

WATERSHED PLANNING, IMPLEMENTATION AND ASSESSMENT: THE MAY RIVER WATERSHED ACTION PLAN CASE STUDY

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Abstract—Prior to exponential growth in the early to mid-2000s, the Town of Bluffton, SC was one square mile; as of 2015, it is approximately 55 square miles. Associated with this growth was a shellfish harvesting closure for nearly one-third of the May River in 2009. The Town and its partners developed and began to implement the May River Watershed Action Plan in 2011. The plan is a “living document” allowing for the incorporation of new information and technology as well as modifications based upon its impact on water quality. The continuous evaluation of the success of any watershed management plan is crucial to keeping a plan relevant. Utilizing an adaptive management logic model strategy provides managers a tool to effectively assess and modify their watershed management plan in response to ever-changing environmental conditions, an increasing technical knowledge base, increasing implementation costs, and decreasing resources, in the face of a constant demand for action and favorable results. This case study provides an example of utilizing an adaptive management logic model to initially evaluate a watershed plan.

INTRODUCTION

The May River (HUC 3060110-03) is a tidal embayment located in southern Beaufort County, SC. The Town of Bluffton (Town), sitting alongside the river, has had strong ties to it since its establishment in 1825. Commercial shellfish harvesting has historically been, and still remains, a significant component of the economy, tradition and community character of the Town. Additionally, the aesthetics and views of the May River increase the popularity of Bluffton for residential, commercial, and tourist visitation growth, tying the Town’s economic conditions directly and indirectly to the river. For these reasons, the May River has been designated an Outstanding Resource Water (ORW) by the South Carolina Department of Health and Environmental Control (SCDHEC 2012).

Rising popularity of the area resulted in the Town’s incorporated limits expanding from one square mile in 1987 to approximately 55 square miles today. Between 2000 and 2010 the Town’s population increased by 883 percent from 1,275 to 12,530. The number of housing units rose from 501 to 5,393 during the same time, an increase of 976 percent (U.S. Census Bureau 2000 and 2010).

With the rapid increase in population and development came rising fecal coliform levels in the May River’s environmentally sensitive headwaters, resulting in nearly

one-third of the river being closed to shellfish harvesting in 2009. Today, the May River is included in the approximately 1,100 Total Impairments listed among 920 Impaired Sites within the state of South Carolina’s Clean Water Act Section 303(d) listed waterbodies (SCDHEC 2014). Thus, the following case study of the development, implementation and initial evaluation of the May River Watershed Action Plan is pertinent for both coastal and interior water resource managers whose goal is to develop a comprehensive approach to prevent, respond to, or to evaluate the impacts of their plans on water quality impairments.

Program Background

The May River is located within the jurisdictions of the Town of Bluffton and Beaufort County, where it bisects the Town’s jurisdiction (Fig. 1). With annexation and substantial residential development, land use was converted from mostly pine crops to residential subdivisions and an associated increase in impervious surface and stormwater runoff. In 2007, SCDHEC reported to the Town that fecal coliform levels in the headwaters of the May River were increasing. In 2008, in response to this increase, the Environmental Protection Agency (EPA) and SCDHEC designated the May River as a priority and threatened watershed, thus making it eligible for EPA Clean Water Act Section 319 grant funding. In 2009 the Town developed an initial watershed

