Final Draft

Eastern Shore Watershed Management Plan

APPENDICES

June 2023

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APPENDIX A

1. **Stakeholder meeting minutes**
2. **Community Survey, May 2021 through December 2022**

thompson
ENGINEERING

Eastern Shore Watershed Management Plan
Steering Committee Kick-Off Meeting

Tuesday, April 13, 2021 ~ 9:00 a.m.
Fairhope Civic Center Auditorium
Fairhope, Alabama

1. Roberta Swann kicked off the meeting introductions around the room and described MBNEP's organizational mission and purpose/role in development of Watershed Management Plans (WMPs) in the Alabama Coastal Counties.
2. Eliska Morgan outlined the objectives of this first meeting of the Eastern Shore WMP Steering Committee.
3. Suzanne Sweetser provided a summary of the components of a WMP and the need for public participation in guiding the WMP's development. She encouraged the attendees to view the poster-size watershed map and aerial photographs that were displayed in the meeting room. She emphasized the need to identify all pertinent data to assist in the characterization of the current quality of the watershed, identify problems/issues, leading to development of watershed management recommendations to facilitate watershed improvements. For example, we want to protect good habitats and areas with good water quality, and to restore/improve degraded priority areas identified. The Team is in the Data Needs phase of the WMP at this time—scheduled completion within 30 days. An online watershed survey will be available soon for public input regarding problem identification, data sources, data needs, etc. (email announcement will be provided to participants and others with expressed interest in the Eastern Shore WMP, and the survey will be located on the MBNEP website). She then summarized some watershed facts such as the subdivision of the Eastern Shore Watershed into seven subwatersheds located from just south of I-10 southward to Pelican Point at the mouth of Weeks Bay, a coastline distance of 23 miles, with 48 miles of streams.
4. Randy Davis and Troy Ephriam then facilitated an interactive discussion among attendees regarding problem areas within the watershed and issues/opportunities that need to be addressed in the WMP. Comments discussed include:
    a. Joey Nunnally, Baldwin County Highway Department, summarized the post-hurricane cleanup of trees in navigable streams on the Eastern Shore that is being undertaken by the Alabama Department of Conservation and Natural Resources. A survey of the woody debris damage areas has been completed and a contractor will soon begin to remove the identified navigation obstructions. Only applies to navigable waters. County could not get funds on their own since they were not responsible for the waterways. State talked with FEMA but will not use their money—state will pay. City of Fairhope cleared all material behind 98 and bay.

b. Casey Williams, Eastern Shore Chamber of Commerce, stated that drainage is a big watershed problem, citing drainage problems leading from areas located upstream of places like Bay Front Park in Daphne through huge drainage pipes/tunnels. These drainage conduits have degraded the beachfront areas in the Daphne area with concrete rubble and rebar exposed along the existing shoreline (dangerous). Connectivity of the shoreline beaches is another problem. Chamber of Commerce is good resource for outreach—has 1300 members.
c. Teddy Faust, Tax Assessor, mentioned concerns of potential contaminated sediments in the depositional areas as you boat northward toward the causeway along the Eastern Shore area. He also is concerned about the loss of grass beds along the shoreline where they historically existed to support the abundant fish and shellfish resources along the Eastern Shore.
d. Cathy Barnette, Dewberry Engineering, stated that better communication and cooperation between the political entities along the Eastern Shore is needed, e.g., Fairhope, Daphne, Spanish Fort. She also mentioned Metro Quest software where you can drop a pin on a map and identify issues.
e. Corey Martin, Fairhope City Council, stated that a more cohesive regulatory approach is needed not only for the Eastern Shore area, but also looking upstream to those areas through which the rivers and stream flow that feed into Mobile Bay.
f. Kim Burmeister, Fairhope Planning Board, Code Enforcement, stated that the Team must create partnerships locally to address watershed issues, such as the MS4 partnership dealing with Eastern Shore transportation issues that includes cooperative efforts by Fairhope, Daphne, and Spanish Fort. She also mentioned not pointing fingers—we are all part of the problem. Focus on ownership of problem and fixes. Need more cohesive ordinances.
g. Ashley Campbell, Baldwin County Planning & Zoning Department, stated this WMP should build upon the template of interagency cooperation that came out of the D'Olive Creek WMP, that has led to several million dollars of stream restoration efforts since that plan was completed in 2010. She recommended Team identification of the key priorities to be addressed in the recommendations for the WMP and not to get derailed on issues that can lead to dead end political/emotional hot topics.
h. DISL doing BP-funded, 10-year study on how water flows through Mobile Bay watershed.
i. No stormwater tax exists for Eastern Shore.
j. ACF has citizen data reports since 1995.

5. In closing, Eliska played the short video highlighting the Eastern Shore WMP. She reiterated that the watershed survey will be completed and put on)ine soon (notifications will be sent out).
6. Mike Eubanks stressed the importance of getting involved in this planning effort and asked the Steering Committee to encourage others to participate to create ownership.
7. Attendees Included:
    - Roberta Swann, MBNEP

- Christian Miller, MBNEP
- Eliska Morgan, Thompson
- Suzanne Sweetser, Thompson
- Steve O'Hearn, Thompson
- Mike Eubanks, Thompson Randy Davis, M&R
- Martha Davis, M&R
- Troy Ephriam, Ephriam Environmental
- Tim Thibaut, Barry Vittor & Associates Chris Warn, ESA
- Amy Paulson, ESA
- Mayor Sherry Sullivan, City of Fairhope Corey Martin, Councilman, City of Fairhope
- Kim Burmeister, City of Fairhope
- Joey Nunnally, Baldwin County Highway Department
- Ashley Campbell, Baldwin County Planning & Zoning Department
- Casey Fulford, Coastal Restoration Planner, AL Association of Conservation Districts
- Teddy Faust, Tax Assessor (resident)
- Casey Gay Williams, Eastern Shore Chamber of Commerce
- Elizabeth Tonsmeire, Local Resident/SALT Board member
- Jeannie Paradise, Fly Creek Marina
- Cynthia Barnette, Dewberry Engineering (Daphne resident)
- Lisa Adams, Mobile County Environmental Dept. (Fly Creek resident)

Meeting Minutes

July 30, 2021

IN ATTENDANCE

Roberta Swann, Mobile Bay National Estuary Program (MBNEP)

Christian Miller, MBNEP

Randy Davis, M&R Solutions, LLC

Christopher Warn, Environmental Science Associates (ESA)

Tim Thibaut, Vittor and Associates

Steve O'Hearn, Thompson Engineering

Suzanne Sweetser, Thompson Engineering

Mike Eubanks, Thompson Engineering

Eric Schneider, ESA

Emily Miller, Thompson Engineering

Alfred Guarisco, Village Point Park Preserve

Tim White, City of Daphne

Tim Patton, Daphne Utilities

Casey Fulford, Alabama Association of Conservation Districts

Christina LaJeune, City of Fairhope

Henry Perkins, MBNEP

Grey Cane, Coastal Conservation Association (CCA)/resident

Connie Whitaker, South Alabama Land Trust (SALT)

Ashley Campbell, Baldwin County Planning and Zoning

Joey Nunnally, Baldwin County Highway Department

Casey Williams, Eastern Shore Chamber of Commerce

Troy Ephriam, Ephriam and Associates Environmental Consulting, LLC

Craig Pouncey, Coastal Alabama Community College

Mike Shelton, Weeks Bay National Estuarine Research Reserve (NERR)

Cathy Barnette, Old Towne Daphne Association/Dewberry

Corey Martin, City of Fairhope City Council/Resident

Selena Vaughn, Daphne Utilities

AGENDA TOPICS

- The meeting was held on July 30, 2021 at the Baldwin County Satellite Courthouse.
- The Team presented watershed characterization and conditions results.
- The Team also presented results from the online survey (Appendix).

DISCUSSION

- It was suggested that the largest developmental growth in Fairhope has been in the headwaters of Fly Creek and Point Clear Creek.
- There was a lot of discussion about public access; specifically that not all the access points had been identified.
- Tim Thibaut presented data on SAV (2019 map compared with 1966 map) that sparked interest for participants. They wanted to see historical maps and wanted to understand the definition of SAV and the importance for it in the bay. Tim also mentioned that the estimated wetlands within the watershed is 3,498 acres.
- Chris Warn discussed the water quality and climate change/resiliency aspects of the watershed. Specifically, he mentioned that the sea level has risen about 1.35-feet over the past 100 years in this area.
    - It was mentioned that there is a need for more public education about environmental problems and specifically about how citizens can take actions to reduce sewage problems by not putting grease or “flushable” wipes down their drains.
    - Shoreline erosion along D’Olive Bay and Yancey Creek was a topic of concern.
- Randy Davis and Troy Ephriam presented the online survey results. They were well received and did not invoke any surprises. All meeting participants were encouraged to get others to take the online survey to get a higher level of participation across all sectors of the watershed.
    - Corey Martin brought up concerns about Alabama SB107, and potential effects on orderly planning and zoning within the watershed. Along the same lines participants were interested in riparian buffers along the bay and how passage of Senate Bill 107 would impact the City’s authority over these buffers. SB107 states: “*Under existing law, the police jurisdiction of a municipality having a population of 6,000 persons or more may extend for three miles from the corporate limits and the police jurisdiction of a municipality having less than 6,000 persons may extend for one and one half miles from the corporate limits. This bill would provide that the police jurisdiction of a municipality would not be extended but would provide that a municipality may reduce its police jurisdiction by any half-mile increment or eliminate its police jurisdiction. Under existing*

law, the planning jurisdiction of a municipality, including the approval of subdivisions, extends for five miles from the corporate limits (Extraterritorial Jurisdiction). This bill would limit the jurisdiction of a municipal planning commission to the corporate limits of a municipality."

- Currently, zoning outside of city limits is citizen driven and subject to a referendum vote to get county zoning.
- Joey Nunnally discussed storm debris removal from Hurricanes Sally and Zeta (2020). He stated that the debris removal project for navigable streams had been completed.

- Suzanne Sweetser summarized the tentative watershed plan meetings:
  - September 2021, Public Stakeholder Meeting
  - January 2022, Presentation of Watershed Management Measures and Critical Issues to Steering Committee
  - April 2022, Public Stakeholder Meeting for present findings/recommendation of the Draft Watershed Management Plan.

Meeting Minutes

DATE / LOCATION

December 6, 2021 / Oak Hollow Farm, Fairhope, Alabama

IN ATTENDANCE

Cathy Alba-Saucier, TripleNetLease

Mike Saucier, Gulf States RE

Nigel Temple, WSP/Fairhope Environmental Advisory Board

Schuyler Huff, Coastal Alabama Community College

Kim Burmeister, City of Fairhope

Ashley Campbell, Baldwin County Planning and Zoning

Mike Shelton, Weeks Bay National Estuarine Research Reserve (NERR)

Project Team

Henry Perkins, MBNEP

Suzanne Sweetser, Thompson Engineering

Nicole Love, Thompson Engineering

Eliska Morgan, Thompson Engineering

Christopher Warn, Environmental Science Associates (ESA)

Amy Paulson, Environmental Science Associates (ESA)

Randy Davis, M&R Solutions, LLC

AGENDA

- The Team presented information about Watershed Management Planning process, Eastern Shore WMP watershed characterization, online survey results, and critical issues.
- Participants were then asked to go deeper on one of the critical issue areas. They were asked three questions:

  1. What are the greatest concerns associated with this critical issue?

  2. What are some solutions to those concerns?

3. What are the challenges to implementing those solutions?

DISCUSSION

Due to low public attendance, breakout groups were not possible; thus, participants chose to focus the discussion on Water Quality. Participant responses to the three questions were recorded on a flip chart and summarized below:

1. What are the greatest concerns associated with Water Quality as a critical watershed issue?

- A large portion of the conversation focused on sedimentation. Sedimentation caused by development, habitat loss, erosion, excess of sod, urban runoff, and more frequent and intense storm events.
- Another cause for concern is stormwater management. A couple of things that are causing these problems are stormwater displacement versus onsite mitigation and inadequate infrastructure. It was noted that is important to distinguish between stormwater and sewage.
- Groundwater and the presence of open groundwater wells and continued drilling was also of note.
- The continued loss of wetlands also raised concerns as to how water quality is affected by the loss.
- Lack of farming best management practices (BMPs) was also noted. One specific example would be lack of enforcement for riparian buffers on agricultural lands.
- Improper use of fertilizers and pesticides from homeowners.
- Poorly maintained garbage trucks and personal vehicles leaking oil onto the streets.

2. What are some solutions to those concerns?

- The creation of a stormwater authority to coordinate infrastructure improvements and funding solutions for those improvements.
    - City of Fairhope has a 5-year sewer plan.
- Improve sewer outfalls – there are a lot of outfall lines that terminate directly into the Bay. Those need to be removed and do more onsite filtration (bioretention).
- Determine clear list of regulations for developers. Need to give clear guidance on what is the developers responsibility versus the city or county – and ideally the responsibilities are shared and balanced in a fair and economic way.
    - Too many regulations put on the developer cause construction/development costs to rise, and those costs are passed onto the consumer.
    - On the reverse side, if there are no regulations put on the developer the costs to the city rise in response actions
    - Municipalities should provide infrastructure Master Plans for utilities, drainage, transportation, etc. For example, the land use plan that the City of Fairhope is working on

will help with some of these issues by identifying areas for conservation (agricultural land, green space, etc.).

1. Need multiple types of housing options; rentals and increased density are options that are needed.
2. Saving/creating greenspace is important and solves a lot of different issues.
3. Protect and build more wetlands. Wetlands can be used for stormwater/sewage storage.

3. What are the challenges to implementing those solutions?

- Willingness to pay. Need to have all involved be willing to pay in some way (i.e., citizens, developers, municipalities, etc.).
    - Sales tax does not work. Property taxes were better, but those require political will and citizen involvement.
- Multi-jurisdictional communication/coordination; cities coordinating with cities, cities coordinating with counties, counties coordinating cities, etc. Also, public-private partnerships are important.

Meeting Minutes

DATE / LOCATION

December 9, 2021 / Daphne City Hall – Daphne, Alabama

IN ATTENDANCE

Tim White, City of Daphne

Cathy Barnette, Dewberry

Cade Kistler, Mobile Baykeeper/resident - Daphne

Anna Miller, Keen Living/resident - Fairhope

Elizabeth Tonsmeire, resident - Fairhope

Lee Yokel, EcoSolutions/resident - Daphne

Gary Grover, Fairhope Environmental Advisory Board, Resident

Connie Whittaker, South Alabama Land Trust (SALT)

Danny ??, resident - Daphne

Maurice Horsey, resident – Daphne

Kent Brewer, Fly Creek Watershed Preservation Association

Stephanie Middlelot, resident – Daphne

Mike Shelton, Weeks Bay National Estuarine Research Reserve (NERR)

Danny Wray, resident - Daphne

Project Team

Henry Perkins, MBNEP

Christian Miller, MBNEP

Suzanne Sweetser, Thompson Engineering

Eliska Morgan, Thompson Engineering

Nicole Love, Thompson Engineering

Christopher Warn, Environmental Science Associates (ESA)

Troy Ephriam, Ephriam Environmental, LLC

Tim Thibaut, Barry Vittor and Associates

AGENDA

- The Team presented information about Watershed Management Planning process, Eastern Shore WMP watershed characterization, online survey results, and critical issues.
- Participants were then asked to go deeper on one or more of the critical issue areas. They were asked three questions: 1. What are the greatest concerns associated with this critical issue? 2. What are some solutions to those concerns? 3. What are the challenges to implementing those solutions?

DISCUSSION

2. Human Health and Wellbeing Critical Issue Area (Troy Ephriam, facilitator)

    1. What are the greatest concerns associated with this critical issue?

        i. Good water quality, clean air, and clean soils

            1. Industries and private/corporate transportation need to be accountable for clean air
            2. With clean soil citizens have access to healthy food

        ii. Quality of life = happiness

        iii. Lack of education and access to resources

        iv. Needs to be a balance of quality of life and access to resources to create a healthy wellbeing

    2. What are some solutions to address those concerns?

        v. More public access to clean water resources/activities

        vi. Improved access to resources (i.e.; education, clean food, clean water, etc.) for citizens

    3. What are the challenges to implementing those solutions?

        vii. The Not In My Backyard (NIMBY) mindset of homeowners and local residents

        viii. How do we educate citizens about these issues and solutions to them? There doesn't seem to be an organized/coordinated method for that.

3. Habitat Loss Critical Issue Area (Tim Thibaut, facilitator)

    a. What are the greatest concerns associated with this critical issue?

        i. Wetland fill (and thus loss of wetlands) is contributing to habitat loss

        ii. Shorelines along the Bay are eroding

            1. One source could be the excessive stormwater outfalls into the Bay.

    b. What at some solutions to address those concerns?

i. No responses

c. What are challenges to implementing those solutions?

i. No responses

4. Litter Critical Issue Area (Christian Miller, facilitator)

a. What are the greatest concerns associated with this critical issue?

i. No responses

b. What are some solutions to address those concerns?

i. Need to identify best locations for litter traps (Osprey Initiative).

c. What are some challenges to implementing those solutions?

i. No responses

5. Erosion/Sedimentation Critical Issue Area (Suzanne Sweetser, facilitator)

a. What are the greatest concerns involving this critical issue?

i. Excessive hardening of shorelines is creating multiple problems including lack of public access.

1. Overuse of bulkheads

ii. Regulatory/permitting hurdles are causing people not to want to use living shorelines

iii. Over development has exacerbated instream erosion

b. What are some possible solutions to address those concerns?

i. Education

ii. Cost sharing/funding

iii. Need more contractors with living shoreline experience

iv. More low impact development practices including larger riparian buffers

c. What are some challenges to implementing those solutions?

i. Costs

ii. Political will

iii. Easy way out

iv. Reducing regulatory burdens

v. Better public education

6. Development Critical Issue Area (Tim White, facilitator)

a. What are the greatest concerns involving this critical issue?
    i. Overdevelopment is creating negative wetland impacts
    ii. Altered hydrology post-construction
    iii. Sewage transmission
    iv. Runoff during construction
        1. Lack of appropriate barriers during construction
    v. Fines for not following rules are too low
    vi. Raising lots with fill
    vii. Using non-native vegetation
b. What are possible solutions to address these concerns?
    i. Higher fines
    ii. Stricter ordinances
    iii. Creation of a stormwater management authority
    iv. Impact fees
    v. Impervious cover limit ordinances
    vi. Build "up" – higher rather than wider
    vii. Mandate green infrastructure
c. What are some challenges to implementing these solutions?
    i. Funding
    ii. Politics
    iii. Developers in the position of power
    iv. Variances
    v. Difficult to put a dollar value on environment and aesthetics
    vi. Not enough examples of good conservation or development practices

7. Water Quality Critical Issue Area (Cathy Barnette, facilitator)
    a. What are the greatest concerns involving this critical issue?
        i. Speckled trout fisheries and other fisheries are strong, but need to maintain good water quality to avoid a potential downfall in populations
        ii. Over application of pesticides
        iii. Septic maintenance by homeowner

iv. Sewer reporting

v. The municipal sewer/stormwater systems do not have a high enough capacity

vi. Identification and protection of groundwater resources.

vii. Is the Bay safe to swim or fish? How do citizens know? Who informs the general public?

viii. Geese at the Fairhope beach.

1. There is a report in Fairhope of bacteria levels that showed 20% of swimmers had gastrointestinal issues. The report states this is due to the geese.

ix. Abandoned steel pipe in Big Mouth Gulley

b. What are some possible solutions for these concerns?

i. Education to homeowners regarding how to apply pesticides/fertilizers in a more environmentally friendly manner.

ii. Education campaign on septic system operation and maintenance to septic owners.

1. Development of a self-reporting system.

iii. Sewer infrastructure improvements

iv. All utilities should do continued sewer capacity studies to ensure new growth and development does not overwhelm system.

1. Need to develop a common definition of “capacity”

v. Need to map septic systems and focus education campaigns accordingly

1. Can source tracking assist with this? Dauphin Island Sea Lab may be getting some funding to do source tracking in Fly Creek.

vi. Conversion of septic to sewer

vii. Create a stormwater authority

1. If there is no political will to create it on a regional scale then the cities could coordinate and develop a regional one.

a. Need to add a public aspect to it.

viii. Goose eradication at Fairhope public beach

1. Model example: Great Lakes also had a goose problem and created a beach management plan. Could see if that would work for Fairhope.

c. What are some challenges to implementing those solutions?

i. Funding

ii. Public education and participation

iii. The ability to identify who “owns” the problems and who is ultimately responsible for providing solutions

thompson
ENGINEERING

Meeting Minutes

DATE / LOCATION

May 25, 2022 / Daphne Civic Center, Daphne, Alabama

IN ATTENDANCE

Paul Brennan, Clean Water Alabama

Diana Brewer, Riviera Utilities

Kim Burmeister, City of Fairhope

Guy Busby, Gulf Coast Media

Rebecca Dunn-Bryant, Watershed

Grey Cane, CCA

Jennifer Foutch, Baldwin County Realtors

Rick Frederick, Resident

Casey Fulford, Alabama Association of Conservation Districts

Gary Gover, Fairhope Environmental Advisory Board

Richard Johnson, City of Fairhope

Anna Miller, Keen Living

Ryan Mitchell, ACES

Missy Partyka, Auburn Extension/MBNEP

Tim Patton, Daphne Utilities

Amy Paulson, Resident

Malcomb Pegues, ACES

Brian Ruffner, Polo Ridge HOA

Nigel Temple, WSP/Fairhope Environmental Advisory Board

Elizabeth Tonsmeire, Resident

Selena Vaughn, Daphne Utilities

Tim White, City of Daphne

Connie Whittaker, SALT

Casey Gaye-Williams, Eastern Shore Chamber of Commerce

Lee Yokel, Resident

Project Team

Randy Davis, M&R Solutions, LLC

Nicole Love, Thompson Engineering

Marti Messick, MBNEP

Christian Miller, MBNEP

Eliska Morgan, Thompson Engineering

Roberta Swann, MBNEP

Suzanne Sweetser, Thompson Engineering

Tim Thibaut, BVA

Christopher Warn, Environmental Science Associates (ESA)

AGENDA

- The Team presented information about Watershed Management Planning process, Eastern Shore WMP watershed characterization, identified critical issues, and introduced recommended management measures.
- Participants were then broken up into small working groups (6 different groups). Facilitators were asked to walk the groups through three questions:

  1. What is missing?

  2. Identify the top 3 most urgent/attainable management measures.

  3. Pick one of the top 3 and brainstorm an action plan for it.

DISCUSSION

Participant responses to the three questions were recorded on a flip chart and summarized below:

Group #1:

1. What's missing?
    a. Incentives and legal structures for habitat protection
    b. Incentives for stormwater management
    c. Need to get buy-in from administrators and politicians for implementation
    d. Identify acquisition targets
    e. Set design standards for development

f. Long-term maintenance requirement for developers
    i. Develop BMPs for stormwater management
g. Coordination with Baldwin County Comprehensive Plan
h. Create a comprehensive Eastern Shore drainage plan
i. Annexations for specific subwatershed requirements
j. Need for coordination among municipalities and County
k. Establish historical baseline of conditions
l. Inventory of artesian springs
m. Tree protection for residential properties

2. Identify the top 3 most urgent/attainable management measures
    a. Gully stabilization
    b. Sedimentation
    c. Fly Creek pathogen source tracking
    d. Duck Pond restoration
    e. Habitat protection
    f. Stormwater runoff
    g. Monitoring status and trends and management measures effectiveness
    h. Accountability for long term sustainability of actions
3. Choose one of the priorities and develop an action plan.
    a. Sedimentation/Gully loss
        i. Who would be involved? Planning and Zoning Departments. Public Works Departments. Legislators. Civic boards. Building Departments.
            - Requires regional and local participation.
        ii. Create a gully ordinance.
        iii. Create an impervious cover ordinance
        iv. How would it get funded? License plate fees, stormwater fees, NRCS grants, RESTORE funding, impact fees.
        v. Create pilot projects to show effectiveness.
        vi. Create an LID manual.
        vii. Revise regulations for onsite infiltration of recharge
        viii. Create a holistic approach which includes consistent standards and regulations for stormwater management development.

Group #2:

1. What's missing?
    a. Information about residential fertilizers: Create education for homeowners. Create an applicators license?
    b. Septic tank information: inventory of current residential septic tanks.
        i. Creation of a program to incentivize replacement/conversion to sewer.

c. Sanitary sewer overflows: Reporting mechanisms. Infrastructure upgrades. Education.
d. Planning for urban sprawl – plan for urban centers, increased public transportation.
e. More data about aquifers: need for water quality testing and standardized reporting mechanisms.

2. Identify the top 3 most urgent/attainable management measures
    a. **Water Quality**
        - Sewer infrastructure upgrades.
        - Monitoring (MST).
        - Septic maintenance, replacement, and conversion.
        - Creation of agriculture BMPs.
        - Education about the effects of water quality on health.
    b. Stormwater mitigation strategy:
        - Planning on a regional level.
        - Education and enforcement of sedimentation and erosion BMPs.
        - Manual on sedimentation and erosion practices for homeowners associations/residents (low-hanging fruit, could be done relatively easily and cheaply).
    c. Land acquisition for preservation and/or strategic conservation easements
3. Choose one of the priorities and develop an action plan.
    a. What: Water Quality (including; pathogens, sedimentation, nutrients).
    b. Who would be involved?
        i. Public/residents, HOAs, developers, utilities, realtors, tourism, schools.
    c. What funding sources could be used?
        i. New fees; ie, impact fees.
        ii. Grants.
        iii. State programs.
        iv. Property taxes.
    d. How would this be accomplished? Utilize assessments per watershed to target.
        i. Create education targeting elected officials.

Group #3

1. What's missing?
    a. Synergy during development stage to address the impacts on environmental issues.
    b. Education
    c. Public/Private property cooperation on services (subsidies/cost sharing)
    d. Effective communication of services, plans etc.
        i. Use modern technology – QR codes, etc.
        ii. Municipal IT staff improvements
    e. Summary of efforts to date and identifying what has worked and what hasn't
    f. Connect the watershed to the Bay more effectively.

2. Identify the top 3 most urgent/attainable management measures
    a. Education
    b. Business outreach partnership (resilience cooperation): Make sure they all are saying the same thing. Incentivize actions.
    c. List of potential projects with data-driven decision matrix
        i. Identify shovel ready projects that incorporate outreach activities.
    d. Engage new residents to the area via realtors and/or city organizations.

Group #4:

1. What's missing?
    a. Funding for living shorelines (controversial)
    b. Media blitz and private tours of existing living shorelines. Strategically design living shorelines project per expanded shoreline segment.
        i. Known cost per foot
        ii. Known shoreline study impacts.
2. Identify the top 3 most urgent/attainable management measures
    a. Land acquisition
    b. Living shorelines
    c. Community signage

Group #5:

1. What's missing?
    a. HOA education on stormwater management, retention pond maintenance, zoning education, HOA needs assessment, require as-built drainage plan. Adoptions of Fairhope's O&M plan watershed wide.
    b. Increased volunteer water quality monitoring.
        i. Identify sites and opportunities.
        ii. Campaign/recruit new water quality monitors.
        iii. Investigate use of water rangers app.
    c. Investigate/identify priority areas for regional stormwater management
2. Identify the top 3 most urgent/attainable management measures
    a. Point Clear Creek restoration
        i. Acquire priority parcels for species/habitat management.
        ii. Removal of storm debris and sedimentation.
    b. Gullies
        i. Evaluation of issues
        ii. Restoration
    c. Fly creek pathogen water quality assessment
        i. Determine sources, develop plan to reduce pathogen load to meet use classification

   ii. Utilities are already on the same page
3. Choose one of the priorities and develop an action plan.
   a. Point Clear Creek (sediment and debris). Fly Creek pathogens
      i. Who are the partners? Baldwin County, Fairhope, ADEM, Polo Ridge HOA, MBNEP, ADCNR, Extension (MEE), Osprey Initiative, AWW, SALT, NRCS, Public, utilities.
      ii. Funding sources? ADEM-319, ADCNR, NFWF other than GEBF, RESTORE (cities/county in-kind contributions).
      iii. What is the process? Define project scope: Catchment assessment, ID project area, field studies, determine restoration reach, pathogen source ID.

Group #6:

1. What's missing?
   a. More information on land use change data included in the presentation
      i. The graphs that indicate change in land use are misleading…need to be redone or explained.
         - What were the methods for obtaining those future values. Can't access/gauge relative risk to remining habitats.
   b. Education. For example, the Chamber has a 2,600 distribution list but only get a 36% click rate so 60% of the people are not getting the information. There is a misconception on the causes of the problems (like where are the sources of litter) .
      i. Passive campaigns are not effective, need more active way to engage public. (low turnout, competition for attention)
      ii. Need diversity of approaches to include churches, HOAs, social media, and signage. Perhaps a blitz approach with simple actions that are easy to do.
      iii. Highlight businesses that are doing the "right" thing.
   c. Lack of attention to underserved communities; specifically, infrastructure needs (Daphmont and Twin Beech area). Kids that live in those communities have never seen the beach.
   d. Need to include incentives and/or consequences on top of education.
   e. Need to coordinate with current municipal initiatives (Fairhope and Daphne comprehensive plans).
   f. Emphasize data, baseline connection and monitoring.
      i. Need continuity in the data collections and understanding and where data can be accessed.
      ii. Think about ways to include other groups in the collection of data.
      iii. Bring in Baldwin County Master Environmental education program (use their curriculum).
2. Identify the top 3 most urgent/attainable management measures
   a. Living Shoreline education and pilot projects.
      i. Consistency in enforceability of regulations across governing bodies.
      ii. Stormwater fixes – actually use the money??

iii. Public education/tours to the waste water treatment plants to understand how water is treated.
iv. Encourage maintenance of native vegetation, keeping trees and prevent removal of all vegetation during development.
- Instead of requiring the need to just "have green space" use language of "keep what you have"

b. Construction site oversight
i. Regulating the use of non-native sediment/soils
- Where does removed top soil go?

ii. Require removal of construction garbage left behind.

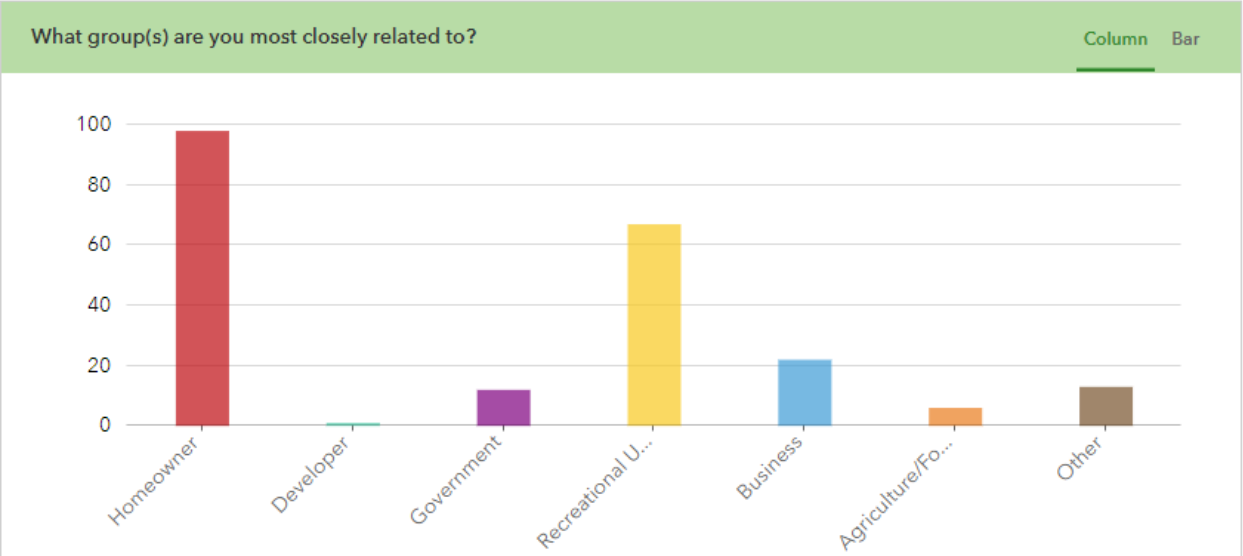
3. Choose one of the priorities and develop an action plan.
a. Sustainable Construction
i. How?
- Create ordinances to include preservation of green space versus creation of simulated green space.
- Stormwater basins and retention/detention ponds should not be included in the total green space percent requirements.
- When creating ordinances they need to go through a governing body to be approved so need to meet with local and regional planning staff and provide them with a draft amended ordinance before getting to the legislators.
- Develop training materials for developers to educate on impacts of construction practices. Target engagement with trade groups.
- Seek investment/partnerships with local nurseries to increase encouragement of native vegetation use.
- Create public/private partnerships to promote native vegetation protection. (examples; advertise initiatives such as "No Mow May".
- Add advertising about native planting to school newsletters.
- Create certification program or adopt existing ones to encourage adoptions of practices (could include tax incentives). (example; florida water??).
- Include SME's in green development
- Go to where "they" are (they = developers, construction firms, etc). Get advocates who speak the same language to explain how the extra work can lead to financial benefits, not losses.

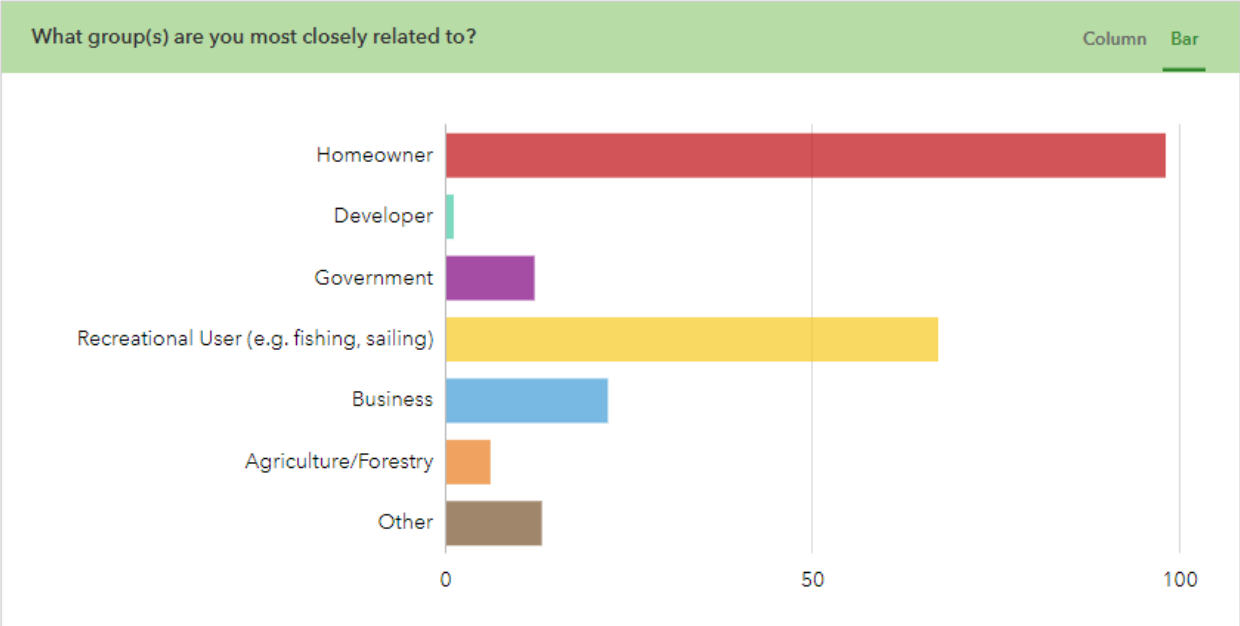
Additional comments/suggestions:

- Utilize the Baldwin County Trailblazers to encourage/increase use of green spaces and trails.
- Identify the differences in perceptions of water quality impacts between Mobile and Baldwin Counties.

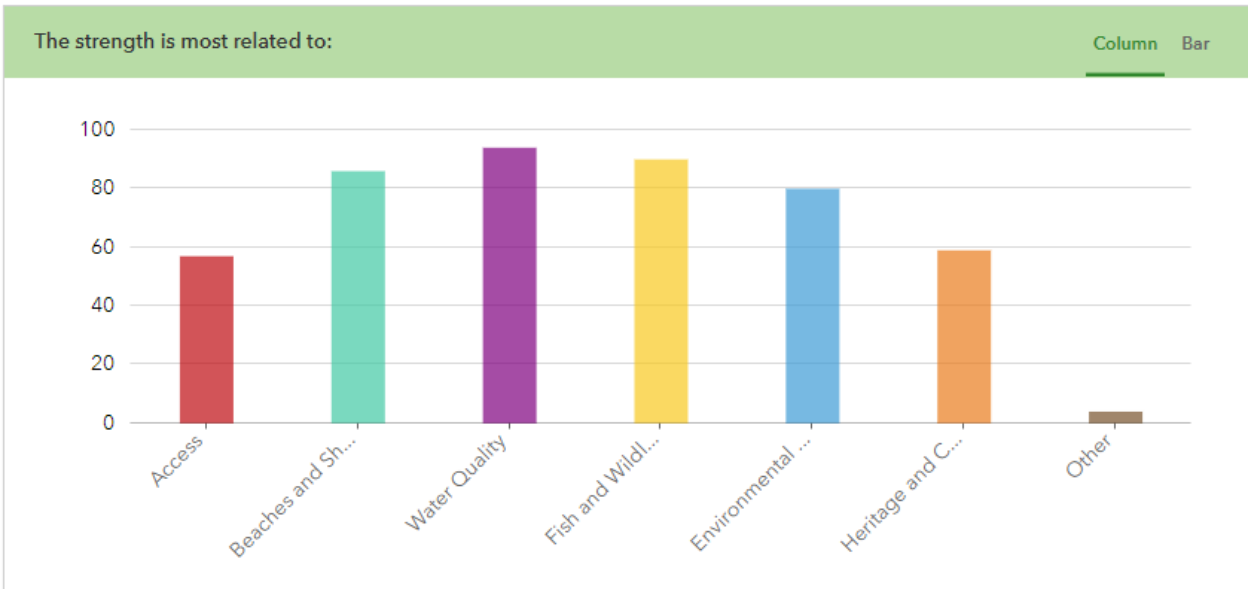
  - May be that access to resources increases understanding.
- Local municipalities are still managing like they are small towns, not recognizing the amount of growth requires a different approach. (Residents don't want regulations/zoning until it impacts them directly).
- Need impact fees and/or rejections of large developments. (incentives, consequences, etc).
- Follow National Green Building standards
- Future land use in the presentation shows agriculture increasing. That seems incorrect and should be the opposite.
- Suggestion for incentives for shoreline conversion to natural.
- Living shorelines can sometimes be more expensive than seawall, may be perception.
- Make living shorelines easier to permit.
- EcoSolutions commented they photos of damaged bulkheads and also draft legislation they will share.
- Historically gullies were used as dumps so there may be lots of debris and litter. Auto businesses and others used to dump drums and other trash. Need to make it easier for homeowners to clean out gullies.
- After Sally there was waterway cleanup but could not get reimbursed by feds because was not their jurisdiction. Municipalities need assistance in clean up.
- Look at Fly Creek fish migration.

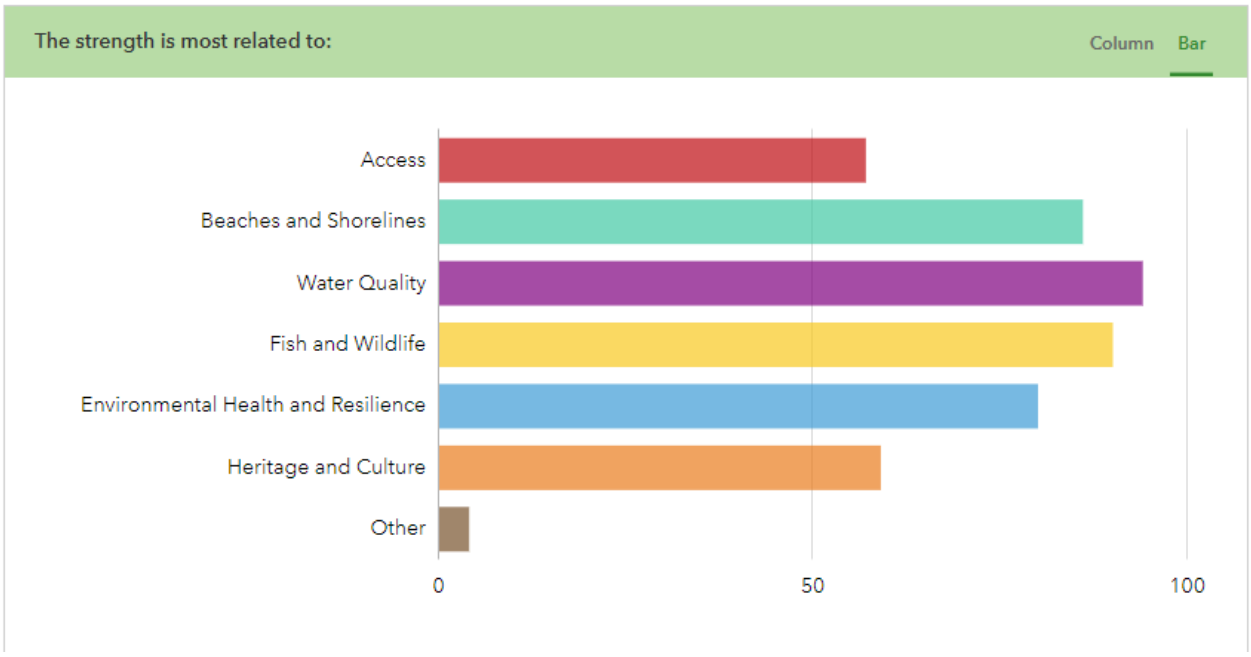
Online Survey Results – May 2021 through December 2022





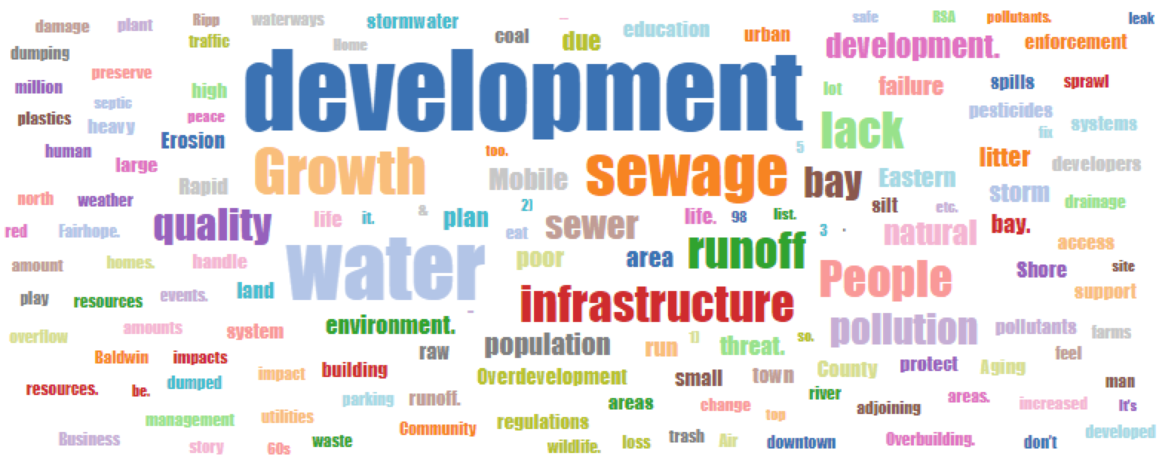
Follow up question to "What are the things that make the Eastern Shore most unique and desirable that should be protected or improved?"





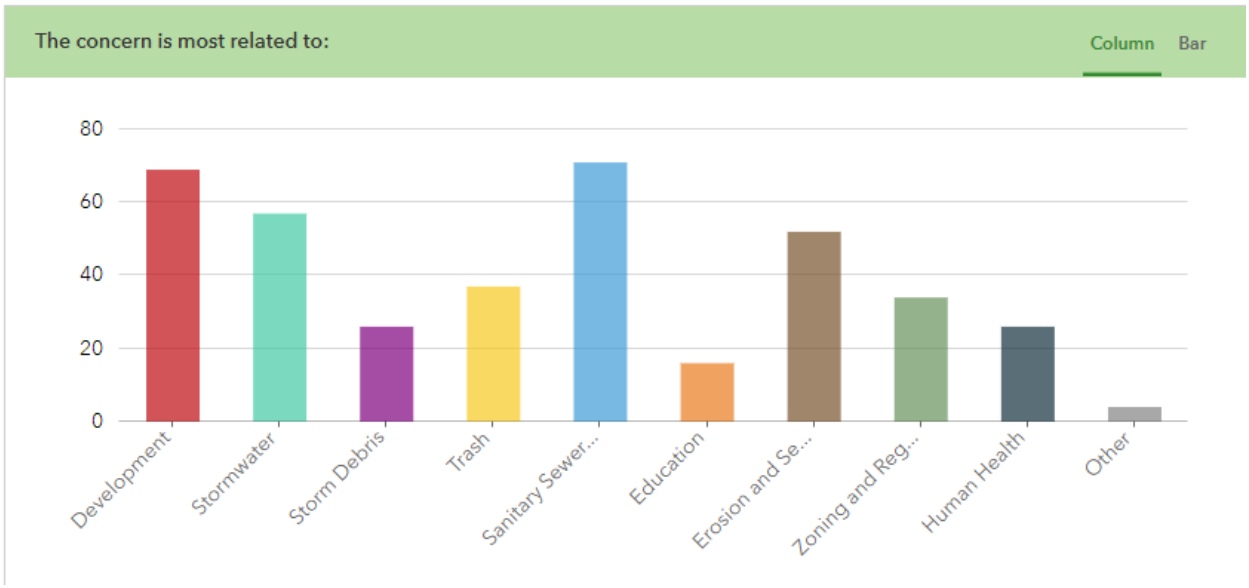
thompson
ENGINEERING

What is threatening our community? Word cloud

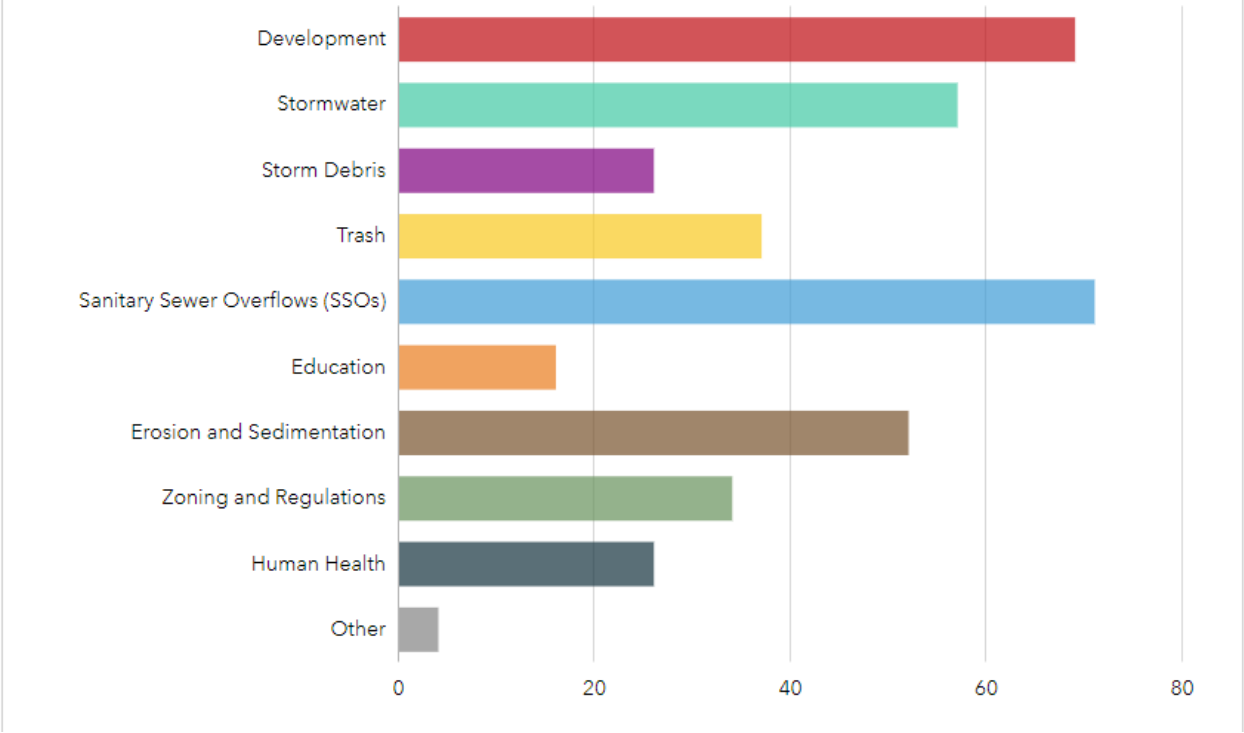


Describe the concern for this location: Word cloud

Follow up to above question:



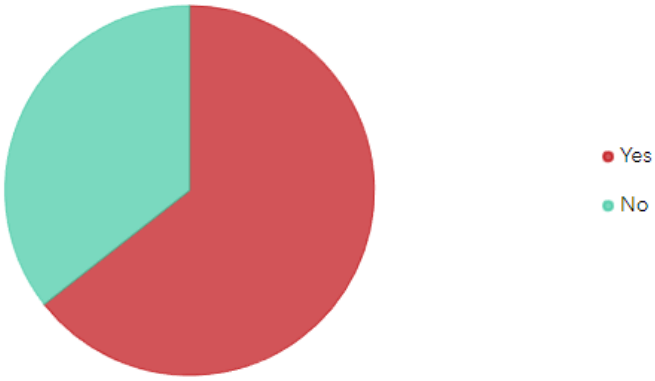
The concern is most related to: Column Bar



Please provide any additional ideas you have to help inform our effort to represent all perspectives in... Word cloud

Would you be willing to attend a focus group to discuss this and other concerns?

Column Bar Pie Map



Hide table

Empty categories Sort

Answers	Count	Percentage
Yes	67	57.26%
No	37	31.62%

Upload an image if desired:

Gallery

Images: 3

Three images uploaded by same individual.

