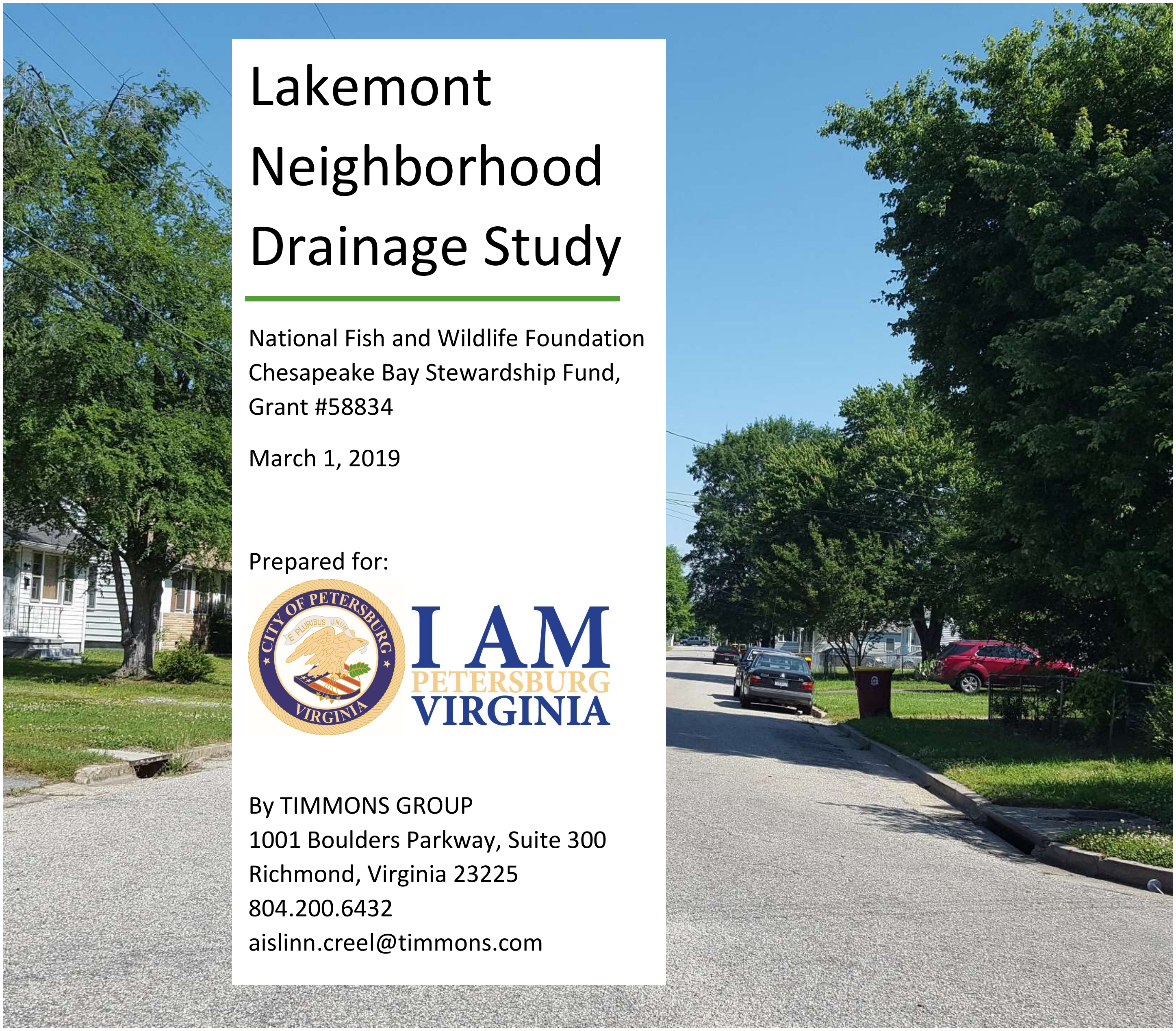


Lakemont Neighborhood Drainage Study

National Fish and Wildlife Foundation
Chesapeake Bay Stewardship Fund,
Grant #58834

March 1, 2019

Prepared for:

I AM PETERSBURG VIRGINIA

By TIMMONS GROUP
1001 Boulders Parkway, Suite 300
Richmond, Virginia 23225
804.200.6432
aislinn.creel@timmons.com

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

JAMES RIVER ASSOCIATION

Skeo

NFWF
Chesapeake Bay Stewardship Fund

Chesapeake Bay Program
Science. Restoration. Partnership.

Table of Contents

Purpose

Objectives

The objectives of the project were to provide sustainable and feasible solutions to address stormwater runoff problems in the City of Petersburg's Lakemont Neighborhood. Specifically, the limits of the study area extended from Washington Street south to the Petersburg National Battlefield, generally located between Poor Creek to the west and Harrison Creek to the east, as illustrated below in the Figure. The purpose of this project is to continue to build upon previous investments by NFWF and others.

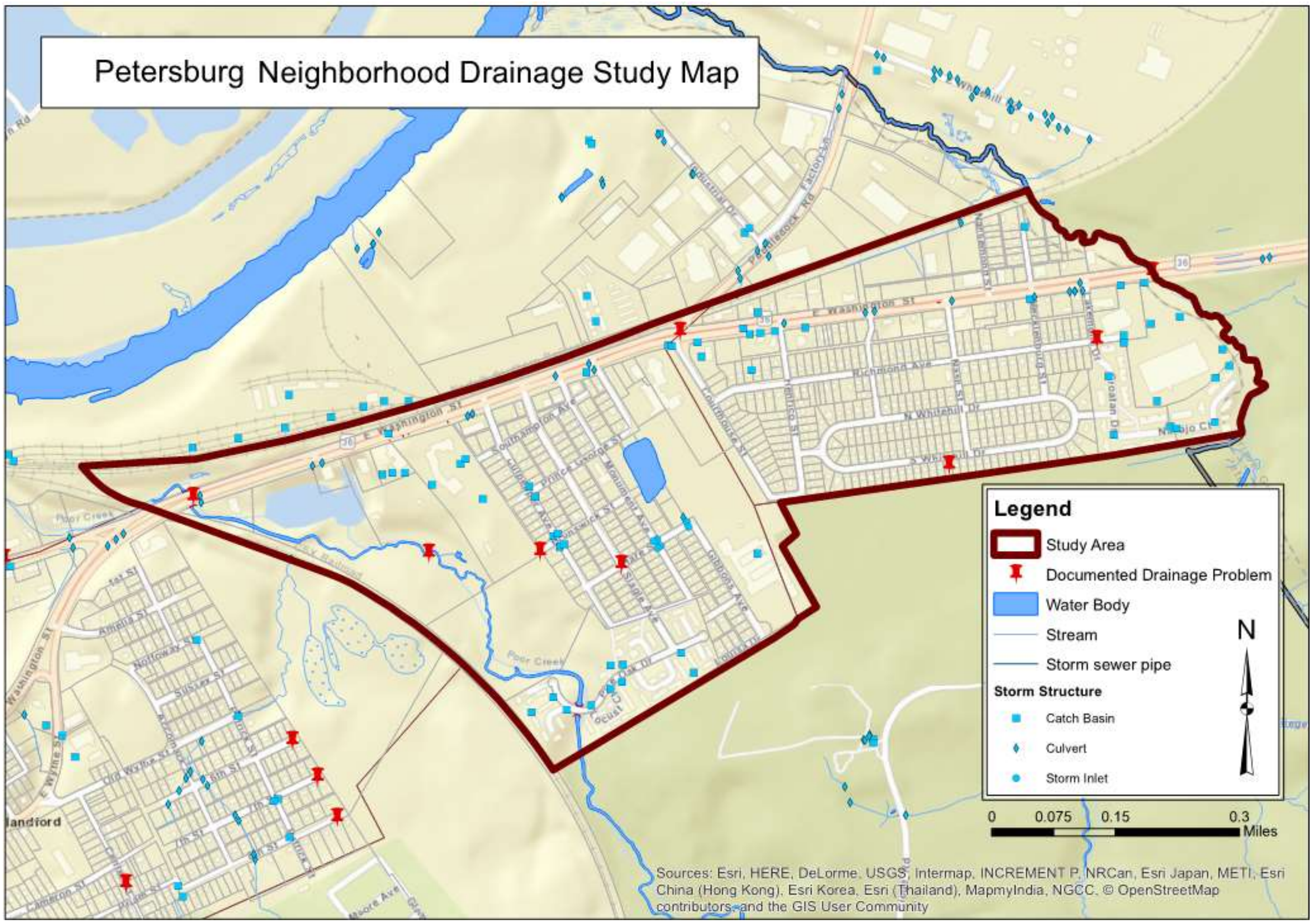


Figure 1. Petersburg Neighborhood Drainage Study Map.

NFWF has previously funded two discrete studies that broadly or specifically focused on the current study area: 1) a Technical Capacity building grant, awarded to Timmons Group on behalf of the City of Petersburg entitled, "GIS Application and Water Quality Master Plan;" and 2) an Innovative Nutrient and Sediment Reduction Grant awarded to James River Association and Skeo Solutions, in which Petersburg was a participant recipient of a "Walkable Watershed Concept Plan," as illustrated below in Figure 2.

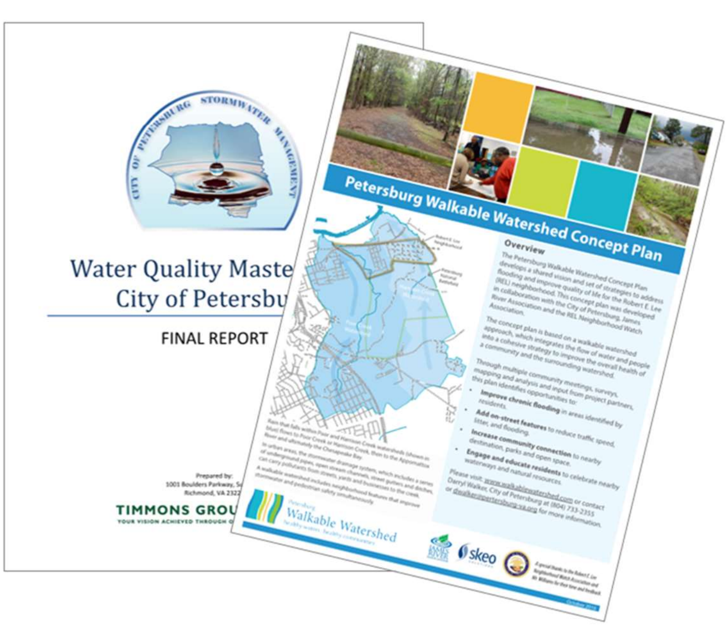


Figure 2. Previous NFWF-funded studies.

A unique aspect of the two previously funded efforts was the differentiation in approach. Where the work for the Water Quality Master Plan was influenced heavily by work sessions with City staff with first-hand knowledge of maintenance efforts, City infrastructure, and associated funds or lack thereof; the Walkable Watershed Concept Plan was focused on educating and engaging the public, soliciting their first-hand knowledge and input in developing truly sustainable solutions addressing stormwater issues and beyond. Therefore, the objective of this Neighborhood Drainage Study is to progress beyond city-wide Water Quality Master Plan level, beyond Watershed Concept Plan level, and toward design and construction by identifying at least four (4) specific sustainable and feasible projects. Each project will identify project extents, alignment, constraints, quantifiable benefits (pollutant reduction and/or hydraulic level of service), and construction cost estimates. The objective of this study is to develop a list of defined and prioritized projects ready to proceed with funding for implementation.

Priority and Overall Context

Situated along the banks of the Appomattox River, the City of Petersburg is designated as a Phase II MS4, which is regulated under the Virginia Stormwater Management Program. As a part of Petersburg's MS4 permit, targeted reductions of nitrogen, phosphorus and sediment are required to meet the goals set out by the Bay TMDL and Watershed Implementation Plans (WIP). Petersburg's MS4 permit calls for significant reductions in urban pollution runoff to meet the Bay TMDL's 2025 goals, including: 3,242 lbs of nitrogen, 613 lbs of phosphorus, and 256,226 lbs of TSS; however, the City continues to struggle with funding projects for implementation.

Figure 3. Neighborhood view of the Tri-cities Landfill.

The neighborhoods adjacent to Lakemont Elementary School are located within the MS4 area, and like other urban environments in Virginia, consist of a large amount of impervious area that are a significant source of pollutant-laden stormwater runoff to receiving streams. According to the 2010 U.S. Census, the study area, as featured in Figure 1, is home to 2,868 residents living in 511.4 housing units.

Though the population and housing unit densities are lower than the City's averages, a higher proportion of residents in this area experience poverty and more than half of the residents do not own their homes. Recent statistics indicate more than half of the residents rely on Food Stamps at least occasionally. These figures along with the neighborhood's proximity to the active Tri-Cities Regional Landfill, an actively expanding landfill, have left many residents of the neighborhood to feel overlooked and isolated from the rest of the city. This historically underserved neighborhood includes Lakemont Elementary School and several churches. Discharging directly to Poor Creek, an impaired stream, to the west and Harrison Creek to the east, the study area is a high priority for projects to enhance the land's ability to absorb and filter polluted stormwater runoff. Implementation of green infrastructure practices will be a significant improvement for local waterways and help the City get closer to the goals outlined in their MS4 permit.

Figure 4. Typical street view.

Previous Studies

GIS and Water Quality Master Plan

In 2013, NFWF provided critical funding that enabled the City to digitize into one central repository an extensive amount of geographic information systems data. All the City's Public Works data that was previously housed in several CAD files was cleaned up and converted to a geodatabase. In addition, many other data layers were developed and/or processed to provide the City with a comprehensive set of data for use in developing the city-wide Water Quality Master Plan. These data layers include tax parcels, public utilities (water and sanitary sewer), transportation layers, soils, Planning District Commission data, etc. During development of the Master Plan, Timmons Group conducted several work sessions with City Public Works staff to document and geocode all known problem drainage areas, as well as, to receive insight into the City's stormwater maintenance activities and initial perception of project feasibility. As a result of the study, water quality projects, aimed at reducing stormwater runoff and/or reducing stormwater pollutant load to receiving waters were preliminarily identified and prioritized. Further, a list of recommended Neighborhood Drainage Studies was generated, which included the Lakemont and East Petersburg neighborhoods, which have since been combined and are known as the Lakemont Neighborhood, represented by one Neighborhood Watch organization. An excerpt from the Project Reference Map that was presented as Appendix D of the Final Report of the Water Quality Master Plan is presented below. For more information regarding the complete Water Quality Master Plan, please refer to Appendix A. In the Lakemont Neighborhood, a total of six (6) drainage problem areas were identified, represented as red pinpoints on the Figure below, and one (1) potential large-scale water quality project, represented as a blue pinpoint. The logical next step following the City-wide Water Quality Master Plan is to further study drainage problems areas and high-level water quality projects to determine potential solutions, which is the purpose of this present study.

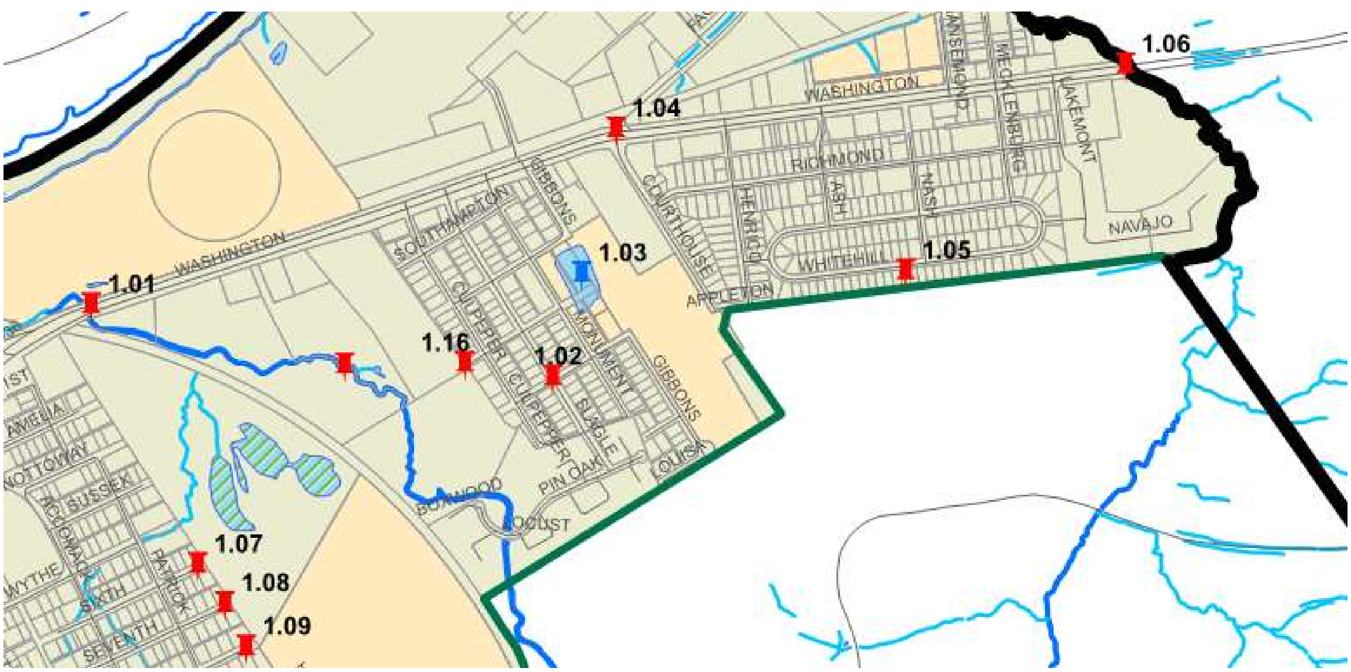
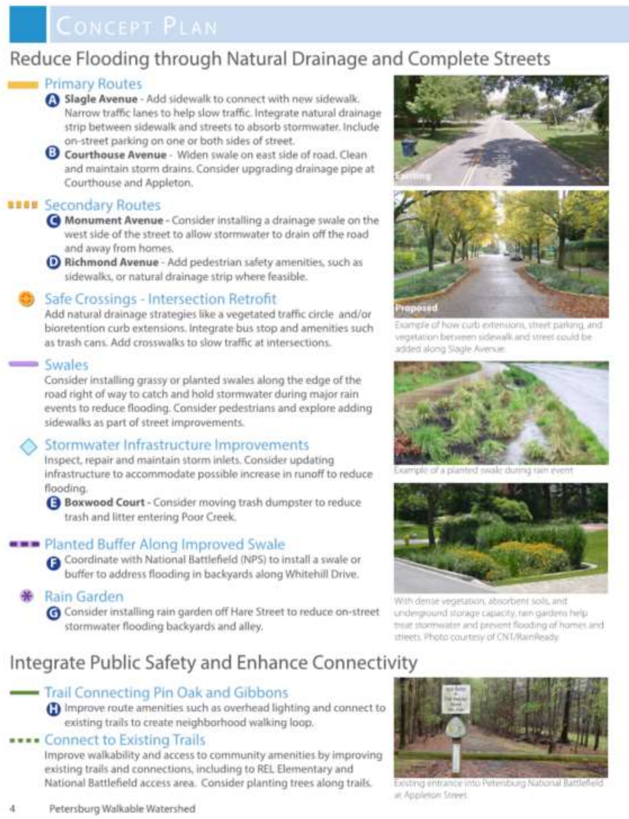


Figure 5. *Water Quality Master Plan* problem areas and potential water quality project in Lakemont Neighborhood excerpt.

Walkable Watershed Concept Plan

In 2013, NFWF also awarded the James River Association an Innovative Nutrient and Sediment Reduction grant for the City of Petersburg's Walkable Watershed Concept Plan in conjunction with two other cities in the James River watershed. Petersburg staff identified the Lakemont Neighborhood adjacent to Robert E. Lee Elementary as the focus of the Walkable Watershed Concept Plan because of the long-standing and well-known issues with stormwater runoff throughout the neighborhoods and the ongoing maintenance expenses associated with excessive sediment accumulation at the Washington Street crossings of both Poor Creek and Harrison Creek. The James River Association (JRA) partnered with the City, Skeo Solutions, and the Neighborhood Watch Association to educate and engage the public for support in developing the Concept Plan. In addition to several other measurable outcomes, the project resulted in the identification of potential green infrastructure strategies to prioritize for further study and development, including: grassy swales, complete streets, vegetated traffic circles, stormwater infrastructure improvements, rain gardens, and planted buffers. Throughout the Concept Plan document, emphasis was placed on the necessity of a drainage study as the next step to hydraulically characterize the existing infrastructure and fully vet the potential for green infrastructure improvements. The Concept Plan is included in Appendix A for reference.


CONCEPT PLAN

Reduce Flooding through Natural Drainage and Complete Streets

Primary Routes

A **Slagle Avenue** - Add sidewalk to connect with new sidewalk. Narrow traffic lanes to help slow traffic. Integrate natural drainage strip between sidewalk and streets to absorb stormwater. Include on-street parking on one or both sides of street.

B **Courthouse Avenue** - Widen swale on east side of road. Clean and maintain storm drains. Consider upgrading drainage pipe at Courthouse and Appleton.

Secondary Routes

C **Monument Avenue** - Consider installing a drainage swale on the west side of the street to allow stormwater to drain off the road and away from homes.

D **Richmond Avenue** - Add pedestrian safety amenities, such as sidewalks, or natural drainage strip where feasible.

Safe Crossings - Intersection Retrofit

Add natural drainage strategies like a vegetated traffic circle and/or bioretention curb extensions. Integrate bus stop and amenities such as trash cans. Add crosswalks to slow traffic at intersections.

Swales

Consider installing grassy or planted swales along the edge of the road right of way to catch and hold stormwater during major rain events to reduce flooding. Consider pedestrians and explore adding sidewalks as part of street improvements.

Stormwater Infrastructure Improvements

Inspect, repair and maintain storm inlets. Consider updating infrastructure to accommodate possible increase in runoff to reduce flooding.

E **Boxwood Court** - Consider moving trash dumpster to reduce trash and litter entering Poor Creek.

Planted Buffer Along Improved Swale

F Coordinate with National Battlefield (NPS) to install a swale or buffer to address flooding in backyards along Whitehill Drive.

Rain Garden

G Consider installing rain garden off Hare Street to reduce on-street stormwater flooding backyards and alley.

Integrate Public Safety and Enhance Connectivity

Trail Connecting Pin Oak and Gibbons

H Improve route amenities such as overhead lighting and connect to existing trails to create neighborhood walking loop.

Connect to Existing Trails

Improve walkability and access to community amenities by improving existing trails and connections, including to REL Elementary and National Battlefield access area. Consider planting trees along trails.

Proposed

Example of how curb extensions, street parking, and vegetation between sidewalk and street could be added along Slagle Avenue

Example of a planted swale during rain event

With dense vegetation, absorbent soils, and underground storage capacity, rain gardens help treat stormwater and prevent flooding of homes and streets. Photo courtesy of CNT/RainReady

Existing entrance into Petersburg National Battlefield at Appleton Street

4 Petersburg Walkable Watershed

Figure 6. Excerpt from *Walkable Watershed Concept Plan*, 2013.

Drainage Study

Data Compilation

An intense effort was focusing on compiling as much data as possible related to the Lakemont Neighborhood drainage infrastructure. This process included the following tasks:

- Obtained record drawings from the City with dates ranging from 1974-2009 for various drainage improvement, street, and school site plans;
- Digitized record drawings, and processed GIS data to create base maps, including: Existing Infrastructure Maps; Working Drawings (with site visit notes and preliminary improvements); and an Overall Hydrology Map (included in Appendix B);
- Coordinated with Miss Utility to mark the location of underground utilities to confirm our GIS data (Slagle/Hare intersection);
- Cross-referenced other studies to enhance our mapping, including the City's Outfall Reconnaissance and Mapping Study (2018), and a National Park Service Wetland Study (included in Appendix C); and

The data compilation task culminated with development of an updated GIS database and existing Drainage Infrastructure Map, presented in Appendix D.

Field Investigations

Neighborhood Hotspots

A cursory field visit was performed on March 16, 2018 following the project kick-off meeting to familiarize the drainage team with the neighborhood layout, and general observations of topography, land use, potential utility constraints, physical improvements/setbacks, and the existing drainage infrastructure.

The cursory field visit was followed up with an initial field investigation visit on April 26, 2018. During the initial field investigations, the team performed the following actions:

- Reviewed the Walkable Watershed Concept Plan;
- Familiarization with the existing site conditions and any changes since the report;
- General observations/confirmation of problem areas;
- Developed an initial sense of feasibility of proposed green infrastructure improvements, i.e., utility constraints, proximity to existing infrastructure/improvements, etc.

Figure 7. City Streets Operations staff assisting with drainage investigations by jetting and vacuuming inlets and providing access to the drainage team on May 24, 2018.

Follow-up field investigations with the City were performed on May 24, 2018. City Street Operations employees accompanied Timmons Group to assist with further understanding of existing systems and gather additional data. A substantial amount of sedimentation throughout the project site was observed.

Figure 8. Storm drain cleanout by City Street Operations staff, June 12, 2018.

Additional observations included: inconsistent slopes in gutter pan along Slagle Ave, Courthouse Street, Henrico Street, and Whitehill Drive. These inconsistencies contribute to low spots, trap water and sediment, and create ponding areas in the gutter pan. A total of 23 stormwater inlets were located, and manhole covers were opened to observe the condition of structures and confirm pipe sizes and directions. Some structures were full of debris; City employees removed trash and sediment from structures as requested for a total of four (4) inlets. The following are detailed observations from the field investigations:

Figure 9. Even after cleaning the inlet, trash, root masses, and sediment clogging the storm drain system remain. The City's infrastructure is old, inadequate, and ineffective.

<u>Slagle Avenue near Prince George and Brunswick:</u> Inlet tops were removed then vacuumed, allowing Timmons Group to determine approximate pipe sizes and flow direction. One inlet cover was unable to be removed due to size of top. City employees were instructed to use larger equipment to perform this task. The inlets that were vacuumed are full of roots.

<u>Slagle Avenue at Hare Street:</u> Storm inlets at this intersection connect to the downstream structure located at the intersection of Culpeper and twenty-foot alley. Upon visual inspection, no outlet pipe was located; however, it may be below a significant accumulation of hardened sediment. City Street Operations

crews do not think this is the case since they have historically vacuumed the inlet to alleviate flooding at the Slagle and Hare intersection.

North Whitehill Drive: Potential crushed pipe located between North and South Whitehill Drive. Timmons recommended CCTV of the pipe run to determine condition of existing pipe; however, City Street Operations crews believe the pipe is crushed or dislocated because they have not been able to jet the entire pipe, and experiences resistance/blockage some 50 feet, or so, into the storm sewer system.

Petersburg National Battlefield

The NPS study designated the entire Battlefield adjacent to the properties along S. Whitehill Drive as wetland. The study recommended against upsizing the 12" culvert that drains the Battlefield wetland area. Further, the study seemed to support the establishment of a berm between the NPS and Whitehill residences.

Figure 10. Petersburg National Battlefield field investigations with National Park Service staff, July 5, 2018.

NPS staff accompanied Timmons Group for a field investigation on July 5, 2018. During the site visit, the team of engineers, scientists, and Park officials, representing various departments walked the perimeter of the Battlefield property starting at the end of Henrico Street, traveling east along the property line to the park access road. At the intersection of the park access road, the team turned and headed south, upgradient, along the access road until intersection with a service road. The team then turned toward the west and followed the service road, making visual observations of topography and drainage patterns. Approximately 800 feet along the service road, a culvert was observed that clearly conveyed concentrated runoff from the southern side of the service road north. The team then followed the concentrated channel as it lost and regained definition, ultimately leading to the rear of the lots along S. Whitehill Drive. The concentrated conveyance system then turned 90^{o} to the west and followed the property line to the headwall and 12"-diamenter storm sewer pipe opening on Henrico Street. The team then continued to explore drainage conveyance features in proximity to the Lakemont Elementary School. A summary of the site visit and recommendations are provided in Appendix E.

Problem Areas

Based on a review of existing data, several problems areas were identified as a starting point for further investigation, as follows:

- North Whitehill Drive flooding: Timmons Group observed flood issues mentioned in the *Concept Plan* on April 26, 2018.
- Properties along South Whitehill Drive adjacent to Petersburg National Battlefield experience flooding: Received wetland study from Petersburg National Battlefield on May 16, 2018. A site visit was conducted on July 5, 2018 that corroborated citizen comments.
- Flooding along Courthouse Street. A significant accumulation of sediment was observed and cleared from the inlet at Courthouse Street and Richmond Road on May 24, 2018.

- Drainage problems at inlets along Slagle Road: Timmons Group observed standing water in gutter pan on April 26, 2018.
- Flooding along Nash Street: Problem area mentioned in Petersburg *Walkable Watershed Concept Plan*.
- Flooding along Monument Avenue: Problem area mentioned in *Petersburg Walkable Watershed Concept Plan*.
- Slagle and Hare Street intersection: No outfall pipes were visually located during site visit with Street Operations crew on May 24, 2018.
- Lakemont Borrow Pit: The Lakemont Borrow Pit was identified for further study in the Water Quality Master Plan; however, little is known regarding its construction, any outlet device, depth, storage volume, *etc*.

