IMPLEMENTATION GUIDE FOR THE WEST ATLANTA WATERSHED ALLIANCE COMMUNITY SCIENCE PROGRAM

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Abstract. The United States lacks adequate legislation to properly address nonpoint source pollution in the nation's waterbodies. Community leaders have mobilized stakeholder groups and residents to participate in monitoring efforts that help restore urban watersheds. The West Atlanta Watershed is an urban watershed that contains multiple impaired sub-watersheds. In 2013, one of the sub-watersheds, Proctor Creek, was designated as a priority water under the Urban Waters Federal Partnership due to high levels of pollution. The West Atlanta Watershed Alliance (WAWA) is a local nonprofit that mobilizes its resources to restore sub-watershed basins in West Atlanta; such as Proctor Creek. WAWA envisions a Community Science Program that will address this pollution by identifying and detecting illicit discharges. I created an Implementation Guide for WAWA's Community Science Program for staff and partners to establish an illicit discharge and detection (IDDE) program suitable for Proctor Creek and other urban watersheds in West Atlanta. Components of this Guide include background information, participant recruitment strategies, stakeholder engagement strategies, fieldwork assessment protocols, a monitoring and evaluation plan, evaluation surveys, a list of terms, and a frequently asked questions page. This Guide supports water quality assessments through community capacity building and investing community resources. While a broad implementation framework was developed to support enhancement of WAWA's Community Science Program, time constraints prevented customization of the Implementation Guide for the Proctor Creek Watershed community. A more tailored training manual specific to Proctor Creek will be developed in the future.

INTRODUCTION

Background

The United States federal government passed the Clean Water Act (CWA) in 1972 to "maintain the chemical, physical, and biological integrity of the nation's waters". Under the CWA, the National Pollutant Discharge Elimination System (NPDES) is a program enforced by the EPA that regulates direct discharges from commercial, industrial, and treatment plant sources[2]. A direct discharge is defined as any pollutant released into surface water by a pipe or single entry -- point source. Hence, facilities who produce direct discharges must obtain a NPDES permit issued or approved by the Environmental Protection Agency (EPA) to control the type and amount of pollutant being discharged. Each state is responsible for classifying waters by their use and setting water quality standards for each use. Over half of all waterbodies in the United States are not clean enough to support recreational uses such as fishing or swimming and 1301 waters are currently impaired in Georgia[3,8]. Under the CWA, waters become impaired when water pollution levels exceed state water quality standards. For Georgia, depending on the designated use of the water and the time of year, bacteria levels cannot exceed a certain bacteria count per 100 mL of water. In a 30-day period, for example, average fecal coliform cannot exceed 200 counts/ 100 mL in the summer. In addition, pH levels have to read between 6.0 and 9.0 for all designated uses[9]. As part of a state's plan to restore impaired waters, a total maximum daily load (TMDL) assessment must be developed to quantify the maximum amount a pollutant can be present in each water body.

Since the CWA only regulates discharges from point sources, it is the role of the public and individual states to enforce programs they deem necessary to control nonpoint sources. Nonpoint sources are defined as discharges that indirectly enter surface water[2]. The CWA has only established the Section 319 amendment that grants governing entities funds to address nonpoint source pollution by reporting its sources and identifying best management practices. This is largely voluntary because these guidelines are only required of funded entities[24, 22]. Although the regulation of point sources has improved since the CWA enactment, nonpoint source pollution has become a primary contributor of waterbodies not meeting their standards[12,13].

Nonpoint source pollution occurs when natural and anthropogenic pollutants enter surface water by means of various forms of hydrologic processes[24]. According to the 2000 National Water Quality Inventory Report to Congress, urban runoff and storm sewers are the third leading causes of river and stream pollution in the United States[19]. Poor conditions of streams have been associated with negative environmental health impacts for humans and ecosystems such as waterborne illnesses and harmful algae blooms[7].

Table 1: Classification of discharges

Mode of entry	**Direct:** Flows to storm drains through a connecting pipe, producing continuous or intermittent flows
	Indirect: Generated outside of storm drain. Examples include groundwater seepage, transitory spills, dumping outdoor washing non-target irrigation that produces overloads of nutrients, organic matter, and pesticides.
Frequency	**Continuous:** Usually produce the most pollutant load.
	Intermittent: Begin and stop after a short period.
	Transitory: Typically, in response to an event such as a spill.
Composition	**Sewage/septage:** Generated by sewer pipes and septic systems
	Wastewater: Generated by graywater from homes, commerce, and industry.
	Liquid wastes: Generated oil, paint, or process water.
	Tap water: Generated by leaks from drinking water supply
	Landscape irrigation: Generated by excess potable water used for recreational and commercial irrigation that ends up in the storm drain system.
	Groundwater: Generated by local water table that rises above the storm drain and enters through cracks and points.

