# Testing an Innovative Environmental Education Program for NPS Pollution:

## Results of a Quasi-Experimental Program Evaluation

**Mark T. Imperial, Ph.D.**
**Master of Public Administration Program**
**Department of Political Science**
**University of North Carolina Wilmington**
**imperialm@uncw.edu**
**http://people.uncw.edu/imperialm/**

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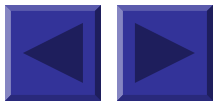
**Master of Public Administration Program**



# Burnt Mill Creek Watershed

- Watershed: 4,274 acres
- 64% is impervious surface
- On the state's 303(d) list and is the most impaired creek in Wilmington, NC
- Primary pollutants are fecal coliform bacteria, nutrients, and low dissolved oxygen
- Stormwater and NPS are major cause of problems


# The BMC Outreach & Demonstration Project

- **The project:**
  - 3-year, $200,000 project funded in part with a Section 319 grant
- **Goal of the project:**
  - Increase awareness about watershed issues and motivate residents and businesses in selected areas of the watershed to adopt responsible watershed practices on individual properties
- **Tested the effectiveness of a proximity-based approach to environmental outreach and education**
  - Used an intensive outreach and education effort focused on a specific target audience located close to a stormwater demonstration site containing BMPs for watershed residents

# BMC Outreach & Demo Project

- **Installed a stormwater demonstration site close to the target audience for education efforts featuring examples of BMPs**
  - Rain garden
  - Habitat garden
  - Pet waste stations
  - Rain barrels
  - Pervious pavement & walkways
  - Grassy swale
  - Native plants

# BMC Outreach & Demo Project

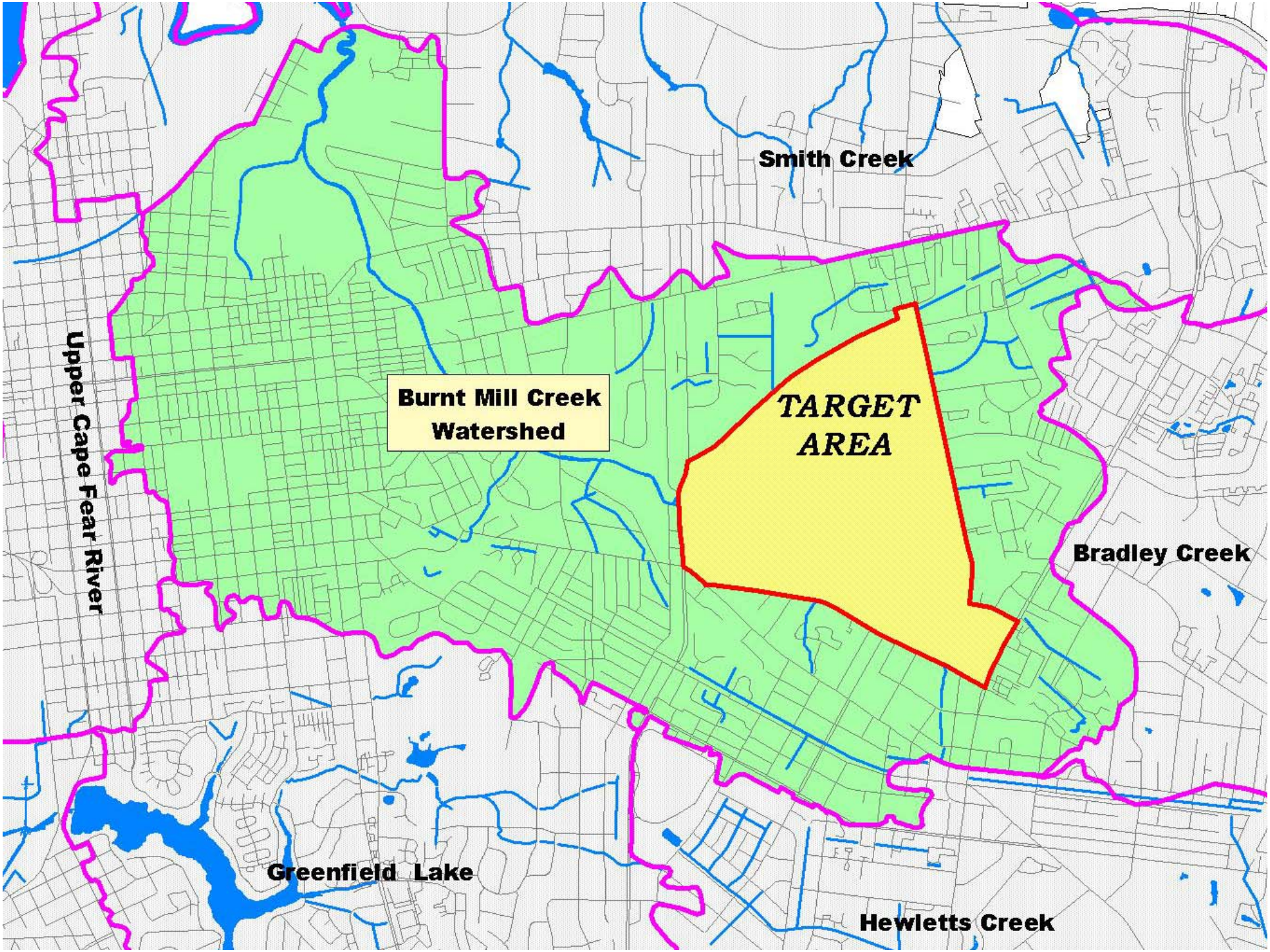
- **Direct mailings to residents in target area**
  - Education materials on such things as pet waste, lawn care, structural and nonstructural BMPs, and other information watersheds and NPS pollution
  - Workshop announcements
- **Public workshops**
  - 16 held at the demonstration site
  - 9 other workshops of various types
- **Mass media**
  - PSAs, radio spots, print adds, cable access TV
- **10 ecowalks at demonstration site**
- **12 presentations to students in BMC watershed**

