



# **Nassau County Stormwater Management Program**



## **BAILEY ARBORETUM SUBWATERSHED Stormwater Runoff Impact Analysis AND CANDIDATE SITE ASSESSMENT REPORT**

***FINAL – October 1, 2007***



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*Engineering • Planning • Construction Management*



**Nassau County  
Stormwater Management Program**

**Bailey Arboretum Subwatershed  
Stormwater Runoff Impact Analysis**

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## **1. INTRODUCTION**

The Bailey Arboretum Stormwater Runoff Impact Analysis (Analysis Report) has been prepared in accordance with the Nassau County Stormwater Management Program *Stormwater Runoff Impact Analysis Procedures Manual* (Procedure Manual). The Procedure Manual provides a methodology to assess and score all of the subwatersheds in the County in accordance with a standardized procedure. The Analysis Report contains a summary of all of the assessment data collected and developed regarding the subwatershed condition and also identifies potential water quality improvements.

The goals and objectives of the Stormwater Runoff Impact Analysis are to:

- Assess the condition of the existing subwatershed;
- Map the drainage infrastructure;
- Identify pollutants of concern; and
- Develop candidate projects and sites for mitigation of pollutant loading and improvement of water quality within the stream to the greatest extent possible.

The Analysis Report is organized into two main sections as follows:

- Subwatershed assessment; and
- Stormwater management practice (SMP) candidate site assessment and recommendations.

The subwatershed assessment section describes the drainage infrastructure mapping, vulnerability analysis and stream assessment which were conducted in accordance with the methodology outlined in the Procedures Manual. The SMP candidate site assessment and recommendations section analyzes the collected data and identifies potential locations to site SMP's and also provides an analysis of potential pollutant load reduction and water quality improvement.

The data developed in this report can be entered into a comparative analysis sheet that will allow the County to track existing conditions and anticipated improvements for each subwatershed in the County.



## **2. SUBWATERSHED ASSESSMENT**

The Center for Watershed Protection (CWP) classifies watersheds into five watershed management units. These include catchment area, subwatershed, watershed, subbasin, and basin. According to the CWP, the subwatershed-scale is preferred for assessment studies and is therefore the scale is used for this analysis. The drainage basins for water in Nassau County are the South Shore Estuary on the south shore and the Long Island Sound on the north shore. Nassau County has defined the watersheds based on the bay or inlet to which tributaries drain. The Oyster Bay Harbor/Mill Neck Creek watershed is located between Locust Valley and Oyster Bay Cove on the north shore. Subwatersheds are the tributaries that drain to the watersheds. For Oyster Bay Harbor and Mill Neck Creek the tributaries include Tiffany Creek, Whites Creek and Mill River which drain directly into the harbor and Francis Ponds/Beaver Brook, Kentucky Brook and Bailey Arboretum Brook which drain into Mill Neck Creek.

The subwatershed assessment includes review of available subwatershed data including Nassau County Geographic Information System (NCGIS) mapping, other available municipal mapping, Nassau County record documents and other available municipal record documents. After available records were reviewed, the land use data was utilized to estimate existing impervious cover, water quality storm volumes and pollutant loads. The stream assessment was conducted to verify mapping, assess field conditions and examine drainage infrastructure systems. The compiled information was then analyzed to identify locations where stormwater runoff is impacting the stream either via inputs (i.e., outfalls, illicit discharges or lack of buffers) or through effects on the stream corridor (erosion, channelization or stream crossings). This data was used to identify potential candidate site locations for recommended stormwater management practices.



## **2.1. DRAINAGE INFRASTRUCTURE MAPPING**

All sources of potentially available drainage data were reviewed and the information collected on a new layer in the GIS system. Prior to completing the stream assessment, areas where drainage infrastructure appeared to be lacking were noted and highlighted for review in the field. Drainage infrastructure data collected during the stream assessment was added to the drainage infrastructure maps.

### **2.1.1. MAP DEVELOPMENT**

The Nassau County Geographic Information System (NCGIS) files for the subwatershed were requested and received from the Nassau County Department of Information Technology. The NCGIS data served as the base map on which newly identified information could be added.

At the offices of the NCDPW Engineering Department, a list of drainage maps for road projects and subdivision developments within the subject subwatershed was compiled from the County drainage books (a series of three sets of documents). A Freedom of Information Law (FOIL) request including the list of drainage maps necessary for the subject infrastructure review was prepared. Table 2-1 shows the list of documents requested via the FOIL. Review of the Nassau County as-built records identified 49 documents that pertained to work conducted in the Bailey Arboretum subwatershed. The maps were provided to a printing sub-consultant for scanning into Tagged Image File (TIFF) formatted documents. The documents were returned to the NCDPW Engineering Department along with a CD copy of the scanned documents. The drainage information from the scanned documents was transferred to a new GIS layer in accordance with Nassau County mapping protocols.

The final layer combining the data from all sources is titled “Final GIS Layers” and includes identification of the source of the data in the “Origin” database column. The



data identified in the field using GPS is included on the “Final GIS Layers” and is identified as “Cashin Associates GPS”.

#### 2.1.2. FIELD DATA COLLECTION

Using the mapping developed in Section 2.1.1, areas with incomplete drainage mapping were identified. A field survey of the drainage infrastructure in those locations was conducted. This task was performed in conjunction with the Stream Assessment described in Section 2.3. During the assessment, the stream corridor was walked to verify the mapped outfalls and to identify other locations where storm runoff appeared to be directly entering the stream. The drainage infrastructure upstream of each outfall was then field verified to identify the extent of the drainage infrastructure contributing to each outfall. The drainage infrastructure of the Bailey Arboretum subwatershed is shown on Map 2-1.

### 2.2. SUBWATERSHED VULNERABILITY ANALYSIS

The Subwatershed Vulnerability Analysis consists of three components as follows:

- subwatershed characterization;
- impervious cover assessment; and
- pollutant load analysis.

The subwatershed characterization includes a description of the subwatershed’s size, land uses, boundary, and length of waterbody. The impervious cover assessment calculates the amount of impervious area in the subwatershed based on: 1) NCGIS data for parking lots, roads, building footprints; and 2) area calculations for sidewalks and driveways. The pollutant load calculation uses NCGIS data for land use in conjunction with standard coefficients for runoff pollutant levels, resulting in an estimate of pollutant loads for the subwatershed.

### 2.2.1. SUBWATERSHED CHARACTERIZATION

The Bailey Arboretum subwatershed is located within the Town of Oyster Bay in the northern portion of Nassau County. Bailey Creek extends from its headwaters in the Bailey Arboretum to the outflow into Mill Neck Creek. Bailey Creek is comprised of a short tidal segment and a longer freshwater segment that are separated by a large culvert at Factory Pond Lane. The tidal section, located north of Factory Pond Lane, drains directly into Mill Neck Creek. The freshwater segment extends southwest from Factory Pond Lane toward Feeks Lane. The freshwater segment has a large pond located immediately south of Factory Pond Lane. The headwaters of the creek are located within Bailey Arboretum County Park. Between the pond and the arboretum the creek runs through forested area. A small weir that controls the arboretum pond elevations is located near the eastern property line of the Bailey Arboretum property. The subwatershed has drainage infrastructure located along the major roads including Factory Pond Lane, Bayville Road and Horse Hollow Road. Most of the road runoff is carried via street gutters to the drainage infrastructure which drain into the creek via the five assessed outfalls.

The Bailey Arboretum subwatershed encompasses approximately 526 acres that contribute runoff that eventually enters the Bailey Arboretum stream. When an area contains storm runoff in on-site drainage infrastructure, that area is described as self-contained. A single location where drainage infrastructure was identified as potentially containing the storm runoff was identified at the southern limit of the watershed east of Ryefield Road. As the area was small and the actual capacity of the existing infrastructure was unknown that area was kept in the drainage area.

