

# Water Quality and Coastal Development in South Carolina: Stormwater Management Challenges and Research, Extension, and Education Opportunities



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# Water Resources in Coastal South Carolina: CONCERNS

- 1) Flooding and conveyance
- 2) Sediment / TSS / turbidity
- 3) Low dissolved oxygen / hypoxia
- 4) Fecal coliforms / pathogenic bacteria
- 5) Harmful algal blooms (HABs)



# Water Resources in Coastal South Carolina: SOLUTIONS

## System levels:

- 1) Best management practices (BMPs)
- 2) Land use / development strategies
- 3) Watershed / basin approaches / TMDL
- 4) Extension and outreach

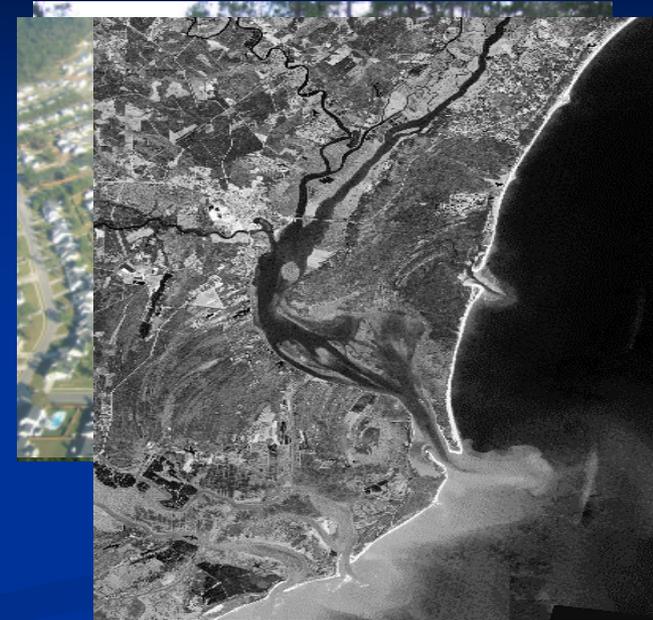
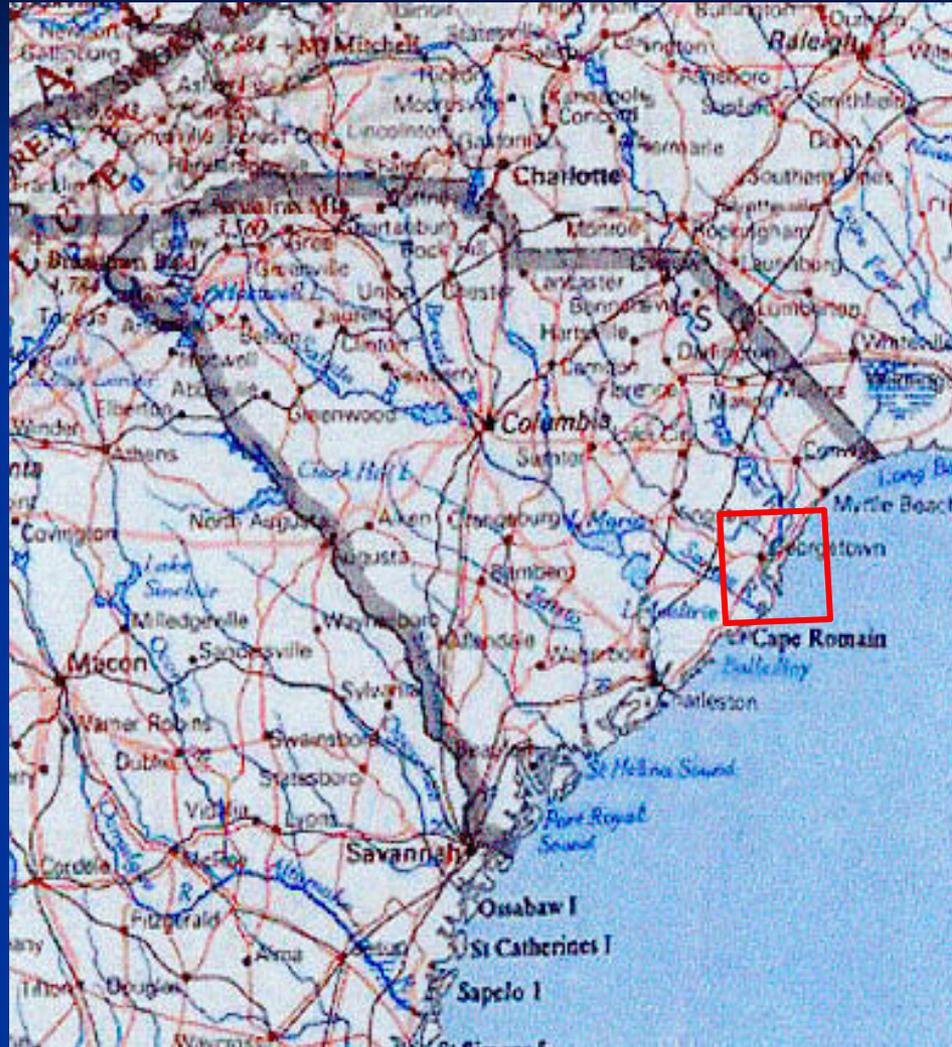


