Appendix A. Existing Conditions

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A-1: Subwatershed Existing Conditions

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Appendix A-1: Existing Subwatershed Conditions

Extensive information was compiled for the subwatersheds in the Anacostia River watershed for preparation of the Anacostia Restoration Plan (AWRP, 2010). An environmental baseline conditions and restoration report was prepared for the watershed in general and also for each subwatersheds (see References). Information from these reports and others is summarized below; however, for further information on conditions in each subwatershed, please refer to the appropriate report.

1.1 Subwatershed Descriptions

The Anacostia River, a tributary of the Potomac River which flows to the Chesapeake Bay, drains portions of Montgomery and Prince George's County in Maryland and the District of Columbia. The Anacostia River watershed drains approximately 176 square miles, with 17.2 percent of its drainage area in Montgomery County, 34.4 percent in Prince George's County, and 48.4 percent in the District of Columbia (AWRP. 2010). The Anacostia River watershed lies across the northwest portion of Prince George's County, and includes the municipalities of Berwyn Heights, Bladensburg, Brentwood, Capital Heights, Cheverly, College Park, Colmar Manor, Cottage City, Edmonston, Fairmount Heights, Glenarden, Greenbelt, Hyattsville, Landover Hills, Mount Rainier, New Carrollton, North Brentwood, Riverdale Park, Seat Pleasant, and University Park. The watershed also contains a large area of federal land (e.g. Beltsville Agricultural Research Center and Greenbelt Park) and state-owned land (University of Maryland) (PGDOE, 2014).

Historically, the Anacostia River watershed was a thriving center of culture for Native Americans, with highly productive ecosystems. As settlers cleared fields for agriculture, the river began to decline. Today the Anacostia River watershed is characterized by the alteration of the natural landscape, including an increase in impervious surface area and disruption of the natural hydrologic regime. The watershed is one of the most densely populated of the Chesapeake Bay subwatersheds, and as a result, suffers from poor water quality and degraded ecosystems (AWRP, 2010).

The ten streams selected for detailed evaluation in this feasibility study are located in six subwatersheds: Northwest Branch, Sligo Creek, Northeast Branch, Paint Branch, Little Paint Branch, and Indian Creek (Figure 1). The Northwest Branch originates in Montgomery County southeast of Olney, Maryland, and flows south for approximately 15 miles before entering Prince George's County and joining with the Northeast Branch. Sligo Creek has its headwaters in Montgomery County in Wheaton, then flows southeast for approximately eight miles before converging with the Northwest Branch in Hyattsville (Prince George's County).

Originating south of Burtonsville in Montgomery County, Little Paint Branch flows south for approximately nine miles before entering Prince George's County where it joins the Paint Branch. Paint Branch begins near Spencerville and flows in Montgomery County for approximately nine miles, entering Prince George's County and joining with Little Paint Branch. The confluence of Indian Creek and Paint Branch in College Park, MD, forms the Northeast Branch. The entire Indian Creek subwatershed is located in Prince George's County.

1.1.1 Northwest Branch

The Northwest Branch subwatershed is approximately 41.7 square miles (26,696 acres) in size (MWCOG, 2009c). The headwaters of Northwest Branch are in a rural area of Montgomery County and are bordered by woodland and pasture. The upper and middle reaches of the mainstem and larger tributaries flow through high quality forest buffer over an average gradient of 0.39% (MWCOG, 2009c). The lower reach flows through Prince George's County to the confluence with the Northeast Branch at Bladensburg, MD. Between the subwatershed boundary and the protected parklands within the stream valley, the middle and lower reaches, including areas within the District of Columbia, are approaching effective full build-out (i.e. maximum development potential).

A GIS analysis using data from the National Land Cover Database (NCLD, 2006) indicates the predominant land cover in the Prince George's County portion of the subwatershed is 1) low to high intensity development, 2) developed open space, and 3) forest. Fifty-eight percent of the Prince George's County portion of the subwatershed is classified as having impervious surface cover with a high degree of imperviousness (26-100% imperviousness).

Since the late 1980's many natural resources professionals working in the Anacostia watershed have monitored aquatic communities using an Index of Biotic Integrity or IBI approach. The IBI compares the fish and macroinvertebrate communities of urban streams with those of healthy reference streams, incorporating geographical, ecosystem, community, and population, as well as distribution and abundance variables that account for differences in water body size, type, and region of occurrence. Aquatic habitat conditions in the watershed are only partially supporting of reference conditions. In general, the aquatic community present in the upper Northwest Branch in Montgomery County is correspondingly healthier and more diverse than that found in the middle and lower portions of the subwatershed (MWCOG, 2009c).

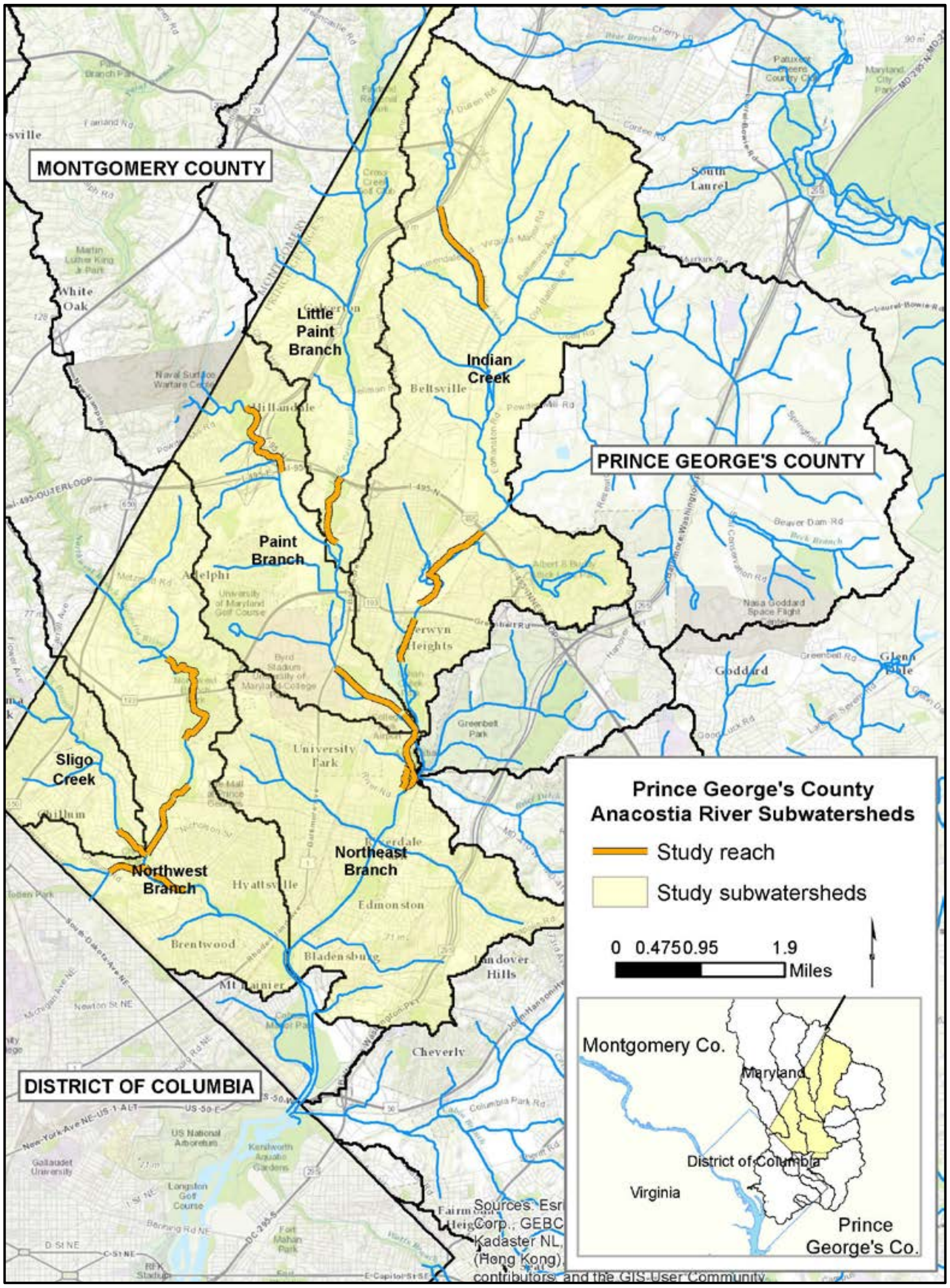

Figure 1. Study subwatersheds and stream reach locations in Prince George's County, MD.

1.1.2 Sligo Creek

The Sligo Creek subwatershed has a drainage area of 11.1 square miles (7,085 acres), and is located in the central western vicinity of the Anacostia River watershed. The subwatershed is located within Montgomery and Prince George's Counties (20-percent of the watershed), Maryland, and the District of Columbia. A GIS analysis using data from the National Land Cover Database (NCLD, 2006) indicates the predominant land cover in the Prince George's County portion of the subwatershed is 1) low to high intensity development, 2) developed open space, and 3) forest.

Fifty-four percent of the Prince George's County portion of the subwatershed is classified as having impervious surface cover with a high degree of imperviousness (26-100% imperviousness).

Sligo Creek flows from its headwaters in the Piedmont physiographic province into the Coastal Plain province over an average gradient of 0.72% (AWRP, 2010). Elevations in the Sligo Creek subwatershed range from 450 feet at the watershed drainage divide to 35 feet at the confluence with Northwest Branch. Sligo Creek has an average gradient of 0.72-percent over 8.3 miles of its main stem length (MWCOG, 2009b). The entire lower mainstem channel, from Riggs Road to the confluence with Northwest Branch, has been channelized and includes a levee on the northern bank associated with various flood protection projects. In addition, major portions of the Sligo Creek mainstem from University Boulevard downstream to Maple Avenue, have been armored with revetment to reduce stream bank erosion.

The condition of fish and macroinvertebrate populations in Sligo Creek has improved since the completion of the first two phases of habitat restoration in the upper third of the subwatershed in Montgomery County. These efforts, which have included controlling stormwater quantity and quality, restoring both tributary and main stem in-stream habitat, creating wetlands, reforestation, and native fish and amphibian reintroduction have resulted in aquatic habitat rankings of greater than 70% (partially supporting) of reference conditions at three main stem sampling sites. Although aquatic biota are correspondingly healthier and more diverse than during previous sampling, main stem populations remain impacted, scoring no better than 36% (moderately impaired) of reference conditions. Several physical barriers to both resident and anadromous fish movement and migration are present downstream of Riggs Road. These, as well as other barriers in Sligo Creek, have been identified and remain as a restoration challenge for this subwatershed (MWCOG, 2009b).

1.1.3 Northeast Branch

The Northeast Branch subwatershed drains approximately 7.2 square miles (4,613 acres) and is home to approximately 39,800 people. The entire subwatershed is located within Prince George's County. The Northeast Branch is formed by the confluence of Paint Branch and Indian Creek. Approximately three miles downstream, the Northeast Branch confluences with Northwest Branch near Bladensburg, Maryland, to form the Anacostia River.