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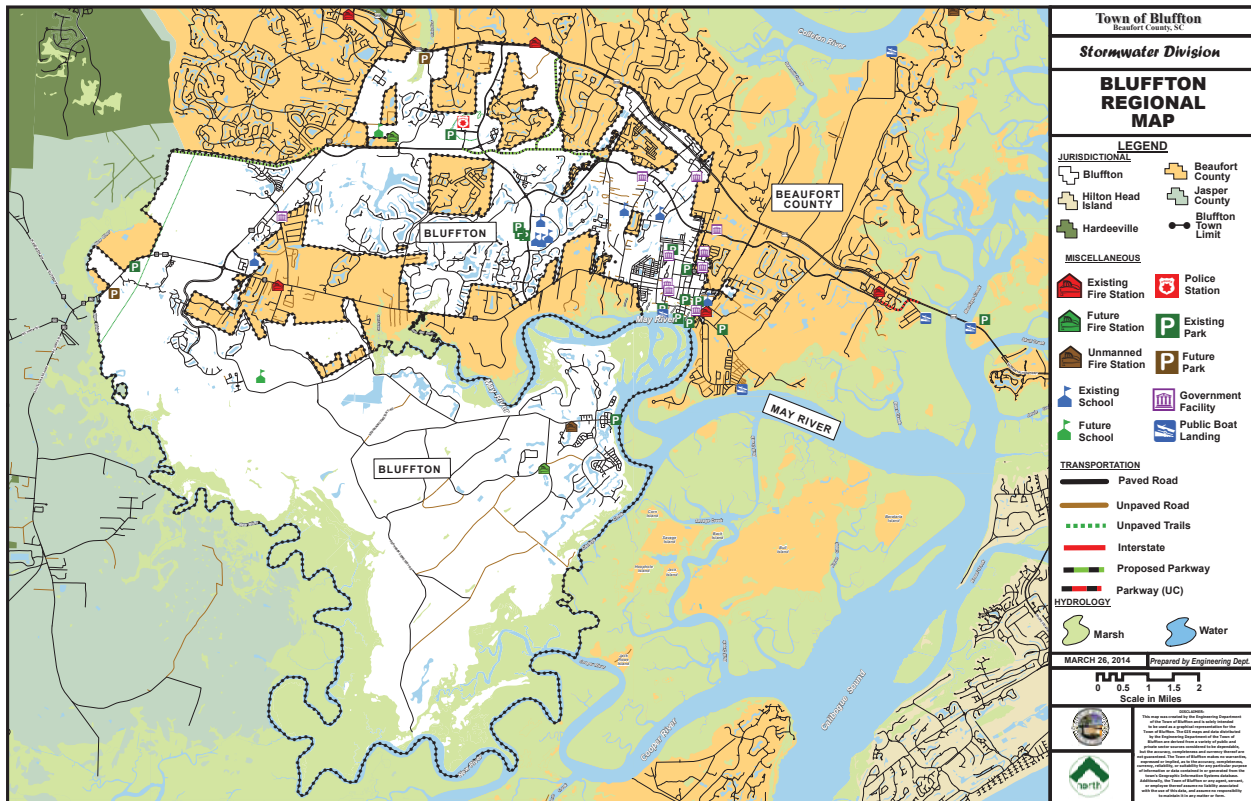


Figure 1—Bluffton region and May River location.

plan which was awarded an EPA 319 grant by SCDHEC for implementation to reduce the fecal coliform levels. Despite initial implementation of that plan, in the fall of 2009 the river received its first-ever shellfish harvesting classification down-grade in the headwaters due to high fecal coliform levels.

While recreational contact is still permissible, rising fecal coliform levels can be an indicator of the deterioration of the overall health of a watershed since an increase in this pollutant is often associated with an increase in other pollutants including sediments, nutrients, and potentially viruses. In response to this degradation of water quality, the Town voluntarily committed to take action to augment the existing 319-funded watershed plan to create an updated, comprehensive May River Watershed Action Plan (Action Plan).

The goal of the Action Plan is to create a program which includes both structural and nonstructural Best Management Practices (BMPs) projects to restore shellfish harvesting within the headwaters of the May River and to protect the river from future degradation. Adapting the guidelines found in the “Handbook for Developing Watershed Plans to Restore and Protect Our Waters” (EPA 2008), Town staff worked for nearly a year with consultants, Beaufort County, and local stakeholders

to develop the Action Plan (AMEC 2011). The Bluffton Town Council adopted the May River Watershed Action Plan by Resolution in November 2011 as a program for stormwater management and May River watershed restoration and protection.

With the Action Plan program providing direction to the Town’s stormwater management and water quality improvement projects for nearly three years, a number of the program’s projects have been implemented or are on-going. Currently, a simultaneous effort is being made to continue with project implementation while objectively evaluating the impact of these projects on improving water quality. As a result of this evaluation, Town staff can make adjustments to the Action Plan program as needed and re-evaluate its impact at regular intervals in the future.