Photo credit: Strom Thurmond Institute  
Clemson

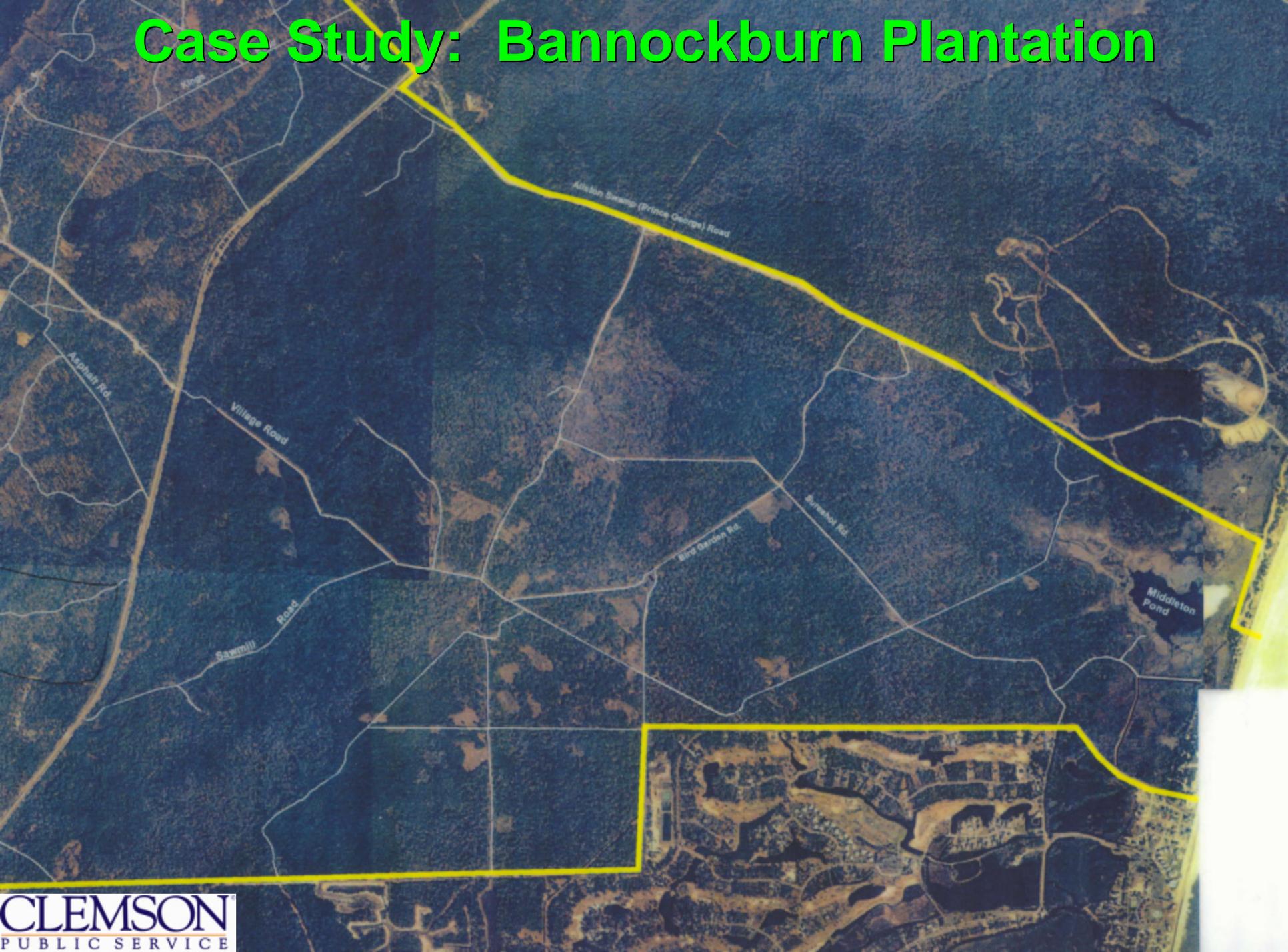
# The Systems Approach



# Case Study: Bannockburn Plantation



# Case Study: Bannockburn Plantation





Bannockburn Plantation Watersheds  
Pre-Development  
NWI Land Use Categories



NWI Land Use

**wshed\_nwilanduse**

**LANDUSE**

- BEACHES
- COMMERCIAL/SERVICES
- FORESTED WETLAND
- MIXED UPLAND FOREST
- NON-FORESTED WETLAND
- OPEN WATER
- WATERSHED DELINEATION**
- UPLAND PLANTED PINE