A GIS analysis using data from the National Land Cover Database (NCLD, 2006) indicates the predominant land cover in the subwatershed is 1) low to high intensity development, 2) developed open space, and 3) forest. Seventy-four percent of the subwatershed is classified as having impervious surface cover with a high degree of imperviousness (26-100% imperviousness).

The Northeast Branch is in the Coastal Plain physiographic province and has an average gradient of 0.18% (MWCOG, 2009f). About 85-percent of the mainstem (south of the proposed project reaches) has been channelized and levees were constructed as part of a local flood risk management project completed by USACE (USACE, 1968).

Each of the two IBI main stem sampling stations were rated as having either non- supporting or partially supporting physical aquatic habitat conditions present. Macroinvertebrate populations in both the Northeast Branch main stem and its tributary network are rated as being poor. Main stem fish populations were rated as being generally good. Unfortunately, tributary fish community-related sampling data is largely non-existent. In general, both main stem and tributary macroinvertebrate and fish communities remain impacted (MWCOG, 2009f).

1.1.4 Paint Branch

The Paint Branch subwatershed is approximately 20.5 square miles (13,121 acres) in size. Approximately 75-percent of the subwatershed is in Montgomery County, with the remaining 25-percent in Prince George's County. With an average mainstem gradient of 0.6-percent over 11.4 miles of the main stem, Paint Branch flows from the Piedmont physiographic province, through the Fall Line, and into the Coastal Plain. Elevations range from 560 feet at the Paint Branch/Patuxent River watershed divide to 35 feet at the confluence with the Northeast Branch, and the average gradient is 0.57% (MWCOG, 2009e).

A GIS analysis using data from the National Land Cover Database (NCLD, 2006) indicates the predominant land cover in the Prince George’s County portion of the subwatershed is 1) low to high intensity development, 2) developed open space, and 3) forest. Thirty-seven percent of the Prince George’s County portion of the subwatershed is classified as having impervious surface cover with a high degree of imperviousness (26-100% imperviousness).

In the Montgomery County portion of the subwatershed, Paint Branch is widely regarded as being the Anacostia’s highest quality Piedmont stream system, supporting reproducing brown trout, with the Upper Paint Branch designated as a Special Protection Area by the Maryland Department of Natural Resources (MD DNR). Concurrent with the post-1989 re-establishment of a forested riparian buffer along the stream, both fish and macroinvertebrate populations in the Beltsville Agricultural Research Center main stem portion of Paint Branch have improved somewhat. Other major efforts in the subwatershed, which have included controlling stormwater quantity and quality, major stream valley park acquisition, restoring both tributary and main stem instream habitat, creating wetlands and riparian reforestation, have resulted in aquatic habitat rankings which are partially supporting of reference conditions. In general, the aquatic community present in the upper Paint Branch is correspondingly healthier and more diverse than that found in the middle and lower portions of the subwatershed. Main stem macroinvertebrate populations typically remain impacted.

1.1.5 Little Paint Branch

The Little Paint Branch subwatershed drains approximately 10.6 square miles (6,785 acres). Little Paint Branch is a tributary of the Northeast Branch of the Anacostia River. It has its headwaters in eastern Montgomery County and flows into Prince George’s County to its confluence with Paint Branch, north of the University of Maryland campus over a 0.66% average gradient (MWCOG, 2009g). This subwatershed is a transitional area between the Piedmont and Coastal Plain physiographic provinces.

A GIS analysis using data from the National Land Cover Database (NCLD, 2006) indicates the predominant land cover in the Prince George’s County portion of the subwatershed is 1) low to high intensity development, 2) developed open space, and 3) forest. Forty-two percent of the Prince George’s County portion of the subwatershed is classified as having impervious surface cover with a high degree of imperviousness (26-100% imperviousness). The lower portion of the subwatershed includes significant agricultural lands associated with the U.S. Department of Agriculture's Beltsville Agricultural Research Center (BARC).

Three (38 percent) out of the eight Little Paint Branch Index of Biotic Integrity (IBI) main stem sampling stations were rated as having either non-supporting or partially supporting physical aquatic habitat conditions present. With the exception of the upper main stem and Silverwood and Spray Irrigation tributaries where conditions are generally rated as being good, the condition of macroinvertebrate populations in both the middle and lower main stem and tributary network is generally poor/fair. Macroinvertebrate community conditions in the Silverwood and Spray Irrigation tributaries are generally considered to be the least impaired; whereas, those in the Galway tributary are the most impacted. Main stem fish populations were similarly rated as being fair to good. The Little Paint Branch headwaters support a relatively healthy fish community, including sensitive species such as the Least Brook lamprey. The main stem is open to both resident and migratory fishes up to I-95. Tributary fish community-related sampling data indicates that the BARC Spray Irrigation tributary supports the highest number of species (i.e., 16); whereas, the Galway tributary supports only two (MWCOG, 2009g).

1.1.6 Indian Creek

The 15-square-mile (9,600 acre) Indian Creek subwatershed is located entirely in Prince George's County. The average gradient along the subwatershed is 0.52% (MWCOG, 2009d).

A GIS analysis using data from the National Land Cover Database (NCLD, 2006) indicates the predominant land cover in the subwatershed is 1) low to high intensity development, 2) developed open space, and 3) forest. Thirty-nine percent of the subwatershed is classified as having impervious surface cover with a high degree of imperviousness (26-100% imperviousness). The upper portion of the Indian Creek subwatershed is dominated by abandoned and active sand and gravel mining operations and forest cover; much of the forest cover is classified as scrub-shrub regenerating. However, at the north end of the watershed on a former sand and gravel pit, there are plans for the construction of a 2,200 acre multi-use area (Konterra Town Center). The middle portion of the subwatershed is largely developed, featuring industrial, residential, and commercial land uses. In the lower portion of the subwatershed, long reaches of the stream have been channelized with poor parkland buffering (MWCOG, 2009d).

Two-thirds (66 percent) of the County's 12 Indian Creek IBI main stem sampling stations were rated as having either non- supporting or partially supporting physical aquatic habitat conditions present. With the exception of the lower main stem where conditions are generally rated as being good, the condition of macroinvertebrate populations in both the Indian Creek main stem and tributary network is generally fair to good (MWCOG, 2009d)

1.2 References

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MWCOG. 2009f. Northeast Branch Environmental Baseline Conditions and Restoration Report. Metropolitan Washington Council of Governments, November 30, 2009.

MWCOG. 2009g. Little Paint Branch Environmental Baseline Conditions and Restoration Report. Metropolitan Washington Council of Governments, November 30, 2009.

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A-2: Existing Conditions - Fish Species and Sample of Habitat Requirements

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FISH SPECIES IN STUDY SEGMENTS OR SUBWATERSHED				Collected - Subwatershed (since 1988) /Segment (since 1997)[a]									
				Indian Creek		Northwest Branch			Sligo	Paint Branch (P-Piedmont, C- Coastal Plain)		Little Paint	Northeast Branch
Common Name	**Fish Species**	**Origin**	**Tolerance**	**1**	**11**	**3**	**13**	**10***	**9**	**5**	**7**	**12**	**15***
Alewife	*Alosa pseudoharengus*	**N**	**	X		X				X-C			X
American brook lamprey	*Lampetra appendix*	N	**	X									
American eel	*Anguilla rostrata*	N	M	X	X	X	X	X	X	X	X	X	X
American shad	*Alosa mediocris*	N	**							X			X
Banded killifish	*Fundulus diaphanus*	N	**	X	X	X	X	X	X	X	X-C	X	X
Black crappie	*Pomoxis nigromaculatus*	N	T	X	X					X		X	X
Blacknose dace	*Rhinichthys atratulus*	N	M	X	X	X	X	X	X	X	X	X	X
Bluegill	*Lepomis macrochirus*	NN	M	X	X	X	X	X	X	X	X	X	X
Blue ridge sculpin	*Cottus caeruleomentum*	N	**							X-P			
Bluespotted sunfish	*Enneacanthus gloriosus*	N	**	X									
Blueback herring	*Alosa aetivalis*	N	**	X		X							X
Bluntnose minnow	*Pimephales notatus*	N	**		X	X	X	X	X	X	X	X	X
Bridle shiner	*Notropis chalybaeus*	N	**			X				X-C		X	X
Brown bullhead	*Ameiurus nebulosus*	N	M	X	X	X	X	X		X		X	X
Brown trout	*Salmo trutta*	NN	I							X			
Chain pickerel	*Esox niger*	N	M	X									X
Channel catfish	*Ictalurus punctatus*	NN	T	X									X
Comely shiner	*Notropis amoenus*	N	**			X				X-C			X
Common carp	*Cyprinus carpio*	NN	T	X	X	X				H		X	X
Common shiner	*Luxilus cornutus*	N	M	X		X	X	X		X	X	X	X
Creek chub	*Semotilus atromaculatus*	N	M	X	X	X	X	X	X	X	X	X	
Creek chubsucker	*Erimyzon oblongus*	N	M	X									X
Cutlips minnow	*Exoglossum maxillingua*	N	**	X		X	X	X	X	X	X	X	X
Eastern mosquitofish	*Gambusia holbrooki*	N	M		X	X	X	X		X		X	X
Eastern mudminnow	*Umbra pygmaea*	N	**	X	X	X	X	X		X		X	X
Eastern silvery minnow	*Hybognathus regius*	N	**		X	X			X	H-P, X-C		X	X
Fallfish	*Semotilus corporalis*	N	M	X		X	X	X		X	X	X	X
Fantail darter	*Etheostoma flabellare*	N	I			X	X	X		H-P			
Fathead minnow	*Pimephales promelas*	NN	T					X	X				X
Gizzard shad	*Dorosoma cepedianum*	N	T	X		X			X	X-C		X	X