The geographic limits of the Bailey Arboretum subwatershed were defined through review of topographic maps, plans of existing municipal drainage infrastructure, and field assessment. Map 2-2 shows subwatershed topography along with existing drainage infrastructure.



The Bailey Arboretum subwatershed extends south from the northern end of Factory Pond Lane to Ryefield Road and east from Sheep Lane/Horse Hollow Road to just west of the Factory Pond Lane/Feeks Lane intersection. Land use within the subwatershed is comprised of mainly low-density residential, with a large municipal or public land uses including the arboretum, a cemetery and a school. The subwatershed contains no commercial or industrial areas and is 71% residential and 25% “other” land uses, which includes the arboretum, cemetery and school. Several vacant parcels are also included on the land use map. Roadways comprise the remaining land use. Of the 214 residences in the subwatershed, 145 or 68% are one half-acre or larger.

#### 2.2.2. IMPERVIOUS COVER ASSESSMENT

Percentage of impervious cover has been determined to be an indicator of subwatershed health. A lower percentage of impervious cover in a subwatershed generally indicates that water quality is less impacted by pollutants than in subwatersheds with higher impervious cover percentages. The CWP has established subwatershed classification based on percentage of impervious cover ranging from sensitive streams (0-10% impervious) to urban drainage stream (>60% impervious). The impervious cover assessment uses methodology included in the NC Procedures Manual. The methodology is based on CWP procedures that use GIS data to estimate impervious cover. The impervious cover within the subwatershed was calculated from the NCGIS data and standardized tables developed by the CWP. The NCGIS data necessary to calculate impervious cover is presented in Table 2-2 GIS Data Chart.

The following sources or methods were used to calculate the impervious cover in the Bailey Arboretum subwatershed:

- NCGIS data allowed the actual footprint of all building areas and parking lot areas within each land use to be calculated.
- Area of roads was calculated from the NCGIS data.





- Total average driveway area was estimated by tallying the number of residences in each of five size categories, ranging from less than 1/8 acre to greater than one acre and applying impervious driveway factors from CWP as developed by Cappiella and Brown , 2001.
- Sidewalks were estimated by viewing aerial photography of the site and estimating the percentage of the subwatershed roads with sidewalks. In the case of the Bailey Arboretum subwatershed, 10% of the streets are estimated to have 4' wide sidewalks on both sides.

The impervious cover data was entered into the standard table from the Procedures Manual. The data table and results of calculations are shown on Table 2-3. The impervious area of the Bailey Arboretum subwatershed is 39 acres of the 526 total subwatershed acres. This represents 7% of the subwatershed. Based on the 7% impervious figure, the Bailey Arboretum subwatershed receives a classification of sensitive stream.

Sensitive streams have a subwatershed impervious cover of 0% to 10%. The streams are generally of high quality, typified by stable channels, excellent habitat structure, good to excellent water quality, and diverse communities of both fish and aquatic insects. Due to the low impervious cover condition, frequent flooding and other hydrological changes that accompany urbanization are not experienced. Field assessment may identify impacts not shown by the impervious cover calculations that may effect the classification of the stream. Consequently, all the properties of a sensitive stream may not be present. However, if impacts are identified and riparian management improves, these sensitive streams are often expected to recover. The main goals for sensitive subwatershed management in the Bailey Arboretum subwatershed are to maintain the biodiversity and channel stability.



### 2.2.3. STORM POLLUTANT LOAD CALCULATION

Nassau County has identified a number of pollutants associated with stormwater runoff to be of concern for the County's subwatersheds. Impervious surfaces act as a "trap and conveyance" mechanism for the pollutants, ultimately resulting in deposition of the pollutants into nearby waterbodies. These pollutants negatively affect the surface water quality. The pollutants identified by the County are carried in large quantities in storm runoff from roads and paved surfaces.

**Total Suspended Solids** – Total Suspended Solids (TSS), which includes silts and sediments, constitute the largest mass of pollutant loadings to surface waters. This pollutant is exported in greatest quantities from construction sites. In addition, TSS is generated from lands with insufficient vegetative cover, stream channel erosion, street sanding operations, and vehicle tires. NYSDEC has identified TSS as a pollutant of concern for New York State waters and requires that 80% of TSS be removed from runoff from new construction. The subwatershed's nearby roads and drainage infrastructure contribute to TSS in the Bailey Arboretum subwatershed.

**Phosphorus and Nitrogen** – Total Phosphorus (TP) and Total Nitrogen (TN) are two nutrients necessary for plant growth. Nonpoint sources of TP and TN are recognized causes of water quality degradation in many water bodies. These nutrients, washed into waterbodies via stormwater runoff, typically originate in lawn fertilizers and animal wastes from pets, waterfowl, small mammals and livestock. NYSDEC has identified TP as a pollutant of concern for New York State waters and requires that 40% of TP be removed from runoff from new construction. Residences with large yards that drain to the street may contribute TP and TN to the Bailey Arboretum subwatershed.

**Fecal Coliform and Other Pathogens** – Pathogens include bacteria, viruses and other microorganisms that can cause human illnesses such as hepatitis A. The suspected



causes of this impairment originate in the feces of pets, livestock and waterfowl that are carried into waterbodies by stormwater runoff. Pet and waterfowl wastes may contribute to fecal coliform levels in the Bailey Arboretum subwatershed.

**Hydrocarbons (Oils and Grease, Petroleum Compounds)** – Oils and grease contain an array of hydrocarbon compounds, some of which can be toxic to aquatic life even at low concentrations. The major source of hydrocarbons in urban runoff is through the leakage of crankcase oil and other lubricating agents from motor vehicles and from facilities that service motor vehicles (e.g., repair shops and gasoline stations). Hydrocarbon concentrations are typically highest in runoff from parking lots, roadways, and service stations. Roadways uses are the main contributors of hydrocarbons within the Bailey Arboretum subwatershed.

**Floatable Debris** – Besides the obvious negative aesthetic effects, trash can impact aquatic life through either ingestion or entanglement. The major contributors to the floatable debris level in the Bailey Arboretum subwatershed are its residential areas. In addition, dumping of debris was also observed in the Bailey Arboretum corridor.

The pollutant loads were calculated in accordance with the Procedure Manual using the “Simple Method” for all pollutants with the exception of Floatable Debris. The Simple Method uses the land uses and CWP pollutant coefficients to calculate the pollutant loads. Land use was separated into the five categories of residential, commercial, industrial, roads and other. Pollutant load coefficients were assigned based on the land use. The “other” category includes parks, municipal properties and any other uses not included in the categories mentioned. Existing land uses within the subwatershed are presented on Map 2-4. The NCGIS land use data necessary to calculate pollutant loads is presented in Table 2-2 GIS Data Chart. Nassau County development criteria have long mandated that commercial and industrial properties contain their storm runoff on site. Those land uses can be excluded from the



calculation if the field assessment confirms that these land uses are self-contained and do not contribute runoff to the waterbodies. For floatable debris, coefficients based on land use were developed for the categories of residential, commercial, industrial, roads and other. The coefficients are applied to each land use area to estimate floatable debris generation with the subwatershed.

The data was entered into the Water Quality Volume and Pollutant Load Calculation Table provided in the Procedures Manual. The resulting pollutant loads are shown on Table 2-4. The pollutant loads for each pollutant were assigned severity points based on the least, 1 point, to the most, 6 points, severe pollutant threat in the watershed. The pollutant loads are multiplied by the assigned severity points and the total is divided by 100 and entered into the pollutant severity score row on the Comparative Analysis Table. The pollutant loads are also used to assess potential SMP improvements to each individual subwatershed.

