

# BREVARD COUNTY STORMWATER AWARENESS AND BEHAVIOR: ANTECEDENTS OF THE LIVE BLUE EDUCATION CAMPAIGN

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**L**IVE BLUE is a cooperative partnership among non-profit organizations, local governments, businesses, educational institutions and residents of Brevard County designed to reduce the pollutant load to the Indian River Lagoon, St. Johns River, and the many tributaries that flow to them. These nationally acclaimed bodies of water support an unparalleled treasure of biological diversity that is increasingly threatened by pollutants transported from the land via stormwater runoff. LIVE BLUE is premised on the notion that by educating community residents on pollution sources, the pathways by which these contaminants enter waterways, and their subsequent impact, more sustainable lifestyle practices will be inculcated. This paper reports results from a survey of almost 1,350 households in southern Brevard County, Florida dealing with stormwater awareness and the household behaviors germane to the contamination of waterways. It represents the pre-LIVE BLUE educational campaign baseline to which post-campaign results will be compared.

*Keywords:* stormwater knowledge, household behavior, non-point pollution

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## Introduction

Pursuant to the Clean Water Act (CWA) Amendments<sup>1</sup>, non-point sources of contaminants flowing into rivers, lakes, and estuaries were codified as a complementing focus in combating water pollution, augmenting the CWA's efforts, to date, which had principally centered on point source discharges. Non-point sources typically are associated with agricultural byproduct, fertilizers, pet

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<sup>1</sup> Water Quality Act of 1987, Title III, Section 316.

waste, litter, and other debris, which are carried into waterways via stormwater runoff. In urban environments, the stormwater issue emanates from residential development, which eliminates natural, pervious surfaces and replaces them with constructed impervious layers such as driveways and roofs, hindering the saturation of rainwater into the ground. Without this natural safety valve, stormwater flows into nearby rivers and streams, transporting nitrogen, phosphorus, fecal coliform, pesticides, and other urban pollutants into waterways, with ultimately deleterious effects. Algal blooms associated with the legacy of nutrient deposition compromise the natural and economic properties of water-assets, potentially yielding large economic losses for surrounding communities.

From its inception, the CWA required EPA to establish Total Maximum Daily Loads or TMDLs.<sup>2</sup> EPA delegated this task to the states, mandating that they determine how much pollution each water body can assimilate, while still meeting designated use. Both point and non-point discharges contribute to water quality deterioration, but it is the latter that EPA defines as the largest water quality problem<sup>3</sup> and which principally falls under the rubric of stormwater management.

Stormwater management has both agricultural and residential components.<sup>4</sup> The focus of this paper is on the development side, and more specifically, the ability of public education and outreach to mitigate the environmental damage associated with stormwater runoff from residential communities. For the past two decades Brevard County, located on Florida's Space Coast, has operated a stormwater management program with revenues derived from a base maximal fee of \$36 per year for single family homeowners,<sup>5</sup> with discount factors available for mitigation. The purchasing power of this utility fee has eroded due to inflation, and combined with legacy nutrient loads, a construction boom, and more stringent TMDL criteria (Gao, 2009), effective stormwater management practices are under-funded.

Investigating whether behavioral modification on the part of Brevard County homeowners can surmount revenue gaps in program budgets is thus of paramount importance. In short, can educational efforts to limit the problem at its origin, rather than remediate after the fact, succeed? Detention and treatment of stormwater runoff is capital-intensive and prohibitively costly. Avoiding capital expenditures closes funding shortfalls and/or frees up dollars for other abatement strategies. This recognition provides the genesis for the LIVE BLUE education campaign.

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<sup>2</sup> Federal Water Pollution Control Act Amendments of 1972, Title III, Section 303(d).

<sup>3</sup> See [water.epa.gov/polwaste/nps/outreach/point1.cfm](http://water.epa.gov/polwaste/nps/outreach/point1.cfm).

<sup>4</sup> It should be noted that the residential dimension includes flooding as well as water pollution.

<sup>5</sup> Slotkin and Vamosi (2010) explore whether Brevard County homeowners would be willing to pay additional rates for stormwater protection.

