**Minutes of the Smart River & Dam Security Task Force**

**Plus an Update on the "Models" Meeting Held On: 06 March 2019**

Message sent to Task Force Members on 05 March 2019 at 5:53 PM

"Task Force Members

Our next Task Force Meeting on Wednesday, March 6, from 1200 to 1400 in the Governor's Conference Room on the first floor of the Wade Hampton Building. Attached are the Notice of Meeting, a Roster of Members, and my collection of information to include minutes since we started.

Tomorrow I plan for us to break into our two subcommittees and start assigning tasks to accomplish our stated goals. Please review the attached background information in preparation for the meeting.

Call in information
Standing Conference Bridge
Choose number local to you:
803-726-9796 {for in-state callers}
864-908-3279 {for in-state callers}
843-737-7035 {for in-state callers}
1-866-325-7677 {for callers outside of South Carolina}
Follow the voice prompts and, when asked, enter the Conferee Code 510147 followed by the # key.

In Attendance:
Bob Livingston
Leonard Pietrafesa
Myra Reece
Hanif Chaudhry
Duke Brantley
Marguerite McClam
Sel Hemingway
Erfan Goharian
John Cleveland

By Telephone:

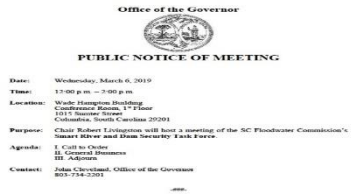
Richie Yow
Jeffery Allen

Not Able to Attend
Kent Williams
Marshall Taylor

Have not heard
Inthuom Sasanakul

I look forward to seeing you on Wednesday.
Bob
MG (Ret) Robert E. Livingston, Jr.

The Public Notices of the Meeting and the Task Force Roster were also provided by Bob.



Office of the Governor

PUBLIC NOTICE OF MEETING

Date: Wednesday, March 6, 2019

Time: 12:00 p.m. – 2:00 p.m.

Location: Wade Hampton Building
Conference Room, 1st Floor
1015 Sumter Street
Columbia, South Carolina 29201

Purpose: Chair Robert Livingston will host a meeting of the SC Floodwater Commission's Smart River and Dam Security Task Force.

Agenda: I. Call to Order
II. General Business
III. Adjourn

Contact: John Cleveland, Office of the Governor
803-734-2201

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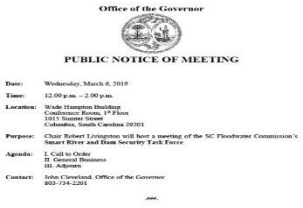

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SC Floodwater Commission

Smart River & Dam Security Task Force

| Prefix | First Nam | Mid | Last Name | Title | Agency | Street Address | City | Stat | Zip | email | phone |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dr. | Leonard | | Pietrafesa | Research Scholar/Professor Emeritus UNC | Coastal Carolina University | 51 Sandpiper Drive | Ocean Isle Beach | NC | 28469 | ljpietra@ncsu.edu | |
| | Marshal | | Taylor | Acting Director | SC DHEC | 2600 Bull Street | Columbia | SC | 29201 | taylorwm@dhec.sc.gov | |
| | Myra | C | Reece | Director Environmental Affairs | SC DHEC | 2600 Bull Street | Columbia | SC | 29201 | reecemc@dhec.sc.gov | 803-667-1113 |
| MG | Bob | | Livingston | Adjutant General | SCNG | 2124 College Street | Columbia | SC | 29205 | blivingston@gregoryelectric.com | 803-466-9885 |
| Dr. | Hanif | | Chaudhry | Associate Dean | USC College of Engineering and | 301 Main Street | Columbia | SC | 29208 | chaudhry@cec.sc.edu | |
| Dr. | Inthuorn | | Sasanakul | Assistant Professor | USC Civil and Environmental Eng | 301 Main Street | Columbia | SC | 29208 | sasanaku@cec.sc.edu | 803-777-7160 |
| Dr. | Duke | | Brantley | Acting Director | USC Earth Sciences and Reso | 701 Sumter Street, EWS 617 | Columbia | SC | 29208 | brantldt@email.sc.edu | 803-521-4289 |
| Sen. | Kent | | Williams | Senator | SC Senate | 4205 Stirk Place | Marion | SC | 29571 | debbiebarthe@scsenate.gov | |
| Rep. | Richie | | Yow | Representative | SC House | 200 W. Main Street | Chesterfield | SC | 29709 | richieyow@yahoo.com | 843-610-9362 |
| Dr. | Jeffrey | | Allen | Director | Clemson - SC Water Resource | 509 Westinghouse Rd. | Pendleton | SC | 29670 | jsallen@clemson.edu | |
| | Marguerite | | McClam | Owner | Palmetto Consulting Engineering | 1416 Chapin Rd. | Chapin | SC | 29036 | mmcclam@pceg.net | 803-932-2300 |
| | Sel | | Hemingway | Administrator | Georgetown County | 716 Prince Street | Georgetown | SC | 29440 | olewis@gtcounty.org | 843-545-3006 |
| Dr. | Erfan | | Goharian | Research Scholar | USC College of Engineering and | 301 Main Street | Columbia | SC | 29208 | goharian@cec.sc.edu | 803 777-4625/401-410-2680 |
| | | | | | Corps of Engineers | Proposed | | | | | |
| | | | | | DNR | Proposed | | | | | |
| | Eric | | Strom | | USGS | Proposed | | | | | |
| | Joe | | Gellisie | | SCGS | Proposed | | | | | |