FISH SPECIES IN STUDY SEGMENTS OR SUBWATERSHED				Collected - Subwatershed (since 1988) /Segment (since 1997)[a]									
				Indian Creek		**Northwest Branch**			**Sligo**	**Paint Branch (P-Piedmont, C- Coastal Plain)**		**Little Paint**	**Northeast Branch**
Common Name	**Fish Species**	**Origin**	**Tolerance**	**1**	**11**	**3**	**13**	**10***	**9**	**5**	**7**	**12**	**15***
Golden redhorse	*Moxostoma erythrurum*	NN	M	X	X								X
Golden shiner	*Notemigonus crysoleucas*	N	M	X	X	X				X		X	X
Goldfish	*Carassius auratus*	NN	**	X				X	X			X	X
Green sunfish	*Lepomis cyanellus*	N	T	X	X	X	X	X	X	X	X	X	X
Hickory shad	*Alosa mediocris*	N	**			X							X
Inland silverside	*Menidia beryllina*	N	**			X							X
Ironcolor shiner	*Notropis chalybaeus*	N	**	X		X				X		X	X
Largemouth bass	*Micropterus salmoides*	NN	T	X	X	X	X	X		X	X	X	X
Least brook lamprey	*Lampetra aepyptera*	N	**	X	X	X	X					X	
Longear sunfish	*Lepomis megalotis*	N	M	X		X				X-C		X	X
Longnose dace	*Rhinichthys cataractae*	N	M	X	X	X	X	X	X	X	X	X	X
Margined madtom	*Noturus insignis*	N	M			X				X	X	X	
Mummichog	*Fundulus heteroclitus*	N	**	X	X	X	X	X		X-C		X	X
Northern creek chub	*Semotilus atromaculatus*	N	**			X			X	X		X	X
Northern hogsucker	*Hypentelium nigricans*	N	M		X	X	X	X	X	X		X	X
Potomac sculpin	*Cottus girardi*	N	**							X-P			
Pumpkinseed	*Lepomis gibbosus*	N	M	X	X	X	X	X	X	X	X-C	X	X
Quillback	*Carpiodes cyprinus*	N	M			X							
Rainbow trout	*Oncorhynus mykiss*	NN	I			X - stocked							
Redbreast sunfish	*Lepomis auritus*	N	M	X	X	X	X	X	X	X	X	X	X
Redear sunfish	*Lepomis microlophus*	NN	M							X-C			
River chub	*Nacomis micropogon*	N	**	H									
Rosyface shiner	*Notropis rubellus*	N	M	X		X				X-C			X
Rosyside dace	*Clinostomus funduloides*	N	**	X	X	X				X	X	X	X
Satinfin shiner	*Cyprinella analostana*	N	M	X	X	X	X	X	X	X	X	X	X
Sea Lamprey	*Petromyzon marinus*	N	**	X	X	X	X	X		X	X	X	X
Sheepshead minnow	*Cyprinodon variegatus*	N	**	X									
Shorthead redhorse	*Moxostoma macrolepidotum*	N	M	X									X

FISH SPECIES IN STUDY SEGMENTS OR SUBWATERSHED				Collected - Subwatershed (since 1988) /Segment (since 1997)[a]									
				Indian Creek		**Northwest Branch**			**Sligo**	**Paint Branch (P-Piedmont, C- Coastal Plain)**		**Little Paint**	**Northeast Branch**
Common Name	**Fish Species**	**Origin**	**Tolerance**	**1**	**11**	**3**	**13**	**10***	**9**	**5**	**7**	**12**	**15***
Silverjaw minnow	*Notropis buccatus*	N	M	X		X	X	X	X	X		X	X
Slimy sculpin	*Cottus cognatus*	N	I								X		
Smallmouth bass	*Miropterus dolomieu*	NN	M	X		X	X	X					
Spotfin shiner	*Cyprinella spiloptera*	N	M	X		X	X	X	X	X-C		X	X
Spottail shiner	*Notropis hudsonius*	N	M	X	X	X	X	X	X	X	X	X	X
Striped bass	*Morone saxatilis*	N	**			X							X
Swallowtail shiner	*Notropis procne*	N	**	X	X	X	X	X	X	X	X	X	X
Tessellated darter	*Etheostoma olmstedi*	N	M	X	X	X	X	X	X	X	X	X	X
White perch	*Morone americana*	N	**	X		X				X-C			X
White sucker	*Catostomus commersoni*	N	T	X	X	X	X	x	X	X	X	X	X
Yellow bullhead	*Ameiurus natalis*	N	T	X	X	X	X	X	X	X	X-C	X	X
Yellow perch	*Perca flavescens*	N	M	X	X	X							X
Total species collected in study segment 1997-2010				15	19	19	25	No data	19	25	20	24	No data
Total species collected in subwatershed 1988-2009				52		54			34	47		42	54

Tolerance indicators from: Meador and Carlisle. 2007. Quantifying tolerance indicator values for common stream fish species of the United States. Ecological Indicators, Volume 7, Issue 2.

[a]Data are shown for the specific stream segement if data exists. If no data exists for the specific stream segement, data for the subwatershed are shown. Blank cells indicate no documented fish presence.

Subwatershed data from: MWCOG. 2009. ARP Subwatershed Baseline Reports

Stream segment data from: Compilation of MBSS sampling and stream monitoring by Tetra Tech.

** - No tolerance data available.

*no monitoring data available for study segments 10 and 15

(blue)	Collected in subwatershed, but not necessarily in study segment
(green)	Collected in or immediately up/downstream of study segment
(tan)	Not collected, but historical presence is documented

Origin: N = Native; NN= Non-native; I = Invasive

Tolerance: M=Moderate; T=Tolerant; I=Intolerant

Summary of habitat requirements from available HSI models for representative fish assemblage.

Species	Water depth (ft)	Preferred velocity (ft/s)	Substrate Preference	Cover	Nest habitat	Notes
Resident						
Bluegill	3.3-9.8	0.03-0.16	fine gravel or sand for spawning	20-60%	quiet, shallow water; prefer fine gravel or sand	Prefer pools, >60% pools, low gradient streams
Green sunfish	.13-1.1	<0.03 (up to .82), Fry = <.16	pebbles and gravel predominate	35-80%	on gravel or sand near rocks, logs, and vegetation	typically inhabit pool area, >50% pools; <30 m wide streams
Warmouth		< .3	soft substrate; stumps, brush, or boulders common	dense	near cover in shallow, protected areas; guarded by male	inhabit slow-moving or still waters; survive extremely low DO levels
Largemouth bass	9.8-49.2	< 0.2	soft bottoms; spawn in gravel substrate	40-60%	gravel preferred; near vegetation, roots, sand, mud, cobbles	>60% pools and backwater areas for rivers/streams
Common shiner	nests in .04-.1 mm	< 0.2	unvegetated gravel, rubble, sandy-gravel	unknown if cover is important	in streams; gravel and sand; re-uses nests built by other fish	frequent pools in small to medium-sized streams; clear, cool water
Smallmouth bass	<39.4	0.3-1	clean stone, rock, or gravel	abundant	gravel or broken rock; slow current	strong cover-seeking behavior
Black crappie	shallow	<0.3	soft mud, sand, or gravel	25-85%	depressions near or in beds of vegetation on soft mud, sand, or gravel	forage in open water over deeper areas; prefer rivers with >50% of pools, backwaters, and cut-off areas
Redear sunfish	< 19.7	0-0.03	unvegetated sand, sandy-clay, mud, limestone, shells, and gravel (nests)	25-75%	mud to gravel with no vegetation; exposed to sun; often within or along water lilies and fallen trees	prefer large, clear, low gradient streams with sluggish currents and aquatic vegetation; pools
White sucker	0.5-3	<0.07	gravel for spawning	pool and streambank cover	clean, coarse sand or gravel	relatively swift, shallow waters over a gravel bottom for spawning
Longnose dace	<0.99-3.3	>1.3	coarse- gravel and rock	100%	spawn in riffles	swift flowing, steep gradient, head-water stream; prefer riffles
Common carp		<0.07	mud or silt	35-55% vegetated, >50% in pools	aquatic or submerged terrestrial vegetation	shallow, warm, sluggish, and well-vegetated waters
Creek chub	<3.3	<0.1	gravel, but found above all substrates	abundant with streambank vegetation	gravel nests in shallow water just above and below riffles	small, clear streams; streams with alternating pools (40-60%)and riffle-run areas; rubble substrate in riffles
Diadromous						
Alewife herring	2-6 3.9-4.9 2.6^	0.5-2.5 4.3-2.5 0.8^	silt (finer then sand), gravel and cobble			deep pools, slow
Alewife-juvenile	4-10	1^	sand, gravel, detritus, SAV			
Blueback herring	1-3.9 2-3.9 1.3-3.3	1-3 2-3 0-1	silt, sand, gravel, detritus			
Blueback-juvenile	4-10	1-2	(silt, sand)			
White perch	1-4.9	0-1	sand, gravel			

^no range available

A-3: Baseline Ecological Conditions of Candidate Restoration Reaches (Tetra Tech)

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Baseline Ecological Conditions of Candidate Restoration Reaches in the Anacostia River Watershed

Prepared for:

Prince George's County Government
Department of the Environment
Stormwater Management Division
1801 McCormick Drive
Largo, Maryland 20774

and

U.S. Army Corps of Engineers (CENAB-PL)
Baltimore District
P.O. Box 1715
Baltimore, Maryland 21203-1715

Prepared by:

Tetra Tech, Inc.
Center for Ecological Sciences
400 Red Brook Blvd., Suite 200
Owings Mills, Maryland 21117

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Abstract

Prince George's County, located along Maryland's Coastal Plain physiographic province, encompasses an area of approximately 1,259 km^2 and is drained by three major river basins: the Anacostia River, the Patuxent River, and the non-Anacostia portions of the Potomac River. The Anacostia watershed covers approximately 223 km^2 in the County, with the Northeast and Northwest Branches as the primary tributaries. In a collaborative effort between the Prince George's County Department of the Environment (DoE) and the US Army Corps of Engineers (USACE)-Baltimore District, 11 reaches were selected for potential future restoration activity. Assessment sites were sampled in 2015 to provide a baseline description of existing, pre-restoration conditions. Field, laboratory, and data analysis protocols were used that were consistent with those of the Maryland Department of Natural Resources' Biological Stream Survey (MBSS). In addition to benthic macroinvertebrates and fish, field data were also collected for selected field chemistry (YSI meters), and substrate particle size distribution (modified 100-particle Wolman pebble count). Using the MBSS Benthic-Index of Biotic Integrity (B-IBI), over half of the sites assessed (6 out of 11) were rated as biologically degraded (poor or very poor B-IBI rating). Site ratings using the Fish IBI scores ranged from fair to good. Physical habitat scores followed more closely with the B-IBI scores with nine of the 11 sites rated as either suboptimal. We also calculated the MBSS physical habitat index (PHI) and relative bed stability (RBS) for additional descriptors of physical habitat and stream channel quality. We conclude this report with recommendations for using additional data and analyses to strengthen this characterization of ecological baseline conditions prior to implementing restoration projects.

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APPENDICES

Introduction

Prince George's County lies in the mid-Atlantic coastal plain of Maryland, immediately east of the Nation's capital (Figure 1). It covers 1,259 km^2 (US Census Bureau 2014), and has more than 994 kilometers of stream channels, which are drained by the Patuxent River on the east, Anacostia River in the west and northwest, Potomac River on the southwest, and Mattawoman Creek in the south. The northwestern border of the county, shared with Montgomery and Howard counties, lies roughly at the Fall Line between the Piedmont and Coastal Plain physiographic regions, although that region is better characterized as a transitional zone. Across the eastern border that is the Patuxent River, are Anne Arundel and Calvert counties; the neighbor to the south is Charles County, with Mattawoman Creek in between for part of the distance before feeding into the Potomac River. The Anacostia River watershed encompasses 223 km^2 within the county. The county ranks second in Maryland, with a total population of 904,430, on average 724 people/km^2 (US Census Bureau 2014).