Figure 11. Typical street with view of the landfill. This street has no drainage infrastructure.

Stormwater Management Strategies

Prior to defining and developing wholistic drainage and water quality improvement projects, a toolbox of stormwater management strategies appropriate for the Lakemont Neighborhood was developed, as presented in Appendix F. With those stormwater management strategies in mind, the following preliminary approaches were identified for further investigation/feasibility analysis:

- Bioretention/rain garden bump-outs along upstream of existing inlets (such as along Slagle and Courthouse);
- Sediment removal enhancements for existing inlets/curb & gutter — with an accompanying education campaign regarding stabilization of denuded areas;
- New alignment/upgrades for Whitehill System to include combination of storm sewer, underground detention, and bio-swales;
- Wetland berm, or other means for addressing Petersburg National Battlefield runoff;
- Outfall/better function for Slagle and Hare intersection;
- Tree planting program in Right of way; and
- Convert existing borrow pit to a Stormwater Management Pond.

Proposed Improvements

A total of seven (7) discrete potential stormwater management improvement projects to address local flooding and water quality were identified and presented to the Community Partners. The projects are listed below in the Table and were presented to the community as the Updated Conceptual Plan (Appendix G) to gather public input and for prioritization. Presented in the Figure below is an image clip of the Concept Plan to provide spatial representation. The projects are presented in detail in the following section as ranked by the Community.

Table 1. Potential stormwater management improvement projects.

Potential Projects to Address Local Flooding and Water Quality		Community Priority
A	Culpeper Avenue Storm Sewer Extension	5 (Top priority)
B	Hare Street Storm Sewer Improvements	3
C	Lakemont Water Quality Retrofit	2
D	Bioretention Bump-outs	0
E	Nash Street Bioretention Rain Garden	1
F	North Whitehill Drive Drainage Improvements	3 (Top priority)
G	Battlefield Flood Remediation and Drainage Improvements	6 (Top priority)

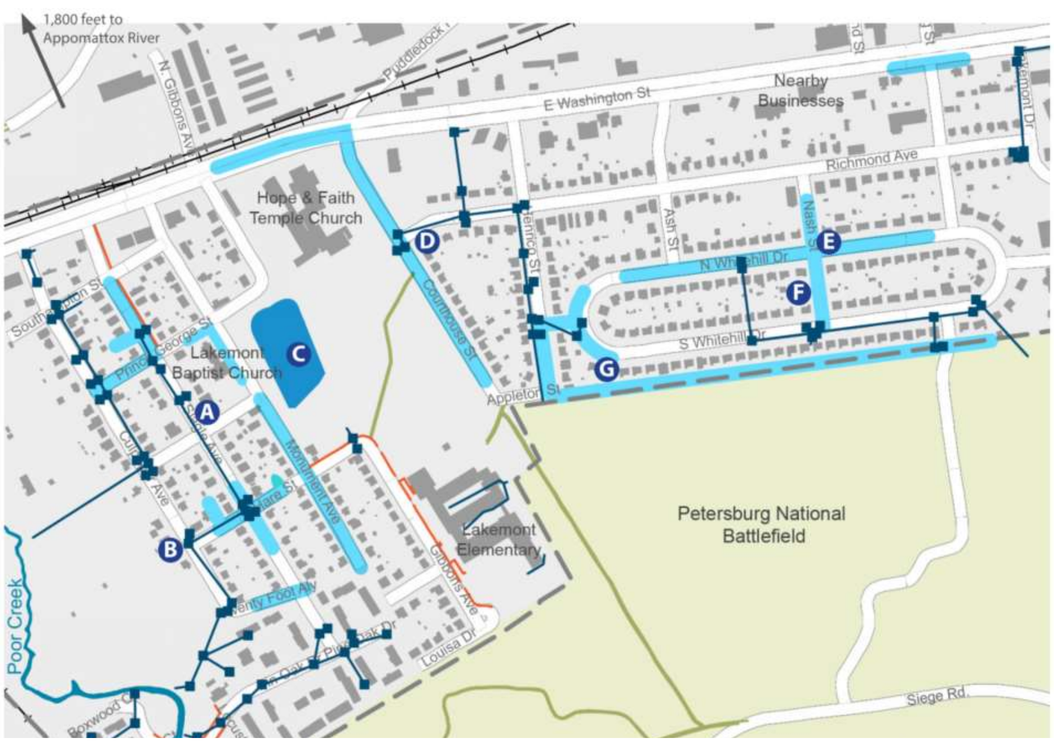


Figure 12. Image clip of the updated Concept Plan. Refer to Appendix G for more information.

Battlefield Flood Remediation and Drainage Improvements

Project Summary

Install new storm sewer system to collect concentrated runoff from the Petersburg National Battlefield and route to existing system along Henrico Street. This system would use a headwall and inlet control to collect surface drainage in a new storm sewer system that would route along South Whitehill Drive to a potential underground detention system that would control discharge to the existing storm sewer system along Henrico Street.

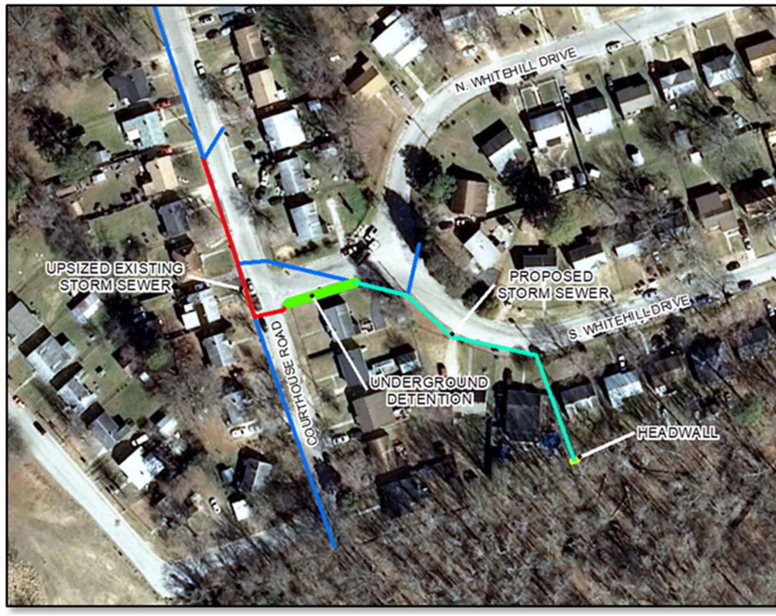


Figure 13. Proposed Improvements.

Stormwater Management Benefits

As observed during site investigations, a significant amount of stormwater runoff from the Petersburg National Battlefield is channelized and routes via a natural channel directly toward the rear of residential lots along S. Whitehill Drive before taking a sharp 90° left turn at the property line. At the property line, the channel loses definition, but makes its way along the rear of the lots, ultimately discharging to an existing 15” diameter storm sewer that runs north along Henrico Street. During storm events, a portion of the runoff does not effectively accomplish the 90° bend and proceeds to inundate the backyards of residents. Several options were considered to alleviate flooding of the lots along S. Whitehill Drive, including re-routing upstream drainage, natural channel design through the wetland, a vegetated berm to protect the properties, etc.; however, ultimately any improvements through the Petersburg National Battlefield would result in significant wetland impacts, potential cultural resources implications, and federal requirements would need to be satisfied. The proposed storm sewer re-alignment would convey drainage past the inundated properties in an enclosed system, result in minimal wetland impacts, and address flooding along Henrico Street by controlling peak discharge in a potential underground detention system prior to outlet to the existing system. Once the storm event subsides and the incoming runoff ceases, the water stored in the underground detention chamber would either slowly discharge and navigate through a series of upsized pipes into the existing storm sewer system, or slowly infiltrate into the ground.

Cost — Benefit Summary

The Battlefield Flood Remediation and Drainage Improvements project is anticipated to cost approximately $350,000, based on initial estimates prepared and presented in Appendix H. The project, as presented, does not include explicit stormwater water quality treatment mechanisms as it is proposed to address localized flooding issues via a combination of improved stormwater conveyance and underground detention. The exact quantity of stormwater that would be routed through the system and stored in the underground detention chamber(s) requires comprehensive modeling and design to accurately determine.

Summary of Site Constraints

The success of the Battlefield project is highly dependent on the ability of the proposed storm sewer to maintain sufficient grade and depth to tie into the existing storm sewer system and that the underground detention system will be able to have the required storage volume, infiltration rate, and spatial extents to meet its design functions. These criteria cannot ultimately be determined without survey data and further investigation. If the project is pursued, there are a few additional constraints that should be considered that will require further investigation prior to construction:

- Easement acquisition;
- Conflicts with existing utilities: water, sanitary sewer, gas, and private utilities (Dominion Power, Verizon, Comcast, etc.);
- Impacts to downstream storm sewer system; and
- Impacts to forested wetland areas.

Figure 14. Drainage channel from Petersburg National Battlefield looking downstream approaching S. Whitehill Drive (above) and after taking the 90° turn along the property line (below).

Culpeper Avenue Storm Sewer Extension

Project Summary

Retrofit hydrodynamic structure along Slagle Avenue between Prince George and Brunswick to provide water quality treatment and enhance maintenance access. Intercept drainage from Slagle Avenue and redirect flow through a new storm sewer segment from Slagle Avenue along Brunswick to the Culpeper Avenue storm sewer system to alleviate localized flooding at Slagle Avenue and Hare Street intersection.

Figure 15. Proposed Improvements.

Stormwater Management Benefits

The storm-sewer that passes through the intersection of Slagle Avenue and Hare Street is part of a larger storm-sewer system that runs the length of Slagle Ave from North to South, which takes a series of turns, ultimately discharging to Poor Creek. The storm sewer system and/or inadequacy is the source of frequent flooding in the intersection of Slagle Ave. and Hare St. Further, a significant accumulation of sediment was observed during site investigations in the drainage system along Slagle Avenue. The purpose of the Culpeper Avenue Storm Sewer Extension project is to redirect drainage through a larger diameter pipe at the intersection of Culpeper Avenue to a more direct outfall to Poor Creek. Redirecting portions of drainage away from the Slagle and Hare intersection will aid in alleviating flooding at that location while also improving sediment loads to Poor Creek through sediment reduction mechanisms (hydrodynamic structure).

Figure 16. Sediment in the gutter pan along Slagle Avenue.

Cost — Benefit Summary

The Culpeper Avenue Storm Sewer Extension project is anticipated to cost approximately $280,000, based on initial estimates prepared and presented in Appendix H. The project is primarily focused on solving neighborhood flooding issues through improved stormwater conveyance. However, the use of a Hydrodynamic Separator is an ideal water quality treatment and improvement mechanism for this site. The Hydrodynamic Separator's pollutant removal benefits are presented below in the Table.

Table 2.Culpeper Pollutant Removal Summary (Hydrodynamic Separator).

	Quantity	Cost
Treatment Area	4.57 ac	$10,940/ac
TP Removed	0.90 lb/yr	$55,555/lb
TSS Removed	983 lb/yr	$51/lb

Summary of Site Constraints

The success of the project hinges on tying the proposed connector pipe into the existing Culpeper Avenue storm sewer; which was designed and constructed in 1975. The final segment of the existing system is a 42"-dia. RCP that discharges directly to Poor Creek. Preliminary estimates indicate that the 42"-dia. pipe has the capacity to receive additional flow from the connector pipe without causing adverse impacts to the existing system, but the system should be appropriately modeled during design to ensure no unintended consequences affect the existing system. If the Culpeper Avenue Storm Sewer Extension Project is pursued, there are some additional constraints that should be considered that will need to be investigated further prior to construction: utility conflicts (public and private); easement acquisition (temporary easements anticipated); traffic maintenance; and Impacts to downstream waterbodies; however, no environmental permitting is anticipated.

N Whitehill Drive Drainage Improvements

Project Summary

The proposed project will alleviate localized flooding along N. Whitehill by establishing a new alignment and hydraulically appropriately sized storm sewer, connecting to S. Whitehill via Nash Street. A grassed swale along the eastern lane of Nash Street and underground detention are proposed to address water quality and quantity requirements.

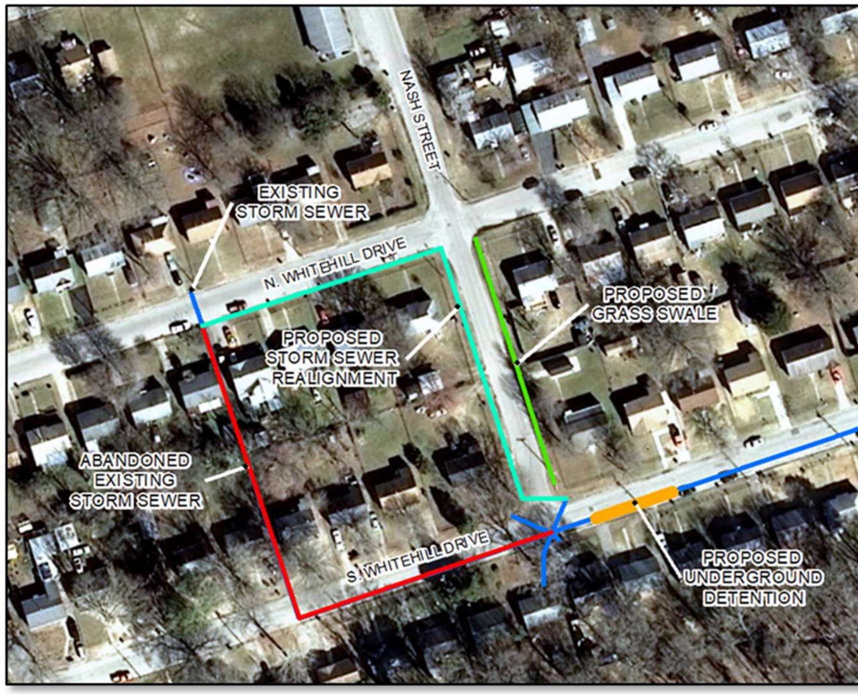


Figure 17. Proposed Improvements.

Stormwater Management Benefits

The City of Petersburg maintenance crews commented that there is a blockage or crushed pipe within the existing storm sewer that runs through two properties just south of N. Whitehill Drive that is preventing the conveyance of stormwater and is flooding N. Whitehill Drive.

Due to the size of the existing system (12"-diameter) and the proximity to adjacent homes, as well as the lack of a drainage easement, it is not feasible to replace or upgrade the pipe system along its existing alignment. If the pipe was intact, cured in place pipe lining might be a viable option; however, the pipe is undersized by present day standards and City staff believe it may have failed due to complete blockage or collapse; therefore, an alternative alignment is proposed. The Whitehill Storm Sewer Drainage Improvement project proposes to alleviate the flooding on N. Whitehill Drive by rerouting the storm sewer system along the alignment illustrated in the Figure above. The existing storm sewer running between properties would be abandoned in place.

The proposed storm sewer would tie into the existing system along the southern side of N. Whitehill Drive and run towards the intersection of N. Whitehill Drive and Nash St. at which point it would take a 90° right angle and run along the side of Nash St. towards S. Whitehill Drive. The appropriate configuration of existing and proposed tie-in to the storm sewer system along S. Whitehill and the necessity of any underground detention to control peak flow discharges to the existing system would need to be determined based upon hydraulic analyses and modeling during design. Designers should consider a grass channel swale along Nash, perhaps on both sides to enhance the water quality treatment potential of the system.

Figure 18. Stormwater extends from inlet to inlet across N. Whitehill Drive during precipitation events due to lack of adequate drainage infrastructure.

Cost-Benefit Summary

The N. Whitehill Drive Drainage Improvement project is anticipated to cost approximately $300,000, based on initial estimates prepared and presented in Appendix H. The project is primarily focused on solving neighborhood flooding issues through improved stormwater conveyance. However, the addition of a Grass Swale on the east side of Nash St. will improve the discharging water quality. Potential pollutant removal benefits associated with implementation of a grass channel are provided in the table below.

Table 3. N Whitehill Pollutant Removal Summary (Grass Channel).

	Quantity	Cost
Treatment Area	1.55 ac	$1,775/ac
TP Removed	0.39 lb/yr	$7,051/lb
TN Removed	3.32 lb/yr	$828/lb
TSS Removed	230 lb/yr	$12/lb
Runoff Volume Reduced	264 cubic feet	$10/cf

Summary of Site Constraints

The proposed alignment was selected to minimize the consideration of site constraints during design and construction, such as driveways, fences, utility conflicts (public and private), easement acquisition, *etc.*

Hare Street Storm Sewer Improvements

Project Summary

Install approximately 970 LF of storm sewer from the Slagle and Hare intersection to outfall at Poor Creek, with hydrodynamic structure at intersection of Hare Street and Culpeper Avenue to provide water quality treatment and enhance maintenance.

Figure 19. Proposed Improvements.

Stormwater Management Benefits

The intersection of Slagle Avenue and Hare Street frequently experiences flooding, standing water, and sediment laden gutter pans because of poor drainage conditions and a storm-sewer system that has a high sediment accumulation rate. Further, during site investigations with City staff, it was remarked that when they vacuumed the inlet near the intersection of Culpeper and the Alley, the flooding at the intersection of Slagle and Hare is alleviated. Several possible scenarios could be the cause of this phenomenon, including: inverted pipes, sub-standard pipe sizes, inefficient hydraulic capacity, sediment accumulation, blockages downstream, etc.; however, based on the age of the infrastructure and the complexity of the existing network, a drainage improvement upgrade for the storm sewer system from the Slagle and Hare intersection to the outfall is proposed. Further, the project should include at least one hydrodynamic structure inline to provide water quality treatment and to manage sediment loads to the system preventing them from discharge to Poor Creek.

Cost-Benefit Summary

The Hare Street Storm Sewer Improvement project is anticipated to cost approximately $980,000, based on initial estimates prepared and presented in Appendix H. The project is primarily focused on solving neighborhood flooding issues through improved stormwater conveyance. However, the use of a Hydrodynamic Separator is an ideal water quality treatment and improvement mechanism for this site. The Hydrodynamic Separator’s pollutant removal benefits are presented below in the Table.

Table 4. Hare Street Pollutant Removal Summary.

	Quantity	Cost
Treatment Area	12.1 ac	$4,132/ac
TP Removed	2.43 lb/yr	$20,576/lb
TSS Removed	2,6612 lb/yr	$19/lb

Figure 20. Slagle and Hare intersection looking south along Slagle Avenue.

Summary of Site Constraints

In addition to typical site constraints to be considered for drainage retrofit projects, a few major conflicts will need to be addressed during design, including: potential sanitary sewer conflicts, bus shelter conflicts, and outfall to Poor Creek. It is recommended that the final pipe segment be replaced with an appropriately sized energy dissipating stilling basin to mitigate adverse impacts to Poor Creek from potential increased velocities or discharges associated with the upgraded storm sewer system. The project will require environmental permitting.

Figure 21. Sediment laden gutter pans along Slagle Avenue.

Lakemont Water Quality Retrofit

Project Summary

Improve the stormwater treatment capacity of the existing pond by redirecting drainage from south of the Elementary School through a natural channel to a designed Level 2 Wet Pond or Constructed Wetland. Install emergency spillway riser and pipe structure to discharge to Culpeper Storm Sewer Extension project.

Figure 22. Existing borrow pit contributing drainage area (CDA). The borrow pit is presently 100% effective at water quality treatment of the 16.5-acre CDA.

Stormwater Management Benefits

Located on the Northwest portion of the Elementary School property is an abandoned borrow pit with a normal pool area of approximately 1.52 acres. The borrow pit has no known outlet structure, resulting in the complete, 100% capture and treatment of the runoff it receives from its 16.49 acre contributing drainage area. The location of the existing borrow pit and contributing drainage area are illustrated in the Figure to the right.

The only way to increase the effective treatment of the borrow pit is to increase the drainage area that it serves. Based on the borrow pit's size and configuration, and property ownership by the City, the borrow pit has the potential to treat additional drainage area through re-routing stormwater runoff to the site. However, to safely redirect additional drainage to the borrow pit, it must be retrofit with both a principal and emergency spillway and will also need to be designed to current VA BMP Clearinghouse design standards. An analysis was performed to both estimate the potential feasibility of redirecting stormwater runoff to the borrow pit, and to accomplish conversion of the borrow pit to a Level 2 Wet Pond or Constructed Wetland design. As both Wet Ponds and Constructed Wetlands accomplish the same pollutant removal and share similar spatial extents, the borrow pit retrofit will hereafter be referred to as a "pond."

There are two options to increase the treatment area for the borrow pit, as follows:
Option 1: Re-route drainage from an existing concrete trapezoidal channel on the southeast portion of the elementary school through a designed natural conveyance channel, thus increasing the treatable contributing drainage area to 21.01 acres and increasing the Pond's treatment capabilities. Note, additional drainage is conveyed through the trapezoidal channel, however, it is Petersburg National Battlefield property and is unregulated from an MS4 and Chesapeake Bay TMDL standpoint, so no additional treatment credit can be received.

<u>Option 2:</u> Re-route drainage from the Richmond Avenue storm sewer system across Courthouse Road, through the northeast corner of the Elementary School property, thus increasing the treatable contributing drainage area to 47.54 acres and increasing the Pond's treatment capabilities. Note, as with the first option, additional drainage is conveyed through the storm sewer system from the Petersburg National Battlefield, but as previously stated, is unregulated from an MS4 and Chesapeake Bay TMDL perspective, so no additional treatment credit can be received for treating additional area beyond the 47.54 acres.

The existing and proposed drainage areas and Pond configurations are illustrated in the figure to the right and their respective pollutant removal quantities are presented subsequently in the Table.

Although preliminary hydrologic and hydraulic calculations show that the proposed Pond can contain the 24 hour 100-year storm event without overtopping, even without an outlet structure, an emergency spillway will need to be installed to prevent any potential flooding from a more severe storm event. The proposed emergency spillway would consist of a riser structure and outfall pipe that would tie-in to the existing storm sewer on Slagle Avenue before eventually discharging into Poor Creek; however, ideally the Culpeper Storm Sewer Extension project would proceed the Lakemont Water Quality Retrofit project, so that the Culpeper drainage system could be used to route overflow discharges to Poor Creek.

Figure 23. Options 1 (above) and 2 (below) to re-route drainage to the borrow pit.

Cost-Benefit Summary

The Lakemont Water Quality Retrofit and Stream Restoration project is anticipated to cost approximately $2.2M -$2.4M, based on initial estimates prepared and presented in Appendix H. The project is primarily focused on redirecting surface runoff to the borrow pit and retrofit of the pond to current design standards, including an outlet control structure for principal and emergency discharge. Potential pollutant removal benefits are provided in the table below. Note, removal rates presented for each option below are presented as total numbers; however, cost effectiveness is presented as incremental improvements to the function of the Existing Borrow Pit.

Table 5. Lakemont Pollutant Removal Summary.

	Existing Borrow Pit	Retrofit, Option 1	Cost, Option 1	Retrofit, Option 2	Cost, Option 2
Treatment Area	16.5 ac	21.0 ac	$488,888/ac	47.5 ac	$77,419/ac
TP Removed	16.64 lb/yr	22.08 lb/yr	$404,412/ac	47.87 lb/yr	$76,849/lb
TN Removed	119.02 lb/yr	157.96 lb/yr	342.42 lb/yr	342.42 lb/yr	$10,743/lb
TSS Removed	4,437 lb/yr	6,022 lb/yr	$1,388/lb	13,000 lb/yr	$280/lb

Summary of Site Constraints

There are considerable site constraints that must be explored prior to implementing either option presented in this report. Though the preliminary investigation demonstrated the possibility of re-routing drainage to the site, as well as demonstrated that the required surface area and volume are present for retrofit of the borrow pit to a standard design, there are many unknowns that would require further study prior to implementation. One of the most limiting factors is absence of an outfall for a principal and emergency spillway. If the second option is chosen to increase the Pond's treatable contributing drainage area, which has been demonstrated to be a more cost-effective solution, there may be presently unknown constructability challenges to route the proposed inlet pipe from the Richmond Avenue storm sewer system to the site. It is recommended that a preliminary engineering study, including a bathometric survey of the borrow pit, geotechnical investigations, utility designation, wetland delineation and pre-permitting, as well as extensive hydrological and hydraulic analysis be conducted to prior to selecting an option and proceeding with design.

Nash Street Bioretention Garden

Project Summary

Move the ponding underground within the right-of-way along Nash Street, near the intersection with N Whitehill Drive by designing a bioretention rain garden to collect and treat stormwater runoff.

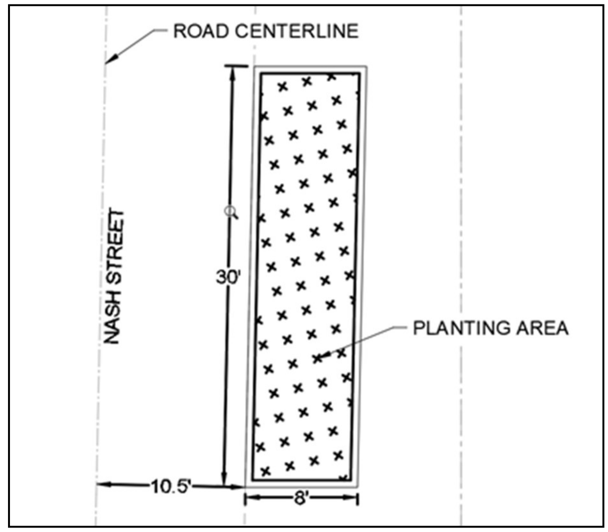


Figure 24. Proposed bioretention rain garden street view (left) and conceptual layout (right).

Stormwater Management Benefits

The purpose of this project is to improve the study area's stormwater runoff quality through various treatment practices. There is an opportunity to installing a bioretention rain garden on the northeast corner of the intersection of Nash St. and N. Whitehill Avenue. The bioretention rain garden would treat pollutant laden runoff, improve the aesthetic appeal of the neighborhood, and would have notable runoff reduction capabilities. Unlike Bioretention Bump-outs, the proposed bioretention rain garden would be a shallow depression adjacent to the existing pavement, causing no impacts to the flow of traffic.

Cost-Benefit Summary

The project is anticipated cost less than $30,000, as detailed in the Appendix and presented below:

	Quantity	Cost
Treatment Area	2.95 ac	$8,976/ac
TP Removed	1.57 lb/yr	$16,866/lb
TN Removed	13.09 lb/yr	$2,023/lb
TSS Removed	427 lb/yr	$62/lb
Runoff Volume Reduced	1,822 cubic feet	$15/cf

Summary of Site Constraints

The project location is directly under overhead power; however, that is not anticipated to be a potential site constraint, as the work can be performed with small equipment and manpower. Education on proper maintenance is important to protect the capital investment of bioretention media and plants and to keep the site from returning to its present condition.

Bioretention Bump-outs

Project Summary

Create on-street bioretention areas using curb bump outs to collect and treat stormwater while achieving neighborhood beautification and traffic calming. Sites along Courthouse Road and Richmond Avenue have been identified as the best candidates for demonstration scale installation.

Figure 25. Proposed locations for bioretention bump-outs along Courthouse Road (left) and Richmond Road (right).

Stormwater Management Benefits

Bioretention Bump-outs are an effective approach to improve stormwater runoff quality in the right-of-way while also achieving a greening effect and traffic calming. Two locations were identified as excellent candidates for a pilot-scale implementation due to their site features, proximity to existing drainage inlets, contributing drainage area, lack of apparent site constraints, and locations at a “gateway” to the neighborhood, at the intersection of Courthouse Rd. and Richmond Rd. These roadways serve as access roads from the local neighborhood to East Washington Street and have a high degree of visibility. The proposed Bump-out locations and their current conditions are shown above.

Cost-Benefit Summary

Total project costs for installation of the pilot bioretention bump-outs is estimated to cost approximately $80,000 per facility, as detailed in Appendix H.

Table 5. Bioretention Bump-out Pollutant Removal Summary.

	Courthouse Road Treatment	Courthouse Road Cost	Richmond Road Treatment	Richmond Road Cost
Treatment Area	0.91 ac	$88,549/ac	0.60 ac	$130,300/ac
TP Removed	0.61 lb/yr	$132,098/lb	0.51 lb/yr	$158,000/lb
TN Removed	5.06 lb/yr	$15,925/lb	4.21 lb/yr	$19,140/lb
TSS Removed	142.46 lb/yr	$566/lb	123.17 lb/yr	$654/lb
Runoff Volume Reduced	704 cubic feet	$114/cf	586 cubic feet	$138/cf

Summary of Site Constraints

The pilot locations for implementation of bioretention bump-outs were selected based on their apparent lack of site constraints; however, a significant sediment load was noted along the gutter pan on Courthouse. In fact, the inlet to which the bioretention bump-out would tie was cleaned during the May site visit with City staff. If the sediment load is not addressed prior to installation, the bioretention bump-out will likely be inundated with a sediment load subsequently stifling the vegetation and clogging the bioretention media. It is recommended that an education campaign and maintenance plan be established prior to implementation to reduce failure of the stormwater control measure due to sedimentation.