unnamed  
1460 acres

waccamaw  
268 acres

899 acres  
debidue

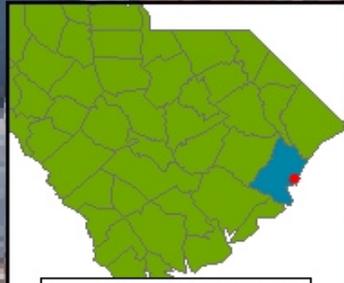
930 acres  
middleton

sheetdebidue  
174 acres



Map produced by "BMP" Group  
EVSS 680 - Case Studies  
February 24th, 2006

Bannockburn Plantation Watersheds  
Post Development Land Cover  
Based on Conceptual Plan

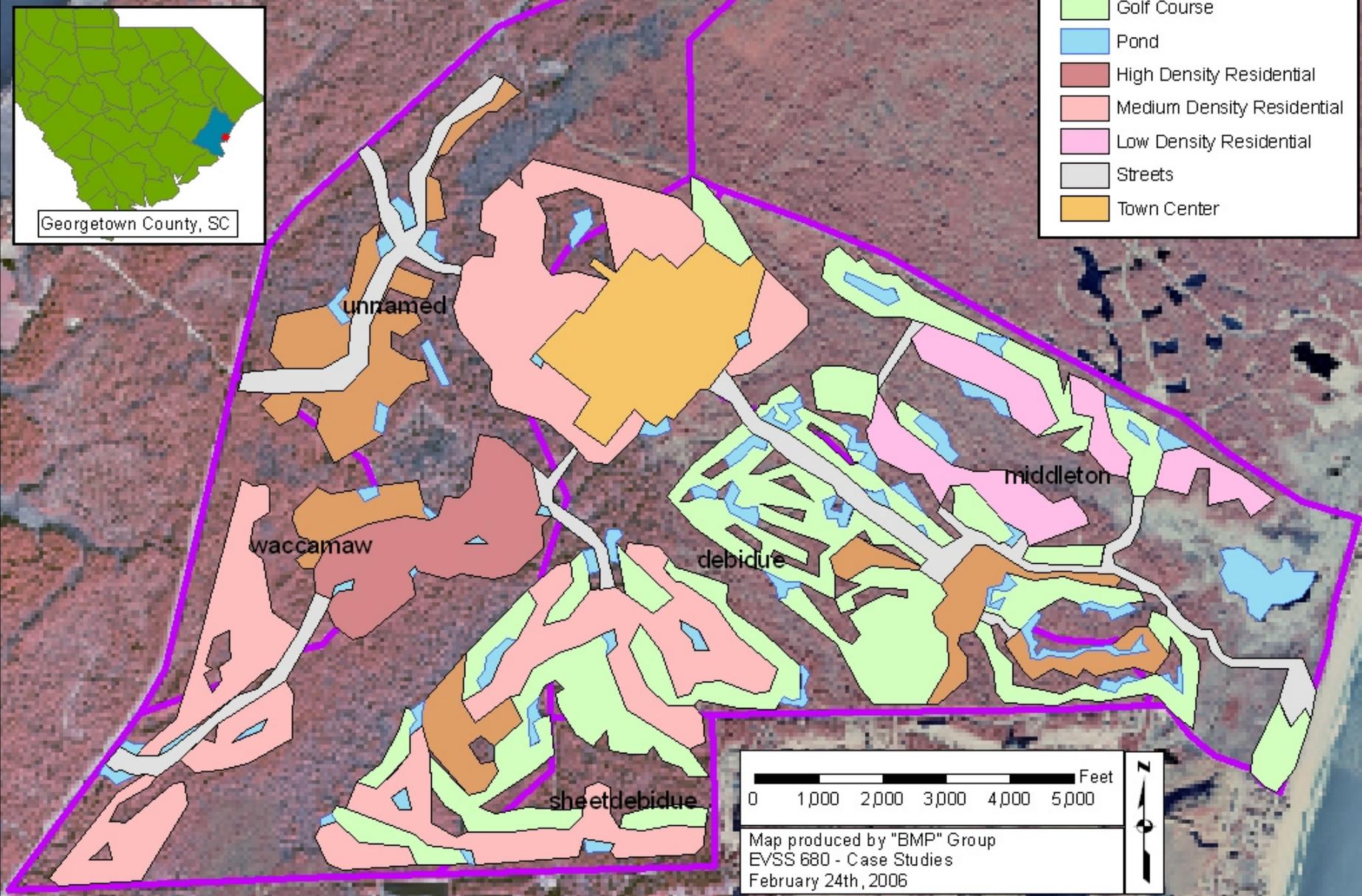


Georgetown County, SC

Post Development Land Cover

landcover

- Corporate/Resort
- Golf Course
- Pond
- High Density Residential
- Medium Density Residential
- Low Density Residential
- Streets
- Town Center