### **2.3. STREAM ASSESSMENT**

The stream assessment was conducted in accordance with the NC Procedures Manual. In addition, the *CWP Unified Stream Assessment: A User's Manual* was reviewed prior to the field effort. The assessment was conducted during the winter months when the lack of vegetation improved access to and provided visibility of the outfalls and stream corridor condition. The Bailey Arboretum subwatershed was assessed by traveling upstream from the mouth of the river at Oyster Bay Harbor. On the data sheets, the banks are described as left (west) and right (east) looking downstream.

The stream assessment for the Bailey Arboretum subwatershed was conducted from January 9, 2007 to January 10, 2007. The equipment used by survey personnel to conduct the assessment included data assessment sheets, GPS unit, dry erase board and markers, digital camera, tape measure and waders. For this subwatershed, aerial photos and property line maps were used to record field data. In the event that property owners had



concerns regarding the work, the survey team carried a contact list of the governing authority to provide to the residents. Each stream assessed was assigned an identification number starting with 100. The Bailey Arboretum creek was the sixth stream assessed by this methodology and was assigned identification number 105.

During the stream assessment, the stream corridor was photographed at regular intervals and at specific locations. The interval photographs record the stream surroundings and any immediately identified points of interest. When a data assessment sheet was completed, a photograph of the specific location was taken. For each Outfall (OT) sheet, photographs were taken from two or three different directions. When the location to be photographed was accessible, a dry erase board was labeled with the RCH and OT #'s and sited to appear within the photograph. All photographs were immediately logged on the Photo Log sheet. The photographic log and photographs are included in Appendix B.

The data sheets were completed in either the field at each location or, when field conditions did not allow the immediate completion, immediately after returning from the field. Data Sheets are included in Appendix A. The data sheets are organized by reach in number order. In each reach section, the reach data sheets (RCH) are first followed by the outfall data sheets (OT), then the other data sheets.

When it was necessary to cross private property to reach the stream corridor, the assessment team would explain the purpose of the assessment and ask the property owner for permission to cross the property.

Reach boundaries were determined during the field assessment. The reach limits are selected based on one or more of the following criteria: change in surrounding land use; change in stream conditions; or a dividing characteristic such as a stream crossing or long culvert. The Bailey Arboretum creek was assigned one reach based on the stream's consistent surroundings and conditions.



The following paragraphs are a summary of the data collected on the assessment sheets. The Bailey Arboretum creek extends through the center of the subwatershed and is approximately one mile long. The Bailey Arboretum creek flows northeast into Mill Neck Creek. The creek consists of a natural stream with some pond areas. The stream appears to enter wetland areas toward the mouth of the stream and at the headwaters of the stream.

In RCH 105-1, which encompasses the entire stream, five outfalls were identified during the field assessment. Several additional outfalls are assumed to exist based on the drainage infrastructure mapping. The outfalls either could not be field located and are assumed to be located in culverts that could not be accessed.

OT-1 is swale located on the north side of Factory Pond Lane that drains into the tidal segment of Bailey Creek. The assessment identifies OT-2 as a manhole that appears to be full and overflowing into the nearby pond. This outfall is located on the northwest side of the pond near Factory Pond Lane. The drainage mapping conducted as described in Section 2.1 of this report identified an extensive drainage infrastructure system along Factory Pond Lane that extends to Bayville Road and Horse Hollow Road. This infrastructure was not observed during the field assessment. The existence of this infrastructure needs to be verified but for this study it is assumed that runoff from the drainage area of that infrastructure is carried to OT-1 and OT-2.

Outfall OT-3 is located at the southern end of Park Lane that contributes runoff from a small subdivision.

The drainage mapping conducted as described in Section 2.1 of this report identified a drainage infrastructure system along Bayville Road north of the arboretum and west of OT-3. Only portion of the street infrastructure was observed during the field assessment. The outfall for this infrastructure could not be field located but the infrastructure is



assumed to extend through a property easement to a small pond located south of Cherrywood Lane. The existence of this complete infrastructure system needs to be verified. This location will be called OT-3A in the candidate site assessment.

A weir is located at the northeast end of the arboretum. The weir is a large concrete structure that retains the ponds located in the arboretum and discharges into the stream in the forested area to the east of the arboretum.

The areas surrounding the ponds in the arboretum consist of mostly grass areas and a parking lot with limited narrow vegetated buffer. The stream itself is mostly channelized within the arboretum due to manmade structures. Two outfall, OT-4 and OT-5 were field identified during the assessment and are a Belgium block swale and a 10" pipe that carry runoff from the arboretums paved parking lot and drive. There may be additional areas where surface runoff is entering the creek from developed area within the arboretum.

The overall stream condition was assessed to fall in the suboptimal to optimal range due to the inadequate vegetation protection areas in the arboretum. The overall buffer and floodplain condition was assessed as being within the suboptimal to optimal range due to minor floodplain encroachment and a narrow vegetated buffer width.

Table 2-5 Subwatershed Comparative Analysis tabulates the information collected during the field assessment, along with the impervious cover results and pollutant severity score to produce a subwatershed total score. While the subwatershed total score can be subjective due to the many additional factors involved in assessing the subwatershed condition and the feasibility of SMP's, the general subwatershed score categories are as follows:

- 0-15 Optimal/Sensitive
- 16-30 Suboptimal/Impacted
- 31-45 Marginal/Non-supporting
- 46+ Poor/Urban





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The Bailey Arboretum subwatershed was scored a 3 placing this creek in the optimal/sensitive category. Optimal/sensitive creeks are estimated to have low levels of impervious cover and pollutant loads. The subwatershed score can also be used to assess the conditions of a specific subwatershed in relation to other subwatersheds in the County or other jurisdiction. For example, a watershed with a score of 48 would be identified as poor/urban and would face greater impacts than a watershed with a score of 11. However, even watersheds with low score may have segments that can be improved by specific stormwater management practices.

The optimal/sensitive rank appears to match the existing conditions found in the Bailey Arboretum subwatershed. The Bailey Arboretum subwatershed is in optimal condition for most of the subwatershed but the drainage infrastructure system carries road runoff directly into the creek and the buffer impacts within the Bailey Arboretum property offer opportunities to improve the subwatershed further.

### **3. SMP CANDIDATE SITE ASSESSMENT AND RECOMMENDATIONS**

#### **3.1. WATER QUALITY CLASSIFICATIONS/DESIGNATED USES**

Table 3.1 summarizes the NYSDEC general water quality classifications in terms of their best usage. The watersheds that were analyzed for this report include the freshwater sections of the creek tributaries which fall within the Class ‘C’ waters.

**Table 3.1 NYSDEC Water Quality Classifications (6 NYCRR Part 885 and Part 701).**

<b>Waterbody</b>	<b>Water Classification</b>	<b>Best Usage</b>
<b>River /Creek - freshwater</b>	C	The best usage of Class C waters is fishing. These waters shall be suitable for fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.
<b>River/Creek - tidal</b>	SC	The best usage of Class SC waters is fishing. These waters shall be suitable for fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.
<b>Oyster Bay Harbor/Mill Neck Creek</b>	SA	The best usages of Class SA waters are shell fishing for market purposes, primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

The NYSDEC has designated Oyster Bay Harbor and Mill Neck Creek and their tidal tributaries priority waterbodies with known aquatic life impairment. A priority waterbody is a waterbody determined by NYSDEC staff, with public input, having uses precluded, impaired, stressed or threatened and, in some cases, requiring establishment of a TMDL. The causes of the impairments have been identified as pathogens from urban/storm runoff and municipal sources. The western portion of Mill Neck Creek is a NYSDEC uncertified shellfishing area. The eastern segment is conditionally certified or seasonally certified. Uncertified shellfishing areas are lands where the NYSDEC has prohibited shellfish



harvesting for food uses in accordance with NYSDEC regulation 6NYCRR Part 41. Conditionally certified and seasonally certified areas are opened on a limited basis dependent on factors defined by the NYSDEC. Pathogen TMDL's for shell waters in Oyster Bay Harbor and Mill Neck Creek have been completed. There are set target percent reductions for pathogens levels.