Figure 26. Jetting and vacuuming the inlet filled with sediment at the intersection of Courthouse Road and Richmond Road.

Community Engagement

Community Partner Meetings

The team identified a series of potential community partners to target for input for this project, as follows:

- Department of Public Works: DPW is an integral part of any successful capital project in the City and is the primary client/beneficiary and liaison for this and previous grant funded efforts.
- Neighborhood Watch: The Neighborhood Watch is a formal, organized group of concerned and involved citizens with an established presence in the neighborhood. The organization is led by Mr. Williams who has been a community champion for improvements throughout the neighborhood.
- National Park Service — Petersburg National Battlefield: The Battlefield is a federal park located immediately south and adjacent to the Lakemont Neighborhood Drainage Study area.
- Virginia Department of Health, Crater Health District, Petersburg Health Department: The Health Department shares many sustainability goals to improve quality of life in the Lakemont Neighborhood.
- Department of Planning: The Planning Department administers the City's Community Development Block Grant Program (CDBG) which is a potential source of funding for project implementation.
- Petersburg Public Schools: The Lakemont Borrow Pit, subject of exploration for conversion to a wet pond or constructed wetland is on public schools' property and any potential land development project would need the concurrence of Petersburg Public Schools.
- VDOT – VDOT has several avenues of funding and may be a beneficial partner for infrastructure projects in the Lakemont Neighborhood.

A detailed summary of the Community Partner meetings held by Skeo are in a report in Appendix I.

Figure 27. Blue crab storm drain stenciling (above) and Girl Scout volunteers (middle), December 27, 2018. Paint Out Pollution, October 10, 2018 (below).

Community Involvement Events

Two community involvement events were organized and conducted by James River Association. The "Paint Out Pollution" events, held on October 10 and December 27 of 2018 resulted in the storm drain stenciling of a total of 8 neighborhood inlets, as well as the removal of 11 bags of trash.

Appendix A

CITY OF PETERSBURG STORMWATER MANAGEMENT

Water Quality Master Plan
City of Petersburg

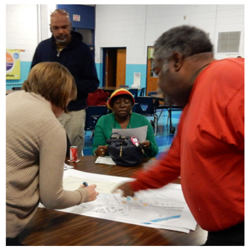
FINAL REPORT

DUE TO THE SIZE OF THIS REPORT, IT HAS BEEN EXCLUDED FROM THE APPENDICES IN ITS ENTIRETY.

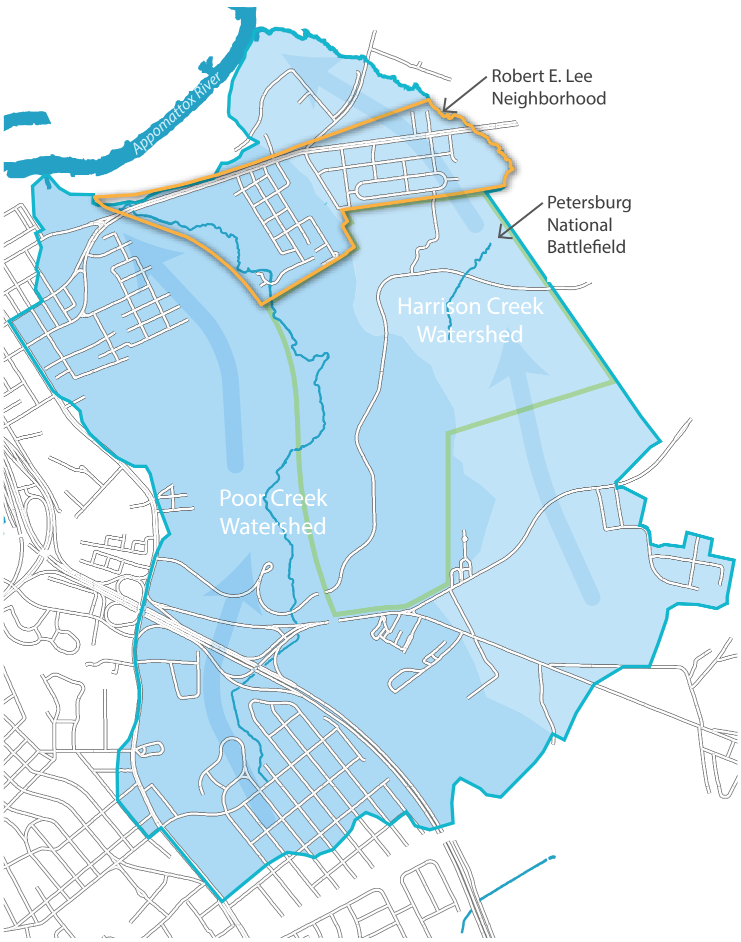
FOR COPIES OR DETAILED INFORMATION, PLEASE CONTACT AISLINN CREEL @ (804) 200-6432 or Aislinn.Creel@timmons.com

Prepared by:
1001 Boulders Parkway, Suite 300
Richmond, VA 23225

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.



Petersburg Walkable Watershed Concept Plan



Rain that falls within Poor and Harrison Creek watersheds (shown in blue) flows to Poor Creek or Harrison Creek, then to the Appomattox River and ultimately the Chesapeake Bay.

In urban areas, the stormwater drainage system, which includes a series of underground pipes, open stream channels, street gutters and ditches, can carry pollutants from streets, yards and businesses to the creek.

A walkable watershed includes neighborhood features that improve stormwater and pedestrian safety simultaneously.

Overview

The Petersburg Walkable Watershed Concept Plan develops a shared vision and set of strategies to address flooding and improve quality of life for the Robert E. Lee (REL) neighborhood. This concept plan was developed in collaboration with the City of Petersburg, James River Association and the REL Neighborhood Watch Association.

The concept plan is based on a walkable watershed approach, which integrates the flow of water and people into a cohesive strategy to improve the overall health of a community and the surrounding watershed.

Through multiple community meetings, surveys, mapping and analysis and input from project partners, this plan identifies opportunities to:

- **Improve chronic flooding** in areas identified by residents.
- **Add on-street features** to reduce traffic speed, litter, and flooding.
- **Increase community connection** to nearby destination, parks and open space.
- **Engage and educate residents** to celebrate nearby waterways and natural resources.

Please visit: www.walkablewatershed.com or contact Darryl Walker, City of Petersburg at (804) 733-2355 or dwalker@pertersburg-va.org for more information.

Petersburg
Walkable Watershed
healthy waters : healthy communities

A special thanks to the Robert E. Lee Neighborhood Watch Association and Mr. Williams for their time and feedback.

Existing Conditions

Project Background

The City of Petersburg partnered with James River Association, Center for Watershed Protection and Skeo Solutions on a Walkable Watershed process in the Robert E. Lee Neighborhood. Funded by the National Fish and Wildlife Foundation, the project focused on training for City staff and community-based planning to identify opportunities to address stormwater using green infrastructure strategies and address related community quality of life goals.

Community Assets and Challenges

The project team conducted resident surveys in late 2015-early 2016 to identify neighborhood assets and challenges. The project team shared results from the survey and initial existing condition analysis with residents during the REL Neighborhood Watch Association's month meeting on April 12. As part of that meeting, residents were asked to identify and prioritize community assets and challenges - those highlighted in **bold** represent top priorities for participants:

Assets:

- Quiet residential neighborhood
- **REL Elementary School and youth who are active in the neighborhood**
- **Neighborhood churches and businesses**
- **Neighborhood Watch Association**
- Harrison and Poor Creeks
- Proximity to Appomattox River, Petersburg National Battlefield and other natural areas

Challenges

- Few sidewalks
- Few play areas
- **Flooding in streets and yards**
- Littering on streets
- Few areas to walk and interact with nature or the creeks
- Perception and awareness of creeks
- **Public safety**
- **Speed of traffic**
- Few public gathering places
- **Home ownership**
- **Street lighting**
- Distance to nearest grocery store
- Few trash cans

Existing Conditions Summary

Resident input and analysis shows there is a strong connection between existing stormwater infrastructure and where chronic flooding occurs in the neighborhood. The map on the following page identifies:

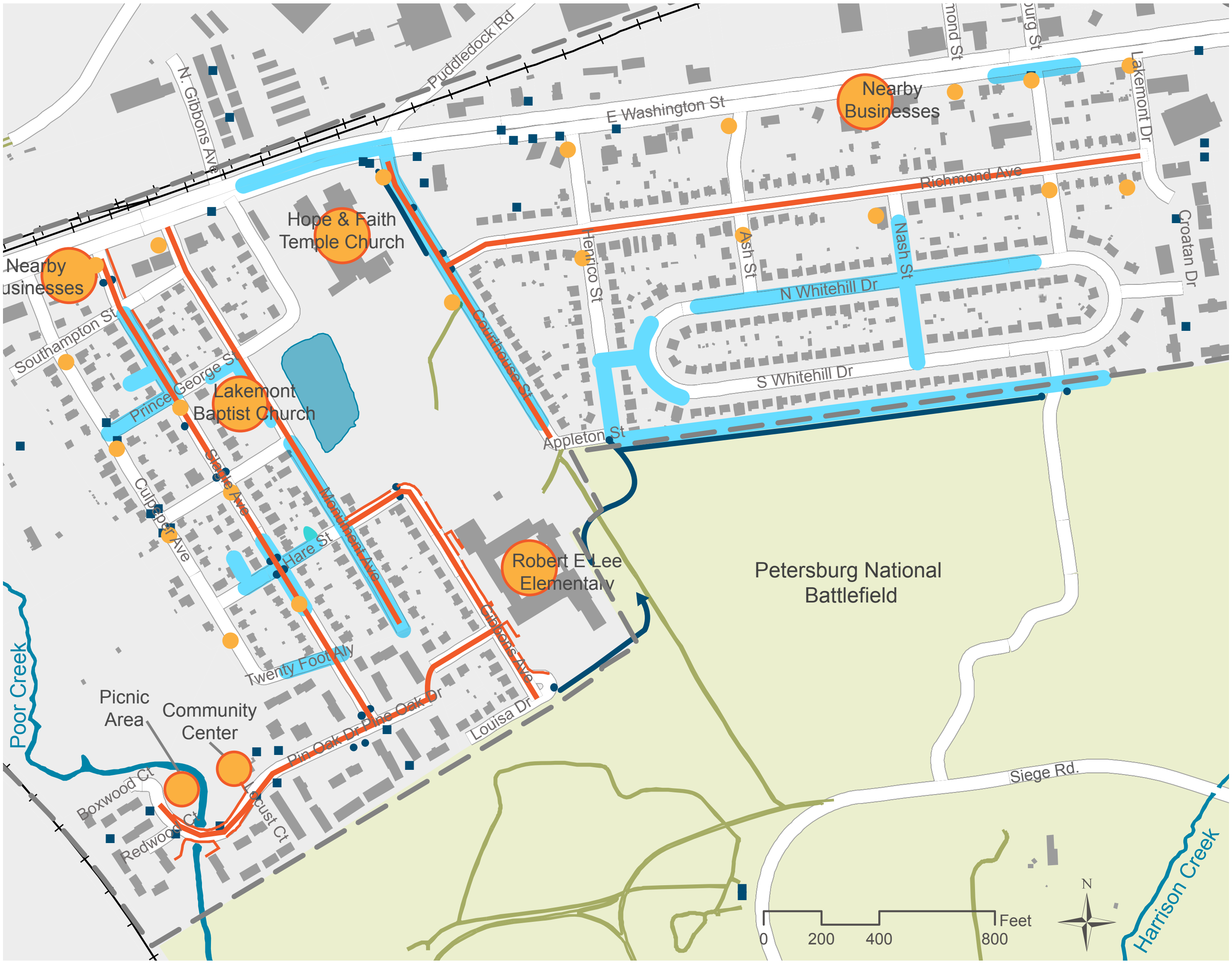
- Areas prone to flooding as experienced by residents
- Existing stormwater infrastructure and sidewalks
- Neighborhood destinations and primary routes to those destinations

Residents reported that regular flooding during and after storm events cause flooding on many streets in the REL neighborhood, shown in the photos that residents took on the following page. A combination of clogged or under sized storm inlets and lack of sidewalks makes walking difficult in these conditions.

By gaining a better understanding of location specific issues, stormwater infrastructure can be improved using a combination of traditional and green infrastructure or natural drainage strategies. Draft strategies were shared with the REL Neighborhood Watch during their April 12 meeting and based on their input, a refined concept plan was shared on June 14.

The Walkable Watershed Concept Plan on page 5 identifies opportunities to address stormwater management and flooding, improve walkability and access, and increase safety through traffic calming. A key next step will be to conduct a drainage study to better understand existing infrastructure capacity and evaluate the combination of traditional and green infrastructure strategies needed to address stormwater and flooding. The Concept Plan identifies opportunities to integrate walkability, safety, access, and amenities into these infrastructure improvements.

Residents discuss neighborhood assets and challenges.



Existing Conditions

Community Destinations	Transit Stops
Primary Routes	Existing Sidewalks
Storm Inlet	Catch Basin
Ditch or Concrete Channel	Resident Reported Flooding

Photos taken by residents document the flooding that occurs during rain events. In the event of heavier rainfall, roads in the neighborhood can be hazardous to drive on due to the depth of stormwater flooding the streets. Especially when stormwater floods impervious areas, it can collect litter, debris and hazardous materials such as oil from roads. These hazardous materials, will eventually drain into storm inlets and ultimately reach the Chesapeake Bay and contribute to water pollution.

Concept Plan

Reduce Flooding through Natural Drainage and Complete Streets

Primary Routes

A **Slagle Avenue** - Add sidewalk to connect with new sidewalk. Narrow traffic lanes to help slow traffic. Integrate natural drainage strip between sidewalk and streets to absorb stormwater. Include on-street parking on one or both sides of street.

B **Courthouse Avenue** - Widen swale on east side of road. Clean and maintain storm drains. Consider upgrading drainage pipe at Courthouse and Appleton.

Secondary Routes

C **Monument Avenue -** Consider installing a drainage swale on the west side of the street to allow stormwater to drain off the road and away from homes.

D **Richmond Avenue** - Add pedestrian safety amenities, such as sidewalks, or natural drainage strip where feasible.

Safe Crossings - Intersection Retrofit

Add natural drainage strategies like a vegetated traffic circle and/or bioretention curb extensions. Integrate bus stop and amenities such as trash cans. Add crosswalks to slow traffic at intersections.

Swales

Consider installing grassy or planted swales along the edge of the road right of way to catch and hold stormwater during major rain events to reduce flooding. Consider pedestrians and explore adding sidewalks as part of street improvements.

Stormwater Infrastructure Improvements

Inspect, repair and maintain storm inlets. Consider updating infrastructure to accommodate possible increase in runoff to reduce flooding.

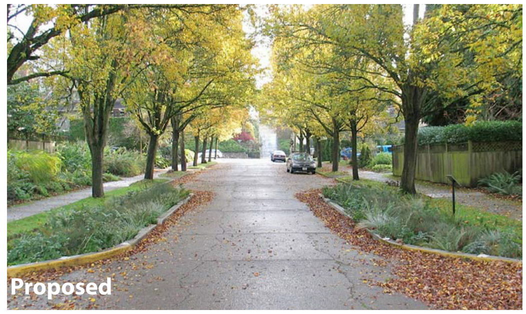
E **Boxwood Court -** Consider moving trash dumpster to reduce trash and litter entering Poor Creek.

Planted Buffer Along Improved Swale

F Coordinate with National Battlefield (NPS) to install a swale or buffer to address flooding in backyards along Whitehill Drive.

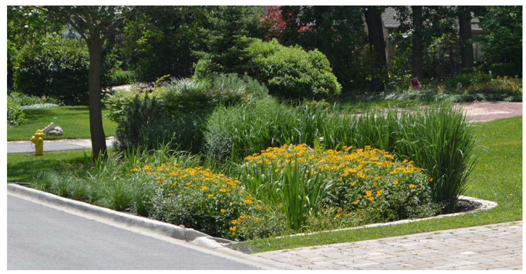
Rain Garden

G Consider installing rain garden off Hare Street to reduce on-street stormwater flooding backyards and alley.



Example of how curb extensions, street parking, and vegetation between sidewalk and street could be added along Slagle Avenue.

Example of a planted swale during rain event



With dense vegetation, absorbent soils, and underground storage capacity, rain gardens help treat stormwater and prevent flooding of homes and streets. Photo courtesy of CNT/RainReady.

Integrate Public Safety and Enhance Connectivity

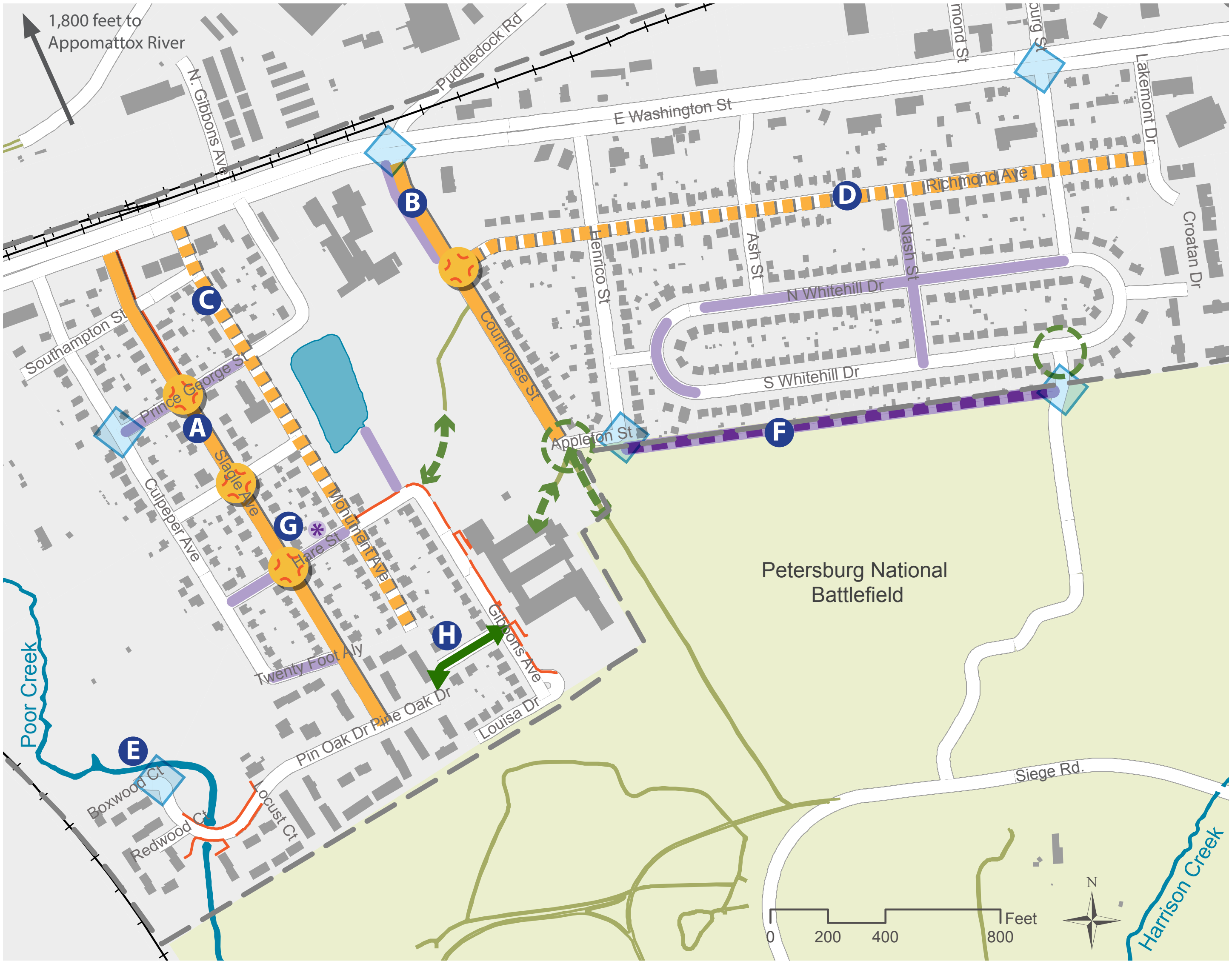
Trail Connecting Pin Oak and Gibbons

H Improve route amenities such as overhead lighting and connect to existing trails to create neighborhood walking loop.

Connect to Existing Trails

Improve walkability and access to community amenities by improving existing trails and connections, including to REL Elementary and National Battlefield access area. Consider planting trees along trails.

Existing entrance into Petersburg National Battlefield at Appleton Street.



On-Street Opportunities

Sidewalks and Natural Drainage

- Primary Route
- Secondary Route

Safe Crossing

- Intersection Retrofit

Natural Drainage Retrofit

- Swales

Existing Infrastructure

- Stormwater Infrastructure Improvements

A Specific Recommendations

Off-Street Opportunities

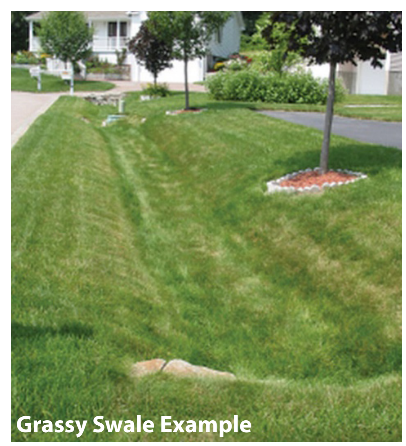
Natural Drainage Retrofit

- Planted Buffer and Improved Swale
- Rain Garden

Trails

- Connect to Existing Trails
- On-Street Route
- Trailhead Access

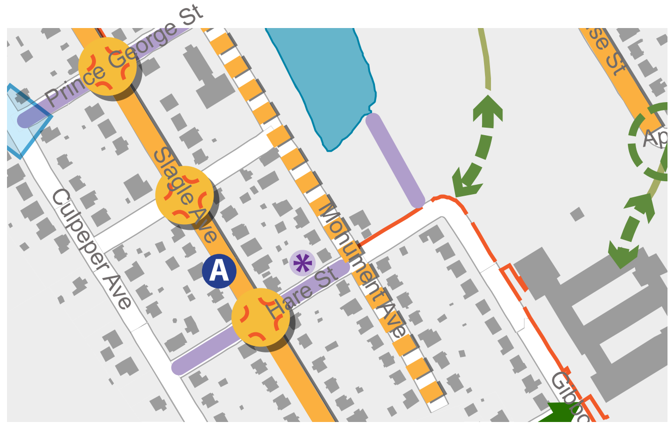
- Existing Sidewalks
- Existing Trails



Grassy Swale Example

Grassy swales along streets without sidewalks could address street flooding by providing holding space for stormwater during rain events -- swales are designed to drain after rain event to avoid standing water. Swales can also be designed for ease of maintenance and to minimize trash collection.

A Hare & Slagle Green Intersection Retrofit



Current Conditions

- Intersection floods regularly.
- Storm inlets regularly clogged with litter.
- No sidewalks, public trash cans or bus waiting areas.
- Cars regularly speed through intersection.

Potential Opportunities

Opportunities to reduce flooding, calm traffic and provide public amenities:

- Add residential scale traffic circle with vegetation to slow traffic and collect stormwater to reduce flooding.
- Add sidewalks and public transportation waiting area to increase pedestrian safety.
- Include crosswalks at intersection of Slagle and Hare Streets.
- Add public trash can at all public transportation waiting areas to reduce neighborhood litter.

Example of a vegetated traffic circle in a residential neighborhood that slows traffic, collects stormwater and adds aesthetic value. A drainage study will identify whether there is adequate road width and right of way to accommodate a traffic circle.

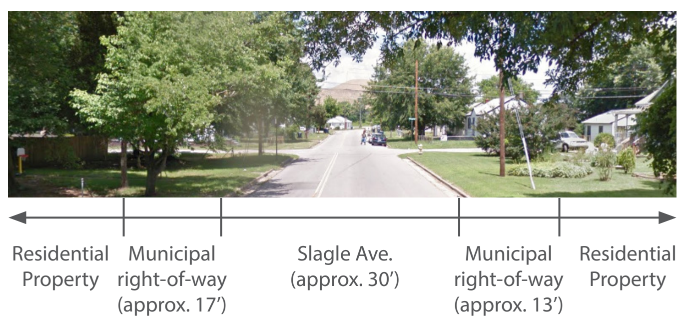
Complete Street on Slagle and Courthouse

Current Conditions

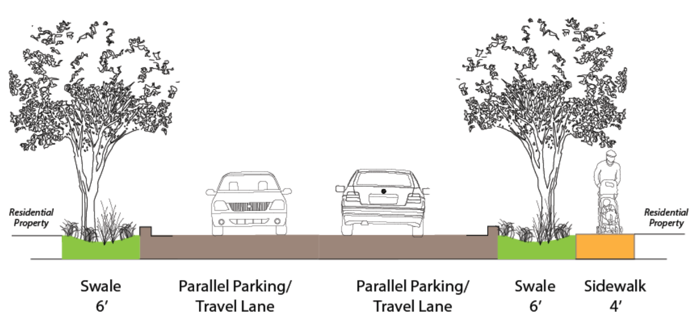
- Main roads lack sidewalks.
- Cars regularly speed on residential roads.
- Regular flooding makes walking, biking and driving unsafe after major storm events.
- Wide residential streets, parking on one or both sides and municipal right-of-way on both sides of street.

Potential Opportunities

- Add sidewalks on one side of street, crosswalks at intersections, and include additional storm inlets where appropriate.
- Include vegetated bump-outs or swales in municipal right-of-way where appropriate to collect stormwater off-street and calm traffic. For example, with approximately 60′ of public right-of-way on Slagle Avenue, there is potential to re-design main roadways to incorporate sidewalks and green infrastructure practices.



Existing Street Dimensions - Slagle Avenue

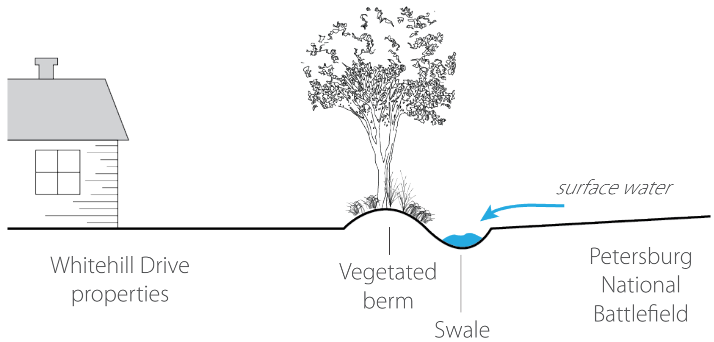


Example of how a sidewalk and stormwater swales can be incorporated within a portion of the right-of-way.

F Planted Buffer and Improved Swale

Current Conditions

- Existing swale on Petersburg National Battlefield is undersized and filled in with tree roots.
- Residential backyards along swale regularly flood, sometimes up to homes.
- Existing stormwater pipe at Henrico Street for swale is undersized.
- Petersburg National Battlefield needs to maintain vegetative buffer for park aesthetics.



A planted buffer along an expanded swale will allow surface water draining from the Petersburg National Battlefield to be collected without flooding residential properties and maintain a visual buffer between residential neighborhood and the park.

Potential Opportunities

Opportunities to reduce flooding and improve aesthetics:

- Resize existing swale to increase capacity to hold and move water during storm events.
- Redesign swale to include a vegetated berm on the northern side to prevent flooding in residential backyards.
- Consider planting native evergreen water tolerant shrubs to provide a buffer between park and homes.

Potential Community Programs

Adopt a Drain Program

Develop an 'Adopt a Drain' program, modeled from other programs around the country. Residents adopt a drain and help keep it clear of trash and debris and report any issues to the City. The program connects residents with their local utility staff. The neighborhood's ~70 drains could be adopted by resident volunteers. Tools could be provided including rakes, brooms, trash bags, safety vests and shovels could be requested via grants. Program could be expanded to include swales or other natural drainage features.

Litter and Debris Reduction

Coordinate with community organizations on education and outreach on:

- promoting litter prevention and removal
- organizing community clean up days
- installing public trash cans and signs that celebrate Poor Creek, Harrison Creek and the Appomattox River.

Public Art as Cue to Care/Education

Work with local artists to design storm drain art to illustrate that rainwater drains to local waterways. Engage residents in the design and identifying key locations for storm drain art and/or storm drain markers.

Photos: (top) residents can Adopt-a-Drain and place medallions on top to educate the community about where stormwater goes; (bottom) public art can be an educational tool to promote awareness and stewardship.

Moving Forward

Next Steps

Key next steps include securing funding for a drainage study to better understand infrastructure capacity and design solutions. The following principles for implementation can guide next steps for moving forward.

- **Build Partnerships -** Strengthen existing and develop new partnerships between federal, state and local governments and community organizations for implementation and stewardship.
- **Grow Community Stewardship -** Continue to grow and foster community stewardship through outreach, education and opportunities for community involvement.
- **Engage Youth -** Build on existing youth programs and initiatives to engage youth in environmental education opportunities. As projects move forward, invite youth to participate in the design process and in the designing and building of outdoor play and learning areas.
- **Seek Funding -** Develop a plan to seek funding, including a list of potential grants and associated deadlines. Assemble teams early to develop winning proposals. Continue to seek opportunities that cross programs and initiatives to leverage funding for projects.
- **Phase Projects Over Time** - While some recommendations may be implemented in the near term, some projects will need to be phased over time. Develop an action list to coordinate initiatives and projects among partners. Continue to refine ideas during the design process.
- **Celebrate Successes! -** Sustain momentum and support by celebrating successes along the way.

