

Development of Basinwide Surface-Water Quantity Models in South Carolina – A Status Report

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Land, Water and Conservation Division
S.C. Department of Natural Resources



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South Carolina Water Plan

Second Edition

2004

South Carolina Department
of Natural Resources

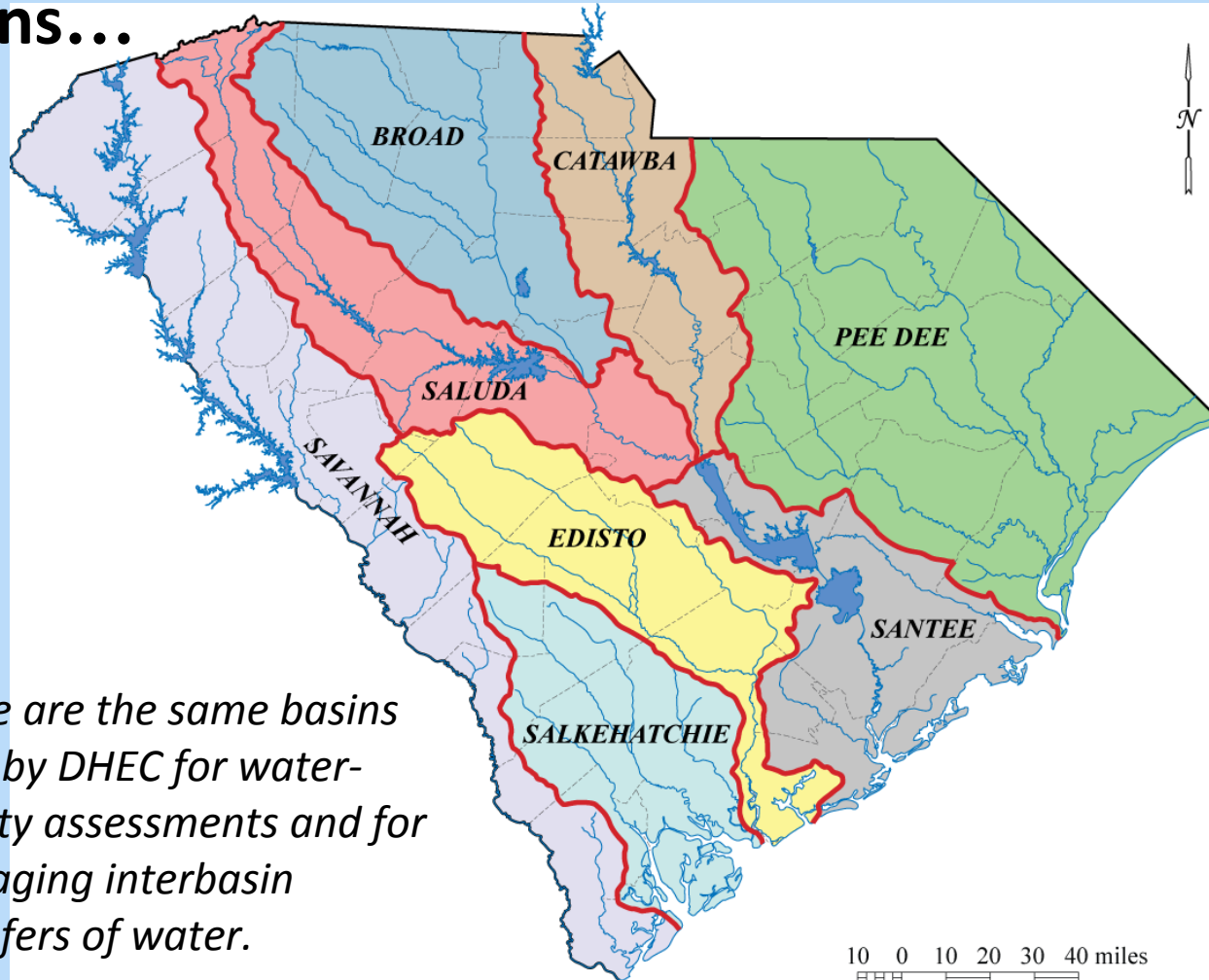
Land, Water and Conservation Division



In 2004, DNR published the second edition of the South Carolina Water Plan incorporating lessons learned from the drought of 1998-2002.

One recommendation is for the development of regional water plans for each major river basin in the State.

Regional water plans...



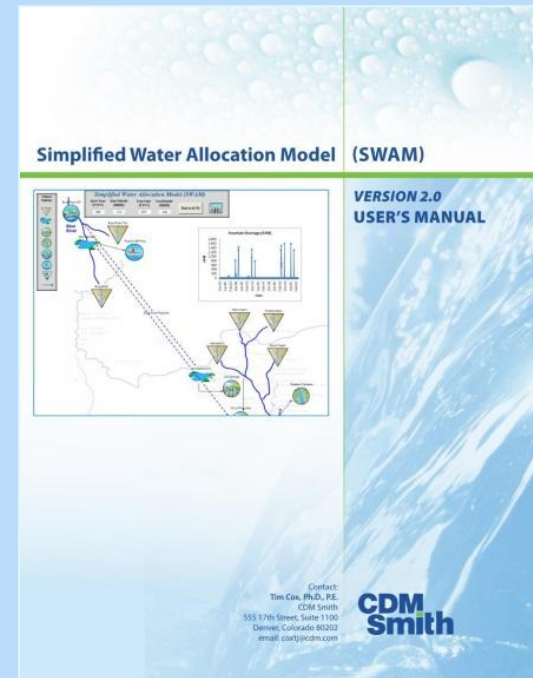
These are the same basins used by DHEC for water-quality assessments and for managing interbasin transfers of water.