Table 3.1 identifies “best usages”. The actual usage of the waters is dependent upon the impairments to the quality of the waters. The numerous parameters that commonly characterize water quality include taste, color, suspended solids, oils, refuse, thermal discharges, phosphorus, nitrogen, pathogens and dissolved solids. A common example of this is Class “B” waters that have a best usage for primary recreational contact (swimming) but are closed due to impacts to the water quality as a result of high bacteria levels. Town and County beaches are often closed after a rainfall that causes high bacteria levels in those waters.

Two major water quality parameters for Class “C” waters are dissolved oxygen (DO) and coliform bacteria concentrations. Adequate DO is essential to the growth and reproduction of finfish and shellfish. DO is also important for the natural decomposition of organic wastes. Current public health standards call for low coliform bacteria concentrations as the presence of such bacteria is regarded to be an indication of potentially pathogenic contamination from human or animal wastes. The actual water quality may not be suitable for the best usage based on these water quality parameters.

### **3.2. SITE ASSESSMENT/SMP SELECTION**

The Bailey Arboretum subwatershed is dominated by low-density land use with some parkland use. The subwatershed was assessed to be 7% impervious and analysis determined that Bailey Arboretum was a sensitive stream with stable channels, little buffer encroachment an extensive vegetative cover. No potential “hot spots” or illicit discharges were identified in the vicinity of the creek. Hot spots are land uses that are known to have



high levels of materials such as oil, grease, automotive or marine parts, dumpsters, gas tanks, or other hazardous materials. Illicit discharges are locations where storm runoff or unpermitted discharges outfall directly into the creek corridor or into infrastructure that discharge into or will eventually reach the creek.

More than half of the subwatershed area surface drains to the creek. The majority of these areas have significant wooded buffers and extremely limited development. No structural SMP's are recommended for these locations. Should the land use of these areas be modified the need for SMP's should be reassessed.

No areas are assumed to be self-contained within this subwatershed. The drainage infrastructure and topography are shown on Map 2-2. In several locations the field assessment did not locate the infrastructure identified during the records review. Additional research is necessary to determine if the infrastructure exists. The areas are described in Section 2.3.

SMP's that can treat pollutants found in runoff from roads include ponds, infiltration trenches, sand filters, and bioretention basins, in addition to ultra-urban retrofits if suitable locations for other SMP's are not available or feasible.

### **3.3. SMP IMPLEMENTATION CANDIDATE SITES**

Bailey Arboretum Subwatershed has several potential parcels that could be used to site SMP's from several of the outfalls identified. The proposed candidate sites and the SMPs discussed herein are shown on Map 3-1 Candidate Sites Map.

Candidate Site 1 is at outfalls OT-1 and OT-2. OT-1 and OT-2 are located at the northern end of Bailey Creek on Factory Pond Lane. They appear to discharge storm runoff from roads extending through the watershed either through an infrastructure system that could



not be field verified or via surface runoff. Some of the runoff may be migrated in conjunction with OT-3A below if the pond is allowed to act as a sedimentation basin and the infrastructure piped to allow runoff to reach the OT-3A outfall. The OT-1 swale should be assessed to determine if the swale can be revegetated. The OT-2 manhole that is overflowing should be assessed to determine if a blockage in the pipes or structures is preventing the system from operating properly.

OT-3 is located on Park Avenue at the southern end of a small subdivision. An infiltration trench may mitigate the storm volume in this location.

OT-3A was not field identified. It appears that a drainage system located on Bayville Road along the west side of the Arboretum may be connected to an outfall at to a small pond on the Bailey Arboretum property. The existing system should be verified. Potential SMPs include an infiltration trench or bioretention basin prior to entering the pond. If land is not available for a trenches or basin a water quality inlet or hydrodynamic structure can be located at the last drainage structure in the road. An additional option is to allow the pond to act as sedimentation basin and direct additional runoff from the road infrastructure to the pod. This can mitigate some of the runoff from Horse Hollow Road.

Outfalls OT-4 and OT-5 are located with the Bailey Arboretum property. As the Arboretum is under County jurisdiction it may be possible to implement improvements to the drainage patterns of the Arboretum. Reconstructing the swales as vegetated dry swales will reduce the flow velocity and allow the sediments to be removed before the runoff reached the creek. The Arboretum should be further inspected to ensure that all locations where concentrated flows are entering the creek are vegetated and stabilized. In addition, locations where the buffers areas adjacent to the creek consist of paved areas or lawns the potential to create vegetated buffers that filter the runoff should be investigated. In addition, if not already in place, the County should adopt and Integrated Pest Management



(IPM) program for the county properties to reduce the nitrogen and phosphorus loads that are generated and reduce pesticide use and the potential for those pollutant loads.

Nonstructural SMP's that can aid in reducing the pollutants that enter Bailey Creek from lands in the watershed include:

- Increased street sweepings;
- Public education on garden fertilizer and chemical use and disposal;
- Public education on the importance of buffers between cultivated lawns and waterbodies; and
- Public education on the importance of vegetative cover to prevent soil erosion.

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**NCDPW Engineering Department**  
**Map File List of Requested Plans**  
**Table 2-1**

<b><u>Bailey Arboretum (ID No. 105)</u></b>					
COUNTY FILE # (BROWN / BLACK BOOK)		OLD COUNTY FILE # (BLUE BOOK)		MUNICIPALITY FILE # (RED BOOK)	
1707-1		60-2		4392-1	
245-13		103-5		4386-4	
286-3		103-7		7207-1	
465-2		493-1		7288-2	
3059-2		1490-2		7263-1	
3195-4		1452-7		1401-4	
1087-7		523-4		83-8	
131-1		237-7		237-71	
238-5		237-10		1414-6	
4384-7		1813-1		7364-1	
1708-1				4082-6	
2044-1				1174-2	
574-8				1478-4	
1534-2				1964-7	
611-3				104-7	
103-2				7210-2	
320-10				7207-4	
317-3				7211-6	
232-2				1495-3	
				103-6	



**Nassau County Stormwater Management Program  
Stormwater Runoff Impact Analysis  
GIS Data  
Table 2-2**

**Name of Subwatershed: Bailey Arboretum (ID No. 105)**

<b>Tributary to:</b>	<b>Mill Neck Creek</b>
<b>Adjacent Land Use:</b>	<b>Low Density Residential</b>

**Impervious Information**

	Area		Building Area		Parking Lot Area		Length of Roads		Number of Residences
<b>Residential</b>	376	Acres	13	Acres	X		X		214
<b>Commercial</b>	0	Acres	0	Acres	0	Acres	X		X
<b>Industrial</b>	0	Acres	0	Acres	0	Acres	X		X
<b>Roadway (Pavement)</b>	18	Acres	X		X		X		X
<b>Other (Parks, Municipal, (ROW-Pvmt), Etc.)</b>	132	Acres	1	Acres	3	Acres	X		X
<b>Total Subwatershed</b>	526	Acres	15	Acres	3	Acres	40,002	LF	X

