U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION 4
CENTERS OF EXCELLENCE FOR WATERSHED MANAGEMENT

2017 ANNUAL REPORT

CLEMSON UNIVERSITY
CENTER FOR WATERSHED EXCELLENCE

PREPARED BY
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The Clemson University Center for Watershed Excellence [the Center], in partnership with the South Carolina Department of Health and Environmental Control (SC DHEC), Clemson University, and US Environmental Protection Agency (EPA) Region 4, seeks to utilize the diverse talent and expertise of Clemson University and through partnership in various geographic areas to provide hands-on, practical products and services to help communities identify watershed-based problems and develop and implement locally sustainable solutions. It is therefore a great honor to serve as an EPA-designated Center for Watershed Excellence with such a critical mission to serve in the long-term protection of this most vital resource.

The realization of the Center’s nine years of partnership-building was fully realized in 2017, with the most substantial collaboration between the Center and DHEC to date. In August 2016, the Center and SC DHEC hosted a summit including Georgia Environmental Protection Division, EPA Region 4, Clemson Public Service & Agriculture, and Upstate Forever to discuss the establishment of South Carolina Adopt-a-Stream, modeled from the successful Georgia Adopt A Stream program. Our discussion initiated the launch of South Carolina’s first statewide citizen monitoring program, co-lead by the Center and DHEC. By July 2017, SC Adopt-a-Stream had its own secure and mobile friendly volunteer monitoring database. Reflecting upon the very rapid upstart of the program and the wildfire reaction of volunteer interest across the state, this timing demonstrates that efforts of such magnitude take time - time to cultivate relationships, explore organizational strengths, share resources, build trust, and develop camaraderie. The work now truly begins, as we lead a statewide movement towards meaningful stakeholder involvement in protecting and managing our shared waterways.

The needs of the Center are many to continue and expand these operations. Funding for staffing to meet growing programmatic requests is essential in 2018-2019 to stabilize the Center’s many projects.

This document has been produced to report on the calendar year 2017 efforts of the Center, designated as such by the EPA. The original Memorandum of Understanding (MOU) between named agencies was signed in June 2008. The Center was re-designated in June 2013 under a new five-year MOU with this same primary purpose. The Center is currently working with EPA Region 4 and SC DHEC to renew our designation.

This report and all products of the Center’s activities will be archived at www.clemson.edu/watershed to encourage greater awareness, involvement and partnerships developed through the Center and its agency partners.

Katie Callahan, Director

Calvin Sawyer, Ph.D., Associate Director
As a direct result of our collaborative Center of Excellence Memorandum of Understanding (MOU), as well as regular communication and interests in partnership, the Center was asked to co-lead the South Carolina Adopt-a-Stream (SC AAS) program with SC DHEC in 2016. This initiative began because of the energy and findings of South Carolinians monitoring the state’s waterways, with training provided by the Georgia Adopt-A-Stream (GA AAS) program. GA AAS is directed by the Georgia Environmental Protection Division (GA EPD); water quality results and observations therefore were being directly reported to GA EPD.

An MOU between Clemson University, SC DHEC, and GA EPD in the fall of 2016 commenced the sharing of resources towards the development of a standalone SC volunteer river monitoring program, with water quality results and observations being channeled directly to SC DHEC. The program has launched in phases to meet the needs of nearly 70 volunteers already actively monitoring.

Phase I of SC AAS seeks to develop the following program infrastructure:

- **Volunteer Freshwater Monitoring Handbook** - Completed September 2017
- **Secure and mobile-friendly database** - Launched June 2017
- **Training resources for the certification of volunteers in three monitoring protocols (Physical/Chemical, Bacteria, and Macroinvertebrate) and the Stream Habitat Assessment** - Completed September 2017
- **Data recording sheets for protocols most suitable for South Carolina’s freshwater resources** - Completed June 2017
- **Communication methods to update and seek feedback from program participants** - April 2017

SC AAS was developed to **promote and protect South Carolina’s waterways, using citizen science.** To achieve our mission, SC AAS must be administered in such a way that quality data is the result of consistent trainings from experienced and expert-guided volunteers. Currently the program works alongside a dozen expert SC AAS Certified Trainers. These trainers typically have an environmental science or freshwater biologist background; they are faculty and staff of universities, counties, colleges, conservation organizations, and SC DHEC. Trainers seek certification
annually to then certify SC AAS Volunteers. These Certified Volunteers then also must seek annual recertification. The procedures that direct SC AAS in training, data collection, equipment, and program policies are outlined in our Quality Assurance Project Plan (QAPP) currently under review by EPA Region 4.