1. Bob called the Meeting to Order at 12:00 Noon
2. Bob reported on having talked to the ACE, USGS, SCGS and SCDNR for names of Task Force Member representatives
3. Ken Rentier is taking the lead for SCDNR and was present.
   a. Ken suggested that He could cover for both DNR and the SCGS since the latter is under the former. All nodded in approval.
4. Bob's asked for a Motion to Approve the Minutes of the Previous Meeting in Charleston on 08 February 2019.
   a. Marguerite made the Motion
   b. Myra 2nded the Motion
   c. Bob called the Question and the Task Force voted to Approve.
5. Bob reiterated the proposal that the Task Force be Split into two Groups:
   a. Rivers, to be headed by Len
   b. Dams and Streams, to be headed by Myra
   c. Myra and Len "thanked" Bob and Marguerite for their "nominations" and promised retribution
   d. Bob then asked for a Motion to approve the Proposed Split
   e. Ken asked "why the split"

f. Bob responded by saying that it: "it made sense to split into modeling of everything fluid and into physical structures and controls of the fluids"
g. Hanif said "he had questions about that approach" and that "he thought everyone should meet together"
h. There was some further discussion about this and with minor exception the Task Force agreed to this partition with a Motion made by Ken and a second by Marguerite. The Motion passed. Hanif agreed to be the "Bridge-Person" between the two Groups.

6. Myra handed out a "State of the Dams" Report – Outline
   a. She referred to it as "Hazard Creep"

"State of the Dams" Report – Outline - Governor's Floodwater Commission

**1.** Introduction to Dam Safety - very basic an concise statute and reg citations/what is regulated/triggers for regulation/classifications/etc.

**2.** Descriptive Analysis – Breakdown of data on SC dams as provided for the 2018 National Inventory of Dams. Use graphs and tables for visual presentation of data.
   a. Potential data sets:
   b. Dams by hazard class (data below may also be broken to be displayed within each of the three hazard classes)
   c. Age range & average age of dams
   d. Impoundment volume range and average
   e. Dam heights/lengths ranges and averages
   f. Dam ownership in SC (% private, state, federal, utility, local)
   g. Primary use (i.e., recreational, irrigation, flood control, etc.)
   h. Most recent inspection rating (i.e., # & % fair, # & % unsat, etc.)

**3.** Dam Safety Incidents – Widespread weather events and Isolated – Snapshot of impacts from recent significant widespread storm events (2015 Rainfall, Matthew, Irma, Florence), as well has summaries of dam safety incidents at dams due to isolated significant rainfall and "sunny day" events.
Present data in a timeline. Include numbers such as # of failures, # of emergency orders issued, etc.
   a. Include summary of status of repairs, removal, permitting, other compliance tools, etc. by storm event.

**4.** Role of Regulated Dams in Flood Management – Backstory on NRCS Flood-control dams, #s and locations in SC. Discussion on how dams may not be designed for flood management but serve that purpose. Dams in series. Risk of cascading failures. Coordination between dam owners needed.

**5.** Dam Safety and Infrastructure – Roads, railways, etc. Discussion of the critical function dams play to maintain infrastructure.

b. Potentially could provide number of state-maintained roads within inundation boundaries of regulated dams. Breakdown by hazard class. Based upon the availability of data, summary of roadway classes (Primary, secondary, interstate, etc.)

**6.** Hurricane Florence Response - Summary of activities taken in prep for event; actions during the event; actions post-event; summary of dam failures; takeaways from lessons learned analysis.