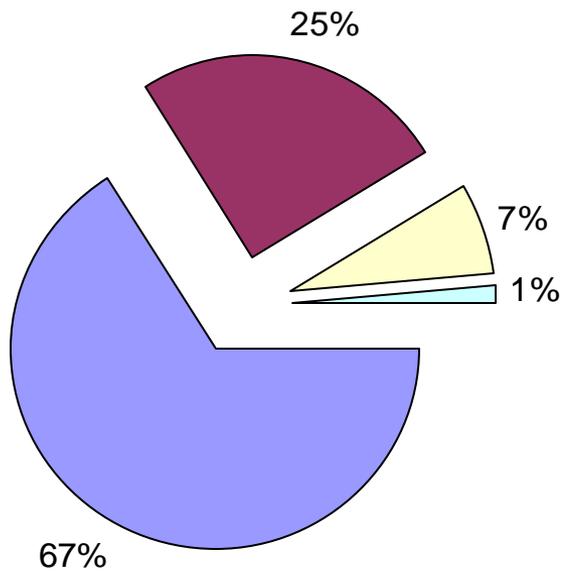


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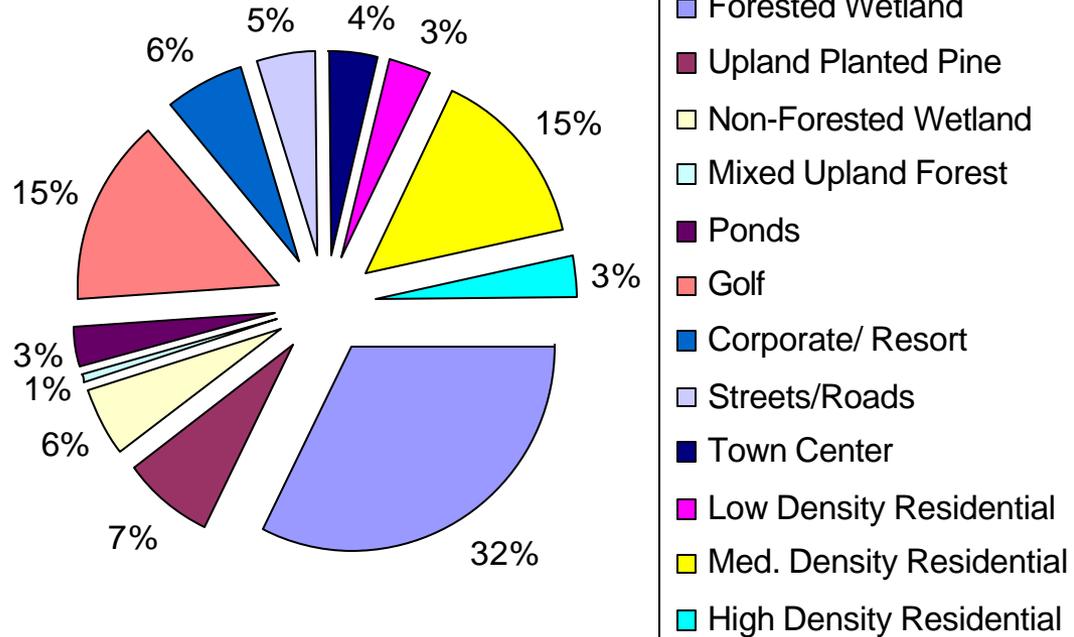
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# Current and Proposed Bannockburn Land Uses