The Center and SC DHEC worked with Clemson’s Computing & Information Technology team (CCIT) to develop the SC AAS Database. Recognizing that a functional, accessible database is a key factor in the organization of volunteers around a cause, we worked to quickly establish the database and outlined phases of its production and capabilities. The SC AAS Database of June 2017 can do the following:

- Register sites using geolocation services and in realtime;
- Receive data across all protocols and alert users where duplicate values are not within acceptable ranges per the QAPP;
- Be used to look at sampling results from stations across the state by the public, without revealing information about the volunteer;
- House information securely about a volunteer, requires a secure log-in, and allows the user to modify their information, certification information, and password.

Work began on phase 2 of the SC AAS Database in spring 2018. Next steps will include profile pages to evaluate trends at monitoring locations, including graphic capabilities; profiles of users to better establish database restrictions and to track certifications; and overall, more capabilities to evaluate results in a watershed or at a site over time.

Next steps in program growth include certifying more SC AAS Trainers to meet emerging needs and grow SC AAS in new areas of the state. More online and video resources will be developed to assist volunteers in strengthening their knowledge and information retention following trainings.
SC AAS in 2017

139 SC AAS Volunteers registered
133 Sampling Events recorded
138 Monitoring Sites registered
3,000+ views of the SC AAS website
325 subscribers to SC AAS E-news
60 attendees to program webinars

8 Program Partners in implementation of this project (Clemson Extension, Richland County, University of South Carolina - Spartanburg Watershed Ecology Center, Upstate Forever, Anderson University, Greenville County Technical College, Pickens County, Anderson County) and GROWING!

Participants at SC AAS Volunteer Monitor Trainings learning hands-on water quality testing and macroinvertebrate collection.
Clemson University is “All In” for Stormwater Education and Involvement!

By Charly McConnell, Water Resources Agent

Now in the third year as an MS4 operator and fourth year in their partnership with the Center for Watershed Excellence and Clemson Extension Carolina Clear, Clemson University continues to evolve and expand upon their stormwater education and involvement. This past year has been all about storm drain marking and getting students in the stream! Campus launched a new storm drain marker design that emphasizes the link between campus storm drains and the adjacent, iconic Lake Hartwell. This is a relatable message, since Lake Hartwell is beloved by so many, and used for recreation and is the source of local drinking water. Students have also been excited to get involved with the SC Adopt-A-Stream program, which allows them to get hands-on experience monitoring the quality of nearby streams and creeks. Student clubs/groups, Creative Inquiries, and classes at Clemson have all been eager to participate in this program and adopt local streams. Other ways that stormwater awareness is addressed on campus is through stormwater presentations, rain barrel paintings, student fairs, and litter pick-ups with different student groups and clubs.

Another avenue that is being used to increase stormwater involvement is through the student internship program. Students are asked to focus on stormwater-related projects that will impact campus and educate students on stormwater. Projects in 2017 focused on one best management practice in particular, floating treatment wetlands. With two floating treatment wetlands installed on campus, student projects centered around the maintenance of these wetlands and how to construct a more affordable DIY option for homeowners. An Esri Story Map was created to document stormwater features and awareness methods throughout campus. Five student interns have passed through this program to date.

Communication is key not only amongst students, but also with faculty and staff. Participation among a variety of different committees on campus, including Solid Green, CU Sustainability Committee, and CU Stormwater Advisory Group create an interconnectedness that includes stormwater as part of the university’s overall sustainability efforts.