Potential Partners and Funding Sources

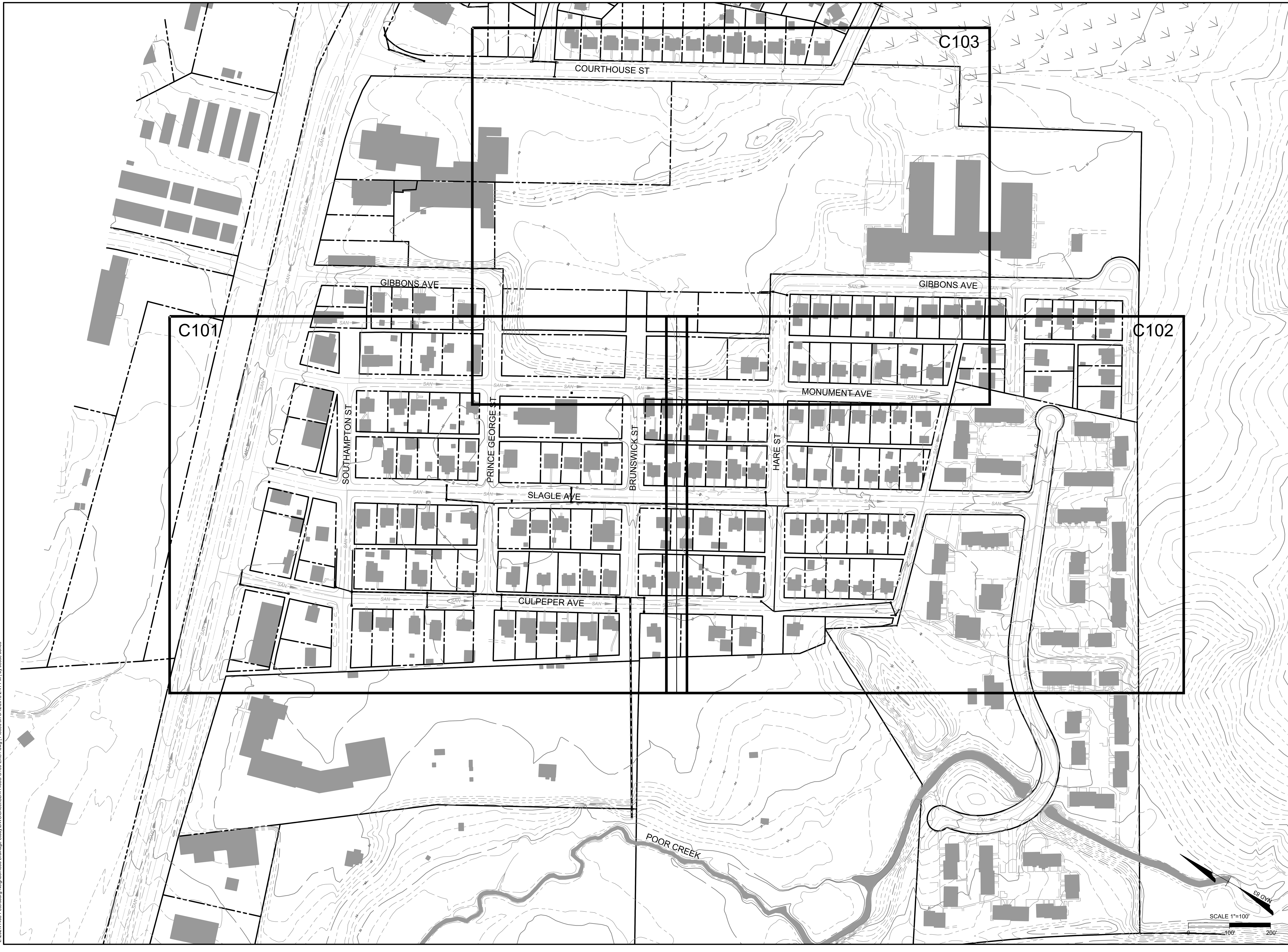
The following organizations have been identified as potential partners and collaborators with the REL Neighborhood to address community goals and address stormwater concerns:

- City of Petersburg (Department of Parks & Leisure, Public Works, Department of Health)
- National Parks Conservation Association
- National Park Service
- Robert E Lee Elementary Parent Teacher Association
- Friends of the Lower Appomattox River
- Fort Lee - Corps Volunteer Coordinator
- Habitat for Humanity
- Project Home
- Petersburg Area Community Development Corporation
- Crater Planning District
- Cameron Foundation
- Faith & Hope Baptist Church
- WOW Camp
- Boy Scouts of America - Area troops
- Petersburg City Council - Ward 1 Councilperson

Potential Funding Sources	*Deadlines and Funding*
National Fish and Wildlife Foundation *Innovative Nutrient and Sediment Reduction Grant*	Up to $750,000. The proposal submitted by James River Association in May 2016 for drainage study, coalition building, and adopt a drain pilot program was not awarded. Reapply in Spring 2017.
National Park Service *Park Project Planning*	As part of their annual budget planning, Petersburg National Battlefield can apply to NPS for funding for specific projects, this could include funds to address the swale project (see H on Concept Plan). A drainage study or further assessment of this area could inform the design of this drainage system.
City of Petersburg *Community Development Block Grant*	Up to $600,000 is awarded to Petersburg each year from U.S. Housing and Urban Development. Deadline for proposals is the second Friday in January each year.

For more information about the project, please visit: www.walkablewatershed.com
or contact Darryl Walker, City of Petersburg at (804) 733-2355 or dwalker@pertersburg-va.org.

Appendix B



THIS DRAWING PREPARED AT THE
CORPORATE OFFICE
1001 Boulders Parkway, Suite 300 | Richmond, VA 23225
TEL 804.200.6500 FAX 804.560.1016 www.timmons.com

YOUR VISION ACHIEVED THROUGH OURS.

DATE	REVISION DESCRIPTION
#	##########
#	#
#	#
#	#

DATE: 6/12/2018

DRAWN BY: J. JONES

DESIGNED BY: J. JONES

CHECKED BY: A.CREEL

SCALE: AS SHOWN

TIMMONS GROUP

LAKEMONT DRAINAGE STUDY

PETERSBURG - VIRGINIA

OVERALL EXISTING INFRASTRUCTURE MAP

JOB NO. 41408

SHEET NO. C100

GENERAL SITE NOTES:

1. GIS INFORMATION PROVIDED BY CITY OF PETERSBURG AND TIMMONS GROUP.
2. STORM SEWER LAYOUT PROVIDED BY CITY OF PETERSBURG RECORD DRAWINGS.

THIS DRAWING PREPARED AT THE
CORPORATE OFFICE
1001 Boulders Parkway, Suite 300 | Richmond, VA 23225
TEL 804.200.6500 FAX 804.560.1016 www.timmons.com

YOUR VISION ACHIEVED THROUGH OURS.

DATE	REVISION DESCRIPTION
#	##########
#	#
#	#
#	#

DATE: 6/12/2018
DRAWN BY: J. JONES
DESIGNED BY: J. JONES
CHECKED BY: A.CREEL
SCALE: AS SHOWN

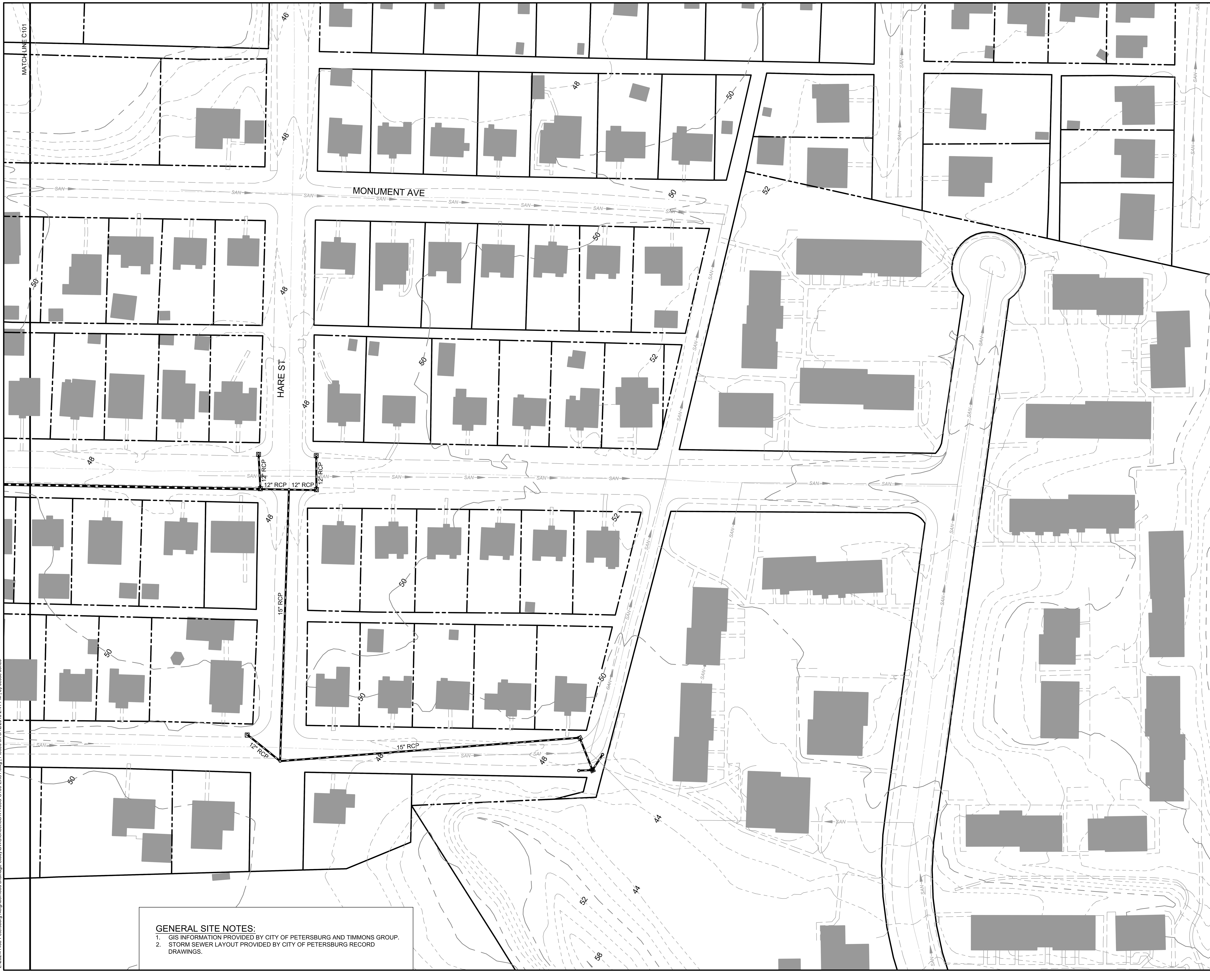
TIMMONS GROUP

LAKEMONT DRAINAGE STUDY

PETERSBURG - VIRGINIA

EXISTING INFRASTRUCTURE MAP

JOB NO. 41408
SHEET NO. C101



GENERAL SITE NOTES:
1. GIS INFORMATION PROVIDED BY CITY OF PETERSBURG AND TIMMONS GROUP.
2. STORM SEWER LAYOUT PROVIDED BY CITY OF PETERSBURG RECORD DRAWINGS.

THIS DRAWING PREPARED AT THE CORPORATE OFFICE
1001 Boulders Parkway, Suite 300 | Richmond, VA 23225
TEL 804.200.6500 FAX 804.560.1016 www.timmons.com

YOUR VISION ACHIEVED THROUGH OURS.

DATE	REVISION DESCRIPTION
#	##########
#	#
#	#
#	#

DATE: 6/12/2018
DRAWN BY: J. JONES
DESIGNED BY: J. JONES
CHECKED BY: A.CREEL
SCALE: AS SHOWN

TIMMONS GROUP

LAKEMONT DRAINAGE STUDY
PETERSBURG - VIRGINIA
EXISTING INFRASTRUCTURE MAP

JOB NO. 41408
SHEET NO. C102

THIS DRAWING PREPARED AT THE
CORPORATE OFFICE
1001 Boulders Parkway, Suite 300 | Richmond, VA 23225
TEL 804.200.6500 FAX 804.560.1016 www.timmons.com

YOUR VISION ACHIEVED THROUGH OURS.

DATE	REVISION DESCRIPTION
#	##########
#	#
#	#
#	#
#	#

DATE
6/12/2018

DRAWN BY
J. JONES

DESIGNED BY
J. JONES

CHECKED BY
A.CREEL

SCALE
AS SHOWN

TIMMONS GROUP

LAKEMONT DRAINAGE STUDY

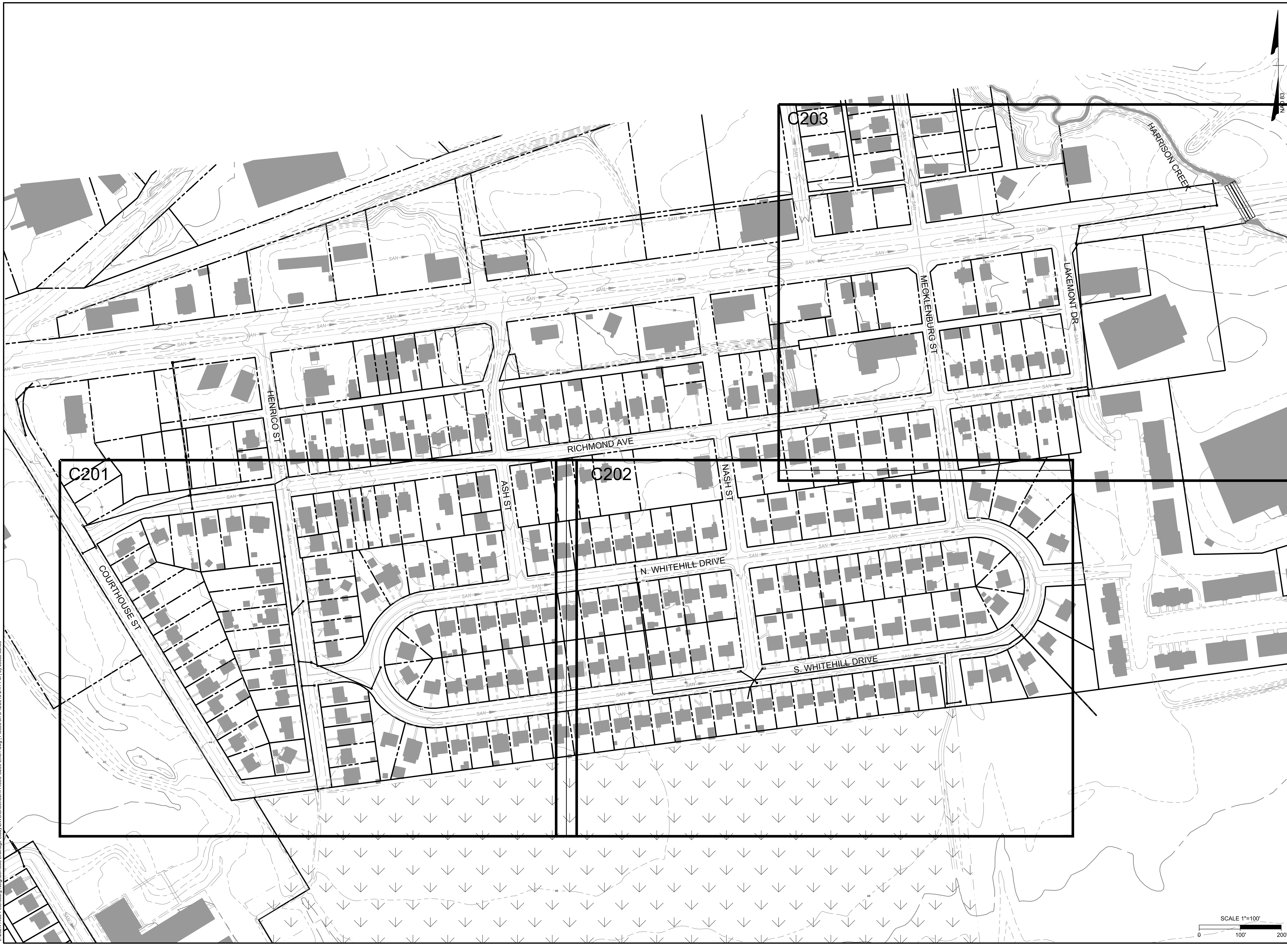
PETERSBURG - VIRGINIA

EXISTING INFRASTRUCTURE MAP

JOB NO.
41408

SHEET NO.
C103

L:\202\41408-Petersburg Neighborhood Drainage Study\DWG\Sheet\CD\41408C-C100-EXST.dwg | Plotted on 6/12/2018 2:41 PM | by Jesse Jones



THIS DRAWING PREPARED AT THE
CORPORATE OFFICE
1001 Boulders Parkway, Suite 300 | Richmond, VA 23225
TEL 804.200.6500 FAX 804.560.1016 www.timmons.com

YOUR VISION ACHIEVED THROUGH OURS.

DATE	REVISION DESCRIPTION
#	###########
#	#
#	#
#	#

DATE: 6/12/2018

DRAWN BY: J. JONES

DESIGNED BY: J. JONES

CHECKED BY: A.CREEL

SCALE: AS SHOWN

TIMMONS GROUP

LAKEMONT DRAINAGE STUDY

PETERSBURG - VIRGINIA

OVERALL EXISTING INFRASTRUCTURE MAP

JOB NO.: 41408

SHEET NO.: C200

GENERAL SITE NOTES:
1. GIS INFORMATION PROVIDED BY CITY OF PETERSBURG AND TIMMONS GROUP.
2. STORM SEWER LAYOUT PROVIDED BY CITY OF PETERSBURG RECORD DRAWINGS.

THIS DRAWING PREPARED AT THE
CORPORATE OFFICE
1001 Boulders Parkway, Suite 300 | Richmond, VA 23225
TEL 804.200.6500 FAX 804.560.1016 www.timmons.com

YOUR VISION ACHIEVED THROUGH OURS.

DATE	REVISION DESCRIPTION
#	###########
#	#
#	#
#	#

DATE: 6/12/2018
DRAWN BY: J. JONES
DESIGNED BY: J. JONES
CHECKED BY: A.CREEL
SCALE: AS SHOWN

TIMMONS GROUP

LAKEMONT DRAINAGE STUDY
PETERSBURG - VIRGINIA

EXISTING INFRASTRUCTURE MAP

JOB NO. 41408
SHEET NO. C201

L:\202\41408-Petersburg Neighborhood Drainage Study\DWG\Sheet\CD\41408C-C200-EXST.dwg | Plotted on 6/12/2018 2:41 PM | by Jesse Jones

GENERAL SITE NOTES:
1. GIS INFORMATION PROVIDED BY CITY OF PETERSBURG AND TIMMONS GROUP.
2. STORM SEWER LAYOUT PROVIDED BY CITY OF PETERSBURG RECORD DRAWINGS.

THIS DRAWING PREPARED AT THE
CORPORATE OFFICE
1001 Boulders Parkway, Suite 300 | Richmond, VA 23225
TEL 804.200.6500 FAX 804.560.1016 www.timmons.com

DATE	REVISION DESCRIPTION
#	##########
#	#
#	#
#	#

YOUR VISION ACHIEVED THROUGH OURS.

DATE	6/12/2018
DRAWN BY	J. JONES
DESIGNED BY	J. JONES
CHECKED BY	A.CREEL
SCALE	AS SHOWN

TIMMONS GROUP

LAKEMONT DRAINAGE STUDY

PETERSBURG - VIRGINIA

EXISTING INFRASTRUCTURE MAP

JOB NO.	41408
SHEET NO.	C202

L:\20241408-Petersburg Neighborhood Drainage Study\DWG\Sheet\CD41408C-C200-EXST.dwg | Plotted on 6/12/2018 2:41 PM | by Jesse Jones

GENERAL SITE NOTES:

1. GIS INFORMATION PROVIDED BY CITY OF PETERSBURG AND TIMMONS GROUP.
2. STORM SEWER LAYOUT PROVIDED BY CITY OF PETERSBURG RECORD DRAWINGS.

THIS DRAWING PREPARED AT THE
CORPORATE OFFICE
1001 Boulders Parkway, Suite 300 | Richmond, VA 23225
TEL 804.200.6500 FAX 804.560.1016 www.timmons.com

YOUR VISION ACHIEVED THROUGH OURS.

DATE	REVISION DESCRIPTION
#	##########
#	#
#	#
#	#

DATE: 6/12/2018

DRAWN BY: J. JONES

DESIGNED BY: J. JONES

CHECKED BY: A.CREEL

SCALE: AS SHOWN

TIMMONS GROUP

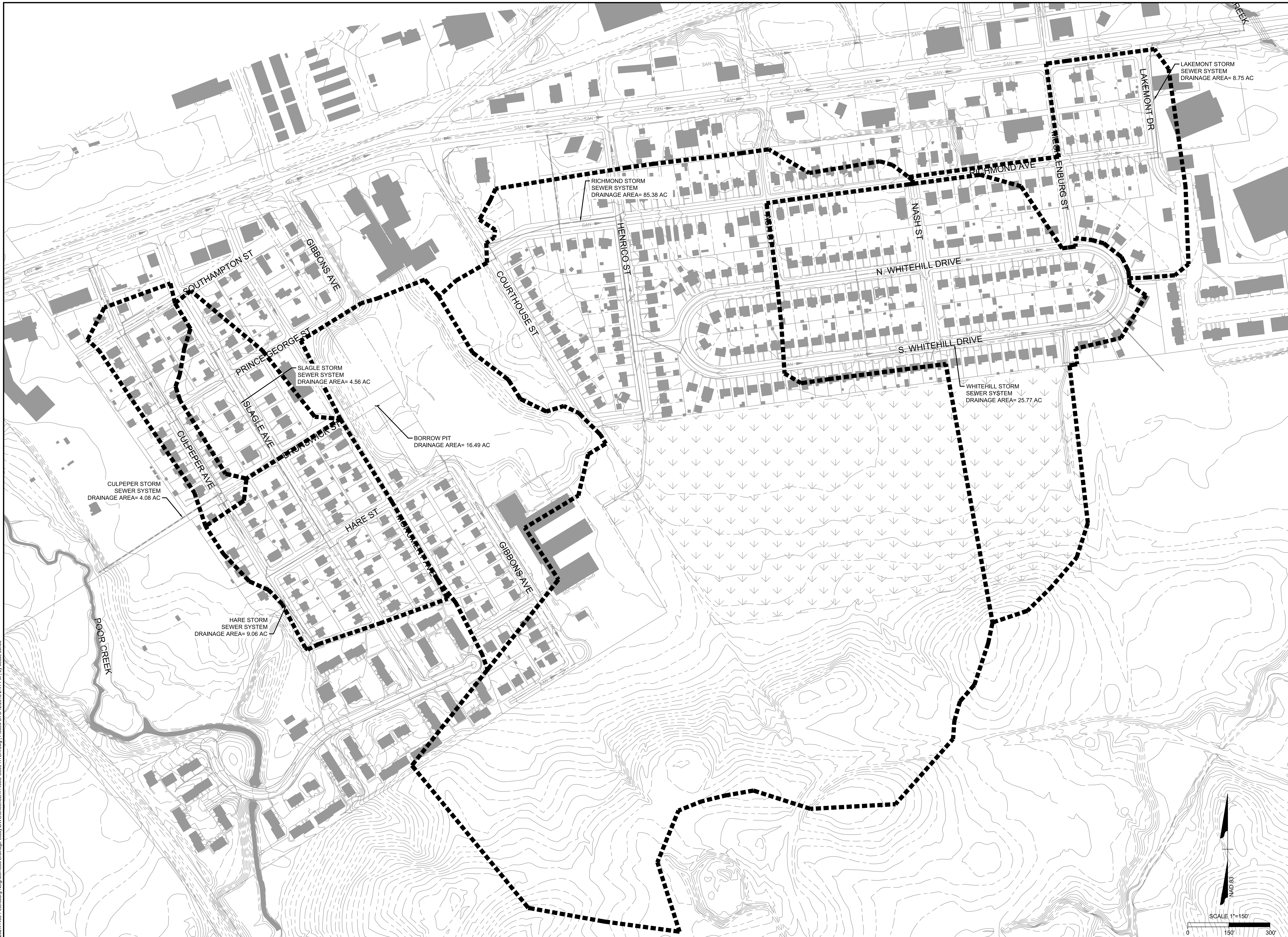
LAKEMONT DRAINAGE STUDY

PETERSBURG - VIRGINIA

EXISTING INFRASTRUCTURE MAP

JOB NO. 41408

SHEET NO. C203



THIS DRAWING PREPARED AT THE
CORPORATE OFFICE
1001 Boulders Parkway, Suite 300 | Richmond, VA 23225
TEL 804.200.6500 FAX 804.560.1016 www.timmons.com

YOUR VISION ACHIEVED THROUGH OURS.

DATE	REVISION DESCRIPTION
#	##########
#	#
#	#
#	#

DATE: 6/12/2018

DRAWN BY: J. JONES

DESIGNED BY: J. JONES

CHECKED BY: A.CREEL

SCALE: AS SHOWN

TIMMONS GROUP

LAKEMONT DRAINAGE STUDY

PETERSBURG - VIRGINIA

HYDROLOGY MAP

JOB NO. 41408

SHEET NO. C300

L:\30241408-Petersburg Neighborhood Drainage Study\DWG\Sheet\CD\41408C-C300-HYDR.dwg | Plotted on 6/12/2018 2:41 PM | by Jesse Jones

Appendix C

United States Department of the Interior

NATIONAL PARK SERVICE
423 Forest Resources Building
University Park, PA 16802

April 2018

Memorandum

To: Timothy Blumenschine, Resource Management Division, Petersburg National Battlefield

From: Peter Sharpe Ph.D., PWS, Hydrologist, Northeast Region

Subject: Wetland Delineation and Watershed Analysis Report for Travel, Pin Oaks and Whitehill boundary sections of Petersburg National Battlefield (PETE)

Report Summary

The objective of this investigation was to respond to a request for regional assistance for a comprehensive delineation of wetland habitats subject to jurisdiction under Section 404 of the Clean Water Act and all wetlands subject to National Park Service (NPS) procedures for implementing *Director's Order #77–1: Wetland Protection* within the Whitehill section of the Petersburg National Battlefield park boundary. A secondary objective was to provide the park with a basic watershed analysis for the Whitehill drainage area. This work utilized the U.S Army Corps of Engineers (USACE) Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain (Version 2.0) (November 2010) as the primary methodology for making wetland determinations in the field and was conducted during non-growing season conditions. One palustrine forested wetland encompassing 22.64 acres and one riverine wetland totaling 0.08 acres were identified and delineated from 8-10 August 2017 within the 27.52 acre study area (Fig. 1). The observed palustrine wetland habitat was classified as palustrine, forested, broad leaved deciduous, seasonally flooded, partly drained (PFO1Cd) habitat. The mapped riverine system was classified as a riverine, intermittent, streambed, mud system (R4SB5). Both of the identified and mapped wetlands meet the U.S. Army Corps of Engineers criteria and the Cowardin et al. (1979) definitions of wetland and waterway habitats. A combination of desktop watershed delineations using the USGS StreamStats software coupled with field observations of anthropogenic drainage features were used to make a general determination of the contributing watershed to the study area. Based on this analysis it appears that the 12 inch diameter reinforced concrete pipe owned by the City of Petersburg which serves as the primary means of conveying water out of the study area is insufficiently sized to pass the modeled 2-year peak urban flow.