Residential Lots	Quantity in Subwatershed
43,561 +	111
21,781 - 43,560 SF	34
10,891 - 21,780 SF	27
5,446 - 10,890 SF	17
0 - 5,445 SF	25
<b>Total Number</b>	214

Assumed Percentage of Roadway With Sidewalks (%)	10
Sidewalk Width (FT)	4
Assumed Sides of Roadway With Sidewalk	2

\* Source NCGIS Database Dated July 24, 2006

**Nassau County Stormwater Management Program  
Stormwater Runoff Impact Analysis  
Impervious Cover Calculations  
Table 2-3**

Impervious Driveway Factors			Average Residential Driveway Area Calculation					Sidewalk Area Calculation		Impervious Area Calculation				
Residential Lot Area (AC)	Average Driveway Area (SF)	NC criteria	Subwatershed:		Bailey Arboretum (ID No. 105)			Subwatershed:	Bailey Arboretum (ID No. 105)		Subwatershed:		Bailey Arboretum (ID No. 105)	
2	3,212	1-2+ AC	Tributary to:		Mill Neck Creek			Tributary to:	Mill Neck Creek		Tributary to:		Mill Neck Creek	
1	2,073	1/2-1 AC	Residential > 1 acre - 3212 SF	Units	111	Acres	1.1	Linear feet of road	40,002		Adjacent Land Use:		Low Density Residential	
1/2	1,152	1/4-1/2 AC	Residential > 1/2 acre to ≤ 1 acre - 2,073 SF	Units	34	Acres	0.3	Assumed percentage with Sidewalks	10		Total Subwatershed Area		Acres	526
1/4	652	1/8 - 1/4 AC	Residential > 1/4 acre to ≤ 1/2 acre - 1,152 SF	Units	27	Acres	0.3	Sidewalk Width	4		Impervious areas			
1/8	432	0-1/8 AC	Residential > 1/8 acre to ≤ 1/4 acre - 652 SF	Units	17	Acres	0.2	Sides Sidewalk	2		Buildings Area	Acres	15	
Source : Capiella and Brown, 2001			Residential ≤ 1/8 acre - 432 SF	Units	25	Acres	0.2	Total Acres Sidewalk	1		Roads Area	Acres	18	
WVA Table 4: Average Driveway Areas in the Chesapeake Bay Region			Total Acres Driveways Impervious		Units	214	Acres	2	Calculation : LF of road x % with sidewalks x 4 ft w x 2 sides		Parking Lot Area	Acres	3	
<b>Impervious Area Notes</b>														
1. GIS Data Table is source for areas of buildings, roads and parking lots.														
2. Sidewalk area calculations are based on percentage of sidewalk area estimated by preparer														
3. Impervious Driveways Factors Table - Average Driveway Areas Souce: WVA Table 4, Capiella and Brown														
TOTAL IMPERVIOUS AREA											Acres	39		
TOTAL % IMPERVIOUS											%	7%		
Classification											8			
<b>Initial Subwatershed Classification</b>														
8	Sensitive Stream	0-10% impervious												
6	Impacted Stream	>10%- to 25% impervious												
4	Non-Supporting Stream	> 25%- 60% impervious												
2	Urban Drainage Stream	> 60% impervious												
Source: WVA Figure 4 and Table 2														

**Nassau County Stormwater Management Program  
Stormwater Runoff Impact Analysis  
Water Quality Storm Event (WQSE) Volume and Pollutant Load Estimates  
Table 2-4**

Subwatershed		Bailey Arboretum (ID No. 105)							
Tributary To		Mill Neck Creek							
Land Use		Residential	Commercial	Industrial	Roadway	Other	TOTAL		
Contributory Area	Acres	375.6	0.0	0.0	18.2	132.1	525.9		
Impervious Area	Acres	13.2	0.0	0.0	18.2	4.4	35.8		
Impervious Area	%	3.5	0	0	100.0	3.4	6.8		
Water Quality Storm Event Volume	WQv-acre-feet	3.1	0.0	0.0	1.7	1.1	5.9		
Water Quality Storm Event Volume	WQv-Cubic Feet	133,470.0	0.0	0.0	75,398.0	46,178.0	255,046.0		
Annual Rainfall	inches	42.0	42.0	42.0	42.0	42.0	42.0		
Annual Runoff	inches	3.1	1.9	1.9	35.9	3.0	4.2		
Total Nitrogen (TN)	coefficient mg/l	2.2	2.0	2.5	3.0	2.0		SEVERITY PTS.*	TOTALS
	lbs	575.9	0.0	0.0	443.6	181.1	1,200.6	3.0	3,601.8
Total Suspended Solids (TSS)	coefficient mg/l	100.0	75.0	150.0	120.0	54.5			
	lbs	26,175.6	0.0	0.0	17,744.1	4,935.6	48,855.3	4.0	195,421.1
Total Phosphorus (TP)	coefficient mg/l	0.4	0.2	0.4	0.5	0.3			
	lbs	104.7	0.0	0.0	73.9	23.5	202.2	2.0	404.4
Fecal Coliform (F Coli)	coefficient mpn/100 ml	7,750.0	3,000.0	2,400.0	1,700.0	5,000.0			
	billion colonies	0.9	0.0	0.0	0.1	0.2	1.2	6.0	7.5
Floatable Debris	coefficient CF/AC	5.0	8.0	5.0	8.0	5.0			
	CF	1,877.9	0.0	0.0	145.8	660.5	2,684.1	1.0	2,684.1
Oil and Grease	coefficient mg/l	3.3	5.0	4.0	8.0	3.0			
	lbs	863.8	0.0	0.0	1,182.9	271.7	2,318.4	5.0	11,592.1
							<b>55,261.8</b>		<b>213,711.0</b>
								<b>SCORE</b>	<b>406.4</b>