Esri Story Map created by Clemson Stormwater Intern.
Clemson Extension’s Carolina Clear Program

BY AMY SCARONI, PH.D., DIRECTOR OF CAROLINA CLEAR

Clemson Extension’s Carolina Clear program partners with over 38 MS4 communities in South Carolina to provide compliance-based stormwater education, outreach, and public involvement opportunities. Our team of nine Water Resources Extension Agents are located in the regions they serve, allowing them to best understand the educational needs of their communities. We strive to protect water resources and encourage pollution prevention by providing quality programs that raise awareness of stormwater issues, and promote actions and behaviors that ultimately protect South Carolina’s water resources.

The Carolina Clear program works hand-in-hand with environmental educators, colleges and universities, municipalities, counties, stormwater engineers, and local non-profits to provide trainings, workshops, resources, tools, demonstration projects, and events to meet the educational needs of our community partners. For additional details on the program, see www.clemson.edu/carolinaclear.

Partnering MS4 communities contract with Clemson Extension to provide compliance-based education to fulfill Minimum Control Measures 1 & 2 of their stormwater permit. This funding provides for designated Clemson Extension personnel and program resources to lead educational efforts. Regional efforts are grouped into Consortiums, and led, or co-coordinated, by a Clemson Extension Water Resources Agent. Current consortiums include:

- Anderson and Pickens Counties Stormwater Partners – participating communities include Pickens County, City of Central, City of Clemson, Clemson University, City of Easley, Town of Norris, City of Pickens, City of Liberty, Anderson County, City of Anderson, and the Town of Belton.

- Ashley Cooper Stormwater Education Consortium – participating communities include Berkeley, Charleston and Dorchester Counties and the municipalities of Charleston, Folly Beach, Goose Creek, Isle of Palms, James Island, Lincolnville, North Charleston, Sullivan’s Island, Summerville, and the Town of Mount Pleasant.

- Coastal Waccamaw Stormwater Education Consortium (led by Coastal Carolina University) – participating communities include the counties of Horry and Georgetown and the municipalities of Atlantic Beach, Surfside Beach, Conway, Myrtle Beach, Briarcliffe Acres, and North Myrtle Beach.

Elementary school children in Richland County have a look at what lives at the bottom of their nearby creek, while learning about stormwater. This outreach is facilitated through the Richland Countywide Stormwater Consortium.
In 2017 Carolina Clear reached audiences through a variety of direct and indirect channels, including mass media campaigns (billboards and television commercials), websites and social media, workshops, trainings, best management practice (BMP) installations, shoreline restoration plantings, stormdrain markings, litter cleanups, teacher trainings, classroom presentations, summer camps, peer-reviewed fact sheets, and distribution of educational materials. In total, our efforts reached over 5 million people. Priority pollutants of concern (POCs) across regional Consortiums in 2017 included bacteria, sediment, fats/oils/grease, trash/litter/debris, nutrients, freshwater (in coastal estuaries), and toxic contaminants.

Multi-Agency Collaboration and Stakeholder Engagement

The Center maintains meaningful communication with the state’s environmental agencies and conservation organizations:

1. The volunteer river monitoring summit held in 2016 resulted in a multi-state partnership to establish SC Adopt-a-Stream with SC DHEC and the Center serving as co-leaders. The MOU also formalized the relationship with GA EPD, where this agency serving as mentors in the establishment of the SC program. Additionally, contacts were made with other state agencies, including the state office for the Natural Resource Conservation Districts and SC’s Department of Natural Resources (DNR).

Multiple partners are involved in and are critical to the success and far-reaching impact of SC Adopt-a-Stream. These include counties, conservation organizations, technical colleges, universities, families, the Clemson Extension Service, and others. These partners ignited this program’s start in the state through their demonstration of demand and relevancy; many of them serve as Trainers, enabling the quick start of volunteer work in monitoring.

A Training Advisory Committee was formed to help refine training procedures and materials. This is a two-year term of service to the program, that meets quarterly to help advance SC AAS. Also, an Advisory Board will form in 2018 to advise the overall direction, sponsorship, and program integration with other water management activities in the state.