For this project, we instituted field sampling, and laboratory and data analysis to characterize current ecological conditions in several locations of the Anacostia River Watershed, including on the mainstems of Northeast and Northwest branches. The primary objective of this work is to provide a comparison baseline prior to implementation of best management practices (BMPs) and/or stream channel restoration projects. The biological assessment protocols used provide credible data, and valid, defensible results to address questions related to the status and trends of stream and watershed ecological condition; problem identification; documentation of the relationship among stressors, stressor sources, and response indicators; and evaluation of environmental management activities, including restoration. The primary difference between this effort and the County's long-term biological monitoring program (see Millard et al. 2013, PG DoE 2015) is that the stream sites evaluated under this task order were not randomly selected; rather, they were targeted and specifically chosen to represent pre-restoration, baseline conditions, and to ultimately be exposed to the effects of rehabilitation projects designed to reduce ecosystem stressors. If these projects are built and succeed in stressor reduction, it is anticipated that there will be detectable positive changes in benthic and fish IBI scores and assessments, and well as in many of the physical habitat features (i.e., those characterized by the visual-based physical habitat assessment from the the rapid bioassessment protocols (RBP) [Barbour et al. 1999], the MBSS physical habitat index [PHI; Paul et al. 2003], and relative bed stability [RBS; Jessup and Kaufman 2008, Kaufmann et al. 2008]).

Figure 1. Prince George's County, Maryland.

Site Selection

Sampling reaches were selected to target channel areas that would be exposed to the effects of future restoration or BMP activities in the study area (Figure 2). Eleven (11) sites were chosen in coordination with the USACE, which has a need for establishing baseline data for stream reaches targeted for restoration or to be exposed to the effects of restoration (Table 1). In general, stream reaches selected are various distances downstream from where restoration or BMP activities will likely be implemented. Final locations were approved by the USACE site selection team.

Table 1. Site locations, including identification number, stream name, Strahler order, and latitude/longitude coordinates.

Site ID	Stream Name	Strahler Order	Latitude	Longitude
01	Indian Creek	1	39.05001	-76.90424
03	Northwest Branch	3	38.96176	-76.97173
05	Paint Branch	3	38.98008	-76.91894
07	Paint Branch	2	39.02367	-76.94775
09	Sligo Creek	3	38.95959	-76.97582
10	Chillum Rd Tributary	1	38.95619	-76.97678
11A	Indian Creek	3	38.98356	-76.91869
11B	Indian Creek	3	39.00517	-76.91356
12	Little Paint Branch	2	39.01217	-76.93597
13	Lower Northwest Branch	3	38.97889	-76.96356
15	Northeast Branch	4	38.97275	-76.91803

Methods

Field Sampling

During the index period (March-April) field collections of benthic macroinvertebrate, physical habitat, water quality, and substrate data were made using protocols consistent with those of the MBSS, and outlined in PG DoE (2015).

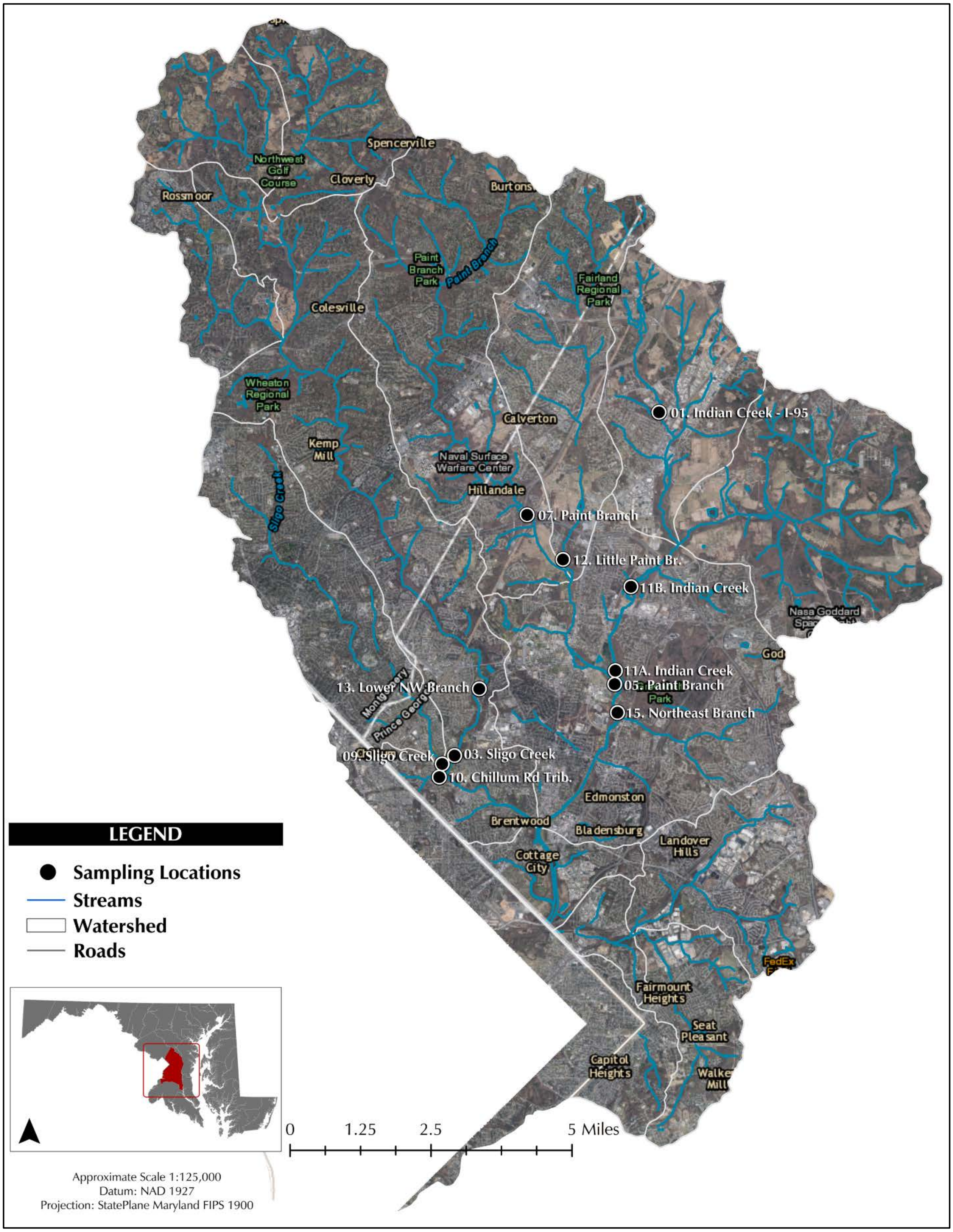

Figure 2. Location of sites within the Anacostia Watershed.

In addition to the spring benthic sampling, sampling of the fish assemblage followed MBSS protocols, with slight modifications, for the summer index period (June-September).

Benthic Macroinvertebrates

Benthic macroinvertebrates were collected from 100m reaches by making 20 one-meter linear sweeps (jabs) with a D-frame net (500-micron mesh) through different habitat types (snag, vegetated bank, bottom, riffle/cobble, sand, leaf packs, root wads), sampled in proportion to their frequency at each site. All sample material was composited in a 500-micron sieve bucket (Figure 3), placed in one or more 1-liter sample containers and preserved with 95% ethanol. Internal and external sample labels were completed for each container.

Figure 3. Processing benthic macroinvertebrate field samples. Sample material (leaf litter, small woody debris, algae, silt) is emptied from the D-frame net to a sieve-bottom bucket for washing of fine silt.

Physical Habitat Quality

Ten parameters describing physical habitat (i.e., instream and planform morphology, riparian zone condition, and stream bank condition) were visually assessed for each of the 75m sample reaches using the Rapid Bioassessment Protocols (RBP) physical habitat assessment procedure (Barbour et al. 1999, PG DoE 2015). Each parameter is scored on a 20-point scale, along a continuum of conditions categorized from optimal, suboptimal, marginal, or poor (with 20 being the best). Rating scores were summed for all PHAB parameters for a total and ranked based on criteria (Table 2). Detailed RBP, visual-based physical habitat assessment (PHAB) results are presented in Appendix E.

Table 2. Criteria for translating total numeric physical habitat scores (PHAB) to narrative ratings, as condition categories and percentage of reference conditions.

Condition Category Method	
Numeric Score	**Narrative Rating**
151-200	Optimal
101-150	Suboptimal
51-100	Fair
0-50	Poor

Water Quality

Dissolved oxygen (DO), conductivity, temperature, and pH were measured at each site using a YSI Quattro field meter that was calibrated each day (PG DoE 2015). Water quality data were collected during both index periods. Field chemistry results are presented for all sites and measurements in Appendix B.

Substrate Particle Size Distribution

Substrate was sampled using the modified Wolman 100 particle pebble count (PG DoE 2015) at a series of ten transects evenly spaced at 10 meter intervals over the length of the sampling reach. Transects extended from bankfull on each bank and particles were sampled at equal intervals across each transect. When water depth prevented actual pebble grabs, size distribution was estimated based on knowledge of the stream bed in other locations, other nearby streams, and visual estimation. Full pebble count results are presented in Appendix C.

Fish

Fish were sampled within the same 100 meter reach that was sampled for benthic macroinvertebrates. Block nets were set at the downstream (0m) and upstream (100m) ends of the reach and a single-pass electroshocking effort was conducted (Figures 4, 5). Depending on the wetted width of the stream, either two backpack units were employed, or we added an additional pram-based electrofisher. Generally, we allotted one shocking unit per 4m wetted width. Fish were counted and identified to species in the field. Where positive field identification was uncertain, individuals were preserved in formalin in the field and returned to the lab for positive identification. Total biomass of fish catch was measured and recorded at each site. Detailed fish sample data are presented in Appendix G.

Figure 4. Electrofishing on Sligo Creek.

Figure 5. Setting block nets in prearation for electrofishing.

Laboratory processing (benthic macroinvertebrates)

Sorting and Subsampling

The sorting and subsampling process is based on randomly selecting portions of the sample detritus spread over a 30-grid Caton screen, with each grid square of 6cm x 6cm (Caton 1991, Barbour et al. 1999, Flotemersch et al. 2006). Prior to beginning the sorting and subsampling process, the sample is mixed thoroughly and distributed evenly across the sorting tray to reduce the effect of organism clumping that may have occurred in the sample container. The grids are randomly selected, individually removed from the screen, placed in a sorting tray, and all organisms removed with forceps; the process is repeated until the rough count by the sorter exceeds the 100 organism target.

Taxonomic Identification

Benthic macroinvertebrates were identified primarily to genus level, unless otherwise indicated, including worms and midges (Oligochaeta and Chironomidae). Appropriate magnification, procedures, and technical literature necessary for attaining target levels are used, along with the most up to date and accepted nomenclature. Full detailed sample results are presented in Appendix A.

Metric Calculation, Data Analysis, and Site Assessments

Data Management

Benthos, habitat, and water quality data were entered into a customized version of the Ecological Data Application System (EDAS) (Tetra Tech 1999). This relational database system allows for the management of locational and other metadata, taxonomic and count data, raw physical habitat scores, calculation and scoring of metric values, physical habitat and water quality rankings, and index values, and assigning index values to narrative assessment categories. As necessary, data and assessment results are spatially displayed using Geographic Information System (GIS).