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This paper has two ulterior purposes. First, it provides a prospectus of the LIVE BLUE educational campaign, and its efforts in educating Brevard County residents on the pathways to limit their stormwater footprint. Secondly, it reports results from a survey of almost 1,350 households in southern Brevard County, Florida dealing with stormwater awareness and the household behaviors germane to the contamination of waterways. As an empirical experiment, pre and post-surveys will be administered to Brevard County residents at both ends of the LIVE BLUE outreach program. The results reported here represent the pre-LIVE BLUE educational campaign baseline to which post-campaign results will be compared.

### **LIVE BLUE<sup>7</sup>**

There are two methodological choices to managing an education, outreach, and marketing program like LIVE BLUE: (a) slow and steady or (b) fast and the furious. Much like the tortoise in Aesop's Fable, LIVE BLUE stakeholders have adopted a deliberative path, mixing old school grass roots operations with modern multi-media marketing. The basis of this decision is predicated upon funding. LIVE BLUE operates on revenues provided by local governments. Municipal *membership* is calculated at \$0.30 per person, with population indicated by the Census Bureau's 2009 estimate.<sup>8</sup> Approximately 27 percent of available revenues funds are steered towards multi-marketing efforts, with about 65 percent of program funds utilized for the delivery of education and outreach

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<sup>6</sup> In 2007 the Indian River Lagoon's economic value was estimated at about \$4 billion per annum. While that number was probably inflated due to "bubble" real estate values, the likely annual benefit still exceeded \$3 billion.

<sup>7</sup> To consult the LIVE BLUE website, see [www.livebluefl.org](http://www.livebluefl.org).

<sup>8</sup> In 2009 the total population of Brevard County amounted to about 535,000 individuals. If all municipal governments participated in LIVE BLUE the membership fee would produce revenues of about \$160,000. In reality, municipal partnership is concentrated in the southern end of Brevard County.

mandates from the federal government. The residual is retained for administrative overhead.

Since the launch of LIVE BLUE in February 2012, educational outreach has adhered to a purposeful, incremental pace, strategizing marketing placement with grass roots operations. In its initial four weeks, LIVE BLUE commissioned eight digital billboard displays, with an estimated viewership of about 225,000 individuals. Additionally, LIVE BLUE used donations from local businesses to prompt viewership of the LIVE BLUE website and friendships on Facebook.

Other platforms for outreach included a “Decal Pal – Summer Sightings” contest. For this competition, residents needed to display a LIVE BLUE decal on their vehicle to be eligible to receive a “Decal Pal Prize Pack,” which included gift cards to local grocery stores, restaurants, gas stations, and other retail outlets. Moreover, for the Sunday edition of a local newspaper (circulation about 21,000), LIVE BLUE commissioned a front page sticky note campaign that simply asked, “Do You LIVE BLUE?” This was accompanied by a banner advertisement on the newspaper’s website, providing exposure to some 60,000 online subscribers during the weekend in question.

In terms of outreach probably the biggest success, to date, for LIVE BLUE was the early completion and airing of music video entitled, “Change to Blue.” Screened during the summer 2102 school recess, the video was shown in three movie theaters for an eight week run, partially supported by a grant from the Florida Department of Environmental Protection. The odd morphing of the Blue Man Group and Blues Brothers provided a lasting impression for theater goers. All told, an estimated 103,250 people saw this entertaining yet effective message on stormwater pollution.

Turning to grass roots efforts, between March–September 2012, LIVE BLUE participated in about 30 events, and held about 100 school age programs. Understanding how to prevent pollution of community waterways is an ongoing effort, designed to instill stewardship and teach healthy lifestyles to local children. Educational curriculum includes but is not limited to the following: 1) Kindergarten, first and second grades, Stormwater Story Time Series, “The Pledge” - young students learn how three little girls discover the resting place of ground debris and take the *pledge* to always LIVE BLUE. Following the story, students take the LIVE BLUE pledge themselves, and sign an oath with the program’s signature, a blue footprint; 2) third grade and up, “Enviroscape” - young students participate in the living story of Billy and his family as they proceed through routine tasks of everyday life and unknowingly create stormwater pollution; and, 3) fourth grade and up, “Pup-Poolution” - not for the weak of knees, this hands on science lab dissects “dog waste” so students can discover for themselves the pathogens that lurk within pet poop. In addition to outreach specifically targeted for children, 18 adult education programs were conducted as well as two kayaking clean up excursions. For the purpose of

reminding people that only rain should flow down a storm drain, 64 volunteers set about marking approximately 300 storm drains, reinforcing the notion that individual behavior has communal impacts.

