D.C. DEPARTMENT OF HEALTH
Environmental Health Administration
Bureau of Environmental Quality
Water Quality Division

DISTRICT OF COLUMBIA

FINAL
TOTAL MAXIMUM DAILY LOAD

for

FECAL COLIFORM BACTERIA
in
UPPER ANACOSTIA RIVER,
LOWER ANACOSTIA RIVER,
Watts Branch, Fort Dupont Creek, Fort Chaplin Tributary, Fort Davis Tributary, Fort Stanton Tributary, Hickey Run, Nash Run, Popes Branch, Texas Avenue Tributary

June 2003

Government of the
District of Columbia
Anthony A. Williams, Mayor

DISTRICT OF COLUMBIA

FINAL
TOTAL MAXIMUM DAILY LOAD

for

FECAL COLIFORM BACTERIA
in
UPPER ANACOSTIA RIVER,
LOWER ANACOSTIA RIVER,
Watts Branch, Fort Dupont Creek, Fort Chaplin Tributary, Fort Davis Tributary, Fort Stanton Tributary, Hickey Run, Nash Run, Popes Branch, Texas Avenue Tributary

DEPARTMENT OF HEALTH
ENVIRONMENTAL HEALTH ADMINISTRATION
BUREAU OF ENVIRONMENTAL QUALITY
WATER QUALITY DIVISION

June 2003

INTRODUCTION

Section 303(d)(1)(A) of the Federal Clean Water Act (CWA) states:

> Each state shall identify those waters within its boundaries for which the effluent limitations required by section 301(b)(1)(A) and section 301(b)(1)(B) are not stringent enough to implement any water quality standards applicable to such waters. The State shall establish a priority ranking for such waters taking into account the severity of the pollution and the uses to be made of such waters.

Further section 303(d)(1)(C) states:

> Each state shall establish for the waters identified in paragraph (1)(A) of this subsection, and in accordance with the priority ranking, the total maximum daily load, for those pollutants which the Administrator identifies under section 304(a)(2) as suitable for such calculations. Such load shall be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality.

In 1998, the District of Columbia developed a list of waters that do not or are not expected to meet water quality standards as required by section 303(d)(1)(A). The list was revised in 2002. The list of water bodies contains a priority list of those waters that are the impaired. This priority listing is used to determine which of those water bodies are in critical need of immediate attention. The list, also known as the 303(d) List, is submitted to the Environmental Protection Agency every two years. For each of the listed waters, states are required to develop a Total Maximum Daily Load (TMDL) which calculates the maximum amount of a pollutant that can enter the water without violating water quality standards and allocates that load to all significant sources. Pollutants above the allocated loads must be eliminated.

This TMDL is for fecal Coliform bacteria for the Anacostia River and its tributaries. The District of Columbia's section 303(d) list divides the Anacostia into two segments. The demarcations isolate the areas not attaining the applicable standards. The Water Quality Standards for fecal bacteria do not divide the Anacostia River into segments, but specify attainment for the entire length.

In February of 1999, the District of Columbia initiated regular technical TMDL stakeholder meetings which included the Environmental Protection Agency, Region III (EPA), the DC Water and Sewer Authority (DCWASA), the Maryland Department of the Environment (MDE), representatives of the local governments, including the Prince George's and Montgomery Counties, Metropolitan Washington Council of Governments, the Interstate Commission on the Potomac River Basin (ICPRB), and citizen and environmental advocates. The group provided significant input and coordination to the DC TMDLs. In particular, the modeling elements used in the bacteria TMDL were developed in coordination with those utilized in the DC Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP). This is in keeping with the 1994 EPA national Combined Sewer Overflow (CSO) policy that required municipalities and authorities to develop and submit a Long Term Control Plan (LTCP) to reduce combined sewer overflows such that water quality standards could be met.

APPLICABLE WATER QUALITY STANDARDS

The Anacostia River and the tributaries are listed on DC's 303(d) lists because excessive counts of fecal Coliform bacteria. The District of Columbia Water Quality Standards (WQS), Title 21 of the District of Columbia Municipal Regulations (DCMR) Chapter 11, 49 D.C. Reg. 3012 and D.C. Reg.4854, specifies the categories of beneficial uses as:

1. Class A- primary contact recreation,
2. Class B- secondary contact recreation,
3. Class C- protection and propagation of fish, shellfish, and wildlife,
4. Class D- protection of human health related to consumption of fish and shellfish, and;
5. Class E- navigation.

The waters are classified on the basis of current use and designated beneficial uses as follows:

Waterbody	Current Use	Designated Use
Anacostia River	B,C,D,E	A,B,C,D,E
Anacostia River Tributaries (except as listed below)	B,C,D	A,B,C,D
Hickey Run	B,C,D	B,C,D
Watts Branch	B,C,D	B,C,D

Class A and Class B waters must achieve or exceed water quality standard for bacteria as measured by fecal Coliform as an indicator organism. While fecal Coliforms, which are microbes that live in the intestinal tracts of warm-blooded animals, are not harmful themselves, their presence indicates the potential for pathogens in the water. Water quality standards are derived from EPA recommendations based on risk levels associated with swimming.

The standard for Class A waters is a maximum 30-day geometric mean of 200 MPN/100 ml, where MPN is a statistically-derived estimate of the "Most Probably Number" of bacteria colonies in a 100 ml sample. This statistical estimate is often called a "count" although it is represented as a concentration. The geometric mean is based on no fewer than five samples within the 30-day period. The standard for Class B waters is a 30-day geometric mean of 1000 MPN/100 ml. However since all the waterbodies, except Hickey Run and Watts Branch, are designated as Class A waters, which have a more restrictive bacteria standard, the 200 MPN/100ml for Class A designation is used as the not-to-exceed criterion for all the waterbodies in this TMDL.

The following sections of the District of Columbia Water Quality Standards have some bearing on this TMDL:

1104.3 Class A waters shall be free of discharges of untreated sewage, litter and unmarked, submerged or partially submerged, man-made structures which would constitute a hazard to the users. Dry weather discharges of untreated sewage are prohibited.

1104.4 The aesthetic qualities of Class B waters shall be maintained. Construction, placement or mooring of facilities not primarily and directly water oriented is prohibited in, on, or over Class B waters unless:

(a) The facility is for the general public benefit and service, and

(b) Land based alternatives are not available.

1105.7 Mixing zones may be allowed for point source discharges of pollutants on a case by case basis, where it is demonstrated that allowing a small area impact will not adversely affect the waterbody as a whole. The following conditions shall apply:

(e) The positioning of mixing zones shall be done in a manner that provides the greatest protection to aquatic life and for the designated uses of the water;
(f) Within the estuary, the maximum cross-sectional area occupied by a mixing zone shall not exceed ten percent (10%) of the numerical value of the cross-sectional area of the waterway, and the width of the mixing zone shall not occupy more than one third (1/3) of the width of the waterway;

Current use - the use which is generally and usually met in the waterbody at the present time in spite of the numeric criteria for that use not being met sometimes.
Designated use - the use specified for the waterbody in the water quality standards whether or not it is being attained.
Existing use - the use actually attained in the waterbody on or after November 28, 1975.
Mixing zone - a limited area or a volume of water where initial dilution of a discharge takes place; and where numerical water quality criteria can be exceeded but acute toxic conditions are prevented from occurring.
Primary contact recreation - those water contact sports or activities which result in frequent whole body immersion and/or involve significant risks of ingestion of the water.
Secondary contact recreation - those water contact sports or activities which seldom result in whole body immersion and/or do not involve significant risks of ingestion of the water.

Class A and B are not existing uses for the Anacostia River. Class B is listed as a current use. Class A and B are designated uses for the Anacostia River. The mixing zone concept implies that even though some area of a water body does not attain the numerical criteria that the use is still attained or protected the water body. The definitions of Class A primary contact Recreation and Class B secondary contact recreation make clear the there is a risk level associated with recreational activities. The EPA criteria document estimated that at a geometric mean of 200 organisms per 100ml that there would be about 8 illnesses out of 1,000 swimmers at a recreation swimming beach. The use of a geometric mean recognizes that there will be occasions where individual samples will be higher than 200 organisms/100ml. Obviously, different types of Class A activities carry different risks, with swimming involving the highest risk. Activities such as windsurfing where the person spends most of the time out of the water but spends significant amounts of time in the water or being splashed with water runs a lesser risk. While in the case of scuba diving, because of increased pressure of the water at depths, may cause a higher prevalence of ear infections than other types of activities. Certain Class A activities maybe limited by factors other than disease risk. Issues such as current velocity, floods, clarity of the water and competing uses such as navigation or fishing may restrict these activities to certain areas at certain times and most certainly winter temperatures and heavy ice create limitations. The District of Columbia Water quality standards do not guarantee risk free primary contact recreation nor do they guarantee that it can occur everywhere all of the time.

