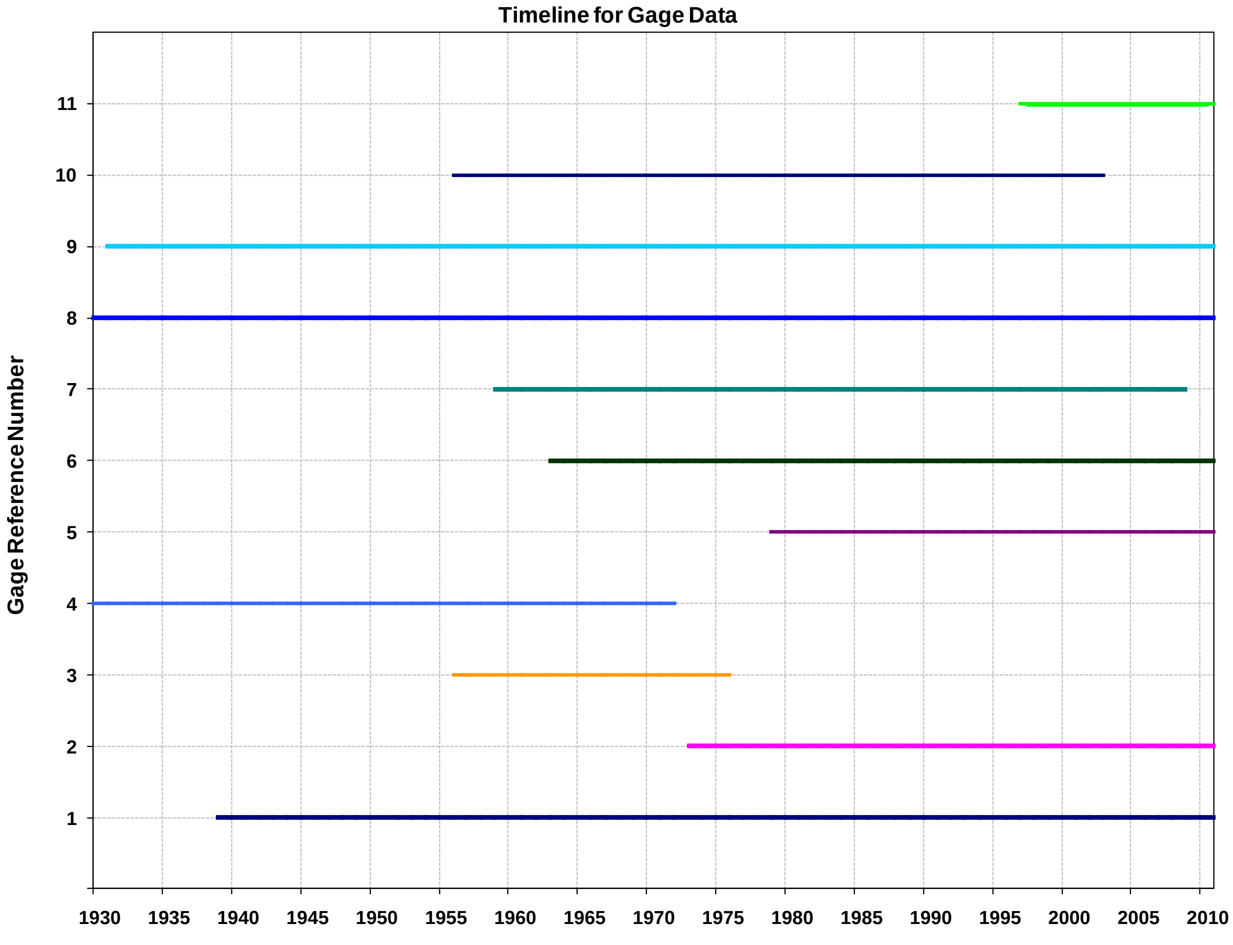
Schematic Development



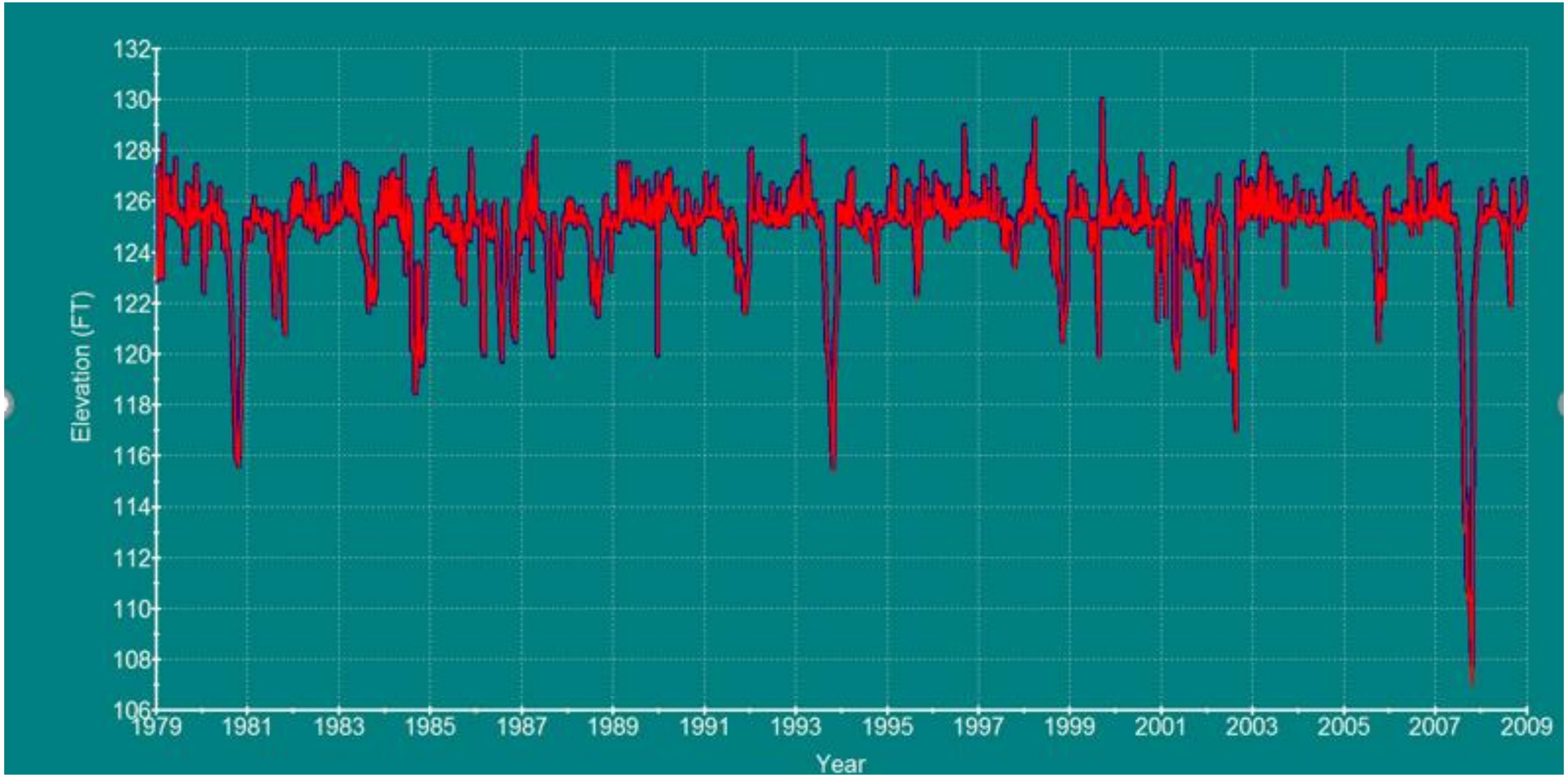


YADKIN RIVER BASIN SCHEMATIC

Inflow Development (Matching at Gages)



Model Development (Sample of Output)



Next Steps

- Coordinate with Technical Review Committee
- Send out data request (in coordination with DWR) and follow-up with users for additional information
- Develop model schematic
- Optional: set up a data repository on SharePoint
- Next meetings
  - **Data collection and inflows (summer)**
  - **Preliminary review of basecase model run (fall)**
  - **Training (winter)**