2. The Center for Watershed Excellence in partnership with the South Carolina Water Resources Center is working with SC Department of Natural Resources (DNR) and SC DHEC to facilitate the stakeholder engagement process of the state’s groundwater assessment. This is the state’s second step in the development of the next State Water Plan. The project team completed their work in facilitating stakeholder engagement in the surface water availability

- Fifteen meetings were held across the state to introduce stakeholders to the planning project, the surface water balance model that would be used, collect additional withdrawal and dam data, and demonstrate the model using three different scenarios.
- The groundwater assessment involves the additional assistance of the USGS in modeling groundwater usage in each county and in consideration of groundwater use permits. Two meetings were held to introduce the public to this next stage of water plan development and seek input. Two additional meetings will be held as the assessment concludes in 2018.

3. Katie Callahan joined the Friends of the Reedy River as technical Board Member in 2017. The Reedy River is the iconic river of the City of Greenville and spans 275 square miles of Greenville and Laurens Counties. Once the multi-colored receiving waters of the city’s textile industry, the Reedy River and its downtown waterfalls are now a major draw to the city and offer the quiet comforts of nature within the fourth fastest growing county in the nation. This involvement has branched into working alongside other conservation groups, City of Greenville, and Greenville County in the Reedy River Water Quality Group. Known as the RRWQG, this collective is an extraordinary model of stakeholder-driven water resources management, as the collective works through an alternative TMDL process to address nutrient and bacteria problems widespread in the basin.
Technical Service in Microbial Source Tracking

The Center, in partnership with the Clemson University Plant Pathogen Detection Laboratory, launched a microbial source tracking technical service in 2016. The partnership intends to maximize use of available quantitative polymerase chain reaction (qPCR) equipment to assist communities, organizations, and individuals in addressing surface water bacteria contamination. E. coli impairments are the most frequent of surface water impairments in South Carolina. The laboratory utilizes qPCR methods described by Griffith et al. (2013); qPCR is a genetic method that quantifies targeted DNA sequences using a fluorescently tagged probe created to seek that matching sequence. The amount of fluorescence resulting is directly proportional to the amount of amplified DNA. The method is not geographic dependent, meaning no library of information and DNA sequences needs to first be developed for species specific to an area. This makes for a more rapid and cost-effective assessment, typically, and is often referred to as real-time PCR. Results include both Bacteroides population and positive/negative results associated with waste of human, bovine, swine, and canines. qPCR is looked at as the most promising method for microbial source tracking and use in bacteria contamination issues in surface waters.

This service had two clients in 2017, both are counties of the South Carolina Upstate. In one year of quarterly sample collection, the prevalence of swine as a major contributor to one station was so conclusive, that the county looked to modify their monitoring plan to include a new, unmonitored location, as we identify potential projects to mitigate.

In addition, two Clemson University students worked with the Center to develop data visualization tools for these complex data sets. Resource managers are challenged today with evaluating many parameters, and the addition of four source results can further complicate the ability to draw conclusions on water quality data and next steps. The students used Tableau to organize data; this intelligent program offers numerous visualization options for interpretation of complex data sets, and was found to be a helpful tool in organizing and interpreting these data.

More information on this effort can be found at [www.clemson.edu/public/water/watershed/projects/qpcr.html](http://www.clemson.edu/public/water/watershed/projects/qpcr.html).

Visualization graphic created by Clemson student, showing qPCR results from one year of monitoring with season comparison, paired with E. coli.
II. REPORT ON ANY CLIENT FEEDBACK COLLECTED

Feedback is received regularly through client communication, meetings with professional associations, stakeholder requests and comments, and program evaluations. Information provided below includes major points of feedback from 2017 and some programmatic responses:

- In the development of the SC Adopt-a-Stream program, the database was expressed as critical to motivating and engaging volunteers. Therefore, the launch of this database was prioritized over the development of monitoring resources, which quickly followed database launch. The ability to evaluate trends by the volunteer and public were expressed as necessary next steps.