## Overall Bannockburn Plantation:



Current Land Uses



Proposed Future Land Uses

# SC NEMO: The *Three-tiered Strategy* for Coping with Polluted Runoff

**1st:** Natural Resource-Based Planning

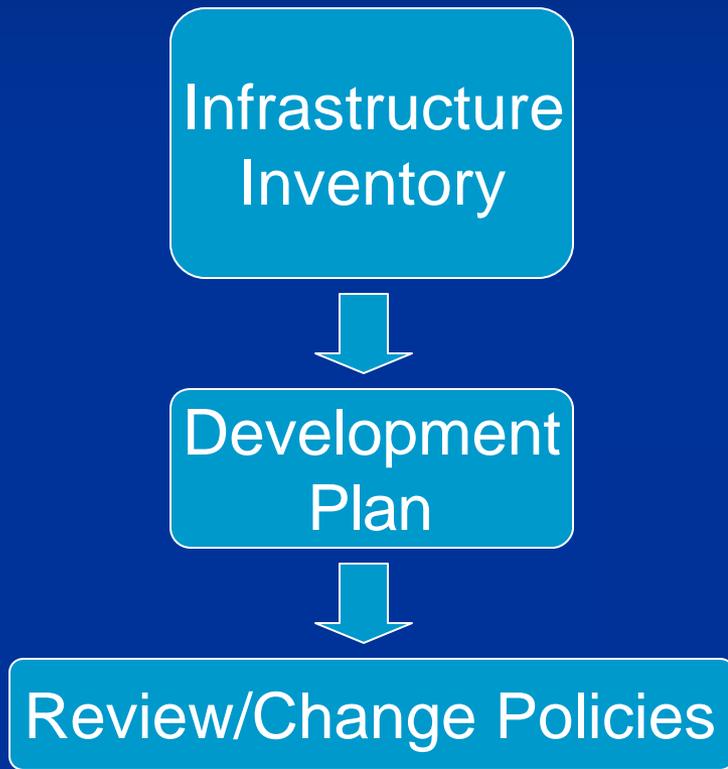
**2nd:** Better Site Design

**3rd:** Stormwater Management Practices (BMPs)

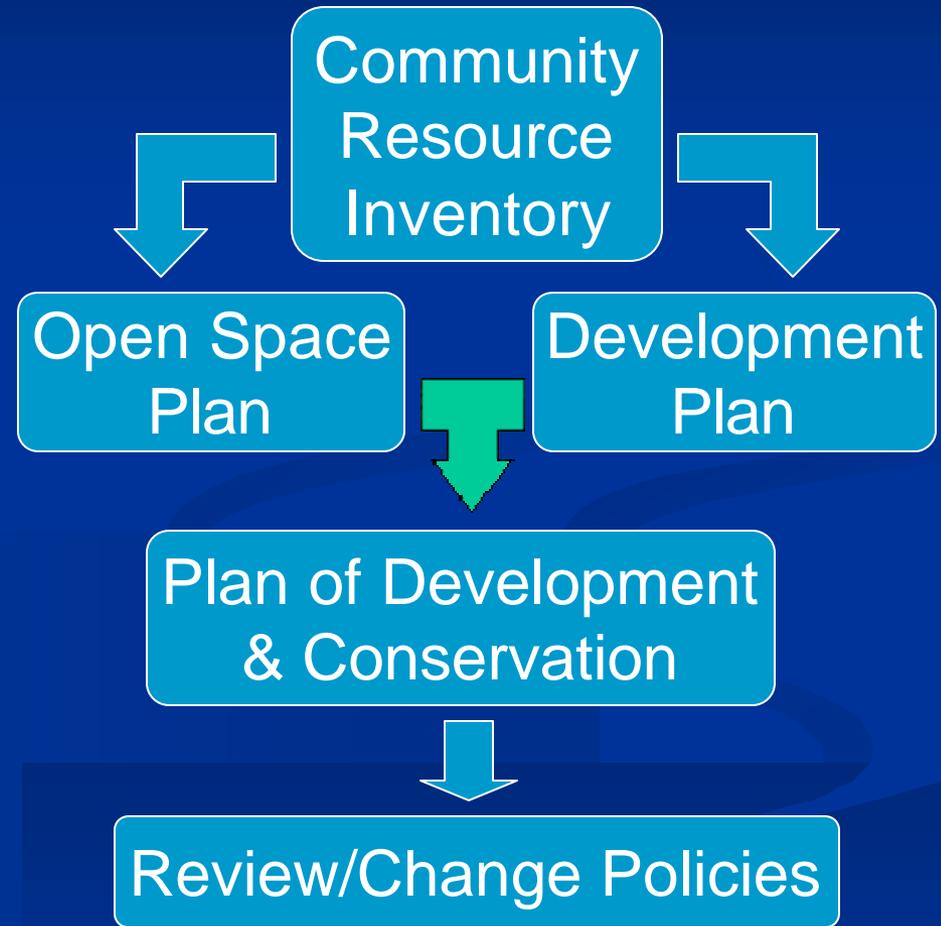




# What is Natural Resource-Based Planning?



Typical Planning Process



Natural Resource Based Planning Process

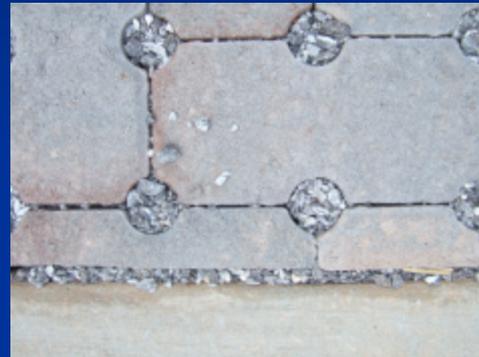
# Components of Natural Resource-Based Planning