APPENDIX B

Soils Information

1. Table of Soils for Eastern Shore WMP
2. Soil Map Unit Description
3. Soil K Factor, Whole Soil

NAME	MUSYM	MUKEY	muname	mukind	KfactWS	AREA_AC
Bailey Creek / UT7 - UT11	Bb	328102	Bibb and Mantachie soils, local alluvium	Undifferentiated grou	.37	43.77
Bailey Creek / UT7 - UT11	BtB	328107	Bowie fine sandy loam, thin solum, 2 to 5 percent slopes	Consociation	.20	13.15
Bailey Creek / UT7 - UT11	CgA	328114	Carnegie very fine sandy loam, 0 to 2 percent slopes	Consociation	.17	10.01
Bailey Creek / UT7 - UT11	CgB	328115	Carnegie very fine sandy loam, 2 to 5 percent slopes	Consociation	.17	58.26
Bailey Creek / UT7 - UT11	CgB2	328116	Carnegie very fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.17	11.67
Bailey Creek / UT7 - UT11	CgC	328117	Carnegie very fine sandy loam, 5 to 8 percent slopes	Consociation	.17	17.96
Bailey Creek / UT7 - UT11	CgD2	328120	Carnegie very fine sandy loam, 8 to 12 percent slopes, eroded	Consociation	.17	2.71
Bailey Creek / UT7 - UT11	Co	328121	Coastal beaches	Association	.02	4.85
Bailey Creek / UT7 - UT11	EuB	328129	Eustis loamy fine sand, 0 to 5 percent slopes	Consociation	.10	126.46
Bailey Creek / UT7 - UT11	EuC	328130	Eustis loamy fine sand, 5 to 8 percent slopes	Consociation	.10	51.04
Bailey Creek / UT7 - UT11	EuD	328131	Eustis loamy fine sand, 8 to 12 percent slopes	Consociation	.10	19.27
Bailey Creek / UT7 - UT11	FaA	328132	Faceville fine sandy loam, 0 to 2 percent slopes	Consociation	.24	1.77
Bailey Creek / UT7 - UT11	FaB	328133	Faceville fine sandy loam, 2 to 5 percent slopes	Consociation	.24	108.37
Bailey Creek / UT7 - UT11	FaC	328135	Faceville fine sandy loam, 5 to 8 percent slopes	Consociation	.24	23.92
Bailey Creek / UT7 - UT11	FaC2	328136	Faceville fine sandy loam, 5 to 8 percent slopes, eroded	Consociation	.24	32.91
Bailey Creek / UT7 - UT11	GoA	328139	Goldsboro fine sandy loam, 0 to 2 percent slopes	Consociation	.24	1.75
Bailey Creek / UT7 - UT11	GoB	328140	Goldsboro fine sandy loam, 2 to 5 percent slopes	Consociation	.24	17.39
Bailey Creek / UT7 - UT11	Gr	328142	Grady soils	Undifferentiated grou	.24	6.40
Bailey Creek / UT7 - UT11	GvC2	328146	Greenville loam, 5 to 8 percent slopes, eroded	Consociation	.24	6.10
Bailey Creek / UT7 - UT11	Hb	328148	Hyde, Bayboro, and Muck soils	Undifferentiated group		472.12
Bailey Creek / UT7 - UT11	IrB	328150	Irvington loam, 2 to 5 percent slopes	Consociation	.32	7.13
Bailey Creek / UT7 - UT11	KlB	328156	Klej loamy fine sand, 0 to 5 percent slopes	Consociation	.15	17.87
Bailey Creek / UT7 - UT11	KlC	328157	Klej loamy fine sand, 5 to 8 percent slopes	Consociation	.15	7.43
Bailey Creek / UT7 - UT11	LaB	328158	Lakeland loamy fine sand, 0 to 5 percent slopes	Consociation	.15	161.25
Bailey Creek / UT7 - UT11	LaC	328159	Lakeland loamy fine sand, 5 to 8 percent slopes	Consociation	.15	115.17
Bailey Creek / UT7 - UT11	Ls	328164	Leon sand	Complex		307.41
Bailey Creek / UT7 - UT11	Lv	328165	Local alluvial land	Consociation	.20	91.99
Bailey Creek / UT7 - UT11	LyA	328166	Lynchburg fine sandy loam, 0 to 2 percent slopes	Consociation	.28	108.14
Bailey Creek / UT7 - UT11	LyB	328167	Lynchburg fine sandy loam, 2 to 5 percent slopes	Consociation	.28	5.46
Bailey Creek / UT7 - UT11	MgA	328170	Magnolia fine sandy loam, 0 to 2 percent slopes	Consociation	.24	2.63
Bailey Creek / UT7 - UT11	MrA	328175	Marlboro very fine sandy loam, 0 to 2 percent slopes	Consociation	.32	170.81
Bailey Creek / UT7 - UT11	MrB	328176	Marlboro very fine sandy loam, 2 to 5 percent slopes	Consociation	.32	22.57
Bailey Creek / UT7 - UT11	NoA	328179	Norfolk fine sandy loam, 0 to 2 percent slopes	Consociation	.28	111.42

Bailey Creek / UT7 - UT11	NoB	328180	Norfolk fine sandy loam, 2 to 5 percent slopes	Consociation	.28	63.72
Bailey Creek / UT7 - UT11	NoC	328182	Norfolk fine sandy loam, 5 to 8 percent slopes	Consociation	.24	15.00
Bailey Creek / UT7 - UT11	OrA	328184	Orangeburg fine sandy loam, 0 to 2 percent slopes	Consociation	.28	4.77
Bailey Creek / UT7 - UT11	OrB	328185	Orangeburg fine sandy loam, 2 to 5 percent slopes	Consociation	.28	3.76
Bailey Creek / UT7 - UT11	OrC	328187	Orangeburg fine sandy loam, 5 to 8 percent slopes	Consociation	.28	2.24
Bailey Creek / UT7 - UT11	OrD2	328188	Orangeburg fine sandy loam, 8 to 12 percent slopes, eroded	Consociation	.28	5.10
Bailey Creek / UT7 - UT11	PmB	328189	Plummer loamy sand, 0 to 5 percent slopes	Consociation	.10	159.61
Bailey Creek / UT7 - UT11	Pt	1412598	Pits, sand or gravel	Consociation		1.34
Bailey Creek / UT7 - UT11	RaA	328191	Rains fine sandy loam, 0 to 2 percent slopes	Consociation	.28	137.80
Bailey Creek / UT7 - UT11	RaB	328192	Rains fine sandy loam, 2 to 5 percent slopes	Consociation	.28	8.60
Bailey Creek / UT7 - UT11	Rr	328197	Robertsdale loam	Consociation	.32	5.78
Bailey Creek / UT7 - UT11	RuA	328198	Ruston fine sandy loam, 0 to 2 percent slopes	Consociation	.28	6.38
Bailey Creek / UT7 - UT11	RuB	328199	Ruston fine sandy loam, 2 to 5 percent slopes	Consociation	.28	135.38
Bailey Creek / UT7 - UT11	RuC	328201	Ruston fine sandy loam, 5 to 8 percent slopes	Consociation	.28	3.97
Bailey Creek / UT7 - UT11	RuD	328203	Ruston fine sandy loam, 8 to 12 percent slopes	Consociation	.28	11.30
Bailey Creek / UT7 - UT11	ScB	328207	Scranton loamy fine sand, 2 to 5 percent slopes	Consociation	.20	3.25
Bailey Creek / UT7 - UT11	SuB2	328210	Sunsweet fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.28	3.79
Bailey Creek / UT7 - UT11	SuC2	328211	Sunsweet fine sandy loam, 5 to 8 percent slopes, eroded	Consociation	.28	24.42
Bailey Creek / UT7 - UT11	SuD2	328212	Sunsweet fine sandy loam, 8 to 17 percent slopes, eroded	Consociation	.28	53.08
Bailey Creek / UT7 - UT11	TfA	328215	Tifton very fine sandy loam, 0 to 2 percent slopes	Consociation	.37	14.08
Bailey Creek / UT7 - UT11	TfB2	328217	Tifton very fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.37	11.98
Bailey Creek / UT7 - UT11	TfC	328218	Tifton very fine sandy loam, 5 to 8 percent slopes	Consociation	.37	3.30
Bailey Creek / UT7 - UT11	W	328220	Water	Consociation		7.33
Fly Creek / UT4	Bb	328102	Bibb and Mantachie soils, local alluvium	Undifferentiated grou	.37	52.06
Fly Creek / UT4	BoB	328103	Bowie fine sandy loam, 2 to 5 percent slopes	Consociation	.20	3.81
Fly Creek / UT4	BoC	328105	Bowie fine sandy loam, 5 to 8 percent slopes	Consociation	.20	9.85
Fly Creek / UT4	BwD	328110	Bowie, Lakeland, and Cuthbert soils, 8 to 12 percent slopes	Complex	.28	305.12
Fly Creek / UT4	BwD2	328111	Bowie, Lakeland, and Cuthbert soils, 8 to 12 percent slopes, eroded	Complex	.28	55.87
Fly Creek / UT4	BwF2	328112	Bowie, Lakeland, and Cuthbert soils, 12 to 25 percent slopes, eroded	Complex	.28	76.92
Fly Creek / UT4	CgA	328114	Carnegie very fine sandy loam, 0 to 2 percent slopes	Consociation	.17	70.53
Fly Creek / UT4	CgB	328115	Carnegie very fine sandy loam, 2 to 5 percent slopes	Consociation	.17	43.17
Fly Creek / UT4	CgB2	328116	Carnegie very fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.17	34.07
Fly Creek / UT4	CgC	328117	Carnegie very fine sandy loam, 5 to 8 percent slopes	Consociation	.17	61.66

Fly Creek / UT4	CgC2	328118	Carnegie very fine sandy loam, 5 to 8 percent slopes, eroded	Consociation	.17	13.48
Fly Creek / UT4	CgD	328119	Carnegie very fine sandy loam, 8 to 12 percent slopes	Consociation	.17	26.82
Fly Creek / UT4	Co	328121	Coastal beaches	Association	.02	8.64
Fly Creek / UT4	CtD	328124	Cuthbert fine sandy loam, 8 to 12 percent slopes	Consociation	.28	5.60
Fly Creek / UT4	EuB	328129	Eustis loamy fine sand, 0 to 5 percent slopes	Consociation	.10	127.90
Fly Creek / UT4	EuC	328130	Eustis loamy fine sand, 5 to 8 percent slopes	Consociation	.10	79.42
Fly Creek / UT4	EuD	328131	Eustis loamy fine sand, 8 to 12 percent slopes	Consociation	.10	87.01
Fly Creek / UT4	FaA	328132	Faceville fine sandy loam, 0 to 2 percent slopes	Consociation	.24	298.45
Fly Creek / UT4	FaB	328133	Faceville fine sandy loam, 2 to 5 percent slopes	Consociation	.24	134.02
Fly Creek / UT4	FaB2	328134	Faceville fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.24	14.29
Fly Creek / UT4	FaC	328135	Faceville fine sandy loam, 5 to 8 percent slopes	Consociation	.24	9.01
Fly Creek / UT4	GoA	328139	Goldsboro fine sandy loam, 0 to 2 percent slopes	Consociation	.24	3.68
Fly Creek / UT4	Gr	328142	Grady soils	Undifferentiated grou	.24	79.18
Fly Creek / UT4	GvA	328143	Greenville loam, 0 to 2 percent slopes	Consociation	.24	548.88
Fly Creek / UT4	GvB	328144	Greenville loam, 2 to 5 percent slopes	Consociation	.24	28.78
Fly Creek / UT4	GvB2	328145	Greenville loam, 2 to 5 percent slopes, eroded	Consociation	.24	4.79
Fly Creek / UT4	GvC2	328146	Greenville loam, 5 to 8 percent slopes, eroded	Consociation	.24	5.95
Fly Creek / UT4	Hb	328148	Hyde, Bayboro, and Muck soils	Undifferentiated group		334.40
Fly Creek / UT4	IrA	328149	Irvington loam, 0 to 2 percent slopes	Consociation	.32	4.27
Fly Creek / UT4	LaB	328158	Lakeland loamy fine sand, 0 to 5 percent slopes	Consociation	.15	271.63
Fly Creek / UT4	LaC	328159	Lakeland loamy fine sand, 5 to 8 percent slopes	Consociation	.15	130.10
Fly Creek / UT4	LaD	328160	Lakeland loamy fine sand, 8 to 12 percent slopes	Consociation	.15	197.85
Fly Creek / UT4	Lv	328165	Local alluvial land	Consociation	.20	105.92
Fly Creek / UT4	MgA	328170	Magnolia fine sandy loam, 0 to 2 percent slopes	Consociation	.24	85.40
Fly Creek / UT4	MgB	328171	Magnolia fine sandy loam, 2 to 5 percent slopes	Consociation	.24	9.80
Fly Creek / UT4	MgB2	328172	Magnolia fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.24	3.68
Fly Creek / UT4	MgC2	328173	Magnolia fine sandy loam, 5 to 8 percent slopes, eroded	Consociation	.24	13.63
Fly Creek / UT4	MrA	328175	Marlboro very fine sandy loam, 0 to 2 percent slopes	Consociation	.32	661.21
Fly Creek / UT4	MrB	328176	Marlboro very fine sandy loam, 2 to 5 percent slopes	Consociation	.32	154.78
Fly Creek / UT4	MrB2	328177	Marlboro very fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.32	19.67
Fly Creek / UT4	NoA	328179	Norfolk fine sandy loam, 0 to 2 percent slopes	Consociation	.28	19.08
Fly Creek / UT4	NoB	328180	Norfolk fine sandy loam, 2 to 5 percent slopes	Consociation	.28	61.64
Fly Creek / UT4	NoC	328182	Norfolk fine sandy loam, 5 to 8 percent slopes	Consociation	.24	1.67
Fly Creek / UT4	OrA	328184	Orangeburg fine sandy loam, 0 to 2 percent slopes	Consociation	.28	74.00

Fly Creek / UT4	OrB	328185	Orangeburg fine sandy loam, 2 to 5 percent slopes	Consociation	.28	135.20
Fly Creek / UT4	OrB2	328186	Orangeburg fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.28	21.17
Fly Creek / UT4	OrC	328187	Orangeburg fine sandy loam, 5 to 8 percent slopes	Consociation	.28	101.14
Fly Creek / UT4	OrD2	328188	Orangeburg fine sandy loam, 8 to 12 percent slopes, eroded	Consociation	.28	44.47
Fly Creek / UT4	RbA	328194	Red Bay fine sandy loam, 0 to 2 percent slopes	Consociation	.32	30.62
Fly Creek / UT4	RbB	328195	Red Bay fine sandy loam, 2 to 5 percent slopes	Consociation	.32	31.89
Fly Creek / UT4	Rr	328197	Robertsdale loam	Consociation	.32	11.99
Fly Creek / UT4	RuA	328198	Ruston fine sandy loam, 0 to 2 percent slopes	Consociation	.28	41.73
Fly Creek / UT4	RuB	328199	Ruston fine sandy loam, 2 to 5 percent slopes	Consociation	.28	127.84
Fly Creek / UT4	RuC	328201	Ruston fine sandy loam, 5 to 8 percent slopes	Consociation	.28	41.32
Fly Creek / UT4	RuC2	328202	Ruston fine sandy loam, 5 to 8 percent slopes, eroded	Consociation	.28	2.68
Fly Creek / UT4	RuD	328203	Ruston fine sandy loam, 8 to 12 percent slopes	Consociation	.28	5.49
Fly Creek / UT4	SbA	328205	Savannah very fine sandy loam, 0 to 2 percent slopes	Consociation	.37	38.29
Fly Creek / UT4	SuB2	328210	Sunsweet fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.28	6.36
Fly Creek / UT4	SuC2	328211	Sunsweet fine sandy loam, 5 to 8 percent slopes, eroded	Consociation	.28	78.33
Fly Creek / UT4	SuD2	328212	Sunsweet fine sandy loam, 8 to 17 percent slopes, eroded	Consociation	.28	65.38
Fly Creek / UT4	TfA	328215	Tifton very fine sandy loam, 0 to 2 percent slopes	Consociation	.37	111.72
Fly Creek / UT4	TfB	328216	Tifton very fine sandy loam, 2 to 5 percent slopes	Consociation	.37	39.63
Fly Creek / UT4	TfB2	328217	Tifton very fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.37	28.54
Fly Creek / UT4	TfC	328218	Tifton very fine sandy loam, 5 to 8 percent slopes	Consociation	.37	16.08
Fly Creek / UT4	TfC2	328219	Tifton very fine sandy loam, 5 to 8 percent slopes, eroded	Consociation	.37	9.34
Fly Creek / UT4	W	328220	Water	Consociation		96.80
Fly Creek / UT4	Wm	328224	Wet loamy alluvial land	Undifferentiated grou	.05	5.78
Jordan Brook / Yancey Branch	Bb	328102	Bibb and Mantachie soils, local alluvium	Undifferentiated grou	.37	56.59
Jordan Brook / Yancey Branch	BoC	328105	Bowie fine sandy loam, 5 to 8 percent slopes	Consociation	.20	23.40
Jordan Brook / Yancey Branch	BtB	328107	Bowie fine sandy loam, thin solum, 2 to 5 percent slopes	Consociation	.20	4.07
Jordan Brook / Yancey Branch	BwD	328110	Bowie, Lakeland, and Cuthbert soils, 8 to 12 percent slopes	Complex	.28	121.40
Jordan Brook / Yancey Branch	BwD2	328111	Bowie, Lakeland, and Cuthbert soils, 8 to 12 percent slopes, eroded	Complex	.28	7.17
Jordan Brook / Yancey Branch	BwF2	328112	Bowie, Lakeland, and Cuthbert soils, 12 to 25 percent slopes, eroded	Complex	.28	18.31
Jordan Brook / Yancey Branch	CgB	328115	Carnegie very fine sandy loam, 2 to 5 percent slopes	Consociation	.17	4.27
Jordan Brook / Yancey Branch	CgB2	328116	Carnegie very fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.17	36.59
Jordan Brook / Yancey Branch	CgC2	328118	Carnegie very fine sandy loam, 5 to 8 percent slopes, eroded	Consociation	.17	14.53
Jordan Brook / Yancey Branch	CgD2	328120	Carnegie very fine sandy loam, 8 to 12 percent slopes, eroded	Consociation	.17	20.86

Jordan Brook / Yancey Branch	Co	328121	Coastal beaches	Association	.02	54.79
Jordan Brook / Yancey Branch	CtE	328125	Cuthbert fine sandy loam, 12 to 17 percent slopes	Consociation	.28	34.40
Jordan Brook / Yancey Branch	EuB	328129	Eustis loamy fine sand, 0 to 5 percent slopes	Consociation	.10	312.95
Jordan Brook / Yancey Branch	EuC	328130	Eustis loamy fine sand, 5 to 8 percent slopes	Consociation	.10	124.22
Jordan Brook / Yancey Branch	EuD	328131	Eustis loamy fine sand, 8 to 12 percent slopes	Consociation	.10	7.98
Jordan Brook / Yancey Branch	FaA	328132	Faceville fine sandy loam, 0 to 2 percent slopes	Consociation	.24	2.02
Jordan Brook / Yancey Branch	FaB	328133	Faceville fine sandy loam, 2 to 5 percent slopes	Consociation	.24	62.61
Jordan Brook / Yancey Branch	FaC	328135	Faceville fine sandy loam, 5 to 8 percent slopes	Consociation	.24	24.44
Jordan Brook / Yancey Branch	GoC	328141	Goldsboro fine sandy loam, 5 to 8 percent slopes	Consociation	.24	5.21
Jordan Brook / Yancey Branch	Gr	328142	Grady soils	Undifferentiated gro	.24	5.24
Jordan Brook / Yancey Branch	GvB	328144	Greenville loam, 2 to 5 percent slopes	Consociation	.24	8.18
Jordan Brook / Yancey Branch	LaB	328158	Lakeland loamy fine sand, 0 to 5 percent slopes	Consociation	.15	239.19
Jordan Brook / Yancey Branch	LaC	328159	Lakeland loamy fine sand, 5 to 8 percent slopes	Consociation	.15	103.46
Jordan Brook / Yancey Branch	LaD	328160	Lakeland loamy fine sand, 8 to 12 percent slopes	Consociation	.15	35.29
Jordan Brook / Yancey Branch	Lv	328165	Local alluvial land	Consociation	.20	42.99
Jordan Brook / Yancey Branch	MgA	328170	Magnolia fine sandy loam, 0 to 2 percent slopes	Consociation	.24	4.82
Jordan Brook / Yancey Branch	MgB	328171	Magnolia fine sandy loam, 2 to 5 percent slopes	Consociation	.24	17.73
Jordan Brook / Yancey Branch	MgB2	328172	Magnolia fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.24	13.71
Jordan Brook / Yancey Branch	MgC2	328173	Magnolia fine sandy loam, 5 to 8 percent slopes, eroded	Consociation	.24	8.05
Jordan Brook / Yancey Branch	MrA	328175	Marlboro very fine sandy loam, 0 to 2 percent slopes	Consociation	.32	52.04
Jordan Brook / Yancey Branch	MrB	328176	Marlboro very fine sandy loam, 2 to 5 percent slopes	Consociation	.32	31.32
Jordan Brook / Yancey Branch	MrB2	328177	Marlboro very fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.32	35.50
Jordan Brook / Yancey Branch	NoA	328179	Norfolk fine sandy loam, 0 to 2 percent slopes	Consociation	.28	77.99
Jordan Brook / Yancey Branch	NoB	328180	Norfolk fine sandy loam, 2 to 5 percent slopes	Consociation	.28	103.96
Jordan Brook / Yancey Branch	NoC	328182	Norfolk fine sandy loam, 5 to 8 percent slopes	Consociation	.24	43.58
Jordan Brook / Yancey Branch	OrA	328184	Orangeburg fine sandy loam, 0 to 2 percent slopes	Consociation	.28	59.32
Jordan Brook / Yancey Branch	OrB	328185	Orangeburg fine sandy loam, 2 to 5 percent slopes	Consociation	.28	67.07
Jordan Brook / Yancey Branch	OrB2	328186	Orangeburg fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.28	13.22
Jordan Brook / Yancey Branch	OrC	328187	Orangeburg fine sandy loam, 5 to 8 percent slopes	Consociation	.28	41.33
Jordan Brook / Yancey Branch	OrD2	328188	Orangeburg fine sandy loam, 8 to 12 percent slopes, eroded	Consociation	.28	16.40
Jordan Brook / Yancey Branch	RbB	328195	Red Bay fine sandy loam, 2 to 5 percent slopes	Consociation	.32	22.37
Jordan Brook / Yancey Branch	RuA	328198	Ruston fine sandy loam, 0 to 2 percent slopes	Consociation	.28	1.10
Jordan Brook / Yancey Branch	RuB	328199	Ruston fine sandy loam, 2 to 5 percent slopes	Consociation	.28	199.83

Jordan Brook / Yancey Branch	RuB2	328200	Ruston fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.28	9.13
Jordan Brook / Yancey Branch	RuC	328201	Ruston fine sandy loam, 5 to 8 percent slopes	Consociation	.28	32.07
Jordan Brook / Yancey Branch	ScB	328207	Scranton loamy fine sand, 2 to 5 percent slopes	Consociation	.20	4.34
Jordan Brook / Yancey Branch	SuB2	328210	Sunsweet fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.28	4.36
Jordan Brook / Yancey Branch	SuC2	328211	Sunsweet fine sandy loam, 5 to 8 percent slopes, eroded	Consociation	.28	5.20
Jordan Brook / Yancey Branch	SuD2	328212	Sunsweet fine sandy loam, 8 to 17 percent slopes, eroded	Consociation	.28	19.25
Jordan Brook / Yancey Branch	Td	328214	Tidal marsh	Undifferentiated group		26.84
Jordan Brook / Yancey Branch	TfB	328216	Tifton very fine sandy loam, 2 to 5 percent slopes	Consociation	.37	8.59
Jordan Brook / Yancey Branch	TfC	328218	Tifton very fine sandy loam, 5 to 8 percent slopes	Consociation	.37	9.77
Jordan Brook / Yancey Branch	TfC2	328219	Tifton very fine sandy loam, 5 to 8 percent slopes, eroded	Consociation	.37	0.15
Jordan Brook / Yancey Branch	W	328220	Water	Consociation		5.18
Jordan Brook / Yancey Branch	Wm	328224	Wet loamy alluvial land	Undifferentiated grou	.05	124.53
Point Clear	Bb	328102	Bibb and Mantachie soils, local alluvium	Undifferentiated grou	.37	9.95
Point Clear	CgA	328114	Carnegie very fine sandy loam, 0 to 2 percent slopes	Consociation	.17	2.35
Point Clear	CgB	328115	Carnegie very fine sandy loam, 2 to 5 percent slopes	Consociation	.17	36.84
Point Clear	CgC	328117	Carnegie very fine sandy loam, 5 to 8 percent slopes	Consociation	.17	18.61
Point Clear	CgD	328119	Carnegie very fine sandy loam, 8 to 12 percent slopes	Consociation	.17	4.29
Point Clear	Co	328121	Coastal beaches	Association	.02	21.39
Point Clear	EuB	328129	Eustis loamy fine sand, 0 to 5 percent slopes	Consociation	.10	43.66
Point Clear	EuC	328130	Eustis loamy fine sand, 5 to 8 percent slopes	Consociation	.10	127.34
Point Clear	EuD	328131	Eustis loamy fine sand, 8 to 12 percent slopes	Consociation	.10	26.70
Point Clear	FaA	328132	Faceville fine sandy loam, 0 to 2 percent slopes	Consociation	.24	7.68
Point Clear	FaB	328133	Faceville fine sandy loam, 2 to 5 percent slopes	Consociation	.24	76.54
Point Clear	FaB2	328134	Faceville fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.24	52.57
Point Clear	FaC	328135	Faceville fine sandy loam, 5 to 8 percent slopes	Consociation	.24	41.04
Point Clear	FaC2	328136	Faceville fine sandy loam, 5 to 8 percent slopes, eroded	Consociation	.24	43.90
Point Clear	GoA	328139	Goldsboro fine sandy loam, 0 to 2 percent slopes	Consociation	.24	53.21
Point Clear	Gr	328142	Grady soils	Undifferentiated grou	.24	23.18
Point Clear	Hb	328148	Hyde, Bayboro, and Muck soils	Undifferentiated group		131.01
Point Clear	IrA	328149	Irvington loam, 0 to 2 percent slopes	Consociation	.32	33.27
Point Clear	IrB	328150	Irvington loam, 2 to 5 percent slopes	Consociation	.32	0.35
Point Clear	KlB	328156	Klej loamy fine sand, 0 to 5 percent slopes	Consociation	.15	109.35
Point Clear	LaB	328158	Lakeland loamy fine sand, 0 to 5 percent slopes	Consociation	.15	516.19
Point Clear	LaC	328159	Lakeland loamy fine sand, 5 to 8 percent slopes	Consociation	.15	38.08
Point Clear	LaD	328160	Lakeland loamy fine sand, 8 to 12 percent slopes	Consociation	.15	4.61
Point Clear	Ls	328164	Leon sand	Complex		355.72
Point Clear	Lv	328165	Local alluvial land	Consociation	.20	108.48

Point Clear	LyA	328166	Lynchburg fine sandy loam, 0 to 2 percent slopes	Consociation	.28	197.06
Point Clear	MgB	328171	Magnolia fine sandy loam, 2 to 5 percent slopes	Consociation	.24	12.74
Point Clear	MrA	328175	Marlboro very fine sandy loam, 0 to 2 percent slopes	Consociation	.32	388.51
Point Clear	MrB	328176	Marlboro very fine sandy loam, 2 to 5 percent slopes	Consociation	.32	10.22
Point Clear	NoA	328179	Norfolk fine sandy loam, 0 to 2 percent slopes	Consociation	.28	7.24
Point Clear	NoB	328180	Norfolk fine sandy loam, 2 to 5 percent slopes	Consociation	.28	4.59
Point Clear	OrA	328184	Orangeburg fine sandy loam, 0 to 2 percent slopes	Consociation	.28	20.66
Point Clear	OrB2	328186	Orangeburg fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.28	9.49
Point Clear	OrC	328187	Orangeburg fine sandy loam, 5 to 8 percent slopes	Consociation	.28	25.14
Point Clear	PmB	328189	Plummer loamy sand, 0 to 5 percent slopes	Consociation	.10	277.05
Point Clear	Pt	1412598	Pits, sand or gravel	Consociation		5.60
Point Clear	RaA	328191	Rains fine sandy loam, 0 to 2 percent slopes	Consociation	.28	56.01
Point Clear	RuA	328198	Ruston fine sandy loam, 0 to 2 percent slopes	Consociation	.28	4.25
Point Clear	RuB	328199	Ruston fine sandy loam, 2 to 5 percent slopes	Consociation	.28	119.30
Point Clear	RuC	328201	Ruston fine sandy loam, 5 to 8 percent slopes	Consociation	.28	88.49
Point Clear	RuD	328203	Ruston fine sandy loam, 8 to 12 percent slopes	Consociation	.28	22.67
Point Clear	SbA	328205	Savannah very fine sandy loam, 0 to 2 percent slopes	Consociation	.37	1.40
Point Clear	SuC2	328211	Sunsweet fine sandy loam, 5 to 8 percent slopes, eroded	Consociation	.28	40.53
Point Clear	SuD2	328212	Sunsweet fine sandy loam, 8 to 17 percent slopes, eroded	Consociation	.28	6.87
Point Clear	TfA	328215	Tifton very fine sandy loam, 0 to 2 percent slopes	Consociation	.37	156.76
Point Clear	TfB	328216	Tifton very fine sandy loam, 2 to 5 percent slopes	Consociation	.37	15.67
Point Clear	W	328220	Water	Consociation		23.18
Rock Creek / UT1-UT3	Bb	328102	Bibb and Mantachie soils, local alluvium	Undifferentiated gro	.37	1.76
Rock Creek / UT1-UT3	BwD	328110	Bowie, Lakeland, and Cuthbert soils, 8 to 12 percent slopes	Complex	.28	308.52
Rock Creek / UT1-UT3	BwD2	328111	Bowie, Lakeland, and Cuthbert soils, 8 to 12 percent slopes, eroded	Complex	.28	157.27
Rock Creek / UT1-UT3	BwF2	328112	Bowie, Lakeland, and Cuthbert soils, 12 to 25 percent slopes, eroded	Complex	.28	54.96
Rock Creek / UT1-UT3	CgA	328114	Carnegie very fine sandy loam, 0 to 2 percent slopes	Consociation	.17	12.95
Rock Creek / UT1-UT3	CgB	328115	Carnegie very fine sandy loam, 2 to 5 percent slopes	Consociation	.17	1.50
Rock Creek / UT1-UT3	CgB2	328116	Carnegie very fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.17	19.25
Rock Creek / UT1-UT3	CgC	328117	Carnegie very fine sandy loam, 5 to 8 percent slopes	Consociation	.17	19.04
Rock Creek / UT1-UT3	CgC2	328118	Carnegie very fine sandy loam, 5 to 8 percent slopes, eroded	Consociation	.17	17.62
Rock Creek / UT1-UT3	CgD	328119	Carnegie very fine sandy loam, 8 to 12 percent slopes	Consociation	.17	42.89
Rock Creek / UT1-UT3	CgD2	328120	Carnegie very fine sandy loam, 8 to 12 percent slopes, eroded	Consociation	.17	6.69

Rock Creek / UT1-UT3	Co	328121	Coastal beaches	Association	.02	44.98
Rock Creek / UT1-UT3	CuE2	328128	Cuthbert, Bowie, and Sunsweet soils, 12 to 17 percent slopes, eroded	Complex	.20	6.80
Rock Creek / UT1-UT3	EuB	328129	Eustis loamy fine sand, 0 to 5 percent slopes	Consociation	.10	235.50
Rock Creek / UT1-UT3	EuC	328130	Eustis loamy fine sand, 5 to 8 percent slopes	Consociation	.10	200.03
Rock Creek / UT1-UT3	EuD	328131	Eustis loamy fine sand, 8 to 12 percent slopes	Consociation	.10	30.93
Rock Creek / UT1-UT3	FaA	328132	Faceville fine sandy loam, 0 to 2 percent slopes	Consociation	.24	133.79
Rock Creek / UT1-UT3	FaB	328133	Faceville fine sandy loam, 2 to 5 percent slopes	Consociation	.24	132.35
Rock Creek / UT1-UT3	FaB2	328134	Faceville fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.24	4.80
Rock Creek / UT1-UT3	Gr	328142	Grady soils	Undifferentiated grou	.24	45.36
Rock Creek / UT1-UT3	GvA	328143	Greenville loam, 0 to 2 percent slopes	Consociation	.24	313.11
Rock Creek / UT1-UT3	GvB	328144	Greenville loam, 2 to 5 percent slopes	Consociation	.24	26.01
Rock Creek / UT1-UT3	GvB2	328145	Greenville loam, 2 to 5 percent slopes, eroded	Consociation	.24	3.83
Rock Creek / UT1-UT3	GvC2	328146	Greenville loam, 5 to 8 percent slopes, eroded	Consociation	.24	27.50
Rock Creek / UT1-UT3	Hb	328148	Hyde, Bayboro, and Muck soils	Undifferentiated group		186.85
Rock Creek / UT1-UT3	IrA	328149	Irvington loam, 0 to 2 percent slopes	Consociation	.32	12.71
Rock Creek / UT1-UT3	LaB	328158	Lakeland loamy fine sand, 0 to 5 percent slopes	Consociation	.15	304.05
Rock Creek / UT1-UT3	LaC	328159	Lakeland loamy fine sand, 5 to 8 percent slopes	Consociation	.15	96.17
Rock Creek / UT1-UT3	Lv	328165	Local alluvial land	Consociation	.20	40.97
Rock Creek / UT1-UT3	MgA	328170	Magnolia fine sandy loam, 0 to 2 percent slopes	Consociation	.24	1.32
Rock Creek / UT1-UT3	MgB	328171	Magnolia fine sandy loam, 2 to 5 percent slopes	Consociation	.24	7.89
Rock Creek / UT1-UT3	MgC2	328173	Magnolia fine sandy loam, 5 to 8 percent slopes, eroded	Consociation	.24	21.02
Rock Creek / UT1-UT3	MrA	328175	Marlboro very fine sandy loam, 0 to 2 percent slopes	Consociation	.32	436.22
Rock Creek / UT1-UT3	MrB	328176	Marlboro very fine sandy loam, 2 to 5 percent slopes	Consociation	.32	93.84
Rock Creek / UT1-UT3	MrB2	328177	Marlboro very fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.32	10.14
Rock Creek / UT1-UT3	NoA	328179	Norfolk fine sandy loam, 0 to 2 percent slopes	Consociation	.28	85.96
Rock Creek / UT1-UT3	NoB	328180	Norfolk fine sandy loam, 2 to 5 percent slopes	Consociation	.28	35.98
Rock Creek / UT1-UT3	NoC	328182	Norfolk fine sandy loam, 5 to 8 percent slopes	Consociation	.24	11.44
Rock Creek / UT1-UT3	OrA	328184	Orangeburg fine sandy loam, 0 to 2 percent slopes	Consociation	.28	13.39
Rock Creek / UT1-UT3	OrB	328185	Orangeburg fine sandy loam, 2 to 5 percent slopes	Consociation	.28	35.54
Rock Creek / UT1-UT3	OrC	328187	Orangeburg fine sandy loam, 5 to 8 percent slopes	Consociation	.28	48.35
Rock Creek / UT1-UT3	OrD2	328188	Orangeburg fine sandy loam, 8 to 12 percent slopes, eroded	Consociation	.28	83.49
Rock Creek / UT1-UT3	RaA	328191	Rains fine sandy loam, 0 to 2 percent slopes	Consociation	.28	8.10
Rock Creek / UT1-UT3	RbA	328194	Red Bay fine sandy loam, 0 to 2 percent slopes	Consociation	.32	315.99
Rock Creek / UT1-UT3	RbB	328195	Red Bay fine sandy loam, 2 to 5 percent slopes	Consociation	.32	73.32
Rock Creek / UT1-UT3	Rr	328197	Robertsdale loam	Consociation	.32	2.28

Rock Creek / UT1-UT3	RuB	328199	Ruston fine sandy loam, 2 to 5 percent slopes	Consociation	.28	132.04
Rock Creek / UT1-UT3	RuB2	328200	Ruston fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.28	7.99
Rock Creek / UT1-UT3	RuC	328201	Ruston fine sandy loam, 5 to 8 percent slopes	Consociation	.28	15.34
Rock Creek / UT1-UT3	SbA	328205	Savannah very fine sandy loam, 0 to 2 percent slopes	Consociation	.37	6.04
Rock Creek / UT1-UT3	SuC2	328211	Sunsweet fine sandy loam, 5 to 8 percent slopes, eroded	Consociation	.28	47.97
Rock Creek / UT1-UT3	SuD2	328212	Sunsweet fine sandy loam, 8 to 17 percent slopes, eroded	Consociation	.28	83.10
Rock Creek / UT1-UT3	TfA	328215	Tifton very fine sandy loam, 0 to 2 percent slopes	Consociation	.37	3.43
Rock Creek / UT1-UT3	TfB2	328217	Tifton very fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.37	2.25
Rock Creek / UT1-UT3	W	328220	Water	Consociation		3.60
Rock Creek / UT1-UT3	Wm	328224	Wet loamy alluvial land	Undifferentiated grou	.05	93.84
UT12	Bb	328102	Bibb and Mantachie soils, local alluvium	Undifferentiated grou	.37	4.69
UT12	CgB	328115	Carnegie very fine sandy loam, 2 to 5 percent slopes	Consociation	.17	28.83
UT12	CgB2	328116	Carnegie very fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.17	34.11
UT12	Co	328121	Coastal beaches	Association	.02	4.33
UT12	EuB	328129	Eustis loamy fine sand, 0 to 5 percent slopes	Consociation	.10	1.20
UT12	EuC	328130	Eustis loamy fine sand, 5 to 8 percent slopes	Consociation	.10	35.22
UT12	FaA	328132	Faceville fine sandy loam, 0 to 2 percent slopes	Consociation	.24	24.72
UT12	FaB	328133	Faceville fine sandy loam, 2 to 5 percent slopes	Consociation	.24	16.89
UT12	GoA	328139	Goldsboro fine sandy loam, 0 to 2 percent slopes	Consociation	.24	11.84
UT12	Gr	328142	Grady soils	Undifferentiated grou	.24	22.10
UT12	GvA	328143	Greenville loam, 0 to 2 percent slopes	Consociation	.24	37.75
UT12	GvB	328144	Greenville loam, 2 to 5 percent slopes	Consociation	.24	1.52
UT12	Hb	328148	Hyde, Bayboro, and Muck soils	Undifferentiated group		505.55
UT12	IrA	328149	Irvington loam, 0 to 2 percent slopes	Consociation	.32	8.55
UT12	KlB	328156	Klej loamy fine sand, 0 to 5 percent slopes	Consociation	.15	38.42
UT12	LaB	328158	Lakeland loamy fine sand, 0 to 5 percent slopes	Consociation	.15	10.67
UT12	LaC	328159	Lakeland loamy fine sand, 5 to 8 percent slopes	Consociation	.15	8.72
UT12	Lv	328165	Local alluvial land	Consociation	.20	4.07
UT12	LyA	328166	Lynchburg fine sandy loam, 0 to 2 percent slopes	Consociation	.28	9.35
UT12	MgA	328170	Magnolia fine sandy loam, 0 to 2 percent slopes	Consociation	.24	91.44
UT12	MrA	328175	Marlboro very fine sandy loam, 0 to 2 percent slopes	Consociation	.32	105.32
UT12	MrB	328176	Marlboro very fine sandy loam, 2 to 5 percent slopes	Consociation	.32	5.04
UT12	NoA	328179	Norfolk fine sandy loam, 0 to 2 percent slopes	Consociation	.28	12.90
UT12	NoB	328180	Norfolk fine sandy loam, 2 to 5 percent slopes	Consociation	.28	11.49
UT12	OrA	328184	Orangeburg fine sandy loam, 0 to 2 percent slopes	Consociation	.28	20.06
UT12	PmB	328189	Plummer loamy sand, 0 to 5 percent slopes	Consociation	.10	485.28
UT12	Pt	1412598	Pits, sand or gravel	Consociation		2.58

UT12	RaA	328191	Rains fine sandy loam, 0 to 2 percent slopes	Consociation	.28	465.26
UT12	RbB	328195	Red Bay fine sandy loam, 2 to 5 percent slopes	Consociation	.32	2.89
UT12	Rr	328197	Robertsdale loam	Consociation	.32	0.84
UT12	RuB	328199	Ruston fine sandy loam, 2 to 5 percent slopes	Consociation	.28	73.50
UT12	RuC	328201	Ruston fine sandy loam, 5 to 8 percent slopes	Consociation	.28	3.28
UT12	ScA	328206	Scranton loamy fine sand, 0 to 2 percent slopes	Complex	.20	14.61
UT12	SuB2	328210	Sunsweet fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.28	2.00
UT12	SuC2	328211	Sunsweet fine sandy loam, 5 to 8 percent slopes, eroded	Consociation	.28	6.18
UT12	Td	328214	Tidal marsh	Undifferentiated group		162.10
UT12	TfB	328216	Tifton very fine sandy loam, 2 to 5 percent slopes	Consociation	.37	1.24
UT12	TfB2	328217	Tifton very fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.37	26.24
UT12	W	328220	Water	Consociation		5.68
UT12	Wm	328224	Wet loamy alluvial land	Undifferentiated grou	.05	10.54
UT5 - UT6	BwF2	328112	Bowie, Lakeland, and Cuthbert soils, 12 to 25 percent slopes, eroded	Complex	.28	99.75
UT5 - UT6	CgB	328115	Carnegie very fine sandy loam, 2 to 5 percent slopes	Consociation	.17	1.76
UT5 - UT6	CgB2	328116	Carnegie very fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.17	110.37
UT5 - UT6	CgC2	328118	Carnegie very fine sandy loam, 5 to 8 percent slopes, eroded	Consociation	.17	33.07
UT5 - UT6	Co	328121	Coastal beaches	Association	.02	23.72
UT5 - UT6	EuB	328129	Eustis loamy fine sand, 0 to 5 percent slopes	Consociation	.10	48.25
UT5 - UT6	EuC	328130	Eustis loamy fine sand, 5 to 8 percent slopes	Consociation	.10	36.05
UT5 - UT6	EuD	328131	Eustis loamy fine sand, 8 to 12 percent slopes	Consociation	.10	46.64
UT5 - UT6	Gr	328142	Grady soils	Undifferentiated grou	.24	10.10
UT5 - UT6	IrA	328149	Irvington loam, 0 to 2 percent slopes	Consociation	.32	11.36
UT5 - UT6	LaB	328158	Lakeland loamy fine sand, 0 to 5 percent slopes	Consociation	.15	365.31
UT5 - UT6	LaC	328159	Lakeland loamy fine sand, 5 to 8 percent slopes	Consociation	.15	53.84
UT5 - UT6	LaD	328160	Lakeland loamy fine sand, 8 to 12 percent slopes	Consociation	.15	126.95
UT5 - UT6	Ls	328164	Leon sand	Complex		0.23
UT5 - UT6	Lv	328165	Local alluvial land	Consociation	.20	19.33
UT5 - UT6	LyA	328166	Lynchburg fine sandy loam, 0 to 2 percent slopes	Consociation	.28	3.96
UT5 - UT6	MrA	328175	Marlboro very fine sandy loam, 0 to 2 percent slopes	Consociation	.32	370.73
UT5 - UT6	MrB	328176	Marlboro very fine sandy loam, 2 to 5 percent slopes	Consociation	.32	22.50
UT5 - UT6	OrB	328185	Orangeburg fine sandy loam, 2 to 5 percent slopes	Consociation	.28	82.59
UT5 - UT6	OrC	328187	Orangeburg fine sandy loam, 5 to 8 percent slopes	Consociation	.28	17.01
UT5 - UT6	OrD2	328188	Orangeburg fine sandy loam, 8 to 12 percent slopes, eroded	Consociation	.28	6.64
UT5 - UT6	Pt	1412598	Pits, sand or gravel	Consociation		7.25
UT5 - UT6	Rr	328197	Robertsdale loam	Consociation	.32	1.73

UT5 - UT6	RuA	328198	Ruston fine sandy loam, 0 to 2 percent slopes	Consociation	.28	100.02
UT5 - UT6	RuB	328199	Ruston fine sandy loam, 2 to 5 percent slopes	Consociation	.28	24.79
UT5 - UT6	SuB2	328210	Sunsweet fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.28	11.28
UT5 - UT6	SuC2	328211	Sunsweet fine sandy loam, 5 to 8 percent slopes, eroded	Consociation	.28	72.32
UT5 - UT6	SuD2	328212	Sunsweet fine sandy loam, 8 to 17 percent slopes, eroded	Consociation	.28	22.36
UT5 - UT6	TfA	328215	Tifton very fine sandy loam, 0 to 2 percent slopes	Consociation	.37	76.55
UT5 - UT6	TfB	328216	Tifton very fine sandy loam, 2 to 5 percent slopes	Consociation	.37	10.79
UT5 - UT6	TfB2	328217	Tifton very fine sandy loam, 2 to 5 percent slopes, eroded	Consociation	.37	3.31
UT5 - UT6	W	328220	Water	Consociation		1.69
UT5 - UT6	Wm	328224	Wet loamy alluvial land	Undifferentiated gro	.05	8.53

SUBTOTAL ########

Map Unit Description

Baldwin County, Alabama

[Minor map unit components are excluded from this report]

Map unit: Bb - Bibb and Mantachie soils, local alluvium

Component: Bibb (40%)

The Bibb component makes up 40 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 9 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 5w. This soil meets hydric criteria.

Component: Mantachie (30%)

The Mantachie component makes up 30 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 15 inches during January, February, March, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 5w. This soil does not meet hydric criteria.

Map unit: BoB - Bowie fine sandy loam, 2 to 5 percent slopes

Component: Bowie, (Malbis) (85%)

The Bowie, (Malbis) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 40 inches during January, February, March, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: BoC - Bowie fine sandy loam, 5 to 8 percent slopes

Component: Bowie, (Malbis) (85%)

The Bowie, (Malbis) component makes up 85 percent of the map unit. Slopes are 5 to 8 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 40 inches during January, February, March, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: BtB - Bowie fine sandy loam, thin solum, 2 to 5 percent slopes

Component: Bowie, (Cowarts) (85%)

The Bowie, (Cowarts) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: BwD - Bowie, Lakeland, and Cuthbert soils, 8 to 12 percent slopes

Component: Bowie, (Cowarts) (30%)

The Bowie, (Cowarts) component makes up 30 percent of the map unit. Slopes are 8 to 12 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no

Map unit: BwD - Bowie, Lakeland, and Cuthbert soils, 8 to 12 percent slopes

Component: Bowie, (Cowarts) (30%)

zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Component: Cuthbert, (Esto) (30%)

The Cuthbert, (Esto) component makes up 30 percent of the map unit. Slopes are 8 to 12 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Component: Lakeland, (Troup) (30%)

The Lakeland, (Troup) component makes up 30 percent of the map unit. Slopes are 8 to 12 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately rapid. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Map unit: BwD2 - Bowie, Lakeland, and Cuthbert soils, 8 to 12 percent slopes, eroded

Component: Bowie, (Cowarts) (30%)

The Bowie, (Cowarts) component makes up 30 percent of the map unit. Slopes are 8 to 12 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Component: Cuthbert, (Esto) (30%)

The Cuthbert, (Esto) component makes up 30 percent of the map unit. Slopes are 8 to 12 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Component: Lakeland, (Troup) (30%)

The Lakeland, (Troup) component makes up 30 percent of the map unit. Slopes are 8 to 12 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately rapid. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Map unit: BwF2 - Bowie, Lakeland, and Cuthbert soils, 12 to 25 percent slopes, eroded

Component: Bowie, (Cowarts) (30%)

The Bowie, (Cowarts) component makes up 30 percent of the map unit. Slopes are 12 to 25 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map unit: BwF2 - Bowie, Lakeland, and Cuthbert soils, 12 to 25 percent slopes, eroded

Component: Cuthbert, (Esto) (30%)

The Cuthbert, (Esto) component makes up 30 percent of the map unit. Slopes are 12 to 25 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Component: Lakeland, (Troup) (30%)

The Lakeland, (Troup) component makes up 30 percent of the map unit. Slopes are 12 to 25 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately rapid. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Map unit: CgA - Carnegie very fine sandy loam, 0 to 2 percent slopes

Component: Carnegie, (Freemanville) (85%)

The Carnegie, (Freemanville) component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 1. This soil does not meet hydric criteria.

Map unit: CgB - Carnegie very fine sandy loam, 2 to 5 percent slopes

Component: Carnegie, (Freemanville) (85%)

The Carnegie, (Freemanville) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: CgB2 - Carnegie very fine sandy loam, 2 to 5 percent slopes, eroded

Component: Carnegie, (Freemanville) (85%)

The Carnegie, (Freemanville) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: CgC - Carnegie very fine sandy loam, 5 to 8 percent slopes

Component: Carnegie, (Freemanville) (85%)

The Carnegie, (Freemanville) component makes up 85 percent of the map unit. Slopes are 5 to 8 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: CgC2 - Carnegie very fine sandy loam, 5 to 8 percent slopes, eroded

Component: Carnegie, (Freemanville) (80%)

The Carnegie, (Freemanville) component makes up 80 percent of the map unit. Slopes are 5 to 8 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: CgD - Carnegie very fine sandy loam, 8 to 12 percent slopes

Component: Carnegie, (Freemanville) (80%)

The Carnegie, (Freemanville) component makes up 80 percent of the map unit. Slopes are 8 to 12 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map unit: CgD2 - Carnegie very fine sandy loam, 8 to 12 percent slopes, eroded

Component: Carnegie, (Freemanville) (80%)

The Carnegie, (Freemanville) component makes up 80 percent of the map unit. Slopes are 8 to 12 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map unit: Co - Coastal beaches

Component: Newhan (60%)

The Newhan component makes up 60 percent of the map unit. Slopes are 2 to 20 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is rarely flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. Nonirrigated land capability classification is 8s. This soil does not meet hydric criteria. The soil has a moderately saline horizon within 30 inches of the soil surface. The soil has a moderately sodic horizon within 30 inches of the soil surface.

Component: Beaches (30%)

Generated brief soil descriptions are created for major soil components. The Beaches is a miscellaneous area.

Map unit: CtD - Cuthbert fine sandy loam, 8 to 12 percent slopes

Component: Cuthbert, (Esto) (80%)

The Cuthbert, (Esto) component makes up 80 percent of the map unit. Slopes are 8 to 12 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map unit: CtE - Cuthbert fine sandy loam, 12 to 17 percent slopes

Component: Cuthbert, (Esto) (80%)

The Cuthbert, (Esto) component makes up 80 percent of the map unit. Slopes are 12 to 17 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map unit: CuE2 - Cuthbert, Bowie, and Sunsweet soils, 12 to 17 percent slopes, eroded

Component: Cuthbert, (Esto) (40%)

The Cuthbert, (Esto) component makes up 40 percent of the map unit. Slopes are 12 to 17 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Component: Bowie, (Cowarts) (30%)

The Bowie, (Cowarts) component makes up 30 percent of the map unit. Slopes are 12 to 17 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Component: Sunsweet (25%)

The Sunsweet component makes up 25 percent of the map unit. Slopes are 12 to 17 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is slow. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map unit: EuB - Eustis loamy fine sand, 0 to 5 percent slopes

Component: Eustis, (Troup) (85%)

The Eustis, (Troup) component makes up 85 percent of the map unit. Slopes are 0 to 5 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately rapid. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3s. This soil does not meet hydric criteria.

Map unit: EuC - Eustis loamy fine sand, 5 to 8 percent slopes

Component: Eustis, (Troup) (85%)

The Eustis, (Troup) component makes up 85 percent of the map unit. Slopes are 5 to 8 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately rapid. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4s. This soil does not meet hydric criteria.

Map unit: EuD - Eustis loamy fine sand, 8 to 12 percent slopes

Component: Eustis, (Troup) (80%)

The Eustis, (Troup) component makes up 80 percent of the map unit. Slopes are 8 to 12 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately rapid. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Map unit: FaA - Faceville fine sandy loam, 0 to 2 percent slopes

Component: Faceville, (Bama) (85%)

The Faceville, (Bama) component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 1. This soil does not meet hydric criteria.

Map unit: FaB - Faceville fine sandy loam, 2 to 5 percent slopes

Component: Faceville, (Bama) (85%)

The Faceville, (Bama) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: FaB2 - Faceville fine sandy loam, 2 to 5 percent slopes, eroded

Component: Faceville, (Bama) (85%)

The Faceville, (Bama) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: FaC - Faceville fine sandy loam, 5 to 8 percent slopes

Component: Faceville, (Bama) (85%)

The Faceville, (Bama) component makes up 85 percent of the map unit. Slopes are 5 to 8 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: FaC2 - Faceville fine sandy loam, 5 to 8 percent slopes, eroded

Component: Faceville, (Bama) (85%)

The Faceville, (Bama) component makes up 85 percent of the map unit. Slopes are 5 to 8 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land

Map unit: FaC2 - Faceville fine sandy loam, 5 to 8 percent slopes, eroded

Component: Faceville, (Bama) (85%)

capability classification is 3e. This soil does not meet hydric criteria.

Map unit: GoA - Goldsboro fine sandy loam, 0 to 2 percent slopes

Component: Goldsboro, (Poarch) (85%)

The Goldsboro, (Poarch) component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderate. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 45 inches during January, February, March, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 1. This soil does not meet hydric criteria.

Map unit: GoB - Goldsboro fine sandy loam, 2 to 5 percent slopes

Component: Goldsboro, (Poarch) (85%)

The Goldsboro, (Poarch) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderate. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 45 inches during January, February, March, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: GoC - Goldsboro fine sandy loam, 5 to 8 percent slopes

Component: Goldsboro, (Poarch) (80%)

The Goldsboro, (Poarch) component makes up 80 percent of the map unit. Slopes are 5 to 8 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderate. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 45 inches during January, February, March, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: Gr - Grady soils

Component: Grady (85%)

The Grady component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. This component is on depressions. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 5w. This soil meets hydric criteria.

Map unit: GvA - Greenville loam, 0 to 2 percent slopes

Component: Greenville, (Lucedale) (85%)

The Greenville, (Lucedale) component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 1. This soil does not meet hydric criteria.

Map unit: GvB - Greenville loam, 2 to 5 percent slopes

Component: Greenville, (Lucedale) (85%)

The Greenville, (Lucedale) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: GvB2 - Greenville loam, 2 to 5 percent slopes, eroded

Component: Greenville, (Lucedale) (85%)

The Greenville, (Lucedale) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: GvC2 - Greenville loam, 5 to 8 percent slopes, eroded

Component: Greenville, (Lucedale) (85%)

The Greenville, (Lucedale) component makes up 85 percent of the map unit. Slopes are 5 to 8 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: Hb - Hyde, Bayboro, and Muck soils

Component: Hyde, (Johnson) (40%)

The Hyde, (Johnson) component makes up 40 percent of the map unit. Slopes are 0 to 1 percent. This component is on flood plains. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderate. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 6 percent. Nonirrigated land capability classification is 7w. This soil meets hydric criteria.

Component: Bayboro, (Pamlico) (30%)

The Bayboro, (Pamlico) component makes up 30 percent of the map unit. Slopes are 0 to 1 percent. This component is on depressions. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is very high. Shrink-swell potential is low. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, July, August, September, October, November, December. Organic matter content in the surface horizon is about 50 percent. Nonirrigated land capability classification is 7w. This soil meets hydric criteria.

Component: Dorovan (30%)

The Dorovan component makes up 30 percent of the map unit. Slopes are 0 to 1 percent. This component is on depressions. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is very high. Shrink-swell potential is low. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, July, August, September, October, November, December. Organic matter content in the surface horizon is about 50 percent. Nonirrigated land capability classification is 7w. This soil meets hydric criteria.

Map unit: IrA - Irvington loam, 0 to 2 percent slopes

Component: Irvington (85%)

The Irvington component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer, fragipan, is 18 to 36 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 24 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Map unit: IrB - Irvington loam, 2 to 5 percent slopes

Component: Irvington (85%)

The Irvington component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer, fragipan, is 18 to 36 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 24 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: KlB - Klej loamy fine sand, 0 to 5 percent slopes

Component: Klej, (Pactolus) (85%)

The Klej, (Pactolus) component makes up 85 percent of the map unit. Slopes are 0 to 5 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately rapid. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 27 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3s. This soil does not meet hydric criteria.

Map unit: KlC - Klej loamy fine sand, 5 to 8 percent slopes

Component: Klej, (Pactolus) (80%)

The Klej, (Pactolus) component makes up 80 percent of the map unit. Slopes are 5 to 8 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately rapid. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 27 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3s. This soil does not meet hydric criteria.

Map unit: LaB - Lakeland loamy fine sand, 0 to 5 percent slopes

Component: Lakeland, (Alaga) (85%)

The Lakeland, (Alaga) component makes up 85 percent of the map unit. Slopes are 0 to 5 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately rapid. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3s. This soil does not meet hydric criteria.

Map unit: LaC - Lakeland loamy fine sand, 5 to 8 percent slopes

Component: Lakeland, (Alaga) (85%)

The Lakeland, (Alaga) component makes up 85 percent of the map unit. Slopes are 5 to 8 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately rapid. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent.

Map unit: LaC - Lakeland loamy fine sand, 5 to 8 percent slopes

Component: Lakeland, (Alaga) (85%)

Nonirrigated land capability classification is 4s. This soil does not meet hydric criteria.