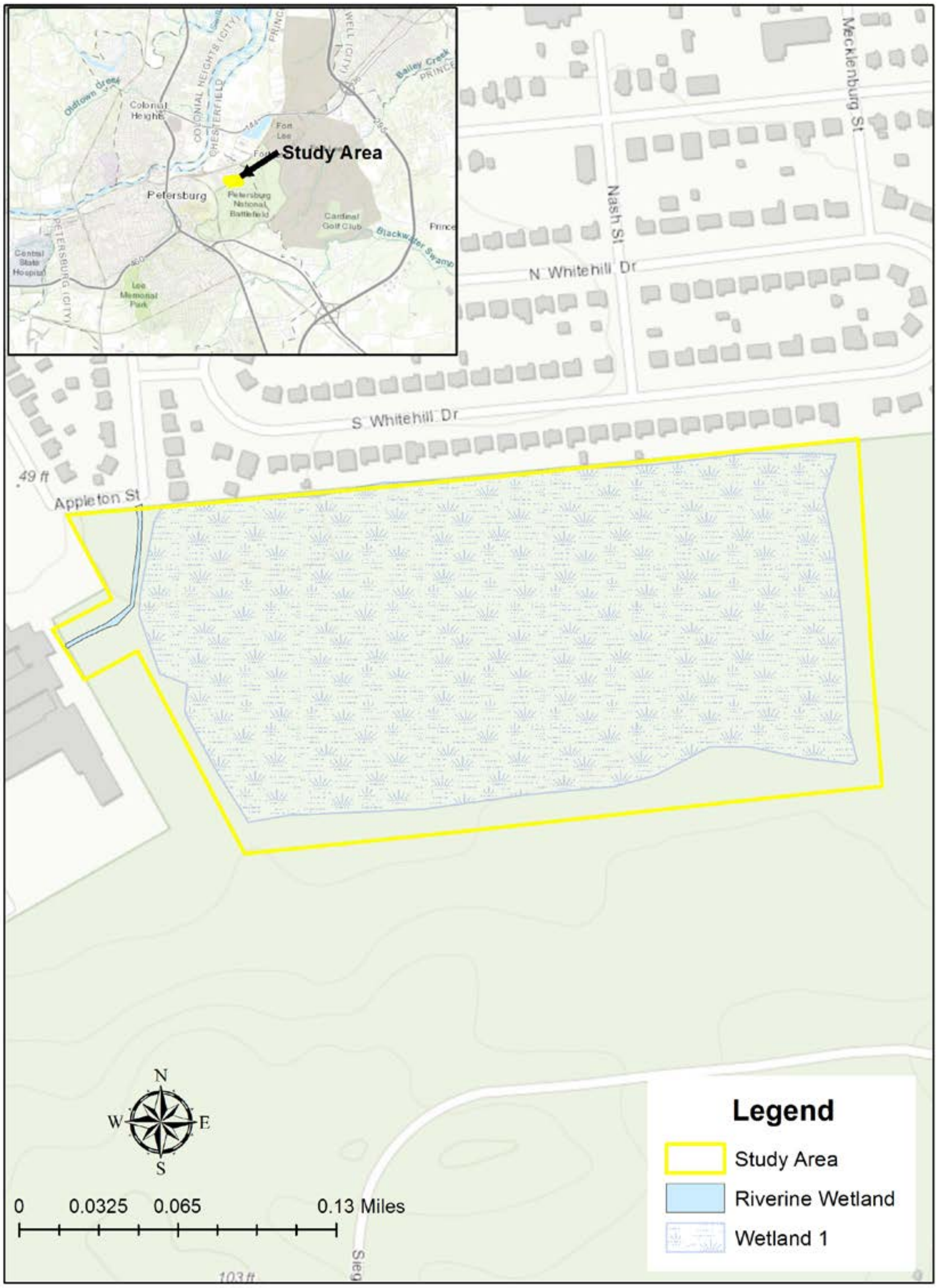


Figure 1. Whitehill development study area map and palustrine/riverine wetland features overview.

Study Objectives

The purpose of this investigation was to provide detailed wetland/aquatic resource identification and boundary information in support of a flooding abatement technical assistance request within PETE (see Fig. 1). A second objective of this effort was to provide NPS staff at the park with a basic watershed assessment for the subject area in an effort to better understand the surface flow dynamics behind the flooding experienced within this area of the park and the adjacent Whitehill neighborhood (Fig. 1). The information obtained from this effort may be utilized for park compliance and planning purposes for potential flooding remediation alternatives and any future hydrologic investigations within this section of the park (Fig. 1).

Photograph 1 (P1). Photo looking Northeast at Wetland 1 and a few of the CCC era drainage features which bisect the habitat within the study area boundary at PETE. August 2018

Field Participants

Peter J. Sharpe, NPS
Timothy Blumenschine, NPS

Introduction

It is the mission of the National Park Service to preserve and maintain the natural and cultural resources of Petersburg National Battlefield and to interpret those same resources to the visiting public and the scientific and scholarly community. Following a traverse of the 27.52 ac study area, wetlands and associated aquatic resources were delineated in the field by the NPS staff listed within this report and located using a GPS system capable of obtaining sub-meter accurate readings (Trimble Geo 7X) for purposes of accurately mapping these aquatic resources. The information contained here-in can be used for external (Section 404 Clean Water Act, and NEPA Compliance), as well as, internal D.O. #77.1 wetlands protection compliance.

The NPS through Director's Order #77–1 requires mapping of wetlands and all other "waters of the United States" via a slightly different criteria than the USACE 1987 manual and associated regional supplements, thus the two types of wetland determination methods employed at PETE were: (1) Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0) and (2) the 1979 USFWS *Classification of Wetlands and Deepwater Habitats of the United States*.

The NPS recognizes that most wetlands on NPS lands will have all three parameters required by the 1987 Corps Manual and its associated regional supplement. Therefore, D.O. #77–1 provides procedures for field biologists to follow so that that wetland delineation and mapping projects on NPS lands will satisfy both the Clean Water Act wetland definition (1987 Corps Manual) and the NPS standard for identifying wetlands (Cowardin et al. 1979), for brevity, only the standard applicable for PETE is described below for a more detailed treatment of the other standards the reader is directed to D.O #77-1:

1. For sites with vegetation and soils, use the most recent version (and any approved Regional supplements) of the 1987 Corps Manual, including "problem area" and "atypical situation" procedures (this procedure was utilized at PETE)

Methods - Interim Regional Supplement USACE Method (1987 Corps Manual) (Routine Onsite Determination, 3-Parameter Approach)

The USACE method for identifying the wetland / upland boundary uses the definition as outlined in the U.S. Army Corps of Engineers *Wetlands Delineation Manual, 1987,* which defines a wetland as:

> "Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

Wetland boundaries were primarily determined by establishing a series of unmarked transects from a known wetland into known upland locations surrounding the area under examination. At suspected boundary locations along the transect investigators looked for evidence of hydric soils, hydrophytic vegetation, and wetland hydrology, as well as, any obvious topographic changes (e.g. abrupt toe-of-slope line) along the wetland/upland perimeter that might occur.

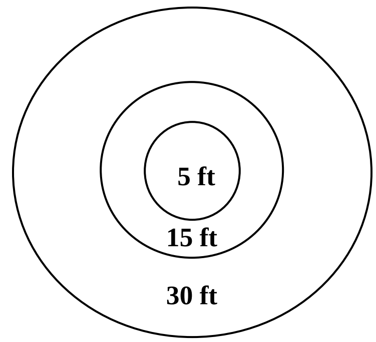


Figure 2. Typical wetland vegetation survey plot utilized within the study area.

Parameter 1- Hydrophytic Vegetation Criteria

For determining the presence of hydrophytic vegetation, plant species within each community were visually identified by strata (e.g. trees, saplings/shrubs, herbs/bryophytes and woody vines) and listed in descending order of dominance. The USACE defined sampling stratum has 5 percent or more total plant cover. If a stratum had less than 5 percent cover during the growing season, then those species and their cover values were recorded on the data form, assuming application of Indicator 3 (Prevalence Test) was necessary. However, these species were not generally included on the data sheets if the wetland determination could be made via Indicator 2 (Dominance Test). For Indicator 2 only those species that comprised 5% or more of a given strata were assessed.

Vegetation survey plots conformed to current USACE supplement guidelines and involved the use of nested circular plots radiating outward from the soil/hydrology test pit (Fig. 2). Plot sizes were as follows:

1. Tree stratum – 30 ft (9.1 m) radius
2. Woody vines (if present) – 30 ft (9.1 m) radius
3. Herb stratum – 5 ft (1.5 m) radius
4. Sapling/shrub stratum – 15 ft (4.6 m) radius

The wetland indicator status of observed dominant plant species was determined using the 2016 National Wetland Plant List for the State of Virginia:

- **OBL** (Obligate Wetland Plants) occur greater than 99 percent of the time in wetlands under natural conditions.

- **FACW** (Facultative Wetland Plants) occur between 67 and 99 percent of the time in wetlands under natural conditions.

- **FAC** (Facultative Plants) occur between 33 and 67 percent of the time in wetlands under natural conditions.

- **FACU** (Facultative Upland Plants) occur between 1 and 33 percent of the time in wetlands under natural conditions.

- **UPL** (Obligate Upland Plants) occur less than 1 percent of the time in wetlands under natural conditions.

Plant species dominance was determined as the most abundant species that individually or collectively accounted for more than 50 percent of the total absolute coverage of vegetation in the stratum, plus any other species that, by itself, accounts for at least 20 percent of the total (i.e. the 50/20 Rule).

The Army Corps regional supplement (Atlantic and Gulf Coastal Plain) to the original 1987 USACE manual identifies 4 primary indicators of hydrophytic vegetation, any of which, when met, signifies that the community indicates a wetland plant community. For purposes of brevity this section will only cover the most commonly encountered indicator at PETE (e.g. Indicator 2). For a complete description of all of the indicators the reader is directed to view the U.S Army Corps of Engineers (USACE) Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0), November 2010.

For a plant community to meet the vegetation criteria under Indicator 2 (a commonly employed indicator at PETE) more than 50 percent of the dominant plant species across all strata must be rated OBL, FACW, or FAC.

Parameter 2 - Hydrology Criteria

Wetland hydrology indicators provide evidence that episodes of inundation or soil saturation lasting more than a few days during the growing season have occurred repeatedly over a period of years and that the timing, duration, and frequency of wet conditions have been sufficient to produce a characteristic wetland plant community and hydric soil morphology. As stated in the Atlantic and Gulf Coastal Plain regional supplement the growing season begins when two or more non–evergreen vascular plant species growing within the study area exhibit one or more of the following biological indicators:

1. Emergence of herbaceous plants from the ground
2. Appearance of new growth from vegetative crowns (e.g., in graminoids, bulbs, and corms)
3. Coleoptile/cotyledon emergence from seed
4. Bud burst on woody plants (i.e., some green foliage is visible between
5. spreading bud scales)
6. Emergence or elongation of leaves of woody plants
7. Emergence or opening of flowers

Hydrologic indicators of wetland conditions are based on the direct observation of surface water or groundwater during a site visit (Group A indicators), evidence that the site is subject to flooding or ponding, although the inundation need not be directly observed at the time of the investigation (Group B indicators). The inundation (Group B) indicators include water marks, drift deposits, sediment deposits, and similar features. Other hydrologic indicators consist of evidence that the soil is saturated currently or was saturated recently such as oxidized rhizospheres and the presence of reduced iron or sulfur in the soil profile (Group C indicators), which indicate that the soil has been saturated for an extended period. The final group of hydrologic indicators (Group D) consists of landscape, vegetation, soil features, and evidence from other sources of data that indicate contemporary rather than historical wet conditions. Wetland hydrology indicators are intended as one–time observations of site conditions that are sufficient evidence of wetland hydrology in areas where hydric soils and hydrophytic vegetation are present. For a site to meet the wetland hydrologic criteria it need only possess one primary indicator or two secondary indicators from one of the aforementioned groups.

Parameter 3 - Hydric Soil Criteria

The National Technical Committee for Hydric Soils defines a hydric soil as a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (USDA Soil Conservation Service 1994). One of the most significant changes to the original 1987 USACE manual with regards to wetland boundary determinations is in the area of hydric soil recognition and characterization. The revised indicators are much more specific and cover a broader range of potential wetland types than the original 1987 manual criteria.

Soil pits were excavated to a maximum depth of 21 inches (45.72 cm) using a sharp shooter shovel, unless on-site conditions such as shallow bedrock or buried alluvial cobbles prohibited excavation or one or more of the hydric soil indicators were met. The data sheets for each mapped wetland include information on the soil profile colors, presence/absence of redoximorphic features, texture, and presence/absence of any shallow confining layers and their depths on–site. A 2-inch diameter Dutch auger was utilized to make soil determinations along the wetland boundaries along with the vegetation and hydrology assessments.

GPS Survey of Wetland Boundaries

Pink wetland delineation flags were marked with a unique alpha numeric code and hung at regular intervals around the perimeter of each identified wetland habitat and located using a sub-meter accurate GPS system. Representative wetland test pits were also similarly flagged and located. GPS-based coordinates were collected for wetland test pit and boundary flags between 8-10 August 2017, using a Trimble Geo7X receiver with an external Hurricane antenna in the WGS 1984 datum, in meter coordinate. A minimum of 4 satellite vehicles were tracked and where possible a maximum Position Dilution of Precision (PDOP) of 6 was maintained for each set and a minimum of 50 positions were taken at each point feature. The data were post–processed and differentially corrected using Pathfinder Office 5.85 and base data were downloaded from the CORS, LOYOLA LS06, Virginia (ITRF00 (1997) derived from IGS08 (New)) site. The corrected data were then exported to shapefile format for polygon creation in ARCMAP 10.5. Following this procedure over 83% of our collected GPS data has accuracies ranging from 0 – 3.5 ft, using the above standards. No tests were done to confirm the X/Y direction accuracy during this investigation. Table 1 below shows a more complete breakdown the GPS data's horizontal precision.

Table 1. Estimated accuracies for the 2945 corrected GPS positions for the Whitehill Flooding Technical Assistance Request.

Horizontal Precision	Percentage of GPS Positions within Range
0 - 2 in	0%
2 - 6 in	0%
6 - 12 in	0.37%
12 - 20 in	37.86%
20 - 40 in	45.57%
40 - 79 in	9.85%
79- 197 in	6.18%
>197 in	0.17%

Wetland Descriptions

Wetland 1 (Size – 22.64 ac): This wetland ecosystem lies almost entirely within the mapped study area boundary shown in Figure 1. The site occupies a historically disturbed bottomland location adjacent to a small housing development. Over 30 small (≈ 1-2 feet deep, 2-4 feet wide) drainage ditches bisect this site in a variety of north/south and northwest/southeast directions (see Photograph 1 and Fig. 3). Presumably these earth works were put in place to promote drainage off-site and according to park staff (Julia Steele) they were probably constructed by the CCC in the early 1940s, but possibly related to WWI Camp Lee, or WWII Fort Lee activities. Regardless of their intent or origins they currently shunt all runoff waters within this watershed to a single collection point (see Fig. 4) which consists of a 12-inch diameter reinforced concrete pipe (see Photograph 4). Numerous incidents of flooding have been observed within the NPS lands in this area and the adjacent neighborhood which over time have likely created conditions ideal for the formation of wetland habitat.

Wetland indicators within this location were originally observed in the plant community and classified and reported by Patterson (2008) as a Coastal Plain/Piedmont Floodplain Swamp Forest (Mixed Oak/Red Maple) Landcover Class. This investigation and boundary delineation in August 2017 supports that original determination. The Cowardin et al. (1979) classification of this wetland is a palustrine, forested, broad leaved deciduous, seasonally flooded, partially drained/ditched system (PFO1Cd). Due to the anthropogenic nature of the site three separate wetland test plots/pits where sited to adequately characterize the community. Direct observations of standing water were made (see data sheet WTP-2, Appendix B), however, the majority of the site was dry at the time of the investigation (see Photograph 2). WTP-1 was a notable exception which was sited very near the main drainage feature of the area the site soils conformed to the F3 hydric soil indicator. Typical dominant canopy species observed within the wetland test plots at the time of the investigation were *Liquidambar stryaciflua*, *Quercus phellos*, and *Ulmus Americana* with an understory dominated by *Nyssa sylvatica*. Ground cover was generally sparse in many places and similar to Patterson (2008) *Pinus taeda* was also found scattered throughout the canopy in 2017.

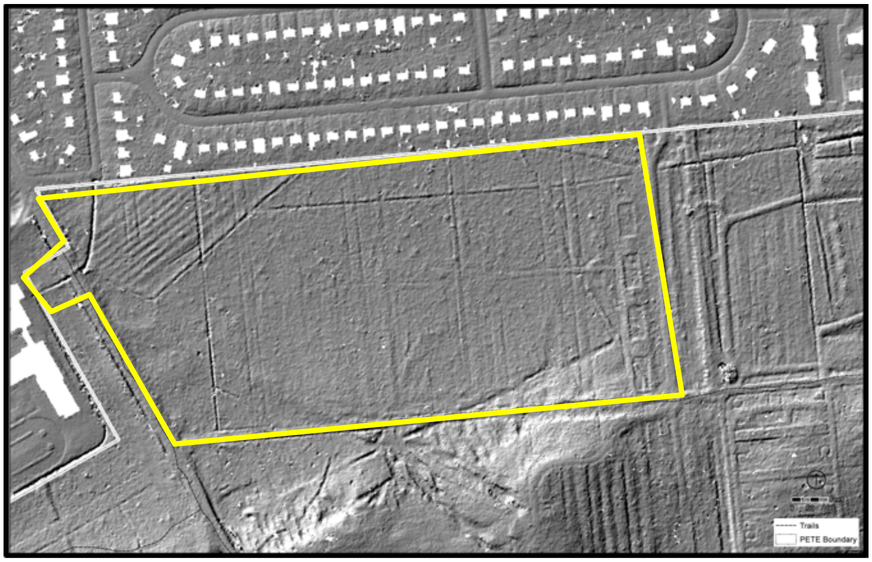


Figure 3. LiDAR image of the study area provided by PETE staff (Adam Baghetti). From the imagery the network of drainage ditches bisecting the Study Area (yellow boundary) can be easily seen.

Wetland 1 Functions and Values

A qualitative function and value analysis utilizing the US Army Corps of Engineers – New England District (*The Highway Methodology Workbook Supplement*, September 1999) was also conducted as supplement to this effort. Assessed principal function and values associated with Wetland 1 were numerous and included floodflow alteration, sediment toxicant/ retention, nutrient removal, production export, wildlife habitat,

Photograph 2 (P2) – Wetland 1 (PSS1E) view facing north. Photo September 2017 – P. Sharpe.

recreation, educational/scientific value, and uniqueness/heritage. The combined cultural aspects of this wetland, its relative size within its contributing watershed, and proximity to schools and urban neighborhoods make this a highly valuable wetland ecosystem in terms of natural resource interpretation.

Riverine Wetland (Size – 0.08 ac):
Riverine wetlands as defined in Cowardin et al. (1979) includes all wetlands and deepwater habitats contained within a channel unless that wetland is dominated by trees, shrubs, or persistent emergents, emergent mosses, or lichens or is contained within water possessing ocean derived salts in excess of 0.50 ppt. Cowardin et al. (1979) further defines the definition of a channel as “an open conduit either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of standing water.

The riverine feature mapped in August 2017 and shown in Photograph 3 below exhibited characteristics of a riverine, intermittent, streambed, mud system (R4SB5). The flow regime of the waterway was determined based off of the presence of a defined bed and banks, natural channel substrates, and the lack of two or more obligate aquatic taxa (i.e. fishes or benthic macroinvertebrates) at the time of our survey. Additionally an assessment of basic hydrologic condition following the methodology described in Fritz et al. (2006) was conducted post-hoc. This unnamed riverine feature is a first order drainage to the Appomattox River originating out of a stormwater culvert at the north western limit of the study area (Figure 3 – “Origin”). This aquatic feature displays evidence of a low gradient system with substrates primarily comprised organic material and mud, with surface water present, but exhibited no signs of visible flow

Photograph 3 (P3) – Mapped riverine wetland system shown on NPS lands view is southeast looking upstream at the system and its riparian zones September 2017 – P. Sharpe.

during this survey. Indications of incision and erosion were observed, however, it appeared as if the system had stabilized with respect to the flow control points (culverts) shown in Photographs 3 and 4. Obligate aquatic taxa were not observed, however, numerous adult green frogs (*Rana clamitans melanota*) were seen utilizing the small pool directly below the culvert outflow in Photograph 3.

Riverine System Functions and Values

As this system appears to be intermittent in flow regime status it likely possess little wildlife habitat (aquatic) function and value apart from providing a seasonal breeding or resting/escape cover component for amphibians. The waterway appears to be relatively stable with some albeit limited connectivity to its floodplain (Wetland-1) within the study area. This system also

Photograph 4 (P4) – 12 inch RCP which serves as the only visible outlet for the 85.52 acre watershed system draining to this point. View is northwest August 2017 – P. Sharpe.

appears to contribute organic materials (i.e. small woody debris and leaf detritus) to the Appomattox River and is nearby a local school giving it some educational value as well.

Watershed Analysis (Basin Size - 85.52 acres)

A preliminary watershed analysis using StreamStats online software https://water.usgs.gov/osw/streamstats/ss_documentation.html was utilized to develop a suite of watershed characteristics and modeled flows in an effort to determine potential flooding characteristics within the project study area. The delineated basin was assessed in the field over the August 2017 field investigation and modified within the StreamStats software post-hoc in the office (Figure 4). As this is a highly modified landscape the watershed didn't conform to the basic model generated in the StreamStats. The delineated watershed receives stormwater runoff from an elementary School, NPS roads (e.g. Siege Road), and an adjacent neighborhood (Pin Oaks Development). Surface water flow arrows were added to the basin in ARCMAP 10.5 to illustrate the surface flow field and the collection systems currently in place to transport runoff waters either to Poor Creek to the west or to the 12 inch reinforced concrete pipe shown in Photograph 4. Developed lands (National Land Cover Data Set 2006 data) cover approximately 22% of the delineated basin with a corresponding percentage of impervious area (NLCD 2011) of 4.63%. The StreamStats software allows the user to calculate a peak flow statistics report using a variety of different scenarios. In this instance the Peak-Flow statistics that were employed were the (Peak Urban06 2014) scenario, which represented a more conservative urban

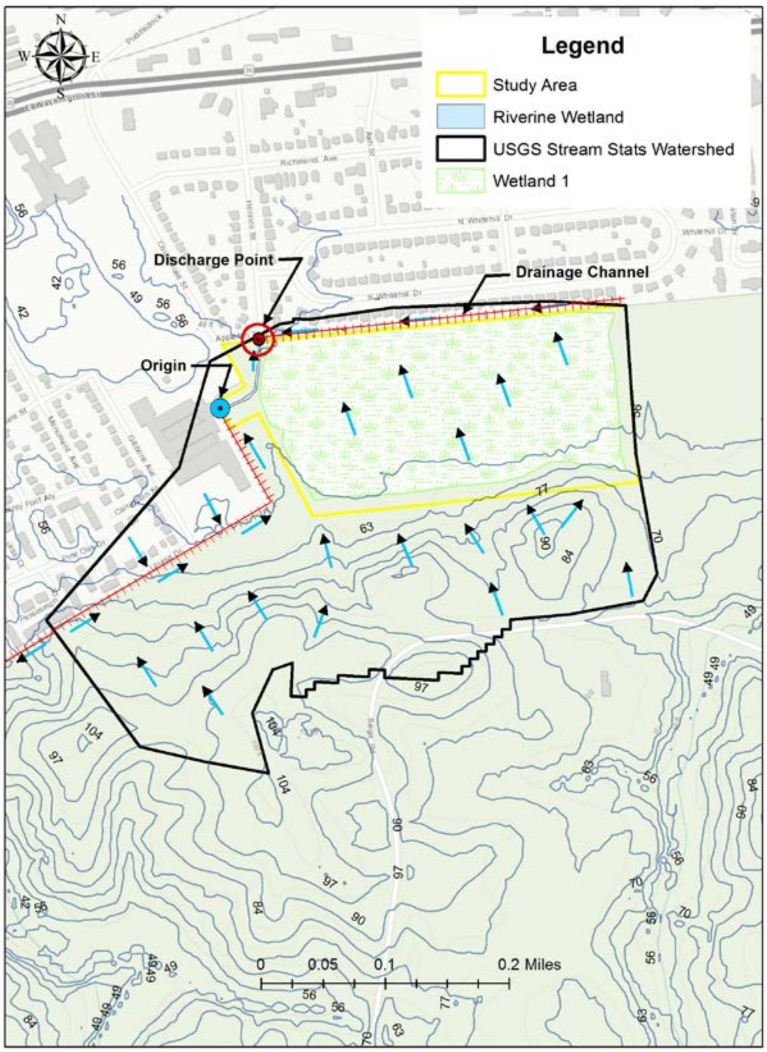


Figure 4. USGS StreamStats watershed boundary (modified and imported into ARCMAP 10.5) showing contours lines (feet) the surface water flow field (arrows) and the existing stormwater collection system in place. It should be noted that all of the flows shown here eventually discharge into a single collection point “Discharge Point” on the map.

modeling effort than the Peak Urban11 2014 scenario (Austin et al. 2011 and Austin, 2014).

The resulting peak flow statistics for the 2-year Peak Flood and the 100-year Peak Flood were then used in conjunction with the Headwater Depth for Concrete Pipe Culverts with Inlet Control nomograph (Chart 1B) from the Federal Highways Administration (FHWA) publication No. FHWA-HIF-12-026. This procedure allowed for a reasonable estimate to be made of appropriate culvert sizing to convey stormwater flows offsite.

An important disclaimer to this analysis is that the StreamStats calculations and model used, as well as, the FHWA nomograph was not done by a professional engineer or storm water hydrologist. Therefore any analysis reported here should be considered provisional and subject to change upon peer review. With these caveats in mind - the 2-year Peak Urban flood within the Figure 3 watershed was calculated at 25.7 cfs (cubic feet per second) with a subsequent 100-year Peak Urban Flow of 162 cfs. Based on these peak flows and the Chart 1B FHWA nomograph the ideal diameter of the culvert shown in Photograph 4 should be somewhere between 27 and 30 inches (it is currently 12 inches in diameter). Using the same nomograph but with the 100-year Peak Urban Flow of 162 cfs the culvert would need to be at least 54 inches in diameter in order to adequately pass stormwater through the site assuming an unsubmerged headwater depth of 1 foot.

These calculations, coupled with the evidence of a large forested wetland ecosystem (Wetland – 1) occupying lands rated as having low levels of hydric soil components (5B Emporia Sandy Loam), no historic National Wetland Inventory Designation (see Appendix A mapping), and public, as well as, NPS observations of severe flooding in this area lend support to the theory that the existing culvert (Photograph 4) is improperly sized to convey stormwater offsite.

Recommendations

Large, mature forested wetlands such as the ecosystem delineated and reported herein are extremely difficult to replace once they are lost. Though the wetland system in question <u>may have</u> formed under anthropogenic circumstances the fact that it exists means that it is afforded protection under the Organic Act, the Clean Water Act, and DO #77.1. Keeping these NPS policy and federal regulatory obligations in mind means that even if the existing culvert and associated drainage system where to be enlarged to promote drainage off-site this would likely alter the existing hydroperiod within Wetland-1 causing it to become drier and possibly convert to a non-wetland state. This would be considered a permanent impact to the wetland that would require compensation under DO #77.1 and possibly Section 404 of the Clean Water Act. Additionally, the NPS does not own the 12 inch RCP in question, that structure and its associated drainage network is the property of the City of Petersburg, (P. Sharpe personal communication, T. Blumenschine August 2017).

<u>Low Earth Berm</u>

With the aforementioned information as context I recommend that the PETE staff consider the construction of a low (3-4 feet high) berm system that runs along the northern boundary of Wetland-1 between the Whitehill Development and the NPS lands. The berm system would need to be designed and built such that overland flows were captured and retained within NPS lands while providing minimal impact to the existing viewshed from the adjacent neighborhood. The berm would also serve as a simple restoration tool to alleviate the influence of the numerous ditches which currently bisect this wetland system (see Photograph 1 and Fig. 3). Engineering design work and coordination with the City of Petersburg would still need to be conducted, as well as, compliance with NPS cultural resource staff, and the Norfolk District of the U.S. Army Corps of Engineers to ensure that this solution doesn't adversely impact cultural resources/landscapes located on-site and ensure Clean Water Act compliance.

Dr. Kevin Noon (NPS-WRD) or myself could be your principal point of contacts for guidance related to the development of a formal wetland statement of findings should the proposed project proceed and it is determined that permanent or temporary wetland impacts should arise as a result of the project and the PETE staff are required to submit those documents to comply with internal DO #77.1 standards.

If you have any questions regarding this report please call Peter Sharpe at (267) 858-1001. This report along with its geospatial data will be posted to the NPS IRMA site for PETE.

cc: (by e-mail only)
PETE – Tim Blumenschine, Julia Steele
WRD - K. Noon, A. Ellsworth
NERO – Carmen Chapin

References Cited

Austin, S.H., J.L. Kristolic, and Ute. Wiegand. 2011. Peak-flow characteristics of Virginia streams: U.S. Geological Survey Scientific Investigations Report 2011-5144, 106 p. +3 tables and 2 appendices on CD (http://pubs.usgs.gov/sir/2011/5144/)

Austin, S.H. 2014. Methods and equations for estimating peak streamflow per square mile in Virginia's urban basins: U.S. Geological Survey Scientific Investigations Report 2014-5090, 25p. (http://pubs.usgs.gov/sir/2014/5090/#StreamStatsDB_2014-11-21 – Copy - Copy.mdb#)

Cowardin, L. M., F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C.

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS. Technical Report Y–87–1.

Fritz, K.M., B.R. Johnson, and D.M. Walters. 2006. Field Operations Manual for Assessing the Hydrologic Permanence and Ecological Condition of Headwater Streams. EPA/600/R-06/126. U.S. Environmental Protection Agency, Office of Research and Development, Washington DC.