This iterative approach is known as adaptive management (EPA 2008) and is depicted in Figure 2. Implementing an adaptive management strategy provides managers a tool to effectively assess and modify their watershed management plans in response to ever-changing environmental conditions, an increasing technical knowledge base, increasing implementation costs, and decreasing funding sources, while under a constant demand for action and positive results.

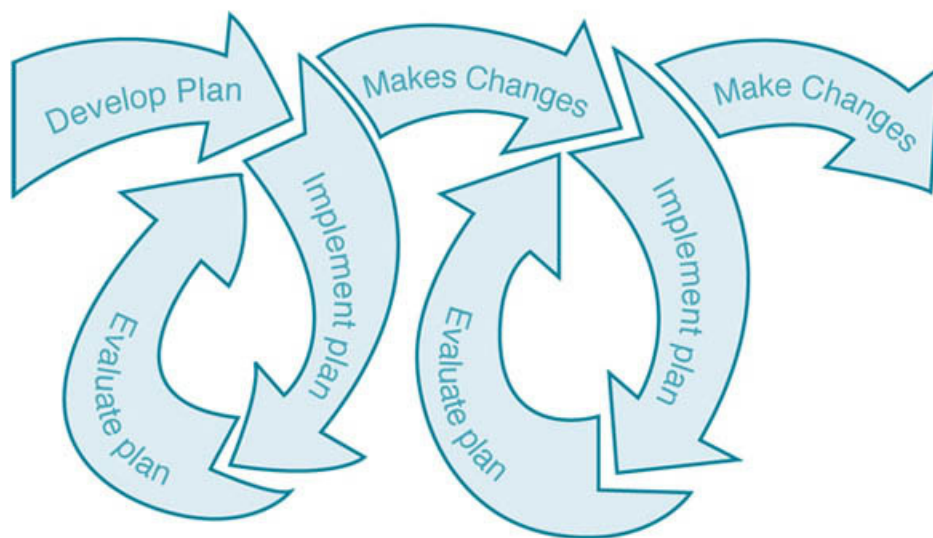


Figure 2—Iterative process of adaptive management.

PROGRAM DESIGN AND IMPLEMENTATION

Program Design

The Town's detailed process to develop and initially implement the Action Plan has been previously documented (Jones and Bullman 2014). By adapting the EPA (2008) guidelines, the Town and its partners worked through each of the following steps. While listed chronologically, many steps occurred simultaneously and are on-going:

Conducted a Social Inventory – identified the stakeholders and built partnerships.

Conducted an Environmental Inventory – coalesced existing data to determine past and present conditions and identify where there were gaps in the data so that they could be acquired.

Set Goal and Initial Objectives – the project team and decision makers (Town Council) determined what “success” would look like and reached consensus to identify the goal.

Designed and Created the Watershed Action Plan – as the plan was under development, short-, mid-, and long-term outcomes which supported the goal were developed.

Implemented the Watershed Action Plan – initial activities and outputs were implemented to show progress and build excitement and momentum toward the desired long-term outcomes.

Measure Progress and Make Adjustments – this is the initial evaluation of the Action Plan utilizing the adaptive management plan logic model strategy to determine program effectiveness and is described in greater detail below.

Program Implementation

To date under the Action Plan program, nineteen projects have produced or are producing on-going outputs for evaluation (Table 1). These diverse projects have vastly differing approaches as a possible means to improve water quality, and include a \$480,000 Capital Improvement Program (CIP) project, nonstructural BMPs such as public outreach and engagement via meetings, events and social media, policies in the form of ordinance changes, as well as small-scale BMPs intended for individual home sites such as rain barrels, rain gardens and bird roosting deterrent systems for docks. Thus, evaluating the projects over time for efficiencies and effectiveness in attaining the Action Plan's goal to improve water quality and protect it into the future will allow Town management to decide which projects warrant receiving continued, but limited resources (both financial and staff time) and which ones should be modified or discontinued.