Surface-water quantity models

- Determine surface-water availability
- Predict where and when future water shortages would occur
- Test alternative water management strategies and “what-if” scenarios
- Resolve water disputes
- Consolidate hydrologic data

- A Request for Proposals (RFP) was recently advertised and a contract was awarded to CDM Smith, Inc. to develop the models.
- Unimpaired inflow datasets will be developed for each basin and a baseline model using current conditions will be provided.
- A stakeholder process will be facilitated by an outside entity (TBD) with support from DNR, DHEC, and the contractor.

CDM Smith's Simplified Water Allocation Model (SWAM) will be used to create the models.

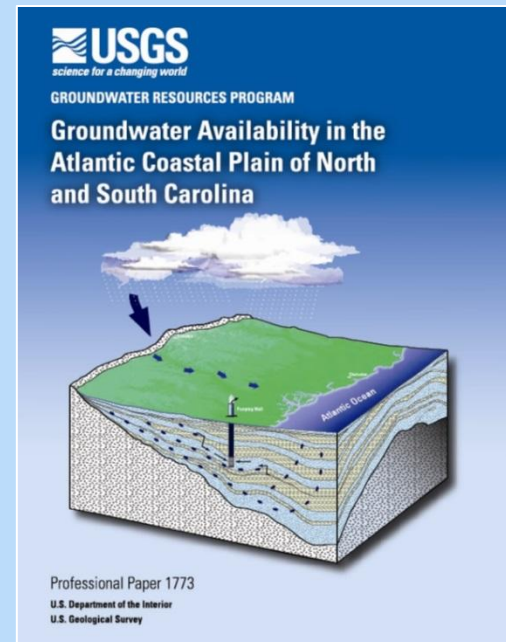


Step 2...

Groundwater flow models

Groundwater models will be used to predict water-level declines, recharge rates, and impacts of groundwater withdrawals on aquifers, streamflows, and on other users in the basin.

A groundwater availability study of the Coastal Plain and a flow model were developed by the U.S. Geological Survey in 2010.



Step 3...

Water-demand forecasts

- Water-demand forecasts will be made for agriculture, energy, industry, and public-supply at 5-10 year intervals over a 50-year planning period.
- It has yet to be determined who will do this work.

Step 4...

Regional water plans

Upon completion of the models and forecasts and with oversight from State agencies, stakeholders will be asked to begin the process of developing regional water plans for each of the eight basins.

Among other things, the plans will contain:

- Current and projected water demands
- An assessment of existing surface and groundwater supplies
- An evaluation of water supply and demand to determine if a surplus or deficit will occur over the planning horizon
- Water management strategies to meet the future demands
- Water conservation and drought management recommendations

Step 5...

State water plan

Upon completion of the regional water plans, the State water plan will be updated by DNR based on information and recommendations made in the regional plans.

Among other things, the State water plan will:

- Assess the overall condition of the water resources of the State
- Summarize and evaluate statewide trends in water use, water demand, and water availability
- Offer water-resource policy and program recommendations
- Prioritize water-resource needs of the State
- Introduce innovative practices

Water Planning Webpage




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- Water Plan (2004 Report)
- White Papers
- Hydrology Section

Water Planning in South Carolina



The South Carolina [Water Resources Planning and Coordination Act of 1967](#) assigned the overall responsibility for developing a comprehensive water resources policy for the State, including coordination of policies and activities among State departments and agencies, to the South Carolina Water Resources Commission. As part of government restructuring, this act was amended in 1993, and these responsibilities were placed with the South Carolina Department of Natural Resources (DNR).

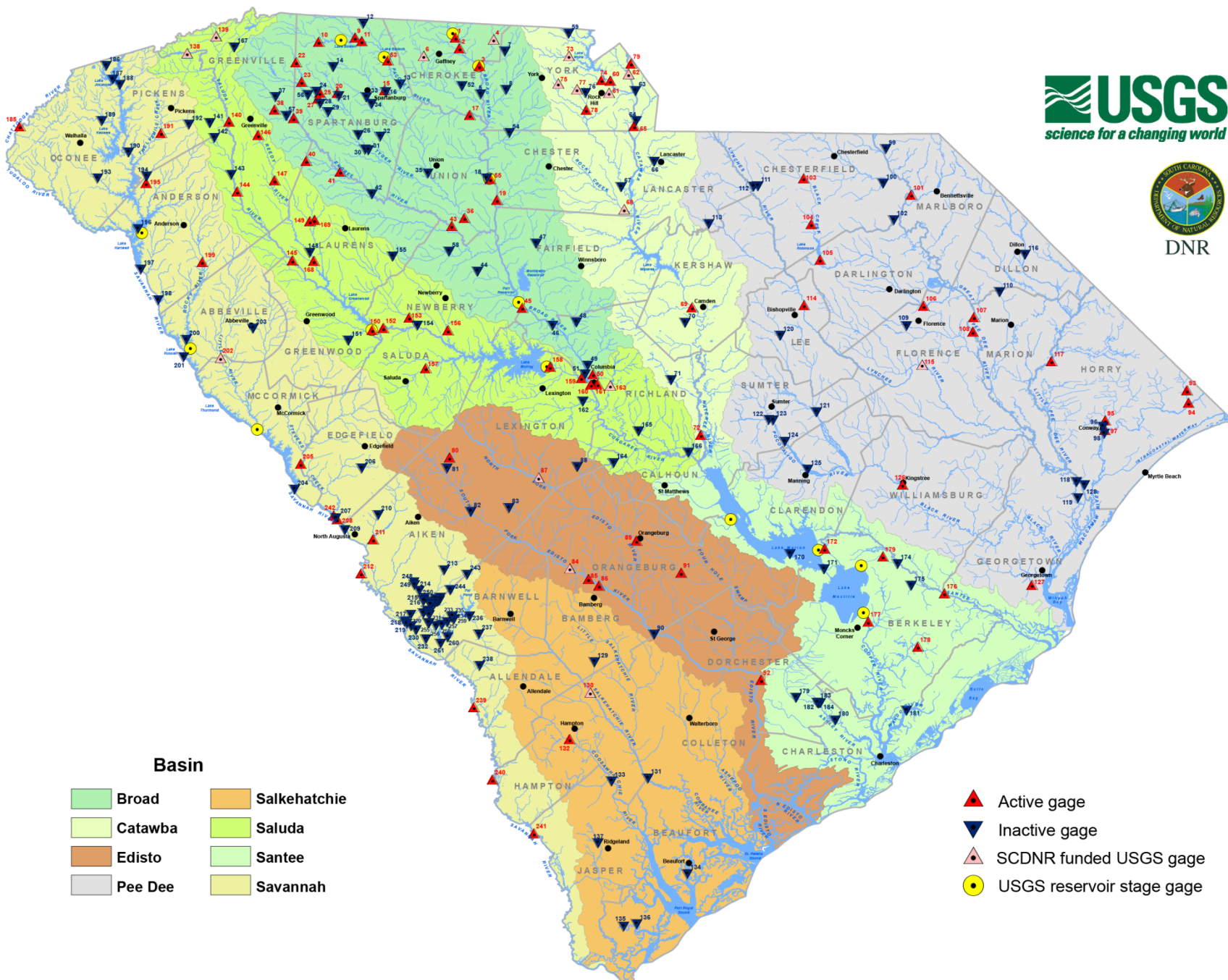
The water resources policy plan consists of two parts. Phase I—an overall assessment of the water resources of the State—was published as Water Resources Commission Report No. 140, South Carolina State Water Assessment. The Assessment describes the State's stream, lake, and aquifer systems and provides information relating to the occurrence and availability of water in South Carolina. Phase II outlines guidelines and procedures for managing the State's water resources, and was first published in 1998 by the Department of Natural Resources as the South Carolina Water Plan.