# BMC Outreach & Demo Project

- Web page with information on stormwater BMPs and pollution prevention
- 3 Creekkeeper trainings
- 3 awards to recognize persons/organizations doing “watershed friendly” activities
- 3 storm drain marking events to install awareness markers on storm drains in the BMC watershed
- 6 watershed clean up events organized and conducted by an area youth group
- Watershed poster featuring BMC watershed

# Research Design

- **Quasi-experimental design**
  - Pretest-posttest nonequivalent control group
  - Intact group of residents made it impossible for the random assignment of individuals to treatment and control groups
- **Evaluation process**
  - Measure a group of subjects (pretest)
  - Introduce a treatment to residents in the target area (BMC Outreach and Demonstration Project)
  - Observe the same subjects again (posttest)
- **BMC watershed and City residents provided a nonequivalent control (comparison) group**
  - Control groups didn't get direct mail but were exposed to media

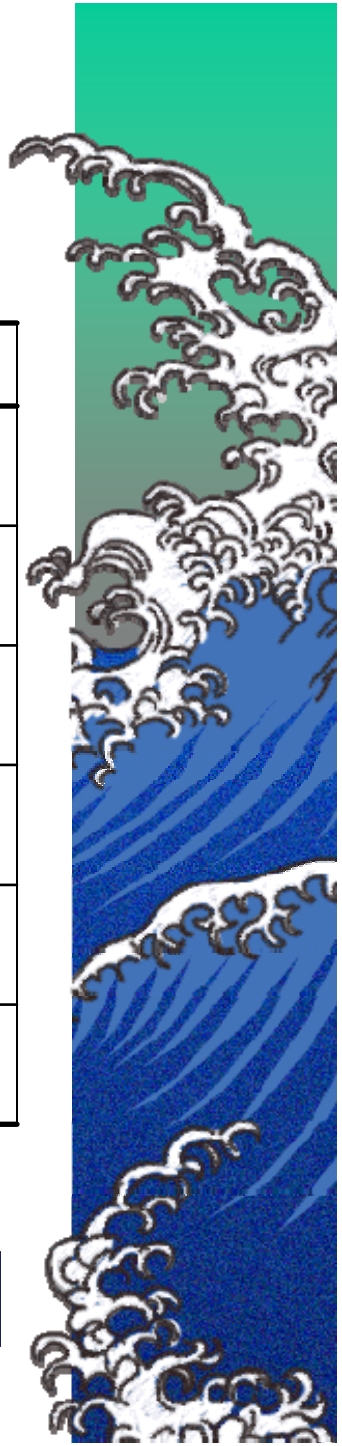

Smith Creek
Upper Cape Fear River
Burnt Mill Creek
Watershed
TARGET
AREA
Bradley Creek
Greenfield Lake
Hewletts Creek

