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South Carolina Department of Health and Environmental Control

Surface Water Availability Assessment in South Carolina
Legislative Quarterly Report, May 2016

Background

South Carolina currently has limited scientific information about the future demands on and availability of our water supply. As a result, the General Assembly allocated $1.5M to complement South Carolina's new surface water permitting program administered by SC Department of Health and Environmental Control (DHEC), and to gather the information necessary to update the State Water Plan developed by SC Department of Natural Resources (DNR). The two agencies are in the process of gathering data on South Carolina's eight basins: Broad, Catawba, Edisto, Pee Dee, Salkehatchie, Saluda, Santee, and Savannah.

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Scientific Process for Measurement and Legislative Reporting

The availability assessment will develop a computer-generated model of each of the eight basins to evaluate existing water availability. These analyses will be used to inform the resource agencies and stakeholders if there are areas of the State where there is a "gap" or concern about the amount of water needed to meet our increasing demands over the next 50 years.

The funds appropriated above to the DNR for the State River Basin Study Project must be used for water data collection to provide scientific information on water resources in the state's eight major river basins. The DNR shall, in cooperation with DHEC, submit to the Senate Finance Committee, the House Ways and Means Committee, the Senate Agriculture and Natural Resources Committee, and the House Agriculture, Natural Resources and Environmental Affairs Committee, a report on the project's timeline, findings, and expenditure of funds on a quarterly basis. Additionally, this information will be posted electronically on DNR and DHEC websites.

Summary of Activities During the Past Quarter

CDM Smith's *Simplified Water Allocation Model* (SWAM) will be used for the project. During the past quarter, the Saluda Basin Pilot Model was updated to include model enhancements that allow for greater flexibility in setting reservoir operating rules. UIF (unimpaired flow) datasets for the Broad and Pee Dee River basins were completed and reviewed by DNR and DHEC. Calibration models and draft model reports for the Broad and Pee Dee basins were completed and are currently under review by DNR, DHEC and the project TAC (Technical Advisory Committee). A revised UIF dataset was finalized for the Edisto basin. The calibration model and model report for the Edisto were updated. A final model framework and schematic were completed for the Santee River basin, incorporating comments received from Santee Cooper, DNR, and the TAC.

To date, model frameworks have been completed for the Saluda, Edisto, Pee Dee, Broad, Catawba, and Santee basins; UIF datasets have been completed for the Saluda, Edisto, Pee Dee, and Broad River basins; draft calibration models have been completed for the Saluda, Edisto, Pee Dee, and Broad River basins; draft model reports have been completed for the Saluda, Edisto, Pee Dee, and Broad River basins; and the draft baseline model for the Saluda River basin has been completed.

Stakeholder meetings are facilitated by Clemson University and are attended by CDM Smith, DNR, DHEC, and basin stakeholders. The first of two planned stakeholder meetings for the Santee River basin was held on March 2nd at Santee Cooper's offices in Moncks Corner. The second stakeholder meeting for the Pee Dee River basin was held on May 2nd at the Doctors Bruce and Lee Foundation Library in Florence. To date, nine stakeholder meetings have been held. A third SWAM training session was held at CDM Smith's offices in Columbia on May 3rd.

Progress reports are being provided by CDM Smith at monthly conference calls and at in-person meetings with DNR, DHEC, and the project TAC. Written monthly progress reports and meeting notes are being posted on the DNR webpage. In addition to the monthly progress reports, CDM Smith is required to prepare quarterly progress reports, the seventh of which is provided below. Financial statements can be found at the end of this report. Additional information on the project can be found at the following websites:

http://dnr.sc.gov/water/waterplan/surfacewater.html

http://www.scwatermodels.com/

South Carolina Surface Water Quantity Models
Quarterly Progress Report No. 7

February 16, 2016 to May 15, 2016

Introduction

The South Carolina Departments of Natural Resources (DNR) and Health and Environmental Control (DHEC) have contracted with CDM Smith to develop surface water quantity models in the eight major river basins in South Carolina. Per the requirements of the contract, CDM Smith will prepare and submit Quarterly Progress Reports summarizing work completed on each basin model. This seventh Quarterly Progress Report covers the three month period from February 16, 2016 to May 15, 2016.

The Quarterly Progress Report provides a bulleted summary of activities and accomplishments; identifies upcoming work and deliverables; highlights issues that have the potential to impact scope, schedule or costs; and provides the current project schedule. Activities and accomplishments are presented for the following categories: (1) project planning and management; (2) data collection; (3) data analysis and modeling; and (4) stakeholder involvement.