**7.** Financial Analysis -How monies have been spent by the program and progress engendered by that spend. Cost of dam repairs/ownership – (Jill to do: Check with

Mark Ogden from ASDSO on national data.)

8. Look Ahead - Opportunities for improvement; challenges, roads and dams, multiple owners, real estate disclosers, etc.
9. Myra stated that there needs to be an Inventory of all Dams, including Large-Federal Dams and Small Dams-including both Non-Federal, and Non-Regulated and Ponds
10. There was a general discussion on "Floodplain Changes" and that 'the responsibilities for these potentially impactful changes are in doubt" (presumably legally speaking)
11. Myra mentioned that there are more "Micro-Bursts that dump lots of rain in very short periods of time"
12. Len said that the published scientific literature indicates "this has been happening more frequently with higher intensities" and that "precipitation is incredibly patchy over very short spatial scales"
13. There was sentiment that this Task Force needs to tie Rainfall Events in SC to Climate Inventories
14. Len reported that he had previously provided a list of Data Sets and their Archived locations in a prior e-mail; and solicited more from the Task Force
15. Len reported that he had provided a list of several "Models" and a brief descriptions of those in a prior e-mail; and solicited more from the Task Force
16. Myra's Group then met
    a. Bob, Marguerite, Duke, Inthuorn,
17. Len's Group then met
    a. Hanif, Jeff, Sel, Ken, Erfan,
18. Myra's Physical Structures Group will send out a Mid-Month Report (by 20 March)
    a. Will provide a first draft of a Large Dam vs. Other Dam Inventory
    b. Would appreciate that the Model Group consider "what inputs are needed for the different models"
    c. Would appreciate knowing "what our current modeling show about climate trends"
19. Len's Group will send out a Mid-Month Report (by, curiously, the same 20 March)
    a. Will provide an Inventory of existing models that are used in SC
    b. Will provide an overview of Types of modeling being done, scale of models, purpose of models
    c. Will provide a list of the Data currently available for models (initial list, produced by Len, is)
        1. Lidar Topography and Bathymetry Data
        2. NWS Ground Station Moisture data;
        3. NWS Snowfall data;
        4. NWS - WSD Radar data;
        5. NOS Coastal Water Level data;
        6. NDBC Marine Buoy data;
        7. NESDIS IOOS data;
        8. NOAA Earth System Research Lab/Global Systems Division (ERSL/GSD)

MRMS Rainfall Estimate Output, which is "operational";

9. High Resolution Rapid Refresh (and RAP) model(s) (together as MRMS, HRRR-RAP);
10. NESDIS Satellite data;
11. USGS River Flow data;
12. CCU and FAU SEA EcoNET (NOAA sponsored NOAA MESO) data;
13. NESDIS, NASA and EuroMet SAR Data and Imagery.
14. For the Record: The NOAA –NREL WRF Atmospheric Forecast Model has Datum built into it; so this is not an issue for interactively coupled model system

d. Will begin to provide examples of Model Output currently available for demonstration purposes
e. Will begin to look for Critical Gaps in data/models/information
f. Each Smart River Modeling Group member will contribute the models that they know of
g. Ken will probe the Office of the SC State Climatologist for Data that could be of use to the Model Group

**20.** There was a request that as the Model Group considers the different models that the question of what inputs are needed is specified

**21.** There was a request that the Model group address the question of what does our current modeling show about climate trends for SC. Is anyone working on this issue? TBD.

**22.** Len raised the Issue of Public Health. There is not a Task Force charged with this Issue. He pointed out that running water is not the only storm related issue and concern. Standing water is also a major issue related to public health.
A very important factor comprises the Public Health of SC residents and visitors, both physical and mental. In the grand scheme, this is an incredibly important factor, as both human and ecological health impacts can be short term and very long-lived and must be studied as a core component of this Task Force. Len offered the following message provided by Dr. John Yanessa of CCU on Public Health. These are John's words.