BACKGROUND

The District of Columbia, like many cities in the 19th and early 20th centuries, developed a combined sewer system, which transported both rainfall and sanitary sewage away from the developed areas and discharged them into the rivers. In the 1930s, Blue Plains Wastewater Treatment Plant (WWTP) was constructed and dry weather sewage flows were transported to Blue Plains. However, wet weather flows can exceed the transmission capacity of the pump stations and piping system and result in overflows. As development expanded, sewer system construction techniques utilized two pipes so that the storm water could be kept separate from the sanitary sewage. Storm water is transported to the nearest stream channel and discharged, while the sanitary sewage is transported to Blue Plains WWTP for treatment. Approximately two third of the city is served by separate sewer systems. Although urban in nature, non-human sources of bacteria are contributing factors.

LAND USE

ANACOSTIA RIVER

The Anacostia watershed is approximately 176 square miles with the drainage area being 49% in Prince George’s County, 34% in Montgomery, and 17% in the District of Columbia. Two thirds of the basin lies within the Coastal Plain and the remaining is in the Piedmont. The head of tide for the Anacostia River is at Bladensburg, MD.

The non-tidal portion of the Anacostia River is composed of the two branches, the Northeast Branch and the Northwest Branch. For all practical purposes the tidal portion of the Anacostia River can be considered to begin at their confluence in Bladensburg, although the Northeast and Northwest Branches are tidally-influenced almost as far as the location of the USGS gages on each branch: Station 01649500 at Riverdale Road on the Northeast Branch and Station 01651000 at Queens Chapel Road on the Northwest Branch.

Land use in the Anacostia River watershed is mostly residential and forested. There are 30% park and forest lands evenly dispersed throughout the watershed, such as the National Park Service, the National Arboretum, Greenbelt Park, and Beltsville Agricultural Research Center. The industrial and manufacturing land use is largely confined to the tidal area of the basin such as Hickey Run, Lower Beaverdam Creek, and Indian Creek. These sub-watersheds contain impervious areas as high as 80%. Figure 1 shows the percent imperviousness associated with different land uses in the Anacostia Watershed.

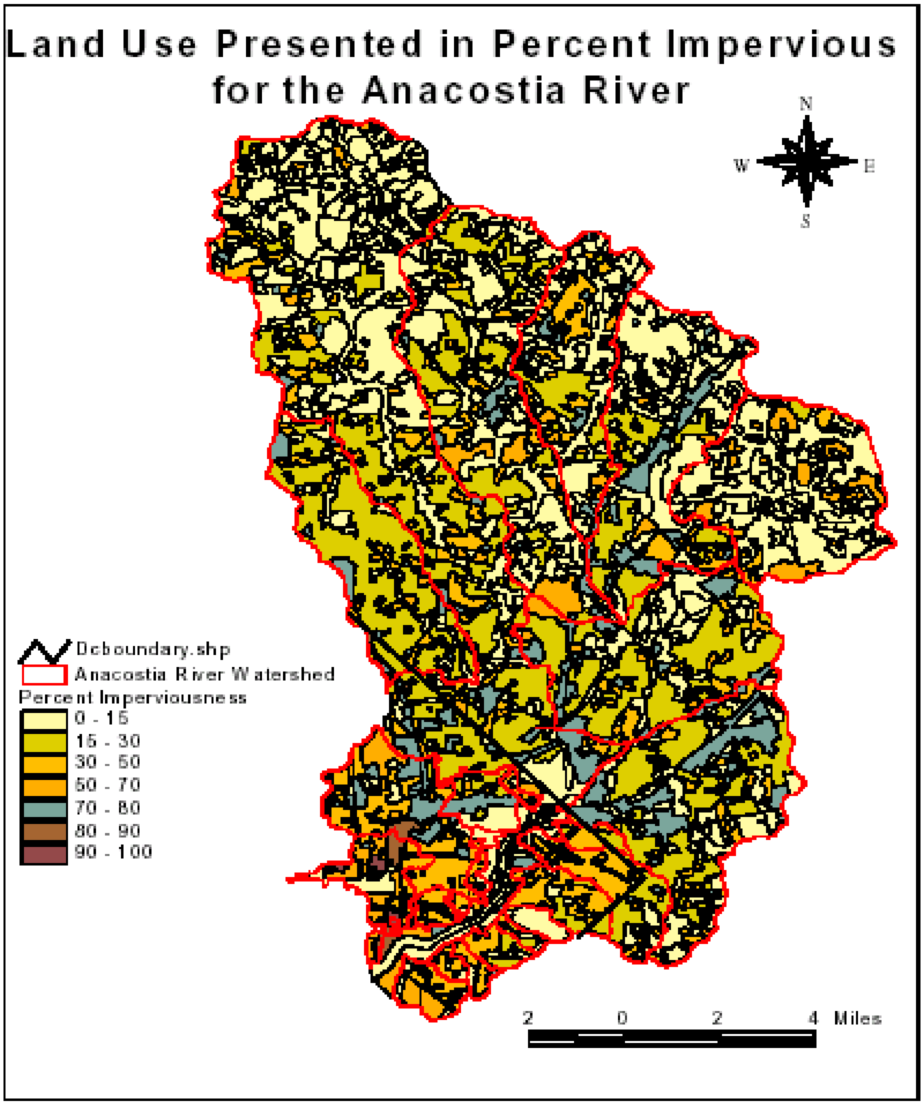


Figure 1. Anacostia River Watershed Land Use.

Anacostia River Tributaries

The watersheds of the Anacostia River tributaries are, with the exception of Watts Branch and Nash Run, within the city limits. While some are flanked by parks, the watersheds are highly urban. Characterization of the watershed for the tributaries takes into consideration both the topographic drainage and the storm water drainage which, in some cases, cover areas outside the topographic drainage. Appendix A. contains maps of the tributaries.

Fort Chaplin

Fort Chaplin Tributary originates from a 6.5 ft. storm discharge near Burns Street and Texas Avenue, Southeast and parallels Burns Street for approximately .57 miles until draining into a pipe at C Street which connects with the East Capitol Street storm drain. Originally, Fort Chaplin would have paralleled what is now Benning Road and parts of East Capitol Street, SE. The mouth of Fort Chaplin is a 21 ft. by 7.5 ft. storm drain which discharges into the Anacostia just south of the eastern foot of the East Capitol Street Bridge. Fort Chaplin's watershed is about .42 mi^2 (270 acres). About 90% of the watershed is residential and 10% is parkland. Most of the stream is buffered by 200 feet of forest on each side.

Fort Davis
Fort Davis is a first order eastern tributary of the Anacostia River. The stream is now conducted by storm drains from Pennsylvania and Carpenter Street SE to a confluent discharge of several storm drains about 2,000 ft. upstream of the Sousa Bridge. The entire watershed measures about .11 mi^2 (70 acres) but about 15% of its watershed is drained away independently of the stream by storm drains. Approximately half of the watershed is forested National Parkland with the other half existing as urban residential and including an elementary school.

Fort Dupont
The stream's watershed measures about 0.64 mi^2 (410 acres) of which approximately 90% falls within Fort Dupont Park. Much of the stream is buffered on both sides throughout its length by forested parkland. Several portions of the lower stream main stem have narrow riparian buffer zones, encroached upon by the remnant greens. The primary headwater stream receives impervious runoff from the adjacent neighborhood outside of the park. Other impervious areas within the park are roads and parking lots serving the community center and park maintenance yard.

Fort Stanton
Fort Stanton's watershed measures approximately .28 mi^2 (180 acres). Roughly half of the watershed is National Park Service parkland with the remaining land existing as residential and commercial property.

Hickey Run
Hickey Run is a western tributary of the Anacostia, which discharges into the river just north of Kingman Lake, near the southern border of the National Arboretum. The mouth of the stream is a broad tidally influenced area. The head water of Hickey Run daylights near Queen Chapel Road and Lawrence and runs into a square culvert for approximately 3000 feet to daylight again

below the historic brick kilns at New York Avenue NE from an 11' x 11'culvert. The watershed is 2 mi^2 (1300 acres). About 20% of the watershed is forest or managed parkland administered by the U.S. Department of the Interior, National Arboretum. The remainder upper reaches of the watershed is residential, commercial and industrial, including easements for railroad as well as a large bus parking and maintenance yard.

Nash Run

Nash Run has been heavily altered as it lies within the developed. The Nash Run watershed measures approximately 0.7 mi^2 (460 acres), with approximately two-thirds of the watershed in the District of Columbia. The remainder of the watershed is in Deanwood Park, Prince George's County, Maryland. All but 5% of the watershed is urban residential and commercial property drained by storm drains.

Popes Branch

The Popes Branch watershed is 0.33 mi^2 (210 acres) and includes Popes Branch Park, a forested section 1.4 miles long and about 400' wide, and all of Fort Davis. The watershed is approximately 15% forested parkland; the remaining 95% is residential and light commercial property.

Texas Avenue Tributary

The Texas Avenue Tributary is a small first order stream segment remotely connected to the Anacostia River by a network of storm water pipes. The watershed of Texas Avenue Tributary measures 0.17 mi^2 (110 acres) and is about 40% forested parkland and 60% residential and light commercial property.