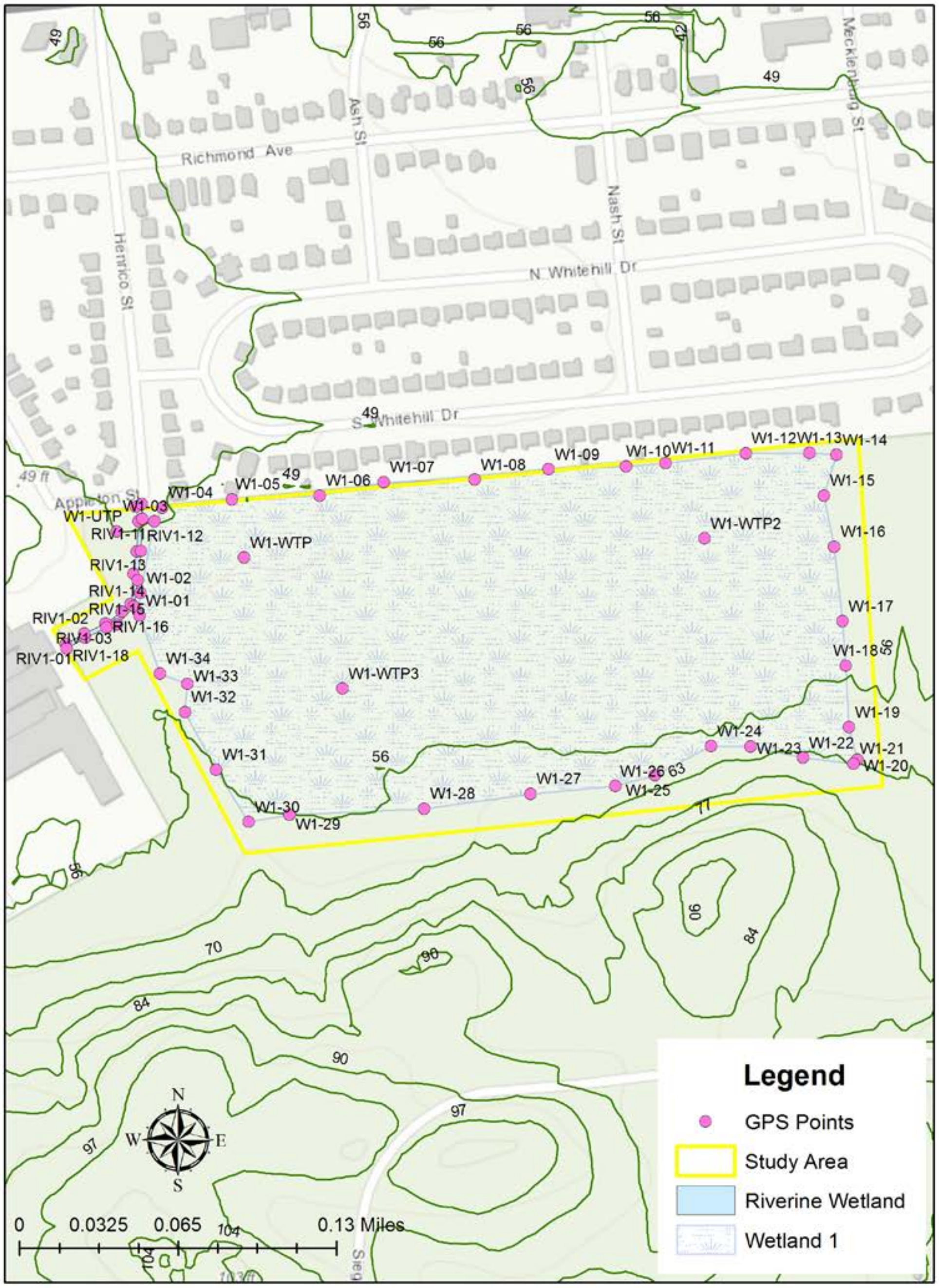
K. D. Patterson. 2008. Vegetation Classification and Mapping at Petersburg National Battlefield, Virginia. Technical Report NPS/NER/NRTR—2008/127. National Park Service. Philadelphia, PA.

U.S. Department of Agriculture, Natural Resources Conservation Service. 1994. National food security act manual, third edition (as amended). Washington, DC.

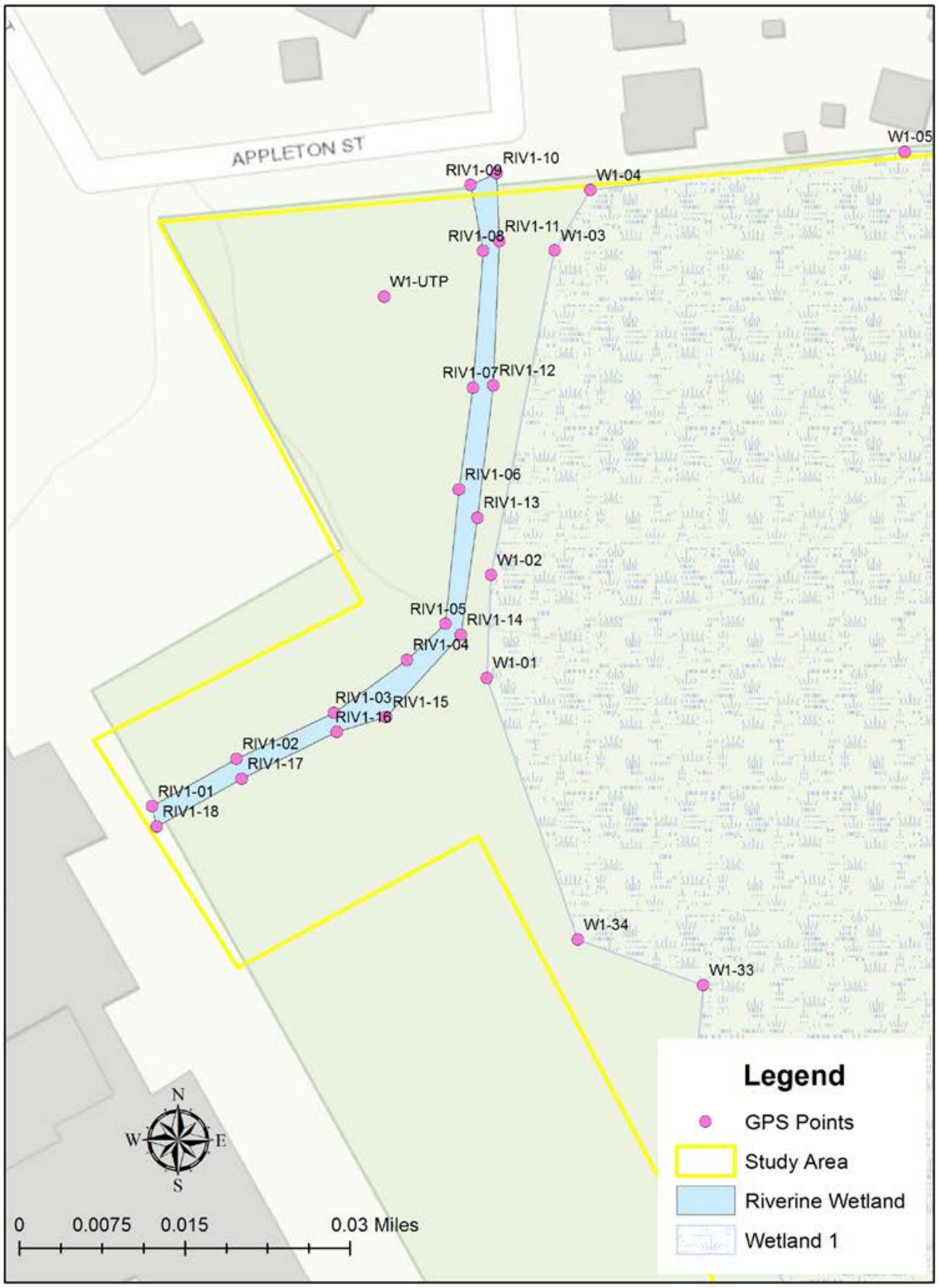
U.S. Army Corps of Engineers. 2010. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0)*, ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR–10–20. Vicksburg, Mississippi: U.S. Army Engineer Research and Development Center.

U.S. Department of Transportation, Federal Highways Administration. April 2012. Hydraulic Design Of Highway Culverts Third Edition. J. D. Schall, P.L.Thompson, S.M. Zerges, R.T. Kilgore, and J.L. Morris. FHWA-HIF-12-026 Hydraulic Design Series Number 5.

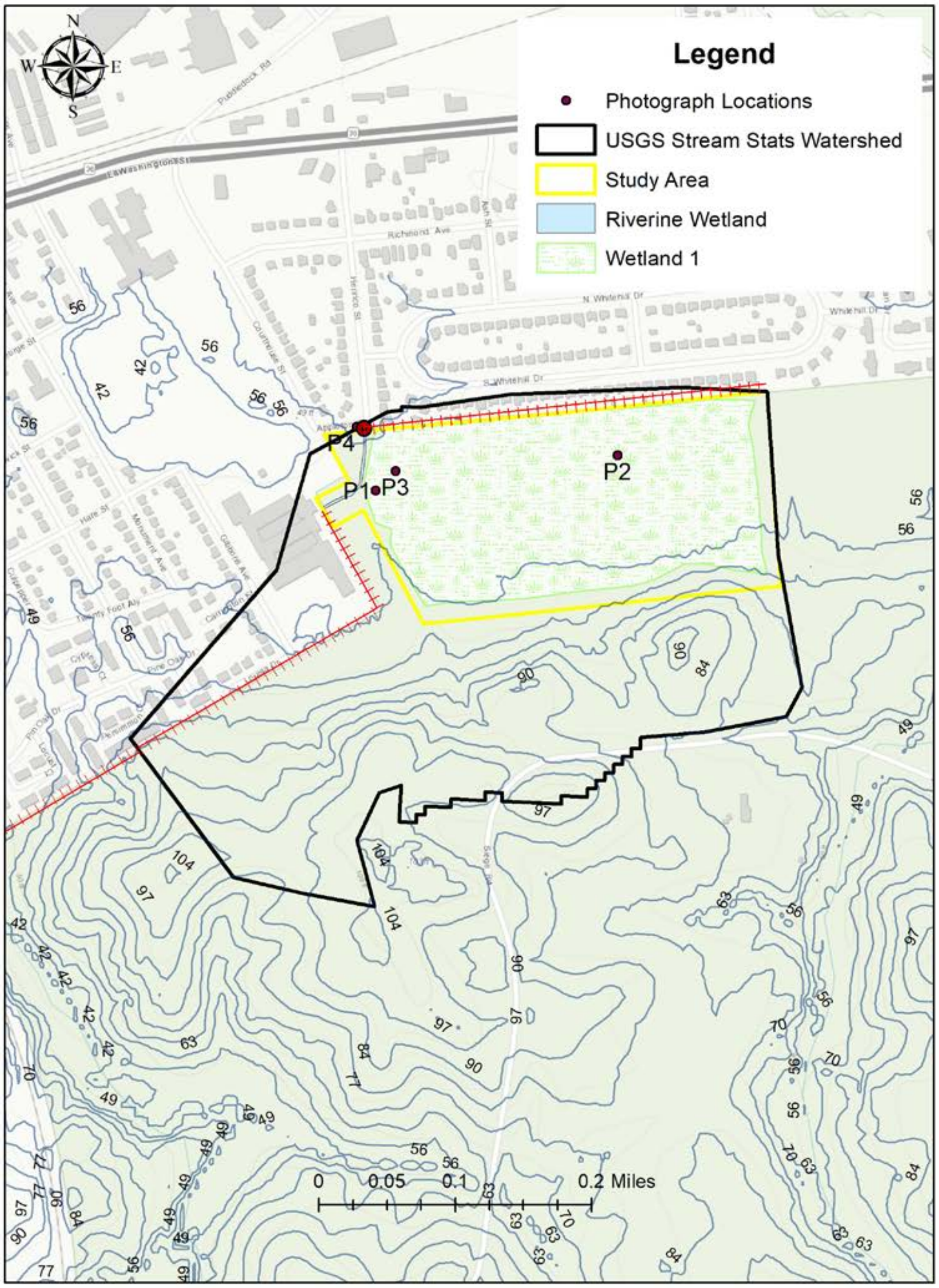
Appendix A – Detailed Project Mapping and NWI/USDA Soil Survey Maps



Wetland-1 showing boundary points and wetland test pit/vegetation data collection locations (WTP/UTP) along with a portion of the riverine system.



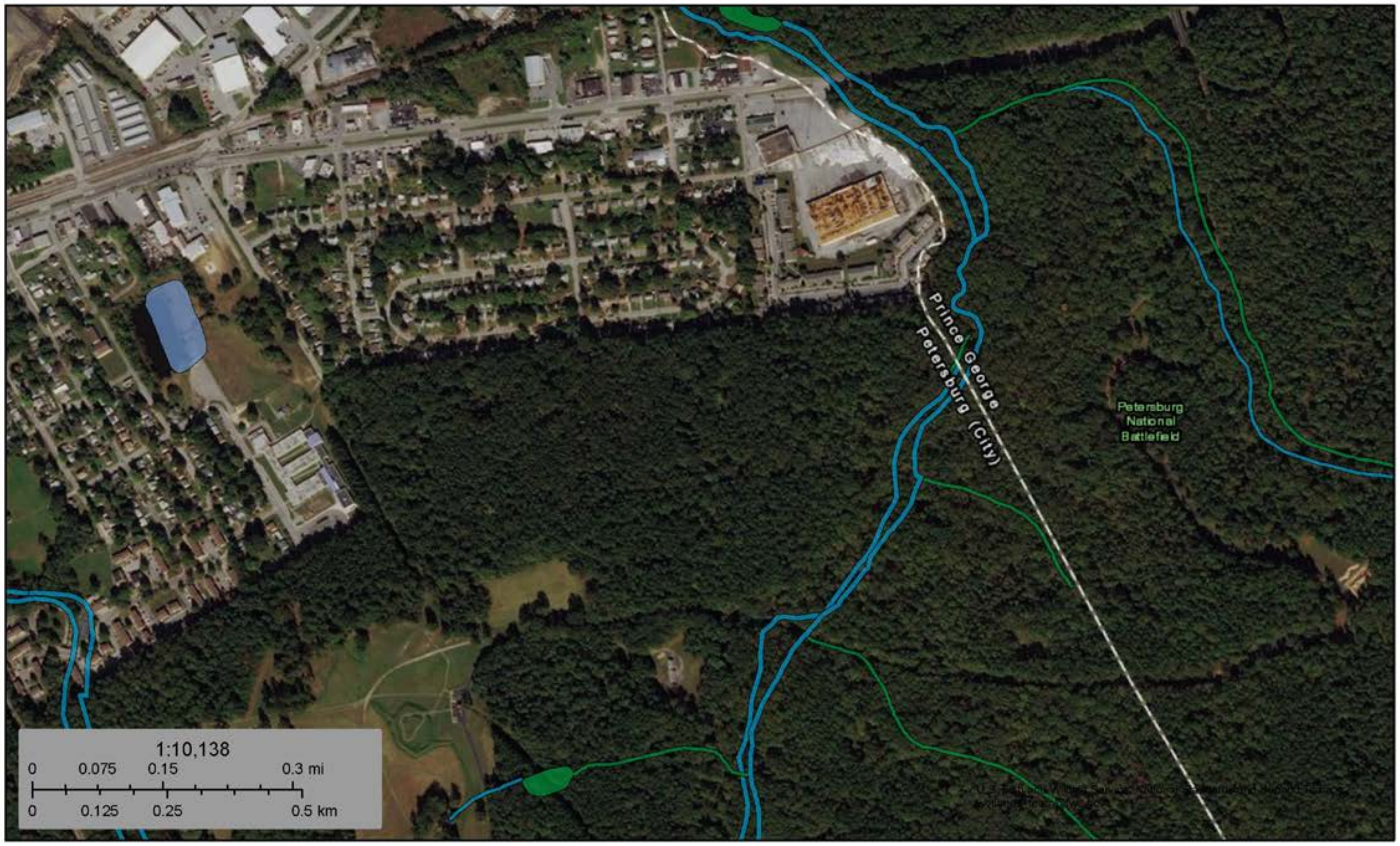
Riverine Wetland (RIV1) showing boundary points and its location relative to Wetland-1 and some of the sites topographic features.



Photograph Location Map for the project. Additional pictures covering the study area and surrounding watershed are available upon request.

U.S. Fish and Wildlife Service
National Wetlands Inventory

NWI Map - Whitehill Area of PETE



February 28, 2018

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper

Hydric Rating by Map Unit—Dinwiddie County Area, Virginia
(Hydric Rating by Map Unit; Whitehill Development PETE)

Appendix B – Wetland Delineation Data Forms and Function and Value Sheets

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: PETE Whitehill Dev. City/County: Petersburg Sampling Date: 8/9/2017

Applicant/Owner: NPS State: VA Sampling Point: W1-WTP 2

Investigator(s): Peter Sharpe, Section, Township, Range: NA

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): Flat Slope (%): 1-2%

Subregion (LRR or MLRA): LRR P Lat: 37.235921 Long: -77.366709 Datum: NAD 83

Soil Map Unit Name: 5B - Emporia Sandy Loam NWI Classification: PFO1Cd

Are climatic / hydrologic conditions on the site typical for this time of year? (x) Yes ( ) No (If no, explain in Remarks.)

Are [ ] Vegetation [ ] Soil [ ] Hydrology significantly disturbed? Are "Normal Circumstances" present? (x) Yes ( ) No

Are [ ] Vegetation [ ] Soil [ ] Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	(x) Yes ( ) No	**Is the Sampled Area within a Wetland?**	(x) Yes ( ) No
Hydric Soil Present?	(x) Yes ( ) No		
Wetland Hydrology Present?	(x) Yes ( ) No		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- [x] Surface Water (A1)
- [ ] High Water Table (A2)
- [ ] Saturation (A3)
- [x] Water Marks (B1)
- [x] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [x] Water Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] Marl Deposits (B15) (LRR U)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Surface Soil Cracks (B6)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [x] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [x] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)
- [ ] Sphagnum Moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	(x) Yes ( ) No	Depth (inches): 0.25	
Water Table Present?	( ) Yes (x) No	Depth (inches):	
Saturation Present? (includes capillary fringe)	( ) Yes (x) No	Depth (inches):	**Wetland Hydrology Present?** (x) Yes ( ) No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Butressed Tree Roots

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W1-WTP

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Liquidambar styraciflua	17.5	● Yes ○ No	FAC
2. Quercus phellos	17.5	● Yes ○ No	FACW
3. Ulmus americana	17.5	● Yes ○ No	FAC
4. Acer rubrum	3.5	○ Yes ● No	FAC
5.		○ Yes ○ No	
6.			
7.			
8.			
	56 = Total Cover		
50% of total cover: 28	20% of total cover: 11.2		

Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Nyssa sylvatica	7.5	● Yes ○ No	FAC
2. Ilex opaca	1.5	○ Yes ● No	FAC
3.		○ Yes ○ No	
4.			
5.			
6.			
7.			
8.			
	9 = Total Cover		
50% of total cover: 4.5	20% of total cover: 1.8		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. poaceae sp. (veg)	17.5	● Yes ○ No	
2.		○ Yes ○ No	
3.		○ Yes ○ No	
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	17.5 = Total Cover		
50% of total cover: 8.75	20% of total cover: 3.5		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.		○ Yes ○ No	
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80.000 % (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☒ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0*
- ☐ Problematic Hydrophytic Vegetation* (Explain)

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? ● Yes ○ No

Remarks: (If observed, list morphological adaptations below).

Herb layer sparse

SOIL

Sampling Point: W1-WTP

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7 in	2.5 Y 2.5/1	100	N/A		MS		Cl,Lo	
7-17 in	2.5 Y 6/1	80	7.5 YR 5/8	20	C	M	Sa,Cl	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Mucky Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A, B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? (•) Yes ( ) No

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: PETE Whitehill Dev. City/County: Petersburg Sampling Date: 8/9/2017

Applicant/Owner: NPS State: VA Sampling Point: W1-WTP1

Investigator(s): Peter Sharpe, Section, Township, Range: NA

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): Concave Slope (%): 0.5%

Subregion (LRR or MLRA): LRR P Lat: 37.235887 Long: -77.370026 Datum: NAD 83

Soil Map Unit Name: 5B - Emporia Sandy Loam NWI Classification: PFO1Cd

Are climatic / hydrologic conditions on the site typical for this time of year? (x) Yes ( ) No (If no, explain in Remarks.)

Are [ ] Vegetation [ ] Soil [ ] Hydrology significantly disturbed? Are "Normal Circumstances" present? (x) Yes ( ) No

Are [ ] Vegetation [ ] Soil [ ] Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	(x) Yes ( ) No	**Is the Sampled Area within a Wetland?**	(x) Yes ( ) No
Hydric Soil Present?	(x) Yes ( ) No		
Wetland Hydrology Present?	(x) Yes ( ) No		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- [ ] Surface Water (A1)
- [ ] High Water Table (A2)
- [ ] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [x] Water Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] Marl Deposits (B15) (LRR U)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Surface Soil Cracks (B6)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [x] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [x] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)
- [ ] Sphagnum Moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	( ) Yes (x) No	Depth (inches):	
Water Table Present?	( ) Yes (x) No	Depth (inches):	
Saturation Present? (includes capillary fringe)	( ) Yes (x) No	Depth (inches):	**Wetland Hydrology Present?** (x) Yes ( ) No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Buttressed tree roots

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: W1-WTP1

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Ulmus americana	17.5	No	FAC
2. Quercus phellos	17.5	No	FACW
3. Liquidambar styraciflua	37.5	Yes	FAC
4. Morus rubra	17.5	No	FACU
5.			
6.			
7.			
8.			
	90 = Total Cover		
50% of total cover: 45	20% of total cover: 18		

Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Ulmus rubra	17.5	Yes	FAC
2. Celtis occidentalis	2.5	No	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	20 = Total Cover		
50% of total cover: 10	20% of total cover: 4		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Microstegium vimineum	37.5	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	37.5 = Total Cover		
50% of total cover: 18.75	20% of total cover: 7.5		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Vitis sp.	3.5	No	
2. Smilax sp. (veg)	3.5	No	
3.			
4.			
5.			
	7 = Total Cover		
50% of total cover: 3.5	20% of total cover: 1.4		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.000 % (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- [ ] 1 - Rapid Test for Hydrophytic Vegetation
- [x] 2 - Dominance Test is >50%
- [ ] 3 - Prevalence Index is ≤3.0*
- [ ] Problematic Hydrophytic Vegetation* (Explain)

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes (selected) / No

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W1-WTP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-5	10 YR 2/2	100	N/A		N/A		Sa.Lo	
5-21	10 YR 5/4	50	10 YR 5/8	50	C	M	Sa. Lo	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Mucky Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☒ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A, B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? ◉ Yes ○ No

Remarks:

Soil does not neatly fit into F8 as only 1 inch of the layer containing redox concentrations occurs within the upper 6 inches of the soil profile. However, this area has an extensive ditch system (CCC era) which coupled with historic earth disturbances has likely affected the normal hydrologic processes on-site, as well as, the soil geochemistry.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: PETE Whitehill Dev. City/County: Petersburg Sampling Date: 8/9/2017

Applicant/Owner: NPS State: VA Sampling Point: W1-UTP

Investigator(s): Peter Sharpe, Section, Township, Range: NA

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): Concave Slope (%): 1-2%

Subregion (LRR or MLRA): LRR P Lat: 37.235738 Long: -77.371222 Datum: NAD 83

Soil Map Unit Name: 5B - Emporia sandy loam NWI Classification: NA

Are climatic / hydrologic conditions on the site typical for this time of year? (●) Yes ( ) No (If no, explain in Remarks.)

Are [ ] Vegetation [ ] Soil [ ] Hydrology significantly disturbed? Are "Normal Circumstances" present? (●) Yes ( ) No

Are [ ] Vegetation [ ] Soil [ ] Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	( ) Yes (●) No	Is the Sampled Area within a Wetland?	( ) Yes (●) No
Hydric Soil Present?	( ) Yes (●) No		
Wetland Hydrology Present?	(●) Yes ( ) No		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- [ ] Surface Water (A1)
- [ ] High Water Table (A2)
- [ ] Saturation (A3)
- [x] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Water Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] Marl Deposits (B15) (LRR U)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Surface Soil Cracks (B6)
- [x] Sparsely Vegetated Concave Surface (B8)
- [ ] Drainage Patterns (B10)
- [x] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [x] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)
- [ ] Sphagnum Moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	( ) Yes (●) No	Depth (inches): ____
Water Table Present?	( ) Yes (●) No	Depth (inches): ____
Saturation Present? (includes capillary fringe)	( ) Yes (●) No	Depth (inches): ____

Wetland Hydrology Present? (●) Yes ( ) No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W1-UTP

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Celtis occidentalis	87.5	● Yes ○ No	FACU
2. Quercus phellos	17.5	○ Yes ● No	FACW
3. Ilex opaca	3.5	○ Yes ● No	FACU
4.		○ Yes ○ No	
5.			
6.			
7.			
8.			
	108.5 = Total Cover		
50% of total cover: 54.25	20% of total cover: 21.7		

Sapling/Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Celtis occidentalis	3.5	● Yes ○ No	FACU
2.		○ Yes ○ No	
3.			
4.			
5.			
6.			
7.			
8.			
	3.5 = Total Cover		
50% of total cover: 1.75	20% of total cover: .7		

Herb Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Bare Ground	95	● Yes ○ No	
2.		○ Yes ○ No	
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	95 = Total Cover		
50% of total cover: 47.5	20% of total cover: 19		

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Vitis sp.	3.5	● Yes ○ No	
2. Smilix sp.	0.5	○ Yes ● No	
3.		○ Yes ○ No	
4.			
5.			
	4 = Total Cover		
50% of total cover: 2	20% of total cover: .8		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.000 % (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	0	x 3 = 0
FACU species	91	x 4 = 364
UPL species	0	x 5 = 0
Column Totals:	91 (A)	364 (B)

Prevalence Index = B/A = 4

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0*
- ☐ Problematic Hydrophytic Vegetation* (Explain)

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? ○ Yes ● No

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W1-UTP

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6 in	10 YR 3/1		N/A		N/A	N/A	SA,LO	
6-21 in	2.5 Y 6/8		N/A		N/A	N/A	SA,LO	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Mucky Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A, B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? ○ Yes ● No

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: PETE Whitehill Dev. City/County: Petersburg Sampling Date: 8/9/2017

Applicant/Owner: NPS State: VA Sampling Point: W3-WTP3

Investigator(s): Peter Sharpe, Section, Township, Range: NA

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): Flat Slope (%): 1-2%

Subregion (LRR or MLRA): LRR P Lat: 37.234535 Long: -77.369092 Datum: NAD 83

Soil Map Unit Name: 5B - Emporia Sandy Loam NWI Classification: PFO1Cd

Are climatic / hydrologic conditions on the site typical for this time of year? (●) Yes ( ) No (If no, explain in Remarks.)

Are [ ] Vegetation [ ] Soil [ ] Hydrology significantly disturbed? Are "Normal Circumstances" present? (●) Yes ( ) No

Are [ ] Vegetation [ ] Soil [ ] Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	(●) Yes ( ) No	Is the Sampled Area within a Wetland?	(●) Yes ( ) No
Hydric Soil Present?	(●) Yes ( ) No		
Wetland Hydrology Present?	(●) Yes ( ) No		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- [ ] Surface Water (A1)
- [ ] High Water Table (A2)
- [ ] Saturation (A3)
- [ ] Water Marks (B1)
- [x] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Water Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] Marl Deposits (B15) (LRR U)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [x] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Surface Soil Cracks (B6)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [x] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [x] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)
- [ ] Sphagnum Moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	( ) Yes (●) No	Depth (inches):	
Water Table Present?	( ) Yes (●) No	Depth (inches):	
Saturation Present? (includes capillary fringe)	( ) Yes (●) No	Depth (inches):	

Wetland Hydrology Present? (●) Yes ( ) No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

butressed tree roots

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: W3-WTP3

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Pinus taeda	17.5	No	FAC
2. Quercus phellos	37.5	Yes	FACW
3. Liquidambar styraciflua	37.5	Yes	FAC
4. Ulmus americana	3.5	No	FACW
5.		Yes / No	
6.			
7.			
8.			
	96 = Total Cover		
50% of total cover: 48	20% of total cover: 19.2		

Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Liquidambar styraciflua	17.5	Yes	FAC
2. Ulmus americana	3.5	No	FACW
3.		Yes / No	
4.			
5.			
6.			
7.			
8.			
	21 = Total Cover		
50% of total cover: 10.5	20% of total cover: 4.2		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Microstegium vimineum	37.5	Yes	FAC
2.		Yes / No	
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	37.5 = Total Cover		
50% of total cover: 18.75	20% of total cover: 7.5		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.		Yes / No	
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.000 % (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	44.5	x 2 = 89
FAC species	110	x 3 = 330
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	154.5 (A)	419 (B)

Prevalence Index = B/A = 2.712

Hydrophytic Vegetation Indicators:

- [ ] 1 - Rapid Test for Hydrophytic Vegetation
- [x] 2 - Dominance Test is >50%
- [x] 3 - Prevalence Index is ≤3.0*
- [ ] Problematic Hydrophytic Vegetation* (Explain)

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes (selected) / No

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: W3-WTP3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR 3/3	100	NA				cl, lo	
7-14	2.5Y 5/2	50	7.5YR 5/8	50	C	M	cl, lo	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Mucky Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☒ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A, B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? ◉ Yes ○ No

Remarks:

Wetland Function-Value Evaluation Form

Total area of wetland 22.64 ac Human made? No Is wetland part of a wildlife corridor? Yes or a "habitat island"? No

Adjacent land use Urband lands Distance to nearest roadway or other development 100 feet

Dominant wetland systems present PFO1Cd Contiguous undeveloped buffer zone present No

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? urban/wildland interface

How many tributaries contribute to the wetland? 1 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. Wetland 1 - PETE/Whitehill

Latitude 37.2345 Longitude -77.3690

Prepared by: NPS Date 8/9/2017

Wetland Impact:
Type NA Area NA

Evaluation based on:
Office X Field ____

Corps manual wetland delineation completed? Y X N ____

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge		X			
Floodflow Alteration	X		1,3,5,6,7,9,10,11,12,13,15,17,18	3	
Fish and Shellfish Habitat		X			
Sediment/Toxicant Retention	X		3,4,5,7,16	5	
Nutrient Removal	X		3,5,7,8,10,13,14	13	
Production Export	X		2,4,5,7,10,13	4	Reptile/amphibain use observed, White-tailed Deer, small mammels, birds
Sediment/Shoreline Stabilization		X			
Wildlife Habitat	X		4,5,7,8,9,10,11,13,15, 16,17,18,19,20,21		
Recreation	X		1,4,5,7,11,12	12	
Educational/Scientific Value	X		3,9,10,13,14	9	
Uniqueness/Heritage	X		8,10,27,19	19	see Patterson (2008) vegetation description
Visual Quality/Aesthetics	X		9	9	site has low visual quality, but easy access by public
ES Endangered Species Habitat		X			
Other					

Notes:

* Refer to backup list of numbered considerations.