- Also during development, the Center and DHEC conducted in-person interviews with all agencies and staff that were training SC volunteers in the Georgia Adopt A Stream protocols. Questions were asked consistently to each participant inquiring what changes they would like to see adopted into a SC program that would better suit our rivers and ecosystems, stakeholders, partnership capabilities, resources, and more. Unanimously, all participants identified the following changes as beneficial to the program and its resiliency: online recertification options and a “master” level of certification that would require recertification every three years (for example) after a specific number of years of consistent monitoring and program involvement. These changes will be worked into the program over time and with advisement from our advisory board, to be formed in 2018-2019.

- There has been immense interest in SC AAS protocols for tidally influenced and coastal waterways. Resources to support monitoring these waterways and engaging coastal stakeholders will be a next step in program development.

III. WATERSHED PLANS DEVELOPED

Several watershed plans and watershed restoration efforts have been a focus of the Center for Watershed Excellence and affiliated programs.

Cane and Little Cane Creek, Oconee County, SC

A proposal to develop a Watershed Management Plan to address bacteria impairments in the Cane Creek Watershed, a 29-square mile watershed draining to Lake Keowee, was approved for 319 (h) funding by SC DHEC. The Center serves as Co-PI on the project, contracted by FOLKS, Friends of Lake Keowee Society.

The Center’s responsibilities include stakeholder engagement, watershed characterization, source identification, BMP recommendations, watershed modeling, and setting objectives and priorities for plan implementation. Stakeholders convened in this effort include the following:

- Local farmers,
• City of Walhalla,
• Oconee County,
• Local utilities,
• Homeowner associations,
• Conservation District,
• Clemson Extension Service.

Cane Creek Watershed is comprised of Little Cane Creek and its rural tributaries, as well as Cane Creek, which includes the City of Walhalla. There are three attributes of this project, which separate Clemson and the Center's involvement as making this plan's development unique in SC.

1. A graduate student completing her Masters in Professional Communication, Sarah Carter, conducted a video series to identify the motivating factors for conservation and water quality protection within the community. The residents of this watershed are stratified, from the more rural headwaters to the gated communities on the lake. The objective of Sarah's project was to identify a motivating message that could possibly reach all residents. Through research and discussion, we developed, “Watershed as Home.” This became a platform for the development of two videos. Her first video highlighted “treasures” of the watershed, from its headwaters and well-known Isaqueena Falls, to its discharge and beaches of Lake Keowee. Sarah emphasized the many outdoor recreational opportunities that residents of this watershed enjoy and that are of cultural significance. Sarah's second video included an interview series of four “cheerleaders” within the community. These were identified as users of the natural resources and spokespeople for their need for protection. The well-known faces of the Mayor of Walhalla, the local u-pick and cattle farmer, high school teacher and whitewater kayaker, and utility director were interviewed to share a story and their perspective on how healthy waterways shape their business, family, community, and values. The project and its outcomes can be found online at https://sarah-carter-mapc-portfolio.squarespace.com/client-project/. Another student, Guy Higdon of the Civil Engineering Department was employed as drone pilot in the completion of these videos.

2. A doctorate student, Hamdi Zurqani, was hired to complete modeling of the watershed using Google Earth Engine. According to Google, “Google Earth Engine combines a multi-petabyte catalog of satellite imagery and geospatial datasets with planetary-scale analysis capabilities and makes it available for scientists, researchers, and developers to detect changes, map trends, and quantify differences on the Earth's surface.” This very powerful platform works in the cloud, where developers share code to conduct analyses.

Google Earth Engine was selected due to the resolution of the satellite imagery available. Images used have 1’ resolution, allowing the project team to more accurately categorize land use and evaluate land use change in the watershed. Of significance to this water quality project, field observations and land use change detection analyses using Google Earth Engine allowed us document significant forest loss in the riparian corridor, at 150’ and 300’ buffering widths. The loss of trees in the riparian corridor is suspected to be a primary cause of sedimentation in the stream bed, and observed sediment loading to Lake Keowee. Furthermore, sediment can harbor bacteria and allow the population to grow until resuspended. Excessive downed trees in the stream prevent natural flushing, and this is being documented as one cause of regular E. coli issues throughout the watershed.
3. The Center is working closely with Extension agents at the Oconee County Clemson Extension office. This project has benefited from involvement of the area’s livestock agent, who has previously worked on 319 (h) projects in the watershed to implement septic system repairs and livestock best management practices. With his knowledge of the area and relationships to farmers and large landowners, we have been able to conduct field work in areas otherwise unavailable to the project team, and build partnerships with the agriculture community.