**SOURCE:**

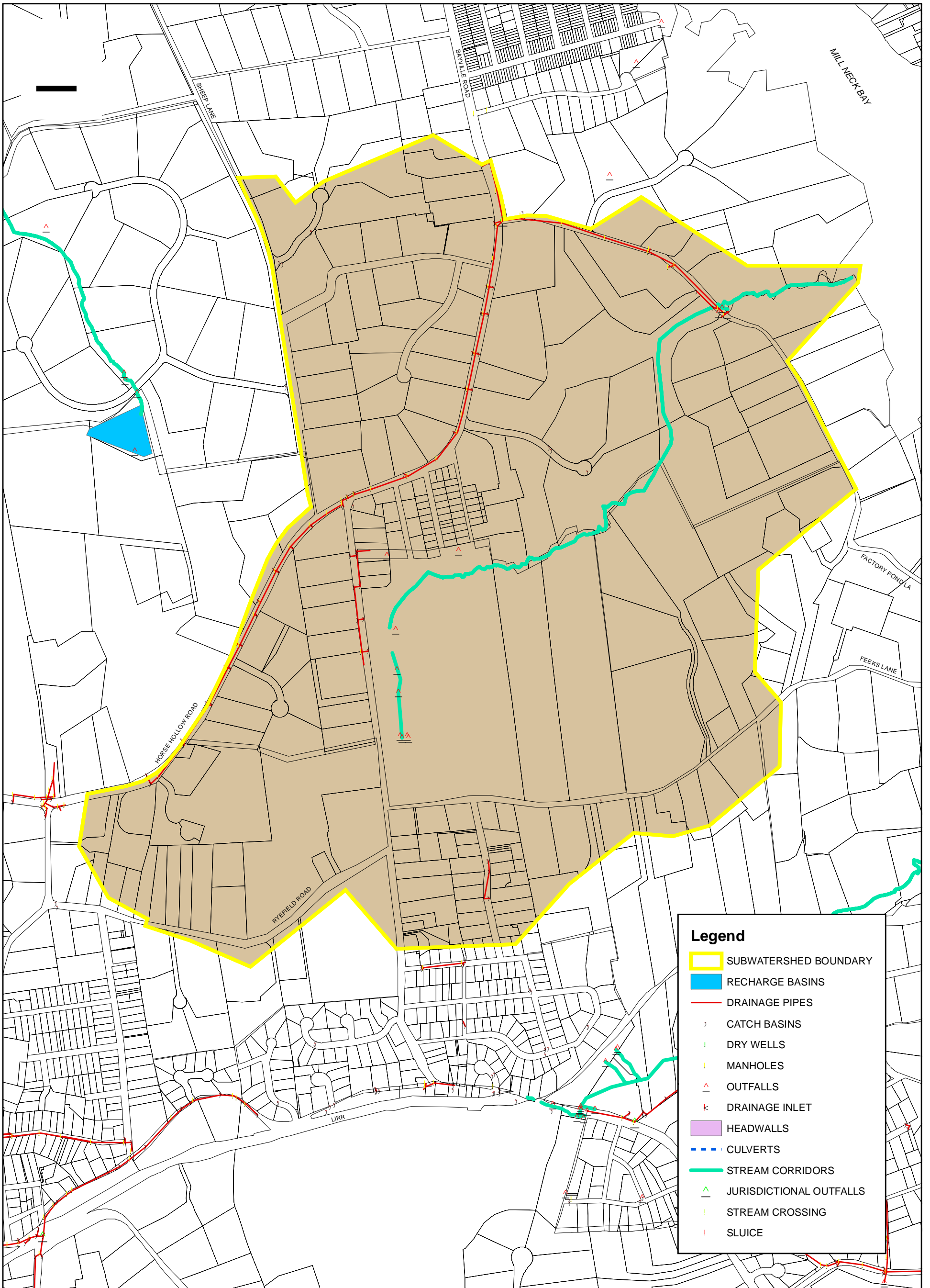
"C" Valve Source; See Table

Impervious Area is based on NCGIS Impervious Area Data from building areas, parking areas, and road areas

\* The pollutant loads for each pollutant were assigned severity points based on the least, 1 point, to the most, 6 points, severe pollutant threat in the watershed. The pollutant loads are multiplied by the assigned severity points and the total is divided by 100

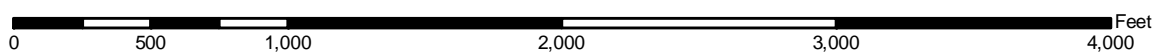
**Nassau County Stormwater Management Program  
Stormwater Runoff Impact Analysis  
Subwatershed Comparative Analysis  
Table 2-5**

	Unit Criteria	Scoring Criteria	Bailey Arboretum (ID No. 105)	
			105-1	
Stream Assessment Quantification	Unit	Points	Qty	Qty x Pts
Outfall	per outfall	2	5	10
Suspected Illicit Discharge or Hot Spot Locations	per location	8	0	0
WQ Retrofit/Restoration Candidates	per location	1	2	2
Infrastructure Investigations Required	per location	1	2	2
Severe Bank Erosion	per location	1	0	0
Inadequate Buffers	per 5% of reach	5	1	5
Road Crossings	per location	1	1	1
Channelized Segments	per 5% of reach	1	1	1
Public Ownership of the Stream Corridor	per 10% of reach	1	6	6
Livestock Encroachment or High Waterfowl Populations	per location	5	1	5
Threatened Infrastructure	per location	3	1	3
Trash Accumulation In Stream	per location	5	0	0
Stream Condition Subtotal (RCH)	from RCH sheet.	80	71	-9
Buffer/Floodplain Condition Subtotal (RCH)	from RCH sheet.	80	69	-9
Reach Total	No. of Reaches	1	18	
Subwatershed Total			18	
Impervious Cover Classification	Sensitive, Impacted, Non supporting, Urban	8,6,4,2	8	
Pollutant Load			4	
Total Score			3	
<b>RANK</b>				

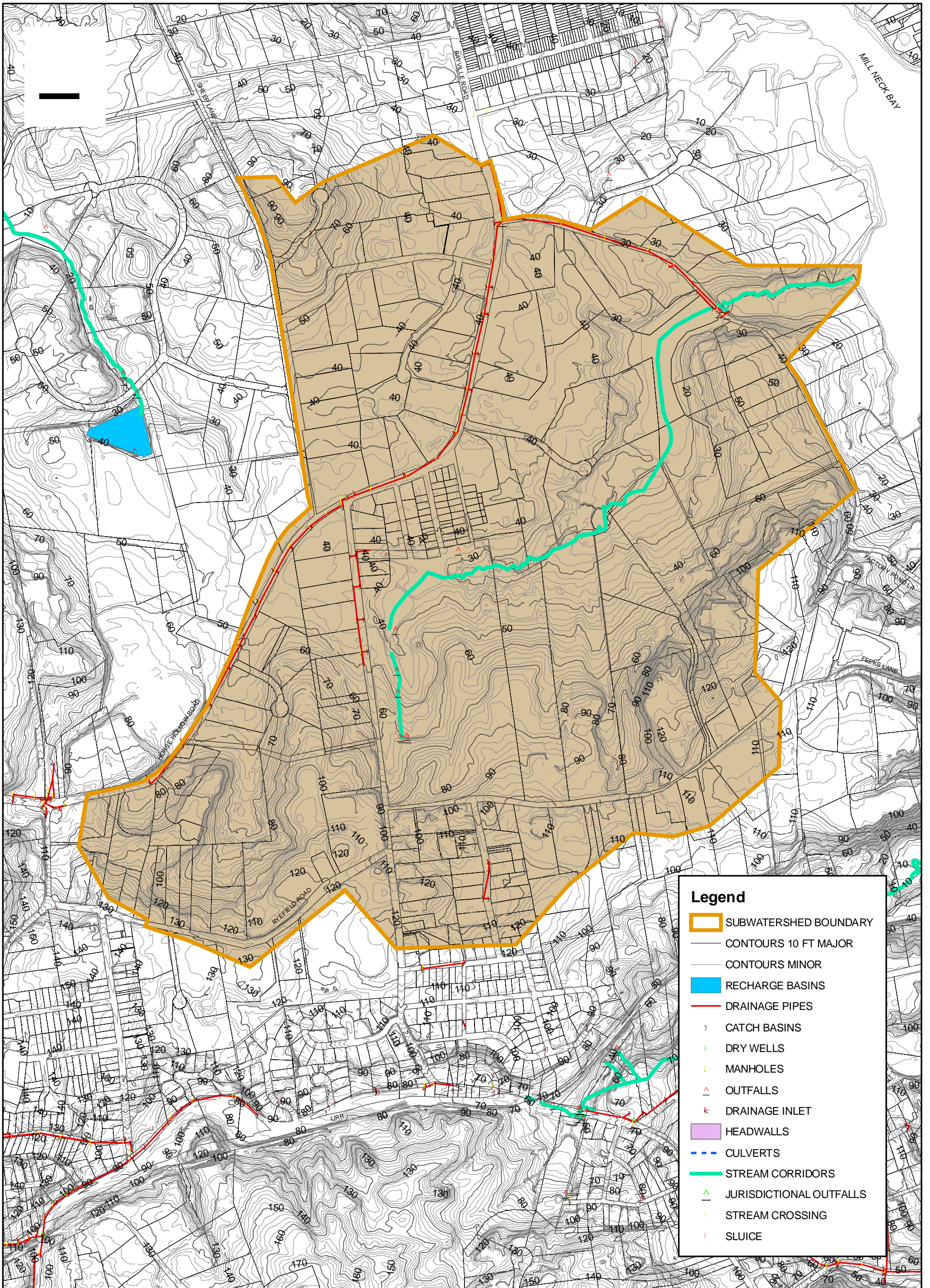


SOURCE: NCGIS AND CASHIN ASSOC. P.C.