According to Northridge et al. (2003), linkages among built environment conditions, health, and well-being have not been adequately supported with sufficient empirical evidence needed to influence planning and policy changes[14]. Fortunately, the Center for Watershed Protection's (CWP) Illicit Discharge Detection and Elimination Manual (IDDE) was developed to help states identify, track, and eliminate nonpoint source pollution in their waterbodies[4]. Nonpoint source pollution is comprised of illicit discharges, untreated or partially untreated flows not comprised solely of storm water entering natural waterways[4]. The IDDE Manual describes these discharges by their mode of entry, frequency, and composition (Table 1).

In addition to mode of entry, frequency, and composition, the CWP's IDDE manual has identified "generating sites" as source locations where these wastes are produced. Examples include residential, commercial, industrial, institutional, or municipal locations. One example of a municipal "generating site", combined sewer systems, are particularly important because when heavy rain occurs, the sewer systems overflow causing untreated sewage discharge to enter surface water unregulated in urban areas[4]. Sources of sewage discharge that result from municipal services such as sanitation, drainage, infrastructure maintenance, and garbage collection, pose harmful risks to human and animal health[3]. NPDES requires municipal separate storm sewer system (MS4) communities to have programs in place that control illicit discharges to storm drain systems. Although there are approximately 7,458 MS4 communities, inadequate municipal capacity specifically in urban areas increases the risk of sewage exposure to humans and natural resources[18].

Some of the harmful risks posed to human and animal health are the presence of pathogens. Pathogens can cause gastrointestinal or respiratory illness in humans through dermal and ingestion exposure routes[11]. Certain pathogens are directly correlated with exposure to fecal contamination. Fecal indicator organisms such as Escherichia coli (E. coli) and Enterococci indicate the presence of fecal contamination in water. According to the CWP, Kaushul, and Divers, the impairment for rivers and streams is caused by pathogens more than any other pollutant, specifically fecal coliforms[20].

Role of Citizens

According to the Urban Watershed Restoration Manual No. 3 developed by the EPA and CWP, spill management and response plans are not considered effective because they are reactionary[15]. Predicting illicit discharge potential before the pollution enters the waterbody is an effective approach; municipalities should implement to be proactive. Six thresholds exist that can predict illicit discharge potential. More than 10 "generating sites"/mi^2; ammonia-nitrogen level values that exceed 0.30 mg/; storm-water outfall density values that exceed 20 outfalls per stream mile; areas with sub-watershed development older than 50 years; sub-watersheds that were once served by septic systems, but now have sewer service; combined sewer systems that are now separated; and older industrial areas built before the Clean Water Act indicate high illicit discharge potential[4,5]. Because urban municipalities struggle with inadequate resources and capital to address watershed pollution, the IDDE manual advocates for integration of community engagement and local government. Local residents and community groups can fill the gap by assessing these prediction thresholds in their watersheds. Through education and outreach efforts, the Urban Restoration Manual No. 3 encourages local residents to serve as stewards of their watershed[15].

NPDES permits also encourage use of community-based programs to facilitate public reporting of discharges within MS4 communities. Phase I of the MS4 regulation requires medium to large municipalities to possess a permit for storm drain systems, while Phase II requires smaller and nontraditional communities to obtain a permit[21]. Both Phases require MS4 communities to map their storm sewer systems with the location of outfalls and the water discharged from those outfalls by visual inspection and field tests[4].

Tracking Discharge to a Source

In addition to mapping outfall locations, there are numerous other ways to track the sources of illicit discharges. Local governments typically have a Pollution Complaint Hotline that residents can call to report a spill they see directly. In Georgia, the number is 311. Visual assessments can be conducted beginning at the headwaters of the stream and move down. Those responsible can look for the presence of certain colors, odors, physical materials, and deposits or stains. They can also conduct indicator sampling to detect the presence of pollution[23]. The IDDE manual suggest ammonia is effective indicator because it can detect sewage, industrial, and wash-water discharge composition in more than half of the samples[4].