Map unit: LaD - Lakeland loamy fine sand, 8 to 12 percent slopes

Component: Lakeland, (Alaga) (90%)

The Lakeland, (Alaga) component makes up 90 percent of the map unit. Slopes are 8 to 12 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately rapid. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Map unit: Ls - Leon sand

Component: Leon, (hydric) (45%)

The Leon, (hydric) component makes up 45 percent of the map unit. Slopes are 0 to 2 percent. This component is on depressions. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately rapid. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, July, August, September, December. Organic matter content in the surface horizon is about 50 percent. Nonirrigated land capability classification is 7w. This soil meets hydric criteria. Error

Component: Leon, (non-hydric) (45%)

The Leon, (non-hydric) component makes up 45 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 18 inches during January, February, March, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4w. This soil does not meet hydric criteria. Error

Map unit: Lv - Local alluvial land

Component: Iuka (90%)

The Iuka component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 24 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Map unit: LyA - Lynchburg fine sandy loam, 0 to 2 percent slopes

Component: Lynchburg, (Escambia) (85%)

The Lynchburg, (Escambia) component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderate. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 24 inches during January, February, March, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Map unit: LyB - Lynchburg fine sandy loam, 2 to 5 percent slopes

Component: Lynchburg, (Escambia) (85%)

The Lynchburg, (Escambia) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderate. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 24 inches during January, February, March, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: MgA - Magnolia fine sandy loam, 0 to 2 percent slopes

Component: Magnolia, (Bama) (90%)

The Magnolia, (Bama) component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 1. This soil does not meet hydric criteria.

Map unit: MgB - Magnolia fine sandy loam, 2 to 5 percent slopes

Component: Magnolia, (Bama) (85%)

The Magnolia, (Bama) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: MgB2 - Magnolia fine sandy loam, 2 to 5 percent slopes, eroded

Component: Magnolia, (Bama) (85%)

The Magnolia, (Bama) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: MgC2 - Magnolia fine sandy loam, 5 to 8 percent slopes, eroded

Component: Magnolia, (Bama) (90%)

The Magnolia, (Bama) component makes up 90 percent of the map unit. Slopes are 5 to 8 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: MrA - Marlboro very fine sandy loam, 0 to 2 percent slopes

Component: Marlboro, (Malbis) (90%)

The Marlboro, (Malbis) component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 36 inches during January, February, March, December. Organic matter content in the

Map unit: MrA - Marlboro very fine sandy loam, 0 to 2 percent slopes

Component: Marlboro, (Malbis) (90%)

surface horizon is about 1 percent. Nonirrigated land capability classification is 1. This soil does not meet hydric criteria.

Map unit: MrB - Marlboro very fine sandy loam, 2 to 5 percent slopes

Component: Marlboro, (Malbis) (85%)

The Marlboro, (Malbis) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 40 inches during January, February, March, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: MrB2 - Marlboro very fine sandy loam, 2 to 5 percent slopes, eroded

Component: Marlboro, (Malbis) (85%)

The Marlboro, (Malbis) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 40 inches during January, February, March, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: NoA - Norfolk fine sandy loam, 0 to 2 percent slopes

Component: Norfolk, (Benndale) (90%)

The Norfolk, (Benndale) component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2s. This soil does not meet hydric criteria.

Map unit: NoB - Norfolk fine sandy loam, 2 to 5 percent slopes

Component: Norfolk, (Benndale) (85%)

The Norfolk, (Benndale) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: NoC - Norfolk fine sandy loam, 5 to 8 percent slopes

Component: Norfolk, (Benndale) (90%)

The Norfolk, (Benndale) component makes up 90 percent of the map unit. Slopes are 5 to 8 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: OrA - Orangeburg fine sandy loam, 0 to 2 percent slopes

Component: Orangeburg, (Heidel) (90%)

The Orangeburg, (Heidel) component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2s. This soil does not meet hydric criteria.

Map unit: OrB - Orangeburg fine sandy loam, 2 to 5 percent slopes

Component: Orangeburg, (Heidel) (85%)

The Orangeburg, (Heidel) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: OrB2 - Orangeburg fine sandy loam, 2 to 5 percent slopes, eroded

Component: Orangeburg, (Heidel) (85%)

The Orangeburg, (Heidel) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: OrC - Orangeburg fine sandy loam, 5 to 8 percent slopes

Component: Orangeburg, (Heidel) (90%)

The Orangeburg, (Heidel) component makes up 90 percent of the map unit. Slopes are 5 to 8 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: OrD2 - Orangeburg fine sandy loam, 8 to 12 percent slopes, eroded

Component: Orangeburg, (Heidel) (90%)

The Orangeburg, (Heidel) component makes up 90 percent of the map unit. Slopes are 8 to 12 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map unit: PmB - Plummer loamy sand, 0 to 5 percent slopes

Component: Plummer (90%)

The Plummer component makes up 90 percent of the map unit. Slopes are 0 to 5 percent. This component is on marine terraces. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately rapid. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during January, February, March, April, May, June, July, December. Organic

Map unit: PmB - Plummer loamy sand, 0 to 5 percent slopes

Component: Plummer (90%)

matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4w. This soil meets hydric criteria.

Map unit: Pt - Pits, sand or gravel

Component: Pits, sand or gravel (95%)

Generated brief soil descriptions are created for major soil components. The Pits is a miscellaneous area.

Map unit: RaA - Rains fine sandy loam, 0 to 2 percent slopes

Component: Rains, (Atmore) (90%)

The Rains, (Atmore) component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. This component is on terraces. Depth to a root restrictive layer, plinthite, is 12 to 30 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, October, November, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4w. This soil meets hydric criteria.

Map unit: RaB - Rains fine sandy loam, 2 to 5 percent slopes

Component: Rains, (Atmore) (90%)

The Rains, (Atmore) component makes up 90 percent of the map unit. Slopes are 0 to 3 percent. This component is on terraces. Depth to a root restrictive layer, plinthite, is 12 to 30 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, October, November, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4w. This soil meets hydric criteria.

Map unit: RbA - Red Bay fine sandy loam, 0 to 2 percent slopes

Component: Red Bay, (Lucedale) (90%)

The Red Bay, (Lucedale) component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 1. This soil does not meet hydric criteria.

Map unit: RbB - Red Bay fine sandy loam, 2 to 5 percent slopes

Component: Red Bay, (Lucedale) (85%)

The Red Bay, (Lucedale) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: Rr - Robertsdale loam

Component: Robertsdale (90%)

The Robertsdale component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 21 inches during January, February, March, April, May, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Map unit: RuA - Ruston fine sandy loam, 0 to 2 percent slopes

Component: Ruston, (Heidel) (90%)

The Ruston, (Heidel) component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2s. This soil does not meet hydric criteria.

Map unit: RuB - Ruston fine sandy loam, 2 to 5 percent slopes

Component: Ruston, (Heidel) (85%)

The Ruston, (Heidel) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: RuB2 - Ruston fine sandy loam, 2 to 5 percent slopes, eroded

Component: Ruston, (Heidel) (85%)

The Ruston, (Heidel) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: RuC - Ruston fine sandy loam, 5 to 8 percent slopes

Component: Ruston, (Heidel) (90%)

The Ruston, (Heidel) component makes up 90 percent of the map unit. Slopes are 5 to 8 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: RuC2 - Ruston fine sandy loam, 5 to 8 percent slopes, eroded

Component: Ruston, (Heidel) (90%)

The Ruston, (Heidel) component makes up 90 percent of the map unit. Slopes are 5 to 8 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land

Map unit: RuC2 - Ruston fine sandy loam, 5 to 8 percent slopes, eroded

Component: Ruston, (Heidel) (90%)

capability classification is 3e. This soil does not meet hydric criteria.

Map unit: RuD - Ruston fine sandy loam, 8 to 12 percent slopes

Component: Ruston, (Heidel) (90%)

The Ruston, (Heidel) component makes up 90 percent of the map unit. Slopes are 8 to 12 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map unit: SbA - Savannah very fine sandy loam, 0 to 2 percent slopes

Component: Savannah, (Saucier) (90%)

The Savannah, (Saucier) component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderate. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 36 inches during January, February, March. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Map unit: ScA - Scranton loamy fine sand, 0 to 2 percent slopes

Component: Scranton, (Stilson) (50%)

The Scranton, (Stilson) component makes up 50 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately rapid. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 33 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Component: Scranton, (Albany) (40%)

The Scranton, (Albany) component makes up 40 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderate. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 21 inches during January, February, March, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Map unit: ScB - Scranton loamy fine sand, 2 to 5 percent slopes

Component: Scranton, (Stilson) (90%)

The Scranton, (Stilson) component makes up 90 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately rapid. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 33 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Map unit: SuB2 - Sunsweet fine sandy loam, 2 to 5 percent slopes, eroded

Component: Sunsweet, (Esto) (90%)

The Sunsweet, (Esto) component makes up 90 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: SuC2 - Sunsweet fine sandy loam, 5 to 8 percent slopes, eroded

Component: Sunsweet, (Esto) (90%)

The Sunsweet, (Esto) component makes up 90 percent of the map unit. Slopes are 5 to 8 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map unit: SuD2 - Sunsweet fine sandy loam, 8 to 17 percent slopes, eroded

Component: Sunsweet, (Esto) (90%)

The Sunsweet, (Esto) component makes up 90 percent of the map unit. Slopes are 8 to 17 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map unit: Td - Tidal marsh

Component: LaFitte, (brackish marsh) (70%)

The LaFitte, (brackish marsh) component makes up 70 percent of the map unit. Slopes are 0 to 1 percent. This component is on tidal flats. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Available water to a depth of 60 inches is very high. Shrink-swell potential is low. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, July, August, September, October, November, December. Organic matter content in the surface horizon is about 40 percent. Nonirrigated land capability classification is 8w. This soil meets hydric criteria. The soil has a slightly saline horizon within 30 inches of the soil surface. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Component: Axis, (salt marsh) (20%)

The Axis, (salt marsh) component makes up 20 percent of the map unit. Slopes are 0 to 1 percent. This component is on tidal flats. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, July, August, September, October, November, December. Organic matter content in the surface horizon is about 10 percent. Nonirrigated land capability classification is 7w. This soil meets hydric criteria. The soil has a slightly saline horizon within 30 inches of the soil surface.

Map unit: TfA - Tifton very fine sandy loam, 0 to 2 percent slopes

Component: Tifton, (Notcher) (90%)

The Tifton, (Notcher) component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not

Map unit: TfA - Tifton very fine sandy loam, 0 to 2 percent slopes

Component: Tifton, (Notcher) (90%)

ponded. A seasonal zone of water saturation is at 42 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 1. This soil does not meet hydric criteria.

Map unit: TfB - Tifton very fine sandy loam, 2 to 5 percent slopes

Component: Tifton, (Notcher) (85%)

The Tifton, (Notcher) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 42 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: TfB2 - Tifton very fine sandy loam, 2 to 5 percent slopes, eroded

Component: Tifton, (Notcher) (85%)

The Tifton, (Notcher) component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 42 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map unit: TfC - Tifton very fine sandy loam, 5 to 8 percent slopes

Component: Tifton, (Notcher) (90%)

The Tifton, (Notcher) component makes up 90 percent of the map unit. Slopes are 5 to 8 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 42 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: TfC2 - Tifton very fine sandy loam, 5 to 8 percent slopes, eroded

Component: Tifton, (Notcher) (90%)

The Tifton, (Notcher) component makes up 90 percent of the map unit. Slopes are 5 to 8 percent. Depth to a root restrictive layer, plinthite, is 18 to 30 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 42 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map unit: W - Water

Component: Water (95%)

Generated brief soil descriptions are created for major soil components. The Water is a miscellaneous area.

Map unit: Wm - Wet loamy alluvial land

Component: Johnston (45%)

The Johnston component makes up 45 percent of the map unit. Slopes are 0 to 1 percent. This component is on flood plains. Depth to a

Map unit: Wm - Wet loamy alluvial land

Component: Johnston (45%)

root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately rapid. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, July, August, September, October, November, December. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 7w. This soil meets hydric criteria.

Component: Pamlico (40%)

The Pamlico component makes up 40 percent of the map unit. Slopes are 0 to 1 percent. This component is on flood plains. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately slow. Available water to a depth of 60 inches is very high. Shrink-swell potential is low. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 0 inches during January, February, March, April, May, June, July, August, September, October, November, December. Organic matter content in the surface horizon is about 50 percent. Nonirrigated land capability classification is 7w. This soil meets hydric criteria.

Map Unit Description

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

The Map Unit Description (Brief, Generated) report displays a generated description of the major soils that occur in a map unit. Descriptions of non-soil (miscellaneous areas) and minor map unit components are not included. This description is generated from the underlying soil attribute data.

Additional information about the map units described in this report is available in other Soil Data Mart reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the Soil Data Mart reports define some of the properties included in the map unit descriptions.

K Factor, Whole Soil

Layer Option: Surface Layer
Aggregation Method: Dominant Condition
Tie-break Rule: Higher

Baldwin County, Alabama
Survey Area Version and Date: 4 - 12/19/2013

Map symbol	Map unit name	Rating	Map unit percent
Bb	Bibb and Mantachie soils, local alluvium	.37	40
BoB	Bowie fine sandy loam, 2 to 5 percent slopes	.20	85
BoC	Bowie fine sandy loam, 5 to 8 percent slopes	.20	85
BtB	Bowie fine sandy loam, thin solum, 2 to 5 percent slopes	.20	85
BwD	Bowie, Lakeland, and Cuthbert soils, 8 to 12 percent slopes	.28	30
BwD2	Bowie, Lakeland, and Cuthbert soils, 8 to 12 percent slopes, eroded	.28	30
BwF2	Bowie, Lakeland, and Cuthbert soils, 12 to 25 percent slopes, eroded	.28	30
CgA	Carnegie very fine sandy loam, 0 to 2 percent slopes	.17	85
CgB	Carnegie very fine sandy loam, 2 to 5 percent slopes	.17	85
CgB2	Carnegie very fine sandy loam, 2 to 5 percent slopes, eroded	.17	85
CgC	Carnegie very fine sandy loam, 5 to 8 percent slopes	.17	85
CgC2	Carnegie very fine sandy loam, 5 to 8 percent slopes, eroded	.17	80
CgD	Carnegie very fine sandy loam, 8 to 12 percent slopes	.17	80
CgD2	Carnegie very fine sandy loam, 8 to 12 percent slopes, eroded	.17	80
Co	Coastal beaches	.02	95
CtD	Cuthbert fine sandy loam, 8 to 12 percent slopes	.28	80
CtE	Cuthbert fine sandy loam, 12 to 17 percent slopes	.28	80
CuE2	Cuthbert, Bowie, and Sunsweet soils, 12 to 17 percent slopes, eroded	.20	55
EuB	Eustis loamy fine sand, 0 to 5 percent slopes	.10	85
EuC	Eustis loamy fine sand, 5 to 8 percent slopes	.10	85
EuD	Eustis loamy fine sand, 8 to 12 percent slopes	.10	80
FaA	Faceville fine sandy loam, 0 to 2 percent slopes	.24	90
FaB	Faceville fine sandy loam, 2 to 5 percent slopes	.24	90
FaB2	Faceville fine sandy loam, 2 to 5 percent slopes, eroded	.24	90
FaC	Faceville fine sandy loam, 5 to 8 percent slopes	.24	85
FaC2	Faceville fine sandy loam, 5 to 8 percent slopes, eroded	.24	85
GoA	Goldsboro fine sandy loam, 0 to 2 percent slopes	.24	90
GoB	Goldsboro fine sandy loam, 2 to 5 percent slopes	.24	90
GoC	Goldsboro fine sandy loam, 5 to 8 percent slopes	.24	80
Gr	Grady soils	.24	85
GvA	Greenville loam, 0 to 2 percent slopes	.24	90
GvB	Greenville loam, 2 to 5 percent slopes	.24	90
GvB2	Greenville loam, 2 to 5 percent slopes, eroded	.24	90
GvC2	Greenville loam, 5 to 8 percent slopes, eroded	.24	85
Hb	Hyde, Bayboro, and Muck soils		60
IrA	Irvington loam, 0 to 2 percent slopes	.32	85
IrB	Irvington loam, 2 to 5 percent slopes	.32	85
KlB	Klej loamy fine sand, 0 to 5 percent slopes	.15	85
KlC	Klej loamy fine sand, 5 to 8 percent slopes	.15	80

K Factor, Whole Soil

Layer Option: Surface Layer
Aggregation Method: Dominant Condition
Tie-break Rule: Higher

Baldwin County, Alabama
Survey Area Version and Date: 4 - 12/19/2013

Map symbol	Map unit name	Rating	Map unit percent
LaB	Lakeland loamy fine sand, 0 to 5 percent slopes	.15	85
LaC	Lakeland loamy fine sand, 5 to 8 percent slopes	.15	85
LaD	Lakeland loamy fine sand, 8 to 12 percent slopes	.15	90
Ls	Leon sand		50
Lv	Local alluvial land	.20	90
LyA	Lynchburg fine sandy loam, 0 to 2 percent slopes	.28	90
LyB	Lynchburg fine sandy loam, 2 to 5 percent slopes	.28	90
MgA	Magnolia fine sandy loam, 0 to 2 percent slopes	.24	95
MgB	Magnolia fine sandy loam, 2 to 5 percent slopes	.24	90
MgB2	Magnolia fine sandy loam, 2 to 5 percent slopes, eroded	.24	90
MgC2	Magnolia fine sandy loam, 5 to 8 percent slopes, eroded	.24	90
MrA	Marlboro very fine sandy loam, 0 to 2 percent slopes	.32	90
MrB	Marlboro very fine sandy loam, 2 to 5 percent slopes	.32	85
MrB2	Marlboro very fine sandy loam, 2 to 5 percent slopes, eroded	.32	85
NoA	Norfolk fine sandy loam, 0 to 2 percent slopes	.28	90
NoB	Norfolk fine sandy loam, 2 to 5 percent slopes	.28	85
NoC	Norfolk fine sandy loam, 5 to 8 percent slopes	.24	90
OrA	Orangeburg fine sandy loam, 0 to 2 percent slopes	.28	90
OrB	Orangeburg fine sandy loam, 2 to 5 percent slopes	.28	85
OrB2	Orangeburg fine sandy loam, 2 to 5 percent slopes, eroded	.28	85
OrC	Orangeburg fine sandy loam, 5 to 8 percent slopes	.28	90
OrD2	Orangeburg fine sandy loam, 8 to 12 percent slopes, eroded	.28	90
PmB	Plummer loamy sand, 0 to 5 percent slopes	.10	90
Pt	Pits, sand or gravel		
RaA	Rains fine sandy loam, 0 to 2 percent slopes	.28	90
RaB	Rains fine sandy loam, 2 to 5 percent slopes	.28	90
RbA	Red Bay fine sandy loam, 0 to 2 percent slopes	.32	90
RbB	Red Bay fine sandy loam, 2 to 5 percent slopes	.32	85
Rr	Robertsdale loam	.32	90
RuA	Ruston fine sandy loam, 0 to 2 percent slopes	.28	90
RuB	Ruston fine sandy loam, 2 to 5 percent slopes	.28	85
RuB2	Ruston fine sandy loam, 2 to 5 percent slopes, eroded	.28	85
RuC	Ruston fine sandy loam, 5 to 8 percent slopes	.28	90
RuC2	Ruston fine sandy loam, 5 to 8 percent slopes, eroded	.28	90
RuD	Ruston fine sandy loam, 8 to 12 percent slopes	.28	90
SbA	Savannah very fine sandy loam, 0 to 2 percent slopes	.37	90
ScA	Scranton loamy fine sand, 0 to 2 percent slopes	.20	90
ScB	Scranton loamy fine sand, 2 to 5 percent slopes	.20	90
SuB2	Sunsweet fine sandy loam, 2 to 5 percent slopes, eroded	.28	90

K Factor, Whole Soil

Layer Option: Surface Layer
Aggregation Method: Dominant Condition
Tie-break Rule: Higher

Baldwin County, Alabama
Survey Area Version and Date: 4 - 12/19/2013

Map symbol	Map unit name	Rating	Map unit percent
SuC2	Sunsweet fine sandy loam, 5 to 8 percent slopes, eroded	.28	90
SuD2	Sunsweet fine sandy loam, 8 to 17 percent slopes, eroded	.28	90
Td	Tidal marsh		70
TfA	Tifton very fine sandy loam, 0 to 2 percent slopes	.37	90
TfB	Tifton very fine sandy loam, 2 to 5 percent slopes	.37	85
TfB2	Tifton very fine sandy loam, 2 to 5 percent slopes, eroded	.37	85
TfC	Tifton very fine sandy loam, 5 to 8 percent slopes	.37	90
TfC2	Tifton very fine sandy loam, 5 to 8 percent slopes, eroded	.37	90
W	Water		
Wm	Wet loamy alluvial land	.05	45

K Factor, Whole Soil

Rating Options

Attribute Name: K Factor, Whole Soil

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

"Erosion factor Kw (whole soil)" indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Layer Option: Surface Layer

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value to represent the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. The components in the map unit name represent the major soils within a map unit delineation. Minor components make up the balance of the map unit. Great differences in soil properties can occur between map unit components and within short distances. Minor components may be very different from the major components. Such differences could significantly affect use and management of the map unit. Minor components may or may not be documented in the database. The results of aggregation do not reflect the presence or absence of limitations of the components which are not listed in the database. An on-site investigation is required to identify the location of individual map unit components.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be generated. Aggregation must be done because, on any soil map, map units are delineated but components are not.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Appendix C

SB107
Modification to Extra Territorial Jurisdictions

Baldwin County Planning Districts

Modification to Extra Territorial Jurisdictions

On January 28, 2021, Alabama Senate Bill 107 (SB107) was introduced by Senator Chris Elliott (R-Daphne) and passed by the Senate on April 20, 2021 as Act No. 2021-297. This legislation altered the jurisdictional control in the unincorporated areas of the Watershed, which account for 58% of the total area within the Eastern Shore Watershed as discussed in Chapter 3.7.

The legislation restricts a municipality's police jurisdiction from extending beyond 1.5 or 3 miles as existing on January 1, 2021; except to include property annexed into its corporate limits. Municipalities whose population increased from less than 6,000 to more than 6,000 per the 2010 and 2020 federal census respectively, may extend its police jurisdiction to 3 miles. It also provides for a municipality to reduce its police jurisdiction by half-mile increments to eliminate its police jurisdiction, or to cease to provide any service to its police jurisdiction outside its corporate limits.

The Act limits the planning jurisdiction of any municipal planning commission to land lying within its corporate limits, and all land lying within the police jurisdiction of the municipality on January 1, 2021. That is, limits or reduces the planning jurisdiction of a municipality from the previous 5 miles to 1.5 or 3 miles respectively as of that date (January 1, 2021); and allowes for municipalities to continue adoption and enforcement of ordinances regulating the construction of buildings within the area of their police jurisdiction and outside their corporate limits.

However, in any county where the county commission is enforcing ordinances and construction of buildings in the police jurisdiction, the municipality must discontinue enforcement no later than 24 months after receipt of written notice from the county commission informing that that body will enforce those ordinances. The county and municipal planning commissions may enter into a written agreement that provides for the municipal planning commission to enforce the development of subdivisions and levy all related fees within their planning jurisdiction. This agreement requires the adoption of an ordinance by the municipal body and a resolution by the county commission. If an agreement cannot be reached; or the county provides notice as described above, the municipal planning commission may not enforce nor levy charges or fees for subdivision regulation outside its corporate limits.

Additionally, beginning on January 1, 2023, the planning jurisdiction of any municipality is limited to 1.5 miles, although may be extended for up to 3 miles through local law enacted after January 1, 2023.

If any portion of a proposed subdivision is located within a municipal planning jurisdiction, the subdivision regulations of the municipal planning commission will apply to the proposed subdivision. All subdivision plans and maps for areas outside municipal corporate limits must be approved by the municipal planning commission (pursuant to Section 11-52-32) and certified by the county engineer.

How has this legislation affected regulation in Baldwin County and, more specifically in the Eastern Shore Watershed? Since the Act was signed into law, the City of Daphne and the City of Fairhope had made no changes to their planning and enforcement processes at the time of this writing (April 2023) and have been operating according to their existing agreements with the County (Instrument No. 1091984, dated 12/17/07 and Instrument No. 0000312, dated 07/29/1991, respectively). Other local municipalities with similar agreements include the municipalities of Spanish Fort, Loxley, Magnolia Springs, and Gulf Shores.

However, 90 days after the Act passed, the Baldwin County Planning Commission did send 24 month notices to the various municipalities in the County, that the County Commission intended to enforce all ordinances regulating the construction of buildings in unincorporated lands of the county per Section 2(b)(2)a of the Act. Thus, beginning July 26, 2023 the Baldwin County Commission will have jurisdiction in all non-incorporated areas of the County and all municipalities will be restricted to their corporate city limits. Per the County Deputy Planning and Zoning Director, the cities of Fairhope and Gulf Shores preemptively retracted their agreements on January 1, 2023, and are already only enforcing within their corporate limits.

The benefits of this action by the County provide citizens clarity of what regulations and regulating authority has jurisdiction when applying for permits. Any discrepancies in legal definitions for the various types of "subdivision" developments that caused for permits to be filled first with the municipality, and then with the county if they were not covered within the local regulations is eliminated. This primarily occurred with non-single-family residence developments such as mobile home parks and condos.

In summary, for Baldwin County and the Eastern Shore Watershed, planning and police jurisdictions still exist, however, the corporate limits are the defining line between municipal vs county authority for the regulation and enforcement of building permits, construction inspection, and building codes.

Baldwin County Planning District Changes

As noted in Section 3 of the report, the County divides unincorporated lands into Planning Districts (per Act No. 91-719) in order to regulate growth and zoning, and beginning July 26, 2023 will have complete regulating authority in all such unincorporated lands outside municipal corporate limits.
In 2022 and early 2023 (since Chapter 3 of the WMP was written), six County Planning Districts were voted on when registered voters petitioned to be under the planning and zoning authority of the Baldwin County Commission. These new districts were parsed from larger un-zoned districts where only some of the voters wished for zoning regulations and to be under the control of the County Commission. Accordingly, the Commission authorized elections on the proposed districts. Four of the six districts were approved by voters in 2022 and early 2023, bringing the total number of County Planning Districts to 37 (from 33 districts noted in Chapter 3 of the WMP).

As shown in Figure C-1, the four new Districts are: District 8 in the UT5-UT6 and Point Clear Subwatersheds (previously part of District 17), District 35 near Foley (previously part of District 34), District 37 in the Fly Creek Subwatershed (previously part of District 14 and 17), and District 39 just barely in a portion of the UT12 Subwatershed (previously part of District 14).

Once a new district is created, five registered voters from the district are appointed to form an Advisory Committee that works with County staff to examine current land uses, lot sizes, and other factors and recommend zoning designations for each parcel. The Planning Commission reviews these recommendations and makes its own recommendations to the Baldwin County Commission. The County Commission then makes a final determination based on the recommendations of both the Advisory Committee and the Planning Commission. During this time, the district is under a 180-day moratorium during which no non-single-family residential permits can be accepted or approved.

Districts 8 and 37 passed in February 2022 and have had the zoning process completed. District 39 passed in February of 2023 and is (as of the date of this report) under the 180-day moratorium until August 2023 when the zoning process is completed. If the County adopts a zoning map before that time, the moratorium will automatically end.

With these new Districts and zoning, the Watershed has approximately only 2,211 acres of un-zoned lands – or 9.89% of total lands. Bailey Creek/UT7-UT11 Subwatershed has 788 un-zoned acres, Point Clear Subwatershed has 309 un-zoned acres, and UT12 Subwatershed has a total of 1,114 un-zoned acres. Thus, the Eastern Shore Watershed is 90% zoned.

In term of jurisdictional control in the Watershed, updates to Figure 3.32 of the report with 2023 data are as follows: beginning in July 2023, the Eastern Shore Watershed is 43% in incorporated lands, 57% unincorporated and under jurisdictional control of the County; 47% of these lands are zoned and 10% un-zoned.

Baldwin County Planning and Zoning Information Pamphlets

The Baldwin County Planning and Zoning Department has produced two informative pamphlets: 1) Baldwin County Planning and Zoning: Steps to Coming Under the Planning and Zoning Jurisdiction of Baldwin County, and 2) Zoning FAQ's (copies included after Figure C-1). These documents are included to facilitate public awareness regarding these recent local regulatory changes.

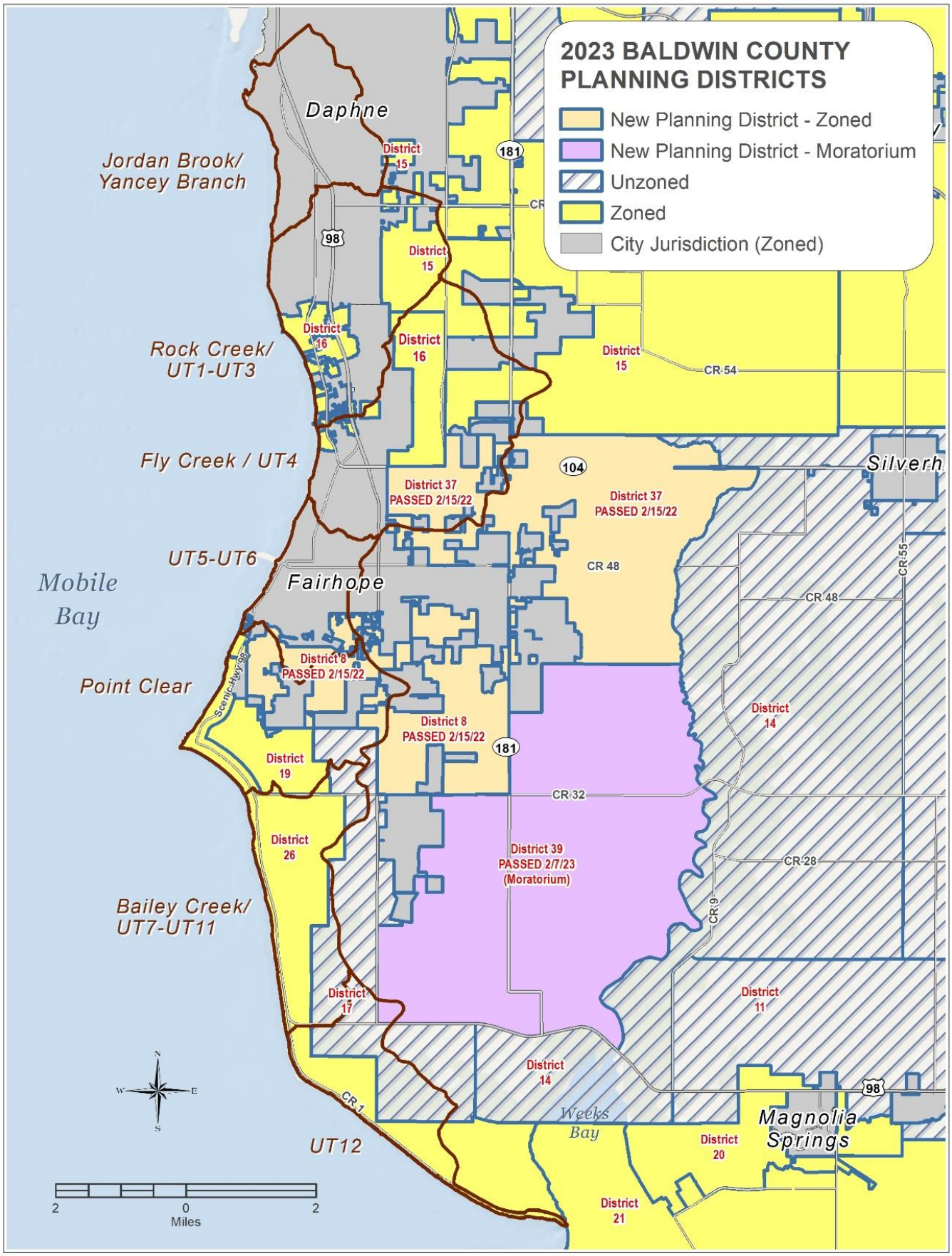
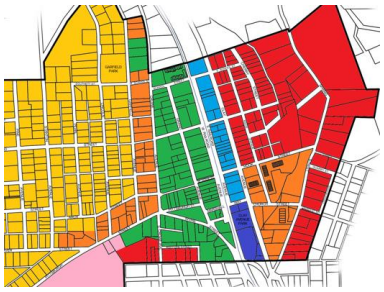


Figure C-1 2023 Planning Districts and City Jurisdictions



Baldwin County Planning & Zoning

Steps to Coming Under the Planning and Zoning Jurisdiction of Baldwin County

1. Citizen(s) sends a letter to the Baldwin County Commission expressing their desire to form a new zoning district and provides the proposed boundaries of the new district.
2. Planning and Zoning staff will review the proposal against the statutory requirements.
3. The Probate Judge will prepare a preliminary estimate of the number of registered voters in the proposed district.
4. Planning and Zoning staff will bring the citizen request to the County Commission for consideration at a regularly scheduled Commission meeting and the County Commission will consider the Citizen request and proposed boundary.
5. If accepted, Planning and Zoning staff will notify the Citizen(s) and provide petition forms for the collection of signatures.
6. The Citizen(s) will have 120 days to collect signatures from 10 percent of the registered voters in the newly proposed district.
7. The Probate Judge will have 45 days to certify or reject the accuracy of the petition.
    - If the number of signatures is not sufficient, the parties shall have another 60 days to complete the petition and have it certified.
    - If the petition is not certified, a petition for the proposed district may not be refiled for two years after the final denial of certification.
8. If the petition signatures are sufficient, the County Commission will instruct the Probate Judge to schedule an election within the district no later than 90 days after the signatures are approved.
9. Notice of the election will be published in the newspaper four times during the 30 days prior to the scheduled election.
10. Planning and Zoning staff will also mail a notice to all registered voters within the district. The notice will state the date of the election and the polling place(s). The judge of probate shall conduct the election.
11. If a simple majority of voters vote in the affirmative, then the district will become subject to the zoning and planning jurisdiction of the Baldwin County Commission.
12. The County Commission will appoint an advisory committee consisting of five registered voters from the district. The membership must reflect the diversity of the land use within the district as nearly as practical. Planning and Zoning staff will meet with the Advisory Committee to prepare a zoning map and draft text amendments to the ordinance for the new district.
13. The Advisory Committee will make a recommendation to the Planning Commission, which will make a recommendation to the County Commission. The County Commission will make the final approval decision.

BALDWIN COUNTY, ALABAMA

Questions? Send an Email to:
planning@baldwincountyal.gov

Alabama Code
Section 45-2-261.07

Procedure for exercising jurisdiction in each district.

The Baldwin County Commission shall not exercise its planning and zoning powers and jurisdiction in any district established hereunder until the majority of the qualified electors of the district voting in an election shall have voted their desire to come within the planning and zoning authority of the Baldwin County Commission. The election shall be held if 10 percent of the qualified electors in any district submit a written petition to the county commission expressing a desire to be subject to the planning and zoning jurisdiction of the Baldwin County Commission under authority of this subpart. For the purposes of the establishment of districts after June 1, 2010, a district shall correspond to a voting precinct or precincts in the county unless the county governing body determines that the use of voting precinct boundaries is not feasible. A party or parties seeking to file a petition shall notify the county governing body in writing that the parties will petition for the formation of a district and the proposed boundaries of the district. The judge of probate within 15 days shall give a preliminary estimate of the number of signatures needed to call the election. The county governing body shall notify the principal party in writing within 30 days of written notification by petitioners of intent to request a referendum, by United States mail, return receipt requested, that the proposed district is acceptable for planning, zoning, and voting purposes and shall furnish forms to the petitioner for use in seeking the number of signatures required to call an election. The parties shall have 120 days thereafter to obtain the necessary signatures and file the petition. The County Commission and the Judge of Probate of Baldwin County shall certify or reject the accuracy of the petition no later than 45 days after receiving the petition. If the number of signatures is not sufficient, the parties shall have another 60 days to complete the petition and have it certified. If the petition is not certified, a petition for the proposed district may not be refiled for two year after the final denial of certification. Upon certification, the county commission shall then instruct the Judge of Probate of Baldwin County to provide for an election within that district no later than 90 days after the certification. Notice of the election shall be published four times during the 30-day period immediately preceding the date of the election in a newspaper of general circulation in Baldwin County. In addition, the county commission shall notify by U.S. mail each elector in a district of the election and the process to obtain additional information. The notification shall state the date of the election and the polling place or places for voting. The judge of probate shall conduct the election. All costs for the notification and election shall be paid from the General Fund of Baldwin County. If a majority of the qualified electors in a district vote in the negative in the election, then the district shall not be subject to the zoning and planning jurisdiction of the Baldwin County Commission, and the qualified electors of the district shall not be eligible to petition for another election until two years from the date of the last election. If a majority of the qualified electors in a district vote in the affirmative, then the district shall be subject to the zoning and planning jurisdiction of the Baldwin County Commission.

(Act 91-719, p. 1389, §8; Act 98-665, p. 1455, §1; Act 2006-609, p. 1672, §1; Act 2010-719, p. 1782, §1.)

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Alabama Code
Section 45-2-261.08

Appointment of advisory committees.
In each district wherein the qualified electors vote to become subject to the planning and zoning authority of the Baldwin County Commission as provided in Section 45-2-261.07, the Baldwin County Commission shall appoint an advisory committee from that district to work with and assist the planning commission in formulating and developing regulations, ordinances, and zoning measures for the district. Each advisory committee shall consist of five members who shall be qualified electors of the district and who shall reflect as nearly as practical the diversity of land use in a district. The members of each district advisory committee shall elect a chair. Upon the adoption of zoning ordinances and regulations for the district by the Baldwin County Commission pursuant to the terms of this subpart, the services of the district advisory committee shall terminate and the committee shall be abolished. In any district which is contiguous to one or more municipalities, a member of the municipal planning commission of each contiguous municipality shall serve in an ex officio capacity on the advisory committee.

(Act 91-719, p. 1389, §9; Act 98-665, p. 1455, §1; Act 2006-609, p. 1672, §1.)

Zoning FAQs

Note: Each new zoned area customizes the regulations to match their community needs. Therefore, some of the information below may differ slightly by area.

1 What is the purpose of zoning?

Zoning is a tool that examines whether a proposed development (or use) is compatible with surrounding land uses, while also providing members of the community with an opportunity to provide input on proposed uses.

2 Will zoning affect my taxes?

No. In Baldwin County taxes are assessed on current use of the property regardless of whether the property is zoned or unzoned. For example, if a property is zoned commercial and is being used agriculturally the taxes will be assessed as agriculture property. A $10-per-parcel fee may be levied for a 2-year period after the vote.

3 If we adopt zoning, what will happen to my existing structures?

Any existing structures—homes, commercial buildings, accessory structures, etc., will all receive a "grandfathered" status. The new zoning ordinances will apply only to new development and changes/renovations to existing structures and uses. The "grandfathered" status of an existing use or structure will remain until a change occurs such as abandonment, severe damage, proposed expansion, etc.

4 If we adopt zoning, how will it impact me personally?

If you have an existing dwelling or business with no plans to expand the structure or change the use, you may not even realize you are zoned. But, if you are building a new structure such as a house, barn, or pool, or if you are adding to an existing structure, you would simply obtain a site plan approval from the Planning & Zoning Department before you apply for a building permit.

Zoning may also affect you if there is a rezoning application for your district. If so, you will be able to attend the public hearings at the Planning Commission and County Commission to voice your support or objection to that rezoning. If your community is not zoned you would not have the right to speak on new development coming to your area.

5 Once property is assigned a zoning designation, will it ever change?

Zoning may be modified over time in response to the changing conditions within a community—the community's needs, population, or policies—through zoning map amendments. Zoning is not a means for a community to remain static but can be used to preserve a community's character and the quality of life. All zoning map amendments (rezonings) follow an established procedure, which includes notice and advertisement of the proposed change and public hearings before both the Planning Commission and the Baldwin County Commission prior to any final decision on the rezoning request.

BALDWIN COUNTY, ALABAMA
Planning and Zoning Department

Zoning FAQ (continued)

6 Will my property be annexed into a city or town because I am zoned?

Annexation has nothing to do with zoning. Property can be annexed whether it is zoned or unzoned. Zoning will not cause or prevent annexation into a municipality.

7 Will zoning take away my property rights?

Zoning does make it more difficult to place an intense use (such as a land fill) near less intense uses (like residential homes). However, owners have a right to use their property whether that property is zoned or unzoned. Zoned property simply has uniform guidelines, such as setbacks or density that help protect the property owners and their neighbors from incompatible or inappropriate uses.

Some would argue that zoning gives new rights to property owners by making the development process open and public. Zoning gives the community the right to have a voice in how their community develops. The initial zoning map is created by a community-based Advisory Committee and is approved during a public hearing. Any proposed changes to the map go through a public hearing and the community is given time to speak about the proposed rezoning.

8 If zoning is approved, how will the County determine the new zoning designation for my previously unzoned property?

If the voters elect to come under the planning and zoning jurisdiction of Baldwin County, five registered voters from the district will then be appointed to form an Advisory Committee. The Advisory Committee will work with County staff to examine current uses, lot sizes, and similar factors. The Committee will then recommend zoning designations for each parcel based on this analysis.

The County Planning Commission will review the recommendation and make its own recommendation to the County Commission. The County Commission will make the final determination based on the recommendations of the Advisory Committee and the Planning Commission.

9 If there is a pending development application in the proposed new district, will voting for zoning stop that project?

If the voters elect to come under the planning and zoning jurisdiction of the County, a 180-day moratorium will be imposed on new structures and land uses in the new district. However, the moratorium does not apply to the following:

1. Applications properly submitted prior to the “Yes” vote for zoning;
2. Family divisions of land;
3. Subdivision of land by court order;
4. Building permits for single family homes or accessory structures.

If a complete application for a subdivision or development is received by the County prior to the zoning vote, and the application is properly advanced, the proposed subdivision or development will not be stopped or impacted by the new zoning.

Zoning FAQ (continued)

10 Can we customize zoning to match our community's needs?

Yes. Every zoned district has "local provisions" which allow the community to customize the rules to meet specific community needs (i.e. prohibiting landfills, etc).

11 What type of new applications & fees will come with zoning?

For zoning to help preserve a community's unique qualities, there must be a mechanism to review proposed changes in zoned areas. The planning and zoning department administers a site plan approval process to ensure the zoning ordinance is followed. These applications generally fall into three basic categories:

1. Administrative Site Plan Approval (for most residential projects - $25 fee)
2. Commission Site Plan Approval (for larger commercial projects - per sq. ft. fee)
3. Land Disturbance Permit (if soil added or removed - $25 fee per activity)

All application fees are listed on the Planning and Zoning website.

12 Can zoning be used to clean up my neighbor's trash-filled yard?

Most of the zoning districts prohibit the parking of "junked vehicles" or vehicles without a current license on residentially zoned property. If the Planning and Zoning Department receives a complaint about a junky yard, a code enforcement team member will determine whether the junked vehicle prohibition applies and then contact Baldwin County Solid Waste, the Health Department, and the Alabama Department of Environmental Management to determine whether the property may be in violation of these regulations.

Finally, if the property is being operated commercially as a scrap yard or junk yard, the code enforcement team member will evaluate to whether the property is properly zoned for that use.

13 How are zoning violations handled in a zoned area?

Due to the size of Baldwin County, as of the date of this publication, the Planning and Zoning code enforcement team only responds to individual complaints from citizens. Team members do not go out "looking for violations." The code enforcement team's objective is compliance and team members work with citizens to help achieve compliance.

If a citizen calls in a potential zoning complaint to the County, a code enforcement team member will review the complaint and determine whether a potential violation exists. If the property appears to be in violation, the code enforcement team member will mail a Notice of Violation (NOV) to the owner as listed on the tax records. The NOV will explain the steps that a citizen needs to take to bring their property into compliance and the potential fine that may result from lack of compliance within a certain timeframe. Again, the Planning and Zoning Department rarely collects fines as long as there is a good faith effort to bring a property into compliance.

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Appendix D

Riparian Buffer Conditions for Eastern Shore Subwatersheds

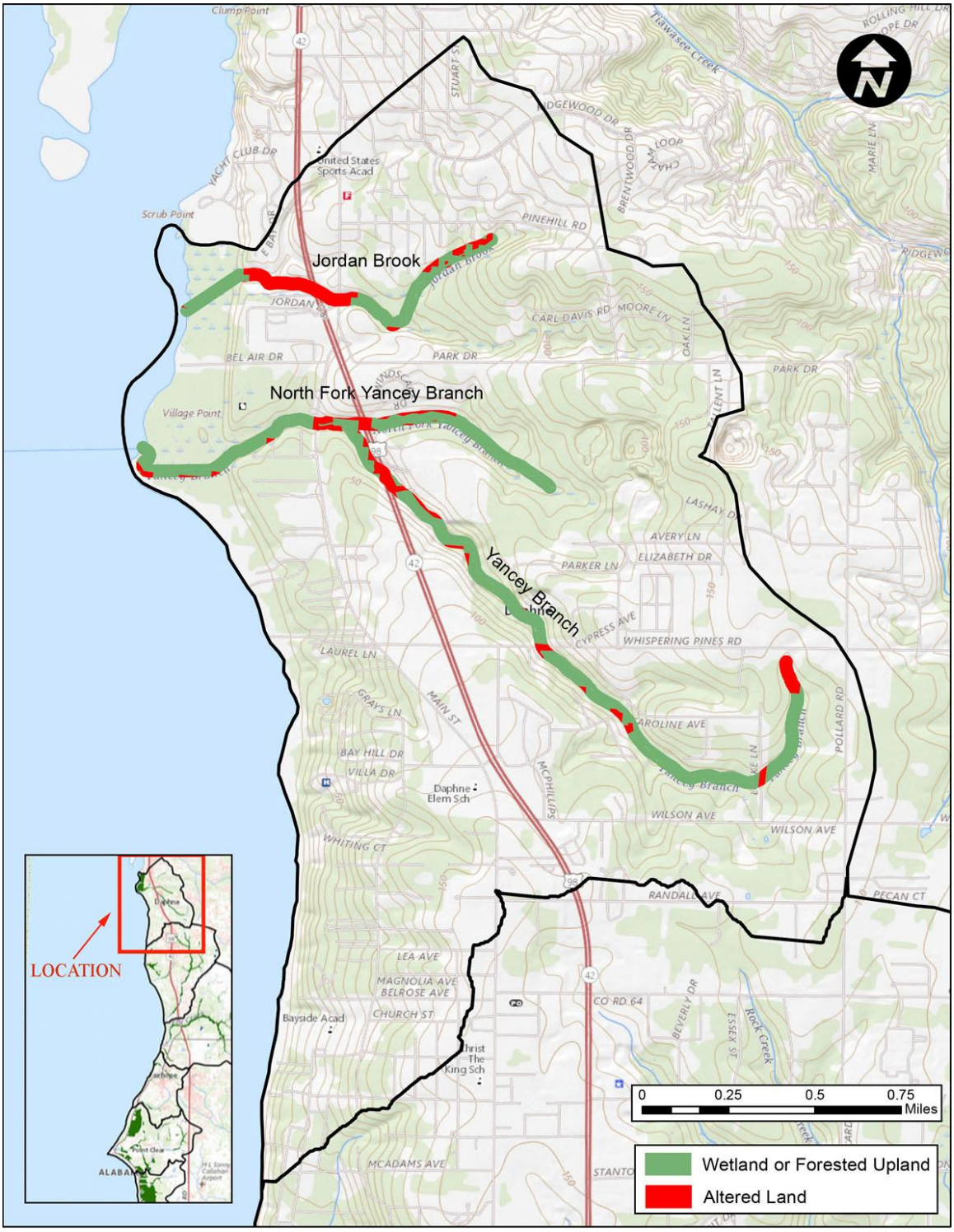


Figure D.1 100-ft-wide riparian corridors in the Jordan Brook-Yancey Branch subwatershed.

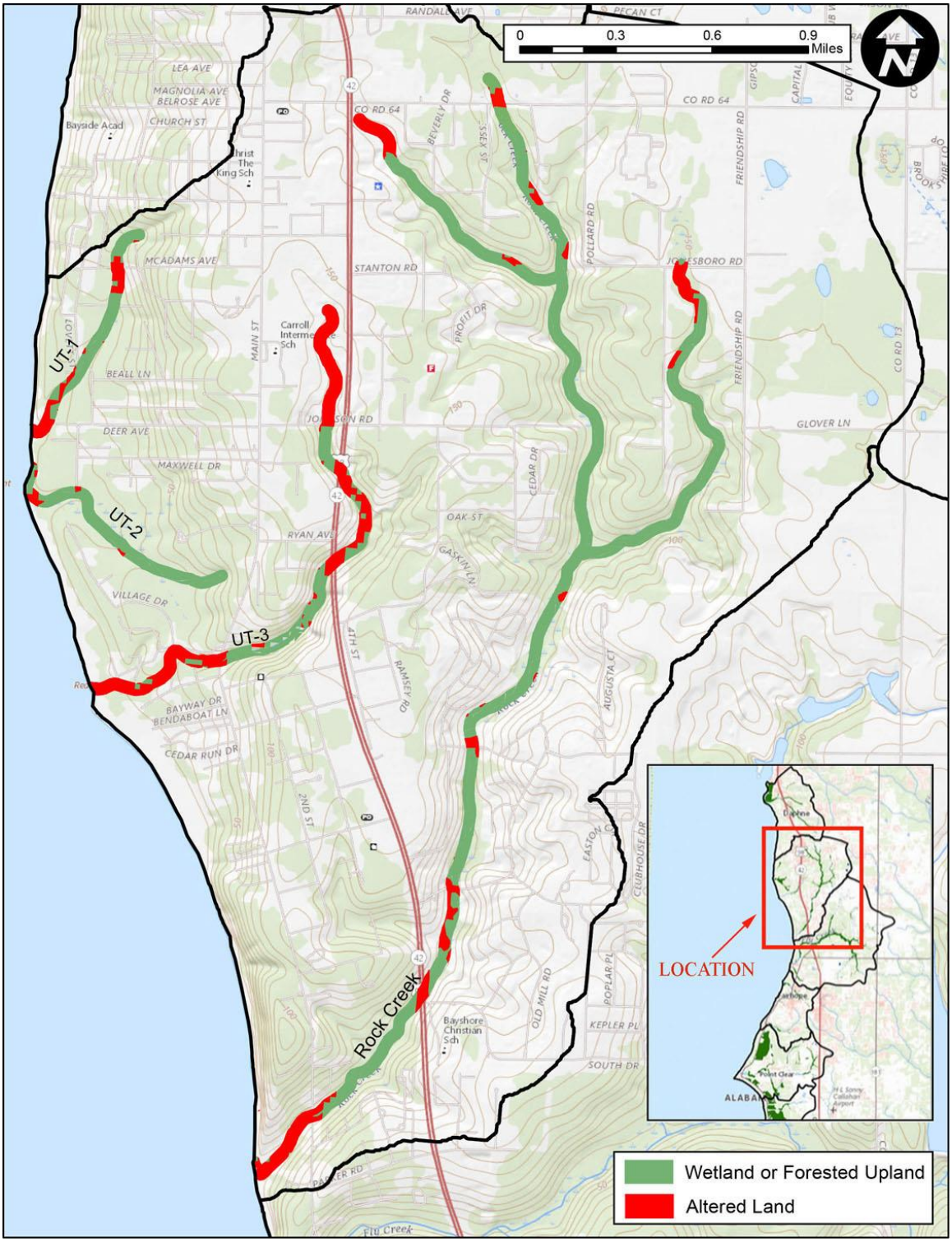


Figure D.2 100-ft-wide riparian corridors in the Rock Creek-UT1-UT2-UT3 subwatershed.

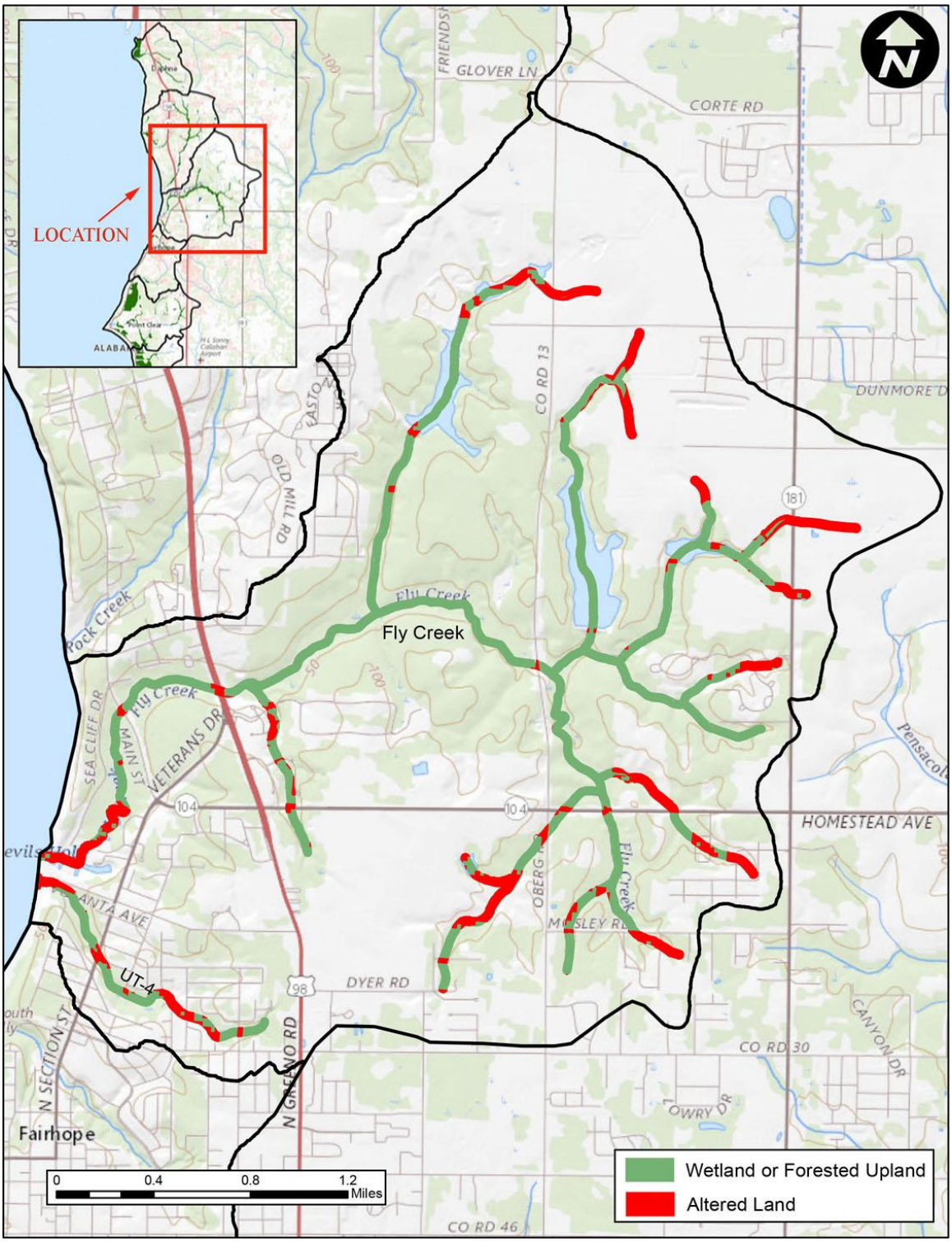


Figure D.3 100-ft-wide riparian corridors in the Fly Creek-UT4 subwatershed.