**MAP 2-1**  
**NASSAU COUNTY STORMWATER**  
**MANAGEMENT PROGRAM**  
**STORMWATER RUNOFF IMPACT ANALYSIS**  
**DRAINAGE INFRASTRUCTURE**  
**BAILEY ARBORETUM SUBWATERSHED**

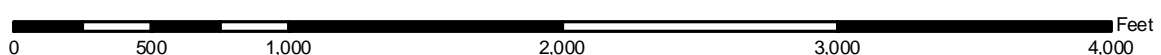




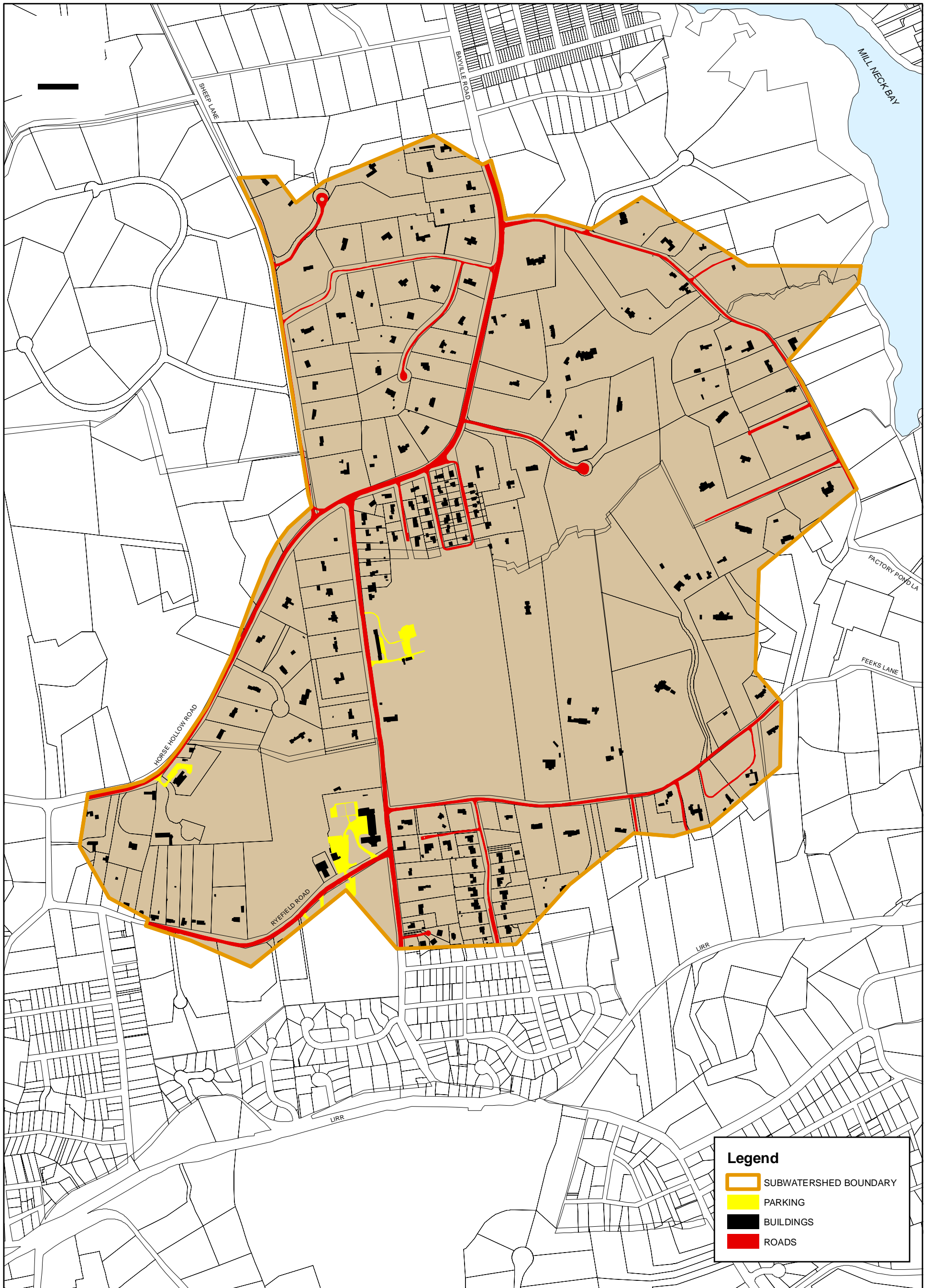


SOURCE: NCGIS AND CASHIN ASSOC. P.C.

MAP 2-2  
 NASSAU COUNTY STORMWATER  
 MANAGEMENT PROGRAM  
 STORMWATER RUNOFF IMPACT ANALYSIS  
 CONTOURS  
 BAILEY ARBORETUM SUBWATERSHED