Physical Habitat Index (PHI)

In addition to the PHAB assessments, we also calculated the Physical Habitat Index (PHI) (Paul et al. 2003) for each of the sites. Variables included in the PHI include remoteness, shading, epifaunal substrate, instream habitat, instream wood, and bank stability. Categorical narrative assessments, such as good, fair, or poor, are not available for PHI; in general, higher values are indicative of dynamic physical stability. Detailed results of the PHI are given in Appendix F.

Relative Bed Stability (RBS)

We used the pebble count data to calculate the percent of sediment particles in each of several sediment size classes: fine (<0.0625 mm), sand (0.0625 - 2 mm), fine gravel (2-16 mm), coarse gravel (16-64 mm), cobble (64-256 mm), boulder (256-4096 mm), and bedrock (>4096 mm). We calculated reach slope by dividing the differences in height between the upstream and downstream points by the distance between them. Lastly, we calculated the relative bed stability described earlier. Relative bed stability (RBS) is the ratio of the median stream particle size (D50), calculated from the frequency distribution of sediment data, to the critical particle size moved during bankfull flow (Kaufmann et al. 1999). Critical particle size is calculated using values for shear stress, and channel cross section, slope, and roughness. The expected value is 1, with values <0.2 and >1 indicating unstable conditions (i.e., those for which at least half of the particles are moving during bankfull events). Detailed RBS results are shown in Appendix F.

Table 3. Relative Bed Stability (RBS) narrative interpretations and scoring criteria (log10 transformed) for streams of the Mid-Atlantic Highlands.

Mid Atlantic Highlands [LRBS = log10(RBS)]
Good Condition, >0.2 to 1.0
Impaired, >-1.0 to 0.2 AND >1.0 to 2.0
Highly Impaired, <-1 and >2.0

Index Calculation and Scoring

Benthic Macroinvertebrates

Metrics (Table 4) were calculated directly from sample data, and associated autecological characteristics[1] (Appendix A); resulting metric values were compared to reference criteria and scored on a scale from 5 to 1 (5=nearest to reference, 3 = neutral, 1=greatest deviation from reference) (Table 5). Detailed metric and index results are presented in Appendix D.

Table 4. Benthic macroinvertebrate metrics and descriptions (Southerland et al. 2007).

Metric Name	Description
Number of taxa	Measure of the overall variety of the benthic macroinvertebrate assemblage in the subsample.
Number of EPT taxa	Total number of distinct taxa of mayflies, stoneflies, and caddisflies (Ephemeroptera, Plecoptera, and Trichoptera, respectively).
Number of Ephemeroptera taxa	Number of distinct taxa of mayflies (Ephemeroptera) in the subsample
Percent individuals as intolerant of urban stressors	Percent of individuals in the subsample with urban stressor tolerance value of 0–3

[1] Refers to functional feeding group, locomotory habit, and stressor tolerance values

Metric Name	Description
Percent individuals as Ephemeroptera	Percent of individuals in the subsample that are mayflies
Number of scraper taxa	Number of distinct taxa in the subsample that are of the functional feeding group scrapers
Percent individuals as climbers	Percent of individuals in the subsamples that of the habitat climbers

Table 5. Metric scoring criteria for the benthic IBI (Southerland et al. 2007).

Metric	1	3	5
Number of taxa	<14	14–21	≥22
Number of EPT taxa	<2	2-4	≥5
Number of Ephemeroptera taxa	<1	1	≥2
Percent intolerant to urban	<10	10–27	≥28
Percent Ephemeroptera	<0.8	0.8-10	≥11
Number of scraper taxa	<1	1	≥2
Percent climbers	<0.9	0.9–7.9	≥8

Overall biological index scores were calculated by summing individual metric scores for each site, and dividing the total by the number of metrics (7 benthic, 6 fish). The resulting mean value was then compared to the scoring criteria (Table 6) for translation to the corresponding narrative assessment. Samples fully picked (30 grid squares) and producing <80 organisms were automatically assigned a rating of very poor. Exceptions to this would be if there was information indicating that the stream was naturally underproductive.

Table 6. Benthic and fish IBI score ranges and corresponding narrative ratings.

Scoring Criteria	Narrative Ratings
4.0 – 5.0	Good
3.0 – 3.9	Fair
2.0 – 2.9	Poor
1.0 – 1.9	Very Poor

Fish

Fish metrics were similarly calculated in accordance with Southerland et al. (2007) for all sites, and resulting metric values were compared to reference criteria and scored on a scale from 5 to 1 (5=nearest to reference, 3=neutral, 1=greatest deviation from reference) (Table 7). The mean value for the F-IBI was then compared to scoring criteria (Table 6) for attaining the condition narrative.

Table 7. Fish IBI metrics and thresholds for Maryland coastal plain streams (Southerland et al. 2007).

Metric	1	3	5
Abundance per square meter	<0.45	0.46-0.71	≥0.72
Number of benthic species adjusted	0	0.1-0.21	≥0.22
Percent tolerants	>97	68-96	≤68
Percent generalists, omnivores, invertivores	100	93-99	≤92
Percent non-tolerant suckers (all suckers except white suckers)	0	1	≥2
Percent abundance of dominant species	>69	41-68	≤40

Results and Discussion

The objective of this project is to characterize existing—or baseline—ecological conditions at 11 stream reaches within the Anacostia watershed that are being considered for restoration/rehabilitation projects. B-IBI ratings were generally poor to fair, with 10.Chillum Road Trib scoring 'Very Poor' and 05. Paint Branch scoring 'Good'; F-IBI scores tended to be higher with narrative ratings from 'Fair' to 'Good' (Table 8). Spatial distribution of the biological condition ratings is shown in Figures 6 and 7). With the different interpretations provided by the two indices, we paid closer examination of the physical habitat as that is likely to provide insight to the differences.

Table 8. Benthic and Fish IBI scores, narrative, and physical habitat (PHAB) scores with mean scores (SD) calculated for the basin.

Site ID	Benthic IBI			Fish IBI			PHAB		
	Score	Narr.	Mean (SD)	Score	Narr.	Mean (SD)	Score	Narr.	Mean (SD)
01.Indian Creek-I95	3.3	F	3.0 (0.72)	3.0	F	3.7 (0.42)	164	O	129.9 (19.14)
03.Northwest Branch	2.7	P		3.7	F		117	S	
05.Paint Branch	2.7	P		3.7	F		123	S	
07.Paint Branch	2.7	P		3.7	F		145	S	
09.Sligo Creek	2.7	P		4.3	G		148	S	
10.Chillum Rd Tributary	1.6	VP		3.3	F		120	S	
11A.Indian Creek	4.1	G		4.0	G		128	S	
11B.Indian Creek	3.9	F		4.0	G		128	S	

12.Little Paint Br.	3.3	F		4.3	G		113	S	
13.Lower NW Branch	3.6	F		3.8	F		146	S	
15.Northeast Branch	2.4	P		3.3	F		97	F	

While ecological integrity is often considered the endpoint for stressor-reduction efforts (e.g., stream channel restoration), watershed management typically addresses mechanisms to enhance the physical habitat available to a diversity of organisms, particularly those that affect water quality.

Assessment of Site Conditions

Site 1. Indian Creek – I-95

This potential restoration reach comprises approximately 7,000 feet (roughly 2,100 meters) between I-95 and Beltsville (Figure 2), and the specific sample site is near an industrial park and cemetery. Access to the site is via the cemetery behind the Beltsville Motor Vehicle Administration on the west side of Rt. 1. The site has an upstream drainage area of approximately 1,250 acres (5.1 km^2). Of the reaches sampled for this project, this site had the best physical habitat, rating as optimal (Table 8) with an RBP physical habitat score of 164. There was some bank instability and sediment deposition, but little evidence of human-induced channel alteration or disturbance of riparian vegetation (Figure 8). There also seemed to be sufficient instream physical complexity.

The physical habitat index (PHI) scored 88.3, resulting from high scores for remoteness, site shading, diverse and complex instream habitat, including woody debris. Substrate particle sizes were primarily made up of medium gravel, with 87% larger than 8mm, and the remainder in the size range of sand and silt/clay; these were associated with a relative bed stability (LRBS) score of -0.938, indicating sediment impairment, and an increased risk of bottom erosion. *In situ* water quality measurements for the Spring sampling were conductivity, 880µS/cm, DO, 8.6mg/l, pH 7.0, and water and air temperature, 14.0 and 9.4°C, respectively; for Fall, measurements recorded were 600 µS/cm, 12.2 mg/l, pH 8.0, and air and water temperature, 22.2 and 22.4, respectively. The B-IBI rated the reach as being in "fair" biological condition (Figure 6), with a score of 3.29. The sample had 103 specimens representing 42 total taxa. Approximately 75% were of the sample was worms (Annelida: Oligochaeta) and midges (Insecta: Chironomidae). The most abundant worms were *Nais* (Naididae; n=20) and *Bothrioneurum* (Tubificidae; n=12).