Watts Branch

Watts Branch is the largest tributary to the Anacostia River in the District of Columbia. Originating Prince George's County, Maryland, Watts Branch travels for four miles to its mouth on the eastern side of the Anacostia. The watershed measures 3.53 mi^2 (2,300 acres). Approximately 80% of the watershed exists as urban residential and commercial property. Less than 15% is forested, mainly along the parkside riparian stream corridor. Approximately 5% is light industrial property.

STREAM FLOW

Anacostia River

The Anacostia River is mostly an embayment of the Potomac River, with very low flow rates compared to the Potomac. Because of the low flows and tidal influence, travel times through the River can exceed 30 days exhibiting poor flushing rates. Flow in many segments of the tidal of the river can move either upstream or downstream, depending on tidal conditions. In the downstream portions of the river, hydrodynamics are dominated by the direction and magnitude of the tidal surge. The mean annual stream flow for the Anacostia, as measured at the upstream flow gages, is 139 cubic feet per second.

Anacostia River Tributaries

Stream flows in the tributaries are comparatively low. A number of storm water outfalls discharge to the streams increasing the flows by several fold during rainfall. Estimated base flow for the tributaries is shown in the table below.

Anacostia River Tributaries Streamflow

Anacostia River Tributaries	Estimated Flow (cfs)
Fort Davis Tributary	0.10
Fort Dupont	0.70
Fort Chaplin	0.19
Fort Stanton Tributary	0.05
Hickey Run	8.00
Nash Run	2.00
Popes Branch	0.24
Texas Ave. Trib.	0.75
Watts Branch	5.00

Flow Record Used

Because of the episodic nature of rainfall and storm sewer runoff, developing a daily load is not an effective means of determining the assimilative capacity of the receiving waters. Rather, looking at total loads over a range of conditions is a more relevant way to determine the maximum allowable loads. A statistical analysis of fifty year rainfall record was conducted and a dry year, a wet year, and an average rainfall year, were identified based on total annual rainfall. The consecutive years of 1988, 1989, and 1990, represent a relatively wet year, a relatively dry year, and an average precipitation year, respectively. These three years were considered the period of record for determining compliance with the water quality standards. Compliance with the water quality standards was based on the frequency of violations as calculated by the simulation model for these three years.

WATER QUALITY STANDARDS

The Anacostia has several designated uses as detailed in DC's Water Quality Standards (WQS). Class A waters have an associated maximum 30-day geometric mean for fecal Coliform of 200 MPN/100 ml based on a minimum of 5 measurements. The MPN is the statistical estimate of the number of Coliform colonies likely to be found in a 100 ml sample. These measurements are often referred to as 'counts'. The purpose of this TMDL is to determine the limit to which fecal Coliform counts must be reduced to achieve and maintain the WQS for bacteria. The criteria must be achieved for all flow conditions. Since fecal Coliform are not measured in traditional concentrations (mass/volume), the TMDL is not a true maximum load, but rather a statistical estimate of the most probable number of Coliform colonies that can be assimilated into the receiving waters without violating the WQS. Computationally, however, this parameter can be represented like a traditional pollutant and so for this TMDL it will be referred as a fecal Coliform load.

SOURCE ASSESSMENT

The sources of fecal Coliform are ubiquitous. Any means by which fecal matter can be transported to the receiving waters are a potential source. These sources include combined sewer overflows (CSOs); separate sanitary sewer overflows (SSOs), which can result from leaky or undersized sanitary sewer pipes; stormwater runoff, which includes overland flow and flow conveyed through storm sewer pipes, and direct deposits of feces into the water from wildlife sources. A bacteria source tracking study is currently being conducted to help identify these sources, however since the water quality standards do not differentiate between sources, these TMDLs do not address sources directly.

Within the District of Columbia, there are three different networks for conveying flows. Originally, a combined sewer system was installed which collected sanitary waste and storm water and transported the sanitary flow to the wastewater treatment plant. When storm water caused the combined flow to exceed the pipe capacity leading to the treatment plant, the excess flow is discharged, untreated, through the combined sewer overflow to the river. Approximately one third of the District of Columbia is served by a combined sewer system.

Separate sanitary pipes for wastewater and storm sewer pipes for storm runoff serve the remaining two thirds of the District. A separate sanitary sewer line should have no storm water inlets to the system and it flows directly to the wastewater treatment facility. Even though sanitary pipes are only intended to carry wastewater flow, they are influence by rainfall. Infiltration and inflow of stormwater into sanitary pipes has the potential to cause surcharging and overflows. These overflows can reach the storm sewer system or the receiving waters directly. For this TMDL, sanitary sewer overflows were not modeled explicitly, as it was assumed that any bacteria from a routine SSO would be represented by the quality of the storm water.

Storm water drains collect storm water from the streets and parking lots and are discharged to the rivers. I n general, the primary sources of bacteria to the storm water are wildlife and pets. Storm sewer pipes should have no sanitary sewer laterals entering the system. However, as in many old cities, illicit and cross connections do exist and can be a significant source of bacterial contamination to the waterways. For this TMDL, illicit connections were not modeled explicitly.

Point Sources

The point sources considered here are CSOs. There are 17 CSOs outfalls located on the Anacostia River. According to the DC WASA, approximately 2.1 billion gallons per year total CSO flow to the Anacostia River (CSO Long Term Control Plan, July 2002). There are no CSO outfalls on the Anacostia tributaries.

Nonpoint Sources

Storm sewer flow to the Anacostia and its tributaries is considered part of the nonpoint source load. Separate storm water outfalls discharge to all the waterbodies. The watershed are highly urbanized and served by storm water sewers and there is a combination of Nonpoint source storm water runoff and point source storm water.

Direct runoff occurs along the Anacostia River and streams. Large parklands flanking the River and not serviced by storm water sewers are accounted under the Nonpoint source category. Additionally, because there is no ability to separate out the sewered loads, it is included in the nonpoint source.

Upstream Sources

The District of Columbia only represents 17% of the Anacostia River watershed area. Therefore this report refers to pollution entering the District of Columbia from the remaining 83% area in Maryland as being an upstream Maryland source. Although the District of Columbia contains the only CSO system in the watershed, water quality analyses indicated that storm sewer loads are a significant source of fecal Coliform. As a result, upstream sources can contribute significantly to the bacteria problem in the District of Columbia waters.

ANALYTICAL APPROACH

The framework for this TMDL was established through a rigorous discussion by stakeholders on all aspects of the watershed processes and interpretation of the loadings and receiving water responses to those loadings. The modeling approach applied included two components. The models used to generate loads from the drainage basin, convey them through drainage systems, and then predict their contribution to the receiving waters were formulated as part of the CSO LTCP. The model used to simulate the hydrology and hydraulics of the CSO and the storm sewer collection systems to generate loads from these sources is a significant refinement to the analytical approach of this TMDL. The in-stream processes were simulated by an upgraded Anacostia Tidal Model (TAM).

Land Model

The combined sewer and storm sewer systems were simulated using a dynamic model called MOUSE. The model was developed by the DC Water and Sewer Authority as part of the CSO Long Term Control Plan (LTCP). The MOUSE model has the ability to generate rainfall runoff based on hydrologic input parameters of the drainage basin, and route this runoff through a collection system. The MOUSE model has the ability to simulate the complex hydraulics found in a combined sewer system, including backflow from surcharging conditions and flow splitting. The model was calibrated and verified using data collected for the LTCP between October 1999 and June 2000.

Anacostia Model

The Anacostia River was simulated using an upgrade to the Tidal Anacostia Model (TAM) originally developed by MWCOG in the late 1980s and the EPA’s Water Quality Analysis Simulation Program (WASP). The Interstate Commission on the Potomac River Basin (ICPRB) developed this hybrid model for the District of Columbia TMDLs. The TAM/WASP model uses the hydrodynamic elements of the TAM model and the water quality elements of the WASP model to simulate the fate and transport of the bacteria once they reach the tidal portion of the River. The model simulates conditions as far upstream as the head of tide at Bladensburg.

The upstream boundary of the Anacostia model is represented by the 3-year forecast period. The daily flow records were screened using rainfall records and analysis of flow patterns to identify baseflow and stormflow conditions in the river. Then daily loads of bacteria are calculated by multiplying the daily flow rate times the estimated concentration of fecal Coliform for dry weather or wet weather conditions. The downstream boundary for the Anacostia model is the three-year time series of flows and concentrations generated by the Potomac River model, also developed as part of the LTCP.

Anacostia River Tributaries

The DC Small Tributaries TMDL Model is a simple mass balance model which predicts water column concentrations of fecal coliform in the tributaries. The model, developed by the Interstate Commission for the Potomac River (ICPRB), predicts daily concentrations of fecal coliform. The simulation is carried out for a three-year time period using the most recent monitoring data to estimate base flow and storm flow concentrations and using ICPRB's Watts Branch HSPF model output to estimate storm and base flows. The Watts Branch HSPF model uses hydrologic inputs from the three-year period of record, 1988, 1989, and 1990.