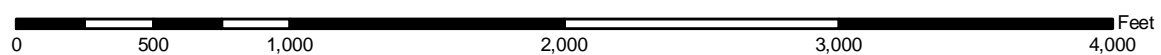




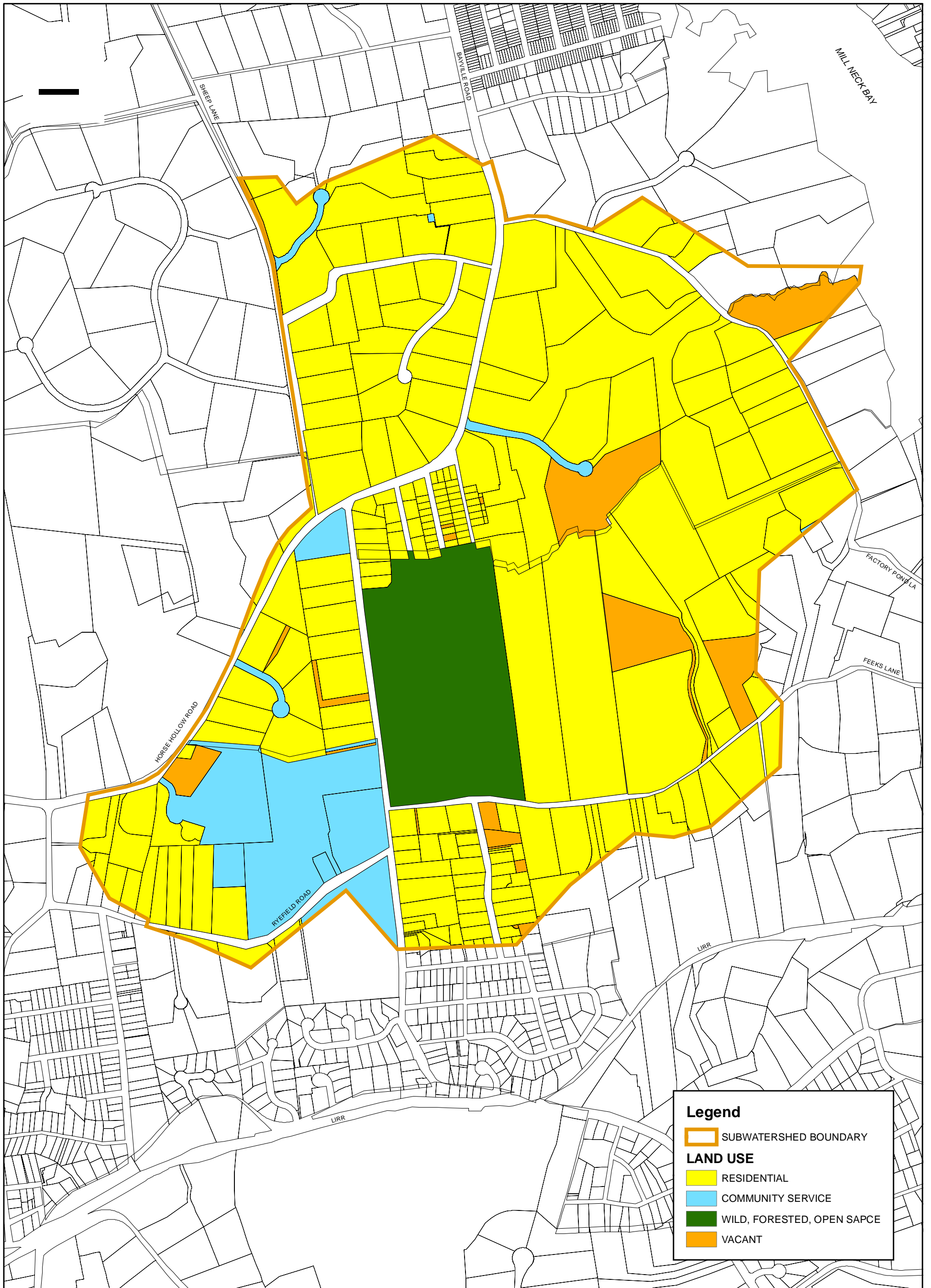


SOURCE: NCGIS AND CASHIN ASSOC. P.C.

MAP 2-3  
 NASSAU COUNTY STORMWATER  
 MANAGEMENT PROGRAM  
 STORMWATER RUNOFF IMPACT ANALYSIS  
 IMPERVIOUS AREAS  
 BAILEY ARBORETUM SUBWATERSHED





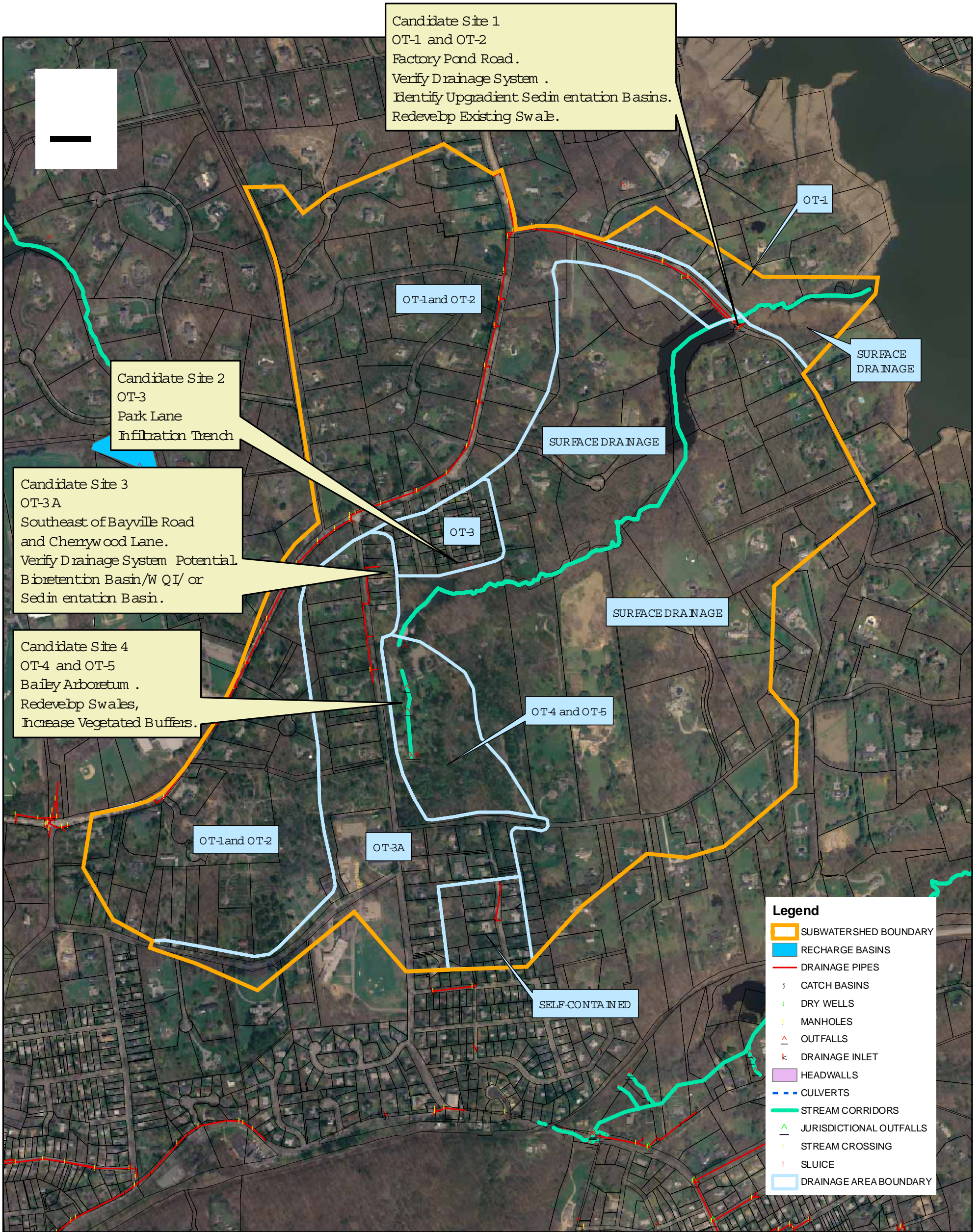


SOURCE: NCGIS AND CASHIN ASSOC. P.C.

**MAP 2-4**  
**NASSAU COUNTY STORMWATER**  
**MANAGEMENT PROGRAM**  
**STORMWATER RUNOFF IMPACT ANALYSIS**  
**LANDUSE**  
**BAILEY ARBORETUM SUBWATERSHED**

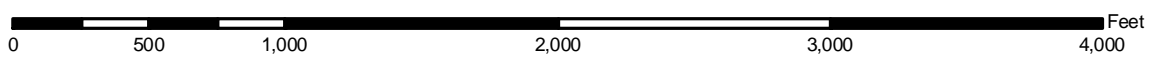
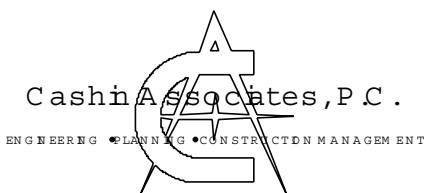
0      500      1,000      2,000      3,000      4,000 Feet





SOURCE: NCGIS AND CASHIN ASSOC. P.C.

**MAP 3-1**  
**NASSAU COUNTY STORMWATER**  
**MANAGEMENT PROGRAM**  
**STORMWATER RUNOFF IMPACT ANALYSIS**  
**SMP CANDIDATE SITE MAP**  
**BAILEY ARBORETUM SUBWATERSHED**







# **Nassau County Stormwater Management Program**



## **BAILEY ARBORETUM SUBWATERSHED Stormwater Runoff Impact Analysis AND CANDIDATE SITE ASSESSMENT REPORT**

### **Appendix a - FIELD DATA**



**CASHIN ASSOCIATES, P.C.**  
*Engineering • Planning • Construction Management*