<http://www.dnr.sc.gov/water/waterplan/index.html>

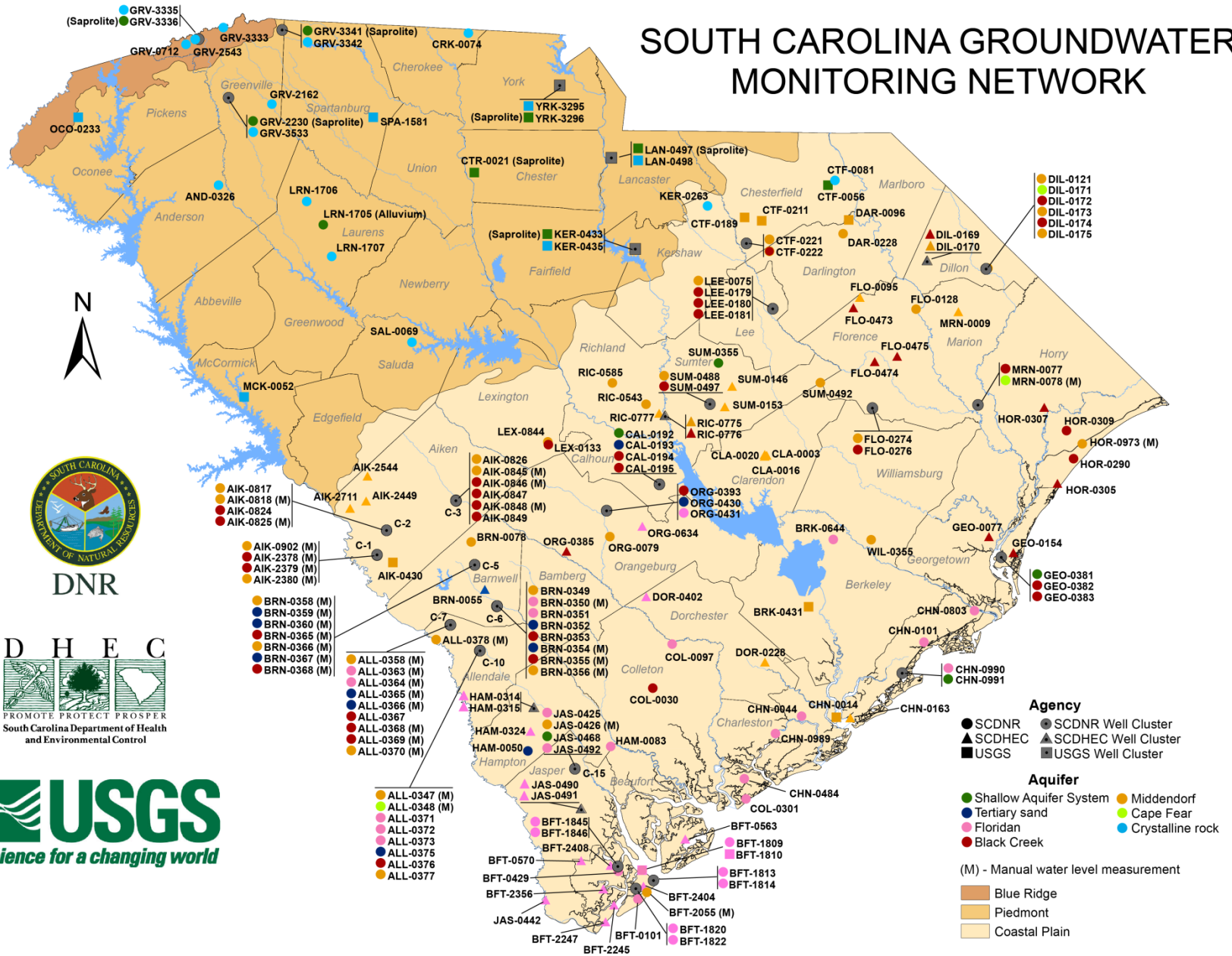
USGS Streamflow and Lake Level Monitoring Network