# Research Design (Cont.)

- **Used a telephone survey to collect pretest and post test data**
  - 5 random samples: single & multi-family residents in target area, single & multi-family residents in BMC watershed, and the City
  - Different phone lists for pretest and posttest samples
  - Pretest: October and November 2002
  - Posttest: January – March 2005
- **Survey questions were open- and close-ended and collected data on:**
  - Watershed awareness
  - Attitudes about the quality of local waterways
  - Behavior changes associated with the adoption of BMPs
  - Outreach effectiveness
  - Demographics

# Total Number of Survey Responses for Pretest and Posttest Surveys

| | 2002 Pretest | 2005 Posttest |
|---|---|---|
| Single-family – Target Area | 63 | 62 |
| Multi-family – Target Area | 44 | 27 |
| Single-family – BMC Watershed | 301 | 318 |
| Multi-family – BMC Watershed | 155 | 314 |
| City of Wilmington | 395 | 1293 |
| **Total** | **958** | **2014** |



# Data Analysis

- **Compared pretest and posttest survey responses**
  - But how do you tell if these changes are important?
  - Some increase in the desired direction, other don't

% within Measurement period

| | | Measurement period | | |
|---|---|---|---|---|
| | | pre target single | post target single | Total |
| COLLECTS DOG WASTE | All the time | 34.5% | 25.0% | 31.1% |
| | most of the time | 24.1% | 43.8% | 31.1% |
| | Somtimes | 3.4% | 6.3% | 4.4% |
| | Never | 37.9% | 25.0% | 33.3% |
| Total | | 100.0% | 100.0% | 100.0% |

# Data Analysis

- **Pearson Chi-Square statistics**
  - Summary statistic that accounts for sample error and comparisons across categories
  - Used $p < .05$ standard as recommended in social sciences
  - Since $p = .518$ and results could occur by chance about 52 out of 100 times, there is insufficient evidence to assert that there were any significant differences in dog waste collection

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 2.272[a] | 3 | .518 |
| Likelihood Ratio | 2.244 | 3 | .523 |
| Linear-by-Linear Association | .122 | 1 | .727 |
| N of Valid Cases | 45 | | |

# Changes in Watershed Awareness

- **Two sets of indicators were examined**
  - Knowledge about the value of selected BMPs
  - Knowledge about water quality and NPS

**Rain barrels are a structural BMP**

# Knowledge About the Value of BMPs

| Indicators of a Change in Watershed Awareness | Target Area | | BMC Watershed | | City |
|---|---|---|---|---|---|
| | Single Family | Multi Family | Single Family | Multi Family | |
| ▪ Planting native plants | N | | N | | N |
| ▪ Pervious materials | N | | | | * |
| ▪ Rain gardens | N | | *** ( - ) | | N |
| ▪ Rain barrels | N | | N | | N |
| ▪ Habitat gardens | N | | N | | * ( - ) |

* p < .1; ** p < .05; *** p <. 01; (-) change in opposite direction; N = no change

# Knowledge About Water Quality

| Indicators of a Change in Watershed Awareness | Target Area | | BMC Watershed | | City |
|---|---|---|---|---|---|
| | Single Family | Multi Family | Single Family | Multi Family | |
| ▪ All rain water is not absorbed by the ground before it gets to streams | N | N | N | **(-) | N |
| ▪ Rain falling on roads picks up pollutants from automobiles | N | N | N | N | N |
| ▪ Water from storm drains is carried to local waterways | N | N | *** | N | * |
| ▪ Major source of poor water quality is NPS runoff | ** | N | *** | N | *** |
| ▪ Recall hearing the term watershed | N | N | ** | N | *** |
| ▪ They recall the name of the watershed they live in | ** | * | N | N | N |