Wetland Function-Value Evaluation Form

Total area of wetland 0.08 ac Human made? No Is wetland part of a wildlife corridor? Yes or a "habitat island"? No

Adjacent land use NPS - Park Land (Forest) Distance to nearest roadway or other development 100 feet

Dominant wetland systems present R4SB5 Contiguous undeveloped buffer zone present No

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? Low

How many tributaries contribute to the wetland? 1 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. Riverine 1- PETE/Whitehill

Latitude 37.235 Longitude -77.371

Prepared by: NPS Date 8/9/2017

Wetland Impact:
Type NA Area NA

Evaluation based on:
Office X Field ____

Corps manual wetland delineation completed? Y X N ____

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge		X			
Floodflow Alteration		X			
Fish and Shellfish Habitat		X			
Sediment/Toxicant Retention		X			
Nutrient Removal		X			
Production Export	X			10	2,4,5,10,11,13
Sediment/Shoreline Stabilization		X			
Wildlife Habitat	X			18	4,7,8,16,18,20
Recreation		X			
Educational/Scientific Value	X			9	3,6,8,9,10,13,12,14
Uniqueness/Heritage		X			
Visual Quality/Aesthetics		X			
ES Endangered Species Habitat		X			
Other					

Notes:

* Refer to backup list of numbered considerations.

Appendix D

PETERSBURG DRAINAGE STUDY
INFRASTRUCTURE MAP

Appendix E

TIMMONS GROUP
YOUR VISION ACHIEVED THROUGH OURS.

1001 Boulders Parkway
Suite 300
Richmond, VA 23225

P 804.200.6500
F 804.560.1016
www.timmons.com

July 5, 2018

Petersburg National Battlefield
1539 Hickory Hill Rd.
Petersburg, VA 23803

Re: Stormwater Improvements

To Whom It May Concern,

A field consultation was completed by Timmons Group with the assistance of the Petersburg National Battlefield staff on July 5, 2018 to assess the current conditions of the wetlands and streams located south of S. Whitehill Dr. in Petersburg, Virginia within the Petersburg National Battlefield property. Adjacent homeowners have voiced concern related to the ongoing flooding issues associated with the adjacent wetlands.

During the onsite consultation on July 5, 2018, Timmons Group inspected and observed the onsite topography, existing drainage patterns and ditching, land uses, and overall health of the current system. A series of man-made ditches were observed onsite and seemed to be providing a routing system throughout the property. Two of the major drainage ditches onsite where converging and creating a confined pathway to one of the properties along S. Whitehill Drive. The existing forested wetland appeared to be in good health exhibiting a mid to late successional forest with a variety of native species throughout. Given the observed site conditions we determined there to be four (4) potential solutions to the stormwater drainage issues. Each of these are discussed below:

1. **Stream Restoration**:
   One of the larger ditches flowing from the south to north along the western portion part of the property has the potential to be re-routed to the northwestern where it could discharge to the existing culvert along Courthouse Road. The current orientation of the ditch is currently heading towards S. Whitehill Drive creating major flooding issues. Re-routing the ditch to the existing culvert located to the northwest via a stream channel would alleviate a significant hydrology source from negatively affecting the homes along S. Whitehill Drive. Looking at historic imagery and mapping of the area, several tributaries previously existed within the current wetland complex. Restoring a stream channel through this area would replicate and mimic the pre-development conditions before the wetland was ditched. A small stream channel with the appropriate sinuosity and channel dimensions to access its floodplain would help alleviate flooding concerns and increase the time of concentration of flow through these areas.

   Permitting the conversion of a wetland to a stream channel has the potential to be problematic given the resource change, however may be worth discussing with the US Army Corps of Engineers (USACE) to determine their willingness given the negative stormwater impacts currently impacting the downgradient properties.

2. **Culvert & Headwall Improvements**:
   The two primary ditches onsite draining to the north converge prior to S. Whitehill Drive creating a strong concentrated flow. Rather than the stormwater discharging to the downgradient properties a culvert and headwall could be installed to route the stormwater to the existing stormwater discharge system along S. Whitehill Drive.

A small amount of wetland impacts would potentially be associated with the construction and installation of a culvert and headwall creating a need for wetland compensation. Additionally, an agreement would need to be reached with the adjacent landowner to develop a stormwater easement through their property to allow for a connection to the existing stormwater system.

3. **<u>Upland Drainage Improvements</u>**:
   A large upland area is located to the south of the existing wetland complex and contributes a substantial amount of drainage to the wetlands. The upland area is connected to the wetland system via topography and several culverts draining under the current park trail which runs west to east bisecting the uplands and wetlands. The current ditch located along the upland side of the trail could be entirely routed around the wetlands and discharged to the existing drainage located along the western portion of the property. This would eliminate a large volume of overland flow to the existing drainage ways while helping to alleviate flooding within the wetland areas.

   Seeing as the existing wetland system appeared to be groundwater and surface driven, the re-routing of the upland flow would most likely have little to no impact on the overall health and hydrology of the current wetland system. Further modeling techniques could be explored to determine the exact effects of this method.

4. **<u>Berm Installation</u>**:
   A natural earthen berm could potentially be used along the northern boundary in an effort to reduce the stormwater impacts during high flow events from impacting the adjacent properties. The overall footprint of the earthen berm may be quite extensive given the height required while achieving 3:1 side slopes at a length of approximately 1,000 linear feet. Installation and construction of the earthen berm would require forested wetland impacts and in term require compensatory mitigation credits to be purchased. The berm could potentially pushed further to the north to alleviate wetland impacts, however the berm would need to be placed on residential property presenting additional issues.

Sincerely,

Ben Snyder, EIT, WPIT
Project Engineer
Timmons Group

Appendix F

Stormwater Management Strategies

Bioretention Bump-outs and Rain Gardens

The primary goals of this study were to reduce the City's discharge of Nitrogen, Phosphorus, and Sediment loads while improving the neighborhood drainage conditions. Due to the study area's residential makeup, minimal topographic variance, and dispersed existing stormwater infrastructure, these issues cannot be easily addressed through large-scale stormwater Best Management Practices (BMPs). A solution to these existing conditions may be to install small-scale BMPs such as Bioretention areas and Bioretention Bump-outs in targeted locations throughout the study area.

Bioretention Bump-outs are installed within an existing roadway and typically take up about the same area as parallel parking spaces. In addition to the benefits provided by standard Bioretention, including capture and treatment of stormwater, these structures also help control the flow of traffic. Treatment mechanisms for bioretention areas include filtrations, soil adsorption, and biological uptake. The facilities can serve to decrease flood frequency, increase the aesthetic quality of the surrounding area, and can increase local property value when properly maintained.

Table 1. Pollutant Types Removed and Removal Rates

Pollutants	Removal Rate
Total Phosphorus	40%
Total Nitrogen	25%
Total Suspended Sediment	55%

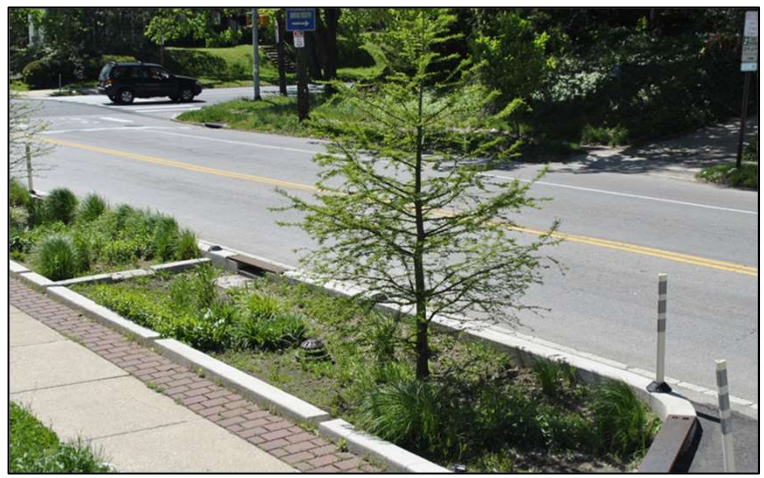


Figure 1. Example Bioretention Bump-out features

Bioretention Bump-outs and Rain Gardens, continued

Bioretention Rain Gardens are also vegetative spaces that capture and treat localized stormwater runoff through a combination of treatment processes such as filtration, soil adsorption, and biological uptake. In addition to removing pollutants **(Table 1**), these areas decrease flood frequency, increase the aesthetic quality of the surrounding area, and can increase local property values when properly maintained. Rain Gardens may or may not include an underdrain and outlet control structure, as they are design to provide a shallow, depressed vegetated area to promote infiltration and biological uptake. Illustrated this page are photos of a rain garden recently installed in a residential neighborhood in the City of Richmond.

Figure 2. Handy Lane Rain Garden, Richmond, VA

Hydrodynamic Separators

A persistent issue that prevents storm-sewer systems from working effectively over time is the build up of sediment in the interconnected system of stormwater pipes and structures. Once sediment accumulates in a storm-sewer, it blocks the flow of stormwater, causing inlets to back-up and overflow. This can cause flooding, standing water, infrastructure damage, and generally deteriorates the aesthetic appeal of the area.

Hydrodynamic Separators can help prevent sediment accumulation by separating and capturing suspended sediments flowing through the drainage system at specified locations **(Figure 3)**. The accumulation of sediment in the Hydrodynamic Separators allows easy access for sediment removal which minimizes the time and resources maintenance crews will require to remove any sediment accumulation in the storm-sewer system. Instead of having to cleanout the entire system, crews can focus solely on cleaning out the hydrodynamic separators.

In addition to sediment removal, Hydrodynamic Separators can remove other urban runoff pollutants with comparable efficiencies to more expansive stormwater BMPs. A summary of the types of pollutants these structures remove and their respective removal rates can be found in **Table 2**.

Table 2. Types of Pollutants Removed and Removal Rates

Pollutants	Removal Rate
Total Phosphorus	20%
Total Suspended Sediment	80%
Oils and Grease	99%

Unlike most stormwater Best Management Practices (BMPs), these structures can be installed along an existing pipe network without having to tie into an existing inlet or construct a new inlet. Instead, a portion of the existing pipe is removed to make room for the Separator, the Separator is installed, and the existing pipes are reconnected to the structure. This aspect of Hydrodynamic Separators significantly decreases their installation costs. A planning level cost of approximately $50,000 per unit to purchase and install can be used to determine cost effectiveness.

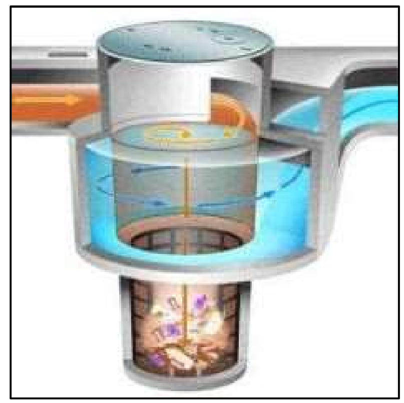


Figure 3. Example Hydrodynamic Separators

Wet Ponds and Constructed Wetlands

Wet Ponds **(Figure 4)** are permanent pools of water that create an environment suited for treating pollutant-laden stormwater runoff through gravitational settling, biological uptake, and microbial activity **(Table 4)**. When designed correctly, they can provide extended detention (ED) above the normal pool, which can help meet channel protection requirements. They can also increase the aesthetic qualities of a space and act as an educational opportunity for any residents or students interested in learning about ecosystem interactions. Additionally, wet ponds require minimal maintenance demands apart from vegetation control and aerator maintenance until sediment removal is required.

Constructed Wetlands **(Figure 5)** have similar pollutant removal efficiencies of wet ponds, but instead of larger deep pool, constructed wetlands tend to accomplish treatment through a series of cell with varying shallow depths. The deep pools of constructed wetlands are much smaller and not as deep as the deep pool of the wet pond. Constructed wetlands tend to provide more ecological habitat and accomplish more of the treatment through vegetative bio-uptake, as opposed to relying primarily on sedimentation for treatment. They can also increase the aesthetic qualities of a space and act as an educational opportunity for any residents or students interested in learning about ecosystem interactions.

Table 4. Types of Pollutants Removed and Removal Rates

Pollutants	Removal Rate
Total Phosphorus	75%
Total Nitrogen	40%
Total Suspended Sediment	60%

Figure 4. Trojan Stormwater Management Pond, VSU

Figure 5. Mulberry Run Constructed Wetland, Waynesboro VA

Underground Detention

An issue plaguing the residential neighborhoods analyzed in this study are overflowing storm-sewer systems that flood intersections and inundate properties. When it rains, the existing storm-sewer system does not have the capacity to route stormwater through the system fast enough which causes it to back-up and overflow.

To prevent storm-sewer overflows, there are three primary stormwater management solutions:

1. Reduce the amount of incoming runoff through upstream treatment practices;
2. Upgrade the storm-sewer system to larger diameter pipes; and/or
3. Install underground stormwater detention.

Based on the site constraints, installing upstream runoff reducing treatment practices or upgrading the storm-sewer may be cost prohibit and would require a significant degree of redevelopment. Therefore, underground stormwater detention systems **(Figure 5)** are an ideal overflow solution due to their simplicity and effectiveness for capturing and storing stormwater before slowly discharging back into the system. Underground detention chambers can be placed underneath the earth or roadways, can be tied into the existing stormwater infrastructure, and can be designed to infiltrate stormwater.

Figure 5. Example Underground Detention Chambers

Grass Swales

Two common approaches for routing stormwater are to direct runoff into either pipes or open-channels. Pipe systems strictly function to convey stormwater; however, grass swales can both convey stormwater and provide water quality treatment and runoff reduction. Grass swales **(Figure 6)** example photographs and treatment capabilities **(Table 5)** are summarized below.

Figure 6. Example Grass Swales

Table 5. Types of Pollutants Removed and Removal Rates

Pollutants	Removal Rate
Total Phosphorus	15%
Total Nitrogen	20%
Total Suspended Sediment	50%

*All “example” photographs used in this summary were taken by others and obtained via the internet.

Appendix G

Draft Recommended Stormwater Management Projects to Address Local Flooding and Water Quality

A **Culpepper Avenue Storm Sewer Extension** – Retrofit hydrodynamic structure along Slagle Avenue between Prince George and Brunswick to provide water quality treatment and enhance maintenance access. Intercept drainage from Slagle Avenue in new storm sewer segment from Slagle Avenue along Brunswick to the Culpeper Avenue storm sewer system to alleviate localized flooding at Slagle Avenue and Hare Street intersection.

B **Hare Street Storm Sewer Improvements** – Retrofit hydrodynamic structure at intersection of Hare Street and Culpeper Avenue to provide water quality treatment and enhance maintenance access. Consider installation of underground detention along Culpeper to alleviate the surcharge at the intersection of Slagle Avenue and Hare Street.

C **Lakemont Water Quality Retrofit and Stream Restoration** - Improve the stormwater treatment capacity of the existing pond by redirecting drainage from south of the Elementary School through a natural channel and/or storm sewer realignment to a designed Level 2 Wet Pond or Constructed Wetland. Install emergency spillway riser and pipe structure to discharge to Culpeper Storm Sewer Extension project.

D **Bioretention Bump-outs** – Create on-street bioretention areas using curb bump outs to collect and treat stormwater while achieving neighborhood beautification and traffic calming. Sites along Courthouse Road and Richmond Avenue have been identified as the best candidates for demonstration scale installation.

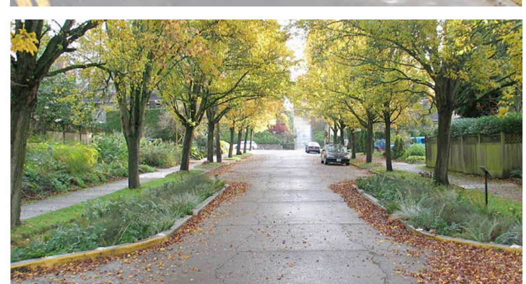
E **Nash Street Bioretention Garden** – Move the ponding underground within the right-of-way along Nash Street, near the intersection with N Whitehill Drive by designing a bioretention cell to collect and treat stormwater runoff.

F **N Whitehill Drive Drainage Improvements** – Alleviate localized flooding along N. Whitehill by establishing a new alignment and hydraulically appropriately sized storm sewer, connecting to S. Whitehill via Nash Street. A grassed swale along the eastern lane of Nash Street and underground detention are proposed to address water quality and quantity requirements.

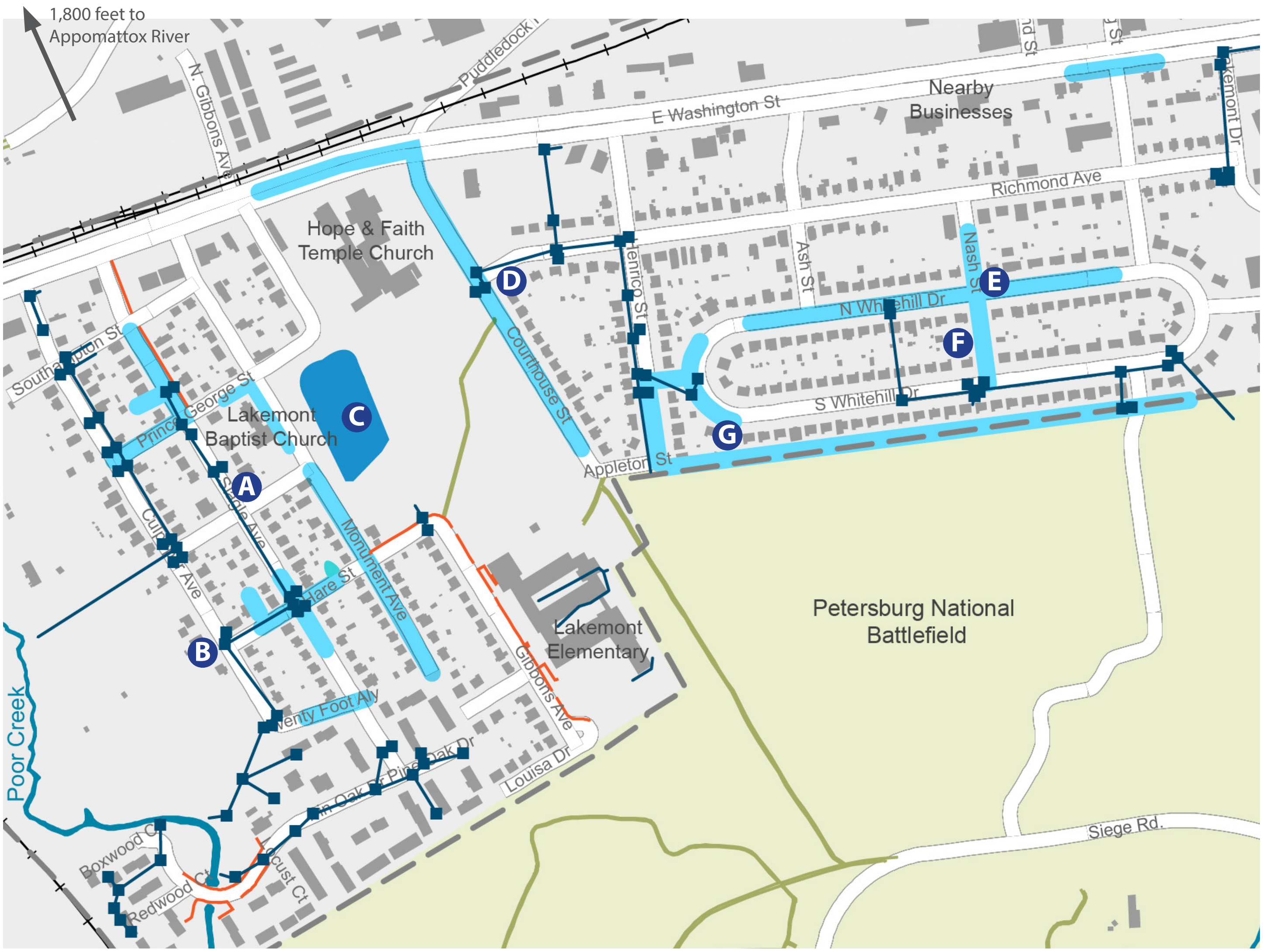
G **Battlefield Flood Remediation and Drainage Improvements** - Install new storm sewer system to collect uncontrolled drainage from the National Battlefield and route to existing system along Henrico Street. This system would use a headwall and open pipe to collect runoff from the Battlefield that is presently channelized in a ditch system that takes a 90-degree bend at the rear of residences along S Whitehill and loses definition before ultimate discharge to an undersized storm sewer system along Henrico Street.

Examples of storm sewer infrastructure installation (top) and an underground detention (above).

Example of pond improvements.



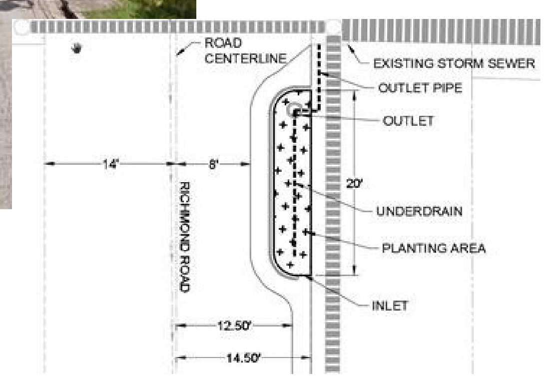
Examples of rain garden bump-outs.



Resident Reported Flooding
Existing Sidewalks
Storm Pipe
Storm Structure
A Recommended Stormwater Projects

Examples of bioretention bump-outs.

Existing Richmond Road



Recommended Approach for Richmond Road

Appendix H

CITY OF PETERSBURG NEIGHBORHOOD DRAINAGE IMPROVEMENTS - BATTLEFIELD DRAINAGE IMPROVEMENTS

PROJECT NO.: 41408

Item No.	ITEM DESCRIPTION	QUANT.	UNIT	Unit Price	Total
1	Mobilization / Demobilization	1	L.S.	$ 10,000.00	$ 10,000.00
2	Demo Asphalt Paving and Dispose Offsite	35	S.Y.	$ 10.00	$ 350.00
3	Site Preparation (Clearing and Select Tree Removal)	1	L.S.	$ 10,000.00	$ 10,000.00
4	Erosion and Sediment Control	1	L.S.	$ 5,000.00	$ 5,000.00
5	Earthwork (Regular Excavation)	1,250	C.Y.	$ 20.00	$ 25,000.00
6	Earthwork (Undercut Excavation)	1,000	C.Y.	$ 45.00	$ 45,000.00
7	Manhole 48" Precast	20	V.F.	$ 275.00	$ 5,500.00
8	24" DIA. RCP	565	L.F.	$ 60.00	$ 33,900.00
9	EW-1	1	EA.	$ 1,700.00	$ 1,700.00
10	Underground Detention	80	L.F.	$ 250.00	$ 20,000.00
11	Stone (#21B)	1,150	TON	$ 26.00	$ 29,900.00
12	SM-9.5A Asphalt (2" Depth)	3	TON	$ 170.00	$ 425.00
13	BM-25 Asphalt (10"Depth)	13	TON	$ 140.00	$ 1,750.00
14	Site Stabilization (Seeding and Landscaping)	6500.00	S.F.	$ 5.00	$ 32,500.00
15	Construction Allowance (Utility Confict Resolution, Maintenance of Traffic, As-built Surveying)	1	L.S.	$ 20,000.00	$ 20,000.00
	PRELMINARY ENGINEERS' OPINION OF PROBABLE CONSTRUCTION COST:				$ 241,025
	CONTINGENCY			20%	$ 48,205
	TOTAL CONSTRUCTION COSTS (WITH CONTINGENCY):				$ 289,230
	ENGINEERING DESIGN COSTS				$ 43,385
	ENVIRONMENTAL PERMITTING COSTS				$ 8,677
	CONSTRUCTION ENGINEERING INSPECTION AND MATERIALS TESTING SERVICES				$ 8,677
	TOTAL PROJECT COSTS				$ 349,968

CITY OF PETERSBURG NEIGHBORHOOD DRAINAGE IMPROVEMENTS - CULPEPER STORM EXTENSION

PROJECT NO.: 41408

Item No.	ITEM DESCRIPTION	QUANT.	UNIT	Unit Price	Total
1	Mobilization / Demobilization	1	L.S.	$ 10,000.00	$ 10,000.00
2	Demo Asphalt Paving and Dispose Offsite	275	S.Y.	$ 10.00	$ 2,750.00
3	Site Preparation (Clearing and Select Tree Removal)	1	L.S.	$ 1,000.00	$ 1,000.00
4	Erosion and Sediment Control	1	L.S.	$ 2,500.00	$ 2,500.00
5	Earthwork (Regular Excavation)	500	C.Y.	$ 20.00	$ 10,000.00
6	Earthwork (Undercut Excavation)	500	C.Y.	$ 45.00	$ 22,500.00
7	Hydrodynamic Structure	1	EA.	$ 50,000.00	$ 50,000.00
8	42" DIA. RCP	230	L.F.	$ 150.00	$ 34,500.00
9	Stone (#21B)	450	TON	$ 26.00	$ 11,700.00
10	SM-9.5A Asphalt (2" Depth)	15	TON	$ 170.00	$ 2,550.00
11	BM-25 Asphalt (10"Depth)	75	TON	$ 140.00	$ 10,500.00
12	Construction Allowance (Utility Confict Resolution, Maintenance of Traffic, As-built Surveying)	1	L.S.	$ 30,000.00	$ 30,000.00
	PRELMINARY ENGINEERS' OPINION OF PROBABLE CONSTRUCTION COST:				$ 188,000
			CONTINGENCY	20%	$ 37,600
	TOTAL CONSTRUCTION COSTS (WITH CONTINGENCY):				$ 225,600
	ENGINEERING DESIGN COSTS				$ 33,840
	ENVIRONMENTAL PERMITTING COSTS				-
	CONSTRUCTION ENGINEERING INSPECTION AND MATERIALS TESTING SERVICES				$ 18,048
	TOTAL PROJECT COSTS				$ 277,488