With the insights of the Extension office staff, we will look to include relevant and model outreach programs that will benefit the residents of Oconee County and are protective of the region’s water resources.

Reedy River, Greenville and Laurens Counties, SC

The Center is a participant in the Reedy River Water Quality Group, in its work with Friends of the Reedy River, addressing impairments in this 275 square mile watershed. The group is an assemblage of stakeholders working to improve water quality of the Reedy River, as well as addressing its many impairments, most especially nutrients. It is the model of stakeholder-led, participatory watershed management, with the potential for significant policy changes and long-term improvements to this urban river corridor.

Learn more at www.cleanreedy.org.
IV. WATERSHED PLANS IMPLEMENTED (PARTNERSHIP)

The Center through its Carolina Clear outreach programming and the Clemson Cooperative Extension Service have conducted the following efforts that relate to Watershed Restoration Plans or watershed management and implementation activities:

1. **Gills Creek, Richland** County, SC – in support of the reduction of bacteria loading to the creek and its tributaries,
   - Best Management Practice tour at Sandhill REC for Gills Creek members. 8/18/2017
   - SC Adopt-a-Stream and water quality presentation to the NE Chapter of the Kiwanis Club. 8/28/2017
   - SC Adopt-a-Stream training for chemical, physical, and bacterial protocols. 10/24/17 (IMG 4912)
   - Stream sampling and macroinvertebrate lesson to students at A. C. Moore Elementary. 1/12/18 (IMG 5292)
   - Macroinvertebrate sampling and stormwater lesson to students at Harmony School. 3/27/18 (DSCN1072)
   - Macroinvertebrate and stormwater lesson to students at Rosewood Elementary. 3/8/18
   - SC Adopt-a-Stream training for chemical, physical, and bacterial protocols. 2/6/18 (AAS Dent, AAS Dent 2)
   - 4H2O: Exploring Watersheds at Sesquicentennial State Park (June 2018).

2. **Crane Creek Watershed**, Richland County, SC – in support of reduction of bacteria to surface waters,
   - 2018 Midlands Area Stormwater Pond Management Conference
   - Distributed dog waste materials to veterinary offices in the watershed.

3. **Generostee Creek Watershed**, Anderson County, SC – in support of reduction of bacteria to surface waters,
   - SC Adopt-a-Stream Chemical and Bacterial workshop at Anderson University- 10/7/2017
   - Monthly SC Adopt-a-Stream Chemical and Bacterial monitoring on Big Generostee Creek- 10/1/2017- continuous
   - Monthly SC Adopt-a-Stream Chemical and Bacterial monitoring on Five mile tributary- 10/2017- continuous
   - Best management practice for pet waste through the puppy love pledge project, All of Anderson County- 01/01/2018- continuous
   - SC Adopt-a-Stream Chemical and Bacterial workshop at the Civic Center in Anderson- 03/13/2018
   - SC Adopt-a-Stream presentation to Keep Anderson County Beautiful focused on the Big Gen- 03/27/2018
   - Big Generostee creek litter pick up- 04/21/2018

Sensor installed on Big Generostee Creek, a major tributary to the Savannah River.
• Continuous water quality sensor install on the Big Gen- 04/26/2018

V. DOCUMENTED WATER QUALITY IMPROVEMENTS

Until the launch of SC Adopt-a-Stream, opportunities for easily and inexpensively monitoring the installation of demonstration practices installed with the assistance of Clemson PSA and Clemson Extension have been limited. Therefore, there are no water quality improvements to report at this time. We believe that the installation of demonstration practices in 2017 (rain gardens, shoreline buffers, bioretention cell) have directly improved water quality or quantity of runoff in specific conditions, such as rain events or season.