* p < .1; ** p < .05; *** p <. 01; (-) change in opposite direction; N = no change

# Changes in Attitudes about Water Quality

- **Examined whether there were changes in attitudes about the quality of local waterways**
  - Cape Fear River
  - Greenfield Lake
  - Intracoastal Waterway (ICW)
  - Burnt Mill Creek

# Attitudes About Water Quality

| Indicators of a Change in Attitudes about Water Quality | Target Area | | BMC Watershed | | City |
|---|---|---|---|---|---|
| | Single Family | Multi Family | Single Family | Multi Family | |
| ▪ Water quality in Cape Fear River | N | N | * | N | N |
| ▪ Water quality in Greenfield Lake | * | N | *** | *** | *** |
| ▪ Water quality in Burnt Mill Creek | N | N | ** | ** | N |
| ▪ Water quality in Intracoastal Waterway | N | N | N | N | N |

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# Changes in Behavior

- **Two sets of indicators were examined that asked whether residents installed**
  - ***Structural BMPs*** like pervious surfaces, plants, trees, rain gardens, rain barrels, habitat gardens, and buffers
  - ***Nonstructural BMPs*** like proper disposal of dog waste, cooking grease, grass clippings, leaves, using soil tests, and not dumping oil, paint, or garbage into storm drains

**Habitat gardens are a structural BMP**

# Use of Structural BMPs

| Indicators of Behavioral Change | Target Area | | BMC Watershed | | City |
|---|---|---|---|---|---|
| | Single Family | Multi Family | Single Family | Multi Family | |
| ▪ Planted native plants | N | | N | | *** |
| ▪ Installed paths with pervious materials | N | | ** | | N |
| ▪ Planted trees for shade | N | | N | | N |
| ▪ Installed a rain garden | N | | N | | *** ( - ) |
| ▪ Installed a rain barrel | N | | N | | N |
| ▪ Have a habitat garden | N | | N | | N |
| ▪ Planted a buffer or vegetation next to waterway | N | | N | | ***( - ) |

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# Use of Nonstructural BMPs

| Indicators of Behavioral Change | Target Area | | BMC Watershed | | City |
|---|---|---|---|---|---|
| | Single Family | Multi Family | Single Family | Multi Family | |
| ▪ Collect your dog's waste | N | N | * | N | ** |
| ▪ Wash your car in proper location | N | N | ** | N | N |
| ▪ Properly dispose of grass clippings | ** | ** | * | *** | N |
| ▪ Properly dispose of leaves or pine needles | N | N | N | *** | ** |
| ▪ Properly dispose of cooking grease | N | N | ** | N | N |
| ▪ Did something to improve water quality | N | N | N | N | N |
| ▪ Planted grass to eliminate brown spots | N | | N | | *( - ) |
| ▪ Got a soil test for their lawn | N | | *** | | N |
| ▪ Proper application of fertilizer | N | | N | | N |

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# Use of Nonstructural BMPs (Cont.)

| Indicators of Behavioral Change | Target Area | | BMC Watershed | | City |
|---|---|---|---|---|---|
| | Single Family | Multi Family | Single Family | Multi Family | |
| ▪ Put grass clippings and leaves into a storm drain or drainage ditch | N | N | *** | N | *** |
| ▪ Poured old or used engine oil or antifreeze into a storm drain or drainage ditch | ** | N | N | N | * |
| ▪ Emptied paint into a storm drain or drainage ditch | ** | N | N | N | N |
| ▪ Hosed down a driveway, sidewalk, or parking lot into a storm drain or drainage ditch | N | *** | ** | N | *** |
| ▪ Put garbage or litter into a storm drain or drainage ditch | ** | * | ** | N | ** |

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# Evidence of Outreach Effectiveness

- **Two sets of indicators were used to assess the effectiveness of education and outreach efforts**
  - Received and acted upon outreach messages
  - Received messages sent by various forms of mass media