CITY OF PETERSBURG NEIGHBORHOOD DRAINAGE IMPROVEMENTS - N. WHITEHILL DRAINAGE IMPROVEMENT

PROJECT NO.: 41408

Item No.	ITEM DESCRIPTION	QUANT.	UNIT	Unit Price	Total
1	Mobilization / Demobilization	1	L.S.	$ 10,000.00	$ 10,000.00
2	Demo Asphalt Paving and Dispose Offsite	45	S.Y.	$ 10.00	$ 450.00
3	Site Preparation (Clearing and Select Tree Removal)	1	L.S.	$ 2,500.00	$ 2,500.00
4	Erosion and Sediment Control	1	L.S.	$ 5,000.00	$ 5,000.00
5	Earthwork (Regular Excavation)	1,115	C.Y.	$ 20.00	$ 22,300.00
6	Earthwork (Undercut Excavation)	1,115	C.Y.	$ 45.00	$ 50,175.00
7	15" DIA. RCP	290	L.F.	$ 50.00	$ 14,500.00
8	Stone (#21B)	150	TON	$ 26.00	$ 3,900.00
9	SM-9.5A Asphalt (2" Depth)	5	TON	$ 170.00	$ 850.00
10	BM-25 Asphalt (10"Depth)	25	TON	$ 140.00	$ 3,500.00
11	Underground Detention Chamber	100	L.F.	$ 250.00	$ 25,000.00
12	Site Stabilization (Seeding and Landscaping)	2500	S.F.	$ 20.00	$ 50,000.00
13	Grass Channel	275	L.F.	$ 10.00	$ 2,750.00
14	Construction Allowance (Utility Confict Resolution, Maintenance of Traffic, As-built Surveying)	1	L.S.	$ 10,000.00	$ 10,000.00
	PRELMINARY ENGINEERS' OPINION OF PROBABLE CONSTRUCTION COST:				$ 200,925
			CONTINGENCY	20%	$ 40,185
	TOTAL CONSTRUCTION COSTS (WITH CONTINGENCY):				$ 241,110
	ENGINEERING DESIGN COSTS				$ 36,167
	ENVIRONMENTAL PERMITTING COSTS				-
	CONSTRUCTION ENGINEERING INSPECTION AND MATERIALS TESTING SERVICES				$ 14,467
	TOTAL PROJECT COSTS				$ 291,743

CITY OF PETERSBURG NEIGHBORHOOD DRAINAGE IMPROVEMENTS - HARE STREET STORM SEWER IMPROVEMENTS

PROJECT NO.: 41408

Item No.	ITEM DESCRIPTION	QUANT.	UNIT	Unit Price	Total
1	Mobilization / Demobilization	1	L.S.	$ 10,000.00	$ 10,000.00
2	Demo Asphalt Paving and Dispose Offsite	200	S.Y.	$ 10.00	$ 2,000.00
3	Site Preparation (Clearing and Select Tree Removal)	1	L.S.	$ 25,000.00	$ 25,000.00
4	Erosion and Sediment Control	1	L.S.	$ 7,500.00	$ 7,500.00
5	Earthwork (Regular Excavation)	4,500	C.Y.	$ 20.00	$ 90,000.00
6	Earthwork (Undercut Excavation)	3,600	C.Y.	$ 45.00	$ 162,000.00
7	24" DIA RCP	285	L.F.	$ 65.00	$ 18,525.00
8	36" DIA RCP	320	L.F.	$ 95.00	$ 30,400.00
9	42" DIA. RCP	366	L.F.	$ 150.00	$ 54,900.00
10	MH-1	75	V.F.	$ 90.00	$ 6,750.00
11	EW-2 Headwall with wingwalls	1	EA.	$ 10,000.00	$ 10,000.00
12	Energy Dissipating Spillway	300	TON	$ 250.00	$ 75,000.00
13	Hydrodynamic Structure	1	EA.	$ 50,000.00	$ 50,000.00
14	Stone (#21B)	2,000	TON	$ 26.00	$ 52,000.00
15	Construction Allowance (Utility Confict Resolution, Maintenance of Traffic, As-built Surveying)	1	L.S.	$ 70,000.00	$ 70,000.00
	PRELMINARY ENGINEERS' OPINION OF PROBABLE CONSTRUCTION COST:				$ 664,075
	CONTINGENCY			20%	$ 132,815
	TOTAL CONSTRUCTION COSTS (WITH CONTINGENCY):				$ 796,890
	ENGINEERING DESIGN COSTS				$ 119,534
	PERMITTING COSTS				$ 23,907
	CONSTRUCTION ENGINEERING INSPECTION AND MATERIALS TESTING SERVICES				$ 39,845
	TOTAL PROJECT COSTS				$ 980,175

CITY OF PETERSBURG NEIGHBORHOOD DRAINAGE IMPROVEMENTS - LAKEMONT BORROW PIT, OPTION 1

PROJECT NO.: 41408

Item No.	ITEM DESCRIPTION	QUANT.	UNIT	Unit Price	Total
1	Mobilization / Demobilization	1	L.S.	$ 100,000.00	$ 100,000.00
2	Site Preparation (Clearing and Select Tree Removal)	1	L.S.	$ 5,000.00	$ 5,000.00
3	Erosion and Sediment Control	1	L.S.	$ 12,000.00	$ 12,000.00
4	Earthwork (Regular Excavation)	15,000	C.Y.	$ 15.00	$ 225,000.00
5	Earthwork (Undercut Excavation)	10,000	C.Y.	$ 45.00	$ 450,000.00
6	42" RCP	450	L.F.	$ 150.00	$ 67,500.00
7	6" PVC Pipe (low level drain)	50	L.F.	$ 20.00	$ 1,000.00
8	EW-12	1	EA.	$ 500.00	$ 500.00
9	SWM-1 Outlet and Riser Structure	1	EA.	$ 15,000.00	$ 15,000.00
10	Stone (#21B)	850	TON	$ 26.00	$ 22,100.00
11	SM-9.5A Asphalt (2" Depth)	20	TON	$ 170.00	$ 3,400.00
12	BM-25 Asphalt (10"Depth)	75	TON	$ 140.00	$ 10,500.00
13	Concrete Class A3	150	C.Y.	$ 400.00	$ 60,000.00
14	Site Stabilization (Seeding and Landscaping)	5.0	AC.	$ 40,000.00	$ 200,000.00
15	Solar Powered Aeration Bubblers	1	EA.	$ 8,000.00	$ 8,000.00
16	Natural Stream Design for Open Channel	625	LF.	$ 500.00	$ 312,500.00
17	Construction Allowance (Utility Confict Resolution, Maintenance of Traffic, As-built Surveying)	1	L.S.	$ 25,000.00	$ 25,000.00
	PRELMINARY ENGINEERS' OPINION OF PROBABLE CONSTRUCTION COST:				$ 1,517,500
			CONTINGENCY	20%	$ 303,500
	TOTAL CONSTRUCTION COSTS (WITH CONTINGENCY):				$ 1,821,000

CITY OF PETERSBURG NEIGHBORHOOD DRAINAGE IMPROVEMENTS - LAKEMONT BORROW PIT, OPTION 2

PROJECT NO.: 41408

Item No.	ITEM DESCRIPTION	QUANT.	UNIT	Unit Price	Total
1	Mobilization / Demobilization	1	L.S.	$ 100,000.00	$ 100,000.00
2	Site Preparation (Clearing and Select Tree Removal)	1	L.S.	$ 5,000.00	$ 5,000.00
3	Erosion and Sediment Control	1	L.S.	$ 12,000.00	$ 12,000.00
4	Earthwork (Regular Excavation)	17,500	C.Y.	$ 15.00	$ 262,500.00
5	Earthwork (Undercut Excavation)	12,500	C.Y.	$ 45.00	$ 562,500.00
6	42" RCP	400	L.F.	$ 150.00	$ 60,000.00
7	36" RCP	810	L.F.	$ 125.00	$ 101,250.00
8	6" PVC Pipe (low level drain)	50	L.F.	$ 20.00	$ 1,000.00
9	EW-12	1	EA.	$ 500.00	$ 500.00
10	SWM-1 Outlet and Riser Structure	1	EA.	$ 15,000.00	$ 15,000.00
11	Stone (#21B)	1,750	TON	$ 26.00	$ 45,500.00
12	SM-9.5A Asphalt (2" Depth)	40	TON	$ 170.00	$ 6,800.00
13	BM-25 Asphalt (10"Depth)	180	TON	$ 140.00	$ 25,200.00
14	Site Stabilization (Seeding and Landscaping)	3.0	AC.	$ 40,000.00	$ 120,000.00
15	Solar Powered Aeration Bubblers	1	EA.	$ 8,000.00	$ 8,000.00
16	Natural Stream Design for Open Channel	625	LF.	$ 500.00	$ 312,500.00
17	Construction Allowance (Utility Confict Resolution, Maintenance of Traffic, As-built Surveying)	1	L.S.	$ 35,000.00	$ 35,000.00
	PRELMINARY ENGINEERS' OPINION OF PROBABLE CONSTRUCTION COST:				$ 1,672,750
			CONTINGENCY	20%	$ 334,550
	TOTAL CONSTRUCTION COSTS (WITH CONTINGENCY):				$ 2,007,300
	ENGINEERING DESIGN COSTS				$ 301,095
	PERMITTING COSTS				$ 60,219
	CONSTRUCTION ENGINEERING INSPECTION AND MATERIALS TESTING SERVICES				$ 60,219

CITY OF PETERSBURG NEIGHBORHOOD DRAINAGE IMPROVEMENTS - LAKEMONT BORROW PIT, OPTION 2

PROJECT NO.: 41408

Item No.	ITEM DESCRIPTION	QUANT.	UNIT	Unit Price	Total
	TOTAL PROJECT COSTS				$ 2,428,833

CITY OF PETERSBURG NEIGHBORHOOD DRAINAGE IMPROVEMENTS - NASH ST. BIORETENTION

PROJECT NO.: 41408

Item No.	ITEM DESCRIPTION	QUANT.	UNIT	Unit Price	Total
1	Mobilization / Demobilization	1	L.S.	$ 2,000.00	$ 2,000.00
2	Site Preparation (Clearing and Select Tree Removal)	1	L.S.	$ 2,500.00	$ 2,500.00
3	Erosion and Sediment Control	1	L.S.	$ 500.00	$ 500.00
4	Earthwork (Regular Excavation)	50	C.Y.	$ 20.00	$ 1,000.00
5	Earthwork (Undercut Excavation)	50	C.Y.	$ 45.00	$ 2,250.00
6	Bioretention Media	50	C.Y.	$ 90.00	$ 4,500.00
7	CD-1 Underdrain	30	L.F.	$ 15.00	$ 450.00
8	6" PVC Pipe (outlet pipe)	30	L.F.	$ 20.00	$ 600.00
9	Plants	1	L.S.	$ 600.00	$ 600.00
10	Construction Allowance (Utility Confict Resolution, Maintenance of Traffic, As-built Surveying)	1	L.S.	$ 1,000.00	$ 1,000.00
	PRELMINARY ENGINEERS' OPINION OF PROBABLE CONSTRUCTION COST:				$ 15,400
	CONTINGENCY			20%	$ 3,080
	TOTAL CONSTRUCTION COSTS (WITH CONTINGENCY):				$ 18,480
	ENGINEERING DESIGN COSTS				$ 8,000
	PERMITTING COSTS				-
	CONSTRUCTION ENGINEERING INSPECTION AND MATERIALS TESTING SERVICES				-
	TOTAL PROJECT COSTS				$ 26,480

CITY OF PETERSBURG NEIGHBORHOOD DRAINAGE IMPROVEMENTS - BIORETENTION BUMPOUTS

PROJECT NO.: 41408

Item No.	ITEM DESCRIPTION	QUANT.	UNIT	Unit Price	Total
1	Mobilization / Demobilization	1	L.S.	$ 10,000.00	$ 10,000.00
2	Site Preparation (Demolition and Disposal)	1	L.S.	$ 2,500.00	$ 2,500.00
3	Erosion and Sediment Control	1	L.S.	$ 750.00	$ 750.00
4	Earthwork (Regular Excavation)	50	C.Y.	$ 20.00	$ 1,000.00
5	Earthwork (Undercut Excavation)	50	C.Y.	$ 45.00	$ 2,250.00
6	Bioretention Media	50	C.Y.	$ 90.00	$ 4,500.00
7	CD-1 Underdrain	20	L.F.	$ 15.00	$ 300.00
8	6" PVC Pipe (cleanout and outlet pipe)	30	L.F.	$ 20.00	$ 600.00
9	Std. Curb & Gutter	50	L.F.	$ 35.00	$ 1,750.00
10	Concrete Class A3	15	C.Y.	$ 400.00	$ 6,000.00
11	Landscaping	250	S.F.	$ 15.00	$ 3,750.00
12	Construction Allowance (Utility Confict Resolution, Maintenance of Traffic, As-built Surveying)	1	L.S.	$ 15,000.00	$ 15,000.00
	PRELMINARY ENGINEERS' OPINION OF PROBABLE CONSTRUCTION COST:				$ 48,400
	CONTINGENCY			20%	$ 9,680
	TOTAL CONSTRUCTION COSTS (WITH CONTINGENCY):				$ 58,080
	ENGINEERING DESIGN COSTS				$ 20,000
	PERMITTING COSTS				-
	CONSTRUCTION ENGINEERING INSPECTION AND MATERIALS TESTING SERVICES				$ 2,500
	TOTAL PROJECT COSTS				$ 80,580

Appendix I

Lakemont Drainage Study

Summary of Neighborhood and Community Partner Meetings

As part of National Fish and Wildlife Foundation Grant: Petersburg Neighborhood Drainage Study, Skeo facilitated three community partner meetings and presented information at three local neighborhood meetings to solicit information on proposed stormwater management projects. An overview is provided below, and meeting summaries attached for additional detail.

Community Partner Meeting #1 – June 12, 2018
Skeo facilitated a meeting with representatives from the project team, City of Petersburg, and Petersburg National Battlefield to discuss project goals and scope, conceptual stormwater management project ideas and opportunities to address local flooding on properties adjacent the Battlefield and coordination moving forward.

Community Partner Meeting #2 – October 4, 2018
Skeo facilitated a conference call with representatives from the project team, City of Petersburg, Virginia Department of Health, Petersburg Planning and Development Department, and Petersburg Public Schools. The project team provided a project update and call participants identified the following opportunities for future collaboration: Complete Streets initiative, Community Development Block Grants, and the Cameron Foundation. The Public Schools representative also confirmed the use of school property for the Lakemont Water Quality Retrofit project.

Community Partner Meeting #3 – December 19, 2018
Skeo facilitated a conference call with representatives from the project team, City of Petersburg, and VDOT. The project team shared an overview of work-to-date and the stormwater project recommendations identified as part of the Drainage Study. VDOT representatives shared related initiatives and opportunities for the City to explore further that may be able to support implementation.

Neighborhood Meeting #1 – June 12, 2018
Skeo facilitated a meeting with concerned residents of South Whitehill Drive who often experience a significant amount of stormwater inundation during rainfall events. The residents shared their observations of flooding in the area and their belief that the cause of flooding and stormwater inundation of their yards and homes is runoff from the adjacent Petersburg National Battlefield.

Neighborhood Meeting #2 – June 12, 2018
Skeo joined the project team at the Lakemont Neighborhood Watch Meeting to provide a project update and share conceptual project ideas for public feedback. Meeting participants provided input on the types of projects that were most appealing.

Neighborhood Meeting #3 – September 11, 2018
Skeo joined the project team at the Lakemont Neighborhood Watch Meeting to share the seven proposed stormwater projects for feedback. Skeo facilitated a discussion with meeting participant about the projects and participants ranked the projects in terms of priority.

Detailed Meeting Summaries

Community Partner Meeting #1 – June 12, 2018

Skeo, James River Association, City of Petersburg Department of Public Works and Timmons Group convened to discuss the preliminary findings from the drainage study and options to address the flooding issue on S Whitehill Ave.

Participants:

- Mr. Williams, President, Lakemont Neighborhood Watch Association
- Lewis Rogers, Superintendent, Petersburg National Battlefield Park
- Darryl Walker, City of Petersburg Department of Public Works
- Aislinn Creel and Jesse Jones, Timmons Group
- Amber Ellis, James River Association
- Alisa Hefner and Beth Schermerhorn, Skeo

The following options were discussed to address the flooding on S Whitehill Ave.:

- NPS grant for Purchase and Development of areas for recreational use is currently open until September 14, 2018. There may be an opportunity to apply for the grant to create a self-mitigating wetland on park property to prevent flooding. Through the grant, resources could be used to enhance the Lakemont neighborhood park entrance with additional educational signage and amenities.
  - NPS expressed interest in applying for the grant and seeing a concept of the self-mitigating wetland design.
  - NPS agreed to share LiDAR data with Timmons to support the wetland concept design.
- Enhancing the wetland could qualify towards reaching the City of Petersburg's Chesapeake Bay TMDL requirements. There could be an opportunity to reduce or eliminate the park's stormwater fees as a part of the wetland enhancements.

Community Partner Meeting #2 – October 4, 2018

Skeo, along with the James River Association, Timmons Group and City of Petersburg, convened a conference call with City of Petersburg staff to review the draft stormwater improvement recommendations developed by Timmons Group and discuss potential funding and implementation opportunities on October 4, 2018.

Participants:

- Lawrence Russel, City of Petersburg Schools
- John Young, City of Petersburg Community Development Block Grant Program
- Tiffany Carter, City of Petersburg Department of Health
- Michelle Peters, City of Petersburg Department of Planning
- Darryl Walker, City of Petersburg Stormwater Department
- Amber Ellis, James River Association
- Aislinn Creel, Timmons Group
- Alisa Hefner, Skeo
- Beth Schermerhorn, Skeo

Call Discussion

- By the end of November, the project will be at the conceptual design stage. To implement the recommendations, we will need to find funding sources to first design the projects and then install.
- Community Block Development Grants (CBDG)
    - CBDG will be looking for ways to apply for CDBG grant opportunities. These funds can be used for any project cost.
    - January 11, 2019 is the application deadline for next year. Proposals are submitted from across the community and the City ranks and submits the plan and gets City Council approval on May 15, 2019 and should learn if the funding is awarded by July 1, 2019.
    - Total awards are usually $625,000 each year for the City total. The City likes to allocate to several projects each year. Capital projects are always a priority and public service awards are usually up to $85,000.
    - Petersburg is getting hit hard on code enforcement for housing. They are putting together a plan to limit public services funding while still addressing homelessness and youth recreation. The remaining funds are typically for CDBG to support management.
    - The project team should be thinking $250-275,000 scale projects.
    - The City put sidewalks in on Slagle with CDBG funds. They are working on N Whitehill sewer improvements $128,000 for this year. City staff were not clear on who has the project now within the City, likely with City Utilities. Aislinn will check with Tim Turner on project status.
- Planning Department
    - The Planning Department recently completed a complete streets workshop. It includes a draft complete streets policy and they are working to get passed by City Council.
    - Planning is interested in ways to begin implementing the complete street policy to ensure that it works for healthy living and multi-modal transportation.
    - Planning can look at complete streets concepts but not implementation.
    - The policy includes standards healthier living spaces.
    - Planning is about to start looking at Comprehensive Plan and looking at walking/biking recommendations.
- Friends of the Lower Appomattox (FOLA) - Lakemont neighborhood is not a priority area for the organization currently. The project team would like to look for ways to connect Lakemont to the Appomattox River but the landfill is between the neighborhood and river.
    - There is a City signage project to connect neighborhoods to trails. For Lakemont, the trail may need to go through the battlefield.
- JRA has received funding from Cameron Foundation in the past and are interested in seeing collaboration with FOLA
    - Cameron foundation is having an event where Ms. Emico (City complete streets) is speaking. They just provided funding to Sportsbackers Stadium on multi-modal transportation.
    - Potential collaboration to come in through Complete Streets Policy rather than FOLA?
- Who owns the pond property and makes decisions about the pond and adjacent property?
    - Paved area by the school does not have much use.

    - City Schools do not see any issues with modifying areas in the paved area and open space surrounding the pond.
    - The school property is just the lot that the school sits on and part of the parking area belongs to the school. Schools do not have any future uses planned.

The following next steps were discussed:

- JRA proposed a quarterly call with partners to check-in on progress.
- Timmons working on finalizing the report.
- Amber is planning to attend the next Lakemont Neighborhood Watch meeting to report on the paint out pollution event on N Whitehill on Oct. 9
- Larger Nov. 3 Petersburg wide cleanup day in Lakemont.
- Darryl will provide guidance and leadership on priorities for the City. Will need to know what Timmons sees as the implementation schedule in order to line up funding requests.

Community Partner Meeting #3 – December 19, 2018

Skeo convened a conference call with the project team and representatives from VDOT to discuss VDOT related initiatives & discussion of near-term opportunities for collaboration.

Call Participants

- Melinda Baicy, VDOT
- Jimmy Shepherd, VDOT
- Darryl Walker, City of Petersburg
- Aislinn Creel, Timmons Group
- Alisa Hefner, Skeo
- Beth Schermerhorn, Skeo

Call discussion

- Other related initiatives: Jimmy has connection to head of scenic rivers program at DCR and could have connections with trails systems and VA Outdoor Plan. Alignment within Outdoor Plan could be potential funding source.
- VDOT related initiatives: Locally administered programs are reimbursement programs, locality applies for the funds, implement the project, incur the expenses and then VDOT reimburses locality. All programs are reimbursable. City of Petersburg would need to make the application. 2-year cycle. Just finished this round of the 2-year cycle. Next is likely in 2020.
    - Transportation Alternatives (TAP) - federal programs - 20/80 local/federal match
        - Enhancements like sidewalks, bikeways or other alternative transportation methods fall under this. Safe Routes to School (still exists for projects underway but not for new projects).
    - Revenue sharing is state-level funding - 50/50 match with state - not as many requirements
        - Street improvements or maintenance projects. Stormwater would fit into maintenance of streets.
- VDOT Central office rates the applications.
    - Request for applications usually come out in the fall and are send to all localities. Petersburg is aware and familiar with locally administered project funding.

- VDOT Local Administered Division website has a lot of information about all of their programs and application information.
- Petersburg has the VSU Gateway project that is being done through VDOT and the Cameron Foundation. It is part of the Appomattox River Trail Network. $4 million. City was applicant for that.
    - Cameron Foundation put up part of the match. But this project is still in the PE phase and is just getting started on VDOT's end.
- Virginia Dept of Forestry - have grants to provide native plants and trees! May be good fit for doing bioretention projects.

Next steps:

- Melinda will send the dates for the next 2-year cycle, likely in 2020.
- Jimmy will share Lynn Crump at DCR contact information.

Neighborhood Meeting #1 – June 12, 2018

Skeo, James River Association, City of Petersburg Department of Public Works and Timmons Group convened a meeting with concerned residents in the Lakemont neighborhood.

Participants:

- Cynthia, Dawn, and Carey, residents of S. Whitehill Ave.
- Mr. Williams, President, Lakemont Neighborhood Watch Association
- Lewis Rogers, Superintendent, Petersburg National Battlefield Park
- Darryl Walker, City of Petersburg Department of Public Works
- Aislinn Creel and Jesse Jones, Timmons Group
- Amber Ellis and Justin Doyle, James River Association
- Alisa Hefner and Beth Schermerhorn, Skeo

Residents in attendance shared the following concerns, specifically regarding the flooding behind their homes on S Whitehill Avenue adjacent to Petersburg National Battlefield Park property:

- Flooding behind their homes has worsened over the last 30 years to become a severe concern. During recent rain events, the flooding prompted residents to notify the local television station to do a news story on the issue.
- Residents have experienced regular damage to their properties which has included their house foundations, garage siding, back porch posts and decking and property fencing.
- Residents believe debris such as logs, branches, and leaves are clogging the ditch along the edge of the park that is supposed to prevent flooding and makes the flooding more severe.
    - There were concerns that neighbors are dumping debris into the trench and that recent tree cleanup by the National Park Service was not cleaned up, resulting in further clogging.
- Residents are concerned that the storm sewer pipe that drains the ditch is undersized and the grade of the ditch does not properly drain, increasing the chances of flooding in certain backyards.
- Several power lines that are regularly flooded appear to be split and/or rotting and seem dangerously close to falling. Residents have notified Dominion Power, but there has been no response or service provided.

- Residents expressed concern that the berm recommended in the Walkable Watershed Concept Plan will not adequately prevent flooding. If water goes over the berm, it will be trapped in their yards with no outlet and will breed mosquitoes.

Participants shared the following potential solutions to the flooding issue:

- Remove nearby trees to clear the area so that the ditch can be widened and deepened to hold more water during heavy rain events.
- Replace power utility poles that are deteriorating.
- Clear logs and debris from ditch and surrounding area.
- Host a cleanup day to remove leaves and debris from ditch.

Superintendent Rogers shared the following in response to the residents' concerns:

- He plans to meet with the Park Maintenance Manager to discuss options for improving the ditch.
- He shared concerns about dumping into the ditch and would be willing to share educational information to reduce dumping on Park property.
- The Battlefield has a small staff and must comply with federal regulations. For work to be completed on the ditch, the Battlefield would need to file for compliance, which is a series of steps to request and approve funds for projects. Because of their federal status, any solution on their end will take time.
- The Battlefield has a priority to preserve the park's historic and cultural history. This includes very specific topographical features which cannot be changed or altered.
- When trees are cut down in the park, they have to be removed and taken to the landfill, which charges the park a fee for their disposal. This is a part of the federal regulations which they are required to comply.

Outcomes of the meeting included:

- Residents are willing to wait while NPS works to determine what they can do to reduce flooding.
- NPS is going to investigate their options to address the flooding issue and report back their findings to the community.
- James River Association (JRA) is willing to host a cleanup day to clear the ditch of debris and provide an opportunity to educate residents of the City's leaf pick-up service.
- Mr. Williams will contact the residents on S Whitehill Ave. to encourage them to stop dumping and use the City's leaf pick-up service. JRA to print information and deliver to Mr. Williams to hand out.

Neighborhood Meeting #2 – June 12, 2018

Skeo, James River Association, City of Petersburg Department of Public Works and Timmons Group shared the preliminary results of the drainage study with members of the Lakemont Neighborhood Watch Association and facilitated a discussion on options for implementation to reduce current stormwater issues that were identified in the Walkable Watershed Concept Plan.

Meeting participants provided the following input during the meeting:

- Stormwater bump outs would enhance aesthetic beauty of the neighborhood and calm traffic.
  - Residents felt that the bump out gardens could be maintained through existing community cleanup days.

    - Residents felt that a pilot bump out would be preferred to test its effectiveness and determine if the community would be able to maintain them.
    - In response to concerns about there being enough room for this option, the project team clarified that the bump out would take up the same space as 1-2 on street parking spaces and would be located near an intersection.
- Stormwater pipes are clogging due to leaves, roots and debris entering the storm inlets.
    - Residents think that the City should clear the inlets at least twice a year, in the spring and fall, particularly November.
    - Residents felt that regular street cleaning could reduce the amount of soil that is entering the storm inlets.
    - The project team informed residents that the soils in the City of Petersburg have a high propensity to migrate based on soil type.
    - Residents are interested in a sediment catch basin that would reduce the amount of sediment entering storm inlets.
- New alignment for Whitehill stormwater system, where there is a potential crushed pipe.
    - Residents would like for the system to have the capacity for a 10-year flood.
    - Residents agreed that the new system should include some above ground stormwater features, such as a swale, especially along Nash St.
- The berm concept for behind S Whitehill Ave. homes may be evolving.
    - Residents resonated with the short-term goal to clear the ditch of debris in July 2018.
    - Residents would like for S Whitehill Ave. residents to be informed of the City leaf pick-up service.
    - Residents noted that when leaves are raked to the curb, the city does not always pick them up. However, when they are bagged, the city seems to prefer that method.
- The pond could be updated to collect additional runoff and serve as a natural area.
    - Residents do not know of an outfall for the pond.
    - Residents prefer a wide footprint with shallower pond areas.
    - Residents noted that the school owns the paved area adjacent to the pond and that parts of the paved area are unused and could become part of the updated pond system.

Neighborhood Meeting #3 – September 11, 2018

Skeo, along with the James River Association, Timmons Group and City of Petersburg, convened a community meeting with the Lakemont Neighborhood Watch Association to review the draft stormwater improvement recommendations developed by Timmons Group on September 11, 2018.

The following is a summary of the discussion from the meeting. During the meeting, Timmons shared a technical explanation of the draft recommendations and Skeo facilitated the discussion, answering any clarifying questions along with James River Association. After reviewing the recommendations, Lakemont residents selected their top 3 priority recommendations and then identified the top 3 recommendations that they feel are the highest priority for installation.

The discussion included the following:

- Residents were interested in having photos, videos and/or diagrams at the next meeting to further describe how the hydrodynamic structure, head wall and other features of the plan will function.
- There was interest in presenting the recommendations at the September 22 Ward meeting.

- Residents asked several questions about the pond modifications. Timmons explained that the pond improvements would make the average depth between 3 – 8 feet deep.
    - Residents are interested in turning th pond into a park and stocking the pond with fish.
- Meeting conveners shared that while residents have selected priorities, projects may need to be prioritized based on funding available. The following potential funding sources were shared during the meeting:
    - Park Funds for pond restoration: the next grant cycle is in two years.
    - Community Block Development Grant (CBDG)
- Mr. Williams was interested in sharing the recommendations handout with additional neighborhood residents.

Lakemont residents each voted for their top 3 recommendations. Based on the voting, residents selected the following top 3 recommendations: A - Culpepper Avenue Storm Sewer Extension, F - North Whitehill Drive Drainage Improvements, and G - Battlefield Flood Remediation and Drainage Improvements.

Recommendation	Voting Results	Top 3 Priorities
A - Culpepper Avenue Storm Sewer Extension	5	Top priority
B - Hare Street Storm Sewer Improvements	3	
C - Lakemont Water Quality Retrofit and Stream Restoration	2	
D - Bioretention Bump-outs	0	
E - Nash Street Bioretention Garden	1	
F - N Whitehill Drive Drainage Improvements	3	Top priority
G - Battlefield Flood Remediation and Drainage Improvements	6	Top priority