TOTAL EXISTING LOADS

The loads for the most probable number of colonies of Fecal Coliform, are calculated for various sources by multiplying the event mean concentration by the modeled volume over the period of analysis. The event mean concentration is used as a representative storm water concentration while the actual bacteria count varies from storm to storm. The average loads are broken down by sources; upstream sources representing the in-stream and watershed loads delivered at the District of Columbia boundaries; direct runoff, separate storm sewers, and CSO representing the DC portion of the loads from lateral flow, separate storm sewers and combined sewer overflows, respectively. The total loads for the Anacostia and tributaries are shown below.

Anacostia River Existing Average Annual Loads

Source	Fecal Coliform	
	(MPN/100ml)	% of Total
Upstream	1.04×10^{16}	17 %
Direct Storm Runoff	5.13×10^{14}	1 %
Tributary Storm Water	5.21×10^{15}	9 %
CSO	4.38×10^{16}	73 %
Total	6.00×10^{16}	100 %

Anacostia River Tributaries Loads

Fort Chaplin	Fort Davis	Fort Dupont	Fort Stanton	Hickey run
$3.38x10^{07}$	$1.78x10^{07}$	$5.81x10^{07}$	$2.54\ x10^{07}$	$1.79x10^{08}$

Anacostia River Tributaries Loads (cont'd)

Nash R(DC)	Nash R(MD)	Popes Branch	Texas Ave Trib	Watts Br. (DC)	Watts Br. (MD)
$3.42x10^{07}$	$2.1x10^{07}$	$3.80\ x10^{07}$	$3.25\ x10^{07}$	$1.67\ x10^{08}$	$1.88\ x10^{08}$

TOTAL MAXIMUM DAILY LOAD AND ALLOCATION

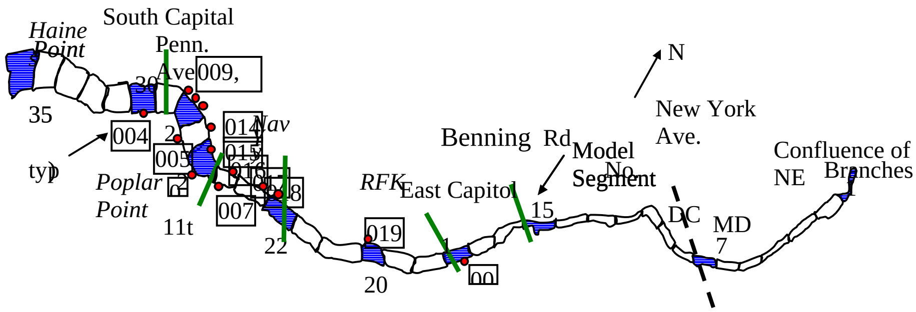
Overview

The first Section summarizes the scenarios that were explored using the models. The assessment investigates water quality responses assuming different loading conditions. Subsequent sections present the modeling results, and allocate the TMDL between point sources and nonpoint sources. The rationale for the margin of safety and a remaining future allocation is also presented below.

Scenarios

To set the TMDL, a series of computer simulations were run to determine the amount of reduction of loads that would be needed to meet water quality standards. Water Quality Standards are considered to be met if no model segment within the District of Columbia had a maximum 30 day geometric mean exceeding the 200 MPN/100 ml Class A, standard. Exceedance is expressed in the number of months exceeding the geometric mean.

The simulation scenarios consist of model runs made for prescribed percent reduction for each of the four upstream, lateral, CSO, and storm water sources. A large number of scenarios for a combination of reduction can be constructed and analyzed. For this TMDL, the models were run over a range of reductions in the storm water given a number of CSO scenarios. Two sample scenarios are presented in this report. The geometric mean was calculated for each of the 36 calendar months in the three-year scenario. Sensitivity runs were conducted based on a rolling 30-day geometric mean, rather than the calendar month. The location of the segments and the number of months WQS was exceeded at selected segments is summarized in the Tables below. Figures showing the results for each month are included in Appendix B.



Anacostia River Segment Locations

Scenario 1 – Only one CSO event in three years, 50% Reduction in Storm Water and Upstream Sources

Number of Months Exceeding WQS

	Model Segment					
Criteria	35	28	25	20	7	1
No. of Months Geomean > 200/100ml	0	0	4	7	11	12
No. of Months Geomean > 1000/100ml	0	0	0	0	2	3

Scenario 2 - Only one CSO event in three years, 75% Reduction in Storm Water and Upstream Sources

Number of Months Exceeding WQS

	Model Segment					
Criteria	35	28	25	20	7	1
No. of Months Geomean > 200/100ml	0	0	0	4	8	9
No. of Months Geomean > 1000/100ml	0	0	0	0	0	0

ALLOCATIONS, REDUCTIONS, MARGIN OF SAFETY, AND THE TMDL

The total allowable load of fecal Coliform reflects the reduction needed to meet the 30-day geometric mean during the three-year (1988, 1989 and 1990) period of analysis. For this TMDL analysis, the parameters to meet water quality standards were the upstream loads, stormwater loads and combined sewer flows. Storm sewer loads were based on the universal reductions from all stormwater sources to meet water quality standards. This TMDL used the rolling-geometric mean to determine compliance. The TMDL was allocated between the waste load allocation (WLA) for the point source contribution, the load allocation (LA) for the nonpoint sources, and an explicit margin of safety (MOS) to further account for uncertainties in the analysis.

Selected Allocation Scenario

The selected allocation scenario meets the District of Columbia Water Quality Standards of 200MPN/100ml for Class A waters. Under the simulation scenario for load allocation, the number of months where the maximum 30 day geometric mean exceeds 200 MPN/100ml must be zero. The results of the selected scenario run are shown below.

Scenario 3 – Allocation Run - Number of Months Exceeding WQS

Criteria	Model Segment					
	35	28	25	20	7	1
No. of Months Geomean > 200/100ml	0	0	0	0	0	0
No. of Months Geomean > 1000/100ml	0	0	0	0	0	0

In selecting the allocation scenario, the number of days that fecal coliform count of 400 MPN/100ml is exceeded was considered. In examining several scenario runs, it is noted that exceedances in the Maryland portion (segments 1-7) bear significantly on the exceedances in the upper segments of the Anacostia River within the District of Columbia. This fact is reflected in the allocation scenario. It was also noted that the highest number of exceedances in the month of May coincides with a storm event exceeding any that occurred during the three year period of analysis and the influence of upstream sources. The table below shows the number of days that fecal coliform count of 400 MPN/100ml is exceeded for the selected allocation scenario.

Number of Days Exceeding 400 MPN/100ml

	FECAL COLIFORM # of days >400 MPN/100ml									
Month	Segment No.									
	35	30	28	25	22	20	17	15	7	1
1	0	0	0	0	1	2	3	3	4	4
2	0	0	0	0	0	1	2	3	3	5
3	0	0	0	0	1	1	2	3	4	4
4	0	0	0	0	0	1	2	3	4	4
5	1	2	1	1	1	2	4	5	6	7
6	0	1	1	1	1	1	3	2	3	3
7	1	2	2	2	3	2	3	3	3	4
8	1	1	1	1	1	1	1	1	1	4
9	0	1	1	1	1	1	1	2	2	4
10	1	1	1	1	1	1	3	3	3	3
11	0	2	1	2	3	3	3	3	3	4
12	0	0	0	1	1	2	2	2	3	3
Total	4	10	8	10	14	18	29	33	39	50
% Year	1%	3%	2%	3%	4%	5%	8%	9%	10%	13%

Wasteload Allocation

Combined Sewer Overflows are the only point sources. CSO outfalls occur between model segments 17 and 30 on the Anacostia River and do not discharge to the tributaries. In selecting the allocation scenario, the number of days exceeding the 400 MPN/100ml count within the segments and potential upstream influences were considered. The following load allocation is made for CSOs:

Average Annual Wasteload Allocated to CSO

To Water body	Total Current Load (MPN)	Allocated Load (MPN)	% Reduction
Anacostia River	4.38×10^{16}	1.94×10^{15}	95

Anacostia River Tributaries Load Allocation

Tributary Name	Existing Load (MPN)	Allocation (MPN)	% Reduction
Fort Stanton	2.54E+07	3.81E+06	85
Fort Davis	1.78E+07	2.84E+06	84
Fort Dupont	5.81E+07	8.72E+06	85
Fort Chaplin	3.39E+07	4.74E+06	86
Hickey Run	1.79E+08	2.51E+07	86
Nash Run	5.52E+07	8.28E+06	85
Popes Br	3.80E+07	6.08E+06	84

Texas Ave Trib	3.25E+07	4.88E+06	85
Watts Br	3.56E+08	4.98E+07	86

Load Allocation

The total allocation for non point storm water sources for all the waters established for this TMDL are as shown below:

Anacostia River Load Allocation

	Total Current Load (MPN)	Allocation (MPN)	% Reduction
Upstream	$1.04x10^{16}$	$3.48x10^{14}$	97
Direct Storm Runoff	$5.13x\ 10^{14}$	$1.71x\ 10^{13}$	97
Tributary Storm Water	$5.21x\ 10^{15}$	$5.21x\ 10^{14}$	90

Other Sources and Reserve
The allocation of fecal Coliform to boats, ships, houseboats, and floating residences is zero. The allocation of fecal Coliform to reserve is zero.