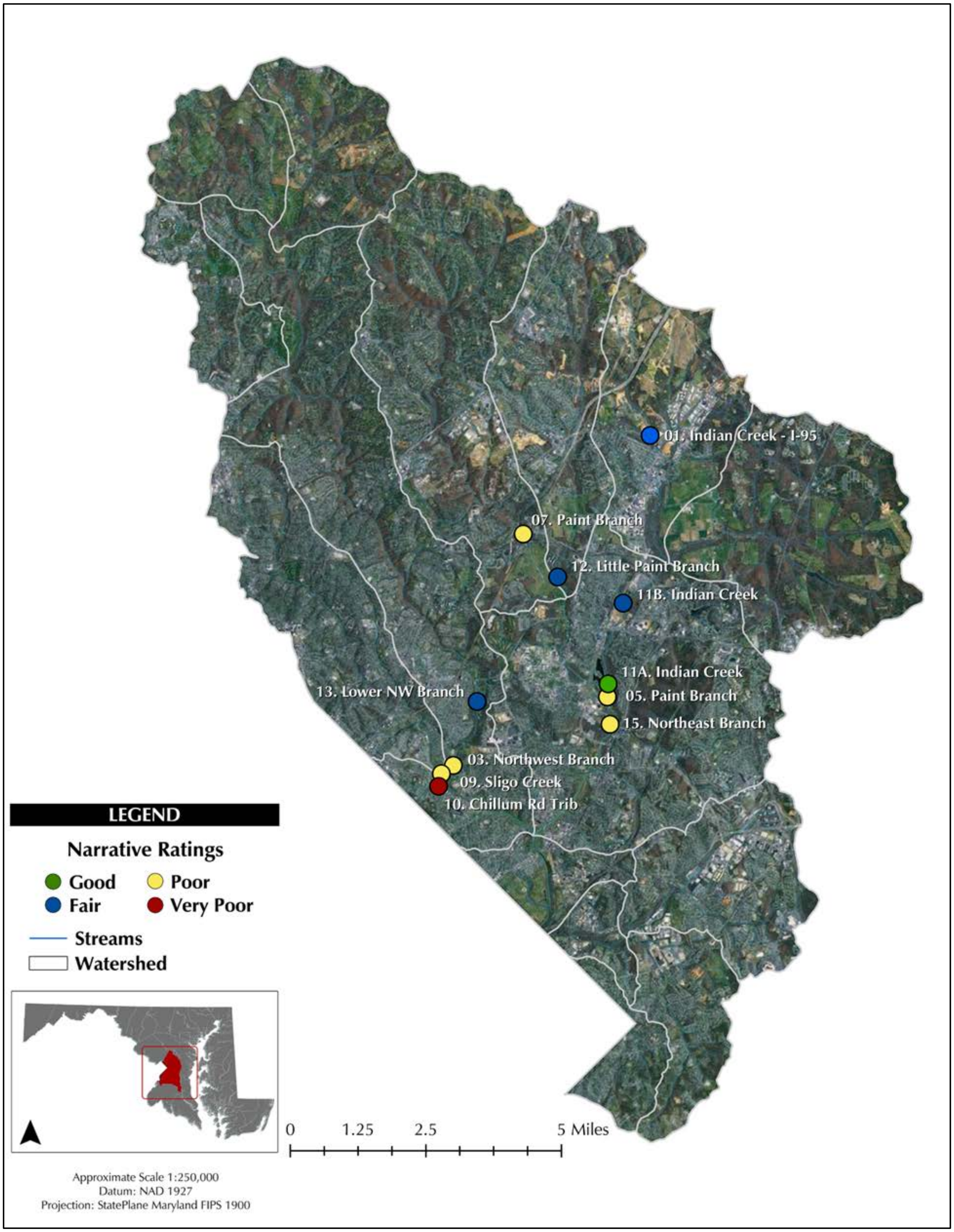

Figure 6. Distribution of B-IBI site condition ratings.

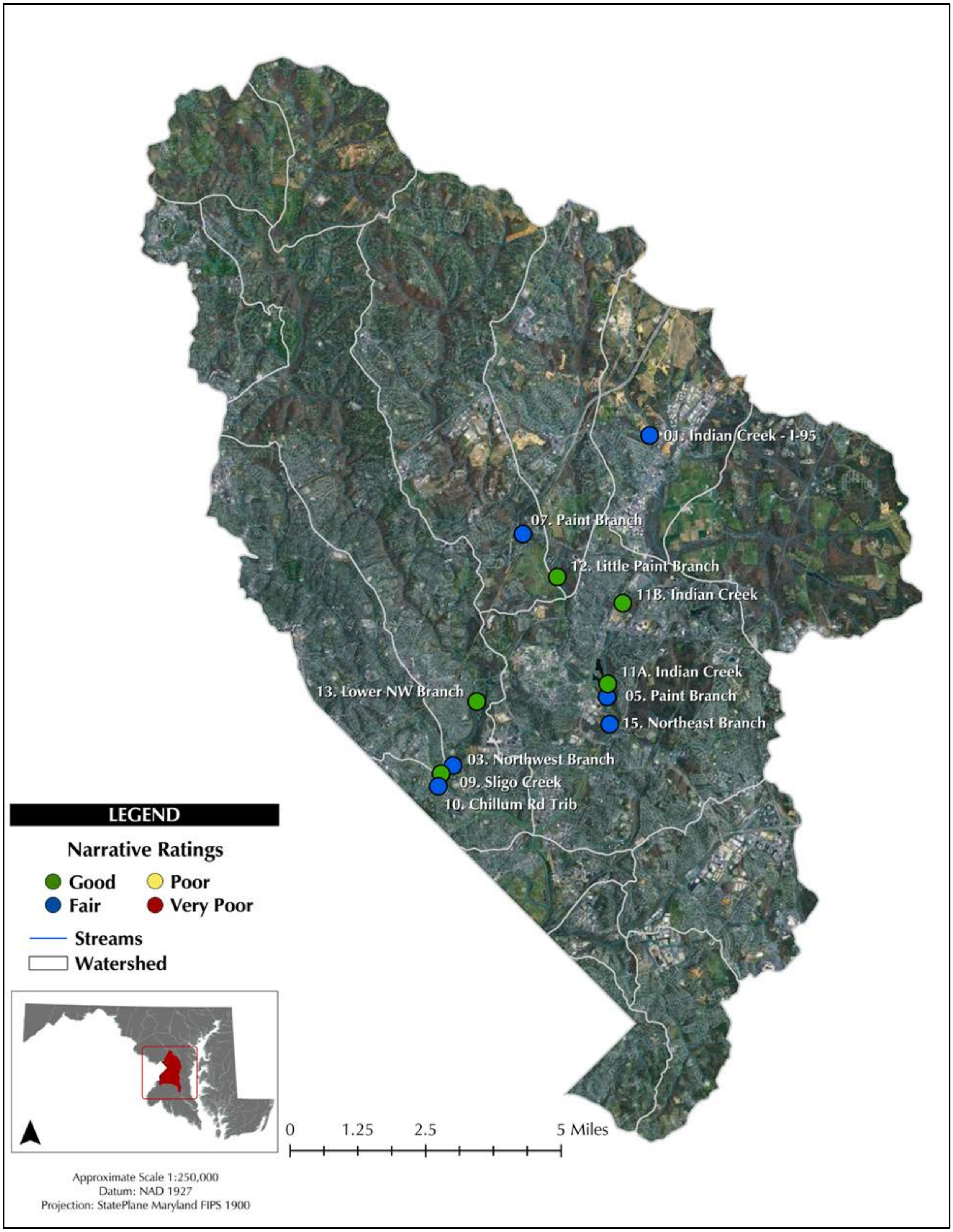

Figure 7. Distribution of F-IBI site condition ratings.

Figure 8. Downstream view of Site 1. Indian Creek-I95.

Midges were mostly in low numbers with 1-3 specimens per genus, with *Orthocladius/Cricotopus* and *Diplocladius* represented by 5 and 6 specimens, respectively. Other taxa represented by only 1-2 specimens included riffle beetles (Elmidae: *Dubiraphia, Macronychus*), biting midges (Ceratopogonidae: *Bezzia/Palpomyia, Dasyhelea, Serromyia, and Culicoides*), caddisflies (Trichoptera: *Hydropsyche, Ironoquia, Polycentropus*), clams (Bivalvia: *Corbicula, Pisidium*), and a freshwater Nemertea (*Prostoma*). The fish IBI rated the site as "fair" (Figure 7) with a score of 3.0. The sample consisted of 141 individuals, and was dominated by Creek chub (n=47; *Semotilus atromaculatus*), Blacknose dace (n=27; *Rhinichthys atratulus*), and American eel (n=27; *Anguilla rostrata*), all considered tolerant species.

Site 3. Northwest Branch

This reach is next to Nicholson Street in Hyattsville (Figure 2), approximately 185 meters downstream of the Ager Road Bridge. The potential restoration area is approximately 7,600 feet long (~2,300 meters). The USACE site selection team noted a partial fish blockage, which had been previously identified by the Metropolitan Washington Council of Governments (MWCOG). There is a large restoration project directly upstream in design by Prince George's County, as well as multiple small projects already completed in the reach. This site receives drainage from 22,680 acres (~92km^2) and is influenced by tributary inflow from Sligo Creek. The RBP habitat assessment resulted in a narrative of 'suboptimal' (score, 117); this part of Northwest Branch has undergone extensive channelization, including straightening and channel armoring. Some bank instability exists, as well as a lack of riparian vegetation (Figure 9).

The PHI score was determined to be 50.4 for the reach, heavily influenced by low scores for remoteness and complexity of habitat. Pebble count showed channel bottom materials to be slightly dominated by fines, 57% composition of sand and silt/clay, with 29% boulder present, suggesting substantial extreme erosional and depositional forces in play for the reach. The reach is 'highly impaired' for RBS with a log10 score of -2.9, indicating severely unstable bottom substrate. *In situ* water chemistry during the spring sampling (April 27) was 435µS/cm for conductivity, 10.8 mg/l for DO, pH of 8.0 standard units (S.U.), and water and air temperature of 1.31°C and 18.3°C, respectively. For the fall sampling (September 02), those parameters were 440 µS/cm, 6.92 mg/l, 6.37 S.U., 24.3°C, and 26.7°C. The B-IBI rated the sampling reach as 'poor' (score, 2.71) (Figure 6); processing resulted in 101 specimens representing 21 macroinvertebrate taxa, no stressor sensitive taxa, and consisting of around 45% midges, and 51% worms. Coarsely, both of these groups are stressor tolerant, and are often overwhelmingly represented in samples from degraded sites. For this site, tolerance values (TV[2]) for the midges ranged from 4.1-8.6, with an average of 6.5; identical values for the worms showed a range of 6-10, averaging 8. In this sample, there are seven different genera of worms of three families, and are dominated by *Nais* (82%). Of 12 genera of midges (Chironomidae), in this sample the most abundant is *Orthocladius/Cricotopus* with 15 specimens, followed by *Polypedilum* with 13, and *Tanytarsus* with 5.

All remaining midge genera are represented by 1-2 specimens. The sample also contained one riffle beetle (Elmidae: *Ancyronyx*), which is relatively stressor tolerant (urban TV=7.6), and one mayfly (Baetidae: *Acentrella*). The fish IBI narrative rating of 'Fair' (score, 3.67) (Figure 7) was based on 450 individuals caught, and high values for the metrics benthic taxa, percent tolerants, and dominant one percent. The most abundant

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[2] Tolerance values range from 0-10, with 0 being most stressor sensitive (=least tolerant), and 10 least stressor sensitive (=most tolerant)

Figure 9. View of the left bank and riparian zone of 3.Northwest Branch. Note minimal riparian zone and relatively unstable bank.

species in the sample were the Redbreast sunfish (*Lepomis auritus*, n=108), White sucker (*Catastomus sommersoni*, n=57), Tessellated darter (*Etheostoma olmstedi*, n=52), Swallowtail shiner (*Notropus procne*, n=45), and the American eel. All other species numbered 23 or less.