Activities and Accomplishments

Project Planning and Management

- Monthly Progress meetings attended by CDM Smith and DNR/DHEC project staff were held on March 7th, April 4th, and May 3rd.
- Project submittals to date include:
    - Draft and Final Modeling Plan
    - Draft and Final Unimpaired Flow (UIF) Results Technical Memorandum for the Saluda and Edisto basins
    - UIF Methodology and UIF Results Technical Memoranda for the Broad Basin
    - Combined UIF Methodology and Results Technical Memorandum for the Pee Dee Basin
    - UIF Methodology Technical Memoranda for the Santee Basin
    - Draft and Final Modeling Framework for the Saluda, Edisto, Broad, Catawba-Wateree, Pee Dee and Santee basins
    - Draft and Final Technical Memoranda and model summarizing historical agriculture irrigation withdrawal estimates for all basins
    - Draft UIF Datasets for the Saluda, Edisto, Broad and Pee Dee basins
    - Draft Modeling Reports for the Saluda, Edisto, Broad and Pee Dee basins
    - An updated version of the SWAM User's Manual (v3.0)
    - Various additional memoranda summarizing modeling methodology

Data Collection

- CDM Smith has substantially finished contacting registered and permitted water users in the Saluda, Edisto, Broad, Catawba, Pee Dee, Salkehatchie and Santee basins to confirm reported withdrawal amounts, sources, and discharge amounts; collect pre-reporting withdrawal amounts (or estimates); and confirm other operational parameters. As work progresses in each basin, certain users are contacted again to clarify data, and seek additional data where necessary.
- Savannah Basin UIFs were received from the Georgia EPD.
- CDM Smith worked with SCE&G to clarify and correct previously submitted hydropower data associated with the Fairfield Pumped Storage (FFPS) Facility in the Broad Basin. Corrections were made to data for the period 2008-2015. SCE&G re-submitted the data to DHEC and CDM Smith and also provided monthly pumping data from FFPS to Lake Monticello and hourly water levels for Lake Monticello, for the period 2002–2015.

Data Analysis and Modeling

Saluda (Pilot Basin Model)

- The Saluda Basin Pilot Model was updated following enhancements to SWAM. The enhancements allowed for additional user flexibility with regard to simulating reservoir operations.
- Based on DNR comments, SWAM's "Node Output" and "Reservoir Output" tables were reconfigured.
- Work continued on finalizing the Saluda Basin Model Report.

Edisto

- CDM Smith performed a verification exercise focusing on the South Fork Edisto River over the period 1940-1966, when streamflow gage data was available at the USGS gage at Montmorenci. The results of the exercise were presented to DNR, DHEC and the TAC.
- Based on DNR review of the Montmorenci gage verification exercise and previous calibration scenarios, a final UIF dataset was selected. The calibration model and model report were updated. Updates to the baseline model were initiated.

Broad

- The Broad Basin Draft UIF dataset was submitted to DNR and DHEC for review.
- The Broad Basin calibration model was completed and submitted to DNR and DHEC for review.
- The Draft Broad Basin Model Report was completed and submitted to DNR, DHEC, and the TAC for review.

Pee Dee

- The Pee Dee Basin Draft UIF dataset was submitted to DNR and DHEC for review.
- The Pee Dee Basin calibration model was completed and submitted to DNR and DHEC for review.
- The Draft Pee Dee Basin Model Report was completed and submitted to DNR, DHEC, and the TAC for review.

Catawba-Wateree

- The process of developing UIFs for the Catawba tributaries was initiated, as was preliminary development of the calibration model.

Santee

- A Final SWAM model schematic and framework of the Santee Basin was prepared, incorporating comments received from Santee Cooper, DNR, and the TAC.
- A UIF methodology memorandum was prepared and development of the calibration model was initiated.

Savannah

- The UIF dataset received from the Georgia EPD was reviewed.

Salkehatchie

- CDM Smith continued work on the draft model framework for the Salkehatchie basin.