Margin of Safety

The reductions made for the Anacostia River are 95% and 97% for CSO and storm water runoff, respectively. However the tributaries only require 84 to 86% reduction. As a margin of safety the loads to all tributaries (hence the load to the Anacostia) will be reduced by 90%.

Beneficial Use

The allocation will achieve the District of Columbia's water quality Standards for Class A-Primary Contact recreation and Class B Secondary contact recreation.

The DC Water Quality Standards Section 1104.3 provides narrative criteria Class A use. These narrative criteria were developed by the District of Columbia and are not commonly in use in the other states. The TMDL requires a 95 % reduction of CSOs to the Anacostia River. Analysis of the computer simulations indicates that the remaining CSOs have only localized impacts upon the Anacostia River. The LTCP, page 14-9 deals with the degree of treatment provided. 98% of the time the Anacostia River will be free from overflows. There is a total capture of the first flush loads containing the most concentrated combined sewage. There is to be a screening of floatables and large solids prior to discharge. The Department of Health interprets the remaining CSO discharges to be "partially treated sewage." The Department of Health does not advocate swimming nor complete, prolonged immersion in the discharge plume or mixing zone or near vicinity of any point source discharge whether sewage or industrial pollutant. Some Class A uses may occur which have a lower risk. However, the fact that for a few areas for a few days of the year the risk will be higher than other days and other areas does not negate the attainment of the designated use of the waterbody. This variation in risk is implicit in the criteria adoption as a regulation of the District of Columbia. Installation of signs and warning lights concerning CSOs will further guide users in managing and reducing risks. The majority of the high risk days are caused by storm flows propagation into the District waters from Maryland.

Implementation

On May 10, 1999, Mayor Williams signed a new Anacostia Watershed Restoration Agreement with Maryland, Prince George's County, Montgomery County, and U.S. EPA to increase efforts to improve water quality. The Agreement has six major goals. The first one pertains to this TMDL:

> Goal #1: dramatically reduce pollutant loads, such as sediment, toxics, CSOs, other nonpoint inputs and trash, delivered to the tidal river and its tributaries to meet water quality standards and goals.

On June 28, 2000, Mayor Williams, Governor Glendening, U.S. EPA and others signed the new Chesapeake Bay Agreement, which states:

> By 2010, the District of Columbia, working with its watershed partners, will reduce pollution loads to the Anacostia River in order to eliminate public health concerns and achieve the living resources, water quality, and habitat goals of this and past agreements.

Thus, an agreement is in place that clearly demonstrates a commitment to the restoration of the river by the year 2010. This establishes a completion date for implementation of those activities necessary to achieve the load reductions allocated in this TMDL.

Source Control Plan

Upstream Target Load Reductions for Maryland

Maryland has committed to a 40% nitrogen and phosphorus reduction in the Bay Agreement and has developed tributary strategies that will achieve that reduction. Both Prince Georges and Montgomery Counties have aggressive and effective stormwater management programs.

CSO Load Reductions

The DC WASA is currently engaged in the implementation of the following CSO reduction programs.

1. Nine Minimum Controls Plan.
2. East side interceptor cleaning to remove sedimentation and restore transmission capacity.
3. Pump station rehabilitation to increase transmission capacity to the treatment plant.
4. Inflatable dam rehabilitation to restore the dam's ability to hold sewage inside the pipe, hence reduce overflows.
5. Swirl concentrator rehabilitation and performance enhancements to improve treatment.

In addition to the above, the Dc WASA has proposed storage system in the Final CSO LTCP to reduce CSOs.

Storm Water Load Reductions

The DC Department of Health issued the Nonpoint Source Management Plan II in June, 2000. The plan contains descriptions of the current programs and activities that are performed by DC Government to reduce nonpoint source pollution.

Major currently operating programs in DC which reduce loads are as follows:

1. Street sweeping programs by the Department of Public Works.
2. Requirements for storm water treatment on all new development and earth disturbing activities such as road construction.
3. Regulatory programs restricting illegal discharges to storm sewers
4. RFK BMPs- The goal of this project is to install stormwater management facilities at the end of two stormwater outfalls. The outfalls are located along the RFK Stadium parking lot. The purpose of these facilities will be to filter pollutants from the stormwater before the water is discharged into the Anacostia River.
5. Fort Dupont-The goal of this project is to restore habitat in and the flow conditions of the Fort Dupont stream. The project is being conducted in phases. The initial phase was funded by the US Geological Service and reviewed by the National Park Service. This phase included a study of the physical, chemical, and biological conditions and a preliminary design for reducing stormwater flows into Fort Dupont. A stormwater management facility will be constructed to remove sediment, oil and grease, and other street runoff pollutants as well as stem stormwater flows causing erosion in Fort Dupont creek. The second phase will restore in stream habitat and determine additional methods for managing stormwater within Fort Dupont Park and will be cost shared with and implemented by the USACE. These efforts should provide some benefit to bacteria reductions, though the extent is likely small.
6. Fort Chaplin-The goal of this project is to completely restore the Fort Chaplin tributary by stabilizing the stream banks and reducing amount of sediment entering the stream and the Anacostia. This project is also examining the possibility of reforming the stream to better accommodate stormwater flows. This project will be implemented after the restoration of Fort Dupont. The USACE is currently conducting a feasibility study of the stream to determine design options. These efforts should provide some benefit to bacteria reductions, though the extent is likely small.
7. Popes Branch-The goal of this project is to restore habitat and improve water quality in the lower Anacostia Park. Restoration efforts will include planting of native trees, restoring tidal and non-tidal wetlands, and opening a portion of Popes Branch that is currently piped under the Park. The US Army Corps of Engineers Aquatic Restoration program is currently designing this project. Design and implementation is cost shared: 65% federal, 35% District. As part of this project, the District has funded a study of Popes Branch to determine restoration options within the watershed. These efforts should provide some benefit to bacteria reductions, though the extent is likely small.
8. Hickey Run- The objective of this project is to improve water quality and habitat conditions of Hickey Run. Improvements include installation of a stormwater management facility where Hickey Run enters the National Arboretum. This facility will filter pollutants such as oil and grease originating from industrial areas north of New York Avenue. Funding has

been transferred to the Arboretum for this facility. This project will also rebuild channelized portions of the stream to a more natural flow pattern to better control sediments and protect fish and other wildlife. Partners on this project include US National Arboretum and USEPA, Chesapeake Bay program. This program should provide bacteria reduction benefits.

9. Environmental education and citizen outreach programs to reduce pollution causing activities.
10. DC WASA has launched a citywide Sanitary Sewer System Investigation. The activities under this program will eliminate infiltration of sanitary sewer to the storm water system.