a. "Dear Len, I agree with you, this is a very important health issue. Horry County, and the Conway-Myrtle Beach area in SC were deeply impacted by the recent storms and massive flooding. I will be happy to assist with public health information as you need it. I wanted to initially provide you a broad overview of *some* of the public health concerns after a natural disaster that includes flooding. I am not sure as to the specific outcomes you need, but am happy to advise. b) Loss of Structures/Built Environment: Personal injuries related to structures may occur as individuals attempt to remove themselves, their families, or possessions from danger. There is also potential for injuries when people return to their homes and businesses

and begin to assess personal damage. These injuries can occur from entering unstable buildings, or unintended contact with electrical power cables. c) Increase in Infectious Disease: When there is flooding, there is potential for increased fecal-oral transmission of disease. As waters rise, it is common for sewers to flood, and the contents to be strewn throughout areas where there is standing, or slow-moving water. Once the storm passes, the standing water remains. Bacteria, Viruses, and other organisms proliferate exponentially. As the waters slowly recede, large areas can remain so contaminated they are unsafe for human habitation. Contact with contaminated surfaces can cause disease outbreaks. For example, this is an ongoing issue in the Conway park by the Waccamaw River. It is costly for DHEC to perform the necessary soil testing and surface cleaning needed for humans to re-enter the contaminated areas. An additional specific interest to the Carolinas is the environmental impact from the flooding of Hog farms. There have been published studies (case-control studies, cross-sectional surveys, outbreak investigations etc.) that have reported post-flood increases in infectious diseases. In rural areas, the population may not have access to clean water and sanitation. This rural isolation intensifies the dangers for infectious disease, and may force relocation of effected families for an extended period of time. d) Mental Health Issues: Less discussed (but as important) are the mental health issues related to flooding from disasters. It is perhaps easiest for me to quote the World Health Organization. It recognizes that the mental health consequences of floods "have not been fully addressed by those in the field of disaster preparedness or service delivery," although it is generally accepted that natural disasters, such as earthquakes, floods, and hurricanes, "take a heavy toll on the mental health of the people involved… Most often we see an increase in the incidence of anxiety and depression";

**23.** Len proposed we invite John Yanessa to join the Smart River Sub-Committee.

**24.** Bob said that he would broach the issue of Public Health with Tom Mullikin.

**25.** Conference Calls within the two Task Force Groups and between the Groups can be arranged as necessary.

**26.** The two Groups will share all information and materials with each other.

**27.** Recent Update on Models

a. See Below:

1. From Erfan:

| Model | Objective | Application | Developer | Potential Future Application |
|---|---|---|---|---|
| EPA's Stormwater Management Model (SWMM) | Simulations of water runoff quantity and quality in primarily urban areas | Part of peninsula of Charleston (including City of Charleston) | City of Charleston | Modeling of nuisance flooding, joint- modeling with hydrodynamic models, implementation of BMPs |

| | | | | |
|---|---|---|---|---|
| Army corps' Reservoir System Simulation (HEC-ResSim) | Reservoir operations for flood management and other services | Savannah River basin, Other examples: Lake Murray, Parr and Monticello Reservoirs | US Army Corps of Engineers Savannah District, SCE&G (by Kleinschmidt) | Forecast informed reservoir operation (FIRO), Changes in operating rule curves and future planning |
| Simplified Water Allocation Models (SWAM) | Water budget and allocation modeling for SC's basins | Edisto, Saluda and Salkehatchie basins | CDM Smith (for DNR and DHEC) | Upgrade to an Integrated Modeling (simulation-optimization) System for multi-purpose planning |
| Hydrologic Modeling System (HEC- HMS) | Hydrologic (rainfall-runoff) modeling simulation | Examples: Gills Creek and Waccamaw watershed | USC | Statewide hydrologic modeling and unimpaired flow estimation |
| Future possible models | | | | |
| Gridded Surface Subsurface Hydrologic Analysis (GSSHA) | Two-dimensional, physically based watershed model | e.g. New York City | Army corps | For coastal areas (even statewide) hydrologic and flood modeling |
| Advanced Circulation Model for Coastal Ocean Hydrodynamics (ADCIRC) + SWAN | Storm surge, flooding and modeling tides and wind driven circulation | e.g. NC Coast and Gulf of Mexico. Coarse scale (350ft) element is available for SC | UNC | Detailed simulation storm surge, tides, and coastal circulation problems |
| Water Resource Integrated Modeling System (WRIMS) (or system modeling tools such as GoldSim) | Linear programming solver for efficient water allocation decisions | e.g. California state water system simulation model | California DWR | Statewide integrated modeling of water resources systems |
| Using AI techniques for modeling and detection of flood | Image and motion detection, large data analysis | | | |

## From Marguerite McClam

to me, Robert

I think AECOM is running HEC RAS and HEC 2 with the $150,000,000 HUD Grant for the PeeDee Watershed, just getting started. Woolpert will be using HEC RAS and HEC 2 on parts of the Lumber and Little PeeDee around Nichols this year with the grant that Nichols has. Woolpert also has some modeling done on Gills Creek and around the Columbia area, they also have lots of data on modeling in and around SCDOT projects. CMD Smith has some modeling done in the State using the following HEC RAS, HEC 2, and SWIMM. If I am remembering correctly, SCDHEC had an RFQ out a few years back on all of the watersheds. I am not sure who got the project, and what software they used. The USCOE also has some modeling, along with SCDNR.