VI. IMPORTANT WORK NOT SPECIFIED ABOVE

1. Continued Efforts in Hybrid Learning

Hybrid learning offered in partnership with the Clemson Extension Service and CU Online, has been a significant success for the Center and has increased awareness of this effort of EPA, CU, and DHEC. These courses have been made possible, and effective, due to the collaboration and variety of expertise of Extension faculty, agents, external professionals, and a course coordinator. More information on each course team and details about each program can be found at www.clemson.edu/watershed.

Master Pond Manager Certification Course

Master Pond Manager (MPM), coordinated by Clemson Extension Natural Resources Agent, Guinn Wallover, is designed to teach participants a wide range of pond management knowledge and skills. As a “hybrid” offering, this course incorporates self-paced lectures, discussions, quizzes, and more interaction, with a mandatory field days for in-person and hands-on learning with recognized experts. Course is structured in two tracks – stormwater and recreational ponds – and those who complete both tracks and pass the exam are certified as Master Pond Managers. The course was held twice in 2017, teaching 52 participants and certifying 14 professionals; to date, more than 200 individuals have participated in the Master Pond Manager program. The year 2017 will offer the course’s field days in the Charleston and Clemson, SC area.

The Master Pond Manager program will be developing special topic courses to include advanced curriculum options for participants. In response to impacts felt in South Carolina from the 2015 and 2016 flood and hurricane events, the program team will be focusing their initial efforts on development of a Master Pond Manager special topics course in “Dam Maintenance.” Other future directions in special topics include curriculum in duck impoundment management, irrigation pond management, and saltwater impoundment management. The Master Pond Manager course instructors include Dr. Lance Beecher, Dr. Cory Heaton, Dr. Dan Hitchcock, Kim Morganello, Derrick Phinney, Ben Powell, Jack Whetstone, and Guinn Wallover.

Post-Construction BMP Inspector Certification Course

This offering, led by Dr. Dan Hitchcock, P.E., is purposed to train professionals in methods and strategies for conducting routine and thorough inspections and proper maintenance of stormwater management practices. This is a five-week, self-paced online offering, with one mandatory field day for hands-on learning and inspections alongside recognized experts. Participants must also pass an exam for course completion and certification. Best management
practices include wet and dry detention basins, stormwater wetlands, bioretention and infiltration practices, manufactured devices, underground detention, swales and buffers, rainwater harvesting, and permeable materials. The course is typically offered twice a year with respective field days held in the upstate and on the coast (spring and fall, respectively).

The 2017 course offerings had a combined total of 53 participants with 47 completing the certification. Since 2014, 172 inspectors have completed the certification program. The next course offering will be this spring 2018 with the field day to be held June 26 in Greenville, SC.

Certification lasts for three years, and the program team is currently working on the recertification course. The program team includes co-instructors Chuck Jarman, P.E., Kim Morganello, and Dr. Cal Sawyer from Clemson University, and J.P. Johns, P.E., from Woolpert, Inc., and course coordinator and technical specialist Valerie Wheeler from Clemson Online.

2. Hunnicutt Creek Creative Initiative

Hunnicutt Creek is a 3rd order stream that drains about 1,200 acres, encompassing almost 80% of Clemson University’s main campus. Several years ago, a multi-disciplinary project was undertaken on the lower section of Hunnicutt Creek to restore and enhance selected areas as part of an approved compensatory mitigation plan. Three hundred and ninety (390) linear feet of perennial stream were restored and activities undertaken to enhance approximately two (2) acres of jurisdictional wetland through conversion from emergent vascular to bottomland hardwood ecosystems. The Hunnicutt Creek restoration project has served as a catalyst for broader ecosystem assessment and enhancement for the entire watershed.

During this reporting cycle, Rebeckah Hollowell completed her MS research, which focused, in part, on Hunnicutt Creek: A Comparative Study of Stream Restoration Projects in the Upstate, Piedmont of South Carolina. Objectives included an examination and assessment of geomorphic and biological stability indicators for restored and unrestored stream reaches in Hunnicutt Creek. Her research was intended to provide academic, regulatory, and design communities with a local dataset that identifies and quantifies stream restoration performance to evaluate empirical success. Data of this nature are not readily available and time consuming to collect. Locally conducted studies such as these are useful in the development of future restoration projects and to help make future restoration projects more effective. Findings have been presented to University Facilities and to the US Army Corps of Engineers Charleston District.