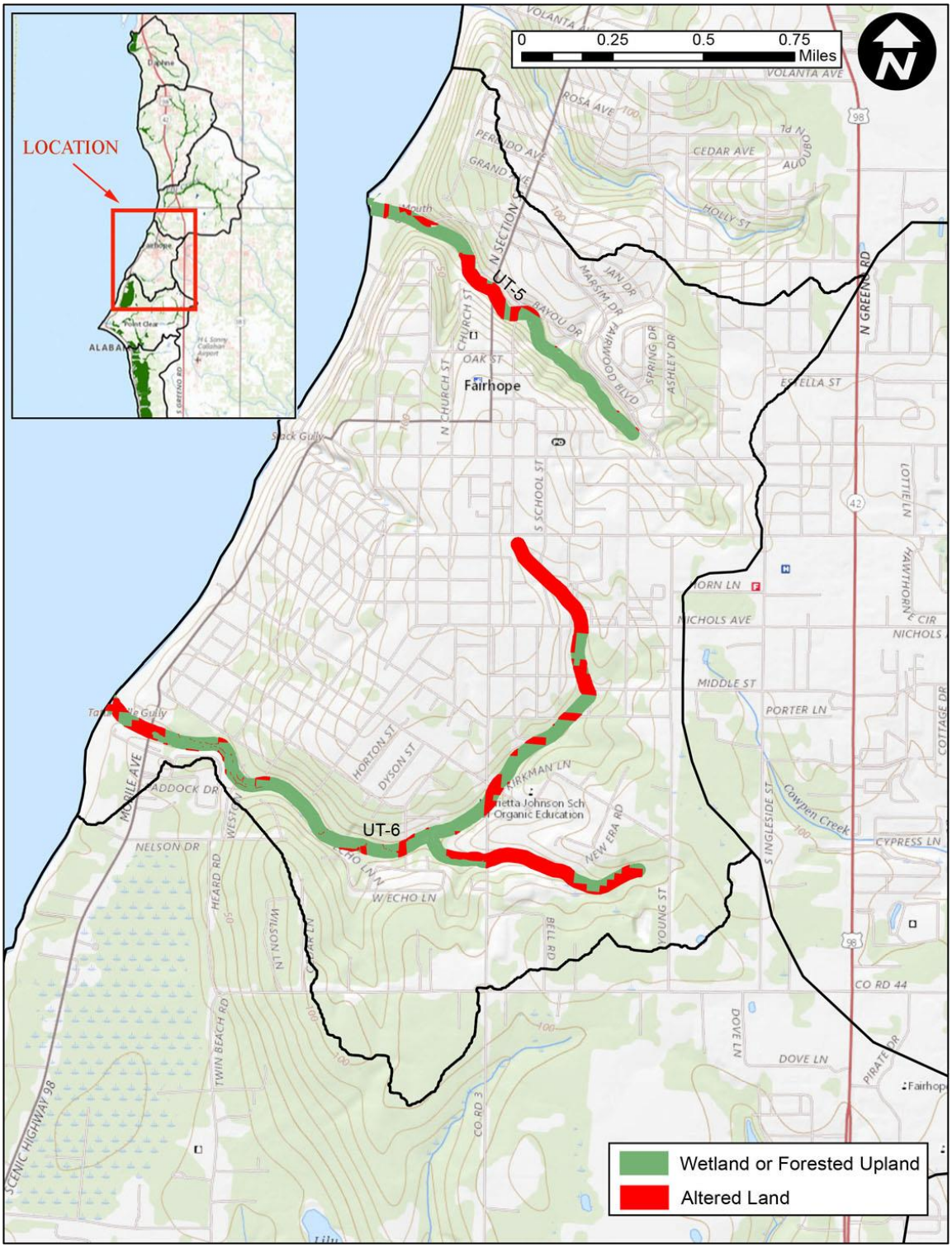


Figure D.4 100-ft-wide riparian corridors in the UT5-UT6 subwatershed.

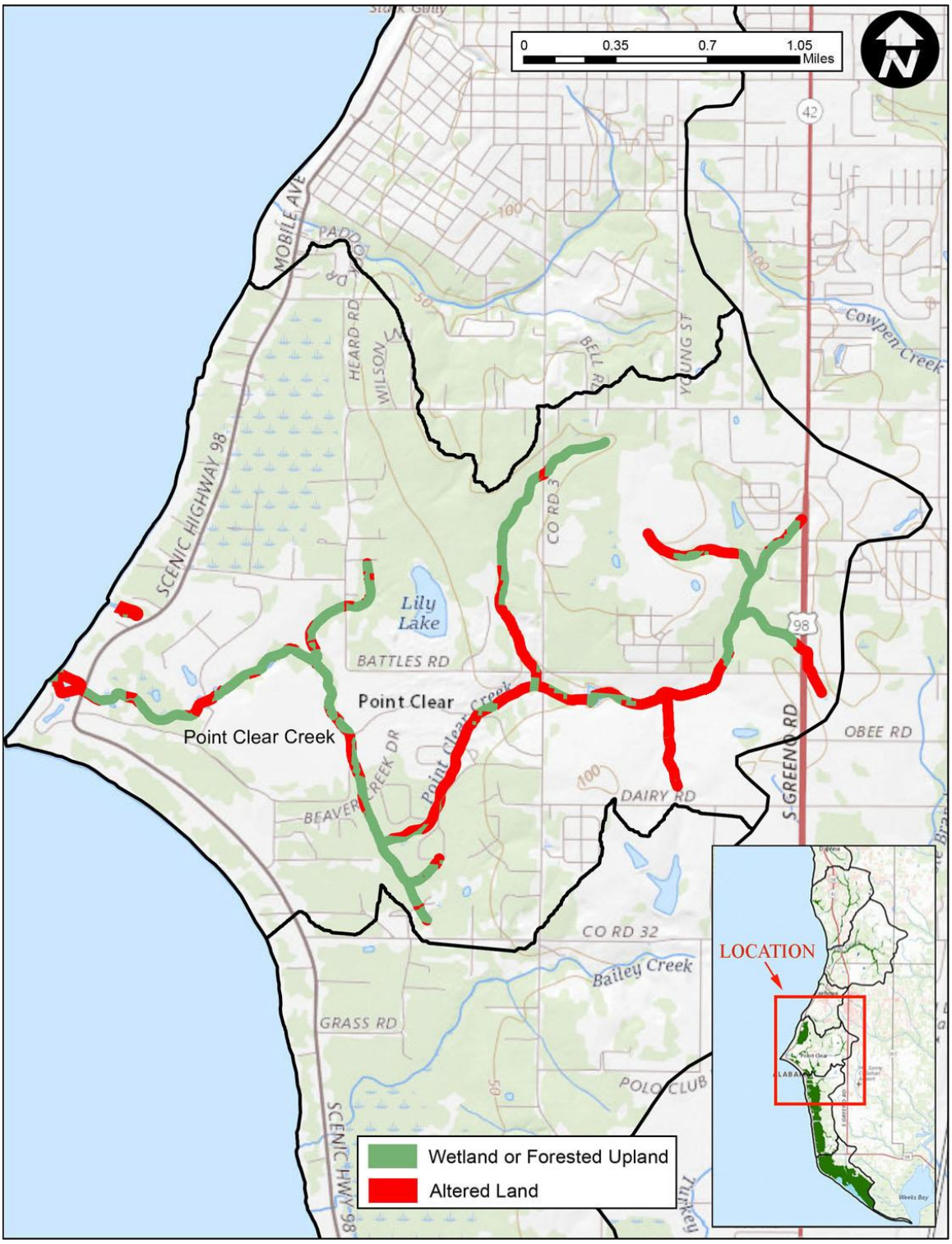


Figure D.5 100-ft-wide riparian corridors in the Point Clear Creek subwatershed.

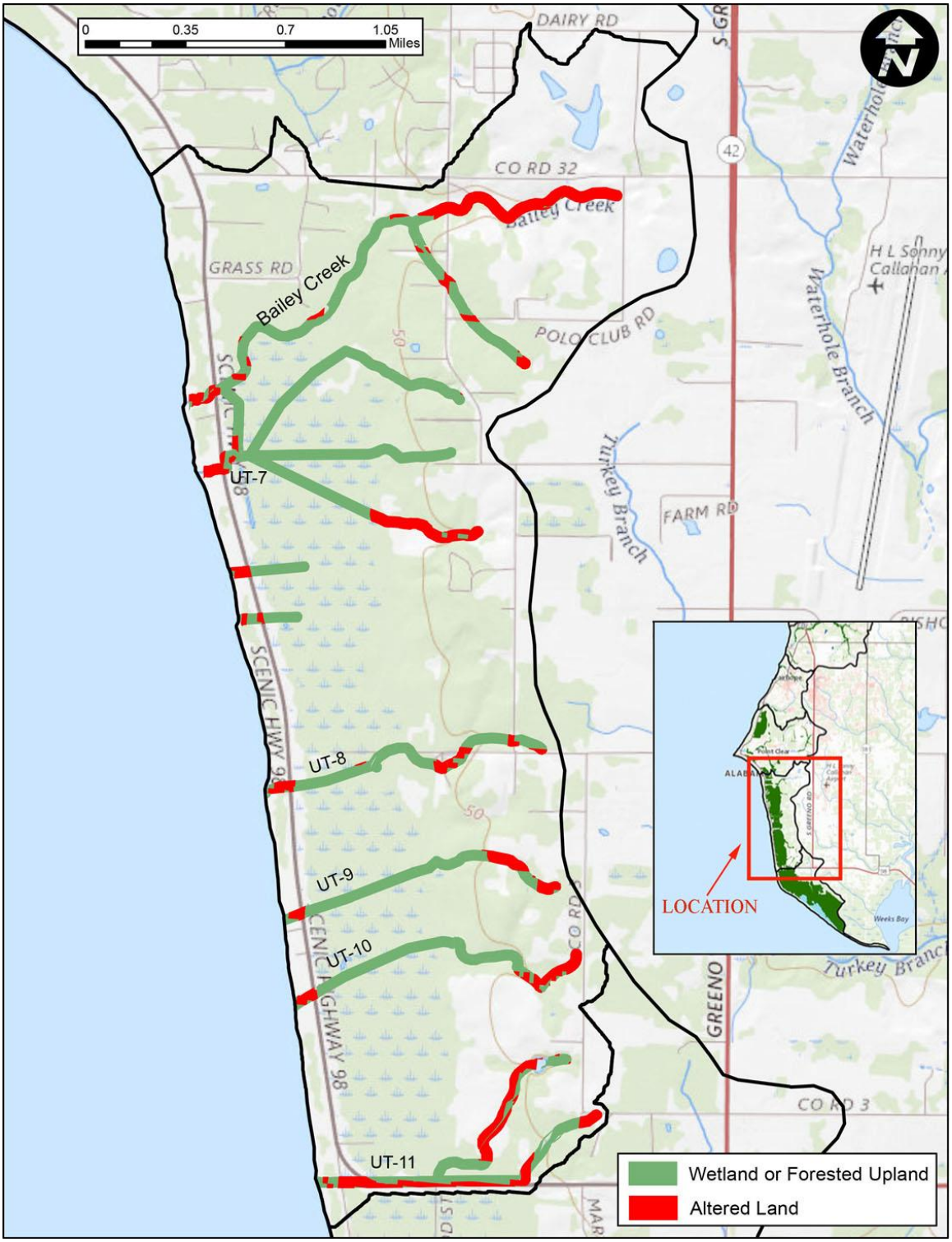


Figure D.6 100-ft-wide riparian corridors in the Bailey Creek-UT7-UT8-UT9-UT10-UT11 subwatershed.

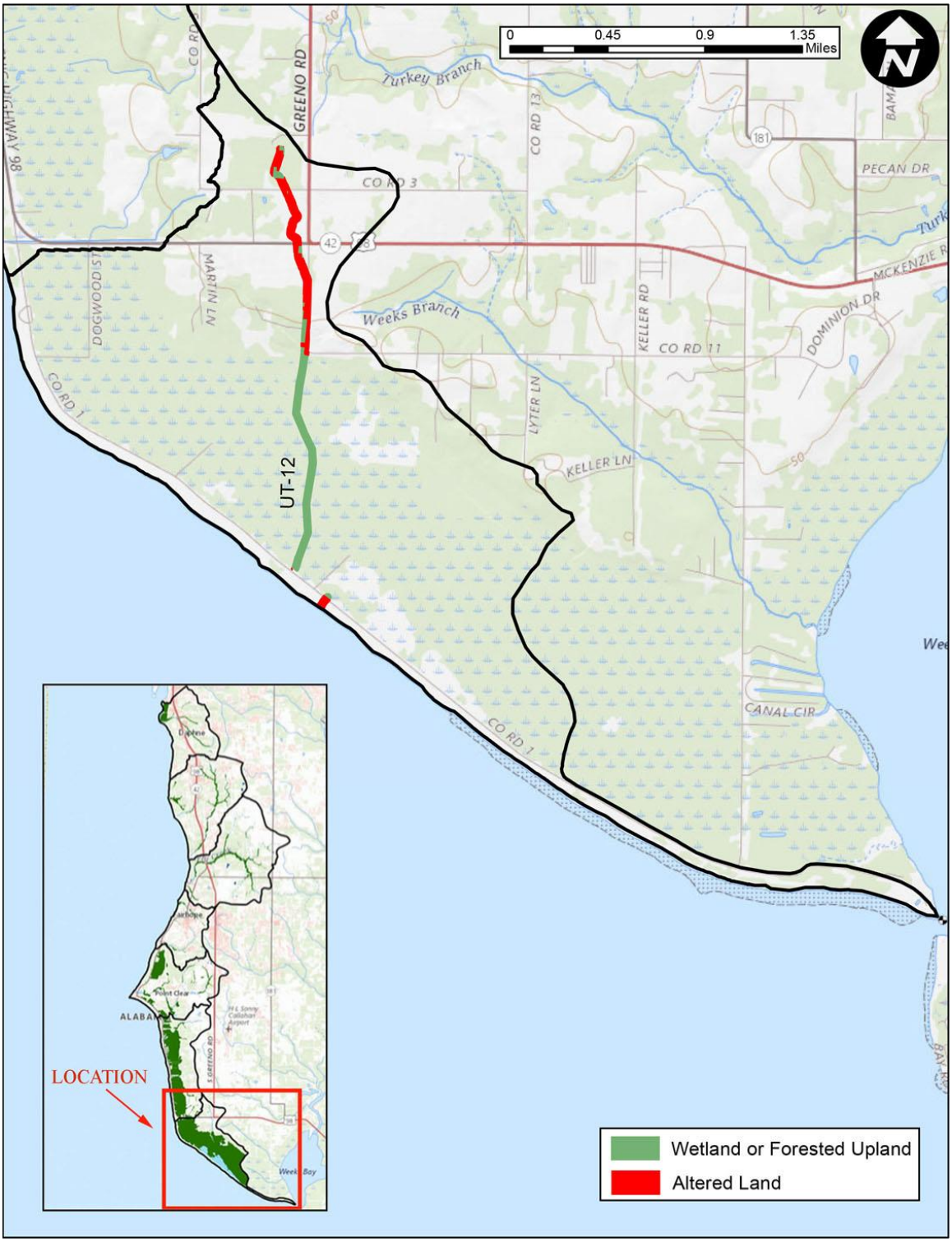


Figure D.7 100-ft-wide riparian corridor in the UT12 subwatershed.

Appendix E

Wetland Buffer Condition for Eastern Shore Sub-Watersheds

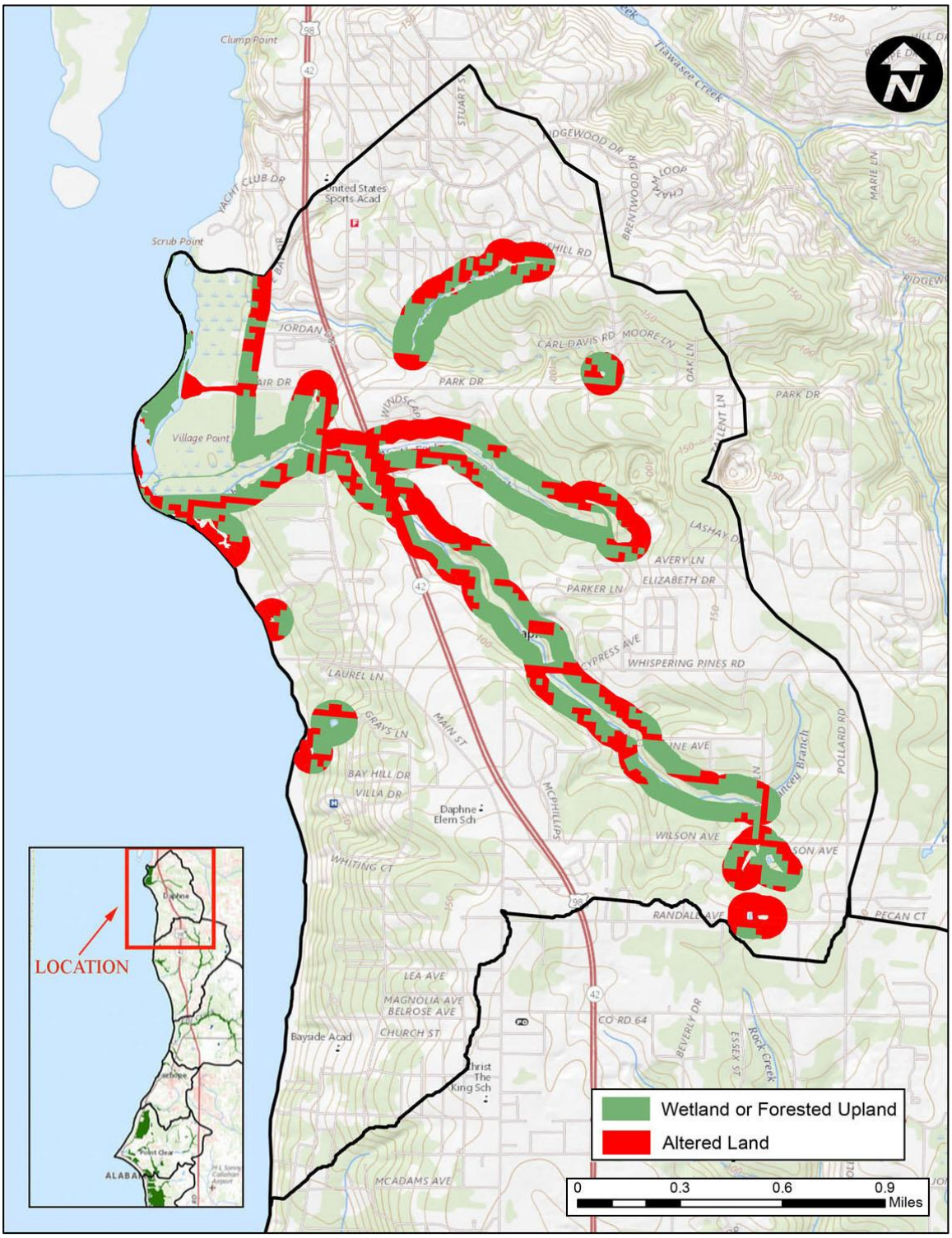


Figure E.1 300-ft-wide wetland buffers in the Jordan Brook-Yancey Branch subwatershed.

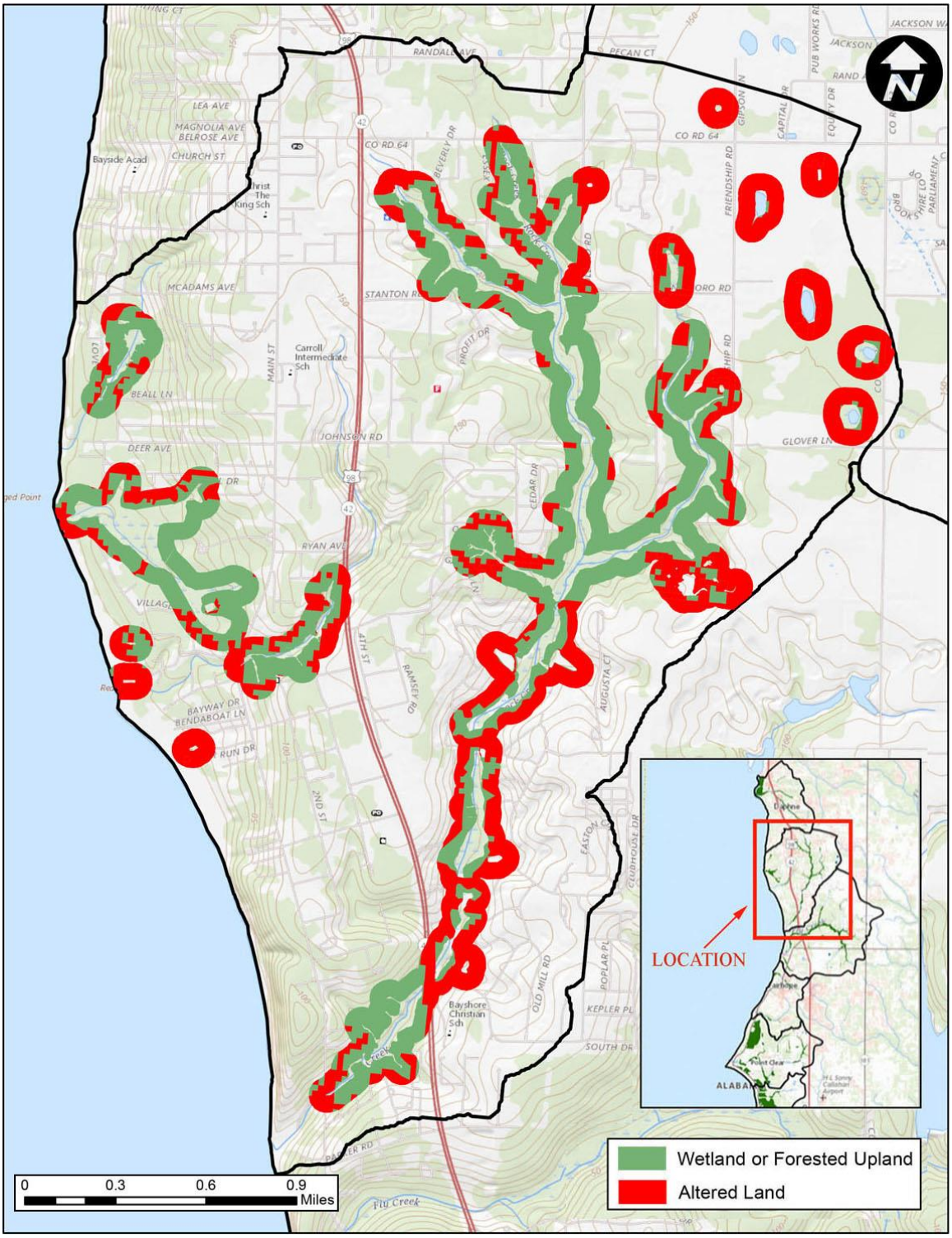


Figure E.2 300-ft-wide wetland buffers in the Rock Creek-UT1-UT2-UT3 subwatershed.

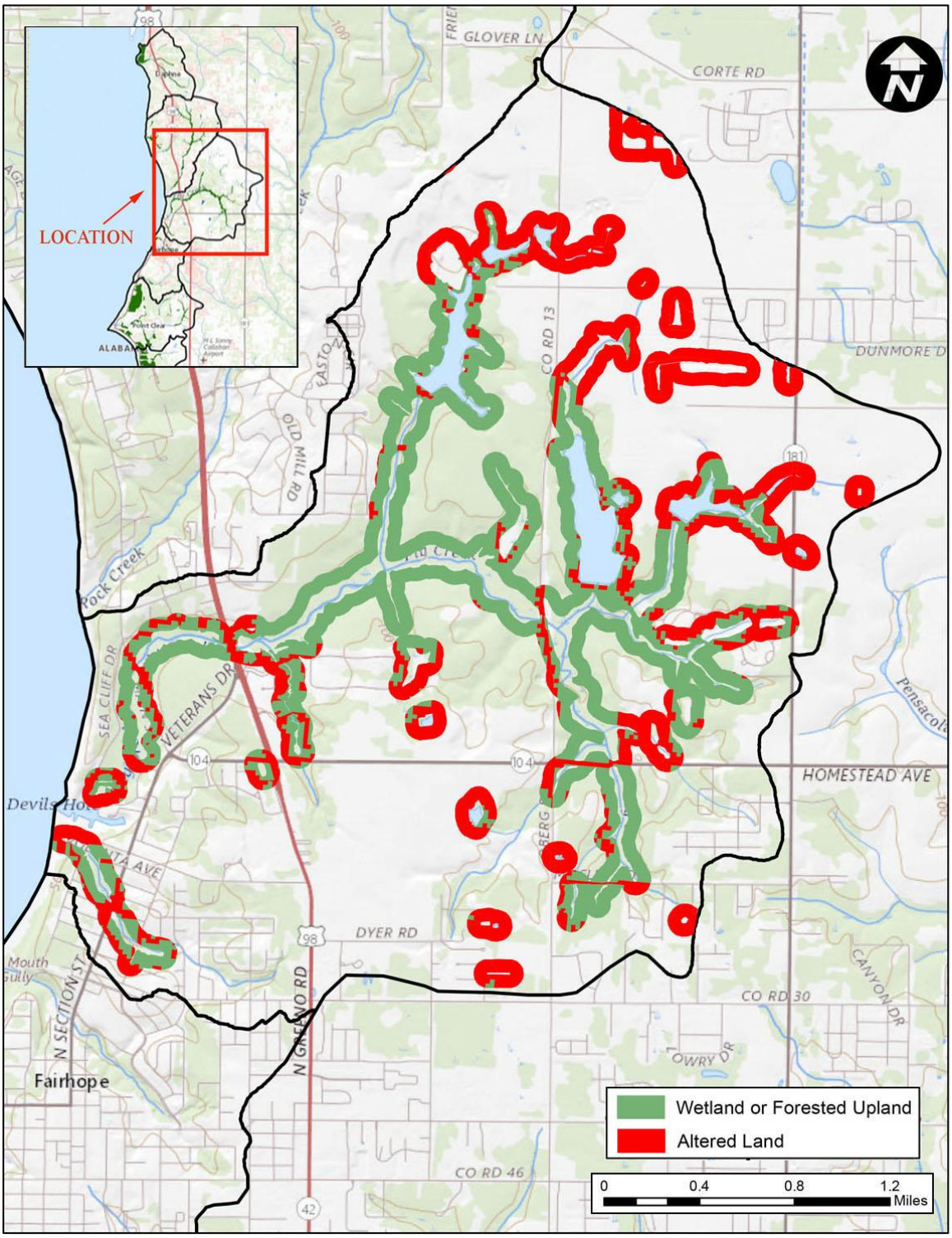


Figure E.3 300-ft-wide wetland buffers in the Fly Creek-UT4 subwatershed.

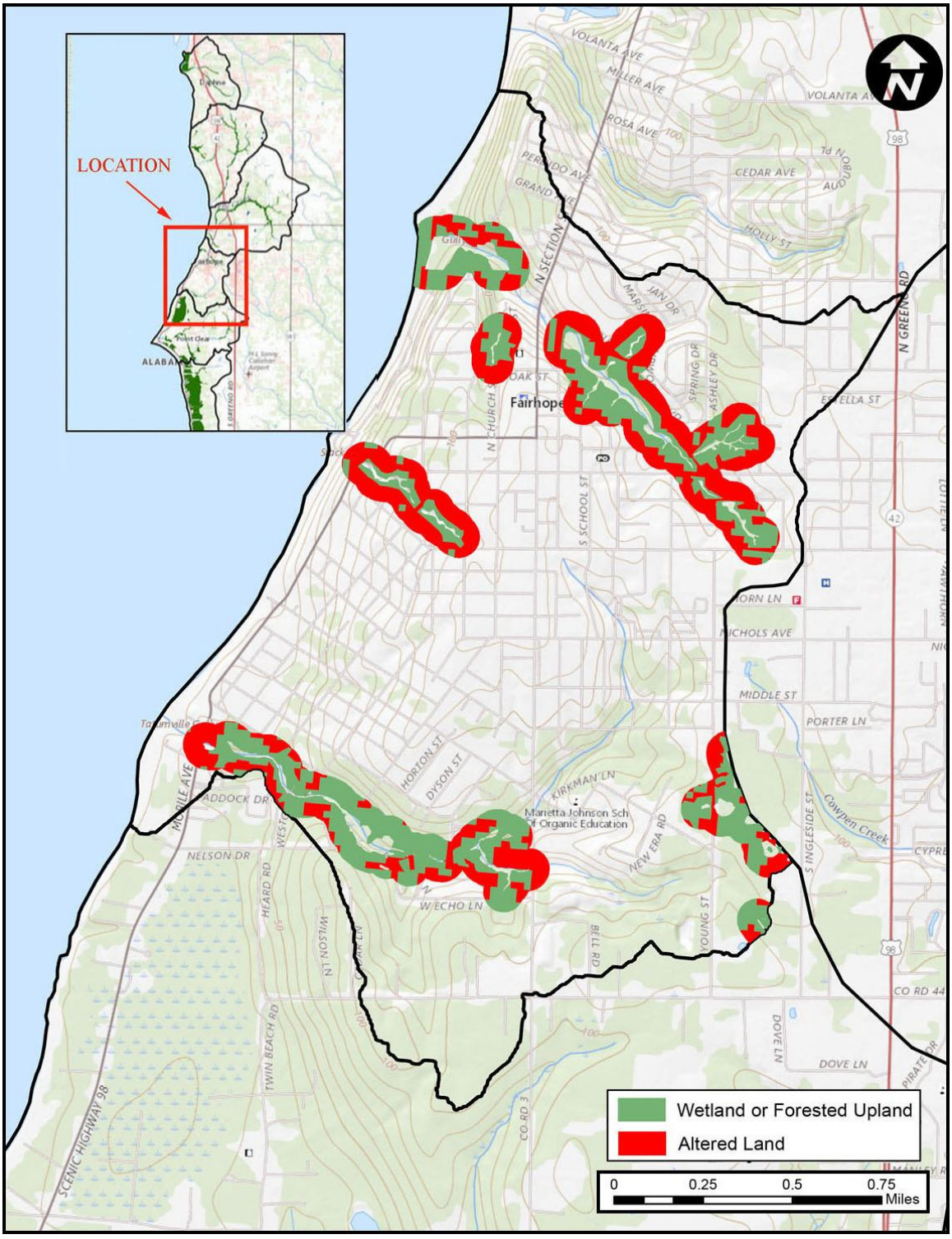


Figure E.4 300-ft-wide wetland buffers in the UT5-UT6 subwatershed.

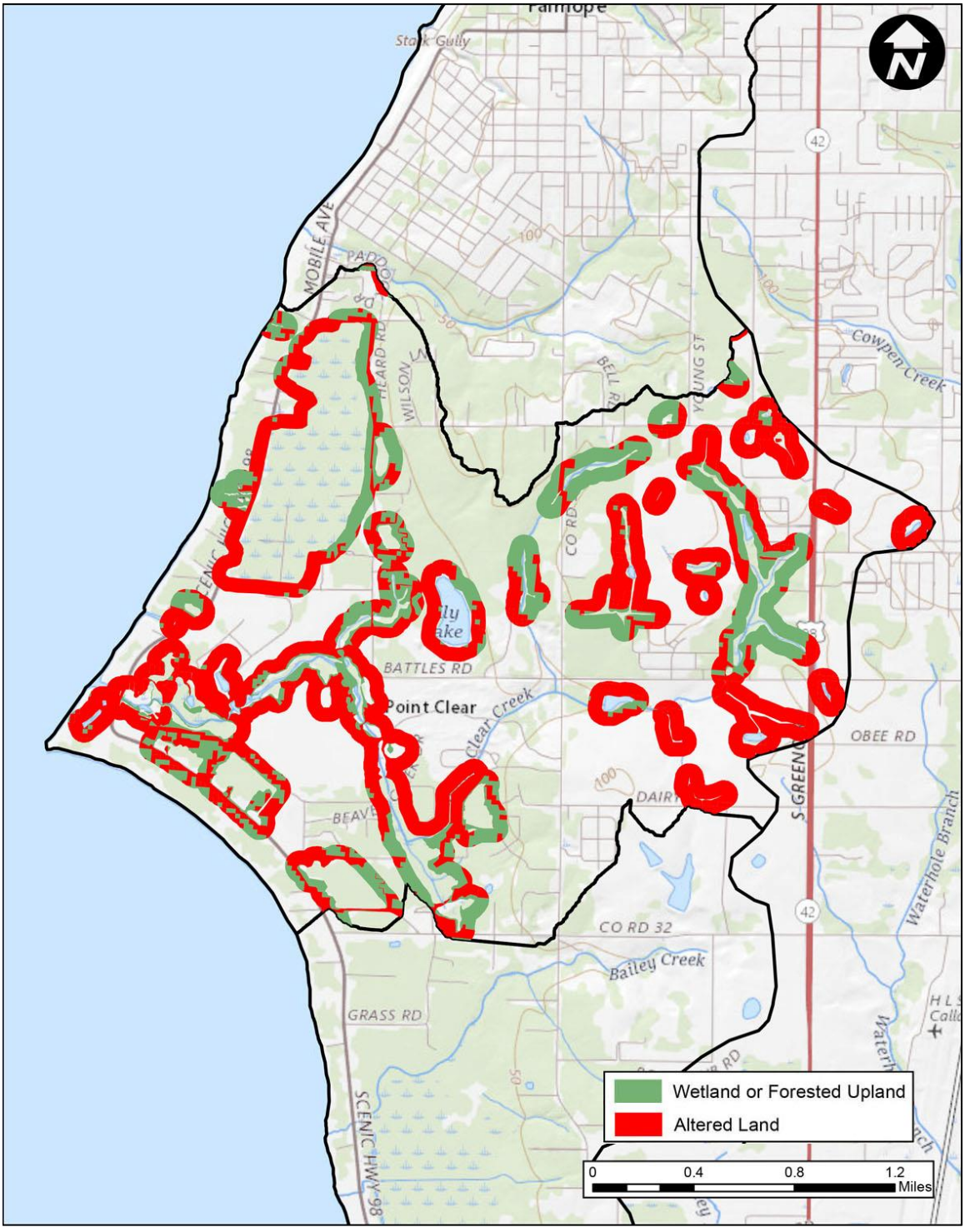


Figure E.5 300-ft-wide wetland buffers in the Point Clear Creek subwatershed.

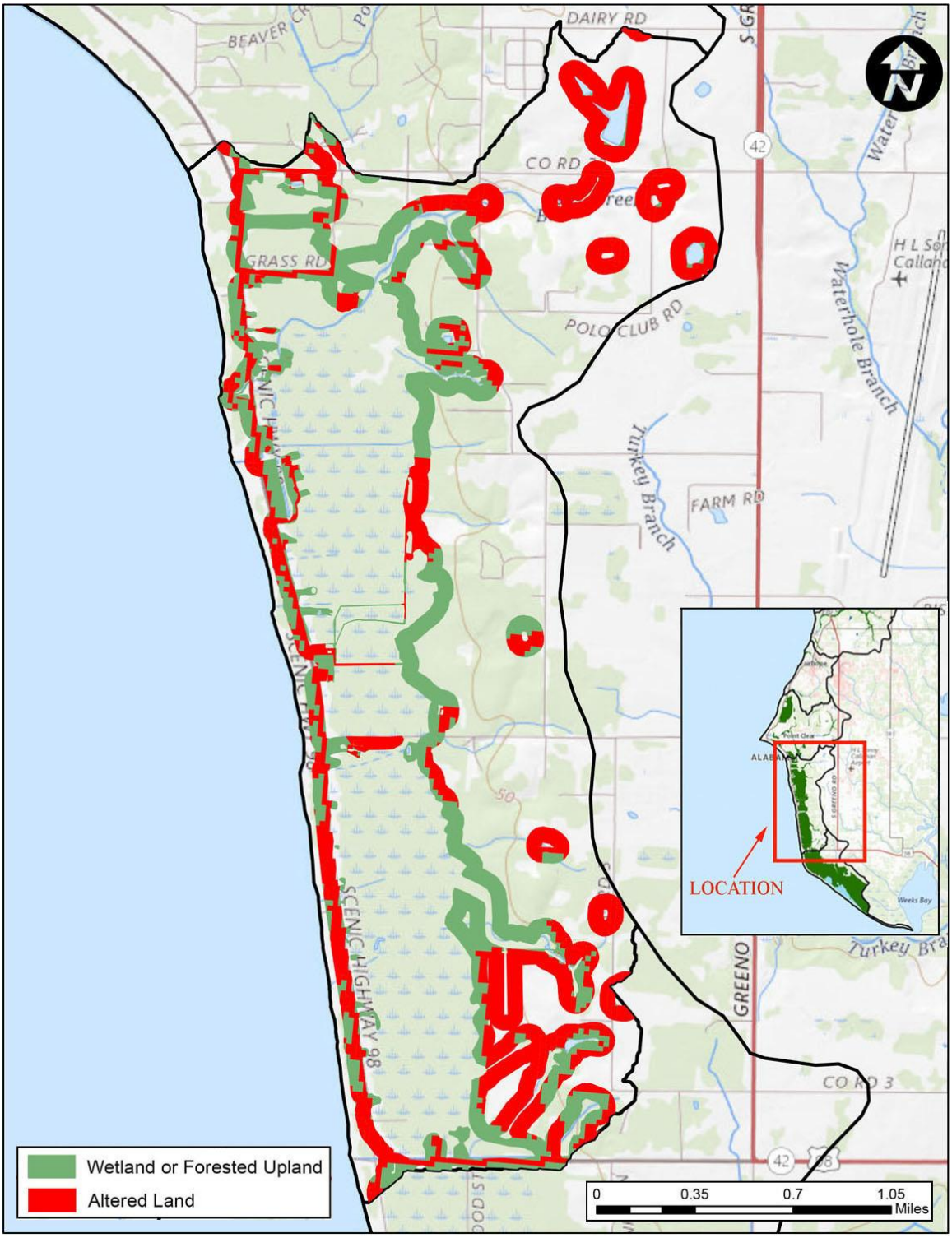


Figure E.6 300-ft-wide wetland buffers in the Bailey Creek-UT7-UT8-UT9-UT10-UT11 subwatershed.

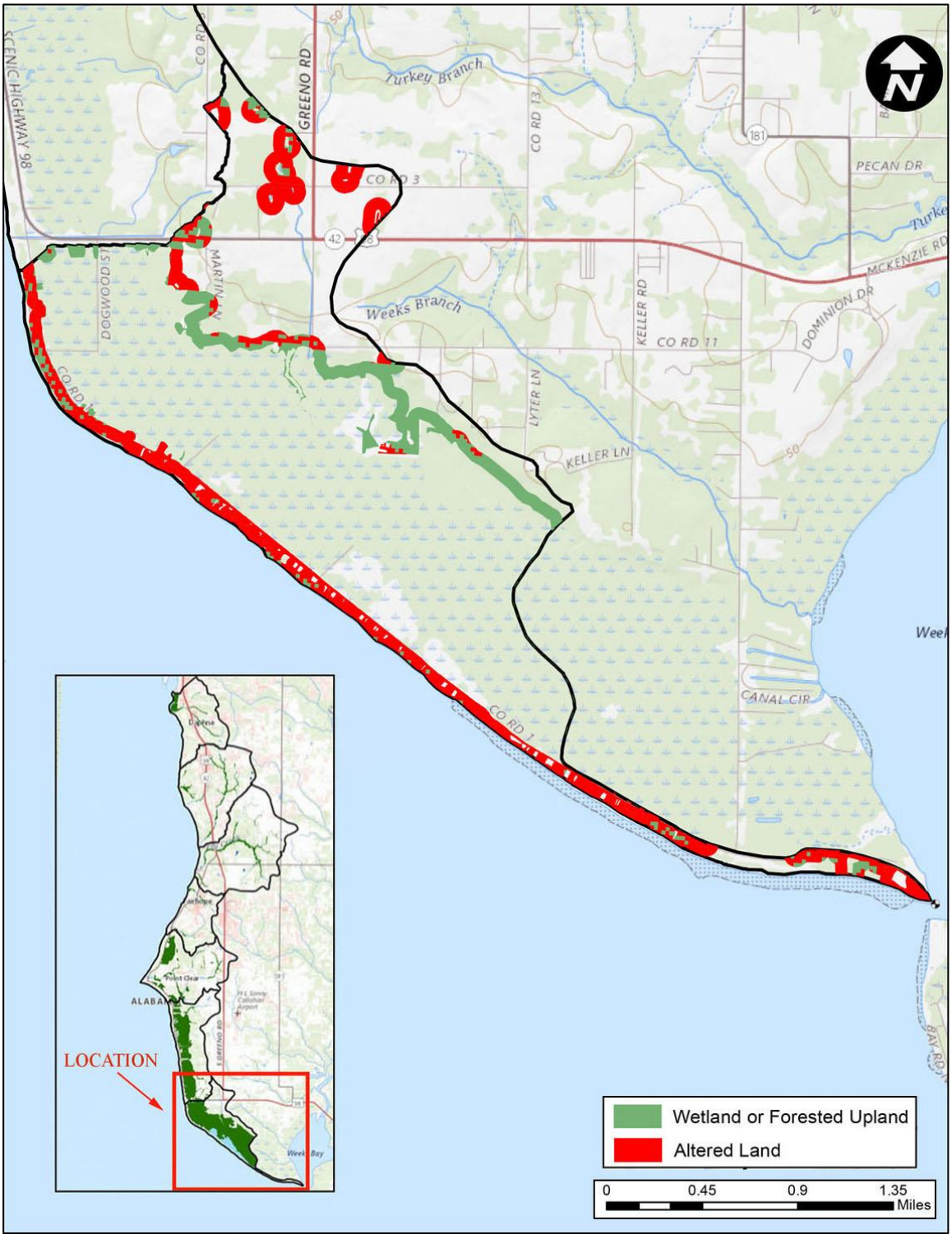
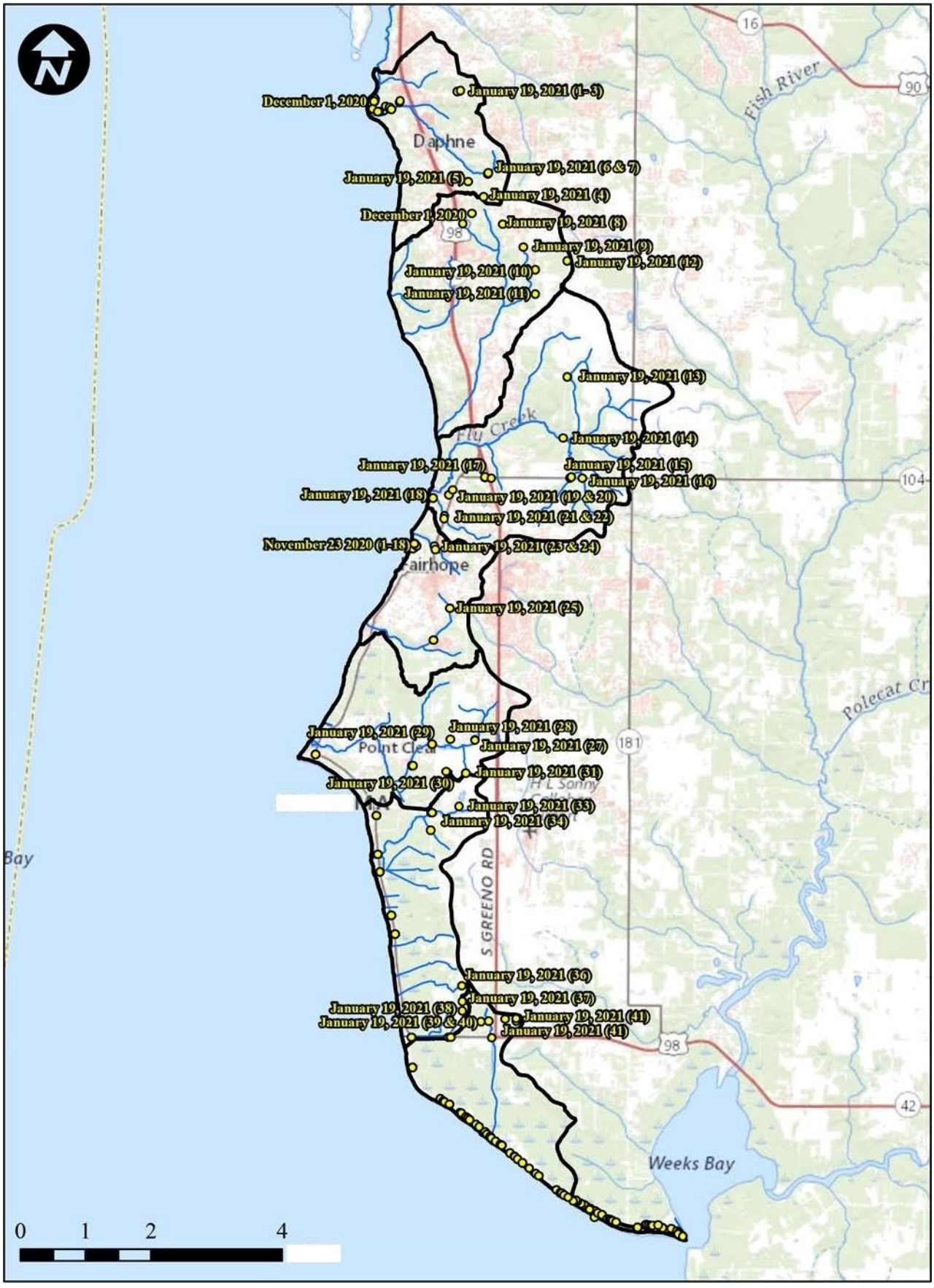


Figure E.7 300-ft-wide wetland buffers in the UT12 subwatershed.

Appendix F

Field Observations and Photographs


December 1, 2020
January 19, 2021 (1-3)
Daphne
January 19, 2021 (5)
January 19, 2021 (6 & 7)
January 19, 2021 (4)
December 1, 2020
January 19, 2021 (8)
January 19, 2021 (9)
January 19, 2021 (12)
January 19, 2021 (10)
January 19, 2021 (11)
January 19, 2021 (13)
Fly Creek
January 19, 2021 (14)
January 19, 2021 (17)
January 19, 2021 (15)
January 19, 2021 (16)
January 19, 2021 (18)
January 19, 2021 (19 & 20)
January 19, 2021 (21 & 22)
November 23 2020 (1-18)
January 19, 2021 (23 & 24)
Fairhope
January 19, 2021 (25)
January 19, 2021 (29)
January 19, 2021 (28)
Point Clear
January 19, 2021 (27)
January 19, 2021 (31)
January 19, 2021 (30)
January 19, 2021 (33)
January 19, 2021 (34)
S GREENO RD
January 19, 2021 (36)
January 19, 2021 (37)
January 19, 2021 (38)
January 19, 2021 (41)
January 19, 2021 (39 & 40)
January 19, 2021 (41)
Fish River
Polecat Cr
Weeks Bay
Bay
16
90
98
104
181
42
0
1
2
4

Miles

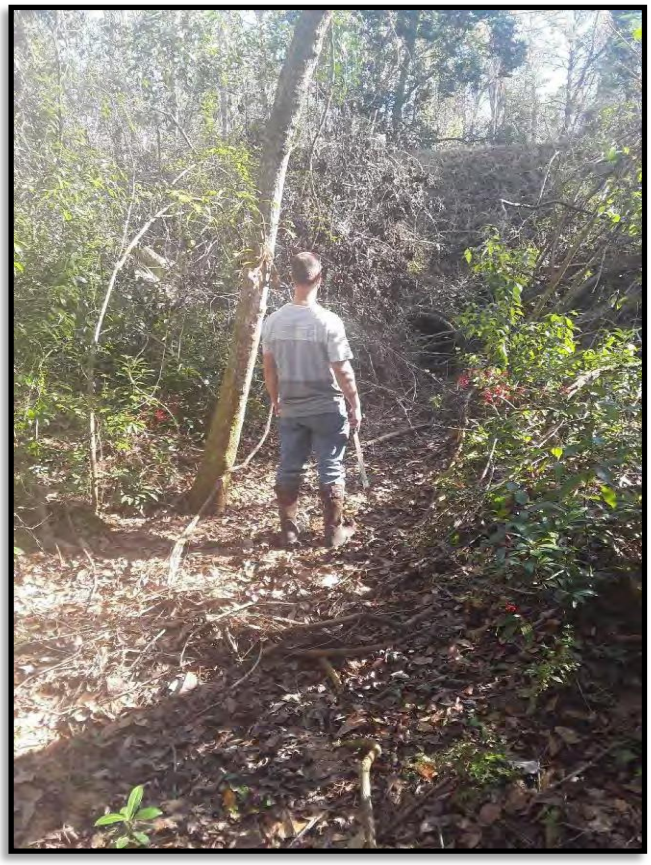
Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; U.S. Census Bureau - TIGER/Line and USFS Road Data

Point 1

30.631138° North, 87.89734° West

Lots of exotics! *Ardisia crenata* (!) *Ligustrum sinense* (!) *Camphora officinarum Lygodium japonicum*

Heavily silted watercourse. Culverted drain silted-in water course. Functionally not a wetland.



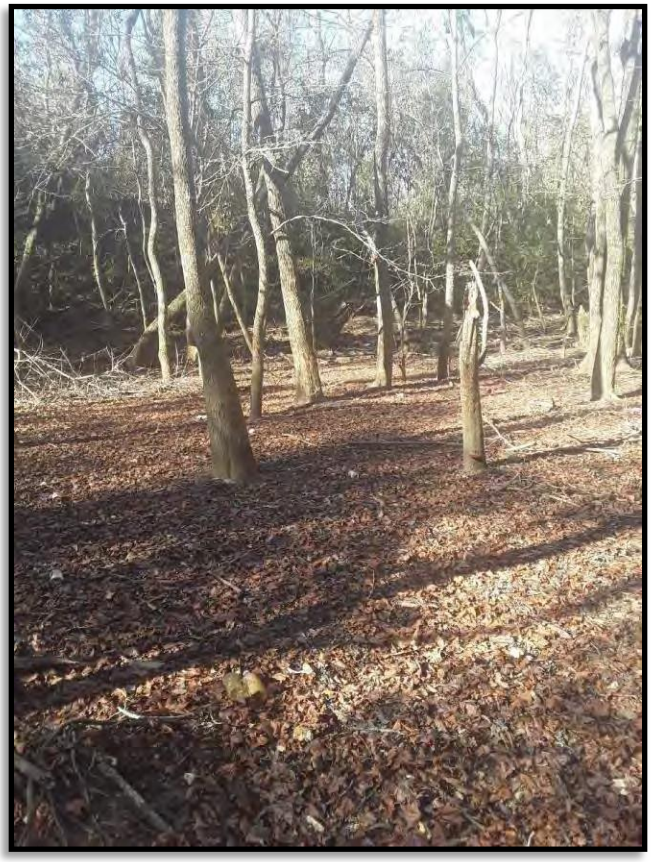
Point 2

30.631103° North, 87.89786° West

Bowl-like depression (Holding basin?). Silted. Lots of trash from flash events into bowl. Sweetgum (*Liquidambar styraciflua*) is dominant canopy tree.

Exotics:

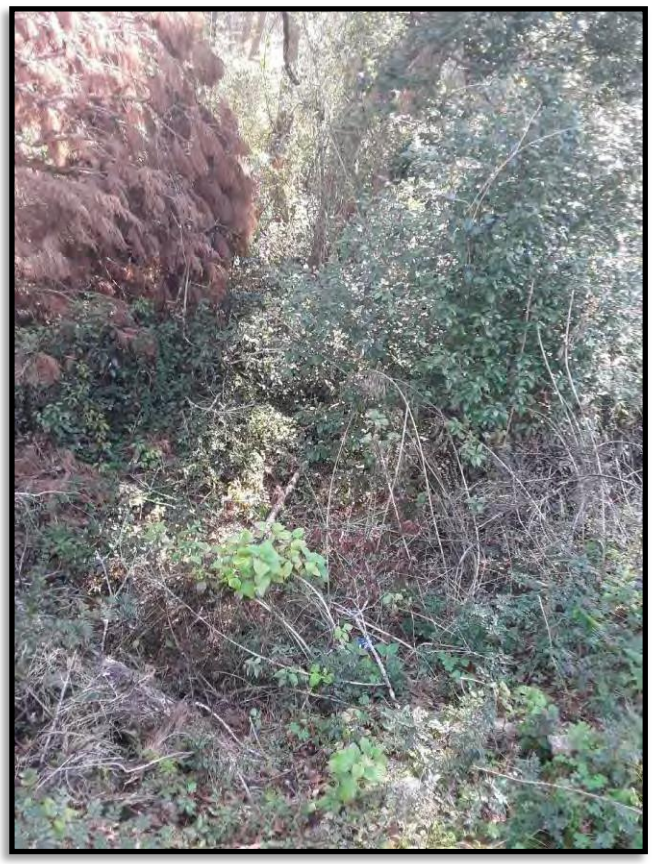
Oxalis debilis (!)