Stakeholder Involvement

- A third SWAM training session was held at CDM Smith's offices on May 3rd, 2016. Three DHEC staff, and five DNR staff attended.
- The first of two planned Stakeholder Meetings in the Santee Basin was held on March 2nd at Santee Cooper's offices in Moncks Corner.
- On March 14th, CDM Smith gave a presentation at the South Carolina Environmental Conference (SCEC) on various aspects of model development and use.
- The second of two planned Stakeholder Meetings in the Pee Dee Basin was held on May 2nd at the Doctors Bruce and Lee Foundation Library in Florence.
- The project TAC was included on monthly progress calls and given the opportunity to review and comment on various deliverables and interim work products.

Summary of Upcoming Work

Over the next quarter, the project team will:

- Finalize the UIF datasets for the Saluda, Broad and Pee Dee basins.

- Finalize development of the Edisto, Broad and Pee Dee Baseline Models.
- Complete development of the draft Catawba, Santee and Salkehatchie UIF datasets.
- Complete draft SWAM calibration models for the Catawba and Santee basins.
- Finalize the model framework for the Salkehatchie and Savannah basins.
- Hold the first Stakeholder Meetings in the Salkehatchie and Savannah basins.

Issues Impacting Scope, Schedule, or Project Cost

In late 2015, discussions were held between CDM Smith and DNR regarding how reservoir operating rules are incorporated in SWAM. DNR indicated the preference for additional flexibility in SWAM to allow the user to evaluate more complex alternative management rules. It was noted that when more complex rules (such as the Lake Murray Striped Basin release rules) were included in SWAM as "prescribed rules", user-initiated adjustments to test variations of the rule were not easily performed. CDM Smith received a change order to implement model enhancements that will allow for increased flexibility with regard to reservoir operating rules.

Schedule adjustments were made to reflect the project progress and more accurately account for future deliverables. It is currently anticipated that due to delays in completion of the pilot model, the project schedule will need to be extended approximately six months, to the end of 2016. An updated schedule is attached.

During the project kickoff meeting, and based on DNR and DHEC review of the draft Modeling Plan, several potential out-of-scope model enhancements were identified. These include:

- A "Current Situation Analysis" for quasi-real time operational support. This functionality would provide a probabilistic analysis of current conditions at any future point in time and how conditions are likely to change within 6 or 12 months based on projected use and management patterns.
- The ability to use near-term hydrologic flow forecasts (for example, 60-day streamflow forecasts from NOAA) for month-to-month operational planning.
- Use of HEC DSSVue for and DSS files for results display and analysis.

CDM Smith has presented a scope for implementing these enhancements to DNR and DHEC. The decision on whether to implement one or more of these enhancements will likely be made once additional models are completed.

South Carolina Surface Water Quantity Assessment

Schedule

Updated May 2, 2016

Basin and Milestone	2016 Jan 4-Jan	11-Jan	18-Jan	25-Jan	Feb 1-Feb	8-Feb	15-Feb	22-Feb	29-Feb	Mar 7-Mar	14-Mar	21-Mar	28-Mar	Apr 4-Apr	11-Apr	18-Apr	25-Apr	May 2-May	9-May	16-May	23-May	30-May	June 6-Jun	13-Jun	20-Jun	27-Jun	Jul 4-Jul	11-Jul	18-Jul	25-Jul	Aug 1-Aug	8-Aug	15-Aug	22-Aug	29-Aug	Sep 5-Sep	12-Sep	19-Sep	26-Sep	Oct 3-Oct	10-Oct	17-Oct	24-Oct	31-Oct	Nov 7-Nov	14-Nov	21-Nov	28-Nov	Dec 5-Dec	12-Dec	19-Dec	26-Dec
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1 = First Meeting
2 = 2nd Meeting
D = Draft Comlpetion Date
F = Final Completion Date
T = Training

2016 Proposed Stakeholder Meeting Schedule

Basin	1st Meeting Week of:	2nd Meeting Week of:
Saluda	*completed*	*completed*
Edisto	*completed*	*completed*
Broad	*completed*	18-May-16
Pee Dee	*completed*	*completed*
Catawba-Water.	*completed*	29-Aug-16
Santee	*completed*	29-Aug-16
Savannah	25-Jul-16	14-Nov-16
Salkehatchie	25-Jul-16	14-Nov-16

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CDM Smith Invoice Number 18

Invoice Date: March 4, 2016
For Services Between: February 1, 2016 and March 4, 2016