Site 5. Paint Branch

This restoration reach is near the College Park Airport, and is immediately downstream of the Paint Branch CAP Section 206 project (Figure 2). It has long been identified as a priority project by the Maryland-National Capital Park and Planning Commission (M-NCPPC), MWCOG, and Prince George's County. This project is intended to connect restoration and BMP activities from its confluence with Little Paint

Branch to Indian Creek. This reach receives drainage from 5,878 acres (approximately 23.8 km^2). The RBP physical habitat assessment score is 123, equating to a narrative of 'fair'. The assessment demonstrated high scores for channel flow status, instream habitat, width of vegetated riparian zone, and sediment deposition; and, low scores for bank stability, channel sinuosity, channel alteration, and the quality of pool size variability and substrate (Figure 10); these habitat conditions led to a PHI score of 54.5. Substrate particle sizes are dominated by gravel (68%) with another 20% as sand and silt/clay. RBS was calculated (log10) as -1.62, indicating 'highly impaired' conditions, and a high risk for substantial sediment mobilization/accelerated erosion. Water chemistry measurements *in situ* during April and September were, respectively, for conductivity (µS/cm), 327 and 550; for DO (mg/l), 10.0 and 10.6; for pH (S.U.), 7.7 and 8.42; water temperature (°C), 15.5 and 29.6; and air temperature (°C), 15.5 and 29.4. The B-IBI narrative rating the site received was "poor" (Figure 6) with a score of 2.71. The final sample was 101 organisms, and the most influential metrics for keeping the index as high as it is are total taxa (value=24) and percent climbers (value=28.7). Of the seven remaining metrics, five of them got scores of 1 or 0. Numerically dominant taxa in the sample are midges (*Polypedilum*, 26 specimens; and *Orthocladius/Cricotopus*, 14 specimens), worms (*Nais*, 15 specimens), and a genus of empidid fly (*Hemerodromia*, 15 specimens). Other than the midge *Saetheria* (5 specimens), all other taxa are represented by only 1-2 specimens. The fish IBI score was 3.67, with a narrative rating of 'fair' (Figure 7), and seemed to be largely driven by the metrics number of benthic taxa, percent tolerants, and percent dominant. There were a total of 383 fishes collected; most dominant in the sample were the Tessellated darter (n=88), Longnose dace (n=46), Swallowtail shiner (n=43), Blacknose dace (n=37), Spottail shiner (n=35), American eel (n=33), Eastern silvery minnow (n=22), and the Banded killifish and Bluegill, each with 20. All other species were represented by 10 or fewer specimens.

Site 7. Paint Branch

This section of Paint Branch is entirely under highway bridges associated with Interstate 95, and is approximately 5,900 feet long (~1,800 meters). The USACE site selection team included this site as a potential opportunity to decrease erosion and bank instability where bedrock-control is lacking, and notes that there are access issues that will make the work difficult. The reach sampled is in a wooded area near the exit ramp off of I – 95/495 interchange, and surrounded on all sides by multiple, elevated highways (Figures 2, 11). This reach receives drainage from 10,457 acres (~42.3 km^2). The RBP

Figure 10. Downstream view of 5. Paint Branch. Note lack of sinuosity and low diversity of instream habitat. vegetative protection.

physical habitat assessment score is 145 with a narrative of 'suboptimal', and exhibits some problems with bank stability, channel alteration/lacking sinuosity, and limited bank vegetative protection. The PHI score is 73.3, and resulted from lower scores for remoteness, and for instream habitat and low woody debris. Bed materials are coarse,with 80% of the particle sizes ranging from gravel to bedrock, but receives a bed stability rating of highly impaired (log10RBS= -1.03), likely reflecting risk of effects from episodes of severe scour during stormflows. Water chemistry measurements in situ during April and September were, respectively, for conductivity (μS/cm), 359 and 407; for DO (mg/l), 9.4 and 9.35; for pH (S.U.), 7.8, for both dates; water temperature (°C), 17.0 and 25.1; and air temperature (°C), 15.5 and 32.2. The B-IBI resulted in a rating of 'poor' (score, 2.71) (Figure 6), with total taxa, EPT taxa, and percent climbers pushing the score higher. There are 104 organisms in the sample, 69 of which are distributed among 11 genera of midges (Chironomidae). The two dominant midges are *Polypedilum* (n=36), *Saetheria* (n=14), and *Orthocladius/Cricotopus* (n=7). All other taxa are in low numbers of 1-2, with the exception of, *Nais* (n=4), *Hemerodromia* (n=6), *Antocha* (n=5), and *Hydropsyche* (n=4). The site was rated 'fair' by the F-IBI (score, 3.67) (Figure 7), with the metrics benthic taxa, percent tolerant, and percent dominants seemingly most influential. There were a total of 17 species captured in 375 individuals; the sample was largely dominated by seven species: Blacknose dace (n=141), Longnose dace (n=87), American eel (n=27), Yellow bullhead (n=26), Creek chub (n=24), Redbreast sunfish (n=17), and Satinfin shiner (n=14).

Site 9. Sligo Creek

This potential restoration reach on Sligo Creek is 2,329 feet long (approx. 710 meters), and parallels Sligo Creek Parkway east-southeast of Chillum, and north of Queen's Chapel Road (Rt. 208) (Figure 2). The USACE site selection team identified a fish passage issue that presents an opportunity for in-stream restoration. The reach sampled for biological assessment (Figure 12) is just off the trail near a project site of the Washington Suburban Sanitary Commission (WSSC). Access was from Nicholson Street adjacent to the parkland. Physical habitat quality assessment resulted in a narrative of 'suboptimal' (score, 148), and like much of this stream, exhibits some problems with low channel sinuosity and channelization, reduced flow status, and lack of complexity of instream habitat (Figure 12); it received a PHI score of 80.6 calculated from low scores for remoteness, shading, epifaunal substrate, and instream habitat. Stream bottom materials are primarily sand and gravel with some cobble and boulders, and receives an RBS rating of 'highly impaired' (log10RBS, -1.05). Water chemistry measurements in situ during April and September were, respectively, for conductivity (μS/cm), 1,290 and 780; for DO (mg/l), 10.8 and 11.2; for pH (S.U.), 7.3 and 7.9; water temperature (°C), 12.3 and 24.3; and air temperature (°C), 10.0 and 29.4. The benthic macroinvertebrate sample consisted of 107 specimens, and resulted in a B-IBI narrative rating of 'poor' (score, 2.71) (Figure 6) . There were 23 total taxa, 2 scraper taxa, and 24.3 percent climbers; these metrics had the greatest influence on the index being as high as it was. The sample was dominated by worms (Oligochaeta) and midges (Chironomidae), the four most abundant taxa being *Polypedilum* (n=22), *Nais* (n=19), *Orthocladius/Cricotopus* (n=17) and *Saetheria* (n=14). Other than the midges and worms, in very small numbers there were also damselflies (Odonata: Coenagrionidae: *Argia, Enallagma*), and nemerteans (Enopla: Tetrastemmatidae: *Prostoma*). The fish IBI rated the sampling reach as 'good' (score, 4.3) (Figure 7) , with the index largely driven by abundance (individuals/m^2), number of benthic taxa, percent tolerants, and percent dominance, with somewhat lower values for percent intolerant suckers, percent generalists, omnivores, invertivores, and percent dominance. There were 747 individuals caught that were distributed among 18 species, with those most dominant as White sucker (*Catostomus commersoni*, n=148), Spottail shiner (*Notropis hudsonius*, n=143), Bluntnose minnow (*Pimephales notatus*, n=134), and Redbreast sunfish (*Lepomis auritus*, n=81). Fourteen other species numbered <50 specimens.

Figure 11. Looking upstream at site 7.Paint Branch. Note overpass from I-95/495 interchange.

Site 10. Chillum Road Tributary

The Chillum Road tributary, feeds into the mainstem of Northwest Branch approximately 225 meters downstream of the Sligo Creek confluence from the west side (Figure 2). This tributary was originally identified by MWCOG as one where a restoration/stabilization project would integrate well with comprehensive restoration

Figure 12. Looking upstream at 9. Sligo Creek, and showing instream habitat of low physical complexity.

activity with the Northwest Branch mainstem. In confirming this, the USACE site selection team noted evident channel incision and erosion. The RBP physical habitat assessment resulted in a score of 120, which translates to 'suboptimal' (Table 8). There is substantial degradation shown through stream bank instability, lack of sinuosity, instream structure (including lack of pool variability), and riparian vegetation (Figure 13). The PHI score of 67.3 resulted from very low scores on remoteness, shading, instream habitat, woody debris, and bank stability. Substrate particle sizes are dominated by sand and gravel (87%), with little cobble. The reach is rated for RBS as 'highly impaired' with a score of -1.99 (log10RBS), indicating substantial risk of accelerated sediment movement. Water chemistry measurements in situ during April and September were, respectively, for conductivity (µS/cm), 1,440 and 690; for DO (mg/l), 7.7 and 10.1; for pH (S.U.), 6.9 and 6.5; water temperature (°C), 16.3 and 22.1; and air temperature (°C), 14.4 and 27.8. The stream is rated as 'very poor' by the B-IBI (Figure 6) , with the sample of 105 specimens resulting in a score of 1.57. There were 16 taxa, primarily consisting of worms and midges.

The seven genera of midges were represented by 66 specimens, of which 50 were *Orthocladius/Cricotopus*, and another seven were *Polypedilum*. The 33 worms were distributed among *Nais*, *Paranais*, enchytraeids, and unidentified Tubificinae. The site was rated as 'fair' by the F-IBI (score, 3.33) (Figure 7) , with the metrics receiving the highest scores including number of benthic taxa, percent tolerants, and percent dominants. Fish sampling produced 529 individuals dominated by six species: Swallowtail shiner (n=167), Satinfin shiner (n=74), Blacknose dace (n=72), Banded killifish (n=64), Bluntnose minnow (n=59), and White sucker (n=41). This is the only site where Fallfish (*Semotilus corporalis*) (n=11 specimens) was encountered.

Site 11A. Indian Creek

This site is situated adjacent to Lake Artemesia just downstream from the pedestrian bridge over Indian Creek (Figure 2). The site was accessed via the walking trail at the intersection of Vassar Drive and Sweetbriar Drive in College Park. This stream has been channelized for at least 70 years (evidence of channelization is apparent in 1945 USGS 7.5 minute topo maps). Additionally, WSSC is currently doing infrastructure repair work just upstream from the sample reach and have partially removed a fish blockage. This sampling reach receives drainage from an area of approximately 18,500 acres (~75 km^2). Physical habitat quality was rated as 'suboptimal', with an RBP habitat assessment score of 128 (Table 8). It is experiencing channel instability, lack of bank vegetative protection, channel alteration, low sinuosity, and lack of complexity in pool structure (Figure 14). Substrate particle size composition is primarily gravel (56%) and sand (23%), with some silt/clay, cobble, and boulder. Stream channel and substrate characteristics were measured as 'impaired' by RBS (score, log10RBS -0.77). The site received a PHI score of 58.7, with very low scores for remoteness, shading, and instream woody debris. Water chemistry measurements *in situ* during April and September were, respectively, for conductivity (µS/cm), 435 and 480; for DO (mg/l), 11.1 and 8.0; for pH (S.U.), 7.4 and 6.7; water temperature (°C), 14.1 and 24.4; and air temperature (°C), 21.1 and 23.9. The B-IBI led to a rating of 'good' (Table 8, Figure 6) , with high scores (5) for the metrics total taxa, EPT taxa, number of mayfly taxa, number of scraper taxa, and percent climbers. In 110 specimens, there were 34 taxa among 18 families; the most abundant taxa were midges, of which *Orthocladius/Cricotopus* (n=26), *Polypedilum* (n=11), and *Cladotanytarsus* (n=10) were most common. The riffle beetle, *Stenelmis* (Coleoptera: Elmidae, n=6) was also found. This site was rated as 'good' by the F-IBI with a score of 4.0 (Figure 7). The highest metrics were benthic taxa; percent tolerants; percent generalists, omnivores, and insectivores; and percent dominants. The fish sampling collected 447 specimens and 25 species, dominated by Longnose dace (n=81), Bluegill (n=56), Spottail shiner (n=55), Pumpkinseed (n=52), and Tessellated darter (n=46). All other species were represented by 27 or fewer individuals; four of which only by a single specimen (Black crappie, Common carp, Mummichog, and Sea Lamprey).