DNR



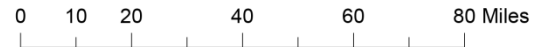
SOUTH CAROLINA GROUNDWATER MONITORING NETWORK



DNR

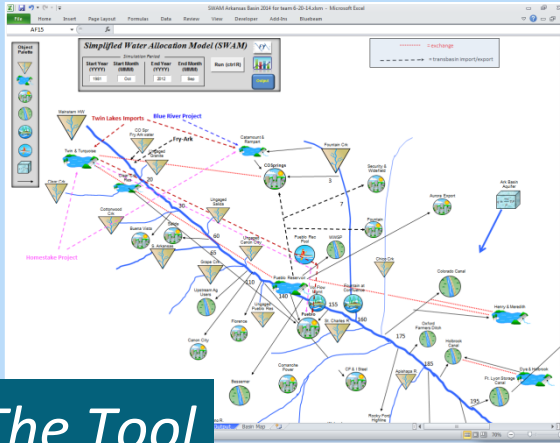


Map prepared by the Land, Water & Conservation Division of the South Carolina Department of Natural Resources: July, 2014.

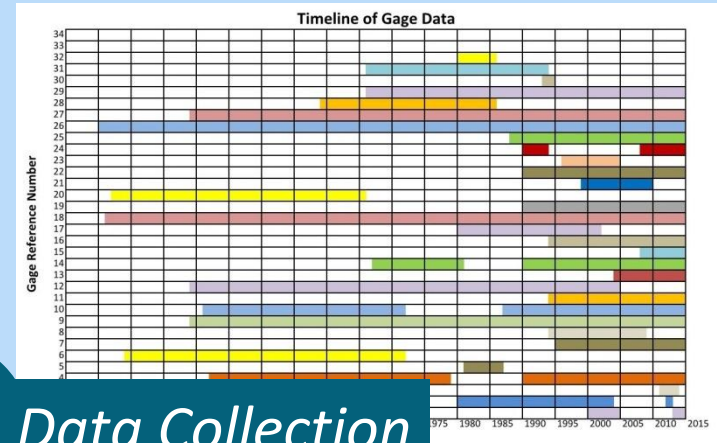


Development of Surface Water Quantity Models

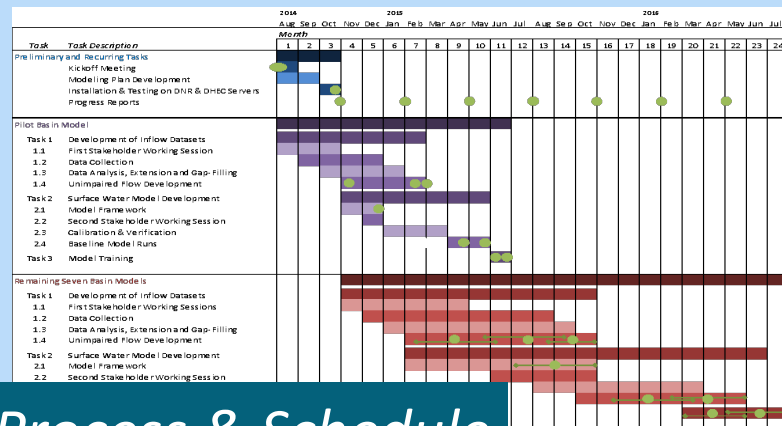
1 The Tool



3 Data Collection

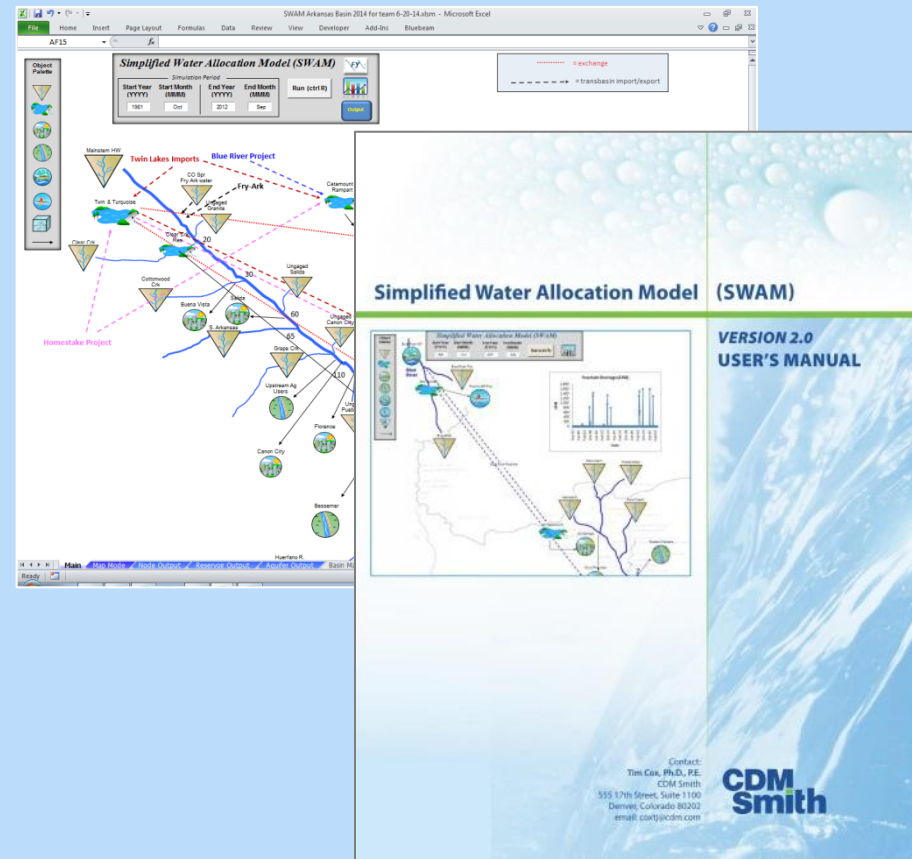


2 Process & Schedule



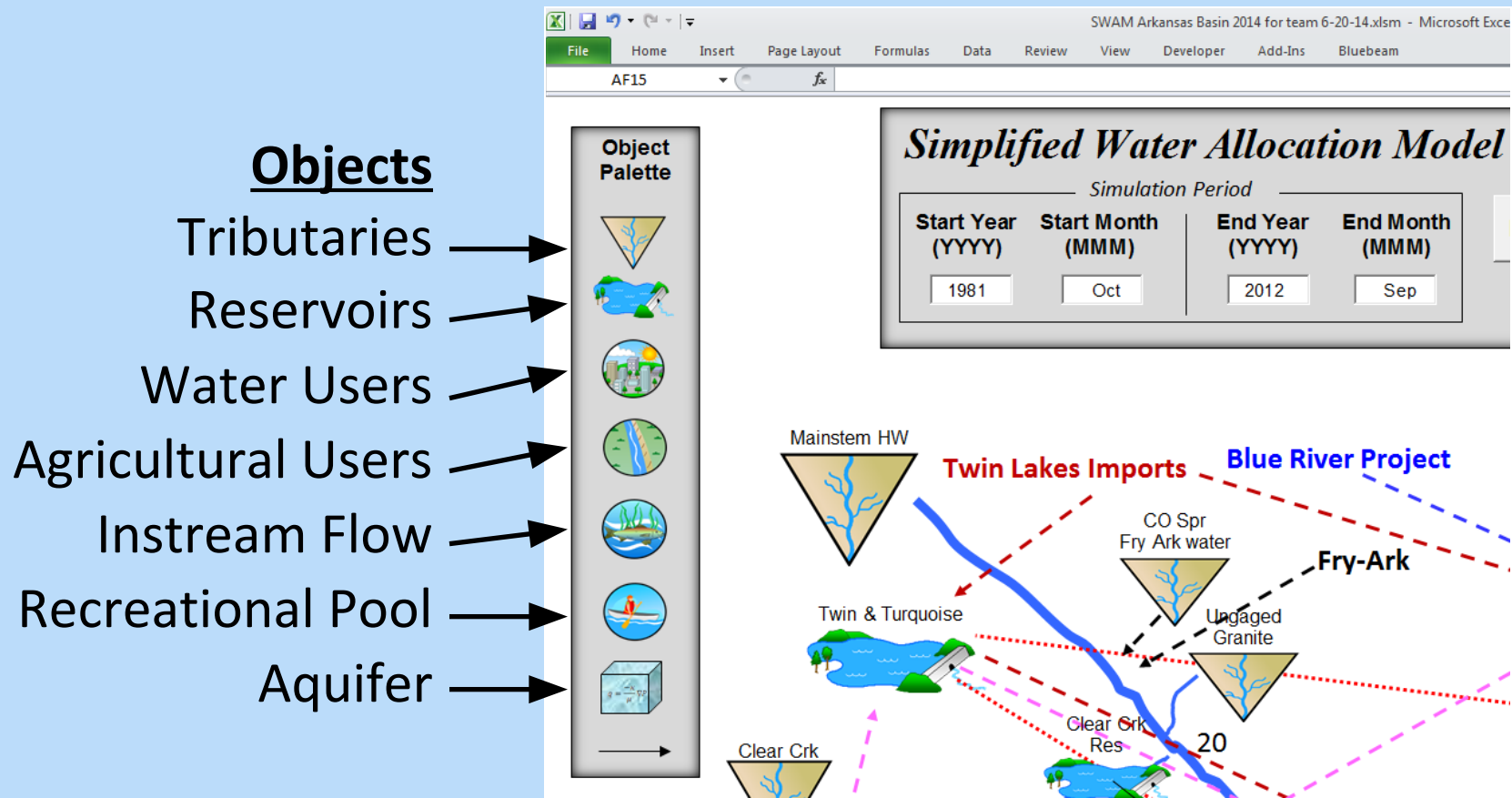
Simplified Water Allocation Model (SWAM)

- Developed in response to an increasing need for a desktop tool to facilitate regional and statewide water allocation analysis
- Calculates physically and legally available water, diversions, storage consumption and return flows at user-defined nodes
- Used to support large-scale planning studies in Colorado, Oklahoma, Arkansas and Texas



Simplified Water Allocation Model (SWAM)

- Object-oriented tool in which a river basin and all of its influences can be linked into a network with user defined priorities



Simplified Water Allocation Model (SWAM)

- **Intuitive & Transparent** Resides within and interfaces directly with Microsoft Excel
- **Ease-of-Use** Point-and-click setup and output access
- **Simple & Robust** Mass balance calculations, but handles operating rules, use priorities, etc.

Input Forms

The input forms are designed for user interaction within the SWAM model. They include fields for user identification, source water characteristics, and return flow management.