- Wildlife habitat (RCW and others)
- Wetlands
- Aquifer recharge areas
- Sensitive waters
- Recreational areas
- Viewsheds
- Floodplains
- Forest conservation
- Water table depths
- Many more!!



# Better Site Design: Low Impact Development (LID)

- Pervious materials
- Rain barrels
- Rain gardens
- Vegetated buffers
- Backyard wetlands
- Maintenance



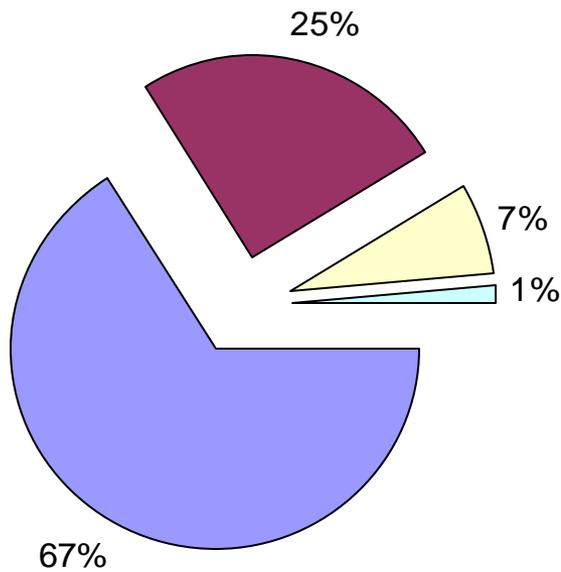
# Types of Stormwater Management Practices

- **Conveyance:**
  - Open channel (grassed swales and ditches)
- **Storage:**
  - Stormwater ponds / lakes
  - Stormwater wetlands
- **Infiltration**
  - Pervious surfaces
  - Rain gardens / bioretention
- **Buffers**
  - Vegetated / forested / riparian

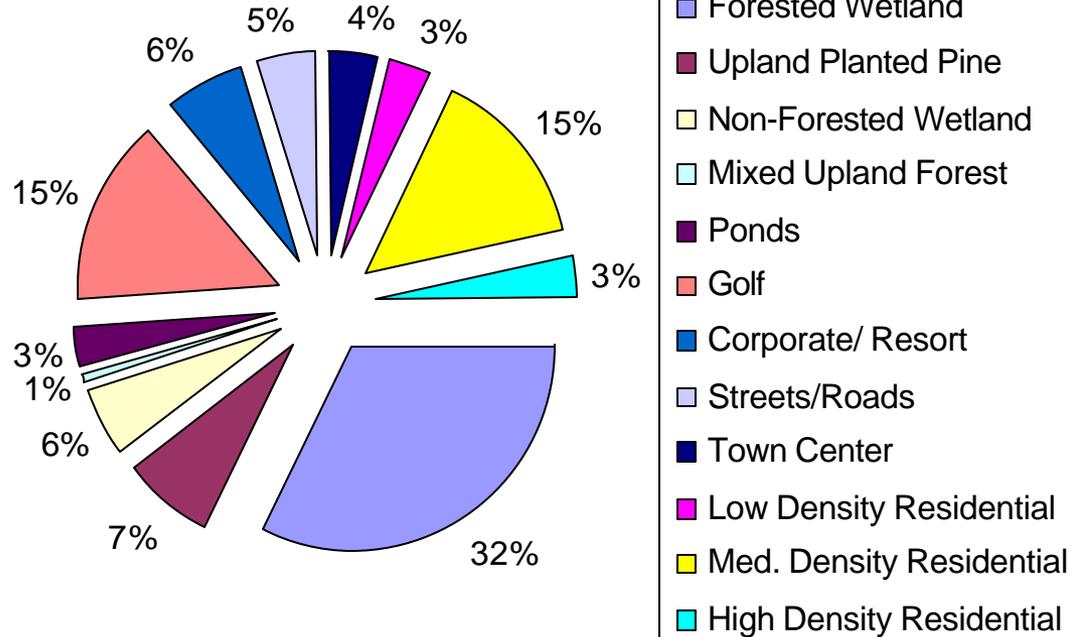


# Current and Proposed Bannockburn Land Uses

## Overall Bannockburn Plantation:



Current Land Uses



Proposed Future Land Uses

# Stormwater Ponds



# Hydrologic Impact Assessment During Land Use Conversion: Forested to Urban Areas

Research question: How is shallow water table hydrology (water quantity and quality) altered when forested areas are converted to urban areas?