River Basin	Original Contract Amount	Amended Contract Amount[2]	This Invoice	Total Invoiced	Amount Remaining	Percent Complete
Saluda	$155,926	$162,489	$0	$162,489	$0	100%
Edisto[1]	$226,034	$232,597	$377	$232,597	$0	100%
Broad	$132,960	$170,023	$8,000	$155,998	$14,025	92%
Pee Dee	$189,865	$196,428	$11,340	$166,865	$29,563	85%
Catawba	$141,639	$164,802	$6,450	$70,182	$94,620	43%
Santee	$128,775	$135,338	$16,900	$60,930	$74,408	45%
Savannah	$154,637	$161,200	$0	$18,900	$142,300	12%
Salkehatchie	$128,775	$135,338	$8,620	$34,720	$100,618	26%
Total	**$1,258,611**	**$1,358,211**	**$51,687**	**$902,681**	**$455,531**	**66%**

[1] Project startup-activities including the kickoff meeting, modeling plan, model enhancement and other activities were included under the Edisto Basin budget. The Edisto was originally identified as the pilot basin for modeling.

[2] The amended contract amount includes an additional (1) $30,500 for the Broad River Basin unimpaired flow development; (2) $16,600 for the Catawba Basin unimpaired flow development; and (3) $52,500 for additional meetings, divided equally between all eight basins ($6,562.50 each).

CDM Smith Invoice Number 19

Invoice Date: April 4, 2016
For Services Between: March 5, 2016 and April 2, 2016

River Basin	Original Contract Amount	Amended Contract Amount[2]	This Invoice	Total Invoiced	Amount Remaining	Percent Complete
Saluda	$155,926	$167,989	$5,060	$167,549	$440	100%
Edisto[1]	$226,034	$232,597	$0	$0	$0	100%
Broad	$132,960	$170,023	$8,630	$164,628	$5,395	97%
Pee Dee	$189,865	$196,428	$18,400	$185,265	$11,163	94%
Catawba	$141,639	$175,802	$14,075	$84,257	$91,545	48%
Santee	$128,775	$135,338	$0	$60,930	$74,408	45%
Savannah	$154,637	$172,200	$10,050	$28,950	$143,250	17%
Salkehatchie	$128,775	$135,338	$4,300	$39,020	$96,318	29%
Total	**$1,258,611**	**$1,385,711**	**$60,515**	**$963,196**	**$422,516**	**70%**

[1] Project startup-activities including the kickoff meeting, modeling plan, model enhancement and other activities were included under the Edisto Basin budget. The Edisto was originally identified as the pilot basin for modeling.

[2] The amended contract amount includes an additional (1) $30,500 for the Broad River Basin unimpaired flow development; (2) $16,600 for the Catawba Basin unimpaired flow development; (3) $52,500 for additional meetings, divided equally between all eight basins ($6,562.50 each); and (4) $27,500 for SWAM code enhancements related to reservoir operations primarily in the Saluda, Catawba, and Savannah basins.

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CDM Smith Invoice Number 20

Invoice Date: May 2, 2016

For Services Between: April 3, 2016 and April 31, 2016

River Basin	Original Contract Amount	Amended Contract Amount[2]	This Invoice	Total Invoiced	Amount Remaining	Percent Complete
Saluda	$155,926	$162,489	$441	$167,989	$0	100%
Edisto[1]	$226,034	$232,597	$0	$232,597	$0	100%
Broad	$132,960	$170,023	$2,100	$166,728	$3,295	98%
Pee Dee	$189,865	$196,428	$6,700	$191,965	$4,463	98%
Catawba	$141,639	$164,802	$24,600	$108,857	$66,945	62%
Santee	$128,775	$135,338	$23,000	$83,930	$51,408	62%
Savannah	$154,637	$161,200	$0	$28,950	$143,250	17%
Salkehatchie	$128,775	$135,338	$1,200	$40,220	$95,114	30%
Total	**$1,258,611**	**$1,358,211**	**$58,041**	**$1,021,236**	**$364,475**	**74%**

[1] Project startup-activities including the kickoff meeting, modeling plan, model enhancement and other activities were included under the Edisto Basin budget. The Edisto was originally identified as the pilot basin for modeling.

[2] The amended contract amount includes an additional (1) $30,500 for the Broad River Basin unimpaired flow development; (2) $16,600 for the Catawba Basin unimpaired flow development; (3) $52,500 for additional meetings, divided equally between all eight basins ($6,562.50 each); and (4) $27,500 for SWAM code enhancements related to reservoir operations primarily in the Saluda, Catawba, and Savannah basins.