Node Output

SWAM Arkansas Basin 2014 for team 6-20-14.xlsx - Microsoft Excel

	A	B	EY	EZ	FA	FB	FC	FD	FE	FF
Output										
1				Priority Rank	Reach (mi)	Location	Water Right (AFM)	Ditch Capacity (AFM)	Storage Capacity (AF)	
2			Pueblo4	32	Mainstem	136	420	1,000,000	5,000	
3							GW Pumping (AFM)	Demand (AFM)	Shortage (AFM)	Return Flow (AFM)
4		Date	Physically Avail. (AFM)	Legally Avail. (AFM)	Diverted (AFM)	Storage (AF)				
5		Min	1,200	0	0	0	0	0	0	0
6		Max	423,253	420	420	5,000	0	0	0	0
7		Avg	44,588	117	33	4,340	0	0	0	0
8		Oct-81	14,837	0	0	0	0	0	0	0
9		Nov-81	23,186	0	0	0	0	0	0	0
10		Dec-81	24,424	0	0	0	0	0	0	0
11		Jan-82	17,870	0	0	0	0	0	0	0
12		Feb-82	16,694	0	0	0	0	0	0	0
13		Mar-82	25,120	0	0	0	0	0	0	0
14		Apr-82	11,977	0	0	0	0	0	0	0
15		May-82	35,025	0	0	0	0	0	0	0
16		Jun-82	146,407	0	0	0	0	0	0	0
17		Jul-82	97,301	0	0	0	0	0	0	0

Simplified Water Allocation Model (SWAM)

- Supports multiple layers of complexity for development of a range of systems, for example...

A Reservoir Object can include:

1. Basic hydrology dependent calculations
2. Operational rules of varying complexity such as prescribed releases, conditional releases, or hydrology dependent releases.

Reservoir



Reservoir

Main

Reservoir Name:

Storage Capacity (AF) Initial Storage (AF)

Offline Online

Evaporation

Inches/day % Volume Input Timeseries

Reservoir Releases

Receiving Stream: Simple Advanced

Release Location (mi)

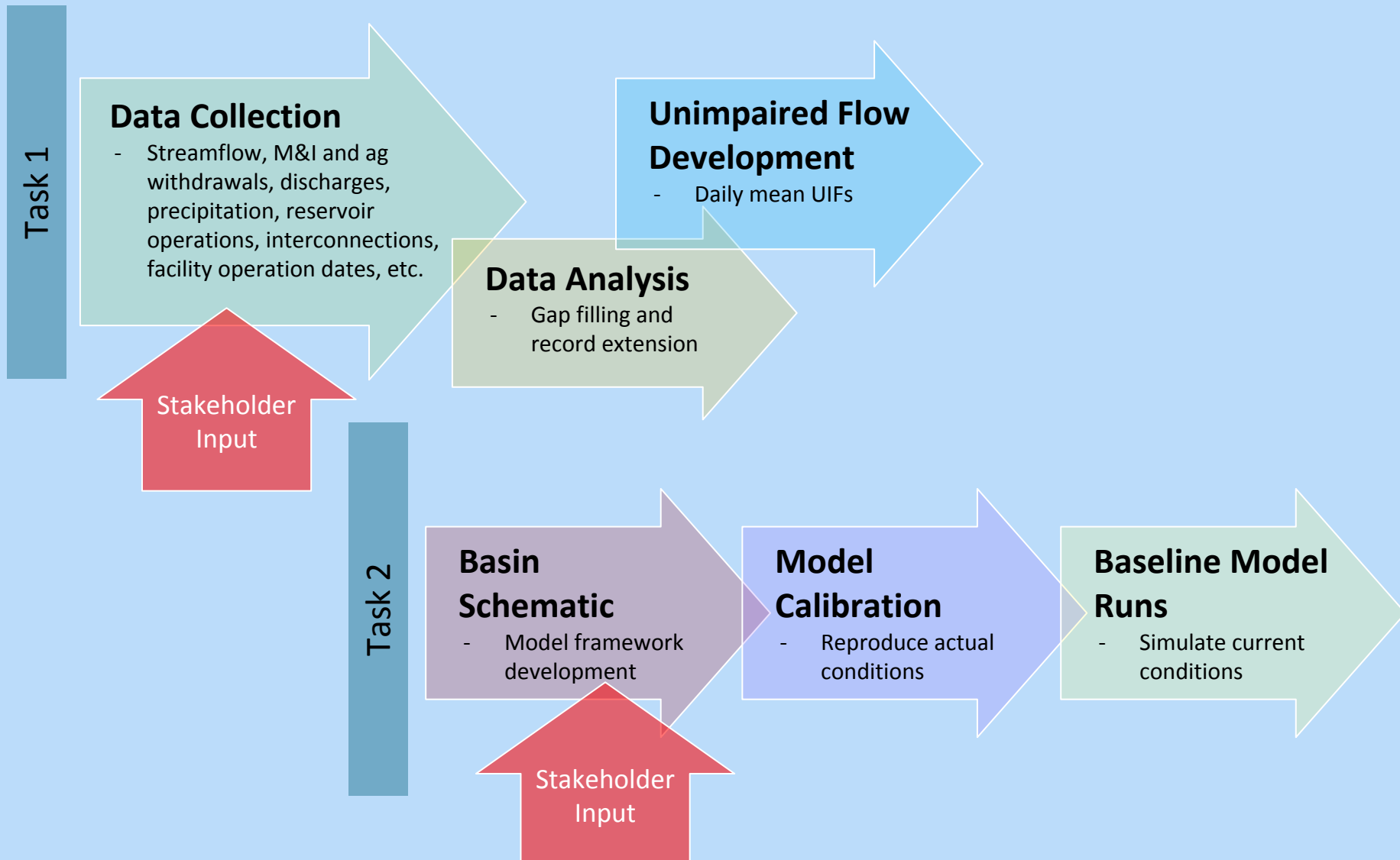
User Defined Releases

Month	Evap. Rates (in./day)	Volume (AF)	Area (ac)	Month	Min. Release (AFM)	(CFS)
Jan				Jan		
Feb				Feb		
Mar				Mar		
Apr				Apr		
May				May		
Jun				Jun		
Jul				Jul		
Aug				Aug		
Sep				Sep		

The Models Can Be Used To...