Point 3

30.631278° North, 87.897088° West

East side of road. Drain / Watercourse. Flows under road downstream. Not a jurisdictional wetland. Exotics present.



Point 4

30.607782° North, 87.89076° West

Pre-plotted point for visitation. Low quality. Scoured wetland drain, ~ 15 ft wide. muddy (clayey) bottom. Photo shows drain south of road. Ponds to north in residential lawns.

Lots of exotics (!)

Camphora officinarum, Ligustrum sinense, Lygodium japonicum.

Point 5

30.611117° North, 87.894966° West

(Pre-plotted visitation point/GPS draw point). Scoured watercourse drain; 4-ft wide. Not jurisdictional wetland. No photo.

Point 6

30.612858° North, -87.889935° West

Culvert on west side of road; rock-lined watercourse (scoured). Privet drain. Not a jurisdictional wetland (mapped as wetland in GIS; need to change).

Exotics: *Ligustrum sinense, Camphora officinarum*

Point 7

30.613092° North, 87.889790° West

No Photo. Not a wetland.

Exotics: *Ligustrum sinense, Camphora officinarum*

Point 8

30.601721° North, 87.885932° West

West side of road: Degraded. Rock-lined watercourse. culverted. possible stream (intermittent or ephemeral???). Exotics: *Ligustrum sinense*

East side of road: **IMPROPER CULVERT PLACEMENT.** Scoured watercourse. silted. Not a wetland. Exotics: *Ligustrum sinense, Camphora officinarum, Lygodium japonicum*

Point 9

30.596620° North, 87.880593° West

Pre-plotted Point.

North side of road: Ponded wetland. Cattle with access to wetland. Low quality. Exotics: *Triadica sebifera.*

South side of road: series of ponds along drain through yards and fields/orchards. Narrow wetland fringe. Not natural.

Point 10

30.591603° North, 87.877515° West

Rock-lined watercourse. Not a wetland. No photo.

Point 11

30.586242° North, 87.877442° West

Rock-lined watercourse. Not a wetland. No photo.

Point 12

30.593909° North, 87.869848° West

Grady Pond. Disturbed secondary cut-over woods with *Ligustrum sinense*.

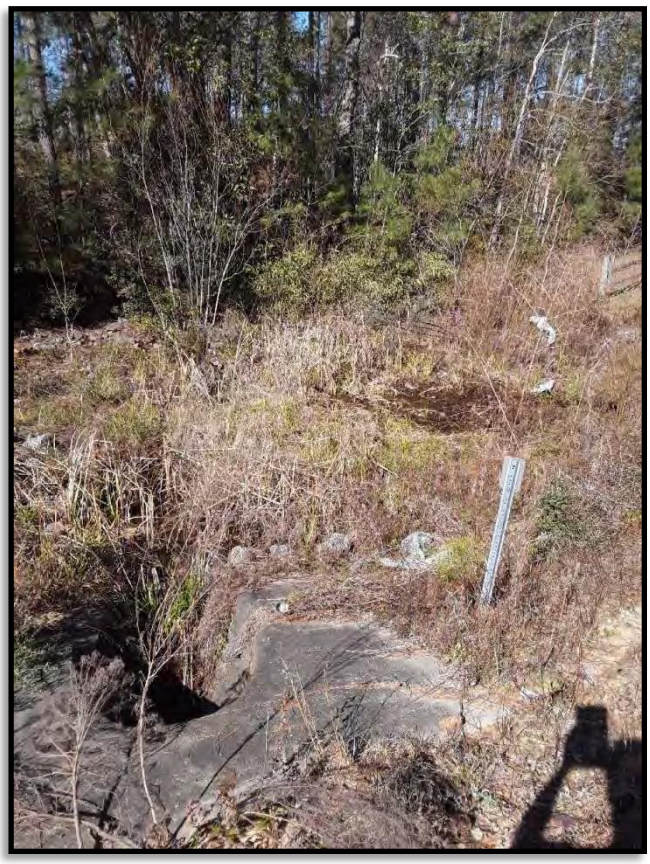
Point 13

30.567930° North, 87.869116° West

West side of road: **No exotics present**. Rock-lined culvert. Wetlands within ROW are open scrub-shrub. Species here are *Typha sp., Salix nigra, and Arundinaria sp.* Forested outside of ROW (*Magnolia virginiana*). No stream present.

East side of road: Forested wetland drain. Rock-lined culvert in ROW. No stream. Native species: *Thelypteris kunthii, Salix nigra*. **Exotics:** *Lygodium japonicum, Triadica sebifera*.

West Side



East Side

Point 14

30.55081° North, 87.870118° West

Fly Creek at bridge crossing. Exotics: *Ligustrum sinense, Triadica sebifera, Camphora officinarum, Stachys floridana*.

Point 15

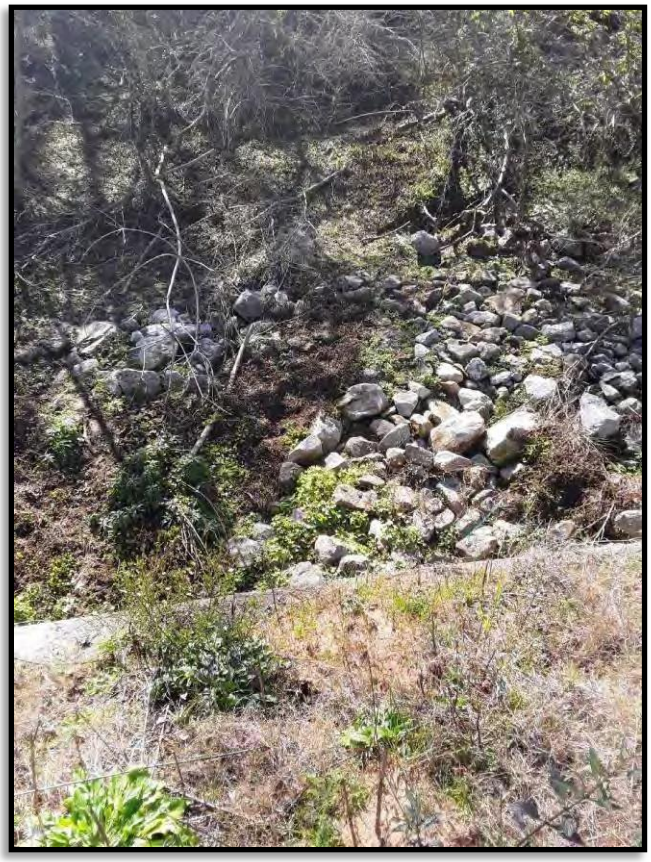
30.545425° North, 87.868002° West

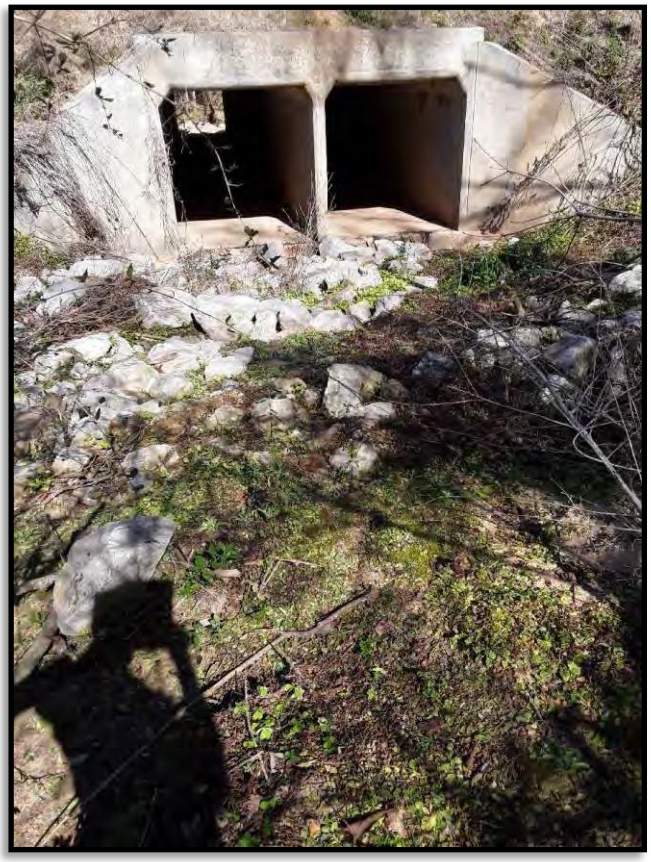
South side of road (HEH): **EROSION PRESENT.** Silted; rock-lined in ROW. Channel not obvious. Wetlands continue. **Exotics:** *Ligustrum sinense, Oxalis debilis.* Native species: *Sambucus canadensis, Viola floridana.*

North side of Road (DK notes, Point 15A)

Highly incised watercourse (not a stream). No wetlands. Signficant erosion at road; headcutting. Exotics present.

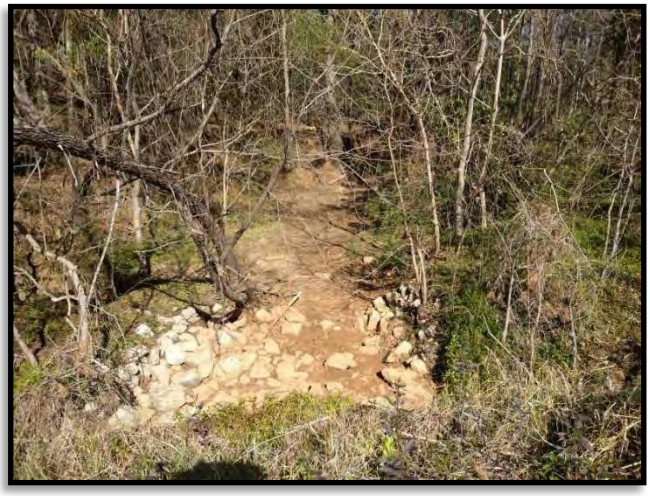
South side of road photos (HEH)





Point 15A Photos (DK)

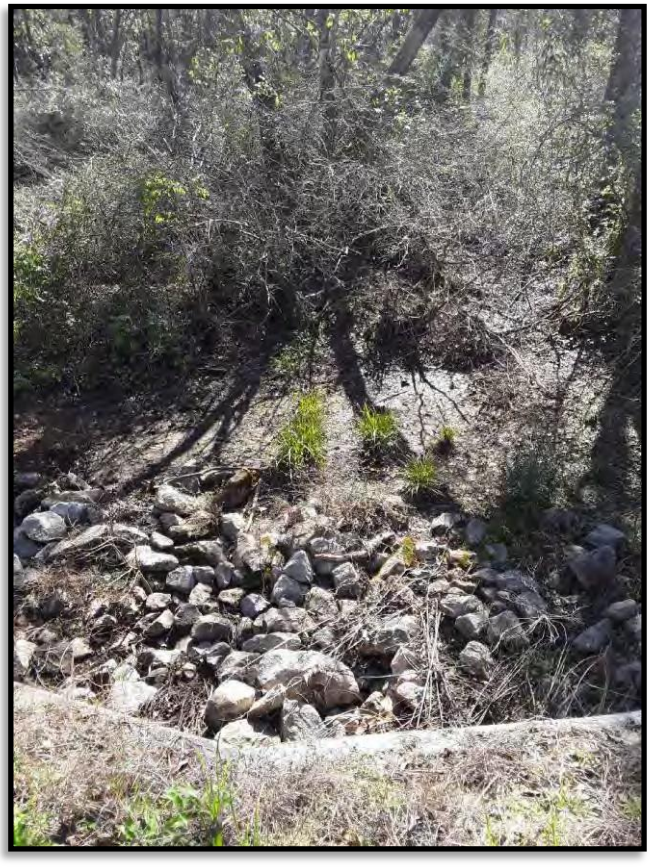
North side of Road (DK)



Point 16

30.545444° North, 87.864981° West

Scoured watercourse. Rock-lined culvert at ROW. Slight channel; braided. No water (Intermittent stream). **Exotics:** *Ligustrum sinense (!!!!), Ardisia crenata, Camphora officinarum, Lygodium japonicum*. Native species: *Sambucus canadensis*.



Point 17

30.545528° North, 87.889986° West

South side of road: Culverted. Narrow drain/watercourse. slight channel. **LOWEST OF QUALITY. NUMEROUS EXOTICS:** *Ligustrum sinense, Ardisia crenata, Nandina domestica, Dioscorea bulbifera, Ligustrum japonicum, Camphora officinarum, Lygodium japonicum*, *Oxalis debilis.*

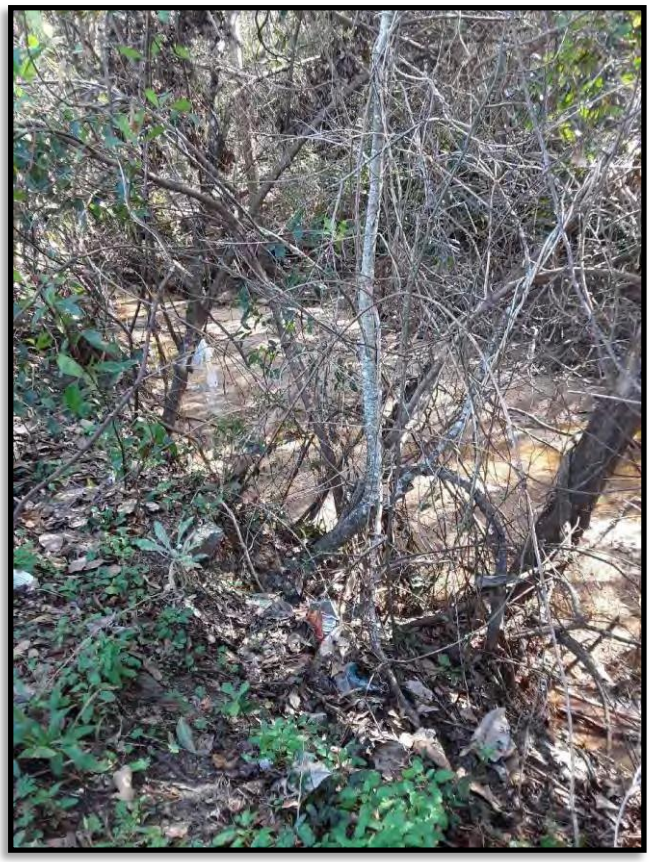
North side of road: "Micro" drain. **LOTS OF EXOTICS**. ***Ardisia crenata* (!!!),** *Ligustrum japonicum.* Possible wetlands to north.

South side of road photo

Point 18

30.540670° North, 87.903358° West

Heavily silted drain. **Low Quality.**



Point 19

30.541497° North, 87.899236° West

No wetlands present

Point 20

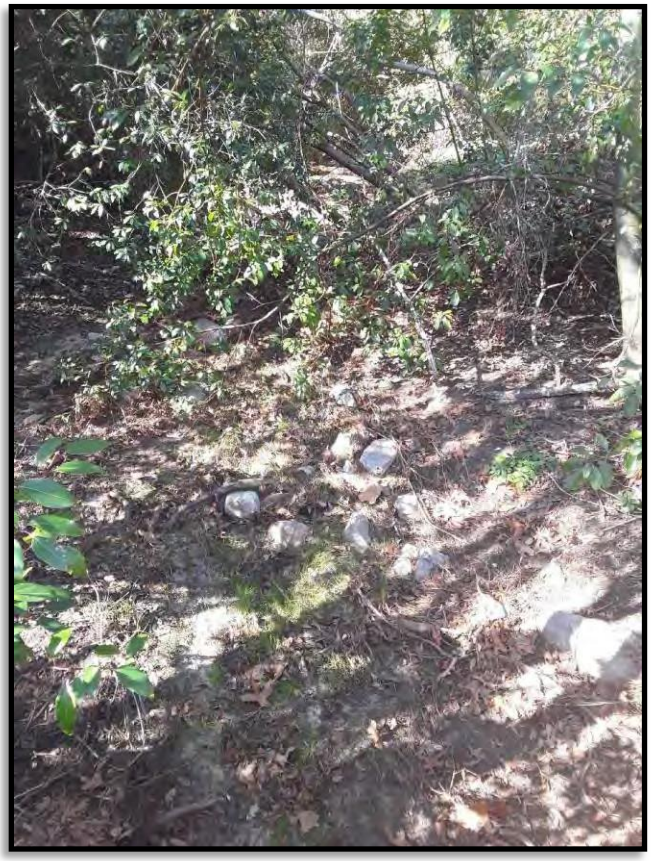
30.542578° North, 87.898231° West

Drainage way/watercourse. No wetlands.

Point 21

30.536775° North, 87.900175° West

Drainage way/watercourse with silted channel. No wetlands.



Point 22

30.536255° North, 87.900225° West

Not a wetland. Silted-in drain/watercourse.

Point 23

30.530085° North, 87.902905° West (North Section St. at UT5)

SERIOUS HEADCUTTING ISSUE. EXPOSED PIPE. EROSION THREATENS ROAD.

Point 24

30.529383° North, 87.902640° West

Open detention basin. Heavily silted. Low spots are wetland; interspersed with mounds of elevated silt.

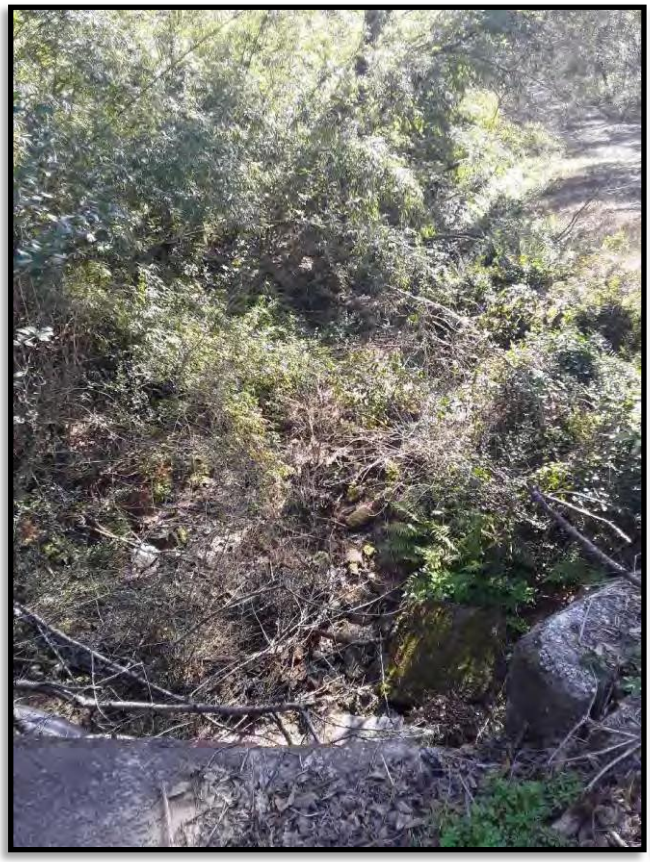
Point 25

30.516242° North, 87.898712° West

South side of road: Heavily silted rock-lined watercourse and associated sewerline. **Erosion an issue.** **Exotics:** *Ligustrum sinense, Ligustrum lucidum, Camphora officinarum, Phyllostachys aurea, Clematis terniflora*

North side of road: Heavily silted drain. **Exotics:** *Eriobotrya japonica, Nandina domestica.*

South Side



North Side

Point 26

30.507728° North, 87.886298° West

West side of road: Herbaceous wetland in ROW at culvert. Standing water. **Exotics:** *Sesbania punicea.* Native species: *Juncus effusus, Salix nigra.* Forested wetland outside of ROW. Watercourse/stream present. **Exotics:** *Ligustrum sinense, Lonicera japonica.*

East side of road: Herbaceous wetland drain, narrow channel, mown lawn. Surrounded by residential subdivisions and commercial development. Low Quality.

West side

East side

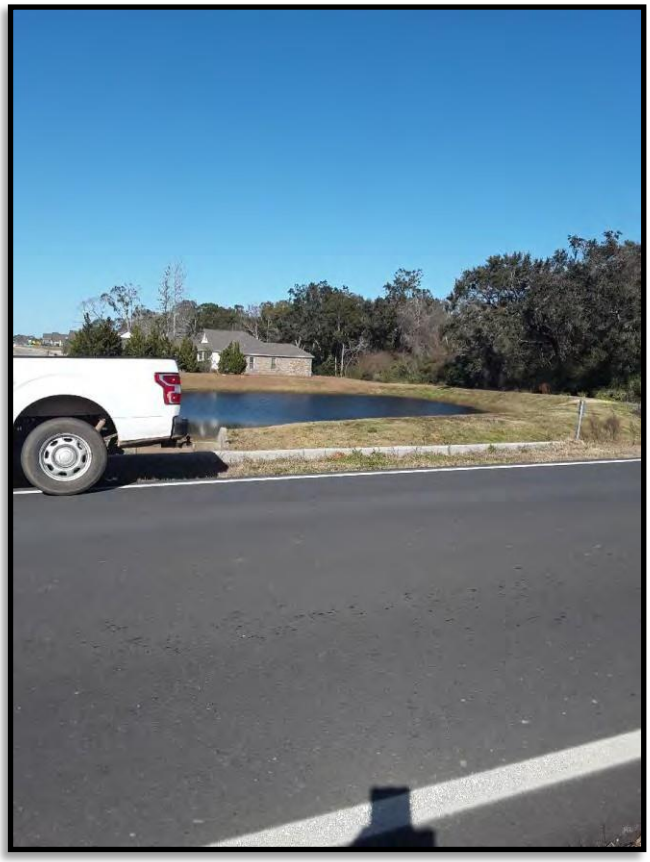
Point 27

30.487067° North, 87.892032° West

South side of road: Pasture / Farm field. Rock-lined culvert. Not a jurisdictional wetland (swale through field). North side of road: Detention pond for subdivision.

South side of road

North side of road



Point 28

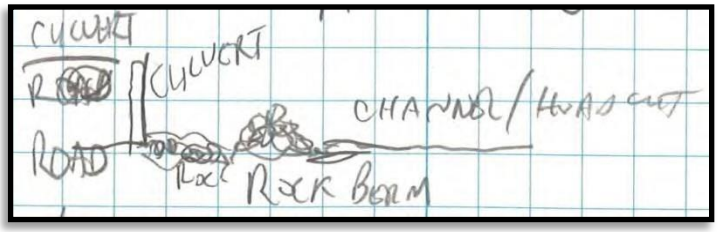
30.487163° North, 87.898305° West

Pond / Swale in field with standing water. South side of road.

Point 29

30.4876483° North, 87.903013° West

Not a wetland. Rock-lined culvert. Headcut drain. Eroded watercourse. Rock berm blocks channel a short distance from culvert. Lots of *Ligustrum sinense* and *Lonicera japonica*.



Point 30

30.479743° North, 87.899328° West

Wet depression in muddy portion of field with standing water. Not jurisdictional. Isolated

Point 31

30.479747° North, 87.894355° West

Swales in field, farm ditch. No photo.

Point 32

30.479770° North, 87.887013° West.

Wet swale in field (outside of study area?). No photo.

Point 33

30.472322° North, 87.895993° West

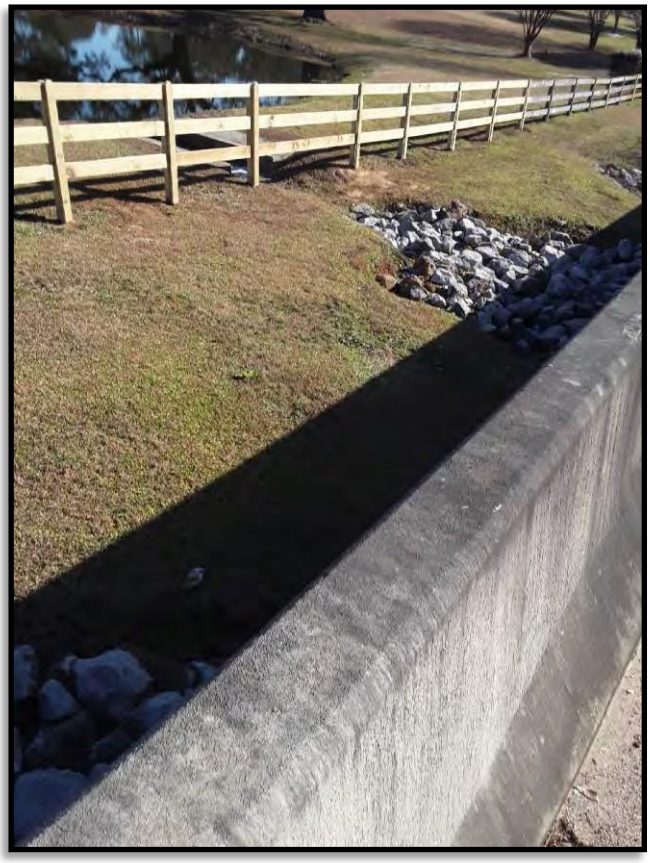
No wetlands to north; low swale with cows. Non-wetland drain to south; scoured narrow watercourse/drainage feature, wooded.

Point 34

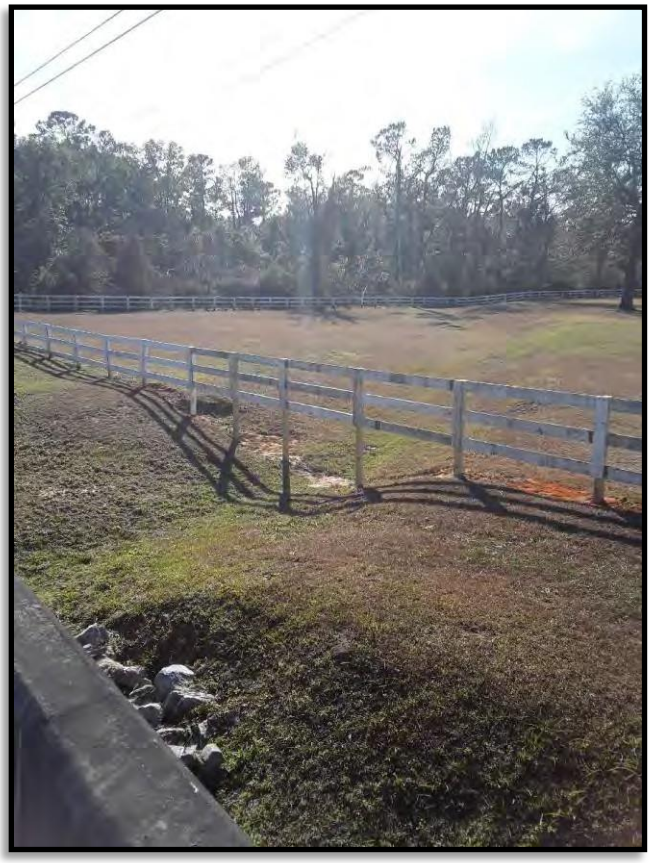
30.471195° North, 87.903098° West

BAILEYS CREEK. Not a creek or stream; no wetlands present. East side of road is a low swale through mown pasture/lawn. Man-made pond on west side of road.

West side of road



East side of road



Point 35

30.467003° North, 87.903226° West

No wetlands on east side of road. Possible forested drain on west side of road. No photos.

Point 36

30.4324903° North, 87.894874° West

Forested wetlands on west side of road. No photos.

Point 37

30.429046° North, 87.894667° West

Wetlands present here. No photos.

Point 38

30.429046° North, 87.894639° West

Forested wetlands. *Sambucus canadensis.* No photos.

Point 39

30.424649° North, 87.889873° West

Wet to road. No photos.

Point 40

30.424739° North, 87.887922° West

Wet ditch / drain. Ends ~100 ft to south. North of road is wet. No photos.

Point 41

30.425210° North, 87.883790° West

Isolated wetland. No photos.

Point 42

30.425310° North, 87.880923° West

Man-made ponds on both sides of road.

Point 43

30.558665° North, 87.852096° West

Pond shown on aerial. Wet herbaceous swale on west side of road. No photos.

Appendix G

Invasive Plants in the Eastern Shore Watershed

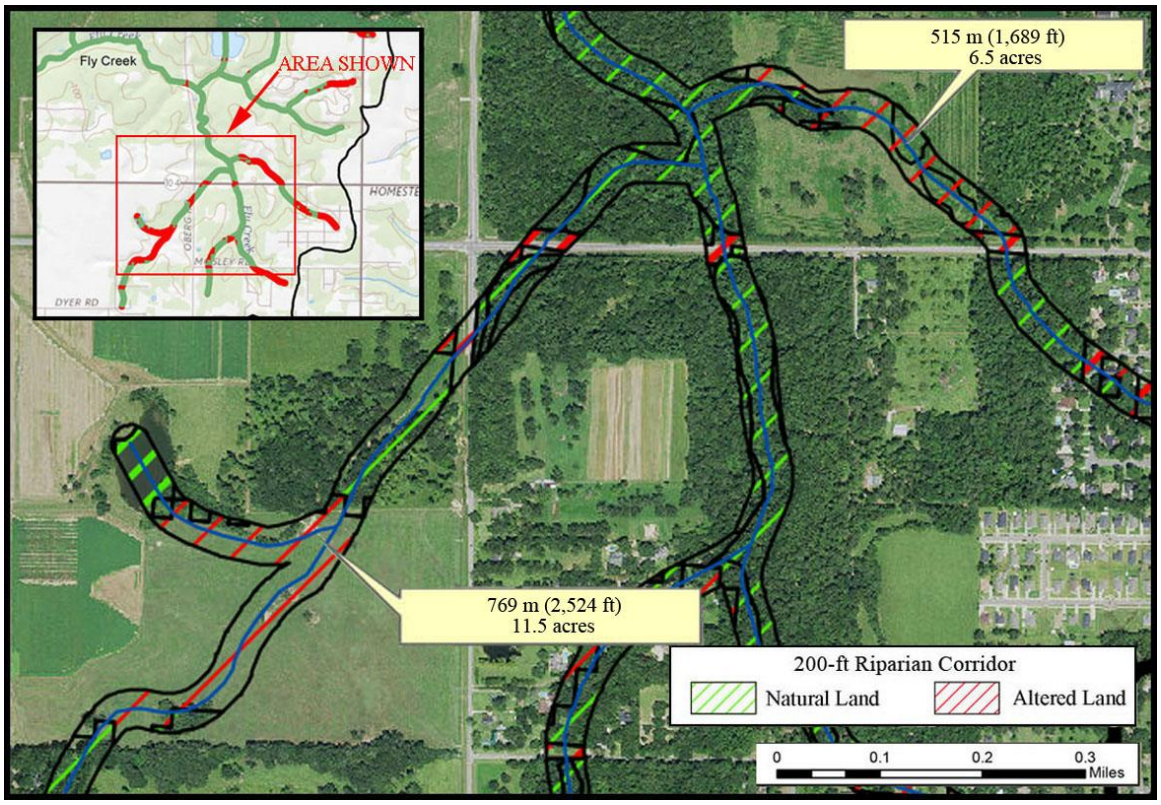
Order	Family	Species Name	Common Name
Schizaeales	Lygodiaceae	*Lygodium japonicum*	Japanese climbing fern
Polypodiales	Thelypteridaceae	*Christella dentata*	Downy maiden fern
Polypodiales	Athyriaceae	*Deparia petersenii*	Japanese false spleenwort
Araucariales	Podocarpaceae	*Podocarpus macrophyllus*	Japanese yew
Laurales	Lauraceae	*Camphora officinarum*	Camphor tree
Alismatales	Araceae	*Colocasia esculenta*	Wild taro
Dioscoreales	Dioscoreaceae	*Dioscorea alata*	White yam
Dioscoreales	Dioscoreaceae	*Dioscorea bulbifera*	Air potato
Liliales	Liliaceae	*Lilium longiflorum*	Easter lily
Liliales	Liliaceae	*Lilium philippinense*	Philippine lily
Asparagales	Iridaceae	*Gladiolus ×gandavensis*	Gladiolus
Asparagales	Iridaceae	*Iris pseudacorus*	Pale yellow iris
Asparagales	Asparagaceae	*Aspidistra elatior*	Cast iron plant
Commelinales	Pontederiaceae	*Piaropus crassipes*	Water hyacinth
Zigiberales	Cannaceae	*Canna ×generalis*	Garden canna
Zigiberales	Zingiberaceae	*Hedychium coronarium*	White ginger-lily
Poales	Poaceae	*Arundo donax*	Giant reed
Poales	Poaceae	*Imperata cylindrica*	Cogon grass
Poales	Poaceae	*Panicum repens*	Torpedo grass
Poales	Poaceae	*Phyllostachys aurea*	Golden bamboo
Ranunculales	Berberidaceae	*Nandina domestica*	Heavenly bamboo
Ranunculales	Ranunculaceae	*Clematis terniflora*	Sweet autumn clematis
Saxifragales	Haloragaceae	*Myriophyllum spicatum*	Eurasian watermilfoil
Vitales	Vitaceae	*Causonis japonica*	Bush killer
Fabales	Fabaceae	*Albizia julibrissin*	Mimosa

Order	Family	Species Name	Common Name
Fabales	Fabaceae	*Pueraria montana*	Kudzu
Fabales	Fabaceae	*Sesbania punicea*	Purple sesban
Fabales	Fabaceae	*Wisteria floribunda*	Japanese wisteria
Fabales	Fabaceae	*Wisteria sinensis*	Chinese wisteria
Fabales	Fabaceae	*Wisteria ×formosa*	Asian hybrid wisteria
Rosales	Rosaceae	*Eriobotrya japonica*	Loquat
Rosales	Rosaceae	*Rosa bracteata*	McCartney rose
Rosales	Rosaceae	*Rosa laevigata*	Cherokee rose
Rosales	Rosaceae	*Rosa lucieae*	Memorial rose
Rosales	Rosaceae	*Rosa multiflora*	Multiflora rose
Rosales	Elaeagnaceae	*Elaeagnus pungens*	Thorny olive
Rosales	Elaeagnaceae	*Elaeagnus umbellata*	Autumn olive
Rosales	Ulmaceae	*Ulmus parvifolia*	Chinese elm
Rosales	Moraceae	*Morus alba*	White mulberry
Rosales	Moraceae	*Ficus pumila*	Climbing fig
Oxalidales	Oxalidaceae	*Oxalis debilis*	Pink wood sorrel
Malpighiales	Violaceae	*Viola inconspicua*	Chinese violet
Malpighiales	Euphorbiaceae	*Triadica sebifera*	Chinese tallow tree
Malpighiales	Euphorbiaceae	*Vernicia fordii*	Tung oil tree
Myrtales	Onagraceae	*Ludwigia peruviana*	Peruvian primrose willow
Sapindales	Meliaceae	*Melia azedarach*	China berry
Caryophyllales	Amaranthaceae	*Alternanthera philoxeroides*	Alligator weed
Ericales	Primulaceae	*Ardisia crenata*	Coral ardisia
Ericales	Pentaphylacaceae	*Ternstroemia gymnanthera*	Japanese cleyera
Solanales	Solanaceae	*Solanum sisymbriifolium*	Sticky nightshade
Solanales	Solanaceae	*Solanum viarum*	Tropical soda apple

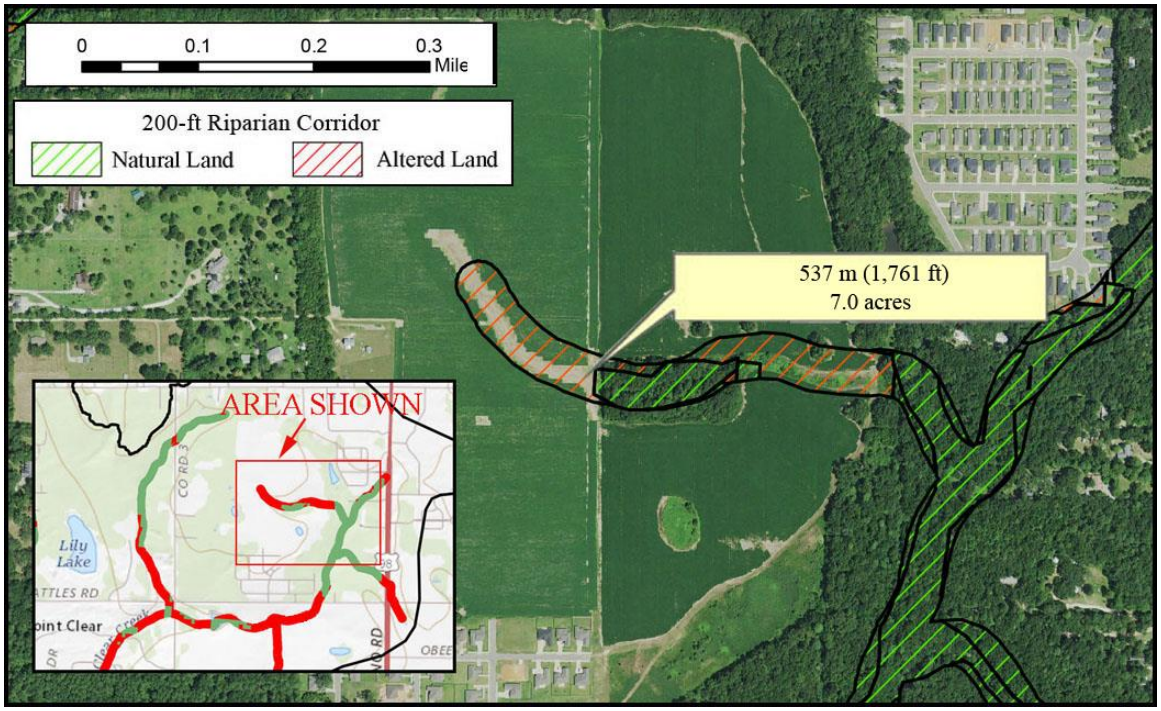
Order	Family	Species Name	Common Name
Lamiales	Oleaceae	*Ligustrum japonicum*	Japanese privet
Lamiales	Oleaceae	*Ligustrum lucidum*	Glossy privet
Lamiales	Oleaceae	*Ligustrum sinense*	Chinese privet
Lamiales	Lamiaceae	*Cantinoa mutabilis*	Tropical bushmint
Lamiales	Lamiaceae	*Clerodendrum bungei*	Rose glory bower
Lamiales	Lamiaceae	*Stachys floridana*	Florida hedge nettle
Asterales	Asteraceae	*Sphagneticola trilobata*	Bay Biscayne creeping oxeye
Dipsacales	Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle

Appendix H

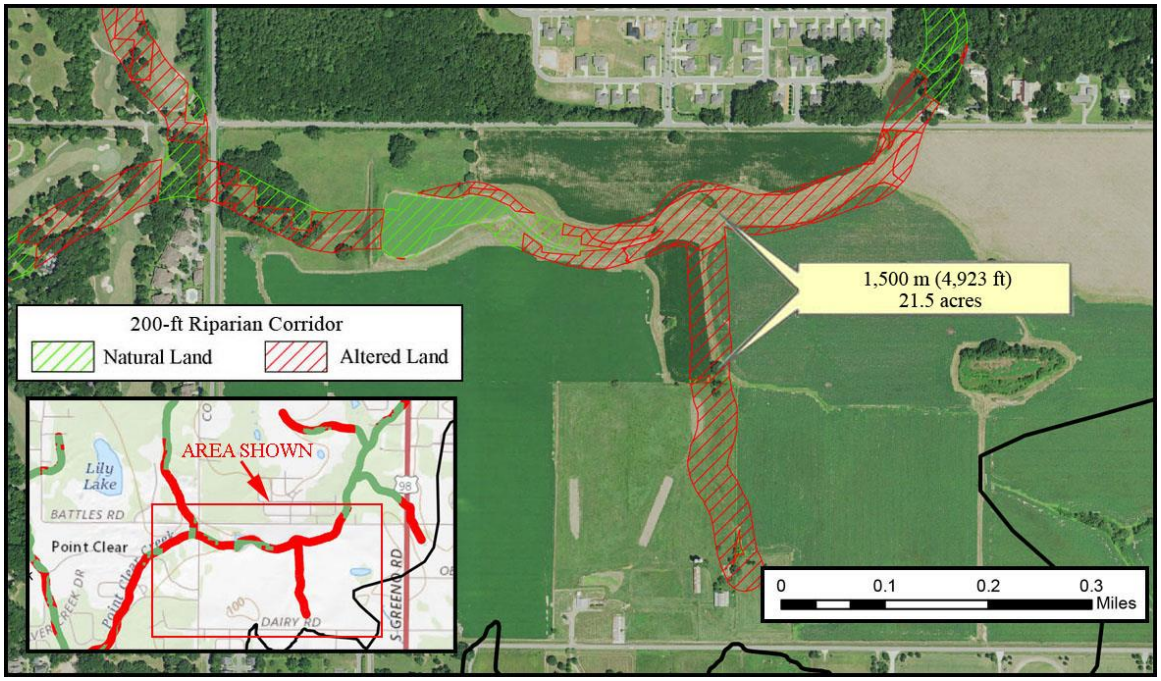
Potential Riparian Buffer Restoration Site Maps



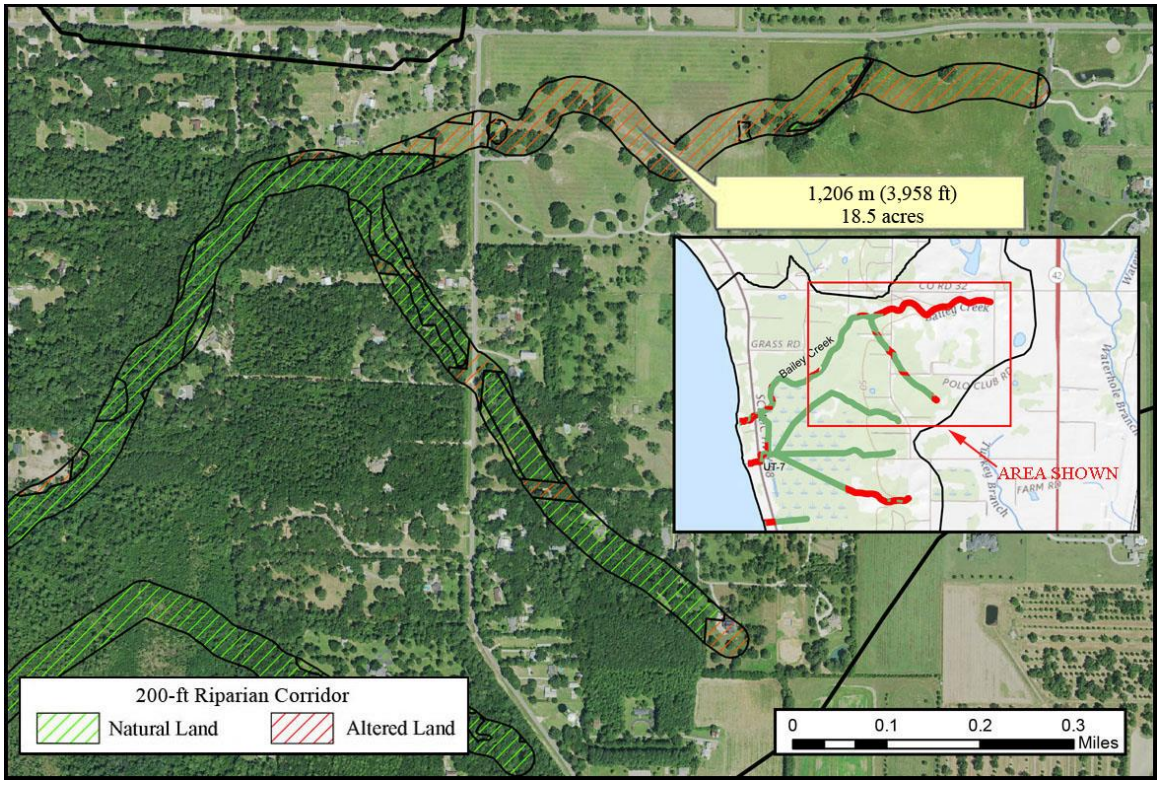
Fly Creek RB1 and RB2



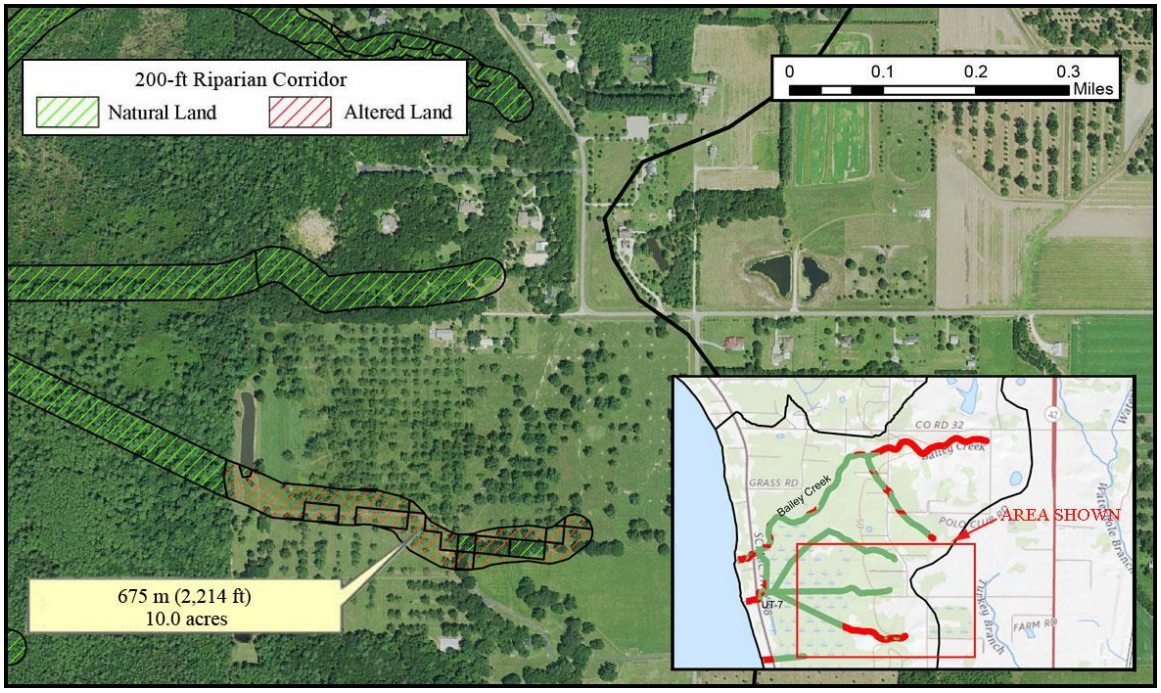
Point Clear Creek RB1



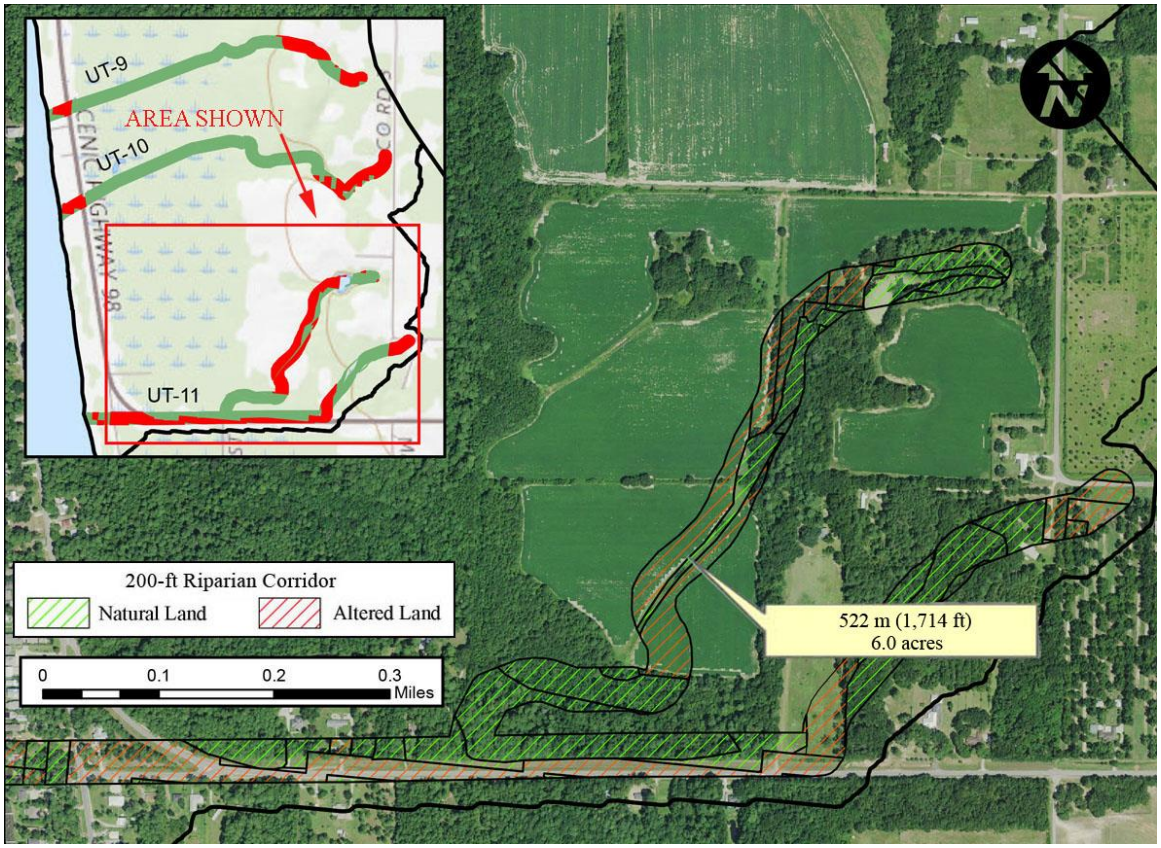
Point Clear Creek RB2



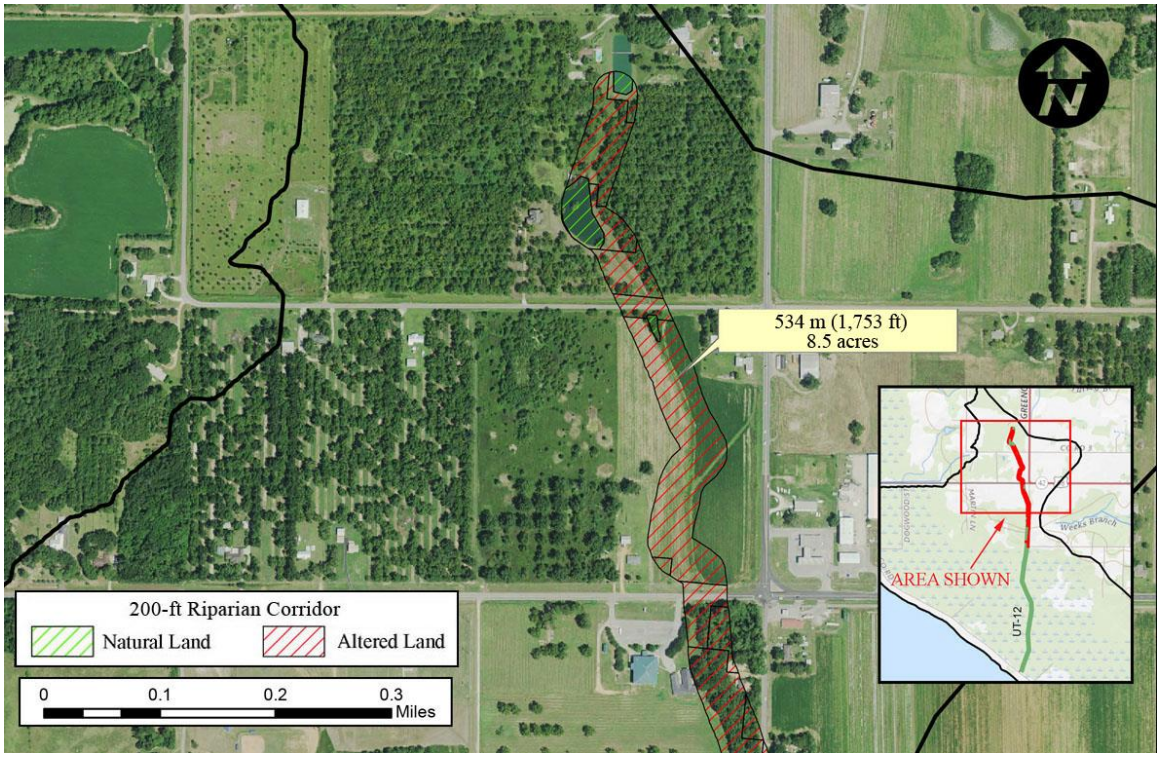
Bailey Creek RB1



UT7 RB1



UT11 RB1


534 m (1,753 ft)
8.5 acres
200-ft Riparian Corridor
Natural Land
Altered Land
0
0.1
0.2
0.3
Miles
AREA SHOWN
UT-12
Weeks Branch