Sewage discharges are the primary concern among continuous and intermittent flows because of its prominence in urban sub-watersheds. For continuous discharges, manhole inspections are one of the ways to track illicit discharges. A manhole is an opening in the street leading to a sewer. This method involves at least two people and dry weather conditions. It is usually implemented on the road. Visual assessments and indicator sampling are completed here[23]. For intermittent discharges, placement of sandbags and optical brightener monitoring traps are two ways to track illicit discharges. Sandbags are placed in manholes to block flows for visual or indicator assessments at a later time. Optical brightener monitoring traps are absorbent pads in storm drains to capture dry weather flows and determine presence of pollutants. There are other ways to track illicit discharges such as onsite investigations, dye, video testing, and other methods but they tend to be more expensive[23]. Once the discharge is tracked to a source, the municipality or property owner is the entity responsible for fixing it[5]. This enforcement can be achieved by education programs and legal authority.

Proctor Creek

Proctor Creek is one of five sub-watershed basins located in the Chattahoochee River, Fulton County, and entirely within the city limits of Atlanta. It contains one MS4 system with two combined sewer overflows (CSOs) – one of which is closed down[1]. In 2009, Proctor Creek officially became impaired when the City of Atlanta conducted a visual assessment survey, followed by E.coli monitoring in 2010. This Creek is impaired for fishing and swimming due to discharges from urban runoff, sanitary sewer systems, and physical pollution of trash and debris. The City of Atlanta estimates that a 97% reduction of fecal coliform bacteria in Proctor Creek is needed to achieve compliance with Georgia's water quality standards[17, 1].

In terms of demographics, Proctor Creek is home to 38 neighborhoods, and 127,418 residents; the majority of whom are African American and experience social and economic disparities. In 2013, Proctor Creek was designated a priority area for investment through the Urban Waters Federal Partnership, resulting in increased collaboration and resources from federal partners, nonprofits, and corporations[6].

Proctor Creek is a classic example of combined community and government efforts to achieve urban stream restoration. In 2014, a pilot study led by Proctor Creek residents identified watershed stressors using a GIS mobile application. At the conclusion of the study, these residents realized numerous hazards that they identified were not publicly available and perceived their mobile app useful in the continuous collection of environmental hazard data in urban watersheds. The aforementioned group of resident researchers have also been trained to identify illicit discharges and can help support an IDDE Community Science Program for Proctor Creek[10].

West Atlanta Watershed Alliance

West Atlanta Watershed Alliance (WAWA) is a nonprofit organization that mobilizes residents to protect green space and water quality in Proctor, Utoy, and Sandy Creek. This organization aims to restore the West Atlanta Watershed through a pilot-tested Community Science Program in Proctor Creek before being modeled in other urban watersheds. A Community Science Program can help the City of Atlanta become more proactive in their identification and elimination of illicit discharges in West Atlanta. According to the CWP's IDDE Manual, there should be a "system to report illicit discharges, suspect outfalls, respond to citizen complaints, and document local management response and enforcement efforts". In addition to Atlanta's 311 hotline, the City's MS4 Program requires only 20% of streams be implemented as an alternative to outfall inspections[16]. Under these circumstances, a community science program can help strengthen city capacity.

METHODS

The West Atlanta Watershed Alliance was a part of a collaborative team with the Center for Watershed Protection that received a grant to pilot an illicit discharge detection program. Moving forward, the Community Science Program that WAWA envisions will include this work but will be broader in scope. I used information from the grant to write the background, monitoring plan, budget, and identify a target audience for their Community Science Program's Implementation Guide. The Implementation Guide is targeted at WAWA's staff to implement a Community Science Program in the Proctor Creek Watershed. Residents can participate in this program by conducting stream inspections, monitoring ammonia levels, and community organizing.

I used Wholesome Wave Georgia's Fruit and Vegetable Prescription Program's Toolkit as a template for this guide. I adapted sections of the Toolkit to fit the scope and community served by the West Atlanta Watershed Alliance.