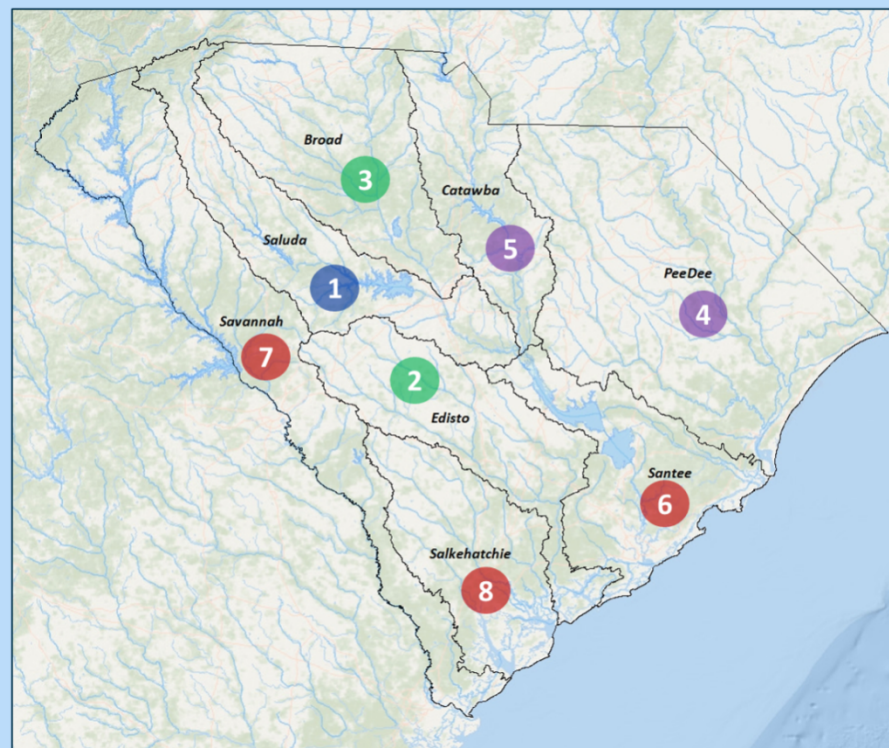
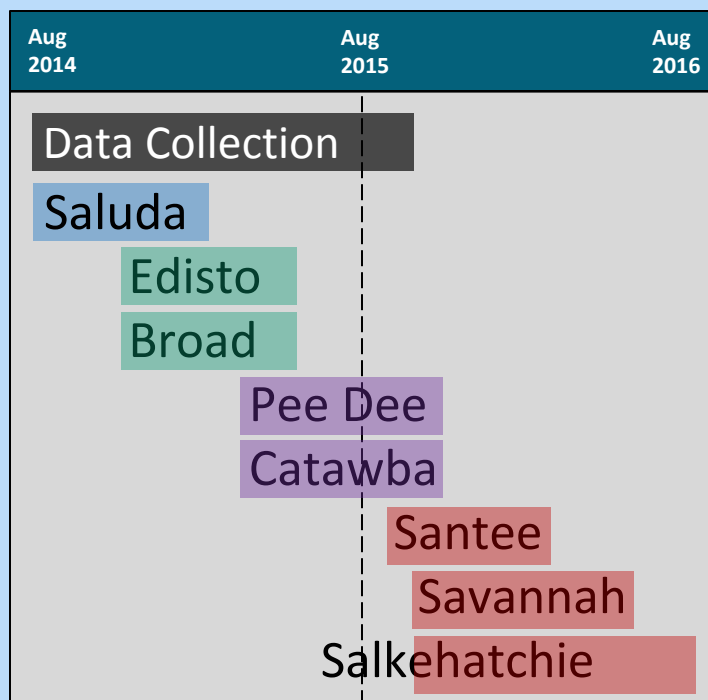
- Determine surface-water availability
- Predict where and when future water shortages would occur
- Test alternative water management strategies, new operating rules, and “what-if” scenarios
- Resolve water disputes
- Consolidate hydrologic data
- Evaluate the impacts of future withdrawals on instream flow needs
- Evaluate interbasin transfers
- Support development of Drought Management Plans
- Compare managed flows to natural flows

Major Tasks



Schedule for Developing the Models

- ***Pilot Model*** of the Saluda River Basin
- Other models to follow, with order based on data availability
- 2-year schedule requires that groups of models be constructed in parallel



Data is Needed to Support...

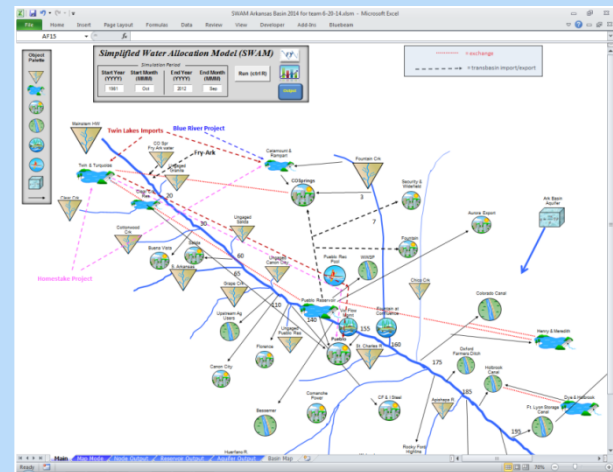
1. Development of Unimpaired Flows (UIFs)

UIF Definitions: - Flow in a river as it would be in a completely unaltered state
 - Historically observed flows with human influences removed

UIFs Provide: A baseline for evaluating impacts of human use by allowing analysts to compare altered flows to UIFs