UT12 RB1

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Appendix I

Priority Parcels for Acquisition/Conservation

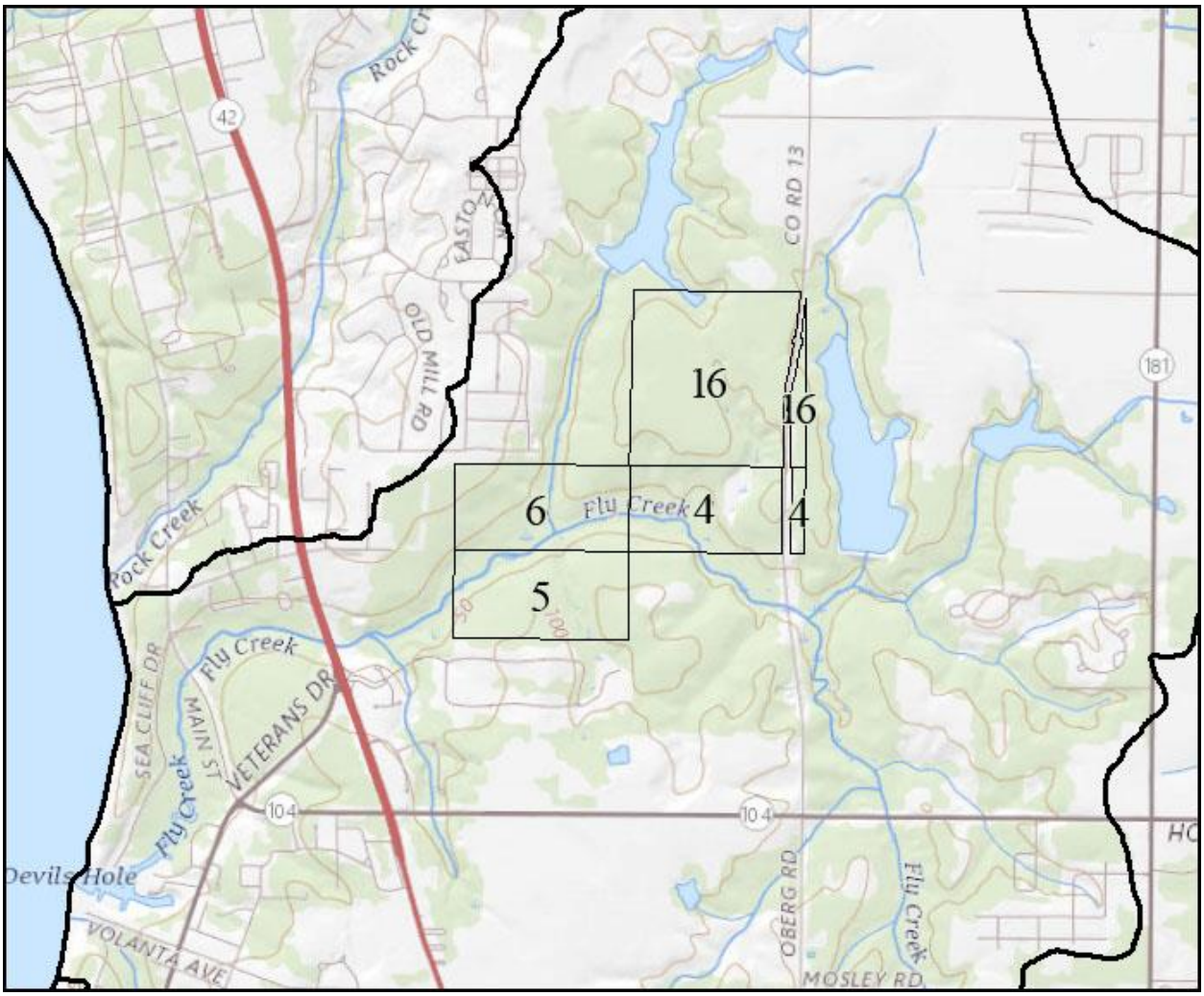
Appendix I

Priority Parcels for Acquisition/Conservation

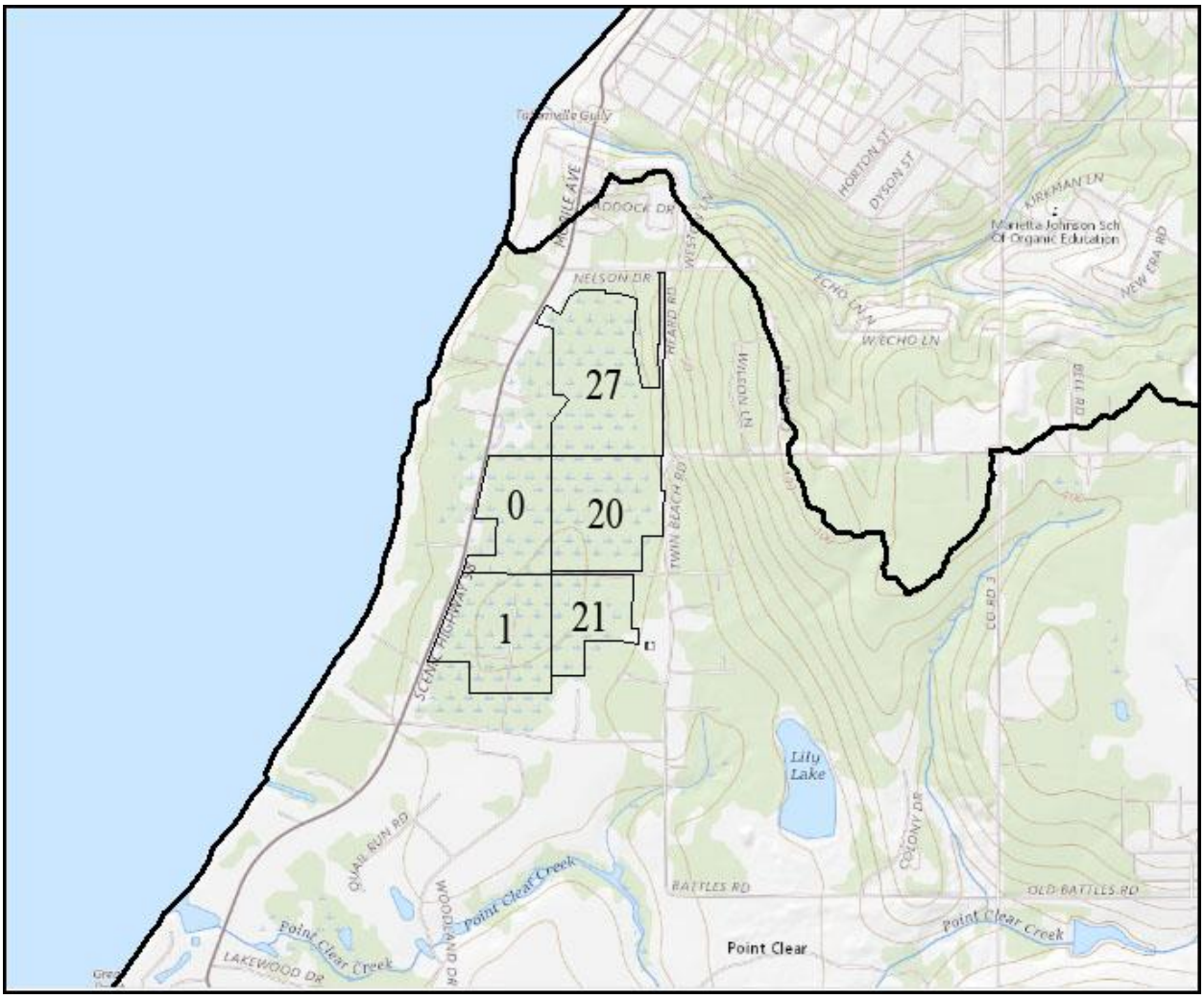
Map ID	Pin	Owner	Owner Address	City	State	Zip	Total Acres	Wetland Acres
0	2334	Pitman Properties LLC	18923 Scenic Hwy 98	Fairhope	AL	36533	25.7	24.2
1	2335	Pitman Properties LLC	18923 Scenic Hwy 98	Fairhope	AL	36533	39.0	38.2
2	7815	Hand, Stephen J et al Hand, Joseph H	4508 Kingsway	Mobile	AL	36608	23.8	23.7
3	7815	Hand, Stephen J et al Hand, Joseph H	4508 Kingsway	Mobile	AL	36608	14.9	14.8
4	8603	AIC Jr Land AI Corte III Family Limit	23100 St Hwy 181	Fairhope	AL	36532	75.4	17.7
5	8618	Corte, Fred L	P O Box 1156	Fairhope	AL	36533	80.8	9.2
6	8619	Corte, Fred L	P O Box 1156	Fairhope	AL	36533	79.4	17.1
7	8807	Olan, Javier et al Olan, Candese M	16335 Holbrook Ct	Fairhope	AL	36532	4.6	4.5
8	13452	Honahlee LLC	18300 Scenic Hwy 98	Fairhope	AL	36532	37.5	25.4
9	13822	Ford, Mike	P O Box 384	Fairhope	AL	36533	85.6	85.5
10	16635	Godard, C G III et al Godard, Mary G	214 Orleans Dr	Fairhope	AL	36532	20.3	19.9
11	20892	Wirtes, David G Jr	1601 Dauphin St	Mobile	AL	36662	8.1	7.3
12	21156	Cowles, Gary D E et al Cowles, Joan C	12593 Co Rd 1	Fairhope	AL	36532	16.9	16.4
13	21766	Jackson, Theodore K III (1/2 Int) et al	P O Box 737	Point Clear	AL	36564	21.6	21.6
14	26931	Regions Bank as Trustee Under Agreement	C/O Harding & Carbone	Houston	TX	77008	75.9	36.6
15	29121	Meaher, Augustine IV Trustee For Augusti	P O Box 321	Point Clear	AL	36564	16.0	12.8
16	35330	AIC Jr Land Del A Corte Family Limited P	23100 St Hwy 181	Fairhope	AL	36532	154.2	3.9
17	40412	Steadman, Charles B Jr	3351 Sheringham Dr	Mobile	AL	36609	4.0	3.9
18	43359	Turnbull, John Howard O'Brien Exec of La	P O Box 2551	Baton Rouge	LA	70821	34.2	34.1
19	47842	Spottswood, John S Jr	P O Box 461	Point Clear	AL	36564	13.5	13.5
20	63312	Bluff Springs Land Company LLC, The	Attn: Robert Sean Coley	Daphne	AL	36526	39.6	37.4
21	63312	Bluff Springs Land Company LLC, The	Attn: Robert Sean Coley	Daphne	AL	36526	22.0	20.2
22	65941	Jackson, Theodore K III (1\2 Int) et al	P O Box 737	Point Clear	AL	36564	5.3	5.3
23	67798	Maury, James L	P O Box 1699	Tybee Island	GA	31328	40.0	39.2
24	68031	Meaher, Augustine IV Trustee For Augusti	P O Box 321	Point Clear	AL	36564	5.3	5.3
25	68495	Nelson, Glenda Johnson et al Nelson, Malc	C/O Malcolm Nelson	Daphne	AL	36526	9.9	9.3
26	68638	Oil Industry Lessors, Inc	P O Box 2551	Baton Rouge	LA	70821	29.7	28.8
27	69539	Breland, Charles K Jr	P O Box 7430	Spanish Fort	AL	36577	51.7	46.7
28	71680	Wirtes, David G Jr	P O Box 66705	Mobile	AL	36660	10.9	10.6
29	71898	Wirtes, David G Jr	P O Box 66705	Mobile	AL	36660	41.3	41.3
30	72072	Turnbull, John Howard O'Brien Exec Of La	P O Box 2551	Baton Rouge	LA	70821	29.2	29.1

31	72074	Turnbull, John Howard O'Brien Exec Of La	P O Box 2551	Baton Rouge	LA	70821	14.1	14.0
32	72075	Turnbull, John Howard O'Brien Exec Of La	P O Box 2551	Baton Rouge	LA	70821	39.7	39.6
33	98505	Simmons, William H Jr Etux Deborah K	120 Fairhope Ave	Fairhope	AL	36532	41.0	39.8
34	98648	Godard, William J Et ux Sally P	503 N Mobile St	Fairhope	AL	36532	22.6	22.6
35	119510	Hand, Joseph Henry Sr Et al Hand, Nancy V	4508 Kingsway Ct	Mobile	AL	36608	5.6	5.5
36	379017	Turnbull, John Howard O'Brien Exec Of La	P O Box 2551	Baton Rouge	LA	70821	46.5	46.5
37	72071	Turnbull, John Howard O'Brien Exec Of La	P O Box 2551	Baton Rouge	LA	70821	11.9	11.5
38	43356	Turnbull, John Howard O'Brien Exec Of La	P O Box 2551	Baton Rouge	LA	70821	14.6	14.5
39	40837	Taylor, Alice Lynn Harper	22915 Main St	Fairhope	AL	36532	23.0	22.8
40	59918	Cope, R E L III et ux Catherine	C/O Wilson Price	Montgomery	AL	36109	9.3	6.6
41	43357	Turnbull, John Howard O'Brien Exec of La	P O Box 2551	Baton Rouge	LA	70821	25.4	25.4
42	222249	Crutcher, William H et al Crutcher, Claud	15204 Scenic Hwy 98	Fairhope	AL	36532	12.6	11.7
43	16097	Thomas, Hollie Marie	12523 Co Rd 1	Fairhope	AL	36532	10.1	10.1

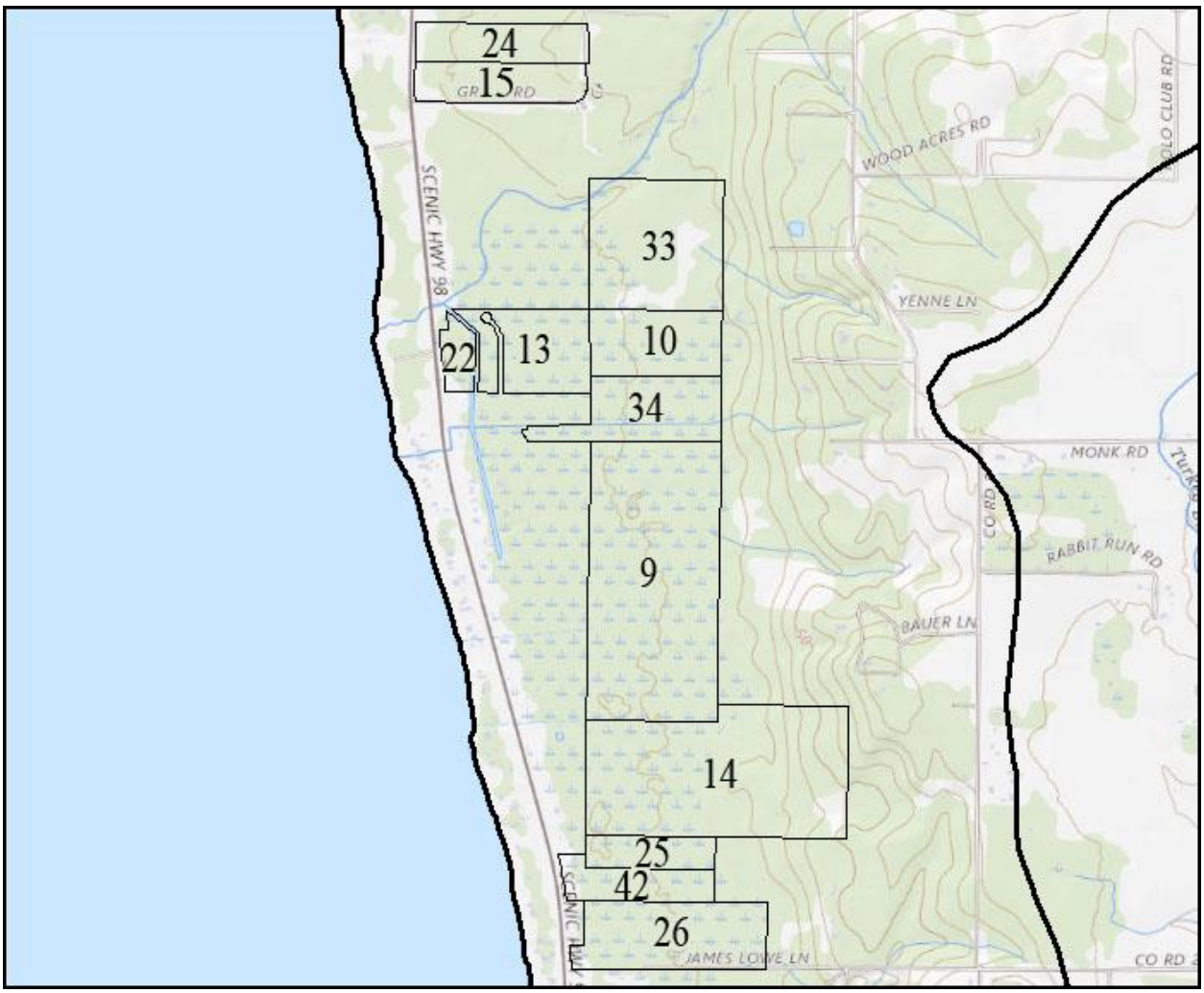
Parcel ID Maps



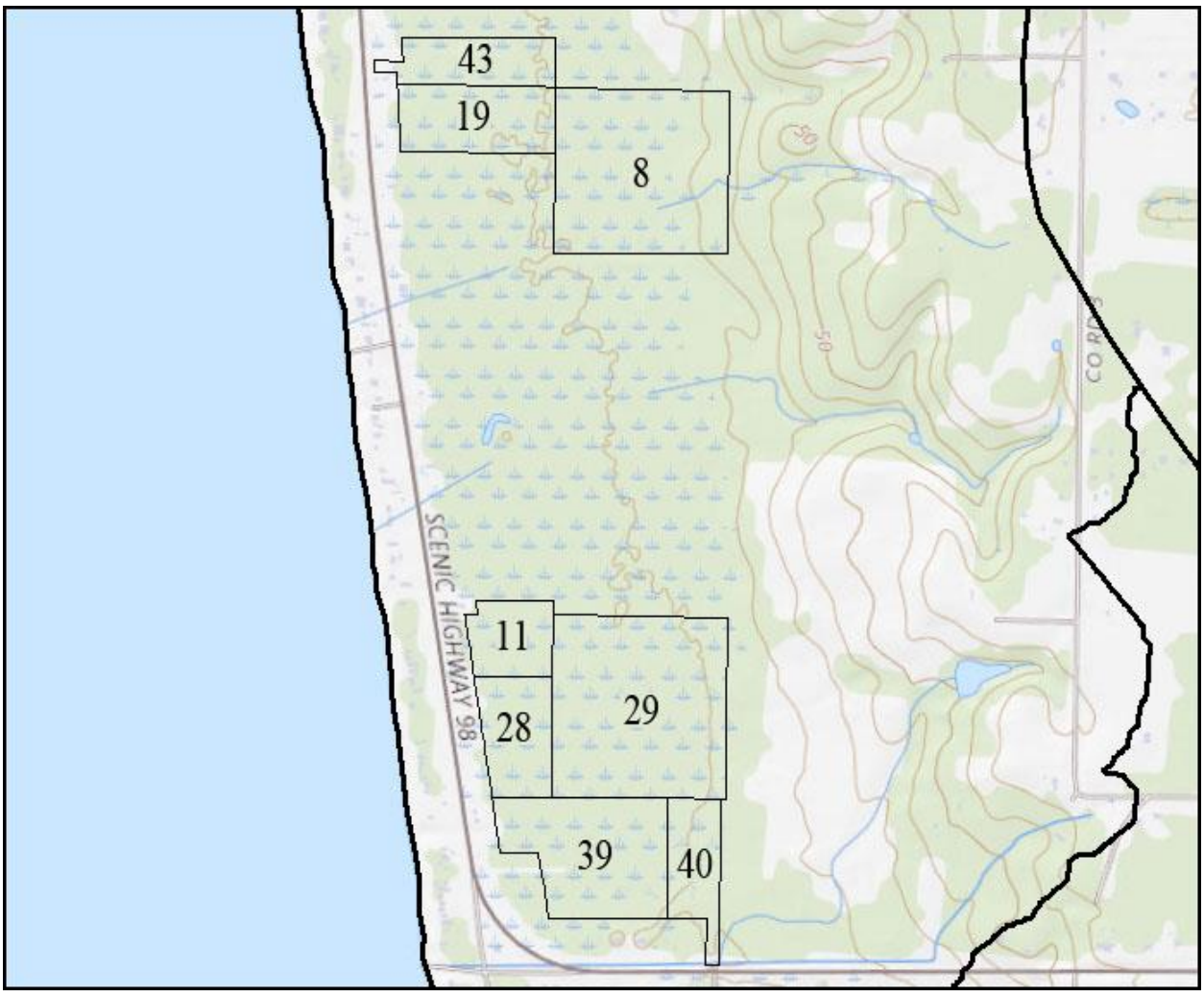
Fly Creek - UT4 Subwatershed



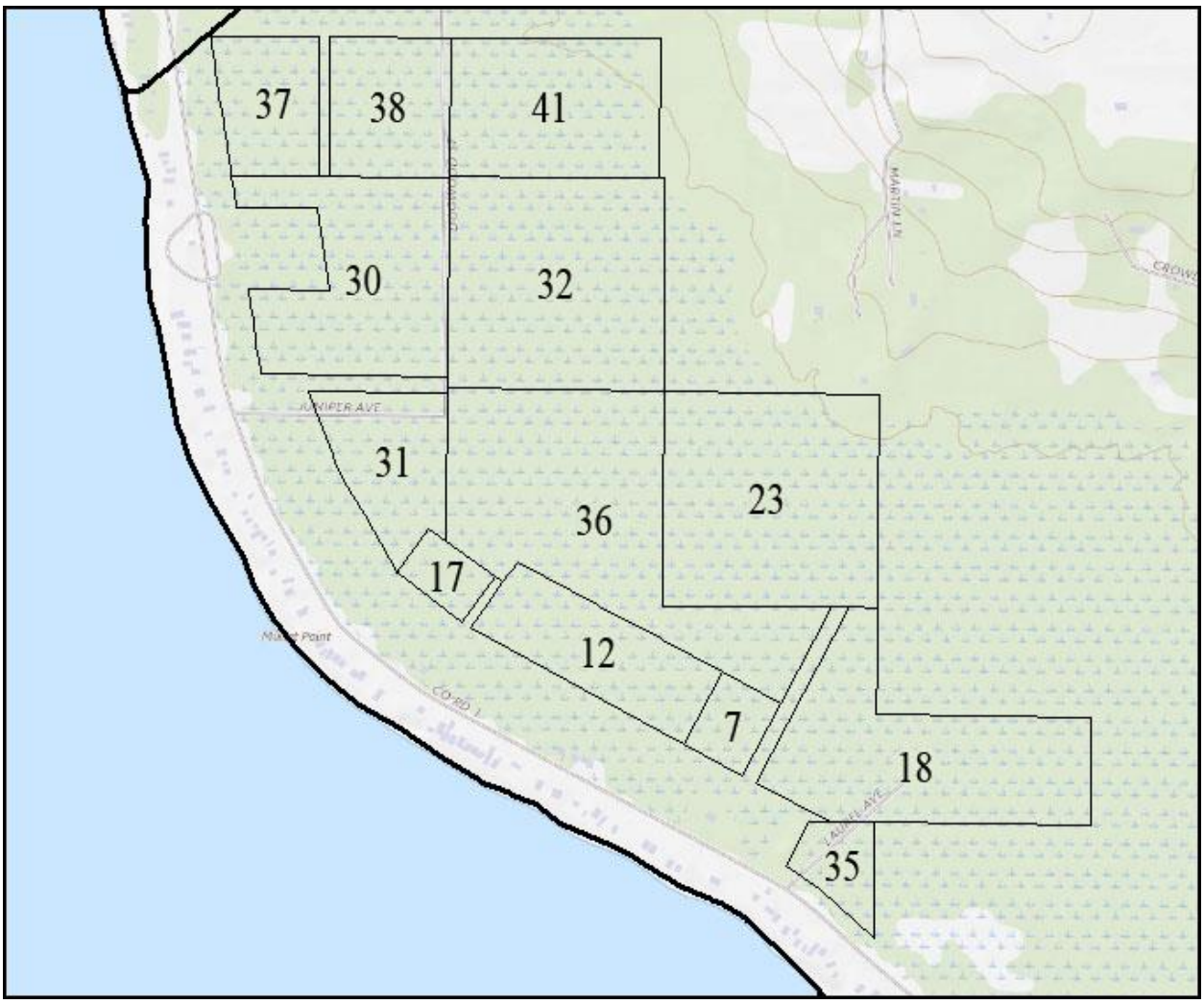
Point Clear Creek Subwatershed



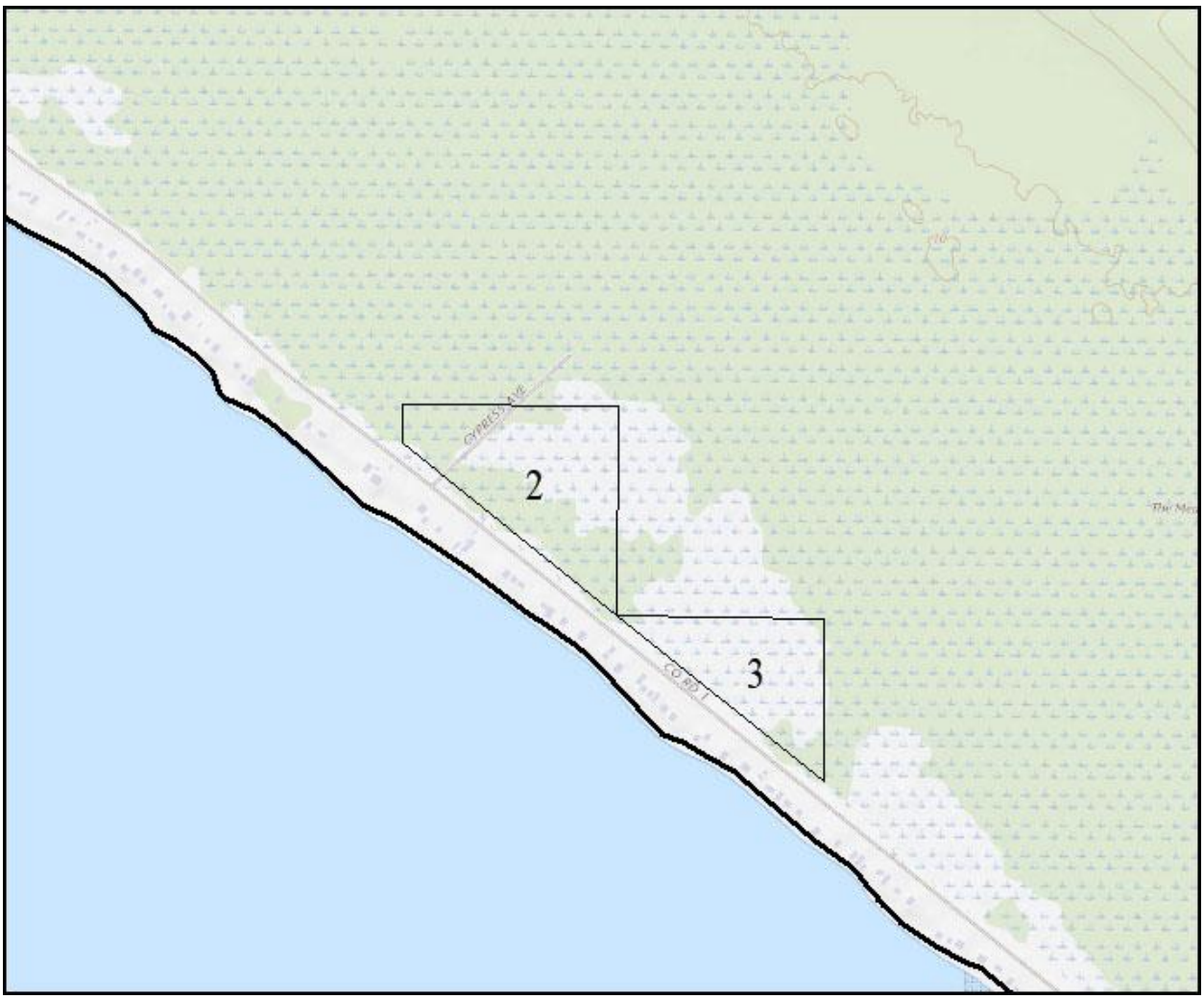
Bailey Creek Subwatershed North



Bailey Creek Subwatershed South



UT12 Subwatershed North



UT12 Subwatershed South

APPENDIX J

Stormwater Wet Pond and Wetland Management Guidebook
U.S. EPA

Stormwater Wet Pond and Wetland Management Guidebook

EPA 833-B-09-001 | February 2009

STORMWATER WET POND AND WETLAND MANAGEMENT GUIDEBOOK

Based on material originally produced by:

Center for Watershed Protection
8390 Main Street, Second Floor
Ellicott City, MD 21043
www.cwp.org
www.stormwatercenter.net

With assistance from:

Tetra Tech, Inc.
10306 Eaton Place
Suite 340
Fairfax, VA 22030

Under:
EPA Contract 68-C-99-253

Revised by EPA
February 2009

Table of Contents

LIST OF TABLES

Introduction

Prior to 1991, a relatively small number of states and municipalities had formal programs in place requiring that Best Management Practices (BMPs) be constructed to mitigate runoff pollution. Then, beginning in the early 1990's with the advent of Phase I of the federal National Pollutant Discharge Elimination System (NPDES) stormwater program, many additional municipalities began programs to limit stormwater pollution. These programs typically include the installation of public and private wet ponds and wetlands as tools to help control runoff volume and mitigate pollution from runoff and, as a result, many of these BMPs have been constructed throughout the United States. Unfortunately, the push to construct them has been substantially stronger than the push to actively maintain them.

The current federal stormwater regulations (e.g., Phase I and Phase II NPDES rules) require permitting authorities and permittees to address BMP operation, maintenance, and retrofit as a major programmatic component. In addition, as we learn more about the limitations and challenges inherent in these types of "one size fits all" approaches to stormwater management, retrofit opportunities are being considered and implemented across the country in order to better address water quality issues, aesthetics, and the maintenance of existing hydrology.

For more information regarding retrofitting BMPs, see the *Urban Subwatershed Restoration Manual No. 3: Urban Stormwater Retrofit Practices Manual* 1.0 (Schueler, 2007) available at www.cwp.org.

The primary audience for this Guidebook is Phase I and Phase II NPDES communities. For Phase I communities that may have a maintenance program in place, this Guidebook provides technical data and information to help improve existing design standards or inspection and maintenance standards. The Guidebook provides a technical resource for both Phase I and Phase II NPDES communities. This Guidebook provides the inspector, program manager, designer, and owner (i.e., responsible party) with an understanding of common stormwater pond and wetland maintenance problems and possible solutions. None of the maintenance solutions mentioned in this Guidebook are required by federal regulations, but they are meant to help those involved in maintaining these BMPs.

This Guidebook has been developed expressly to assist communities in developing an integrated stormwater management system which includes proper maintenance of existing wet ponds and wetlands, the exploration of retrofit opportunities, as well as the implementation of micro-treatment practices and low impact development design principles. A set of web-based tools was produced to accompany the Guidebook and can be found on the Stormwater Manager's Resource Center (SMRC) website (www.stormwatercenter.net, click on Program Resources then STP Maintenance).

This Guidebook does not address the maintenance needs of dry ponds or underground detention. These practices are not widely recommended as stand alone practices that provide water quality and water quantity benefits. Dry ponds, however, exist in many communities, as flood control facilities, and many of the maintenance considerations for stormwater ponds and wetlands presented in this Guidebook are relevant to dry ponds.

Terminology

Stormwater management terminology is often confusing and can convey multiple meanings. This Guidebook uses several terms throughout the text that merit upfront explanation and definition to provide the reader with a foundation for the understanding the context of the subsequent text.

Barrel – The closed conduit used to convey water under or through an embankment: part of the principal spillway.

Channel Protection Volume (Cp_v) – Storage volume for the control of downstream channel erosion.

Emergency Spillway – A dam spillway designed and constructed to discharge flow in excess of the principal spillway design discharge.

Extended Detention (ED) – Design feature that provides for the gradual release of a volume of water to increase settling of pollutants and protect downstream channels from frequent storm events.

Forebay – Additional storage space located near a stormwater practice inlet that serves to trap incoming coarse sediments before they accumulate in the main treatment area.

Micropool – Small permanent pool used to avoid resuspension of particles and minimize impact to adjacent natural features.

Overbank Flood Control, (i.e., Peak Discharge Protection Volume (Q_p) – Storage volume needed to control the magnitude of flows associated with larger, out of bank flooding events (e.g., 10-year return frequency storm events).

Permanent Pool – Open area of water impounded by a dam, embankment or berm, designed to retain water at all times.

Pond Drain – A pipe or other structure used to drain a permanent pool within a specified time period.

Principal Spillway – The primary pipe or weir that carries baseflow and storm flow through the embankment.

Riser – A vertical pipe which extends from the bottom of a pond stormwater practice and houses the control devices (weirs/orifices) to achieve the discharge rates for specified designs.

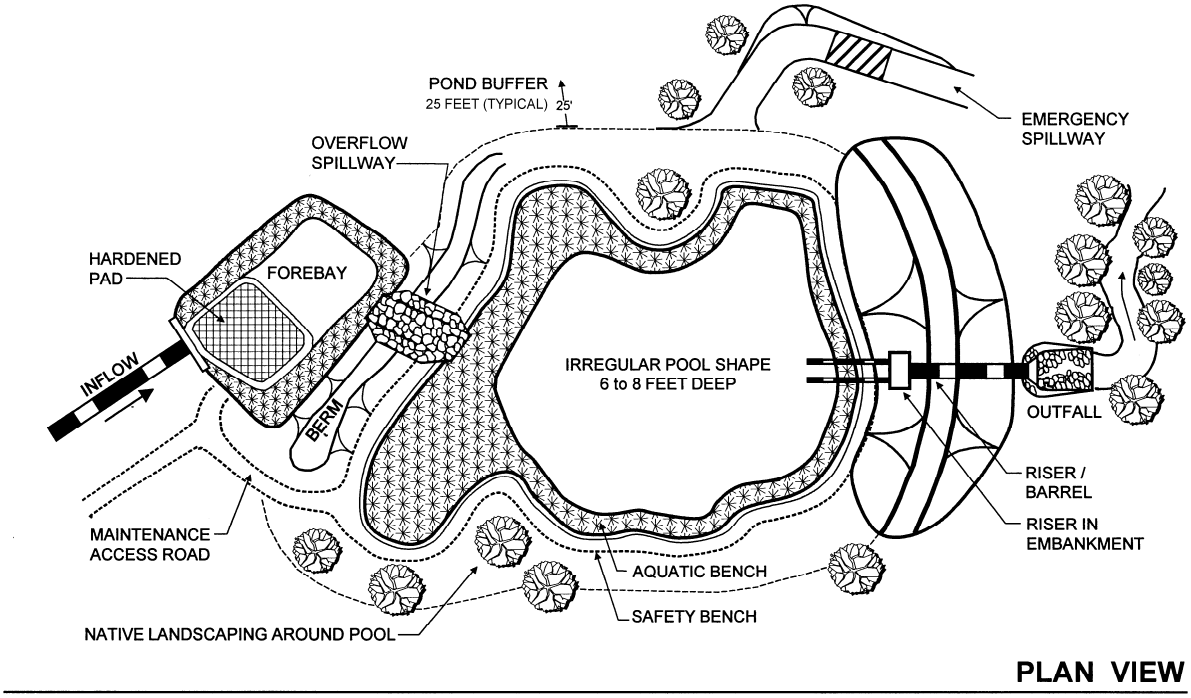
Shallow Marsh – Human-made wetland with water depths ranging from <6” to 18”, planted with native wetland vegetation.

Stormwater Ponds (Figure A) – practices with a permanent pool, or a combination of extended detention (ED) or shallow marsh with a permanent pool that provides storage equivalent to the entire Water Quality Volume (WQv). Stormwater ponds may also provide channel protection storage volume (Cpv) and overbank flood control (Qp) through stormwater detention above the WQv storage. Pond design variants include micropool ED ponds, wet ponds, wet ED ponds, and multiple pond systems.

Stormwater wetlands (Figure B) – shallow marsh areas that treat urban stormwater, and often incorporate small permanent pools and/or extended detention storage to achieve the full WQv. Stormwater wetlands may also provide peak discharge control (Qp) and channel protection storage volume (Cpv) through

stormwater detention above the WQv storage. Wetland design variants include shallow marsh, ED/shallow marsh, and shallow marsh/wet pond.

Water Quality Volume (WQ_v) – Storage volume needed to capture and treat runoff associated with smaller, frequently occurring storms (e.g., 0.5" – 1" rainfall depth).



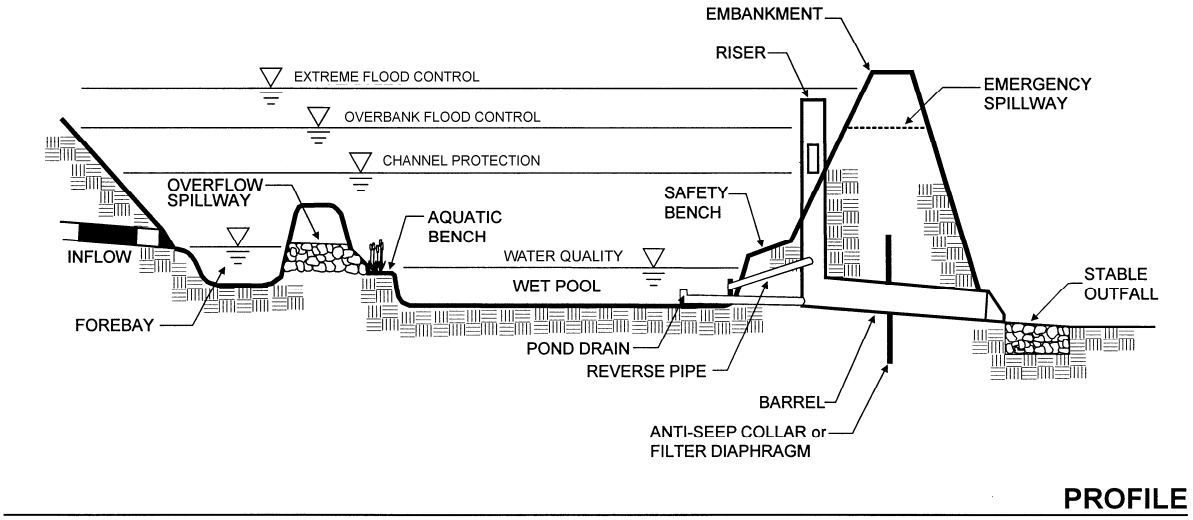
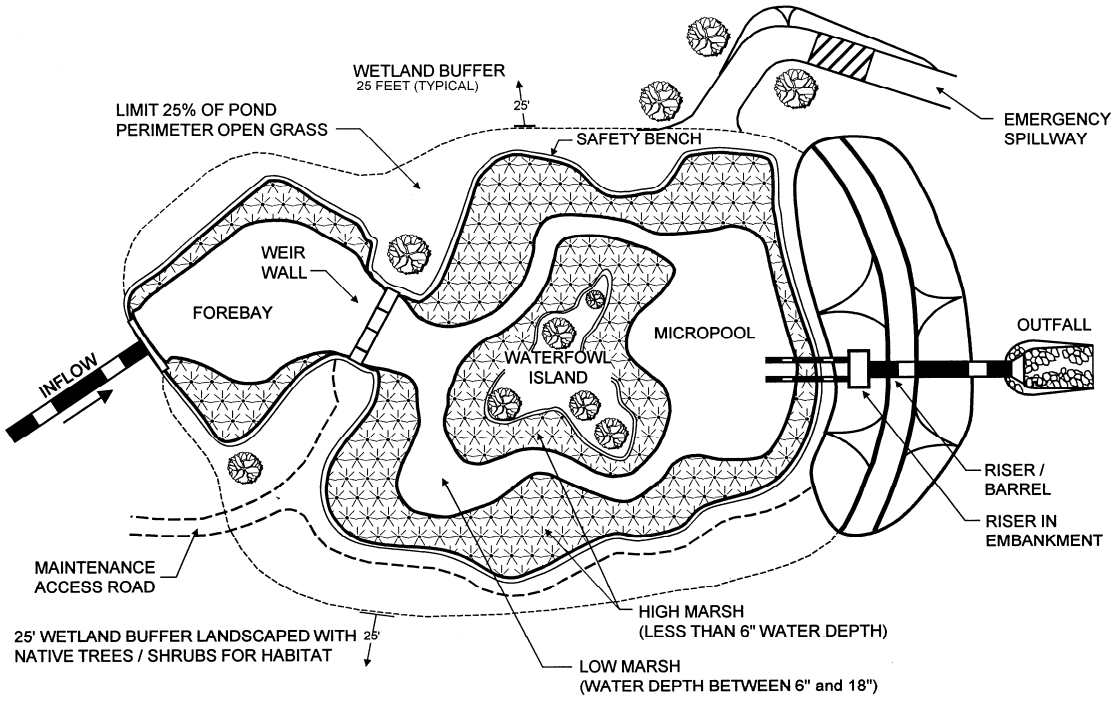


Figure A: Stormwater Pond Schematic



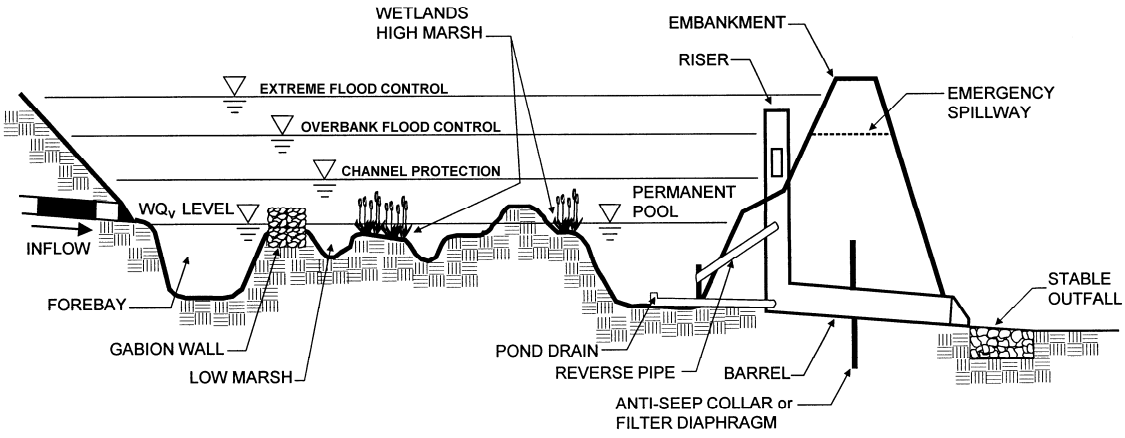


Figure B: Stormwater Wetland Schematic

Section 1: Wet Pond and Wetland Challenges and Opportunities

Challenges

Water Quality Impacts

Stormwater ponds and wetlands are designed and constructed to contain and/or filter pollutants that flush off of the landscape. Without proper maintenance, nutrients such as nitrogen and phosphorus that are typically found in stormwater runoff can accumulate in stormwater ponds and wetlands leading to degraded conditions such as low dissolved oxygen, algae blooms, unsightly conditions and odors. Homeowners adjacent to stormwater ponds and wetlands sometimes complain about these issues. When nutrient concentrations exceed certain thresholds, the trophic state of the system can change. These excess nutrients are often the result of human actions. For example, the amount of fertilizer applied to lawns or the method for disposing of leaves and yard waste in residential and other developed land uses can affect nutrient loads delivered to ponds and wetlands. Excess sediment from the watershed above can also accumulate in wet ponds and wetlands. This sediment can smother the vegetation and clog any filtering structures in the BMPs thereby impacting the overall water quality effectiveness of the stormwater BMP. In addition, standing water in ponds can heat up during the summer months. This warmer water is later released into neighboring waters.

Without proper maintenance, excess pollutants in ponds and wetlands may actually become sources of water quality issues such as poor water color/clarity/odor, low dissolved oxygen leading to plant die off, and prevalence of algal blooms. When these stormwater BMPs are "flushed" during a large rain event, the excess nutrients causing these problems may be transferred to the receiving waterbody.

Habitat Impacts

The placement of ponds or wetlands, especially large regional facilities, in low-lying areas may harm natural wetlands or existing riparian habitats. Siting ponds or other structural management practices within natural buffer areas and wetlands degrades their functions and may interrupt surface water and ground water flow when soils are disturbed for installation. In addition, during large rain events, breaches of large wet ponds can cause downstream erosion and degradation due to high volumes and velocity of the discharge (EPA, 2005b).

Health and Safety Issues

Waterfowl

Geese and mallards may become undesirable year-round residents of a pond or wetland if structural complexity is not included in the pond design (i.e., features that limit large contiguous open water areas and open short grass loafing areas favored by these birds). Waterfowl that reside in vast numbers eat available grasses and emergent plants. Water quality in permanent pools often becomes degraded due to increased fecal coliform counts and nutrients from geese and duck droppings. Geese behavior can also be noisy during breeding seasons.

Mosquitoes

The public's concern that stormwater ponds and stormwater wetlands generate large mosquito populations rivals their concern that good water quality be maintained. Sometimes the public will be correct in assuming that the source of local mosquitoes is a nearby pond or stormwater wetland. At other times, however, the problem may come from other sources or breeding habitats (either nearby or remote), and at times it may be a combination of both. Regardless, stormwater managers will have to deal with the public's perceptions concerning the origins of problematic numbers of mosquitoes. Stormwater managers should consider all possible locations that could be contributing to mosquito outbreaks. Mosquito population control also factors into many community health issues such as West Nile Virus.

The proliferation of mosquitoes is usually an early indication that there is a maintenance problem. Mosquitoes reproduce by laying eggs in still pools of water or on mud or fallen leaves. A few inches of standing water such as found in dry pond depressions, voids in riprap linings, or other inconspicuous places can become mosquito-breeding areas. It is possible for mosquitoes to complete their life cycle in 7 to 10 days, with approximately half being spent in the aquatic stage. Therefore if a shallow pool is stagnant for only 4 to 5 days and no predator habitat is available, one generation of mosquitoes can be bred.

Children's Safety Issues

Standing water in permanent pools often causes public concern for children playing in and around the wet ponds. Depending upon the design of the structure, the banks could be steeply sloped which could increase the likelihood of children falling in. Often, fences or other impediments are required in order to deny access and this often reduces the aesthetic qualities of the structures.

Aesthetics

Research has shown that stormwater ponds can increase property values. A survey in Columbia, Maryland, found that 75 percent of homeowners felt that permanent bodies of water such as stormwater ponds added to real estate values. Seventy-three percent were willing to pay more for property located in a neighborhood with stormwater control basins designed to enhance fish or wildlife uses (Adams et al., 1984; Tourbier and Westmacott, 1992; USEPA, 1995). Residents of a Champaign-Urbana, Illinois neighborhood with stormwater ponds stated that lots adjacent to a wet pond were worth an average of 21.9 percent more than comparable non-adjacent lots in the same subdivision. The same survey revealed that 82 percent would in the future be willing to pay a premium for a lot adjacent to a wet pond (Emmerling-DiNovo, 1995). In Alexandria, Virginia, condominiums alongside a 14-acre runoff detention pond sold for $7,500 more than comparable units not adjacent to the pond (USEPA, 1995).

Like wet ponds, wetlands can increase adjacent property values. One study in Boulder, Colorado, found that lots located alongside a constructed wetland sold for up to a 30 percent premium over lots with no water view (USEPA, 1995). In Wichita, Kansas, a developer enhanced existing wetlands rather than filling them and the waterfront lots sell for a premium of up to 150 percent of comparable lots (USEPA, 1995).

However, inherent in these findings is the assumption that the ponds are designed for aesthetic appeal and are maintained as necessary to function properly as a water quality structure and a neighborhood amenity. If the commitment by the owner to maintain the structure is not solid and long-term, however, the structure can quickly become an eyesore and a blight in the neighborhood (USEPA, 2005b).

Maintenance Problems

Maintenance is necessary for a stormwater pond or wetland to operate as designed on a long-term basis. The pollutant removal, channel protection, and flood control capabilities of ponds and wetlands will decrease if:

- Sediment accumulates reducing the storage volume,
- Debris blocks the outlet structure,
- Pipes or the riser are damaged,
- Invasive plants take over and out-compete the planted vegetation,
- Slope stabilizing vegetation is lost, or
- The structural integrity of the embankment, weir, or riser is compromised.

Pond and wetland maintenance activities range in terms of the level of effort and expertise required to perform them. Routine pond and wetland maintenance, such as mowing and removing debris or trash, is needed multiple times each year, but can be performed by citizen volunteers. More significant maintenance such as removing accumulated sediment is needed less frequently, but requires more skilled labor and special equipment. Inspection and repair of critical structural features such as embankments and risers, needs to be performed by a qualified professional (e.g., structural engineer) who has experience in the construction, inspection, and repair of these features.

This Guidebook identifies appropriate frequencies and skill levels needed for each maintenance activity to provide program managers and responsible parties with an understanding of the relative effort and expertise that may be required.

Program managers and responsible parties need to recognize and understand that neglecting routine maintenance and inspection can lead to more serious problems that threaten public safety, impact water quality, and require more expensive corrective actions. Appendix A of this Guidebook provides program managers with specific maintenance activity unit cost and frequency information.

It should be noted that structural stability issues associated with embankments and pipes (e.g., earth, concrete and metal repairs) are not addressed in the Guidebook. While earth, concrete and metal repairs are essential elements of stormwater pond and wetland maintenance, the assessment and design for repair of such items should be performed by a qualified structural or geotechnical engineer and are beyond the scope of this document. Where applicable, the importance of conducting a more thorough inspection of structural stability is called out in this Guidebook. More detailed guidance on structural inspections and repairs for ponds and wetlands can frequently be obtained from state dam safety agencies or local Natural Resources Conservation Service (NRCS) offices.

Permanent Pool

For stormwater ponds and wetlands, a common maintenance issue is abnormally high or low permanent pool levels. Permanent pools are normally designed for a stable water surface elevation between storm events that will rise during and shortly after a significant rain event. Pond elevations should not dip appreciably below the specified level unless under extreme conditions, such as drought. Ponds used as an alternative water supply for irrigation or other reuse options are also an exception.

Permanent Pools Too Low

Permanent pools provide functions including aquatic habitat, water quality protection, and visual aesthetics. When pool levels drop too low, water quality is threatened by algal blooms and anoxic conditions, which can lead to fish kills and plant stress that in turn can undesirably reduce predation on mosquito larvae.

Pond and wetland facilities should keep their permanent pools at or near the elevation of the low flow orifice or weir. Low permanent pools that are not drought-induced are usually caused by leaks either (1) in the pond embankment/perimeter, (2) in the principal spillway, or (3) in the pond bottom.

Leaks within the facility embankment or through the bottom of the pond are often difficult to locate unless they are large or severe. Active dam leaks often produce a vortex, an unmistakable indication of a leak. Water may leak through sinkholes formed in pond bottoms or infiltrate through porous underlying soils.

Leaks in the principal spillway riser are fairly easy to spot. Leaks in the barrel are harder to locate, as they require either manual entry or remote TV inspection. Broken or missing valves can also lead toward abnormally low water levels in ponds.

If the permanent pool becomes low during or immediately following construction, it can be a sign of poorly compacted berms or dams or damaged or leaking barrels and risers. All of these features should be inspected during and immediately following construction. A low pool may also signify that the water budget was miscalculated during design.

Permanent Pools Too High

A clogged low flow orifice is the most common reason for a higher than normal permanent pool level (Figure 1.1). Clogging is discussed in detail in the next section.

Figure 1.1: Abnormally high permanent pool – Water spills into 2- year weir because beavers have clogged the low flow orifice.

The high permanent pool disrupts the pond or wetland function by:

- Decreasing storage volume thereby reducing the ability to attenuate flood flows.
- Causing the flow velocity leaving the pond or wetland to be greater than the design release rates therefore increasing downstream channel erosion.
- Compromising water quality because runoff short-circuits[1] the pond and enters the downstream channel without adequate residence time for quality treatment.
- Killing riparian trees by flooding their roots which are not normally submerged in the high pool.
- Compromising public access and safety when adjacent pathways and recreational use areas are flooded.
- Saturating areas designed to be outside the permanent pool potentially causing mosquito-breeding habitat to be created. (Basins should be designed so that pooling or ponding of water in isolated peripheral areas does not occur for more than 4 consecutive days.)

[1] Short circuiting is the term used when stormwater runoff residence times in the pond are reduced.

Clogging

Clogged low flow orifices[2] and weirs represent the most frequent, persistent maintenance item common to all types of ponds or wetlands. Serious impacts can easily be minimized through design and retrofit. However, without frequent maintenance, even openings with trash racks can become clogged.

Clogging occurs when debris or sediment accumulates at riser/weir openings or outfalls, blocking the flow of water (Figures 1.2 and 1.3). Debris includes vegetative material such as dead plants, twigs, branches and leaves as well as litter and trash. Large storms can transport large amounts of debris. Vandalism and nuisance problems such as beavers contribute to clogging as well.

Figure 1.2: Flattop riser covered with debris.

Figure 1.3: Riser without trash rack

In addition to the permanent pool fluctuation problems noted above, clogged orifices can cause the following concerns:

- Obscuring the upstream slope of embankments, preventing adequate inspection.
- Blocking low flow openings causing overtopping of the embankment or dam in the event of a flood.
- Blocking underwater spillway inlets such as 'reverse slope' pipes once floating debris becomes waterlogged and sinks.

Pipe Repairs

Pipes and riser structures are designed to convey stormwater safely and at a controlled rate. If pipes or risers are damaged, these functions will be affected. Often, risers are made from the same materials as pipes, and therefore can be treated as such with respect to maintenance and repair.

Pipes through the embankment – the principal spillway and other utilities – are designed to be watertight. If damaged, pipes may leak water into the embankment through holes or separated joints (Figure 1.4). This can lead to piping of water along the pipe, which results in erosion (Figure 1.5) and can lead to embankment failure.

Pipe damage can occur at any point in a pond or wetland lifecycle and can be caused by improper design, poor construction, inadequate maintenance, or wear and tear. While problems with design and

[2] Low flow orifices or openings pass baseflow and control detention time in ponds and wetlands.

Figure 1.4: Pipe invert abrasion

Figure 1.5: Severe erosion around riser and barrel

construction are preventable, wear and tear is a wild card. Extreme storm events, chemical attack, abrasion, or other unforeseen circumstances may challenge the longevity of the design.

Table 1.1 presents mechanisms of pipe failure and the lifecycle point where the failure typically occurs.