# Message Delivery and Action

| Indicators of Outreach Effectiveness | Target Area | | BMC Watershed | | City |
|---|---|---|---|---|---|
| | Single Family | Multi Family | Single Family | Multi Family | |
| ▪ Recalled receiving direct mail about water quality | *** | N | N | N | ** |
| ▪ Recalled seeing a local watershed sign | N | N | ** | N | N |
| ▪ Looked on the internet for information about local water quality and things to do to improve it | N | N | N | N | N |
| ▪ Read a brochure, fact sheet, or newsletter with information about local water quality | *** | * | * | * | N |
| ▪ Attended a workshop on local water quality | * | N | N | N | N |
| ▪ Are likely to read stories about local water quality in the newspaper | * * ( - ) | N | ** | N | N |

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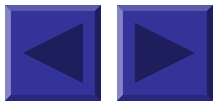

# Mass Media Campaign

| Indicators of Outreach Effectiveness | Target Area | | BMC Watershed | | City |
|---|---|---|---|---|---|
| | Single Family | Multi Family | Single Family | Multi Family | |
| ▪ Recalled seeing PSAs about water quality on TV | N | N | N | N | *** |
| ▪ Recalled seeing news stories about water quality on local television | N | N | N | N | ** |
| ▪ Recalled seeing news stories about water quality in the Star News | N | N | N | N | N |
| ▪ Recalled hearing news stories or PSAs about water quality on the local radio | N | N | *** ( - ) | N | N |

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# Conclusions of Evaluation

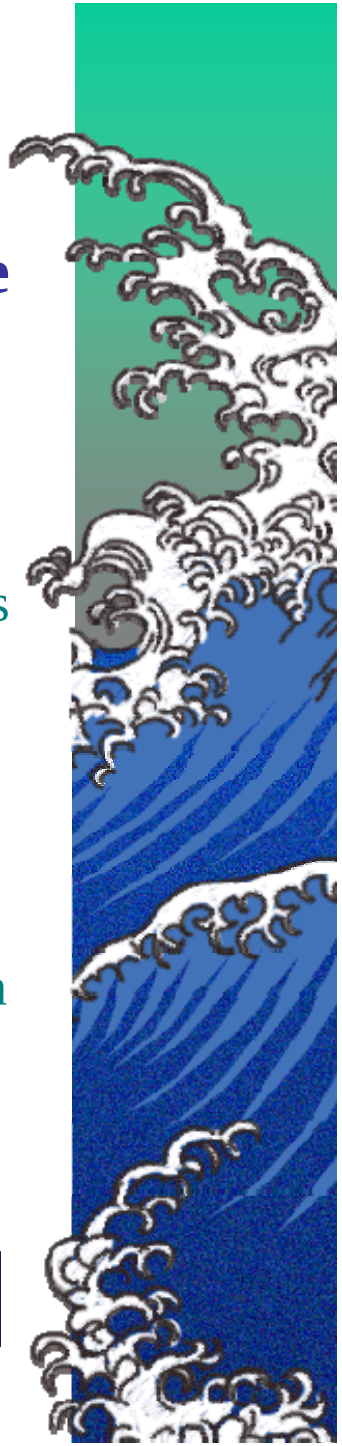
- **The data clearly suggests that this program failed to do what it set out to do**
  - Targeting public education and outreach on residents located in close-proximity to watershed restoration and stormwater improvement projects does not improve the effectiveness of education efforts
  - It also does not significantly increase residents' motivations to adopt structural or nonstructural BMPs
- **On the upside, local officials can take some comfort in the fact that**
  - Few respondents reported that they put grass clippings, leaves, paint, engine oil, antifreeze, or garbage in storm drains
  - Much needs to be done to educate about some structural BMPs

# Public Policy Implications

- **Nationwide there is a substantial investment in producing and disseminating educational materials**
  - Example: To comply with the NPDES Phase II requirements, countless local governments will be conducting numerous educational campaigns
  - Results raise questions about whether these resources could be allocated better?
- **Do we really know whether environmental education changes behavior?**
  - Do we want to know the answer to this question?