Finally, LIVE BLUE adheres to the methodology of cyclic outreach. If children can be reached in the school, positive spillover effects occur vis-a-vis parents. By engaging in cyclic outreach and utilizing a slow and steady marketing technique, the LIVE BLUE message can sustain itself for the foreseeable future.

### **Stormwater Awareness and Behavior Survey**

The LIVE BLUE cooperative effort contacted the economic consulting firm PRÆCIPPIO EFS for purposes of survey design, data collection, and statistical analysis assessing whether educational outreach can significantly influence the personal behaviors that impact stormwater management. Utilizing monthly water bill mailings in the municipality of Melbourne, Florida, about 50,000 utility recipients were solicited for input via a paper survey which they could return with their bill, or through a weblink which would take them to an online survey platform housed by Survey Monkey. The pre-campaign baselines would then be compared to post-campaign results revealed after a period of educational outreach.

From an economic perspective, the ability to modify behavior solely through education is an uncertain outcome. One of the foundations of environmental economics involves the Pigovian tax, which attempts to rectify market failure through a financial penalty equivalent to spillover costs. This serves to steer the market to the correct or efficient outcome. That polluters would necessarily amend their behavior and absorb the spillover costs in the absence of a policy corrective is doubtful.

Another factor which potentially impacts behavioral modification is the magnitude of outreach dollars. The ability to introduce and reinforce educational messages with the goal of altering client behavior requires sizable budgeting for marketing and grassroots efforts. Given revenue decreases experienced by municipal governments in the aftermath of the real estate bust,<sup>9</sup> LIVE BLUE, like any program, operates on thin margins.

Nevertheless, with respect to household actions, educational outreach has achieved marked increases in behaviors such as recycling, even in areas without garbage collection penalties. With respect to stormwater, educational outreach programs such as Tallahassee-based TAPP (Think About Personal Pollution; [www.tappwater.org](http://www.tappwater.org)) and North Carolina-based CWEP (Clean Water Education

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<sup>9</sup> In the United States, local governments are typically funded through property taxes.

Partnership; [www.nccwep.org](http://www.nccwep.org)) reveal mixed success with respect to behavioral modification. The CWEP program greatly informed this research effort, which now turns towards the pre-campaign instrument.

### **Survey Composition and Sample Attributes**

The survey was composed of three sets of questions pertaining to demographics, knowledge, and behavior. Basic demographic questions inquired about household income, education, age, gender, ethnicity, household composition, and resident location. These were followed by questions designed to reveal respondent “knowledge” about the location and source of stormwater runoff, as well as how much information the respondent had already received about these issues prior to the Live Blue campaign. The survey also included a series of “behavioral” questions primarily related to lawn maintenance. These included an inquiry as to whether respondents had tested their lawn to determine the correct amount of fertilizer usage, and additional questions dealing with fertilizer types, amounts of fertilizer and pesticides applied to the lawn, and the disposal of lawn clippings. Some additional behavioral questions concerning car-washing, oil disposal, and dog waste were also asked.

Data was collected during early spring 2012, and a total of 1,347 usable surveys were collected. In terms of demographics, about 50 percent of respondents had household income of \$50,000 or more, and more than 25 percent had household incomes in excess of \$75,000. The educational attainment of the respondent group was quite high, with close to 50 percent of the sample indicating that they had earned a 4-year college degree or post-graduate degree. The sample respondents were collectively an older population, with almost 67 percent indicating an age of 55 years old or higher. All told, more than 40 percent of respondents fell in the traditional retirement ages of 65 years or greater.

Regarding their knowledge about stormwater runoff, about two-thirds of respondents had received little or no previous information about stormwater runoff prior to the Live Blue campaign. Despite this, almost 60 percent were aware that stormwater drains to the nearest pond or river and knew that the largest sources of water pollution in Brevard County are lawn and garden fertilizer, stormwater runoff, and pet waste.