Table 1.1: Mechanisms of Pipe Failure			
Mechanism	**Lifecycle Point**		
	Design	**Construction**	**Wear and Tear**
Joint Separation The physical separation of different sections of pipe along the barrel typically caused by differential settlement or improper pipe compaction.	✓	✓	✓
Buoyancy Failure Failure occurs because trapped air in the pipe creates uplift forces. This force can cause the ends of the pipe to bend upward or the entire culvert to be displaced.	✓	✓	
Static and Dynamic Loading Overburdening (placing too much static weight on the pipe) or inappropriate dynamic loading (e.g. driving a heavy piece of equipment over a pipe with insufficient backfill) causes failure.	✓	✓	
Material Compatibility Designs with several pipe materials may not bond well, especially if dissimilar pipe materials are placed in pre-cast forms on holes, and then grouted to be water-tight. Most non-cementatious materials do not bond well to concrete or masonry as these materials tend to shrink over time. It is common to see leaks in the control structures where plastic or steel pipes enter through concrete.	✓	✓	
Installation Technique See Section 2 for description.		✓	
Insufficient Compaction See Section 2 for description.		✓	
Vandalism Acts include filling with rubble and debris and crushing exposed ends of plastic and clay piping.	✓		✓
Corrosion Fatigue Fatigue type cracking of metal caused by repeated or fluctuating stresses in a corrosive environment is characterized by shorter life than would be encountered as a result of either the repeated or fluctuating stress alone or the corrosive environment alone.	✓		✓
U/V Deterioration Plastic piping is susceptible to deterioration from sunlight and even UV resistant material will become brittle and fracture given enough exposure.			✓
Freezing and Cracking Water pockets in the pipes, which are constantly exposed to surface water, freeze and thaw several times each winter, stressing and weakening the pipe.			✓
Internal Corrosion Corrosion that occurs inside a pipe because of the physical, chemical, or biological interactions between the pipe and the water.			✓
Abrasion Deterioration of a surface by the abrasive action of moving fluids - this is accelerated by the presence of solid particles or gas bubbles in suspension			✓

Vegetation Management

Vegetation management involves sustaining the landscaping as designed and preventing the growth of unwanted species. There are three primary types of vegetation that require management and maintenance in stormwater ponds and wetlands: turf and grasses, wetland plantings, and trees and forested areas.

Turf and Grasses

Native and non-native grasses are the most common vegetative stabilization used in stormwater pond and wetland construction today for reasons of aesthetics, ease of maintenance, and price (Figure 1.6). The root system of any vegetative cover holds the surface soil in place and protects the slopes from wind and surface runoff erosion.

A regularly scheduled program of cutting and trimming of grass at facilities during the growing season will help to maintain a tightly knit turf and will also help prevent diseases, pests and the intrusion of weeds.

Figure 1.6: Mowed dry pond bottom

Wetland Plantings

Native wetland plants promote biological uptake of pollutants (Figure 1.7). Though natural propagation is desirable, vegetation will still need to be managed to meet the design goals. Depending on the design of the system, vegetation harvesting[3] and control of aquatic plants (such as cattails and phragmites) may be required.

Trees and Forested Areas

Trees are often planted for aesthetic, stabilization, and temperature control reasons. They have to be maintained to prevent clogging of orifices with debris and the spread to unwanted areas.

Vegetation management is probably the most frequent maintenance activity that occurs in association with the upkeep of stormwater ponds and wetlands. While the activity requires little expertise or special equipment, there are still important site conditions to be aware of in order to maintain a properly functioning stormwater pond or wetland. Examples of common vegetative problems include:

Figure 1.7: Wetland vegetation

- Trees and brush with extensive woody root systems can destabilize dams, embankments, and side slopes due to the creation of seepage routes (Figure 1.8).
- Monolithic stands of cattails (*Typha sp*) and Common Reed (*Phragmites australis*) can take over shallow marsh wetlands and drainage swales, out-competing other useful native emergent plants that would otherwise establish more varied, mature marsh plant ecology. Nuisance aquatic weeds are like any other pest; they are opportunistic and invasive. Small shallow ponds provide optimal conditions for their proliferation.
- Misunderstanding of which areas of a stormwater pond or wetland require mowing or management can lead to under or over management.

[3] Vegetation harvesting is removing vegetation on a routine basis and land applying it in an upland location. The purpose of harvesting is to remove plant material before winter die-off to prevent nutrients from reentering the water column and being flushed downstream.

- Unseen areas may be neglected. For example, the downstream dam face of an embankment is the most commonly neglected and most critical area requiring regular clearing.
- Heavy pedestrian use, particularly along the top of dams and along pond edges can create patches of bare soil.
- Industrial pollutants can cause alteration in the chemical composition and pH of the discharge water, which, in turn, can affect plant growth even when the source of contamination is intermittent. Nutrients increase plant growth and acidic discharges can decrease vegetation.
- Un-maintained vegetation can obscure large portions of the dam, preventing adequate visual inspection and limiting access to the dam and surrounding areas. Access is critical in emergency situations (Figure 1.9).
- Excessive vegetation often provides habitat for rodents and burrowing animals. (See Nuisance and Health Issues.)
- Excessive vegetation can affect the flow rates through earthen spillways.

Figure 1.8: Woody vegetation on embankment

Figure 1.9: Excessive vegetative growth obscures riser

Dredging and Muck Removal

Sediment accumulates in stormwater ponds and wetlands by design and eventually requires removal to maintain efficiency and safety (Figure 1.10). The maintenance interval for removing accumulated sediment will vary based on the design parameters.

Stormwater ponds and wetlands are frequently presumed to be 80% efficient in trapping total suspended solids. Sources of solid and semisolid wastes retained in a pond or wetland include:

- Soil loss from lawns and open areas
- Litter and yard waste
- Sand from winter sanding operations
- Natural leaf litter and down branches
- Grit from roofing shingles
- Atmospheric deposition wash off
- Construction sediments
- Erosion from upstream conveyance swales
- Asphalt grit

As sediment accumulation is expected, stormwater ponds and wetlands should be designed with sediment forebays, pond drains, access for sediment removal, and a designated onsite disposal area. These

Figure 1.10: Sediment accumulation in a dry pond

Figure 1.11: Muck removal and slope dressing by long reach backhoe

considerations will reduce eventual costs of sediment removal, as major cost items in dredging include dewatering, transport of sediment for off-site disposal, re-establishment of wetland communities, and accessing the site (Figure 1.11).

Ease of Access

Access is needed to all parts of the stormwater treatment facility for inspection maintenance. Key access points include:

- Riser structure
- Embankments
- All outfalls and inlets
- Forebays and pond bottoms
- Aerators and electrical panels

Additionally, public access should be limited to only some pond or wetland components to prevent vandalism.

Access for Regular Inspection and Maintenance:
Frequent maintenance items usually involve small pieces of equipment such as mowers and light trucks. Access also involves facilitating inspector access to, into and through a stormwater pond or wetland to note items in need of repair. Figure 1.12 shows good maintenance access to a facility. Critical appurtenances should be easily and safely accessed for inspection and minor maintenance, such as lubricating a pond valve. Access must be provided to inspect for mosquito production and take appropriate actions when necessary. Figure 1.13 shows good manhole access.

Typical problems that impede maintenance access include:

Figure 1.12: Pond with good access to public road.

Figure 1.13: Ladder and steps in riser.

- Inadequate or unsafe ingress to and egress from facility components
- Fencing that does not have gates.
- Pond risers installed without provision for access.
- Manhole blocked by debris.
- Air monitoring results that are unsafe.
- Steps/ladder that are missing, broken, unsecured, non-aligned, or under water.
- Trash racks or valves that are blocking safe access to riser.
- Heavy gratings and hatches
- Corroded locks
- Aerators that require special considerations, such as a boat or manual power disconnections.

Infrequent Maintenance Access

Less frequent maintenance items, such as dredging, will require site access for heavy equipment (e.g. Figure 1.14) including backhoes, dump trucks, and vacuum trucks. Maintaining ingress and egress points for the facility at all times is wise in case emergency repairs are needed. Lack of a permanent access route necessitates the creation of a temporary route (Figure 1.15) which may be disruptive to plant life and community aesthetics.

Figure 1.14: Typical large maintenance equipment.

Access for major repairs is similar to construction access and involves protecting existing trees, pavement, utilities, and signage against damage while accessing the areas needing repair.

Many older stormwater ponds and wetlands do not adequately provide stable access and staging areas for repair equipment. Older facilities typically include a designated ingress point, but they often suffer from one of the following shortfalls:

Figure1.15: Temporary access road widening

- There is no way to safely move equipment over existing curbs and pavement without damage.
- The slope of the access path is too steep, especially if wet.
- The path is not wide enough to accommodate heavy repair equipment.
- The path is overgrown with significant vegetation or has been planted with landscape quality material.
- Smaller structures such as decks and sheds are built in access areas (gardens and dump areas are also common).
- There is no legal access easement allowing for access from a public right-of-way to the facility; this can be a contentious issue if the only practical access is across land not owned by the pond or wetland owner.
- No staging or equipment area is available once heavy equipment is onsite (contractors often need material storage space and a place to securely park heavy equipment overnight).

Vandalism protection:
Vandalism protection involves common sense measures such as chaining and locking mechanical components (valves and security manhole accesses). It also includes the use of well-designed trash racks to discourage vandalism and reduce clogging.

Although there are many passive options to keep people away from a facility, including screening with vegetation and locating the pond or wetland out of eyesight, the most common method of exclusion is fencing. Fences can be damaged by many factors, including vandalism and storm events. Timely repair will maintain the security of the site and reduce potential liability.

Appurtenances should be locked with key locks as opposed to more corrosion-prone combination locks. The design life of the typical lock left exposed to the elements is one to five years. They often become corroded and cannot be opened at time of inspection or maintenance. Therefore this often requires that the chain be cut and a new lock placed. For municipalities, one master key should open all stormwater facility locks to avoid confusion if keys are lost.

Typical locations for locks include the following:

- Chaining all valves with hand wheels
- Sluice gates
- Entrance points through fencing

Damage of Mechanical Components

Pond and wetland mechanical components tend to be simple and few in numbers. They include:

- Valves
- Sluice gates and flap gates
- Anti-vortex devices
- Pumps
- Access hatches
- Aerators (fountains, bubblers, diffusers)
- Electric control panels for aerators

Figure 1.16: Corroded plumbing and valve.

These components should be inspected at least annually and repaired according to manufacturer's recommendations. Mechanical components may be damaged as a result of:

- Clogging
- Sediment accumulation
- Vandalism
- Weathering or corrosion (Figure 1.16)
- Extended use
- Lack of preventative maintenance such as lubrication

Design considerations and preventative maintenance can address most of these issues. Failure to maintain these items could prevent the pond from functioning as designed, cause the problems described in the Clogging and Access sections, or, in the case of aerators, affect water quality.

Nuisance Issues

Rodents usually damage ponds or wetlands through burrowing or dam building. Burrowing may jeopardize embankment stability for dams and berms; beaver dam building reduces live storage and creates clogging problems.

The following animals routinely cause destruction to embankments and berms: groundhogs/woodchucks, muskrats, prairie dogs, badgers, pocket gophers and Richardson ground squirrels. Animal burrows can deteriorate the structural integrity of dams, embankments and slopes (Figure 1.17). Muskrats in particular will burrow tunnels up to 6 inches in diameter.

Figure 1.17: Animal burrow in pond embankment.

Beaver activity in urban areas usually results in tree and vegetation mortality, flooding from dam building that causes water to encroach into unwanted areas, and impairment of stormwater management facilities. Beaver activity can be either an aesthetic issue that detracts from the visual appeal of the community, or a property damage issue that poses liability concerns. Management options for beaver control include trapping, dam and lodge removal, and the use of beaver "baffles."

Opportunities

Owners of existing wet ponds or wetlands should evaluate them for retrofit opportunities to improve water quality benefits. Not all facilities can or should be retrofitted and the evaluation is based on a number of factors. Facilities that cannot be retrofit should be inspected and maintained to retain optimum performance with the least resource expenditure (see Section 2).

The *National Management Measures Guidance to Control Nonpoint Source Pollution from Urban Areas* (EPA, 2005b) outlines the following steps for determining retrofit opportunities for existing ponds and wetlands:

Step One: Identify, Prioritize, and Schedule Retrofit Opportunities

In the watershed assessment phase of the urban runoff management cycle, watershed managers should identify waterbodies that have been degraded by urban runoff and prioritize them for restoration based on the costs and benefits for watershed stakeholders. One method to halt further degradation and initiate waterbody improvement is to retrofit existing runoff management practices or conveyance structures. It is important for watershed managers to have clear goals and realistic expectations for retrofitting existing structures. Each retrofit project should be planned in the context of a comprehensive watershed plan, and managers should have a clear set of objectives to ensure that the project results in measurable improvements in hydrologic, habitat, and/or water quality indicators.

Step Two: Evaluate existing data

The first step in identifying candidate sites for stormwater retrofitting is to examine existing data. These data can include results from a watershed assessment, topographic maps, land use or zoning maps, property ownership maps, aerial photos, and maps of the existing drainage network. For example, results from a watershed assessment can be used to identify areas with good habitat and water quality that should be protected, as well as areas with poor habitat and water quality that need to be improved. Topographical maps can be used to delineate drainage units within the watershed at the subwatershed and catchment levels. Land use or zoning maps can be used to estimate areas of high impervious cover to target areas that contribute a large amount of runoff to receiving waters, while property maps provide land ownership data. Finally, aerial photographs can be used to identify open spaces that can be more easily developed into runoff management facilities. According to the Center for Watershed Protection (Center for Watershed Protection, 1995a), the best retrofit sites:

- Are located adjacent to existing channels or at the outfall of storm drainage pipes;
- Are located within an existing open area;
- Have sufficient runoff storage capacity;
- Can divert runoff to a potential treatment area (forested or vegetated area) or structural management practice; and
- Have a sufficient drainage area to contribute meaningfully to catchment water quality.

Information for potential retrofit sites, such as location, ownership, approximate drainage area, utility locations, and other pertinent details, can be compiled in a retrofit inventory sheet (Center for Watershed Protection, 1995a). A site visit can provide information on site constraints, topography, adjacent sensitive land uses, receiving water conditions, utility crossings, and other considerations that would affect the feasibility of implementing the management practice. At this point, a conceptual sketch for rerouting drainage and siting management practices should be drawn and preliminary cost estimates made for each site.

Step Three: Choose appropriate management practices based on site conditions

Deciding which site to select to retrofit can be based on several different factors in addition to site limitations and cost. For instance, the preliminary goals of a retrofit program may be to preserve streams or reaches known to have high-quality habitat or exceptional water quality. The goal of another program may be to restore poor habitat and degraded water quality. The program may elect to target particular land uses thought to contribute the majority of pollutants to receiving waters. Retrofit facilities also can be installed to treat runoff from large parts of a watershed or subwatershed (regional controls), thereby requiring fewer overall projects. Once retrofit sites are identified and prioritized, a schedule for updating old facilities should be devised.

If a pond or wetland stormwater management facility cannot be retrofitted, it is still critical that it be maintained properly to function properly and not become a nuisance or a pollutant source itself.

The Center for Watershed Protection has developed a manual to assist property owners in retrofitting existing stormwater management facilities, including, but not limited to, wet ponds and wetlands (Schueler, 2007).

The manual provides guidance regarding the selection of practices viable for retrofit and their locations within appropriate subwatersheds as well as the steps to take when designing, implementing and maintaining the retrofits.

Section 2: Inspection and Maintenance of Existing Ponds and Wetlands

Long-term functioning of stormwater BMPs requires periodic inspections, routine maintenance, and corrective actions. Often the efforts of both community stakeholders and stormwater management professionals are necessary to insure the management practices are operating as they were intended.

Inspections

Inspections help the stormwater manager monitor the safety, longevity, and effectiveness of these practices over time. This section outlines some tips for inspecting ponds and wetlands, focusing on the inspection frequency, inspection checklists, documentation photographs, and repair item documentation.

Inspectors

Ongoing post-construction inspections of stormwater ponds and wetlands can be conducted by a variety of stakeholders including:

- Professional engineers and specialized contractors
- Municipal Inspectors and Maintenance Crews
- Commercial, Institutional, and Municipal Owners
- Concerned citizens and adjacent homeowners
- Homeowners Associations
- Property Managers

Property owners should reach an agreement with the property management, maintenance team or landscaping contractor to conduct frequent inspection and maintenance items such as mowing, checking for clogs, and debris removal. Clearly identify the expectations so that the landscaping design is preserved for optimal stormwater treatment.

Attentive landscapers, adjacent homeowners, and homeowner associations can be the first to identify potential problems. A homeowner checklist is included in Appendix B. Several local maintenance guidebooks aimed at citizens are also available on the SMRC website (www.stormwatercenter.net) under Program Resources, STP Maintenance, STP Maintenance Educational Materials.

The range of experience needed to diagnose a problem during inspection is quantified below in Table 2.1. These skill levels are used to describe the inspection items in Table 2.2.

Table 2.1: Inspection Skill Level Descriptions

Skill Level	Description
0	No special skills or prior experience required, but some basic training via manual, video, or other materials is necessary.
1	Inspector, maintenance crew member or citizen with prior experience with ponds and wetlands
2	Inspector or contractor with extensive experience with pond and wetland maintenance issues
3	Professional engineering consultant

Inspection Frequency

Ponds and wetlands should ideally be inspected on a monthly basis for minor items, and annually for major inspection items, such as structural components. In reality, many communities are unable to inspect all of their ponds this frequently, and a more typical scenario is providing inspection once every three years. This less frequent full inspection can be supplemented with a routine inspection conducted by a property owner or contractor responsible for maintenance. In the case of wetlands, an additional inspection may be required after the first year to ensure that wetland plantings remain viable.

Table 2.2 shows the frequency timeline with typical inspection and maintenance items at these times. Inspection frequency may be refined by the maintenance history of the practice as generated by ground crews charged with maintenance and mowing, or other interested parties. The profile sheets referenced under maintenance items are provided in Section 3.

Table 2.2: Typical Inspection/Maintenance Frequencies for Ponds And Wetlands

Frequency	Inspection Items (Skill Level)	Maintenance Items (Related Profile Sheet)
One time - After First Year	▪ Ensure that at least 50% of wetland plants survive (0) ▪ Check for invasive wetland plants (0)	▪ Replant wetland vegetation (See M-4 Vegetation Management)
Monthly to Quarterly or After Major Storms (>1")	▪ Inspect low flow orifices and other pipes for clogging (0) ▪ Check the permanent pool or dry pond area for floating debris, undesirable vegetation (0) ▪ Investigate the shoreline for erosion (0) ▪ Monitor wetland plant composition and health (0-1) ▪ Look for broken signs, locks, and other dangerous items (0)	▪ Mowing – minimum Spring and Fall (See M-4 Vegetation Management) ▪ Remove debris (M-2 Clogging) ▪ Repair undercut, eroded, and bare soil areas (See M-4 Vegetation Management)
Several Times per Hot/Warm Season	▪ Inspect stormwater ponds and stormwater wetlands for possible mosquito production (0-1)	▪ Inspect for mosquitoes (See M-8 Nuisance Issues)
Semi-annual to annual	▪ Monitor wetland plant composition and health (0-1) ▪ Identify invasive plants (0-1) ▪ Ensure mechanical components are functional (0-1)	▪ Setup a trash and debris clean-up day ▪ Remove invasive plants (See M-4 Vegetation Management) ▪ Harvest wetland plants (See M-4 Vegetation Management) ▪ Replant wetland vegetation (See M-4 Vegetation Management) ▪ Repair broken mechanical components if needed (See M-7 Mechanical Components)
Every 1 to 3 years	▪ Complete all routine inspection items above (0) ▪ Inspect riser, barrel, and embankment for damage (1-2) ▪ Inspect all pipes (2) ▪ Monitor sediment deposition in facility and forebay (2)	▪ Pipe and Riser Repair (See M-3 Pipe Repair) ▪ Complete forebay maintenance and sediment removal when needed (See M-5 Dredging and Muck Removal)
2-7 years	▪ Monitor sediment deposition in facility and forebay (2)	▪ Complete forebay maintenance and sediment removal when needed (See M-5 Dredging and Muck Removal)

Table 2.2: Typical Inspection/Maintenance Frequencies for Ponds And Wetlands		
Frequency	**Inspection Items (Skill Level)**	**Maintenance Items (Related Profile Sheet)**
5-25 years	▪ Remote television inspection of reverse slope pipes, underdrains, and other hard to access piping (2-3)	▪ Sediment removal from main pond/wetland (See M-5 Dredging and Muck Removal) ▪ Pipe replacement if needed (See M-3 Pipe Repair)

Inspection Checklists

A community should use standard inspection checklists to record the condition of all practices, and particularly those that need frequent maintenance. Most communities will find it easier to track maintenance electronically, using either a database or spreadsheet, rather than relying on paper files. Well-designed checklists can be integrated with these systems to prioritize maintenance, track performance over time, and relate design characteristics to particular problems. To effectively achieve these goals, the checklist should:

- Be quantitative, so that maintenance can be easily prioritized.
- Be very specific about possible problems to reduce subjectivity.
- Be concise with text particularly if integrated with a database, so that the checklist user will not be inundated with too much text.
- Link problems to specific actions.
- Where possible, track the function of the pond or wetland over time for future research and design.

Inspection checklists should also be grouped in the order the inspector would inspect the practice. For example, ponds should typically be inspected from downstream to upstream, so the investigation begins with the outfall channel. Sample checklists are presented in Appendix B.

For additional example checklists, consult SMRC (www.stormwatercenter.net). Checklists can be found by clicking "Program Resources" then "STP Maintenance" and "Maintenance Checklists, Reminders, and Notifications." In addition to providing detailed "professional" checklists for various BMPs, it also includes a simplified pond inspection checklist for homeowners. A Pond-Wetland Maintenance Checklist can also be found as part of Tool #6 of the Post-Construction Guide (www.cwp.org/postconstruction).

Documentation of Inspection Findings

Inspectors should clearly identify the extent and location of problems identified during inspection. In addition to clearly describing problem areas on the checklists, inspectors should help repair crews locate repairs both at the site and on design plans.

Immediate Concerns

While all maintenance and inspection items are important, some maintenance concerns actually pose an immediate safety concern. Many of these are caused by missing or damaged elements that would normally prevent access by the public. Examples include missing manhole covers or trash racks, missing or damaged fencing that normally prevents access to a pond with steep side slopes, or a missing or damaged grate at a large inflow or outfall pipe.

Another set of immediate pond and wetland repairs involve dam safety or flooding hazards. If a practice shows signs of embankment failure, or if an inspector is unsure, an appropriately qualified person or

engineer should be called in to investigate the situation immediately. Similarly, cracks in a concrete riser that drains a large area may pose a dam safety threat.

As-built Drawings
The inspector should bring a copy of the as-built plan of the practice to mark potential corrections and problem areas on this plan. The marked up as-built plan should be stored either digitally or in a paper file system so that it can be brought out to confirm that maintenance was performed correctly on the follow-up inspection.

Photographs
Inspectors should take a core set of documentation photographs of practices being inspected. In addition, specific problem areas should be photo documented. A recommended set of core photographs for ponds and wetlands include:

- Vehicle access points.
- Overview of practice.
- Overview of principal spillway structure.
- Upstream face of dam embankment.
- Downstream face of dam embankment.
- Outfall to practice and downstream outfall from practice.
- Emergency spillway (if applicable).

In addition, because of the large number of photographs that will likely be generated, a digital camera should be used when possible to allow photographs to be stored electronically. (In advanced database programs, these photographs can be retrieved digitally). Finally, photographs should be named using a standard convention. The photograph name should indicate the practice identification number, feature (or problem) being photographed, and date of photograph.

Field Marking
Inspectors can highlight key areas of concern with spray paint or other marker. This is particularly useful for problems that may otherwise be difficult to find by others. Marking should be used as discretely as possible. For example, only dots sprayed at the base of trees should be used to mark limits of clearing for vegetation removal. Figures 2.1 to 2.4 show examples of helpful spray paint markings.

Figure 2.1: Marking outfall deficiencies.

Figure 2.2: Marking trees to be removed.

Figure 2.3: Marking pipe joint separation

Figure 2.4: Marking a hole in gabion fabric

Routine Maintenance

In addition to routine inspection, routine maintenance needs to be performed to maintain the function of the control structure. Runoff treatment controls require specific maintenance activities at varying schedules. The cost and time commitment should be planned for all maintenance activities delegated to a responsible party, regardless of whether it is a contractor, local municipality, or community stakeholder. Table 2.3 describes maintenance activities, and schedules for several categories of stormwater management strategies.

Table 2.3: Maintenance Activities and Schedules

Category	Management Practice	Maintenance Activity	Schedule
Ponds	Extended detention ponds, wet ponds, multiple pond systems, "pocket" ponds	– Cleaning and removing debris after major storm events (>2" rainfall) – Harvesting of vegetation when a 50% reduction in the original open water surface area occurs – Repairing embankment and side slopes – Repairing control structure	Annual or as needed
		– Removing accumulated sediment from forebays or sediment storage areas when 60% of the original volume has been lost	5-year cycle
		– Removing accumulated sediment from main cells of pond once 50% of the original volume has been lost	20-year cycle

Table 2.3: Maintenance Activities and Schedules			
Category	**Management Practice**	**Maintenance Activity**	**Schedule**
Wetlands	Shallow wetlands, pond wetlands, "pocket" wetlands	– Cleaning and removing debris after major storm events (>2" rainfall) – Harvesting of vegetation when a 50% reduction in the original open water surface area occurs – Repairing embankment and side slopes – Repairing control structure	Annual or as needed
		– Removing accumulated sediment from forebays or sediment storage areas when 60% of the original volume has been lost	5-year cycle
		– Removing accumulated sediment from main cells of pond once 50% of the original volume has been lost	20-year cycle
Infiltration practices	Infiltration trench	– Removing accumulated sediment from forebays or sediment storage areas when 60% of the original volume has been lost	5-year cycle
		– Removing accumulated sediment from main cells of pond once 50% of the original volume has been lost	20-year cycle
	Infiltration basin	– Cleaning and removing debris after major storm events; (>2" rainfall) – Mowing and maintenance of upland vegetated areas – Cleaning out sediment	Annual or as needed
		– Removing accumulated sediment from forebays or sediment storage areas when 50% of the original volume has been reduced	3- to 5-year cycle
Open channel practices	Dry swales, grassed channels, biofilters	– Mowing and litter/debris removal – Stabilizing eroded side slopes and bottom – Managing the use of nutrients and pesticides – Dethatching the bottom of the swale and removing thatching – Disking or aeration of swale bottom	Annual or as needed

Table 2.3: Maintenance Activities and Schedules			
Category	**Management Practice**	**Maintenance Activity**	**Schedule**
		– Scraping of swale bottom, and removal of sediment to restore original cross-section and infiltration rate – Seeding or installing sod to restore ground cover (use proper erosion and sediment control)	5-year cycle
Filtration practices	Sand filters	– Removing trash and debris from control openings – Repairing leaks from the sedimentation chamber or deterioration of structural components – Removing the top few inches of sand, and cultivation of the surface, when filter bed is clogged	Annual or as needed
		– Cleaning out the accumulated sediment from filter bed chamber once depth exceeds approximately ½ inch, or when the filter layer will no longer draw down within 24 hours – Cleaning out the accumulated sediment from sedimentation chamber once depth exceeds 12 inches	3- to 5-year cycle
	Bioretention	– Repairing eroded areas – Mulching of void areas – Removing and replacing all dead and diseased vegetation – Watering of plant material	Biannual or as needed
		– Removing mulch and applying a new layer	Annual
	Filter strips	– Mowing and removing litter/debris – Managing the use of nutrients and pesticides – Aerating the soil on the filter strip – Repairing eroded or sparse grass areas	Annual or as needed

Maintenance Activities

Along with routine maintenance, specific activities for maintaining stormwater ponds and wetlands are detailed in the profile sheets in Section 3, which are organized by the top eight maintenance concerns introduced in Section 1. Each profile sheet provides the following:

- Problems to Inspect For
- Corrective Actions
- Cautions and Safety Tips

In addition, a subjective rating of skill level is presented with many of the maintenance activities to aid the program managers and responsible parties in understanding the severity of the problems described. Ratings and descriptions of the required skill levels can be found in Table 2.4 below.

Table 2.4: BMP Maintenance Skill Level Descriptions

Skill Level	Description
0	No special skills are required but some basic training via manual, video, or other materials is necessary.
1	Ordinary maintenance crew skill level.
2	Contractor familiar with pond and wetland maintenance issues.
3	Professional engineering consultant.

Lastly, Appendix A provides useful unit cost information for specific maintenance activities along with typical maintenance frequencies to be expected.

Maintenance Activity Profile Sheets

M-1 Permanent Pool

Problems to Inspect For

An important aspect of any pond or wetland inspection is having sufficient background information. In the absence of familiarity, a good set of as-built drawings can present a considerable amount of information about the way a pond was built and how it should function. Construction drawings or as-built drawings will include anticipated levels for permanent pools and sizes and locations of orifices.

The best tool for confirming pool elevation fluctuation is familiarity. Abnormally high or low levels are more likely to be noticed in a pond that has been frequently inspected at normal levels. Signs that the permanent pool is too high include:

- Water levels remain high for more than 2 or 3 days after a storm.
- Pond edges normally visible are covered in water and plant species normally above permanent pool are now immersed in water.

INSPECTION TIP:

Stormwater ponds and wetlands often have higher than normal water surface elevations after storm events, sometimes for a number of days. This is a normal part of the design. Consider the last significant rainfall event when determining your inspection schedule. Try to avoid examining permanent pool levels within 2 to 3 days of a significant rainstorm to give the facility time to discharge the runoff temporarily stored in the pond. Exceptions to this rule apply if vortexing or another problem that may be more apparent at higher stage is suspected.

If a stormwater pond or wetland is well constructed, with an adequately sized and protected low flow orifice, it will only suffer from an abnormally high pool when outside forces act on it. Examples are clogging, vandalism (damaged riser or low flow valve being opened), or rodent activity.

Signs that the permanent pool is too low include:

- Stain marks on the riser or flow control structure.
- Exposure of a non-vegetated pond bottom around the pool perimeter.

To review a dam embankment for possible seepage, look at the color of the vegetation as well as changes in the plant species present and their density, particularly in dry weather. These changes may indicate seepage or leaking on the downstream dam face. Embankment leaks on the downstream side of a berm or dam are usually easily discovered if the vegetative cover has been recently mowed and the slope is not too steep (generally, 2H:1V or flatter). Leaks on the upstream dam face are usually impossible to locate visually, unless it is at the surface (such as a flooded animal burrow) or there is an active vortex. Slow leaks that are only apparent over long time periods are particularly difficult to observe and may require a dye test or complete pond dewatering.

Often, inspections of stormwater ponds and wetlands falsely report leaks during warm weather when droughts or improper water budget analysis may be the problem. This latter scenario makes a pond prone to frequent lowered pools due to natural evaporation.

Conversely, larger facilities or facilities fed by constant inflow (surface streams, springs, or seeps) may have leaks or excessive seepage that is masked by the apparent normal permanent pool supported by a strong water source. Recorded measurements over time are the best way to confirm this problem.

Corrective Actions

Fixing the problems associated with permanent pool fluctuation can vary in difficulty, from relatively simple to complex and expensive. Regardless of the level of skill required for fixing the problem, only properly trained and authorized personnel should perform the maintenance.

Table M1.1 includes a list of problems, potential solutions, a subjective analysis of problem classification, and an estimate of the skill level recommended to correct problems associated with permanent pool issues. Estimated costs to fix the types of problems outlined here are included in the Maintenance Cost / Frequency Table in Appendix A.

Table M1.1: Permanent Pool Fluctuation Diagnoses

Finding	Solution	Classification	Level of Skill Recommended
Clogged low flow	Clear low flow, install trash rack if not present or inadequate. See M-2 – Clogging.	Minor maintenance	(0) See cautions in M-2.
Low flow or pond drain valve opened	Shut valve and lock shut with chain and lock. See M-2 – Clogging.	Minor maintenance	(0) See cautions in M-2.
Rodent activity (dams, lodges, burrows)	Fill burrows. See M-8 – Nuisance Issues	Minor to major repair	(1)
Leak in riser	Seal leak. See M-3 – Pipe Repairs.	Major repair	(2)
Leak in barrel	Seal leak. See M-3 – Pipe Repairs.	Major repair	(2)
Leak in upstream dam face or pond bottom	Drain remainder of permanent pool and install waterproof liner; dye test recommended.	Major repair	(2)
Leak or seepage in downstream dam face	Dye test recommended; seal leak source if found; liner may need to be installed and dam or principal spillway repair or replacement may be required depending on leak severity.	Major repair	(3)
Vortexing[1]	Consider a call to civil authorities immediately as dam failure may be imminent and down stream evacuation may be necessary; do not attempt to repair without professional help.	Usually major repair	(3)

Inspection frequency beyond typical annual inspection should be set by the pond or wetland maintenance history and/or its use. For example, ponds with chronic clogging due to beaver activity should be put on a more frequent inspection schedule.

[1] Swirling action of water caused by submerged orifice flow, usually in the vicinity of the dam, riser or principal spillway.

Cautions and Safety Tips

Risers near the shore or located in the embankment are often easy to examine from the surface (See Figure M1.1). Normal personal protection equipment (PPE) as defined by the U.S. Occupational Safety and Health Administration (OSHA) is sufficient to view from the top and photograph and/or measure with a drop tape. Risers located out in the permanent pool, or those with inaccessible tops (such as the typical round anti-vortex shell CMP riser) are more difficult and may require confined space entry and/or boat access. Similarly, barrels may require confined space entry to examine for leaks or to gain access to the riser itself; some barrels are too small for entry or are damaged or clogged. In these situations, remote TV inspection from either or both ends may be the only practical way to examine for leaks. However, if a leak in a riser or barrel is large and obvious, it may be easy to spot, particularly if it is a hole in a metal riser that now acts as a "low flow orifice".

Figure M1.1: Riser located near pool edge for easier access.

M-2 Clogging

Problems to Inspect For

External clogging can easily be identified through routine visual inspection. Clogging within low flow pipes and underdrains can be more difficult to find. A well functioning opening and trash rack should be clear of debris. Trash racks should show little or no corrosion and should be completely visible. Examine design or as-built records to determine which weir/orifice is supposed to set the permanent pool.

Record water surface elevations by leaving a stake or marker at a high water mark and recheck at regular intervals to determine if pond or wetland permanent pool levels are staying higher than designed for longer periods than expected following a rainfall event (see Profile Sheet M-1). If pool levels are higher than expected for long durations, then a clogged low flow pipe or orifice, or internal clogging of a low flow drain may be the problem.

Figure M2.1: Clogged valve.

Corrective Actions

Trash and debris removal should occur during the regularly scheduled inspection and maintenance to reduce the chance of outlet structures, trash racks, and other components becoming clogged and inoperable during storm events. Proper preventative maintenance includes removal of debris from pond bottoms, embankments and side slopes, perimeter areas, and access areas that can lead to clogging, as well as debris jams at outlet structures and trash racks.

Metal trash racks should be inspected, and any exposed steel should be brushed free of corrosion and coated or spray coated with protectant or water sealant.

Figure M2.2: Clogged low flow orifice (before maintenance).

Techniques for removing clogs depend on the accessibility and severity of the clog. They include:

- Manual removal of debris by hand or by machine
- Jetting, back flushing, or routing a clogged pipe. High velocity spray and hydraulic head pressure devices include high velocity jet cleaners, cleaning balls, and hinged disc cleaners.
- Sediment or muck removal around the low flow structure, to locate the opening and return it to design conditions. (See M-5 – Dredging and Muck Removal)
- A professional diver may be needed for deeply clogged facilities.
- Dewatering of facility via pumping or other means to reveal the source of clogging and allow access (if regulatory laws permit).

Disposal of debris and trash must comply with all local, county, state, and federal waste regulations. Only suitable disposal and recycling sites should be utilized.

Cautions and Safety Tips

Clearing clogged openings may be easy or difficult depending on access to the opening. If removing an obstruction or clog seems like it might be unsafe, it probably is - leave it to a qualified contractor. Clogged openings can cause dangerous headwater conditions behind the blocked orifice. In addition to the normal hazards associated with low flow maintenance (confined space entry, poor footing, and potential for sharp objects including syringes and glass), strong flow can be generated instantaneously.

Figure M2.3: After clog is removed.

If a facility has had deep backwater for a long period of time, sudden de-clogging may actually cause damage due to the slumping of un-vegetated, waterlogged slopes. Further, the downstream receiving swale, storm drain or stream may not be stable enough to withstand the instantaneous release of water. The released water will probably be silt-laden, releasing a large amount of sediment, nutrients and possibly toxics. Employ a professional to conduct slow, safe draw-down and to remove any muck as required.

OSHA approved personal protection equipment will be needed and confined space entry may be required. See M-6 Access for additional riser and manhole access concerns.

M-3 Pipe Repairs

Problems to Inspect For

Pipes are the most challenging feature of ponds and wetlands to thoroughly inspect. Repairs are often expensive and require specialized equipment. Table M3.1 presents a summary of maintenance concerns typical for different pipe materials. Following Table M3.1 are a number of inspection tips to inform an inspector or lay person about things to look for with respect to pipes when inspecting stormwater ponds and wetlands:

Table M3.1: Common Pipe Uses, Material, and Maintenance Concerns

Use	Most Common Material	Typical Maintenance Concerns
Principal spillway or barrel	CSP and RCP	Scour damage, leaking joints, misaligned joints
Under drains, internal drains	PVC, HDPE and Clay	Filter media failure, crushing
Inlets	RCP and CSP	Blockages, frost heave, undercutting
Hydraulic control	All types	Clogging, corrosion, vandalism
Quantity control	CSP	Construction rips and tears, misalignments and non-soil-tight joints

Notes:
CSP – corrugated steel pipe; RCP – reinforced concrete pipe; PVC - polyvinyl chloride pipe; HDPE – high density polyethylene pipe

Figure M3.1: Improper pipe joint but rubber seal is visible.

Joint Tightness: All pipe sections should abut evenly with little or no gap. In particular, no barrel should leak. Barrel pipes for ponds should not pass soil or water. Corrugated steel pipe (CSP) joints should meet smoothly, be free of rough or jagged edges, and have a butyl rubber seal surrounding the outside of the joint (Figure M3.1). The seal should not be torn, dry-rotted or bulging. CSP joints are not expected to be watertight (only soil tight[1]) except when used as principal spillways. Figure M3.2 illustrates a joint that is neither soil nor watertight.

Concrete bell and spigot pipe joints may have a gap up to the allowable dimension as described by local ordinance or as determined by the manufacturer. Joints are usually parged with high strength non-shrink grout, but this does not guarantee water

[1] Soil tight means that pipe joints can pass water but they do not allow soil intrusion.

tightness. The tongue and groove end sections of individual pipe sections should be free from damage, especially damage that exposes the underlying re-enforcing steel.

Figure M3.2: Soil entering open pipe joint.

Plastic and clay piping are used in small diameter applications such as underdrains and splitter pipes. high density polyethylene pipe (HDPE) piping is usually installed in long sections without joints but polyvinyl chloride pipe (PVC) is usually installed with a rubber-coated bell and spigot connections similar to reinforced concrete pipe (RCP). The use of clay pipes for the principal spillway is discouraged as clay joints are not watertight.

Misalignment: One of the most common causes for repair is pipe misalignment (Figure M3.3). Misalignment is often apparent at or shortly after construction. Otherwise, alignment changes occur due to differential settlement, freeze-thaw cycles, or dynamic loads such as traffic.

Figure M3.3: Misalignment in RCP (left and right) and CSP (center) applications.

Pitting and corrosion: Unprotected CSP usually has a relatively long design life on its soil side but is very susceptible to erosive scour, pitting and corrosion on its flow side, particularly along the invert of the pipe. Pitting is highly localized corrosion causing perforations large enough to infiltrate or exfiltrate water. Soil side design life often exceeds 50 years, but flow side design life is usually between 20 and 35 years before the first pitting appears. CSP manufacturers coat piping with various substances to lengthen design life such as bituminous asphalt, aluminum, or concrete poured along the invert of the pipe.

Staining and Calcification: Rust stains inside RCP often indicate that acidic groundwater is leaching in through a crack or hole, slowly dissolving the steel rebar and precipitating it back into a form of ferrous oxide on the inside of the pipe (Figure M3.4). Once the anaerobic water comes in contact with the oxygen within the pipe interior the reaction occurs. These stains usually indicate that repairs should be made

Figure M3.4: Rust intrusion demonstrates improper pipe joint.

Figure M3.5: Calcification..

to the pipe to stop the water from infiltrating the pipe.

Calcification occurs when acidic water enters concrete cracks from the inside of the pipe, dissolving and reconstituting the hydrated Portland cement in the RCP (Figure M3.5). Calcification may or may not mean that a crack has breached the entire thickness of the pipe and adequate experience is necessary to determine when repairs are truly necessary.

Root Intrusion: Root intrusion into pipe systems is an especially difficult and damaging phenomenon but fortunately is relatively easy to observe. Roots typically enter loose pipe joints and can cause clogging by snagging debris. Willows (*Salix sp*.) are notorious for root intrusion.

By following the described pipe inspection tips above, the lay person or inspector can better understand the types of problems likely to be encountered during stormwater pond and wetland maintenance inspection. Once experience is gained in performing inspections, inspectors can foresee potential problems and plan preventive maintenance.

Corrective Actions

Fixing pipe problems can be approached from two directions: repair or replacement. Different methods for pipe repair and replacement are presented below, as well as a recommended skill level. All involve the need for professional contractor or engineer assistance. Consult an engineer to determine the most appropriate technique.

Common pipe repair methods include:

- *Joint Sealing*: In the injection grouting method, RCP leaking joints and concrete cracks can be sealed with high strength non-shrink grout or epoxy. Holes are drilled all the way through the pipe to the soil beyond. The grout is injected to the other side where it reacts with groundwater and hardens. This method is often used for difficult access areas such as a buried concrete pipe barrel joints. OSHA confined space entry training may be required. CSP joints are similarly sealed, except polyurethane foam water stop material is injected. Recommended skill level (3).

- Another joint sealing method utilizes an inflatable packer inserted into a pipeline to span a leaking joint. Resin or grout is then injected into cracks and cavities until the joint is sealed, after which the packer is removed. This localized repair of pipes prevents leakage and further deterioration and may increase the structural strength of the pipeline. Recommended skill level (3).

- *Invert Protection*: This method involves protecting the lower segment of a corrugated metal pipe by lining it with a smooth bituminous or concrete material that completely fills the corrugations. This approach is intended to give resistance to scour/erosion and to improve flow. Recommended skill level (2).

- *Chemical Stabilization*: Chemical stabilization involves isolating a length of pipeline between two access points by sealing the access points. One or more compounds in solution are introduced into the pipe, and the surrounding ground produces a chemical reaction that forms a stable protective coating over cracks and cavities. Recommended skill level (3).

Pipe rehabilitation typically involves more intensive and comprehensive correction of pipe problems aimed at restoring or upgrading the performance of an existing pipe system. Often, rehabilitation is

needed when there is major structural and/or hydraulic weakness. Common pipe rehabilitation methods, all involving the need for professional contractor or engineer assistance, include:

- *Folded Liners*: A PVC or HDPE liner is folded to reduce its cross sectional area. The liner is pulled into a failing pipe system and reverted to its original size using pressure and heat to form a tight fit with the host pipe wall. Recommended skill level (3).

- *Cured-in-place pipe (CIPP)*: CIPP is a thin flexible tube of polymer or glass fiber fabric that is impregnated with thermoset resin and expanded by means of fluid pressure onto the inner wall of a defective pipeline before curing the resin to harden the material. Recommended skill level (3).

- *Ferro-cement*: Steel fabric mesh, usually in multiple layers, is fixed to the existing pipe, then covered in high strength grout. It is either placed in situ to form a structural lining (in large diameter pipes with human access) or pre-formed into segments for later installation. Recommended skill level (3).

- *Pipe bursting*: Also known as in-line expansion, this is a method by which the existing pipe is demolished and a new pipe is installed in its void. Recommended skill level (3).

- *Pipe eating*: A pipe replacement technique usually based on micro tunneling to excavate defective pipe with the surrounding soil as for a new installation. Recommended skill level (3).

- *Pipe pulling*: Method of replacing small diameter pipes where a new product pipe is attached to the existing pipe which is then pulled out of the ground. Recommended skill level (3).

- *Slip-lining*: Insertion of a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. The new pipe may be continuous or a string of discrete pipe sections. The latter is also referred to as segmental slip-lining. Recommended skill level (3).

- *Modified slip-lining*: A range of techniques in which the liner is reduced in diameter before insertion into the carrier pipe, then restored to its original diameter, forming a close fit with the original pipe. Recommended skill level (3).

- *Spray lining*: A technique for applying a lining of cement mortar or resin by rotating a spray head, which is winched through the existing pipeline. Recommended skill level (3).

Table M3.2 summarizes the limitations of the different types of pipe rehabilitation methods mentioned above.

Table M3.2: Limitations of common pipe rehabilitation methods

Method	Limitations
CIPP	• Bypass or diversion of flow required • Curing can be difficult for long pipe segments • Must allow adequate curing time • Defective installation may be difficult to rectify • Resin may clump together on bottom of pipe • Reduces pipe diameter
Pipe bursting	• Bypass or diversion of flow required • Insertion pit required • Percussive action can cause significant ground movement • May not be suitable for all materials
Slip-lining	• Insertion pit required • Reduces pipe diameter • Not well suited for small diameter pipes
Modified Slip-lining	• Bypass or diversion of flow required • Cross section may shrink or unfold after expansion • Reduces pipe diameter • Infiltration may occur between liner and host pipe unless sealed • Liner may not provide adequate structural support

Cautions and Safety Tips

Most stormwater pond and wetland pipe work can be visually inspected from a daylighted end or manhole access. However, some piping is difficult to inspect due to being buried, flooded, cramped, or deteriorated. In this case, inspection work should be left to qualified professionals who are versed in confined space entry and exit as defined and regulated by state and federal OSHA standards. Some piping is impossible to inspect manually (such as a 6-inch underdrain), and remote TV video inspection or complete unearthing are the only options.

M-4 Vegetation Management

Problems to Inspect For

Vegetation management is the most frequent type of maintenance conducted on stormwater ponds and wetlands. In most instances, vegetation management is straightforward and does not require special expertise or equipment. However, if facilities have gone long periods of time without proper vegetation maintenance, then the level of effort and complexity of the activity can become significant.

Telltale signs of vegetative problems include the following:

- Standing water and emergent plant growth where none should be present
- Poor or spotty grass growth or completely bare areas (Figure M4.1)
- Soggy surfaces
- Excessive sedimentation at pond inlets or outfalls with corresponding emergent plant growth (Figure M4.2)
- Limited visibility or access to the principal spillway or embankment areas due to vegetation
- Deep-rooted woody vegetation (trees and shrubs) on any areas of a dam
- Woody vegetation growing in riprap on slope areas meant for erosion protection
- Signs of seepage around any tree stumps or decaying root systems on embankment areas
- Changes in vegetative color, species or height due to possible groundwater or seepage problems
- Areas where local residents have been dumping yard waste
- Pond embankments with newly planted ornamental trees or shrubs not originally included in the design
- Damaged or torn erosion control matting (ECM)
- Ruts or erosion channels in vegetated swales or level spillways
- Tree or shrub growth in or around major pond appurtenances such as the principal spillway
- Monoculture vegetation in wetland

Figure M4.1: Bare soils on embankment and slopes.

Figure M4.2: Excessive vegetation near an outfall.

Corrective Actions

The following describe specific activities associated with maintaining the vegetation in and around stormwater ponds and wetlands as well as the recommended skill level of the person performing the maintenance in parentheses (reference Table 2.4):

Grass and Turf
Consistent mowing and monitoring should control any unwanted vegetation. Typical mowing areas include pond bottoms (dry ponds), embankments, side slopes, perimeter areas, and access areas (Figure M4.3). The actual mowing requirements of an area should be tailored to the specific condition and grass type. Other actions to maintain grassed areas include de-thatching, soil conditioning, re-seeding, and periodic fertilization as necessary.

Figure M4.3: Representative mowing for wetland.

Most grass is hardiest when maintained as an upland meadow, cut no shorter than 6 to 8 inches. If a more manicured look is desired, special attention to the health of the turf is needed. Grass should not be cut below 4 inches. Typical mowing schedules for grass on embankments are at least twice during both the spring and fall growing seasons and once during the summer. Recommended skill level (0).

Vegetated Buffer
A 10-foot unmowed vegetated buffer around the perimeter of the pond or wetland (exclusive of the dam embankment) may be established to filter pollutants from adjacent properties and help prevent shoreline erosion (Figure M4.4). Areas set aside for pond access such as fishing can be secured with stone, timber wall or one of many commercially available plastic retaining wall products. Recommended skill level (0).

Figure M4.4: Vegetated buffer.

Vegetation Harvesting
In stormwater wetlands, vegetation harvesting[1] may be required. To perform wetland harvesting, selected plant materials are tagged for removal by a qualified professional, then cut and hauled to a disposal location. Recommended skill level (1 - 2).

[1] Vegetation harvesting is removing vegetation on a routine basis and land applying it in an upland location. The purpose for vegetation harvesting is to remove plant material before winter die-off to prevent nutrients from reentering the water column and being flushed downstream.

Bare areas
Vegetation can be established by any of five methods: mulching; allowing volunteer vegetation to become established; planting nursery vegetation; planting underground dormant parts of a plant; and seeding. Seeding can come in the form of broad-cast seeding, hydro-seeding or sodding. Donor soils from existing wetlands can be used to establish vegetation within a wetland. If the soil has become compacted, it will require aeration. Areas without grass or vegetation should be vigorously raked, backfilled if needed, and covered with topsoil. Disturbed areas should be seeded and mulched if necessary. A tall fescue grass seed is often recommended; however consult the local Natural Resources Conservation Service (NRCS) office for the best native mixes for the project location. Recommended skill level (0).

Bare or monoculture stormwater pond and wetland slopes and bottoms offer the best opportunities to enhance areas with native trees, shrubs, and groundcovers to help the water soak into the ground. Select species that need little fertilizer or pest control and are adapted to specific site conditions. Again, contact your local NRCS office for guidance.

Unwanted vegetation
Some vegetation, such as that on embankments (Figure M4.5), requires complete removal, including root masses, to ensure that it does not return; this is often best done with landscaping Brush Hogs™ or small earthmoving equipment. Stump removal may also require tractor and chain. The removal of large trees may require the skills of a professional arborist. The use of herbicides should be avoided; however if deemed necessary, they must be applied by a state-licensed herbicide applicator. Recommended skill level range (0 - 2).

Figure M4.5: Unwanted vegetation - tree on embankment.

Root removal
Roots should be removed in the designated sections where root intrusion is a problem. To remove roots from a pipe, use mechanical devices such as rodding machines, bucket machines, and winches using root cutters and 'porcupines' or equipment such as high-velocity jet cleaners. Chemical root treatment is available but discouraged and herbicides must be applied by licensed applicators.

Roots should be removed from the embankment to prevent their decomposition within the embankment. Excavate to remove roots, then plug or cap root voids. Recommended skill level (2).

Dumping areas
Grass clippings, leaves, soil and trash are often dumped directly into storm drain inlets or stormwater ponds and wetlands. Any of these items can lead to clogging, and leaves and grass clippings release bacteria, oxygen consuming materials, and nutrients. Removal is easy assuming a suitable disposal area or trash pickup location is available. Posting signage explaining the importance of not dumping will help dissuade the good intentioned. Signage may also advise natural lawn care to minimize the use of chemicals and pesticides. Recommended skill level (0).

Inadequate drainage slopes
To promote proper conveyance and to prevent standing water, conveyances to and from ponds and wetlands should have a minimum slope of one to two percent. Inadequate slopes typically result in the conveyances filling with sediment and vegetation (Figure M4.6). Removal of muck and vegetation from

conveyances can be accomplished with small equipment. See Section M-5 – Dredging and Muck Removal. Recommended skill level range (1 - 2).

Figure M4.6: Vegetation establishment where the inflow channel slope is inadequate to drain properly.

Cautions and Safety Tips

Although the removal of unwanted vegetation is not a professional skill, it is not without hazards. Possible hazards include cuts and scrapes from the brambles and thorns of species such as Multiflora Rose (*Rosa multiflora*) and Tear Thumb (*Polygonum perfoliatum*). Overgrown vegetation can also obscure ledges, burrows, drop-offs, stumps, and wasp nests.

M-5 Dredging and Muck Removal

Problems to Inspect For

The need for dredging may be indicated by sediment plumes or deltas at storm drain inlets that feed stormwater ponds and wetlands, as most sediment falls to the pond floor quickly and within a short distance from storm drain inflow points (Figure M5.1). Alternatively, accumulated sediment can be measured through use of a staff gauge[1].

Figure M5.1 Sediment delta.

The best way to determine if a pond or wetland needs dredging is to perform a bathymetric study, which involves taking field measurements to calculate the volume of water within a pond or lake. The survey is similar to a topographic measurement of the contours below the permanent pool surface of a pond. The end result of the survey is a two-dimensional map indicating depth contours at all locations within the permanent pool. Bathymetric surveys indicate the amount of silt or muck that has accumulated within a pond or lake; consequently, estimates of remaining stormwater pond life, dredging volumes and associated costs can be made. A pond that appears full may still have adequate volume for settling suspended solids and for meeting stormwater management design criteria purposes, yet the owner may wish to have the pond dredged for aesthetic value.

Bathymetric surveys require use of level rods, electric distance measurement equipment (EDM), small watercraft, sediment probes or depth finders to gather pond depth information (Figure M5.2). Usually a staff person measures the pond depth while in a canoe or johnboat. On shore, another staff uses EDM equipment to determine distance and azimuth (angle) measurements to the test location. Existing volume measurements can be compared against design volumes to determine the amount of muck requiring removal (Figure M5.3). If no previous design records exist, the procedure is basically the same, but additional sediment depth probing must be done to measure muck levels.

Figure M5.2: Measuring pond depth from canoe.

[1] A staff gauge is a fixed marker rod that enables easy reading of sediment levels in a pond once the pond has been drained.