PROGRAM EVALUATION METHODS

The Town conducted an initial evaluation of the Action Plan utilizing the adaptive management logic model (Fig. 3) strategy. The ultimate criterion utilized to gauge success of the Action Plan is a decrease in fecal coliform concentration numbers at SCDHEC shellfish monitoring stations, resulting in a re-opening of the closed shellfish

Table 1—May River Watershed Action Plan outputs, outcomes and evaluation

	ACTION PLAN CURRENT INITIATIVES	OUTPUTS	OUTCOMES	MEETING GOAL		CONT.?
				YES	NO	
		2011 - 2014				
1	Fecal Coliform "Hot Spot" Monitoring	~1,000 samples collected annually	Provides data to assess project efficacy and environmental indicator for program successes; Provides input for future project retrofit areas.	x		YES
2	May River Watershed Action Plan Advisory Committee	Committee formed and meets quarterly to review project progress and performance measures.	Provides public forum to gather input into project, programs & initiatives; Provides process for quarterly assessment of data and adaptive management of Action Plan.	x		YES
3	Neighbors for Clean Water - Facebook, Twitter, Website	Brand created; Social media sites launched and continued; 3 watershed entry signs installed.	Continued opportunities to reach a broad audience via social media and traditional media venues.	x		YES
4	Community Clean-Ups	Annually - 2 events; with 250 volunteers; 2 tons collected total	Community clean-ups will continue and staff will increase participation levels by broadening the scope of the events to be more festival-like.	x		YES
5	Outreach/Education Events & Participant #s	Annually 40 events; reach of 2,000	Continued outreach & engagement is necessary for success, however improved performance metrics need to be investigated and adopted.	x		YES
6	Unified Development Ordinance Based on Watershed Principles-Growth Framework Map	Map directs future growth to desired areas to protect headwaters.	Uncertain what impact the Growth Framework Map has had on development patterns on the whole.	?	?	?
7	Unified Development Ordinance Based on Watershed Principles-Low Impact Development Incentives	Incentives are identified and available.	Uncertain what impact the incentives have had on development designs; requires better promotion of availability and tracking in the development process.	?	?	?
8	Unified Development Ordinance Based on Watershed Principles-Stormwater Volume Control	Requires post-construction stormwater run-off volumes to equal pre-construction levels.	Uncertain what impact the volume requirement has had for protecting receiving waterbodies; requires calculation of percentage of stormwater volume decrease compared to previous design requirements.	?	?	?
9	Unified Development Ordinance Based on Watershed Principles-Transfer of Development Rights	1,300 units transferred; prevents 146 acres impervious surface in headwaters.	While this program was effective in this single case, it needs to be more broadly promoted and applied.	?	?	?
10	Rain Barrel (55-gallon)	175 installed	Increased awareness and engagement for 150 homeowners (several sites received multiple barrels); prevented additional run-off from home sites.	x		YES
11	Rain Garden (~70 sq. ft. each)	13 installed	Not the most effective stormwater BMP due to cost & maintenance needs making homeowners reluctant to participate.		x	NO
12	Doggie Dooley Pet Septic Installation	5 installed in support of "scoop the poop" pledge campaign; 30 pledges signed	While this small-scale program was used as an incentive to have pet owners sign a "scoop the poop" pledge to be eligible to win a Doggie Dooley, only 30 pledges were made.		x	NO
13	Manure Management Plan & Riparian Buffer Garden	250 sq. ft. garden installed	This particular project stabilized the soil and provided filtration of runoff. Wide-spread application of this BMP would be time consuming and costly.	?	?	?
14	Bird Roosting Deterrent for Docks	40 deterrents obtained; 10 installed	Homeowners were reluctant to deploy a roosting deterrent due to their appearances.		x	NO
15	Septic System Maintenance Assistance	Annually - 56 service requests	Until sanitary sewer service is extended to most residents, this program is necessary for environmental and health/safety/welfare of the public.	x		YES
16	New Riverside BMP Pilot Project	1.25 acre lagoon created to treat a 300 acre sub-basin; one year of monitoring data shows 70% reduction in fecal coliform conc.	The long-term efficacy of a pond to reduce fecal coliform loading from an undeveloped drainage area is currently being investigated via the monitoring data.	?	?	?
17	Animal Waste Ordinance Completed	Adopted; 1 ticket written and dismissed by judge	Widespread education in support of this ordinance needs to be conducted for police officers, judges and general public to increase its effectiveness as a BMP for fecal coliform reduction.		x	YES
18	Trash Can Installation in Old Town	6 cans installed	Trash cans are emptied weekly and more frequently after festivals, thus preventing debris from entering the river. Quantification of amounts needed to determine impact.	x		YES
19	Construction Site Sediment & Erosion Control Inspections	Annually - 1,050 inspections	Sediment and erosion control inspections are effective to prevent sediment transport of pollutants to receiving waterbodies.	x		YES