3. From Hanif:

Following email to Bob provides info on the available models for flood modeling. For SC applications, the following river segments have been modeled by various entities. Two modeling efforts listed in the attached email are available in public domain.

Congaree River from Lake Murray dam to I-77. (numerous detailed studies, conducted by or for state and federal agencies and publicly available; a few by consulting firms that are comprehensive but are confidential)

Saluda River from Lake Murray dam to the confluence with the Broad River

Saluda River Upstream of Lake Murray

Broad River (not detailed.)

We conducted a study on the development of protocol for the evaluation of hydrologic and hydraulic models. It was funded by the Federal Highway Administration and the final report, "Development of a Standard Protocol for Evaluating Hydrologic and Hydraulic Engineering Software Models," was issued in 2005 as NCHRP Project 20-07(146). I was the PI for the project. I will be happy to share the final report with the group if there is an interest.

4. From Sel:

**Sel Hemingway** 8:52 AM (8 hours ago)

to me

Len,

I know that you asked that each member submit any models that they are using or aware of by March 20. Obviously Georgetown County does not have any models, but I do have a question regarding a term that has been used in conversations with the USACOE yet has not been mentioned in our task force meetings. The term is HEC-HMS. I know that we have mentioned the HEC-RAV tool that USACOE utilizes, but I am wondering how the HEC-HMS tool might fit in or if there is a similar tool that you have already listed.

While I do not have any models to share, as a life-long resident of Georgetown County and with experience of 5 consecutive years' of Federally declared disasters I see my role as a layman to question if the model(s) is taking the following into consideration:

- Pre-storm river levels/stages necessary to calculate pre-storm capacities
- Breadth of the coastal estuaries – i.e. Winyah Bay
- Tidal impacts
- Moon phases
- Wind speed and direction
- Influence of other rivers feeding into Winyah Bay

5. From Myra:

**Water Accounting Model:**

Simplified Water Allocation Model (SWAM) for the eight major basins. (Edisto, Saluda and Salkehatchie have been released)

**Reservoir Operation Models:**

Computer Hydro-Electric Operations and Planning Software (CHEOPS) - FERC

Hydrologic Engineering Center's Reservoir System Simulation (HEC-ResSim)-Army Corps

**Flood Models:**

Southeast River Forecast Center Ensemble (National Weather Service)

SC DNR is working on flood inundation modeling (not sure of the name of the model) Major

limitation is the lake of Long term Gauge data (USGS)

Maria Cox at DNR is the most knowledgeable person on flood mapping for SC.

From Ken: From Ken:

Two models that were not on your list that are potentially useful for flood studies:

1) the RIV-1 model that Georgia EPD developed for the lower Savannah River. It is used mainly for water quality evaluation, but is a one-dimensional model that can be used to predict river flow, stage, velocity and water-surface elevation at points along the river

2) In the FERC relicensing of Parr Shoals and Monticello, a HEC-RAS model was developed to look at streamflow stage along the river between Parr Shoals and Columbia. It can be accessed from the following websites:

http://parrfairfieldrelicense.com/studyreport.html

http://parrfairfieldlicense.com/contactus.html

Bill Argentieri is the SCE&G (now Dominion) contact listed on the second website, he can provide access to this model.

From Len:

1) Weather Research Forecast Model (WRF)
2) Regional Ocean Model System (ROMS)
3) Simulating Waves Nearshore Model (SWAN)
4) WRF - Hydraulic Model (WRF- HYDRO)
5) Hydraulic Engineering Center –River Analysis System (HEC-RAS)
6) Princeton Ocean Model (POM)
7) Wave Watch III (WW-III)
8) Environmental Fluid Dynamics Code (EFDC)
9) Fluid Volume Conservation (FVCOM)
10) Sea and Lake Overwash & Surge from Hurricanes (SLOSH)

## Save the Date: The next Smart River & Dam Security Task Force will meet 03 April, 1200 to 1400 in the Governor's Conference Room on the first floor of the Wade Hampton Building