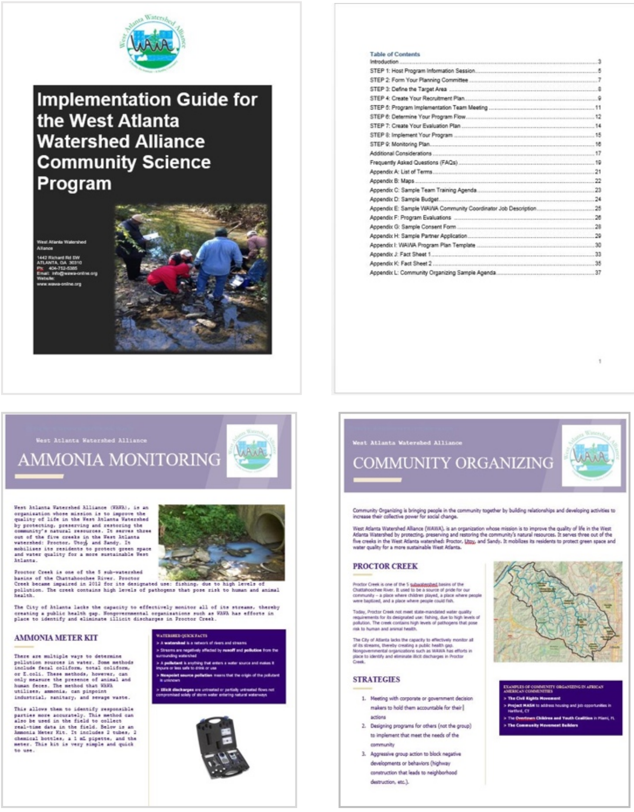

Figure 1. Materials used for Proctor Creek community.

I spent 16-24 hours total on-site at WAWA gaining experience with ammonia testing, interacting with Proctor Creek residents, and attending public meetings. Beginning the week of February 25, 2019, I spent 4 hours a week at WAWA planning for my pilot test. First, I reviewed literature on ammonia metering and community organizing. Next, I practiced using the ammonia meter on tap water samples in the office. Then, I created an ammonia monitoring fact sheet and community organizing fact sheet to hand out for the Program Coordinator to review and provide feedback. Once approved, these fact sheets were distributed at the pilot test on Monday, April 15th.

On April 13th, I attended the Proctor Creek Stewardship Council meeting and WAWA's Urban Forest Festival to engage with community members and promote my event with flyers. I organized two activities -- an Ammonia Monitoring workshop and a Community Organizing role-playing scenario for residents as a pilot test. The Ammonia Monitoring workshop taught residents how to identify illicit discharges, particularly from sewage (or from a particular source) using ammonia as an indicator. The Community Organizing facilitated role-playing to prepare for stakeholder meetings (city officials, facility owners, NGOs, etc). I developed an agenda with talking points and had residents take on roles of individuals who are typically present at these public meetings. Both activities aimed to empower West Atlanta residents to increase their collective power for social change. Both activities were also complemented with fact sheets to serve as visual aids for the participants.

The pilot test took place from 4pm- 6pm at WAWA's Outdoor Activity Center. I coordinated this event with WAWA's Community Science Program Coordinator. I also purchased light refreshments to offer participants the day of the pilot test. Results were used to tailor the Program Implementation Guide for the Proctor Creek community. Figure1 presents snapshots of the fact sheets, evaluation survey, and results. Three people participated in the seminar. There were two women and one man. Each participant resided in the following zip codes: 30018, 30035, and 30318. Their ages ranged from mid-twenties to early fifties. Overall, participants rated the activities positively and seemed to gain valuable information from them.

After adjusting the activities based on the feedback received from the evaluations, these two components of the Implementation Guide should be more applicable to the Proctor Creek community. The feedback gained from the evaluation surveys also informed other parts of the Implementation Guide. A more community-centered protocol will increase sustainability of resident engagement, retention, and program goals.

RESULTS

Components of this Program Implementation Guide include an introduction, resident and partnership requirements, recruitment strategies, fieldwork assessment protocols, evaluation surveys, and a frequently asked questions page. The introduction includes background information on illicit discharges in urban streams, Proctor Creek, and WAWA. Resident and partnership requirements entail time commitments, rules of conducts, and age requirements. Recruitment strategies incorporate target area, target number, and a designated staff member. Fieldwork assessment protocols incorporate onsite investigation forms to help residents conduct visual surveys to identify various potential sources of illicit discharges in local streams as well as focus on ammonia testing to help identify illicit discharges, particularly from sewage (or from a particular source). Evaluation surveys incorporate retention and interest questions on ammonia metering and community organizing. Frequently asked questions page answers the most important questions for implementation. A video trailer was developed to advertise WAWA's program. The 40-page Implementation Guide is placed in an appendix at the end of this document.

DISCUSSION

The creation of this Implementation Guide enables West Atlanta Watershed Alliance to standardize their Community Science Program. It provides a framework in which the organization can invest their resources to support water quality assessments in the Proctor Creek community. This project simplifies the approaches towards urban restoration in a way that will facilitate adaptation in other urban watersheds. This project advances the public health sector by increasing community capacity to advocate for programs that assess population needs and assets around community health. While a broad implementation framework was developed to support enhancement of WAWA's community science program, time constraints prevented customization of the implementation guide for the Proctor Creek Watershed community. In the future, a literature review will need to be done to educate myself around the best practices to frame a training manual. I intend to tailor this guide more specifically to Proctor Creek and the detection of illicit discharges as an actual training manual.

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