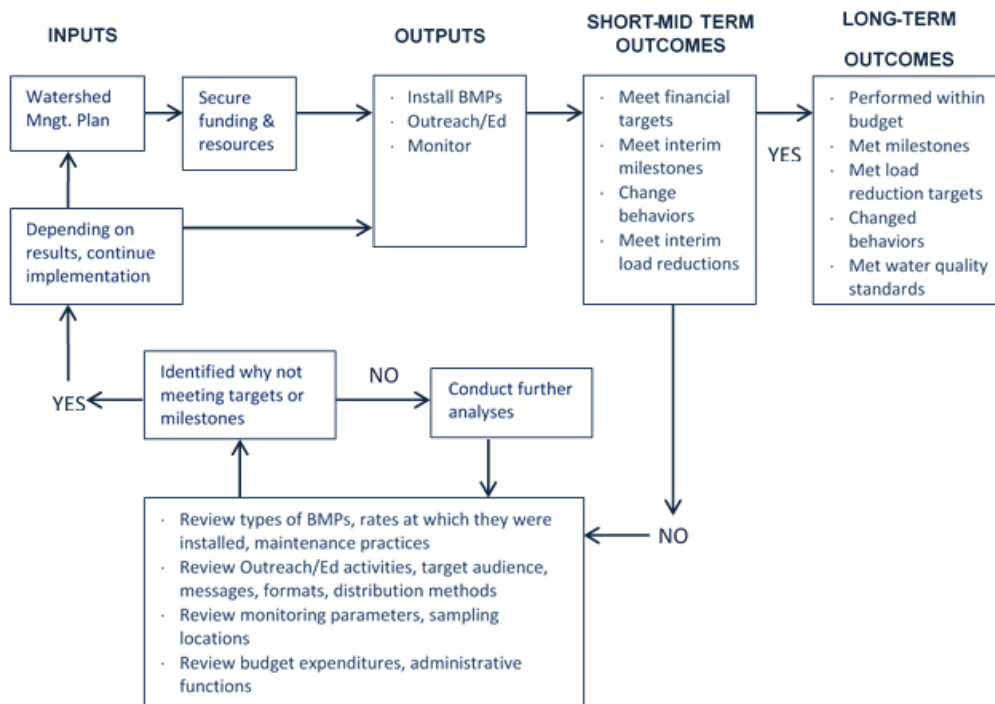


Figure 3—EPA example of an adaptive management logic model for a watershed management plan assessment.

harvesting beds, thus attaining the goal of the Action Plan. This long-term outcome is an indication of holistic watershed health. However, the success of each individual project and its outputs which contribute to that goal were assessed to determine if short-, and mid-term outcome performance measures, previously identified during each project’s design, are being achieved.

Town staff, with the input of the six public members of the May River Watershed Action Plan Advisory Committee (WAPAC), review the status of project completion and overall program implementation on a quarterly basis. Together, the WAPAC and staff decide when evaluation of a project should be conducted at meaningful time intervals. If the intended performance measures are not being met, further investigation will occur as to why.

Based upon the information, the Action Plan projects, performance measures or resources will be adjusted as necessary with the input of the WAPAC and other stakeholders previously identified during the Action Plan planning process. This iterative process will continue until the shellfish beds are re-classified as open for harvesting. From that point, the Action Plan will continue to be assessed using the adaptive management logic model approach to ensure future protection of the May River and its watershed.