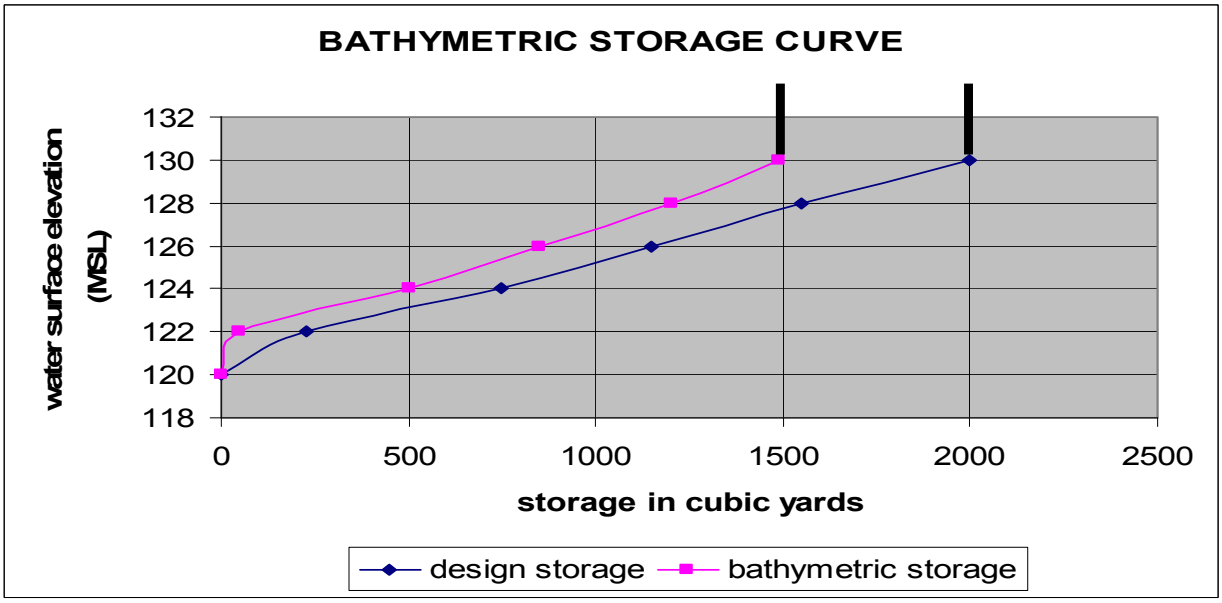


Figure M5.3: Plot of elevation vs. storage for existing and design conditions.

Dredging needs for dry ponds are easier to identify. There may be a profusion of vegetation, particularly wetland species, at the bottom of the facility. Pilot channels may disappear due to the accumulation of sediment and trash. An obvious sign for quick action is a buried low flow opening. Sediment in a dry pond can also be measured with a preset staff gauge; but hand-taped or simple field surveys can also suffice.

Corrective Actions

In smaller ponds and wetlands, the pond water may be drawn down to a point where the residuals can begin to dry in place. After the material is dried, heavy equipment can remove the sediment from the bottom of the pond, a process referred to as mechanical dredging. Mechanical dredging may be accomplished with a standard or long reach backhoe, front end loader, dipper, bucket dredge, drag line or clamshell dredge (Figure M5.4). Care should be taken to minimize soil compaction around the pond or wetland that can be caused by the heavy machinery.

Figure M5.4: Mechanical dredging with backhoe.

Where dredging cannot be accomplished mechanically from the shore, it may be necessary to remove sediment using hydraulic dredging methods[2]. Larger ponds that cannot be drained are

[2] Hydraulic dredging uses a combination of water jet and vacuum to resuspend settled material and pump it to an upland location or other place for dewatering.

often de-mucked via hydraulic suction or with the use of draglines operated from barges. In ponds not large enough to warrant hydraulic dredging, mechanical dredge methods are used and removed material is de-watered to minimize trucking requirements and potential spilling.

Sediments from ponds and wetlands are usually dewatered and then disposed of onsite or land filled. It is typical to spread this material out on a site for use as a soil amendment. Onsite disposal usually entails digging a pit, wasting the muck material, covering the pit with previously removed topsoil and planting the appropriate native plantings. Once a dredge area disposal site is established, it cannot be used for structural support or building foundations as long-term settlement will occur.

If on-site storage is not specified, sediment can typically be landfilled. Wet sediment is not accepted at many disposal sites; therefore, the material must be dewatered prior to disposal. This extra step adds to the cost and requires a location where wet material can be temporarily and safely placed to dry.

If the practice drains a stormwater hotspot, such as a gas station, a Toxic Contaminant Leachate Procedure (TCLP) or other analytical analysis should be performed in accordance with receiving landfill requirements to determine if the removed sediment should be considered a hazardous waste. If the residual solids are determined to be hazardous, they must be managed according to Resource Conservation and Recovery Act of 1976 (RCRA), which requires either treatment to decrease the concentration of the hazardous constituent or disposal in a hazardous waste landfill.

Cautions and Safety Tips

Dredging and muck removal involve additional costs and safety considerations including proper disposal, confined space work, permitting and utility damage. This work is best left to general contractors and specialty maintenance companies with adequate training and bonding. The recommended skill level range for all dredging issues is (3)

WETLAND DREDGING TIP:

Maintenance dredging of a stormwater wetland can significantly damage the wetland community that has developed over the life of the practice, and may be met with resistance from regulators and adjacent property owners. Typically, if a wetland was constructed specifically for stormwater treatment and not as mitigation for other wetland impacts, owners can maintain them without permits. However, permitting authorities that have jurisdiction over the site should be informed prior to disturbing any wetland area for maintenance or other purposes.

If a diverse native wetland plant community is present in a stormwater wetland, for maintenance purposes it may be advisable to scrape and stockpile the surface soil layer in a designated location for future reapplication. The surface layer may contain a variety of seeds thatcan be reapplied to help the wetland plant material reestablish after the excess sediment has been removed. If a non-native or invasive wetland plant community has been established, conduct removal with care or during a dormant season to discourage seed distribution.

M-6 Access

Problems to Inspect For

Inadequate access is typically discovered by inspectors or maintenance contractors who cannot enter a site or particular site features (e.g. risers). Inspectors should be cognizant of the types of equipment needed to maintain a stormwater pond or wetland, so they can note potential access issues (Figure M6.1). If potential access issues are noted up front, the maintenance contractor can be warned and can plan accordingly.

Figure M6.1: Poor vehicle access.

Risers and manhole access can be particularly challenging and dangerous, particularly when access steps are missing (Figure M6.2) or no manhole access has been provided. In these cases, it is necessary to lower staff by winch once the atmosphere has been tested. Therefore, mandatory fall protection should be used when accessing risers or manholes.

Figure M6.2: Missing manhole step.

If no manhole access is provided and water enters a riser through weirs or orifices that are too small to allow direct access, the riser may still be entered safely through the barrel (principal spillway) under certain conditions. In Howard and Montgomery Counties, Maryland, safe barrel access is defined by the following conditions:

- Access is conducted by qualified confined space entry-trained staff (team of two with proper equipment).
- The barrel is open to daylight at both ends and no atmospheric dangers are present.
- The diameter of the barrel is 36 inches or greater.
- There is little to no tailwater making access unsafe, defined as blocking more than a third of the opening (Figure M6.3).

Figure M6.3: Forced access location.

Given these conditions, the barrel may be crawled. Verbal contact should be kept with the crawler at all times. Each joint may be examined by hand for leaks and discontinuities. The inspector may enter the riser to inspect it once he or she has traversed the barrel.

Corrective Actions

Many access issues are best addressed during the design of ponds and wetlands. However, there are routine maintenance activities that will also be required. Most notably, it is important and advisable to maintain primary access features as they were designed. This typically involves removal of woody vegetation from access roads and the upkeep of gravel areas. Risers with missing steps, manhole covers, or trash racks that present unsafe situations should also be repaired so that future access for inspection is not compromised.

Figure M6.4: Tree scar protection.

In some cases, where major work needs to be performed, temporary construction access for large, heavy equipment will need to be provided. In these situations, special provisions should be taken to minimize impacts to adjacent areas, particularly if they are forested. Common tree protection measures include fencing that is sufficiently set off to provide protection of the critical root zone and protective sheathing (Figure M6.4).

Figure M6.5: Paved access road.

Heavy vehicle access can also impact areas with paving, curbs, and decking (Figure M6.5). It may also compact unpaved soil. For the mutual protection of both the owner and contractor, these access points should be clearly marked or flagged and then photographed prior to equipment arrival onsite. Temporary pavement protection devices include:

- Steel sheeting
- Timbering and mats
- Stabilized stone and gravel construction accesses and mountable berms
- Unloading and 'walking' equipment in on rubber tires

If a fenced pond or wetland does not have vehicle gates large enough to accommodate heavy equipment, sections of fence will need to be temporarily removed to allow access.

Cautions and Safety Tips

Mandatory fall protection should be used when accessing risers or manholes. Risers and manholes may be missing access steps, and lowering staff by winch may be required once the atmosphere has been tested.

M-7 Mechanical Components

Problems to Inspect For

Early identification of problems and speedy repair is important to ensure the maximum design life of mechanical components, most of which are metal. Signs of common mechanical failures include:

- Loose trash rack pieces
- Rust and corrosion
- Original lift lugs still in place for pre cast concrete structures
- Nicks and cuts in protective coatings
- Loose or corroded bolts
- Form nails and ties still present for cast-in-place concrete structures
- Leaking valves
- Corroded locks
- Hand wheels that won't turn
- Missing tools necessary for valve maintenance
- Pock marks
- Standing water
- Flaking

Corrective Actions

Although most mechanical component maintenance is straightforward, it is usually out of the range of normal services provided by landscaping staff. Therefore, repairing and replacing these components should be left up to general contractors. For mechanical component problems external to confined spaces (Figure M7.1), the recommended maintenance skill level would be (1). For mechanical components in confined spaces, the recommended maintenance skill level would be (2).

Figure M7.1: Valve outside riser.

Valves

Appurtenances with moving parts, especially valves, require annual exercising and lubrication. Most valves are hand-wheel valves that take several turns to completely open (often over thirty turns); however, exercising or temporarily opening a valve does not necessarily involve opening it completely. Staff need only rotate the wheel enough times to make sure the metal gate moves up and down. This procedure may involve two or three wheel rotations and a small amount of water may be released. After the valve is exercised, the staff should slowly close the valve, making sure the gate properly re-seats to a watertight closure position or to the appropriate opening dimension. If a valve gate won't move, it may need to be serviced or replaced. If the valve won't close after being opened a few turns, it will also need service.

Valve service typically means applying lubrication. Lubrication involves greasing the valve corkscrew stem and should only be done once it is determined that the valve will safely close again. Water will be released during this 5 to 15 minute operation as most valves must be completely open during lubrication.

Most valves draw water from, at, or near the pond bottom where sediment accumulates. Avoid the quick opening of valves as water released will be turbid and sediment will be introduced to downstream receiving areas. Open the valve slowly and allow the conditions at the permanent pool end to stabilize prior to complete opening.

Extended length and non-hand wheel valves
Some valves are installed with extended stems to allow safer opening from well-above the actual valve itself. Some valve types do not have hand wheels and are more vandal-resistant but require either a cog or 'T' key to open. The key may or may not be present in the riser box. If it is, it should be securely stored in a place where it cannot be removed and preferably as far removed from running water as possible. If the key is stored off-site, this may pose a problem if the pond needs to be dewatered in an emergency.

Rust-proofing
Although some plastic, aluminum, or PVC appurtenances are available, most mechanical components are galvanized metal. Metal oxidization is an inherent maintenance concern in stormwater pond and wetland environments. Therefore, several methods of rust protection should be employed including painting with zinc-rich or galvanizing paint, coating with bituminous tar or rubber and using stainless steel. Water chemistry, temperature extremes, clogging, and vandalism will speed oxidization.

Repair work usually involves the removal of all rust with a wire brush to expose clean metal, if still present. Exposed metal is painted with a rust-proofing agent. Metal that has rusted through should be patch welded or replaced.

Securing bolts
Usually the bolts securing the metal to a concrete wall are the weakest metal components. An under-strength or under-protected bolt may meet temperature and shear stress extremes, as well as the concrete chemistry or other potential chemical attack. Often, bolts securing a trash rack or orifice plate fail long before the appurtenance fails. Once bolts have rusted through, they must be replaced. Usually the original drill hole has been compromised and a new drill hole must be made.

Aerators
Aerators will be wired to an outside electricity source and they will most likely have an air hose running out to the underwater diffuser head (Figure M7.2). Both types of lines (electrical and air) should be inspected for kinks, exposed wire, and dry rot and replaced as necessary.

Ponds having bubblers, aerators, fountains or diffusers may require specialty contractors or manufacturer representatives for repairing severe maintenance problems. Pump clogging, air hose deterioration or diffuser head clogging may be simple repair items, but an assessment of the difficulty must be made prior to making a judgment call about who is suited to perform the maintenance activity.

Figure M7.2: Surface aerator / fountain.

Cautions and Safety Tips

The opening of valves is an inherently risky procedure, especially when in confined space conditions. There is a small potential that opening a valve may cause an uncontrolled quick release of ponded water, which will flood the access area. Therefore, it is critical that correct confined space procedures be adhered to and suitable removal gear (such as a winch and harness system) be employed for emergency retrieval of maintenance staff that may be momentarily overcome by water under high pressure flow, slick, or cold conditions.

Servicing of electrical components and welding repairs should be performed by professional contractors. Inherent wet conditions can pose safety threats to inexperienced inspectors and maintenance crews where electricity is involved. When inspecting electric-dependent mechanical components, power should be shut off prior to inspection and full body rubber coverage, including gloves, should be used.

M-8 Nuisance Issues

Animals

Problems to Inspect For

Animal burrows, dams, and dens can be significant maintenance issues associated with proper pond and wetland operation and structural stability (Figure M8.1).

Figure M8.1: Animal burrow in pond embankment.

Groundhog/woodchuck burrows will be above the permanent pool and are easier to spot than muskrat burrows, which are located both at and below the permanent pool. Overgrown dam embankments may be riddled with burrow complexes that are not visible to the eye until the brush has been cleared. Usually, if one burrow is found, more are present, as rodent burrowing complexes usually have several ingress/egress points.

Beaver dams and dens (Figure M8.2) tend to be obvious in all but the most neglected stormwater ponds and wetlands where damming may have been present for so long that the original appearance has been almost permanently altered.

Figure M8.2: Beaver dam.

Muskrats tend to be elusive but are occasionally visible. Groundhogs tend to be less shy and sometimes can be seen either feeding or loafing in grassy areas. Beavers are visible in relation to how comfortable they are with human presence. Another indication of rodent activity is the 'slide trail' located on slopes where rodents have created paths for commuting and dragging brush.

Corrective Actions

Rodent management is a contentious issue with strong feelings both for and against the presence of these animals in a suburban setting. There are many types of measures that can be used to ensure that the animals will not continue to negatively impact the stormwater pond or wetland.

Existing burrows should be plugged by filling with material similar to the existing material and capped just below grade with a 50/50 mix of soil and concrete. If plugging of burrows does not discourage the animals from returning, further measures should be taken to either remove the animal population or make critical areas of the facility unattractive to them.

Management options for beaver control include complete tolerance, evaluation on a site-by-site basis, and complete removal. Beaver populations typically will only respond to trapping, dam and lodge removal, or the use of beaver "baffles". Beavers usually do not remain in unsuitable areas. If their dams are breached and their lodges are damaged on a regular basis, the animals typically move on to another location. For instance, their lodges and dams may be removed by simple mechanical methods over two to three seasons. Once these structures are destroyed, regular maintenance of the facilities is often adequate to prevent their activity from becoming a future problem.

However, maintenance staff should be prepared for the displaced animals to be persistent in their efforts to maintain their dams and lodges. Monthly site checks are recommended to ensure that dams and lodges are not rebuilt in the weeks after the initial removal. Once there is no evidence of recent beaver activity, normal less frequent maintenance usually suffices to keep the facility functioning properly.

If there can be no tolerance of beaver activity, then the parties responsible for beaver control must consider relocating or trapping the unwanted animals. It is important to keep in mind that whatever features make the community appealing to one beaver will also make the area desirable to other beavers. Once one animal or family is removed, the pond or wetland will likely be re-occupied by other beavers, as young males are forced to find their own habitat areas each spring. Animal specialists perform trapping. If removal or trapping is utilized as a management tool, expect to continue trapping the area on a regular (i.e., seasonal) basis to maintain the level of control desired by the community. There are two additional points to consider concerning trapping:

- Beaver relocation is much more expensive and challenging than straight trapping (killing beaver with standard beaver traps).
- The existence of jurisdictions willing to accept relocated beavers is limited.

The final option for minimizing the impact of beaver activity is the use of proprietary beaver baffles. The baffles do not eliminate the beaver impoundments, but are intended to minimize their size. The purpose of the baffle is to reduce the impact of rising water levels on real property (bridges, open areas, private property, pathways, etc.) by providing a manual method for changing the water level in the ponds (thus, making dam building more difficult).

Waterfowl

Problems to Inspect For

Waterfowl damage usually takes the form of either reduced vegetative species due to overgrazing, or poor water quality due to high fecal coliform counts. Waterfowl issues usually involve the overpopulation of year-round duck (Figure M8.3) and geese populations (usually Canadian Geese, *Branta canadensis*). Geese and duck droppings on asphalt paths, pond side slopes, docks and cart ways are also easy aesthetic nuisances to spot.

Figure M8.3: Duck family.

Corrective Actions

The following actions can control waterfowl impacts:

- Adding shoreline vegetation and no-mow zones.
- Using proprietary products for managing/discouraging waterfowl/goose populations
- Using trained canines to intimidate geese - Border Collies are the most common species used.
- Addling eggs - shaking the eggs of nesting geese to make the eggs nonviable while still allowing the female goose to perform her breeding duties.
- Introducing predators such as snapping turtles.

Mosquitoes

Problems to Inspect For

Mosquito problems are usually brought to the attention of the maintenance authority by adjacent homeowners, or where organized mosquito control programs exist, by mosquito control or abatement districts. In some locations, the primary cause of a mosquito infestation may be a stormwater structure(s), but in other areas the primary cause may be natural or other man-made habitats. Sometimes, it will be both. Stormwater structures should be periodically checked to determine if there are excessive amounts of mosquitoes.

Stormwater ponds typically will not have mosquito production problems in a central pool that's 6-8 ft. deep, as long as it never dries out or becomes so depleted that water quality is impaired. A relatively large, deep pool helps promote and maintain aquatic predators of mosquito larvae (e.g. larvivorous fishes, dragonfly naiads, predacious diving beetles, water boatmen, backswimmers, salamander larvae). However, in some locations, even an abundance of natural predators may not be enough to control mosquito populations. A deep central pool also inhibits vegetation colonization within the pool, allowing wind to agitate the surface water, which discourages mosquito egg-laying. The primary areas of mosquito production are in the shallow aquatic bench areas that form the pond's periphery and margins. Fluctuation in the pond's water levels can cause isolated areas or pockets within the aquatic bench to cycle in a wet-dry-wet manner, creating conditions under which peripheral low spots, swales or potholes may become mosquito-rearing habitats. Sites like these that have fluctuating water levels (i.e. wet-dry-wet) for extended periods of time can favor the production of floodwater or temporary water mosquito species, many of which can fly long distances.

Maintaining relatively high and stable water levels over the aquatic bench helps reduce floodwater mosquito populations. In many locations, however, (and for the best water quality functioning of the pond) it may be impossible to achieve or maintain such high water level stability. In some cases, thick mats of vegetation that cover aquatic and safety benches, emergent plants, submerged aquatic vegetation, or floating algae, can also promote mosquito production. Thick vegetation can inhibit access of mosquito predators to mosquito rearing sites, creating a refuge within the aquatic or safety benches where either permanent ("standing") water mosquitoes or more ephemeral floodwater mosquitoes can develop and emerge. As such, without unduly sacrificing water quality goals, the aquatic and safety benches should not be allowed to develop excessively thick screens or layers of aquatic vegetation. In some situations, mosquito production may still be high despite these precautions. Insecticides may need to be applied in limited quantities to control mosquito larvae.

Like stormwater ponds, stormwater wetlands have similar concerns and remedies with mosquito production. Of particular concern is a stormwater wetland's smaller and possibly shallower central micro-pool, and an expanded high marsh pond periphery containing less than 6 inches of water. Even the

wetland's low marsh zone, being only 6-18 inches deep, could form problematic breeding spots during times of drought and subsequent rewetting. In some instances, limited amounts of larvicides may need to be used.

Corrective Actions

The most effective mosquito control program is one that eliminates potential breeding habitats. Most stagnant pools of water can be attractive to mosquitoes and the source of a large mosquito population. Ponded water such as open cans and bottles, debris and sediment accumulations, and areas of ground settlement provide ideal locations for mosquito breeding. A maintenance program dedicated to eliminating potential breeding areas is preferable to controlling flying mosquitoes.

Whenever excessive mosquito production is encountered in a stormwater structure, a state, county, or local mosquito control or abatement district should be contacted to request appropriate control actions. In areas where such organized mosquito control programs do not exist, contract with a private company for control actions. Alternatively, a knowledgeable homeowner or homeowner's association might be able to undertake some limited control actions on their own. Quite often, it might be a matter of contacting a local stormwater management agency to undertake needed or neglected maintenance activities within a stormwater structure.

Organized mosquito control or abatement districts typically provide comprehensive, integrated pest management remedies for addressing excessive mosquito production, involving source reduction, larviciding and adulticiding techniques. Private companies tend to be restricted to larviciding efforts, and wherever they might attempt some source reduction remedies in a stormwater structure, they should only do so in consultation with the local stormwater management agency. Larvicide efforts target potential or actual breeding areas and treat them with insecticides that include bacterially-produced products, juvenile growth hormone mimics, and organophosphates. Adulticides that are applied to more widespread areas by aircraft or truck-mounted sprayers include organophosphates and synthetic pyrethroids and should be used only when source reduction or larviciding efforts are not working. Application of any pesticides must be in accordance with the requirements specified on the labels.

Seasonal stocking of predatory fish that eat mosquito larvae is also undertaken in many areas by mosquito control or abatement districts, relying upon mosquitofish (*Gambusia spp*.) in warmer climates, and on the black-striped topminnow (*Notrophus fundulus*), in colder climates. Private companies or homeowners should not undertake fish stocking on their own without first consulting with their state fish and wildlife management agency and/or their state nongame or natural heritage programs to be sure that such fish stocking is permissible and that all pertinent regulations are followed.

Undesirable Plant Communities

Problems to Inspect For

Diverse plant communities support diverse and balanced aquatic communities that host beneficial species such as mosquito predators. Poorly maintained ponds and wetlands are particularly susceptible to the establishment of undesirable plant communities that include monocultures and non-native invasive species. Aquatic plant species such as cattails and common reed are typical monocultures seen in ponds and wetlands, and as previously mentioned cattail stands in particular can produce the very difficult to control *Coquilletidia perturbans* mosquito, an aggressive biter. Similarly, side slopes and embankments are susceptible to rapid colonization by non-natives such as multiflora rose, kudzu (southeastern states), purple loosestrife, and porcelain berry.

Corrective Actions

Management of monolithic plant communities and weeds requires a long-term commitment to action to prevent large-scale problems. Mechanical and hand removal of monocultures such as cattails and common reed is often necessary in conjunction with replanting with other appropriate native emergent species. Algaecides and herbicides are often used to eradicate existing weed species. This method treats the problem as an ongoing maintenance issue and generally requires multiple treatments throughout the growing season. It is often the most effective method of maintaining the desired aesthetic standard for a pond.

Caution should be exercised in performing chemical applications in that some applications may have the desired affect of removing unwanted vegetation, but may increase toxic risks to other resident species. The removal of one weed species creates an opportunity for the growth of another. Once the initial weed is eliminated, the ecological niche previously occupied by the species becomes available to other opportunistic species. Note that multiple applications may be necessary to maintain the desired aesthetic standard for a stormwater pond or wetland.

Maintaining and/or planting upland buffer zones can help to reduce the introduction of nuisance plant species. Planting emergent vegetation may also reduce nuisance algae blooms and waterfowl access. These plants compete with the algae for the available nutrients stored in the pond substrate. As fewer nutrients are available for the algae, their prolific growth potential can be suppressed. Another vegetation management technique is through the establishment of buffer strips or "no mow areas" around the perimeter of stormwater wet ponds and wetlands. These zones help intercept and filter nutrient laden runoff as well as stabilize pond banks. Therefore a mixture of plants with varying heights is recommended.

Water Quality Degradation

Problems to Inspect For

Stormwater ponds and wetlands are susceptible to poor water quality when upland land uses are highly urbanized, deliver large quantities of nutrients, or contain illicit discharges with high concentrations of bacteria and other pollutants. Pond and wetland designs with inefficient turn over (i.e., poor flow circulation) also contribute to water quality degradation. Common indications of poor water quality include an off color (e.g., bright green sheen from algae) or unpleasant odor (e.g., presence of bacteria). Poor water quality, including low dissolved oxygen and organic over-enrichment can also undesirably promote mosquito production by reducing mosquito predators and providing food for mosquito larvae.

Corrective Actions

Maintaining water quality in stormwater ponds and wetlands is challenging, as they are designed to retain constituents in stormwater that can degrade receiving waters. However, a number of water quality related fixes are noted below:

- *Bacterial Improvements*
  Excessive sediments in a pond can contribute to algae problems. If sediment layers become anaerobic, harmful chemicals, noxious odors, and phosphorus can be released into the water column. These conditions can be minimized through the introduction of bacteria in the pond. The bacteria, in the presence of adequate aeration, "digest" the muck layer without producing the harmful side effects,

such as odor, associated with anaerobic decomposition. Through the reduction of available phosphorus, algae growth can be limited. Treatments usually start in early April and continue through September.

- *Diffusers and surface aerators*
  Air can be introduced into the pond or wetland through various systems to facilitate biological decomposition of pond muck, de-stratify thermal layers in the water and improve the ecological health of the system. In general air promotes biological activity, which reduces the amount of available nutrients for algae.

  Diffusers use an air compressor and hoses to bring air into the water column of the pond or wetland. Diffuser systems are low maintenance and are often compared to aquarium compressors on a larger scale. They require annual maintenance and are not recommended for permanent pools less than eight feet deep.

  Aerators resemble fountains in their appearance. They require a motor mounted to an impeller or other type of agitator to "splash" the water. This physical action introduces air to the water. They should be removed from the pond in the late fall to prevent freeze damage and returned to the pond in the spring, after the last freeze. Trash, debris, algae, pond weeds and aquatic plants can bind up moving parts, causing excessive wear and generally cause motors to burn out prematurely. Because these aerators typically draw from the surface of the pond, they are generally not recommended for reducing algae bloom potential or increasing dissolved oxygen in the system, but may provide visual enhancement.

- *Flocculants*
  Flocculants are chemicals applied to ponds to act indirectly on the algae through promotion of settling. The application of flocculates of buffered alum products to the water causes phosphorus and other materials suspended in the water column to settle. Removal of phosphorus from the water column limits the amount of this nutrient available to support algal growth. This works best when water clarity is greater than 24 inches. However, soils with excessive nutrients introduce phosphorous with every rain event and as a result, phosphorus levels are quickly recharged and the value of flocculating the pond is minimized. The application of flocculants may require a permit. Therefore check with local authorities prior to application.

Cautions and Safety Tips

Addressing nuisance issues has few associated safety hazards when appropriately trained individuals conduct the specific tasks (e.g., trapping, chemical application).

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Appendix A:

Unit Costs for Pond and Wetland Maintenance

TABLE A-1. UNIT COSTS FOR POND AND WETLAND MAINTENANCE[1]

Maintenance Item	Unit Price ($)	Unit	Mobilization Cost ($)[2]	Maintenance Interval (yrs)[3]
Permanent Pool Issues				
Dam/ Embankment				
unclog internal drains for embankments	10	lf	1,500	R (10)
repair low spots in dam or berm	170	cy	1,500	R (5)
Clogging				
debris removal (preventative)	350	event	0	0.25-1
clear outfall channel of sediment	130	cy	0	5-15
clogged low flow	750	event	800	0.25-1
Pipe Repairs				
Structural - Riser and Barrel				
re-tar CMP barrel	11	sf	800	15-20
install new elbow underground	1,200	ea	800	R
repair CMP barrel joint leak	530	ea	800	R (3-5)
repair leaking concrete principal spillway joint	1,200	ea	0	R (5-10)
replace riser (CMP)	12,000	ea	>2,500	R (25)
replace riser (concrete)	20,000	ea	>2,500	R (50)
replace barrel	1,000	lf	>2,500	R (25-50)

1) These costs were largely derived from data from the Maryland region, based on bid proposal and actual 2005 project data.
2) Cost at four levels: $0 for no mobilization; $800 for minimal mobilization; $1,500 for small project mobilization; >$2,500 for large project mobilization. Note that these are approximations. For items with no mobilization cost, it is assumed that the mobilization cost is incorporated into the overall unit cost, or that the maintenance can be completed during inspection.
3) Bottom number in range represents ideal maintenance interval. Top number represents maximum interval between maintenance activities. R indicates repair items, whose frequency is somewhat unpredictable. The frequencies sometimes reported in parentheses represent an estimate of typical repair frequency.

Maintenance Item	Unit Price ($)	Unit	Mobilization Cost ($)[2]	Maintenance Interval (yrs)[3]
Structural - Pipes				
replace existing underground elbow	1,400	ea	800	R (10)
slip line failing pipes	90	lf	>2,500	R
replace end sections <36"	600	ea	1,500	R
remote control TV video pipes	1	lf	800	5-25
Structural - Other Concrete				
concrete work under ground	600	cy	1,500	R
concrete work above ground	450	cy	1,500	R
grout cracks	50	lf	0	R
parge spalling	25	sf	0	R
repair gutter spalling	230	event	800	R
injection grout concrete leaks	180	lf	800	R
Structural: Metal				
new low flow trash rack	1,700	ea	800	R (5-10)
install high stage trash rack 4'x2'	1,100	ea	1,500	R (20+)
replace CMP anti-vortex device <48"	1,500	ea	1,500	R (10-15)
replace CMP anti-vortex device >48"	4,600	ea	1,500	R (10-15)
remove bolts, lift lugs, form nails	80	ea	800	R

1. These costs were largely derived from data from the Maryland region, based on bid proposal and actual project data.
2. Cost at four levels: $0 for no mobilization; $800 for minimal mobilization; $1,500 for small project mobilization; >$2,500 for large project mobilization. Note that these are approximations. For items with no mobilization cost, it is assumed that the mobilization cost is incorporated into the overall unit cost, or that the maintenance can be completed during inspection.
3. Bottom number in range represents ideal maintenance interval. Top number represents maximum interval between maintenance activities. R indicates repair items, whose frequency is somewhat unpredictable. The frequencies sometimes reported in parentheses represent an estimate of typical repair frequency.

Maintenance Item	Unit Price ($)	Unit	Mobilization Cost ($)[2]	Maintenance Interval (yrs)[3]
Vegetation Management				
sod	3.30	sy	800	1-2
seed and top soil bare areas (3 inch depth)	4.40	sy	800	1-2
plant 1.5 inch tree	84	ea	0	R[3]
plant shrub	15	ea	0	R
mowing	300	ac	0	0.5-1
clear outfall and channel of trees	5.50	sy	800	0.5-1
clear embankment of small trees by hand	3.30	sy	800	0.5-1
clear embankment trees with Ambusher or Brushhog	0.90	sy	800	0.5-1
remove live tree (<12 inches)	130	ea	800	R (1-10)
remove live trees larger than 12 inches, <24 inches	250	ea	800	R (10-25)
remove downed timber (up to 40 cy of material)	2,200	event	0	0.25-1
remove dumped vegetative material (up to 40 cy)	2,600	event	0	0.25-1
install wetland plant	6	ea	800	R (3-5)
remove invasive wetland vegetation (machine remove phragmites) (up to 40 cy)	3,000	event	0	R
spray for algae (0.25 ac pond)	600	ea	0	R
spray for cattails (0.25 ac pond)	330	ea	0	R
repair low spots in dry pond bottom	25	sy	1,500	R
remove woody vegetation from dry pond bottom	1,700	event	0	5-10

1. These costs were largely derived from data from the Maryland region, based on bid proposal and actual project data.
2. Cost at four levels: $0 for no mobilization; $800 for minimal mobilization; $1,500 for small project mobilization; >$2,500 for large project mobilization. Note that these are approximations. For items with no mobilization cost, it is assumed that the mobilization cost is incorporated into the overall unit cost, or that the maintenance can be completed during inspection.
3. Bottom number in range represents ideal maintenance interval. Top number represents maximum interval between maintenance activities. R indicates repair items, whose frequency is somewhat unpredictable. The frequencies sometimes reported in parentheses represent an estimate of typical repair frequency.

Maintenance Item	Unit Price ($)	Unit	Mobilization Cost ($)[2]	Maintenance Interval (yrs)[3]
Dredging and Mucking				
dredge wet ponds (jobs larger than 1000 cy) haul offsite	60	cy	>2,500	5-15
dry pond sediment removal	7,600	event	0	15-25
dewater pond	900	event	0	15-25
muck out undergrounds	390	cy	0	0.5-1
dewater and remove sludge from underground facilities	1	gal	0	0.25-1
typical sediment dump fee (not including trucking)	66	ton	0	NA
truck day for landfill to transport underground dredge materials (minimum, assume 2 to 4 trips in one day)	800	trip-day	0	NA
Access/ Safety				
install warning signs	210	ea	0	R
add manhole steps	100	ea	800	R
new manhole cover	250	ea	0	R
create 12' access road (permanent, cut/fill balances)	40	lf	1,500	R
create 12' access road (permanent, cut/fill non-balance)	65	lf	1,500	R
create 12' access road (temp)	12	lf	1,500	R
install chainlink fence	26	lf	800	R
install ladder (8 foot)	220	each	800	R
install three rail fence	15	lf	800	R
repair asphalt path	26	cy	800	R
supply lock and chain for first one (additional at $30 apiece)	130	ea	0	4-8

1. These costs were largely derived from data from the Maryland region, based on bid proposal and actual project data.
2. Cost at four levels: $0 for no mobilization; $800 for minimal mobilization; $1,500 for small project mobilization; >$2,500 for large project mobilization. Note that these are approximations. For items with no mobilization cost, it is assumed that the mobilization cost is incorporated into the overall unit cost, or that the maintenance can be completed during inspection.
3. Bottom number in range represents ideal maintenance interval. Top number represents maximum interval between maintenance activities. R indicates repair items, whose frequency is somewhat unpredictable. The frequencies sometimes reported in parentheses represent an estimate of typical repair frequency.

Maintenance Item	Unit Price ($)	Unit	Mobilization Cost ($)[2]	Maintenance Interval (yrs)[3]
Mechanical Components				
remove old valve	300	ea	800	R (10)
install new valve (<36 inches)	4,600	ea	1,500	R
install new valve (< 24 inches)	3,100	ea	1,500	R
install new valve (<11 inches)	1,300	ea	1,500	R
install new valve (<7 inches)	460	ea	800	R
lubricate valves (same price for first four)	300	ea	0	1-2
Nuisance Issues				
pond/ wetland aeration	560	ea	0	1
treat pond for mosquitoes	1,000	acre	0	R
trap beavers (one week, one location, family of 6)	1,000	event	0	R
fill animal burrows	23	sy	800	R (5-10)
remove graffiti	310	day	800	1-3
Erosion/ Channel Maintenance				
establish new riprap pilot channels (8' wide, 1' deep)	38	lf	1,500	5-15
remove and replace rip rap or pea gravel	160	sy	1,500	15-25
shoreline protection	50	lf	1,500	R
new riprap (general)	80	cy	1,500	R (5-10)
erosion repair	1,100	event	0	R (2-5)
jet clean rip rap (6X 15, 1' silt)	2,500	event	0	15-25

4) These costs were largely derived from data from the Maryland region, based on bid proposal and actual project data.
5) Cost at four levels: $0 for no mobilization; $800 for minimal mobilization; $1,500 for small project mobilization; >$2,500 for large project mobilization. Note that these are approximations. For items with no mobilization cost, it is assumed that the mobilization cost is incorporated into the overall unit cost, or that the maintenance can be completed during inspection.
6) Bottom number in range represents ideal maintenance interval. Top number represents maximum interval between maintenance activities. R indicates repair items, whose frequency is somewhat unpredictable. The frequencies sometimes reported in parentheses represent an estimate of typical repair frequency.

Appendix B:
Pond and Wetland Checklists

STORMWATER POND / STORMWATER WETLAND CONSTRUCTION INSPECTION CHECKLIST

Date: Time:

Project:

Location:

Site Status (active, inactive, completed):

Inspector(s):

Type of Practice:

☐	Micropool ED Pond	☐	Shallow Wetland
☐	Wet Pond	☐	Shallow ED Wetland
☐	Multiple Pond System	☐	Pond / Wetland System
☐	Pocket Pond	☐	Pocket Wetland

Construction Sequence	Satisfactory	Unsatisfactory	Comments
I. Pre-Construction / Materials and Equipment			
Pre-construction meeting			
Pipe and appurtenances on-site prior to construction and dimensions checked			
1. Material (including protective coating, if specified)			
2. Diameter			
3. Dimensions of metal or pre-cast concrete riser			
4. Required dimensions between water control structures (orifices, weirs, etc.) are in accordance with approved plans			
5. Barrel stub for prefabricated pipe structures at proper angle for design barrel slope			
6. Number and dimensions of prefabricated anti-seep collars			
7. Watertight connectors and gaskets			
8. Outlet drain valve			
Project benchmark near pond site			
Equipment for temporary de-watering / sediment and erosion control			
II. Subgrade Preparation			
Area beneath embankment stripped of all vegetation, topsoil, and organic matter			
Core trench excavated and backfilled			
III. Pipe Spillway Installation			
Method of installation detailed on plans			
A. Bed preparation			
Installation trench excavated with specified side slopes			
Stable, uniform, dry subgrade of relatively impervious material (If subgrade is wet, contractor shall have defined steps before proceeding with installation)			
Invert at proper elevation and grade			

Construction Sequence	Satisfactory	Unsatisfactory	Comments
B. Pipe placement			
Metal / plastic pipe			
1. Watertight connectors and gaskets properly installed			
2. Anti-seep collars properly spaced and having watertight connections to pipe			
3. Backfill placed and tamped by hand under “haunches” of pipe			
4. Remaining backfill placed in max. 8 inch lifts using small power tamping equipment until 2 feet cover over pipe is reached			
Concrete pipe			
1. Pipe set on blocks or concrete slab for pouring of low cradle			
2. Pipe installed with rubber gasket joints with no spalling in gasket interface area			
3. Excavation for lower half of anti-seep collar(s) with reinforcing steel set			
4. Entire area where anti-seep collar(s) will come in contact with pipe coated with mastic or other approved waterproof sealant			
5. Low cradle and bottom half of anti-seep collar installed as monolithic pour and of an approved mix			
6. Upper half of anti-seep collar(s) formed with reinforcing steel set			
7. Concrete for collar of an approved mix and vibrated into place (protected from freezing while curing, if necessary)			
8. Forms stripped and collar inspected for honeycomb prior to backfilling. Parge if necessary.			
C. Backfilling			
Fill placed in maximum 8 inch lifts			
Backfill taken minimum 2 feet above top of anti-seep collar elevation before traversing with heavy equipment			
IV. Riser / Outlet Structure Installation			
Riser located within embankment			
A. Metal riser			
Riser base excavated or formed on stable subgrade to design dimensions			
Set on blocks to design elevations and plumbed			
Reinforcing bars placed at right angles and projecting into sides of riser			
Concrete poured so as to fill inside of riser to invert of barrel			
B. Pre-cast concrete structure			

Construction Sequence	Satisfactory	Unsatisfactory	Comments
Dry and stable subgrade			
Riser base set to design elevation			
If more than one section, no spalling in gasket interface area; gasket or approved caulking material placed securely			
Watertight and structurally sound collar or gasket joint where structure connects to pipe spillway			
C. Poured concrete structure			
Footing excavated or formed on stable subgrade, to design dimensions with reinforcing steel set			
Structure formed to design dimensions, with reinforcing steel set as per plan			
Concrete of an approved mix and vibrated into place (protected from freezing while curing, if necessary)			
Forms stripped & inspected for honeycomb prior to backfilling; parge if necessary			
V. Embankment Construction			
Fill material			
Compaction			
Embankment			
1. Fill placed in specified lifts and compacted with appropriate equipment			
2. Constructed to design cross-section, side slopes and top width			
3. Constructed to design elevation plus allowance for settlement			
VI. Impounded Area Construction			
Excavated / graded to design contours and side slopes			
Inlet pipes have adequate outfall protection			
Forebay(s)			
Pond benches			
VII. Earth Emergency Spillway Construction			
Spillway located in cut or structurally stabilized with riprap, gabions, concrete, etc.			
Excavated to proper cross-section, side slopes and bottom width			
Entrance channel, crest, and exit channel constructed to design grades and elevations			
VIII. Outlet Protection			
A. End section			
Securely in place and properly backfilled			
B. Endwall			
Footing excavated or formed on stable subgrade, to design dimensions and reinforcing steel set, if specified			

Construction Sequence	Satisfactory	Unsatisfactory	Comments
Endwall formed to design dimensions with reinforcing steel set as per plan			
Concrete of an approved mix and vibrated into place (protected from freezing, if necessary)			
Forms stripped and structure inspected for honeycomb prior to backfilling; parge if necessary			
C. Riprap apron / channel			
Apron / channel excavated to design cross-section with proper transition to existing ground			
Filter fabric in place			
Stone sized as per plan and uniformly place at the thickness specified			
IX. Vegetative Stabilization			
Approved seed mixture or sod			
Proper surface preparation and required soil amendments			
Excelsior mat or other stabilization, as per plan			
X. Miscellaneous			
Drain for ponds having a permanent pool			
Trash rack / anti-vortex device secured to outlet structure			
Trash protection for low flow pipes, orifices, etc.			
Fencing (when required)			
Access road			
Set aside for clean-out maintenance			

Additional Comments:

Action to be Taken:

No action necessary. Continue routine inspections.

Correct noted site deficiencies by

1st notice

2nd notice

Submit plan modifications as noted in written comments by

Notice to Comply issued

Final inspection, project completed

POND / WETLAND MAINTENANCE INSPECTION FORM

Facility Number:_____ Date:_____ Time:_____

Subdivision Name:_____ Watershed:_____

Weather:_____ Inspector(s):_____

Date of Last Rainfall:_____ Amount:_____ Inches Streets:_____

Mapbook Location:_____ GPS Coordinates:_____

Property Classification: Residential 9 Government 9 Commercial 9 Other:_____

Type of Practice: Wet Pond 9 Dry Pond 9 Micropool ED 9 Multiple Pond System 9 Pocket Pond 9

Shallow Wetland 9 Shallow ED 9 Pond/ Wetland 9 Pocket Wetland 9

Confined 9 Unconfined 9 Barrel Size_____ As-built Plan Available? Yes 9 No 9

Is Facility Inspectable? Yes 9 No 9 Why?_____ Comments Specific Location(s):_____

Scoring Breakdown:

N/A = Not Applicable
N/I = Not Investigated
0 = Not a Problem
1 = Monitor (potential for future problem exists)
2 = Routine Maintenance Required
3 = Immediate Repair Necessary

* **Use open space in each section to further explain scoring as needed**

1. Outfall Channel(s) from Pond						
Woody growth within 5' of outfall barrel	N/A	N/I	0	1	2	3
Outfall channel functioning	N/A	N/I	0	1	2	3
Manholes, Frames and Covers	N/A	N/I	0	1	2	3
Released water undercutting outlet	N/A	N/I	0	1	2	3
Erosion	N/A	N/I	0	1	2	3
Displaced rip rap	N/A	N/I	0	1	2	3
Excessive sediment deposits	N/A	N/I	0	1	2	3
Other:	N/A	N/I	0	1	2	3
2. Downstream Dam Bank						
Cracking, bulging, or sloughing of dam	N/A	N/I	0	1	2	3
Erosion and/or loss of dam material	N/A	N/I	0	1	2	3
Animal burrows	N/A	N/I	0	1	2	3
Soft spots or boggy areas	N/A	N/I	0	1	2	3
Woody growth or unauthorized plantings on dam	N/A	N/I	0	1	2	3
Other:	N/A	N/I	0	1	2	3
3. Upstream Dam Bank						
Cracking, bulging, or sloughing of dam	N/A	N/I	0	1	2	3
Erosion and/or loss of dam material	N/A	N/I	0	1	2	3
Animal Burrows	N/A	N/I	0	1	2	3
Soft spots or boggy areas	N/A	N/I	0	1	2	3
Woody growth or unauthorized plantings on dam	N/A	N/I	0	1	2	3
Other:	N/A	N/I	0	1	2	3

4. Emergency Spillway							
Woody growth or unauthorized plantings	N/A	N/I	0	1	2	3	
Erosion or back cutting	N/A	N/I	0	1	2	3	
Soft or boggy areas	N/A	N/I	0	1	2	3	
Obstructions / debris	N/A	N/I	0	1	2	3	

5. Principal Spillway Built to Plans							
# of Barrels:_____ Size:_____	RCP	CMP	PVC	STEEL	or	MASONRY	(Circle One)
Confined space entry permit required for entry into all riser and barrels			Entry Approved 9			Entry Denied 9	
Minor spalling or parging (<1”)	N/A	N/I	0	1	2	3	
Major spalling (exposed rebar)	N/A	N/I	0	1	2	3	
Joint failure	N/A	N/I	0	1	2	3	
Loss of joint material	N/A	N/I	0	1	2	3	
Leaking	N/A	N/I	0	1	2	3	
Corrosion	N/A	N/I	0	1	2	3	
Protective material deficient	N/A	N/I	0	1	2	3	
Misalignment or split seams / joints	N/A	N/I	0	1	2	3	
Other:	N/A	N/I	0	1	2	3	

6. Riser Built to Plans							
Size:_____	CONC	CMP	or	MASONRY		(Circle One)	
Minor spalling or parging (<1”)	N/A	N/I	0	1	2	3	
Major spalling (exposed rebar)	N/A	N/I	0	1	2	3	
Joint failure	N/A	N/I	0	1	2	3	
Loss of joint material	N/A	N/I	0	1	2	3	
Leaking	N/A	N/I	0	1	2	3	
Manhole access and steps acceptable	N/A	N/I	0	1	2	3	
Corrosion	N/A	N/I	0	1	2	3	
Protective material deficient	N/A	N/I	0	1	2	3	
Misalignment or split seams / joints	N/A	N/I	0	1	2	3	
Anti-vortex device secure / acceptable	N/A	N/I	0	1	2	3	
Sediment Accumulation within riser	N/A	N/I	0	1	2	3	
Woody or vegetative growth within 25’ of riser	N/A	N/I	0	1	2	3	
Safety Rebar/pipes in place	N/A	N/I	0	1	2	3	
Safety Rebar/pipes corroded	N/A	N/I	0	1	2	3	
Other:	N/A	N/I	0	1	2	3	

7. Low Flow Built to Plans							
Orifice and/or trash rack obstructed	N/A	N/I	0	1	2	3	
Trash Rack Corrosion	N/A	N/I	0	1	2	3	
Other:	N/A	N/I	0	1	2	3	

8. Weir Trash Rack							
Structurally sound	N/A	N/I	0	1	2	3	
Debris removal necessary	N/A	N/I	0	1	2	3	
Corrosion	N/A	N/I	0	1	2	3	

N/A = Not Applicable
N/I = Not Investigated
0 = Not a Problem
1 = Monitor for Future Repairs
2 = Routine Repairs Needed
3 = Immediate Repair Needed

9. Control Valve(s) Built to Plans							
Size:_____ Type:_____							
Operation limited	N/A	N/I	0	1	2	3	
Exercised	N/A	N/I	0	1	2	3	
Leaks	N/A	N/I	0	1	2	3	
Chains & Locks	N/A	N/I	0	1	2	3	
Set to design opening	N/A	N/I	0	1	2	3	
Other:	N/A	N/I	0	1	2	3	
10. Pond Drain Valve							
Operation limited	N/A	N/I	0	1	2	3	
Exercised	N/A	N/I	0	1	2	3	
Leaks	N/A	N/I	0	1	2	3	
Chained & locked correctly	N/A	N/I	0	1	2	3	
Other:	N/A	N/I	0	1	2	3	
11. Toe & Chimney Drains Clear & Functioning	N/A	N/I	0	1	2	3	
12. Rip-Rap Pilot Channel (Micropool only)							
Sediment or debris build up	N/A	N/I	0	1	2	3	
Erosion/ Undermining	N/A	N/I	0	1	2	3	
13. Permanent Pool							
Visible pollution	N/A	N/I	0	1	2	3	
Shoreline and / or side slope erosion	N/A	N/I	0	1	2	3	
Aquatic bench inadequately vegetated	N/A	N/I	0	1	2	3	
Abnormally high or low water (pool) levels	N/A	N/I	0	1	2	3	
Sediment / debris accumulation	N/A	N/I	0	1	2	3	
Bathometric study recommended			No		Yes		
Other?	N/A	N/I	0	1	2	3	
14. Dry Storage							
Vegetation sparse	N/A	N/I	0	1	2	3	
Undesirable woody or vegetative growth	N/A	N/I	0	1	2	3	
Low flow channels obstructed	N/A	N/I	0	1	2	3	
Standing water or spots	N/A	N/I	0	1	2	3	
Sediment or debris accumulation	N/A	N/I	0	1	2	3	
Bathometric study recommended			No		Yes		
Other:	N/A	N/I	0	1	2	3	
15. Pretreatment							
Maintenance access	N/A	N/I	0	1	2	3	
Is pretreatment a practice other than a forebay			No		Yes		Of so,_____(code)
Dredging required			No		Yes		
Hard pad condition (Wet pond only)	N/A	N/I	0	1	2	3	
Fixed vertical sediment depth marker present			No		Yes		
Marker Reading_____							
Sediment accumulation	N/A	N/I	0	1	2	3	Estimated % full_____%

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16. Inflow Points							
Number of inflow pipes:_____	Direction: N		E		W	S	
Endwalls, headwalls, end sections	N/A	N/I	0	1	2	3	
Outfall pipes	N/A	N/I	0	1	2	3	
Discharge undercutting outlet or displacing rip-rap	N/A	N/I	0	1	2	3	
Discharge water is causing outfall to erode	N/A	N/I	0	1	2	3	
Sediment accumulation	N/A	N/I	0	1	2	3	
17. Wet Pond Vegetation							
Invasive plants	N/A	N/I	0	1	2	3	
% cover_____							
Vegetation matches landscape design plan	N/A	N/I	0	1	2	3	
Planting needed	N/A	N/I	0	1	2	3	
Shore erosion	N/A	N/I	0	1	2	3	
Coverage needs improvement	N/A	N/I	0	1	2	3	
18. Pond Buffer							
Encroachment by structures	N/A	N/I	0	1	2	3	
Clearing of vegetation	N/A	N/I	0	1	2	3	
Planting needed	N/A	N/I	0	1	2	3	
Predominant vegetation types:	Forested □		Shrubs □		Meadow □		Maintained Grass □ Other:_____
19. Special Structures							
Manhole access (steps, ladders)	N/A	N/I	0	1	2	3	
Vehicular access	N/A	N/I	0	1	2	3	
Concrete/masonry condition	N/A	N/I	0	1	2	3	
Trash racks	N/A	N/I	0	1	2	3	
Elbows	N/A	N/I	0	1	2	3	
Sediment / trash removal	N/A	N/I	0	1	2	3	
Manhole lockable nuts	N/A	N/I	0	1	2	3	
20. Miscellaneous							
Encroachment in pond area and/or easement area	N/A	N/I	0	1	2	3	
Fence condition	N/A	N/I	0	1	2	3	
Safety signs	N/A	N/I	0	1	2	3	
Complaints from local residents	N/A	N/I	0	1	2	3	
Graffiti	N/A	N/I	0	1	2	3	
Public hazards	N/A	N/I	0	1	2	3	
Excessive mosquitoes	N/A	N/I	0	1	2	3	
Were any pad locks cut and replaced			No		Yes		How Many?_____

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Overall Condition of Facility

Total number of concerns receiving a: **(1)_____ - Need Monitoring**
(2)_____ - Routine Repair
(3)_____ - Immediate Repair Needed

Inspector's Summary

Pictures	Clock/Degrees	Prin. Spill. Barrel Joints	Clock/Degrees
1.		1.	
2.		2.	
3.		3.	
4.		4.	
5.		5.	
6.		6.	
7.		7.	
8.		8.	
9.		9.	
10.		10.	
11.		11.	
12.		12.	
13.		13.	
14.		14.	
15.		15.	

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Sketches, If Necessary:

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Home Owner Pond Inspection Checklist

We encourage you to copy this checklist and maintain record of your inspections. (Adapted from Hampton Roads: A Guide for Maintaining and Operating BMPs.) Answering YES to any of these questions indicates a need for corrective action or consultation with a professional inspector.

Date:_____ Inspected by:_____

	What to look for . . .	Yes	No
✓	Does the facility show signs of settling, cracking, bulging, misalignment or other structural deterioration?	❑	❑
✓	Do the embankments, emergency spillways, side slopes or inlet/outlet structures show signs of erosion?	❑	❑
✓	Are the pipes going into and/or out of the pond clogged or obstructed?	❑	❑
✓	Do the impoundment and inlet areas show erosion, low spots or lack of stabilization?	❑	❑
✓	Are there trees present on the banks?	❑	❑
✓	Is there evidence of animal burrows?	❑	❑
✓	Are contributing areas unstabilized with evidence or erosion?	❑	❑
✓	Do vegetated areas need mowing or is there a build up of clippings that could clog the facility?	❑	❑
✓	Does sedimentation greatly decrease the BMPs capacity to hold water within the structure?	❑	❑
✓	Is there standing water in appropriate or inappropriate areas?	❑	❑
✓	Is there accumulation of trash or debris?	❑	❑
✓	Is there evidence of encroachment or improper use of the impounded areas?	❑	❑
✓	Are there signs of vandalism?	❑	❑
✓	Do any safety devices such as fences, gates or locks need repair?	❑	❑
✓	Is there excessive algae or dominance of one type of vegetation?	❑	❑
✓	Is there evidence of automotive fluids entering or clogging the facility?	❑	❑
✓	Is there evidence of a fish kill?	❑	❑
✓	Do you see a lot of mosquito larvae (small “wigglers” or “tumblers”) in the water?	❑	❑
✓	Is there evidence of excessive amounts of mosquitoes?	❑	❑

Additional Observations: _____

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