The mean responses to the behavioral questions suggest that knowledge does not always drive behavior in the desired direction. For instance, when their grass is mowed, almost 80 percent of respondents indicated that the grass clippings are left on the lawn, which is the desired response. On the other hand, almost 80 percent of respondents have not had their lawn tested to determine the correct amount of fertilizer to use, and when fertilizer or pesticide is utilized, the frequency of application is excessive (more than twice per year) for at least one-

half of the respondents. Most respondents engage in the correct behavior with respect to disposing their car oil or retrieving their dog's waste, yet a larger proportion wash their cars at home rather than taking it to a commercial or volunteer car wash, and most respondents allow the dirty washwater to flow down the street or driveway rather than soaking into grass, dirt, or gravel.

### Knowledge and Behavior Correlates

This section further explores which of the stormwater related "behaviors", if any, is significantly correlated with "knowledge" of stormwater runoff. Whether prior "information" better correlates with behavior than "knowledge" is also considered.

The following table summarizes the correlates between the behavior of Brevard County residents and two proxy measures signifying their knowledge of stormwater runoff. As a point of reference, the pre-campaign survey results revealed by the CWEP program are also included.<sup>10</sup> In addition to the two measures of knowledge, correlates between behavior and how much "information" the respondent had received on stormwater runoff in the past are also provided. The correlates associated with "information" are for Brevard County only.

Table 1  
*Comparison of Correlates: Pre-Campaign CWEP v. LIVE BLUE<sup>11</sup>*

QUESTION	<i>What is the biggest source of water pollution?</i>		<i>Where does stormwater go once it enters a storm drain?</i>		<i>Information</i>
	CWEP	LIVE BLUE	CWEP	LIVE BLUE	LIVE BLUE
What do you do with the grass clippings after you mow your lawn?	0.174**	0.087*	0.003	0.108*	0.061**
How often does someone fertilizer your lawn?	-0.285**	0.028	0.011	0.020	-0.111*
Has anyone ever tested the soil to determine how much fertilizer it needs?	-0.043	-0.039	0.027	-0.018	0.064**

<sup>10</sup> The comparisons to the CWEP correlates are suggestive only; there are minor differences between the two sets of survey questions and the list of allowable responses.

<sup>11</sup> The usable sample size is larger in Brevard County for many of the behavioral responses. For this reason, the correlates can be smaller, yet statistically significant.

QUESTION	<i>What is the biggest source of water pollution?</i>		<i>Where does stormwater go once it enters a storm drain?</i>		<i>Information</i>
	CWEP	LIVE BLUE	CWEP	LIVE BLUE	LIVE BLUE
How do you get your vehicle washed?	-0.009	0.017	0.040	-0.091*	0.005
When you wash your vehicle at home, where does the soapy water flow?	-0.051	0.013	-0.484*	0.117*	-0.004
If you change your own oil, how do you dispose of the used oil?	0.184	0.148**	0.111	0.039	0.024
How often do you pick up your dog's waste?	-0.106	-0.070	0.188	0.042	-0.004

\*Correlation is significant at the .01 level

\*\*Correlation is significant at the .05 level

*Note.* Smaller correlates in LIVE BLUE are statistically significant because the sample size for CWEP is much larger.

The survey responses were re-coded so that correlations are positive when those who are more knowledgeable or have more information are more likely to engage in the “desired” behavior. Conversely, a negative correlation signals that respondents who are more knowledgeable or have more information are more likely to engage in “undesirable” behavior.

At first glance there appears to be a dearth of statistically significant relationships between behavior and knowledge in either the LIVE BLUE or CEWP experiments. Out of a possible fourteen relationships in each study location, knowledge correlates with behavior in five instances in the LIVE BLUE study area, and on three occasions only in the CWEP analysis. On closer inspection, however, it is observed that all but one behavioral response in Brevard County is significantly related to at least one measure of knowledge or to information. The only behavior that is unrelated to either knowledge or information is the response to the disposal of pet waste.<sup>12</sup>

A more thorough assessment of the LIVE BLUE outcomes reveals that both measures of knowledge are positively correlated with the desired behavior in the disposal of grass clippings, i.e., more knowledgeable people are more likely to leave the clippings on the grass or to pile the clippings in the yard or composted

<sup>12</sup> The insignificance associated with pet waste disposal may reflect municipal and county ordinances that require people to pick-up their dog waste or risk a citation and the prospect of paying a fine. People are responding to information, but information that is unrelated to stormwater runoff. It is related, however, to an economic penalty.