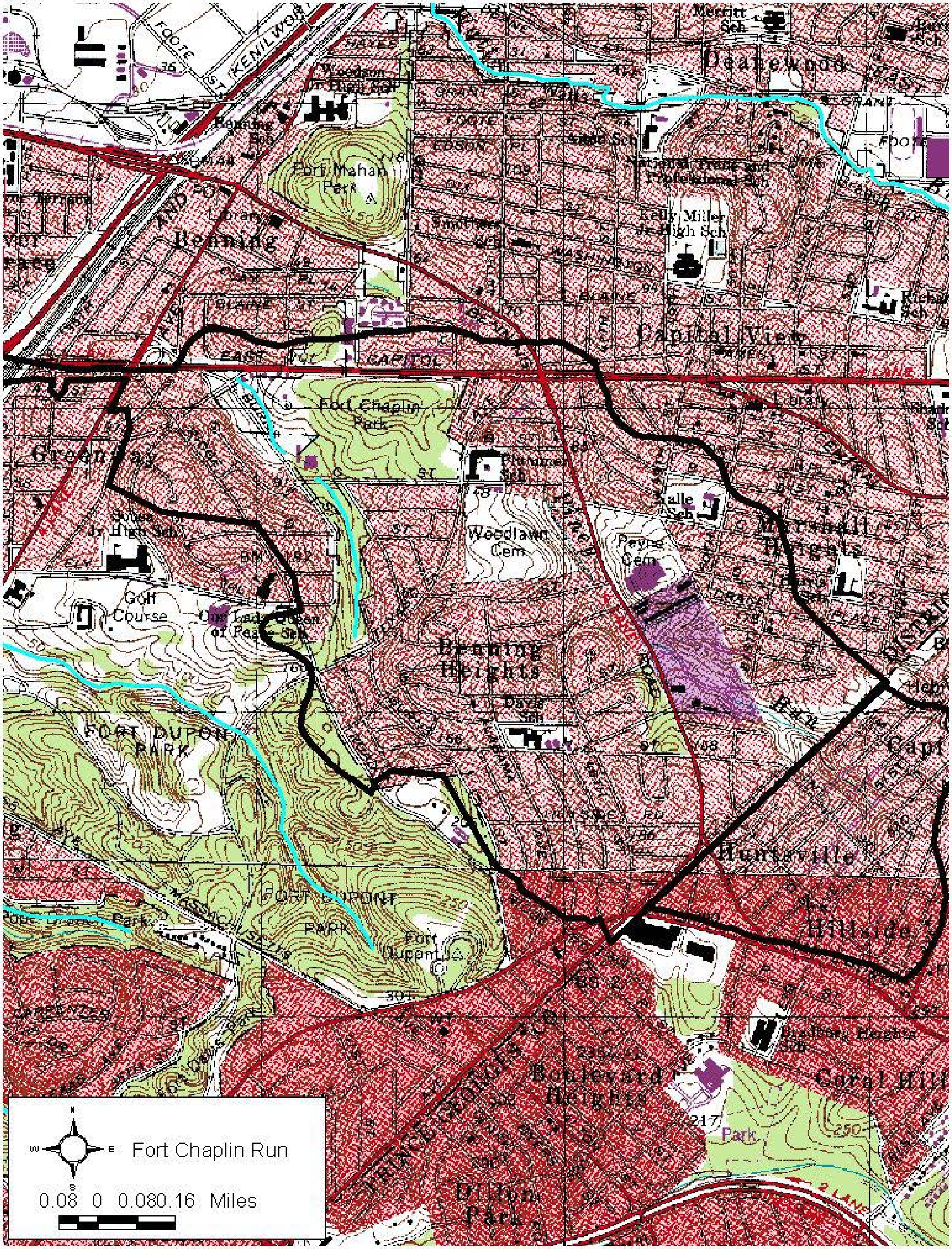
Boat Discharges

The Anacostia and Potomac Rivers have been allocated a Zero Discharge from watercraft in this document. In the Chesapeake Bay 2000 Agreement, which was signed by the signatory states, the District of Columbia, and US EPA, has a provision that by 2003 there will be no discharge of human waste from any boats. These wastes contribute bacteria to the water column. DOH has funded pump out stations at every marina in the Anacostia River.

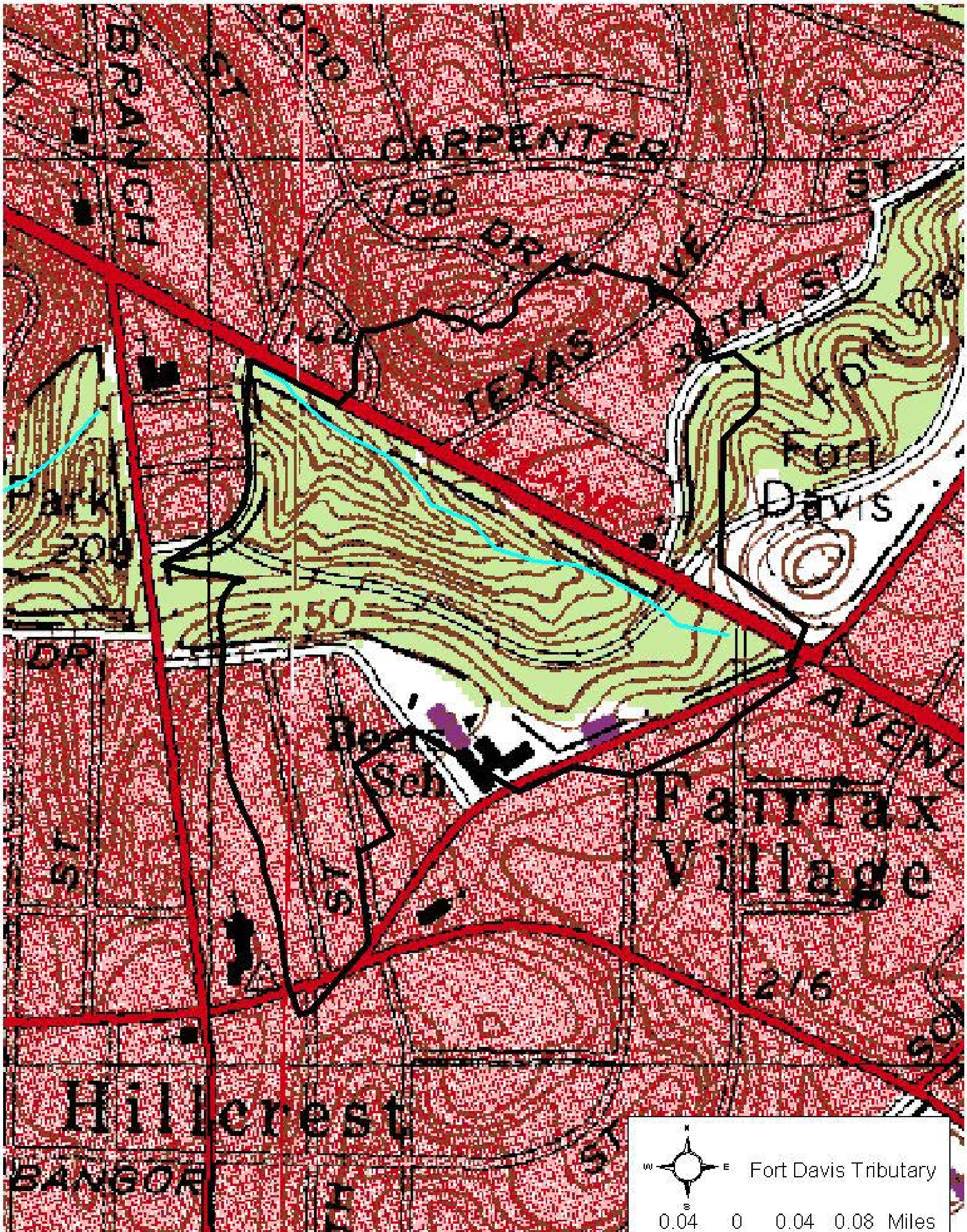
Monitoring

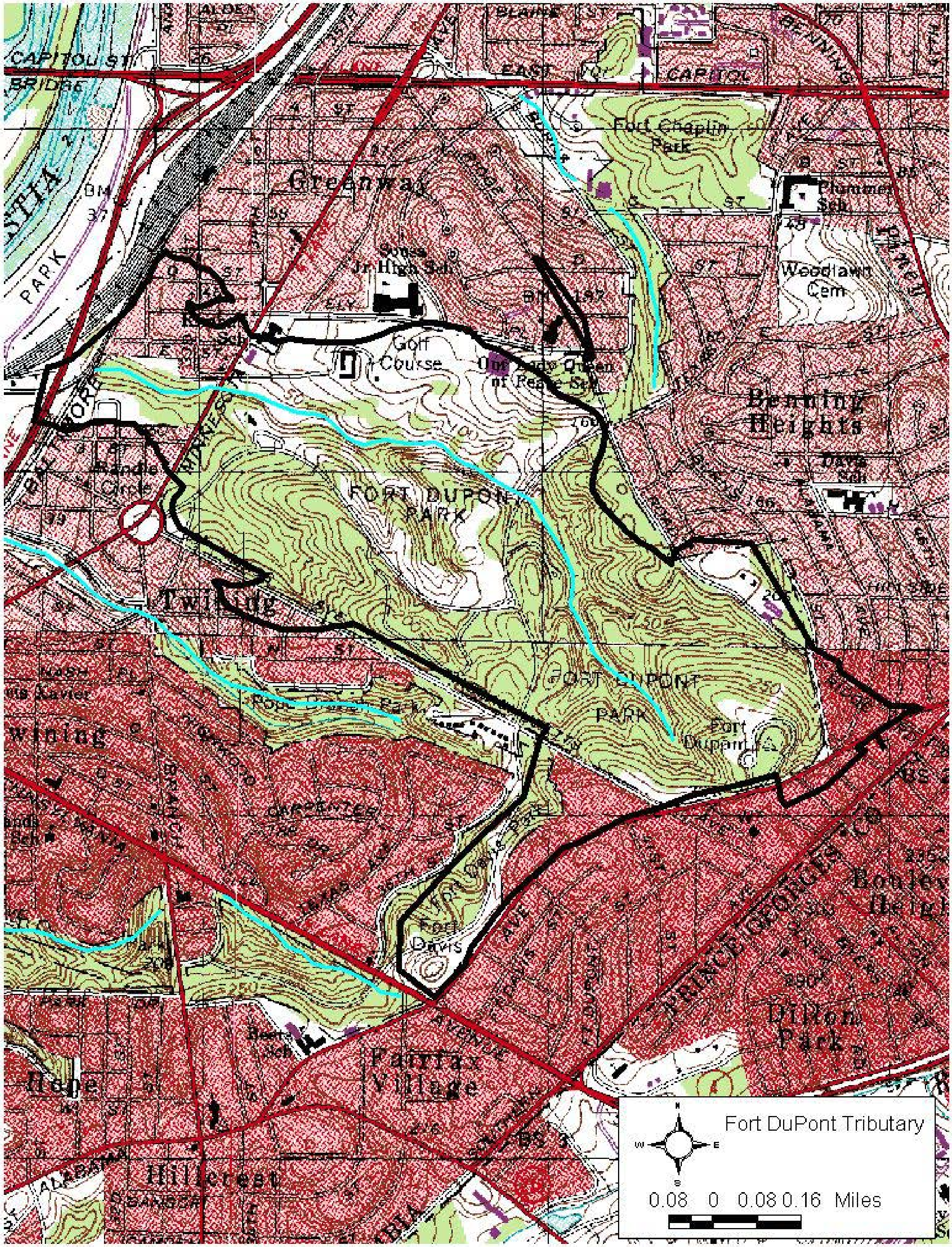
The Department of Health maintains an ambient monitoring network that includes the Anacostia and Potomac Rivers and Rock Creek. Data is collected on fecal Coliform typically monthly. The tributaries are monitored on a monthly basis.