2. Development of each baseline model

- A. Withdrawal and return amounts and locations
- B. Current reservoir operating rules
- C. Drought Management Plans and Requirements
- D. Instream flow requirements



Data Needed to Support Unimpaired Flows



Streamflow, dating back to earliest continuous gage data



Historical withdrawals (>100,000 gpd) and discharges for M&I, thermoelectric, agriculture, hydropower



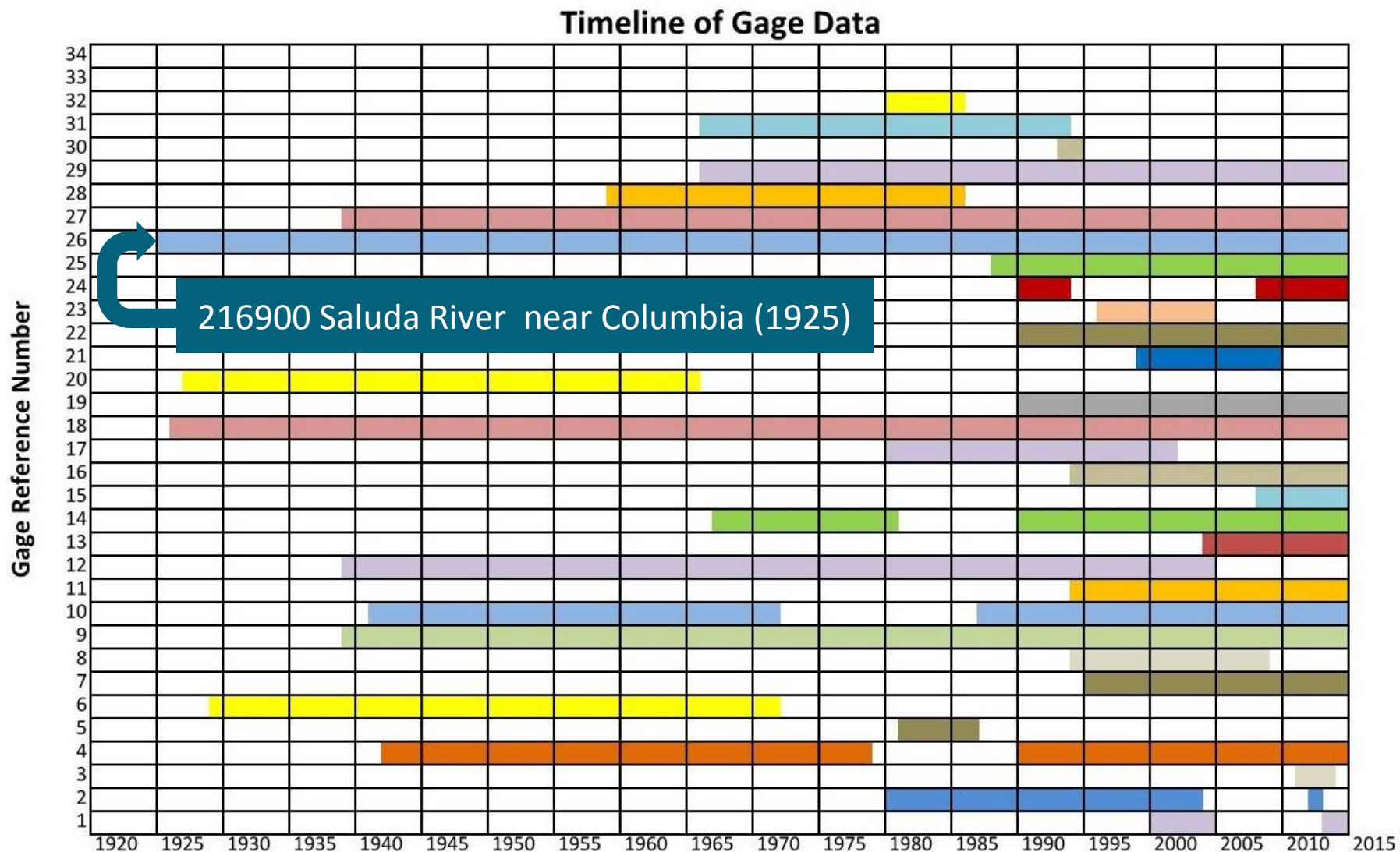
Reservoirs

- a) Operating rules and elevation-storage-area curves
- b) Historical elevation release data
- c) Precipitation and evaporation records



Interconnections

Streamflow at USGS Gages – Saluda Basin



Data Collection

1. Permitted surface water users will be contacted by CDM Smith to:
 - A. Confirm the history of your water source(s) and operation
 - B. Collect additional data that may be useful to characterize and quantify historical water withdrawals and discharges for UIF development
2. CDM Smith will follow-up with a letter confirming our understanding of your data



Catherine B. Tompkins, Director
Promoting and protecting the health of the public and the environment

September 20, 2014

Name
Address

Re: Surface Water Availability Assessment Modeling
Abbeville City Of
Permit ID# 01WS002

Dear Permit Holder:

You are receiving this letter as your company or utility has a surface water withdrawal permit from the South Carolina Department of Health and Environmental Control (DHEC). As you may be aware, DHEC and the South Carolina Department of Natural Resources (DNR) have retained a consulting firm, CDM Smith, to develop models of our surface water resources. While your recent water use data has been reported to DHEC, you may have historical water use data or other information that will be helpful to CDM Smith in developing the models.

Someone with CDM Smith may be contacting you to discuss the data from your facility. DHEC and DNR requests, and would greatly appreciate, your participation in this data collection and verification process.

If you have any questions, please contact Rob Devlin at DHEC, (803) 898-3798 or John Boyer at CDM Smith, (919) 325-3509.

Thank You

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