mulch. But the disposal of grass clippings is the only variable associated with lawn maintenance that is correlated to a measure of knowledge.<sup>13</sup>

Although lawn maintenance activities in the LIVE BLUE study area are largely uncorrelated with knowledge, it is observed that all three behaviors are significantly correlated with “information.” Brevard County residents who had received more information prior to taking the survey were more likely to dispose of their grass clippings in the desired manner and have their lawn tested to determine how much fertilizer to apply. On the other hand, they were *less* likely to limit the frequency of application to one or two times per year. What cannot be discerned from the data is whether the negative correlation described in the latter result is influenced by the testing of lawns that call for more than two applications a year, but (perhaps) with less fertilizer per application.<sup>14</sup>

With respect to the correlates related to car washing behavior, it is observed that those who are more knowledgeable about “where” stormwater runoff ultimately flows to are *less* likely to take their vehicle to a commercial or volunteer car wash (the desired response); however, when washing their vehicle at home (a less desirable behavior), the dirty washwater is *more* likely to soak into grass, dirt, and gravel rather than flow down the street or driveway. Thus, the seemingly contradictory responses associated with car washing may have some basis. Apparently, many people who avoid the desired behavior of taking their vehicles to a car wash may still be behaving in an environmentally responsible manner by washing their vehicles in a location that allows the dirty washwater to soak into grass, dirt, and gravel.

The final behavior that has a significant relationship to knowledge is the disposal of car oil. Results indicate that those who are more knowledgeable about the largest sources of water pollution are more likely to dispose of their car oil by taking it to a recycling center. Knowledge about where stormwater ultimately flows to, or pre-survey information about stormwater runoff, is statistically unrelated to the disposal of oil.

## Conclusion

In contrast to the findings in the CWEP study, LIVE BLUE pre-campaign results suggest that almost all behavioral responses are significantly related to at least one measure of “knowledge” and/or to pre-survey “information” pertaining to

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<sup>13</sup> The significant correlations associated with the disposal of grass clippings may be spurious. Many residents in Brevard County live in neighborhoods governed by Homeowners Association covenants that limit the control individual homeowners have in cutting and disposing of grass clippings, testing the lawn, utilizing types of fertilizer and pesticides applied to gardens and lawns, the frequency of fertilizer and pesticide application, and watering of lawns.

<sup>14</sup> Pre-survey information about stormwater runoff is unrelated to any other behavioral response.

stormwater runoff. The behavioral responses of Brevard County residents appear to vary according to the type of knowledge or information they possess about stormwater runoff. For example, lawn maintenance responses are associated primarily with pre-survey “information.” Car washing behavior is significantly correlated to knowledge about where stormwater ultimately flows, and there is a direct relationship between the disposal of car oil and knowledge about the largest sources of water pollution in Brevard County. There is also the suspicion that the disposal of pet waste is related to pre-survey information about county and municipal ordinances that mandate the pick-up of dog waste.

Some of the correlations with behavior are negative, meaning that those with more knowledge or information were less likely to engage in the desired behavior. There are, however, seemingly rational explanations for these contradictory results. For instance, those with more knowledge about where stormwater runoff ultimately flows apply fertilizer to their lawns more frequently than desired. This result may partially reflect that those with more knowledge are also more likely to have their lawn tested to determine the optimal amount of fertilizer to apply. In another example, people with more knowledge about where stormwater runoff ultimately flows are also less likely to take their vehicle to a car wash; however, they are more likely to wash their cars in an area that allows the dirty washwater to soak into the surrounding grass, dirt, and gravel. Thus, there is more than one response that can attain the desired outcome of less pollution.

This preliminary investigation has shown that desired behavior may be influenced by certain types of knowledge and/or information that people possess about stormwater runoff and pollution. Pre-campaign results suggest that a successful educational campaign may yield incremental improvements in behavior by properly aligning the information specific to the activity and its desired response; be it lawn maintenance, car washing or the disposal of oil or pet waste.

In future research, assessing the relationship between “knowledge” of stormwater runoff and variables such as pre-campaign information, educational attainment, and household income will be undertaken. It is conjectured that responses to the knowledge question (i.e., where stormwater goes once it enters a storm drain and the largest sources of water pollution) are significantly related to pre-campaign information, educational attainment, and household income, and thus, the latter items moderate the relationship between knowledge and behavior.

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