APPENDIX A

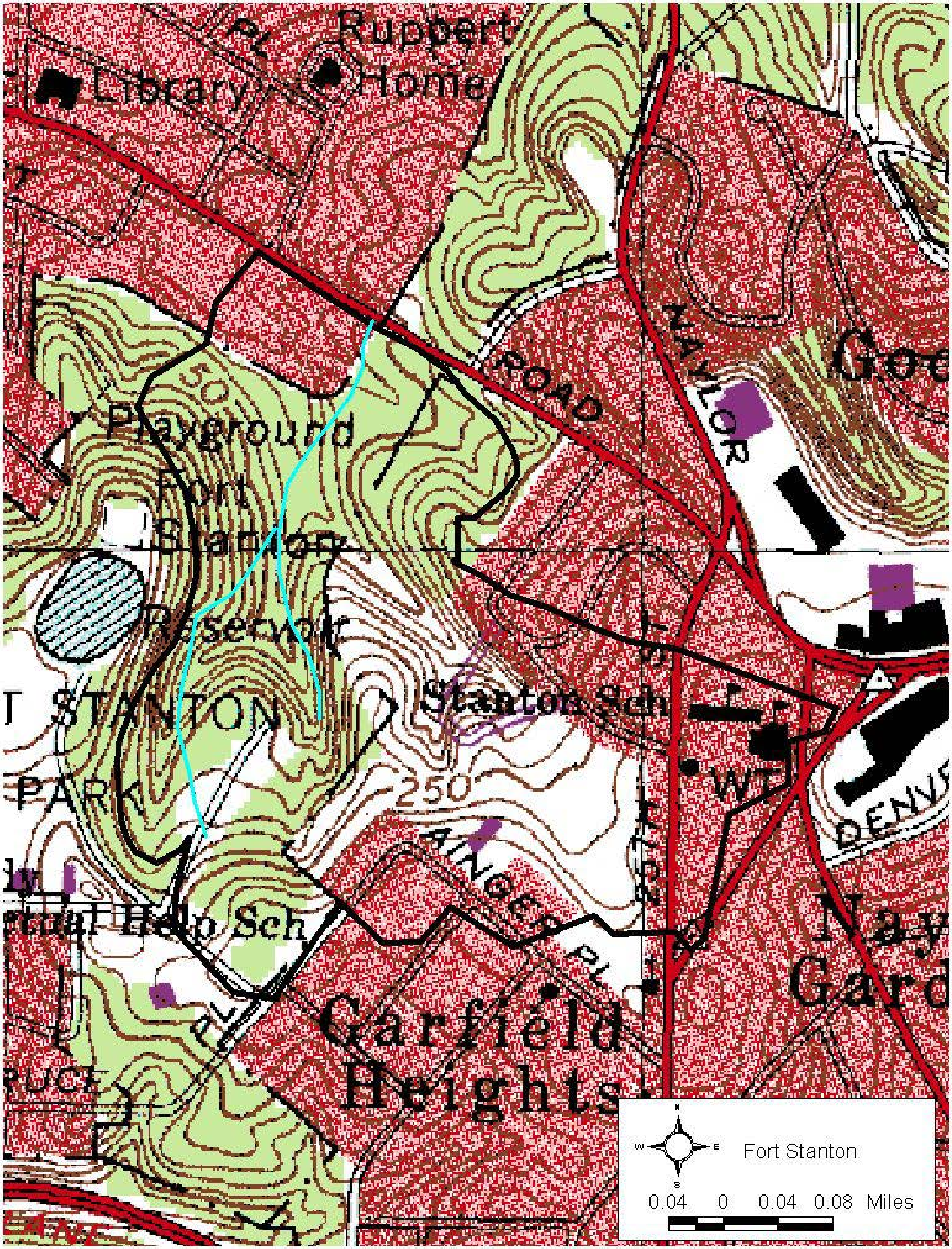


Fort Chaplin Run
0.08 0 0.080.16 Miles
Fort Chaplin Park
Fort Mahan Park
Benning
Deanewood
Capital View
Marshall Heights
Woodlawn Cem
Benning Heights
Golf Course
FORT DUPONT PARK
Boulevard Heights
Hillside
Park

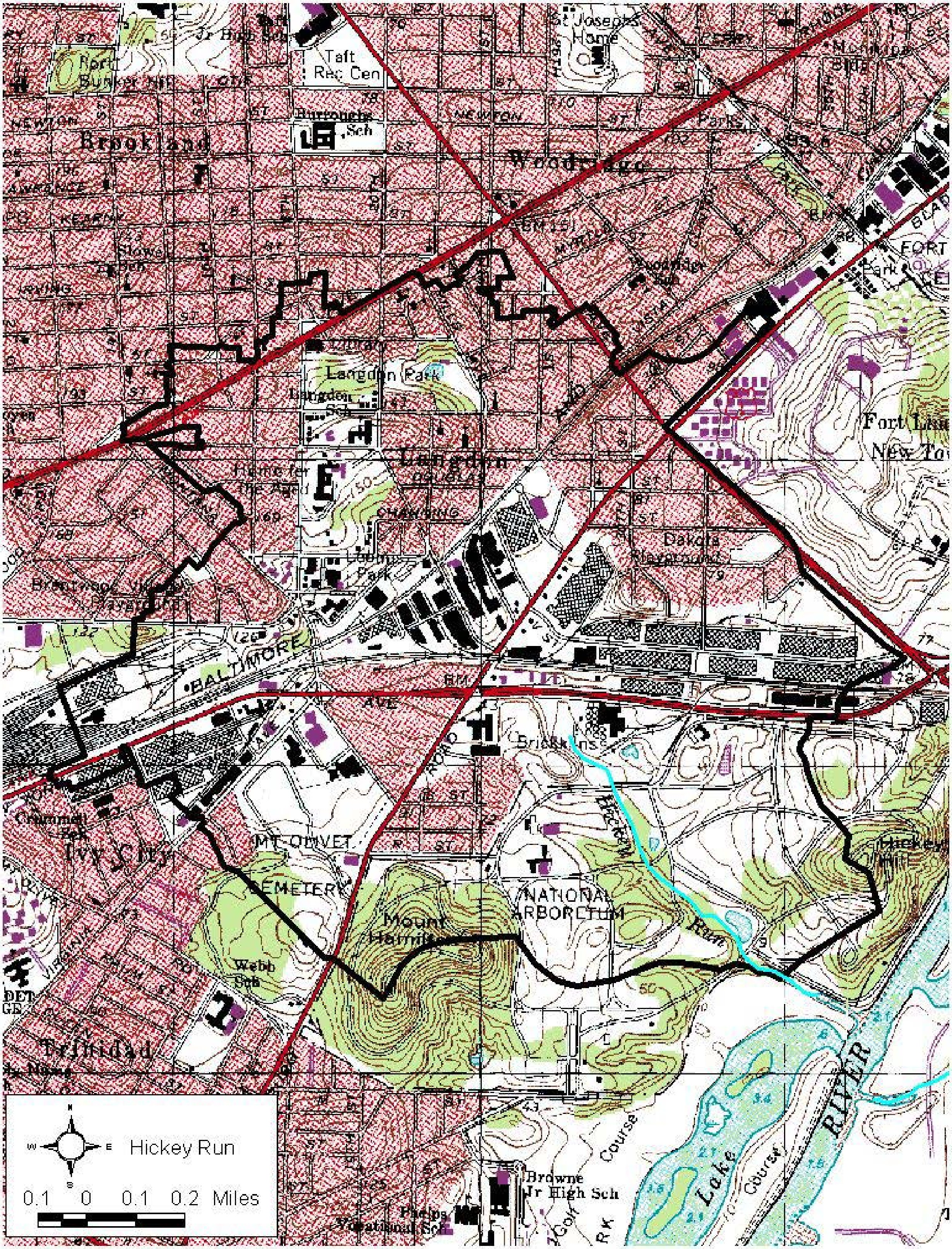

CARPENTER
DR
TEXAS
AVE
Fort Davis
Park
Fairfax Village
Hillcrest
BANGOR
Fort Davis Tributary
0.04 0 0.04 0.08 Miles