# Public Policy Implications

- **Raises questions about what the "message" should be**
  - 84% knew that rainwater is not absorbed before reaching local streams, creeks, and rivers
  - 97% knew that rainwater falling on roads and paved surfaces picks up pollutants from automobiles
  - 80% knew that storm drains don't go to sewage treatment plants but creeks
  - 82% knew that major source of poor water quality was NPS runoff rather than factories and industry
  - 84 % have heard the term watershed but only 32% know the name of the watershed they live in
  - Very few (1.5% or less) admit to dumping cooking grease, lawn debris, engine oil, paint, or garbage into storm drains
  - Few adopted structural BMPs or knew their benefits



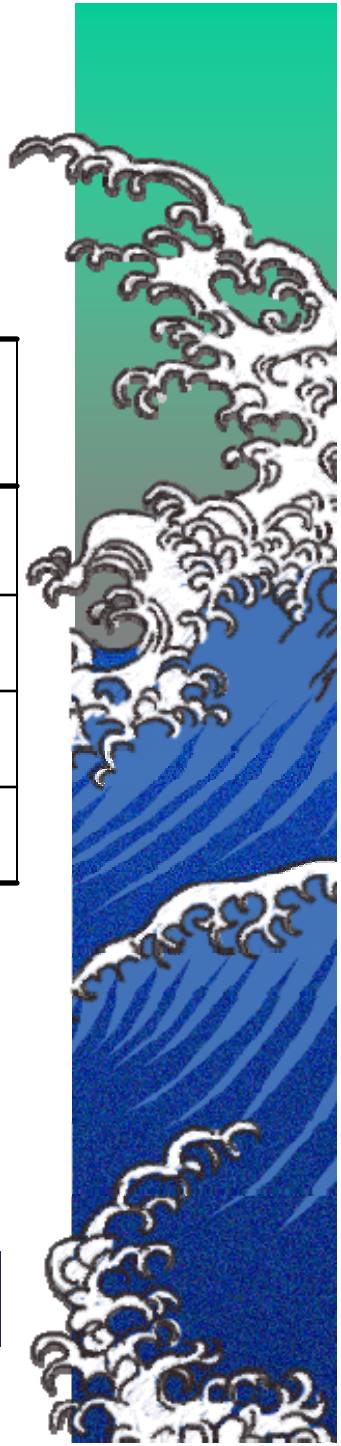
# Public Policy Implications

- **Raises questions about how to deliver "messages"**
  - Only 75% recalled getting direct mail even though they received dozens of mailings
  - 48% read a fact sheet, brochure, or newsletter of some type
  - Only 8% said they had ever attended a workshop about water quality
  - Only 8% looked on the internet for water quality information (even fewer in target area)
  - 56% viewed PSA on TV
  - 58% saw stories on TV
  - 53% read stories in local paper
  - 22% heard stories or PSAs on radio

# Questions?

# Pretest and Posttest Phone Samples for the Target Area

| Land Use | Phone Numbers for the Pretest Sample | Phone Numbers for the Posttest Sample |
|---|---|---|
| Single-Family | 473 | 396 |
| Multi-family | 205 | 429 |
| Business | 67 | 149 |
| **Total** | **745** | **974** |



# Significant Demographic Changes Between the Pretest and Posttest Surveys

| Changes in Demographic Characteristics | Target Area | | BMC Watershed | | City |
|---|---|---|---|---|---|
| | Single Family | Multi Family | Single Family | Multi Family | |
| ▪ Have a dog | N | ** | N | N | N |
| ▪ There is a creek, stream, or marshy area on or next to their property | *** | | N | | N |
| ▪ Home ownership | N | *** | ** | *** | N |
| ▪ Education level | N | N | N | N | ** |
| ▪ Spanish or Hispanic origin | N | N | N | N | N |
| ▪ Racial or ethnic group | N | N | N | * | ** |
| ▪ Household Income | N | N | N | ** | N |
| ▪ Gender | N | N | N | N | N |

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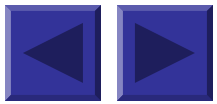

# Can the Findings Be Generalized?

- **Results are for one project and a target area with a particular set of demographic characteristics**
  - But demographics are not unusual
- **Was it a "bad" project?**
  - Resources, time, and effort expended are more substantial than countless other local governments
  - High quality materials and programs
- **Quasi-experimental design suggests results should be generalizable to other areas**
  - More research needed in other areas further increase generalizability