- *Short-term objectives:*

- (a) determine baseline forest hydrology and water quality

- *Long-term objectives:*

- (b) pre- versus post-development changes in hydrology and water quality

- (c) stormwater mgmt practice selection in areas with shallow water tables

- (d) water management, retention, and re-use (irrigation)

- (e) use of innovative stormwater management strategies (vegetated buffers, rain gardens, wetlands)



## Mission and Purpose

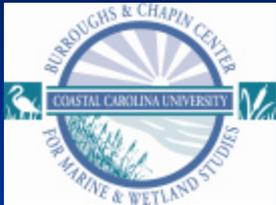
To develop and implement effective, outcomes-based stormwater education and outreach programs to meet federal requirements and satisfy local environmental and economic needs.



# Goals of the CWSEC

- Use a **regional/watershed approach** for maximum efficiency of stormwater education efforts
- Help local SMS4s meet **NPDES Phase II permit requirements** by providing resources and services
- Develop a **comprehensive stormwater education plan** for local SMS4s that capitalizes on local training resources
- Collaborate among education providers to **maximize expertise** and best meet local needs
- Serve as a **national model** for collaborative stormwater education

# CWSEC Education Providers



- ◆ Coastal Carolina University's Waccamaw Watershed Academy



- ◆ North Inlet-Winyah Bay National Estuarine Research Reserve (NERR) Coastal Training Program