During the summer of 2017, the third field trial for invasive species management using prescribed grazing took place within the Hunnicutt Creek Watershed. The ongoing project, which has been mostly funded by Clemson University Facilities, is titled “Evaluating Control Strategies for Effective Invasive Species Management – Prescribing Grazing with Goats.” The results of all three trials have been favorable. Within the browsing areas, almost every invasive plant species – including kudzu, Chinese privet, silverthorn, English ivy, nandina, liriope, Japanese stiltgrass and Japanese honeysuckle – were either eliminated entirely or significantly reduced and thus easier to manage.

For additional project details including stream restoration overview, wetland enhancement efforts, invasive species research, student work and ecosystem monitoring, visit the project web site: www.clemson.edu/public/hunnicutt.
3. Participation in the Southeast Chapter of the International Erosion Control Association

Center Associate Director serves on the International Erosion Control Association Southeast Chapter Technical Advisory Committee. In that role he assists in organizing the technical program of the Erosion and Sediment Control Training and Field Day each year at the TRI Denver Downs Research Facility in Anderson, SC. This year’s event took place on September 28, 2017 and included 162 participants and over 25 vendors. One of the goals of the field day was to provide training and demonstrations for improving the understanding of products and practices in the erosion and sediment control industry through practical application of the products in the field. Research updates were given on turbidity reduction using linear sediment control practices and basin modeling to optimize trapping efficiency on active construction sites.

4. Clemson Extension’s Rain Garden Initiative & Master Rain Gardener

The Carolina Rain Garden Initiative (CRGI) was launched by Clemson Extension in 2015 and can be found at www.clemson.edu/raingarden. The initiative was led by Clemson Extension’s Water Resources Agent Kim Morganello. The objective of this program is to increase the number of residential-scale “pocket” rain gardens present in SC. The program brings together diverse tools and resources pertaining to rain garden design, installation and maintenance. One such tool, the Virtual Rain Garden, was created to provide a 17 video tutorial of step-by-step information ranging from soil assessment to plant selection to long term maintenance. Residents can showcase their rain garden at the SC Rain Garden Tracker and receive a free rain gauge in the mail. The Clemson Extension “Guide to Rain Gardens in South Carolina” was published in December, 2016 and is available as a free download on the CRGI website. Interested individuals can also learn about rain gardening opportunities throughout South Carolina, including a listing of demonstration rain garden sites as well as past and upcoming workshops. During the reporting year, the CRGI experienced 2,595 unique views.

In 2018, Clemson Extension launched The Master Rain Gardener (MRG) program led by Kim Morganello. This program is a new hybrid certification course focused on rain garden and rainwater harvesting system design and implementation. MRG includes two tracks to meet the needs of diverse audiences; a Letter of Completion Track intended for Master Gardeners, Master Naturalist and home gardeners, and a Certification Track for landscape installers, designers and contractors. MRG offers multiple weeks of online instruction that includes audio-recorded presentations, supplemental videos, discussion forums, at home activities, resources and weekly quizzes. Individuals in the Certification Track also participate in a one-day field session in which they actively participate in the design and installation of a rain garden and rainwater harvesting system. Clemson Extension’s MRG was first offered in the spring of 2018, the course filled to capacity of 45 participants and also included a waiting list. Participants in the first offering represent 25 different cities and towns across South Carolina, and one out-of-state participant from Louisiana.
THANK YOU FOR YOUR SUPPORT OF CLEMSON PUBLIC SERVICE & AGRICULTURE’S WATER RESOURCES RESEARCH AND EXTENSION PROGRAMS.

SC WATER CONFERENCE (OCT. 2018)  www.scwaterconference.org

STATE WATER PLANNING  www.scwatermodels.com

CAROLINA CLEAR  www.clemson.edu/carolinaclear
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SC ADOPT-A-STREAM  www.scadoptastream.org

CENTER FOR WATERSHED EXCELLENCE  www.clemson.edu/watershed
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