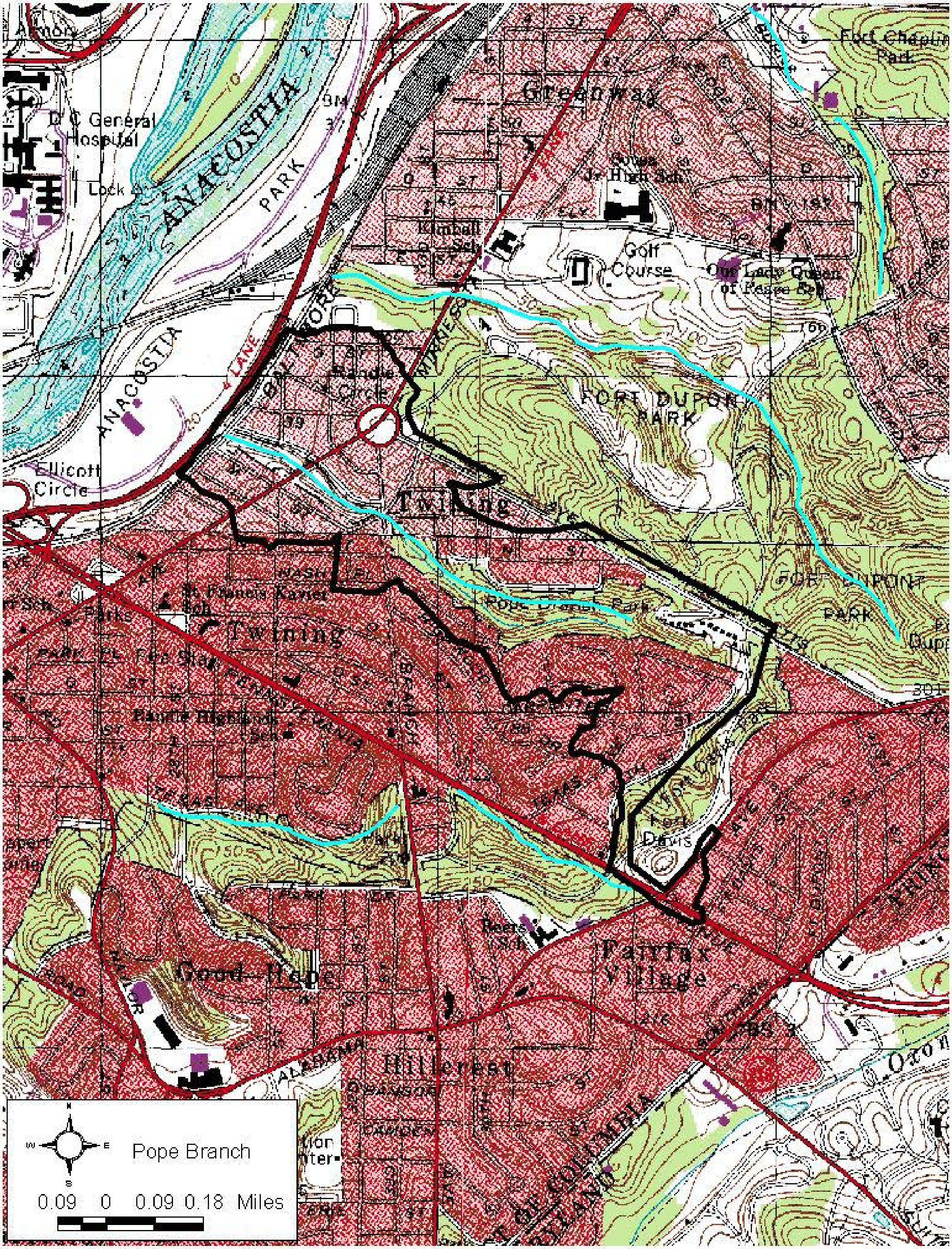


Fort DuPont Tributary
0.08 0 0.08 0.16 Miles
Fort Chaplin Park
Woodlawn Cem
Golf Course
Benning Heights
FORT DUPONT PARK
Fort Davis
Fairfax Village
Hillcrest
Dillon Park
PRINCE GEORGES

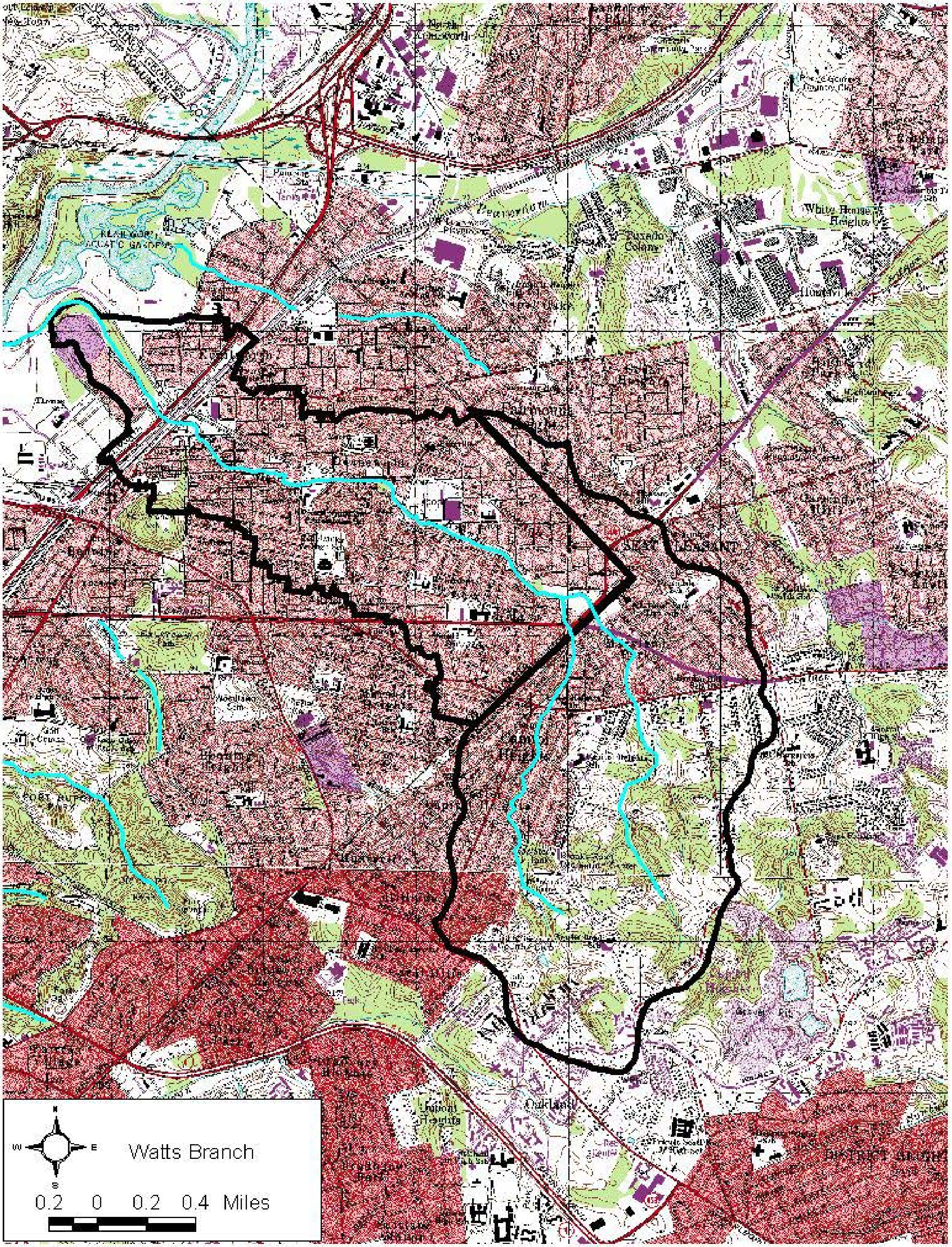


Ruppert
Home
Library
Playground
Fort
Stanton
Reservoir
ROAD
NAYLOR
Stanton Sch
250
PARK
Garfield
Heights
Fort Stanton
0.04 0 0.04 0.08 Miles


Hickey Run
0.1 0 0.1 0.2 Miles
Brookland
Woodridge
Langdon
Langdon Park
Ivy City
Trinidad
BALTIMORE
MT OLIVET
CEMETERY
NATIONAL
ARBORETUM
Mount
Hamilton
Webb
Sch
Browne
Jr High Sch
Hickey
Run
RIVER
Taft
Rec Cen
Fort Lincoln
Dakota
Playground
Course
Lake
Course


Pope Branch
0.09 0 0.09 0.18 Miles

Randle Highlands
Sch
28TH
PENNSYLVANIA
BRANCH
TEXAS AVE
150
Park
200
PARK DR
Good Hope
W ST
NAYLOR
ALABAMA
Hillcre
BANGOR
DENVER ST
ALABAMA
WT
Recreation
Texas Ave.
0.05 0 0.05 0.1 Miles


Watts Branch
0.2 0 0.2 0.4 Miles

APPENDIX B