- ◆ SC Sea Grant Extension Program



- ◆ Clemson University



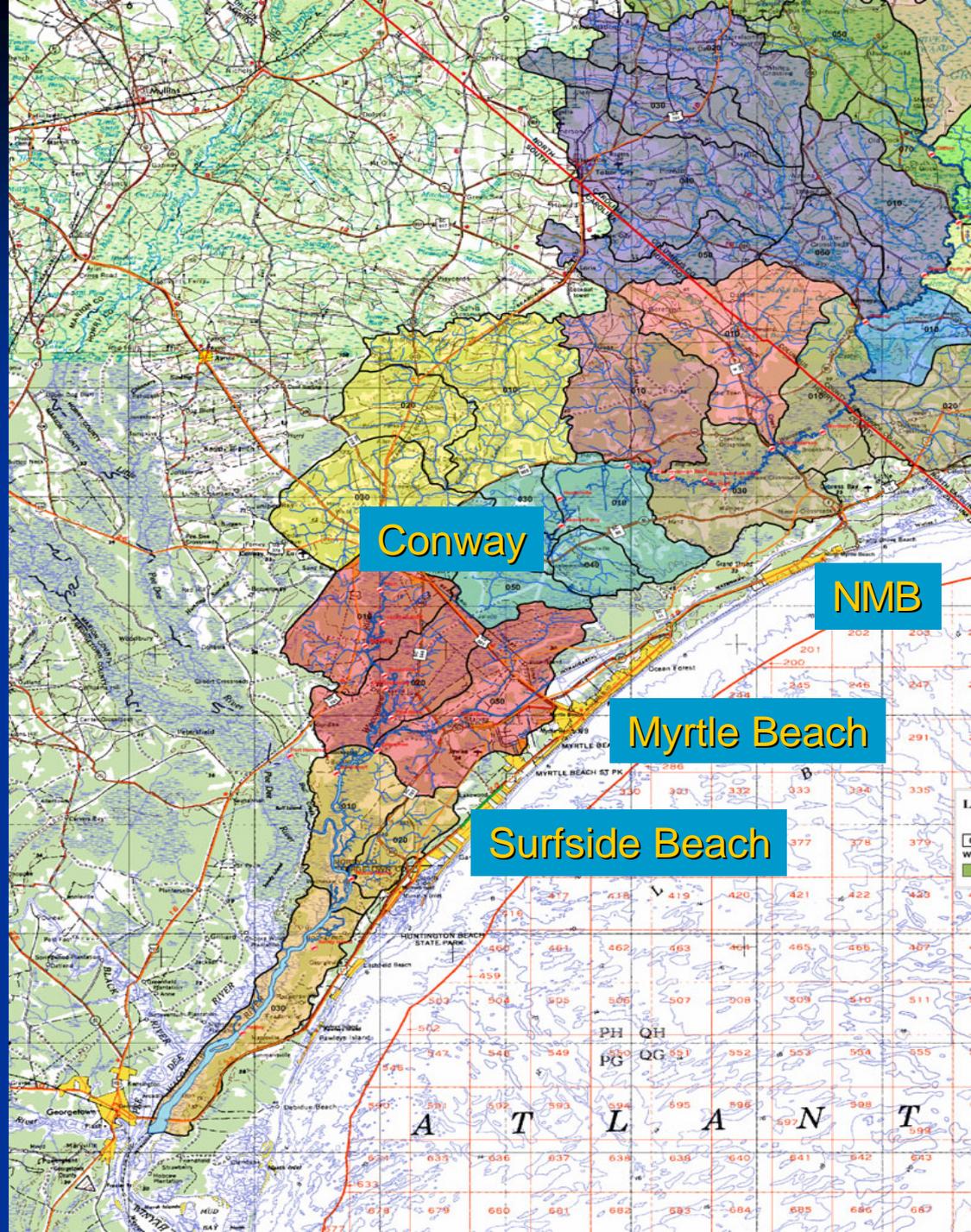
- ◆ Waccamaw Riverkeeper™



- ◆ Murrells Inlet 2007

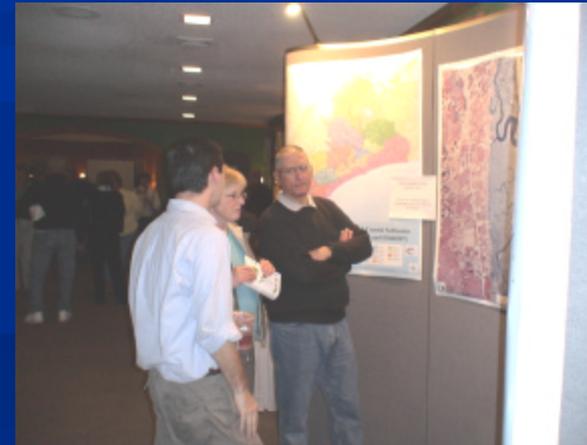
# CWSEC Cooperators

City of Conway  
Georgetown County  
Horry County  
City of Myrtle Beach  
City of North Myrtle Beach  
Town of Surfside Beach



# Target Audiences

- Elected and Appointed Officials
- General Public
- Professionals
  - Engineers
  - Architects
- K-12 Students



# Types of Programs

- Stormwater education workshops



- Rain garden workshops

- Pond clinics



- Certified EPSC inspector and stormwater plan reviewer trainings

# Stormwater Education for Homeowners

- Deliberate and conservative irrigation – not on sidewalks!
- Fertilize only when needed – Clemson can help!
- Scoop the poop!
- Pesticide management
- Keep debris, yard waste, and leaves out of storm drains
- Take care of potentially hazardous chemicals



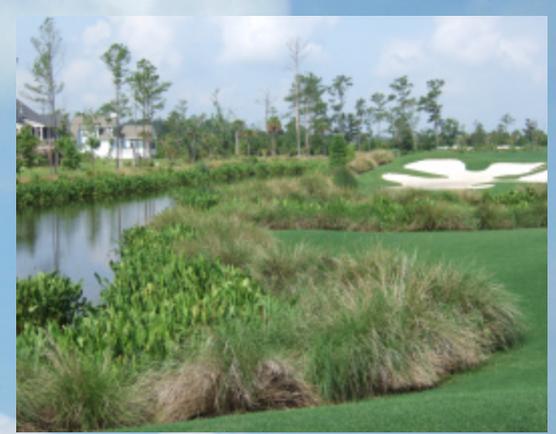
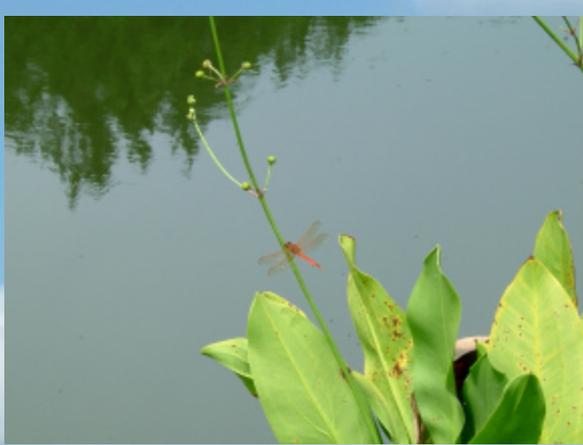
# Stormwater Education: Maintenance!

- Developer to homeowner
- A plan: who, what, when, how?
- HOAs or homeowner?
- Ordinances or neighborhood covenants?
- Education and outreach programs available



# Coastal Stormwater Pond Clinics

- Design and Planning
- In situ Strategies
- Buffers
- Maintenance



**Questions?**  
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