RESULTS

The results of the adaptive management logic model evaluation for the Action Plan projects from the last three (3) years are presented in Tables 1 and 2. Programs and projects that were part of the Town’s first EPA Clean Water Act Section 319 Grant, as awarded by SCDHEC, are fully summarized in the final report to SCDHEC (Jones 2014).

Evaluating the nineteen Action Plan projects indicates that, to date, nine projects resulted in outcomes considered to be positive improvements for water quality. The outcomes of four projects are not considered to be meeting the goal of improving water quality, and six projects require modification and re-assessment to determine if their outcomes are contributing to water quality improvement.

Sixteen projects are considered worth continuing, though seven of those require modifications either in design or performance metrics to be fully re-evaluated as they are currently not meeting or are uncertain of meeting the desired outcomes. Three initiatives – rain gardens, Doogie Dooley pet septic installation, and bird roosting deterrents – were not considered worth continuation due to poor public response or participation, as well as limited water quality improvements in spite of high staff effort or monetary requirements.

Table 2—Results of the May River Watershed Action Plan evaluation

	# of Projects	# of Projects to Continue	# of Projects to Modify	# of Projects to Discontinue
Meeting Outcomes	9	9	0	0
Not Meeting Outcomes	4	0	1	3
Uncertain of Meeting Outcomes	6	0	6	0
Totals	19	9	7	3

Of the seven projects determined to require modification, only one is a structural BMP, while the remaining six are policies. The recently completed CIP stormwater BMP, the New Riverside Pilot Project Pond, has a year of monitoring data collected. Initial indications are that the pond is reducing fecal coliform concentrations by 80 percent. Despite this, the long-term outcome of this project is unclear as not enough data have been collected yet to fully understand the system.

The six policy-related projects are either not meeting, as is the case with the Pet Waste Ordinance, or are unclear as to their contribution to the long-term desired outcomes and goal of the Action Plan. The metrics of these projects must be reassessed, as well as the overall project design, to better quantify their contribution to the desired outcomes.

DISCUSSION

The benefits of the adaptive management strategy and several case studies are summarized by the EPA (2013) in its “A Quick Guide to Developing Watershed Plans to Restore and Protect Our Waters.” The routine and intensive evaluation and analyses of pre-determined performance measure data are crucial to the success of any watershed management plan as these ensure the plan is current with industry standards and technical knowledge as well as adapting to a variable physical environment. Additionally, these periodic “check-ups” of a plan ensure that tangible steps toward water quality improvements are being made to meet not only local expectations, but possibly regulatory requirements as well if the waterbody in question is subject to a Total Maximum Daily Load (TMDL).

The benefits of utilizing the adaptive management logic model to assess the Action Plan are evident in the results. The evaluation of the projects in the Action Plan indicates that approximately half of the initiatives are resulting in outcomes considered positive for water quality improvement. What is striking is that 38 percent (7 of the 19 projects) are believed to be producing positive results, but require modification of design, performance measures or data acquisition to re-evaluate and fully support this assumption. Notably, the projects which are unclear as to their success are all policies, with the exception

of the stormwater BMP which, as previously stated, requires more time and data to allow a full evaluation. This observation points out the need for the Town, and others who may adopt a policy as a BMP, to clearly define performance measures which can be obtained following policy implementation. Additionally, all of the initiatives require a quantitative assessment of contributions to fecal coliform load reduction.

Applying the adaptive management approach also provided insight to the Town into which efforts are worth continuing. Sixteen percent (3 of the 19 projects) are not currently considered worthy for continuation based upon poor return on staff investment of time and resources, thus allowing those resources to be dedicated toward the other projects which require modification. Alternatively, if more resources (staff and funding) become available, these projects may be revised based on the input received to improve their reception and implementation by the public.

While applying the adaptive management strategy logic model may seem complex, it actually helps to clarify a watershed management program’s or individual project’s path forward by elucidating where efforts are paying off, where they are not, and where it’s unclear. In the era of doing “more with less,” while still expected to make progress by citizens and regulators, this strategy helps to justify managerial decisions aimed at maximizing the return on resources expended toward a common goal.

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