Figure 13. Downstream view at 10.Chillum Road Tributary. Note the eroding banks.

Site 11B. Indian Creek

This potential restoration reach is located behind a new housing development that is actively under construction. Field crews noticed evidence of uncontained sediment from the construction zone washing off and down into the stream valley, eventually reaching the creek. However, this area is downstream from the sampling site. The upstream drainage area is 17,204 acres, or, approximately 70 km2. The RBP physical habitat score of 128 ('suboptimal'; Table 8)) results from bank instability and minimal undisturbed riparian vegetation, excessive deposition, and lack of both sinuosity and complexity of pool structure (Figure 15). The PHI score of 66.4 resulted from low scores for remoteness, instream habitat, and woody debris. Bed materials are primarily made up of gravel and sand (68 and 26 percent, respectively); the reach is rated as 'highly impaired' for bed stability (log10RBS [LRBS] = -1.29).

Figure 14. Site 11a.Indian Creek, looking at the right bank. Note abundance of gravel.

Water chemistry measurements in situ during April and September were, respectively, for conductivity (µS/cm), 395 and 400; for DO (mg/l), 9.6 and 8.6; for pH (S.U.), 7.3 and 7.3; water temperature (°C), 13.5 and 24.3; and air temperature (°C), 12.8 and 31.1. The B-IBI rating of 'fair' (score, 3.86) (Figure 6) was driven by high scores for the metrics total taxa, number of Ephemeroptera taxa, number of scraper taxa, and percent climbers. There are 23 total taxa of invertebrates in the sample; of note in this sample is that worm and midges combined are not the overwhelmingly dominant groups. There were 31 riffle beetles (Elmidae) in the genera *Stenelmis* (n=31) and *Oulimnius* (n=1), while there were 33 midges (primarily, *Polypedilum* and *Cladotanytarsus*). There were also two genera of relatively stressor-sensitive mayflies, *Maccaffertium* and *Plauditus*. There were 309 fish caught at this site, from which an F-IBI rating of 'good' was attained (Figure 7).

Metrics scoring highest were number of benthic taxa, percent tolerants, percent intolerant suckers, and percent dominant. The most common species in the sample were American eel (n=73), Redbreast sunfish (n=43), Tessellated darter (n=43), Longnose dace (n=41), Spottail shiner (n=17), Swallowtail shiner (n=17), White sucker (n=11), and Satinfin shiner (n=10). Some of the other species showing up in the sample with <7 specimens included Northern hogsucker, Pumpkinseed, Sea Lamprey, Creek chub, Mummichog, Bluntnose minnow, Bluegill, Green sunfish, Largemouth bass, Yellow bullhead, and Least brook lamprey.

Figure 15. Looking downstream at site 11b.Indian Creek. The stream reach was well-forested with an extensive vegetated riparian zone.

Site 12. Little Paint Branch

This potential restoration reach is in College Park (Figure 2), directly upstream of an Inter-County Connector (ICC) mitigation project at Paint Branch/Little Paint Branch confluence. Access to the site was via the foot trail that parallels the stream beginning where Cherry Hill Road crosses the stream. The length of this reach is 4,389 feet (approx.

Figure 16. Looking downstream at 12.Little Paint Branch. Like many other streams, this was historically straightened and therefore scored low due to no sinuosity.

1,338 meters), and the USACE site selection team recognizes the opportunity to increase stream habitat heterogeneity (mix of pools, riffles, runs) where it has been degraded by channelization (Figure 16). The 100 meter sampling reach drains an area of 6,874 acres (approx. 28km^2).Physical habitat quality is rated by the RBP habitat assessment as ‘suboptimal’ with a score of 113 (Table 8). This channel has been straightened, resulting in a low score for sinuosity, pool substrate and variability, and riparian vegetation. The PHI score of 68.8 reflects very low scores for shading and instream woody debris, but moderate to high scores for epifaunal substrate, instream habitat, and bank stability. Inorganic bottom materials are dominated by gravel and sand, with the pebble count of 62 and 33%, respectively, and there is some cobble present (5%). The reach is rated ‘highly impaired’ for RBS (Table 8), with a log10 score of -1.50. Water chemistry measurements in situ during April and September were, respectively, for conductivity (µS/cm), 476 and 540; for DO (mg/l), 9.8 and 12.4; for pH (S.U.), 7.6 and 7.0; water temperature (°C), 16.3 and 24.7; and air temperature (°C), 18.3 and 28.9. The site is rated as being in ‘fair’ biological condition by the B-IBI (Table 8, Figure 6) . The only metrics that scored 5 points (the highest possible) was total taxa and percent climbers, whereas EPT taxa, Ephemeroptera taxa, percent Ephemeroptera, and number of scraper taxa scored the next step down, 3. There are a total of 25 taxa, which are characteristically dominated by midges. Eighty (80) of the 104 total specimens are chironomids, typically considered to be a stressor tolerant group at the family level. The two genera represented by the most individuals are *Polypedilum* (n=26) and *Orthocladius/Cricotopus* (n=25). This reach was rated as ‘good’ by the fish IBI (Figure 7), with a score of 4.33; there were 875 individuals caught. Metrics which seem to have driven the rating are density of individuals, number of benthic taxa, percent tolerants, and percent dominance. Almost 80% of the total catch (n=692) was made up of six species: Blacknose dace (n=275), Longnose dace (n=116), Swallowtail shiner (n=98), Mummichog (n=73), and the American eel and Banded killifish, each with 65. A few of the remaining species found in this sample that may be of some interest, but are in lower numbers, include Yellow bullhead, Spottail shiner, Bluegill, Bluntnose minnow, Sea lamprey, Cutlips minnow, Eastern mudminnow, Brown bullhead, and Northern hogsucker.

Site 13. Lower Northwest Branch

This sampling reach is located on Lower Northwest Branch off a paved trail adjacent to Gumwood Drive and has an upstream drainage area of 21,745 acres (approximately 88km^2) (Figure 2). Access to the site was via the adjacent residential neighborhood. The reach was rated as ‘suboptimal’ by the RBP physical habitat assessment procedure (score, 146) (Table 8), and has been exposed to channelization, there is some bank instability, and low scores for riparian vegetation and bank protection (Figure 17).

Low habitat scores for remoteness, shading, instream habitat, and woody debris resulted in a low PHI score, 65; scores for epifaunal substrate and bank stability were moderate. Distribution of substrate particle sizes was gravel (60%), sand (29%), and cobble (11%). Relative bed stability calculations rated the reach as 'highly impaired' (log10RBS = -1.15). Water chemistry measurements *in situ* during April and September were, respectively, for conductivity (µS/cm), 990 and 440; for DO (mg/l), 10.5 and 9.9; for pH (S.U.), 7.3 and 6.9; water temperature (°C), 13.9 and 25.5; and air temperature (°C), 19.4 and 31.1. Analysis of the benthic macroinvertebrate sample resulted in high scores

Figure 17. View of left bank at 13.Lower Northwest Branch. Note incomplete vegetated riparian zone, in addition to unstable steep banks, a likely result of past channelization.

for the metrics total taxa, number of scraper taxa, and percent climbers, combined with lower score in the remaining six metrics resulted in a B-IBI rating of 'fair' (score, 3.57) (Figure 6). There are 109 individuals in 24 taxa, and 93.6% of the sample is comprised of worms and midges. The worms captured in the sample are *Nais* (n=30), *Limnodrilus* (n=11), unidentified tubificines (n=11), *Bothrioneurum* (n=3), and Enchytraeidae (n=2); whereas, the three most abundant midges are *Polypedilum* (n=15), *Orthocladius/Cricotopus* (n=12), and *Thienemannimyia* (n=4). There are 10 additional midge genera with either 1-2 individuals. Other non-midge or worm taxa represented by a single individual include *Hydropsyche, Corbicula, Physa, Nematoda,* and *Prostoma*. The F-IBI rated the site as 'good' (Figure 7) with an index score of 4.67. There were 1,458 individual fish caught, resulting in high index score for density (individuals/m^2), benthic taxa, percent tolerants, percent intolerant suckers, and percent dominant. The top seven most abundant species account for 77% of the sample (Spottail shiner [n=328], Swallowtail shiner [n=213], Bluntnose minnow [n=193], Redbreast sunfish [n=109], White sucker [n=99], Blacknose dace [n=94], and Northern hogsucker [n=87]). Some of the remaining species with 70 or fewer individuals include Longnose dace, Yellow bullhead, Least brook lamprey, Brown bullhead, Fantail darter, and Smallmouth bass.

Site 15. Northeast Branch

This site is on the mainstem of Northeast Branch, approximately 250 meters west of the intersection of Good Luck Road and Kenilworth Avenue (Hwy. 201) (Figure 2). Access to the site was via WSSC temporary roadway as they were conducting work on a nearby tributary. The upstream drainage area is 39,263 acres (~159km^2). The reach was rated as 'fair' by the RBP physical habitat assessment, with a score of 97. There is severe bank instability, low sinuosity due to straightening, diminished epifaunal substrate and pool quality, riparian vegetation is nearly nonexistent, there is substantial fine sedimentation, and little vegetative protection of the banks (Figure 18). The degraded bank stability, complete lack of instream woody debris, lack of remoteness, and poor epifaunal substrate and instream habitat resulted in a PHI score of 42.9. Wolman pebble count resulted in 81% gravel and sand, with some cobble and boulder, likely reflecting intermittent episodes of high scour during storm flows. The RBS narrative rating for this reach is 'impaired' (log10RBS = -0.858). Water chemistry measurements *in situ* during April and September were, respectively, for conductivity (μS/cm), 446 and 2475; for DO (mg/l), 10.2 and 9.2; for pH (S.U.), 7.7 and 7.2; water temperature (°C), 14.9 and 24.6; and air temperature (°C), 15.6 and 29.4. The B-IBI resulted in rating of 'poor' (Table 8, Figure 6); only one of the metrics received a score of 5, percent climbers, total taxa got a 3, and all other metrics were either 0 or 1. The benthic macroinvertebrate sample was 106 individuals, and overwhelmingly dominated by midges (n=93), with Polypedilum (n=54) and *Cladotanytarsus* (n=16) being most abundant. Other midge genera in the sample, but not commonly observed are *Cryptochironomus, Phaenopsectra, Dicrotendipes, Ablabesmyia,* and *Rheotanytarsus*. Fish sampling produce 242 individuals, and received an F-IBI rating of 'fair' (Figure 7) with a score of 3.33. Metrics that provided the highest scores (5) were number of benthic taxa and percent dominant, where 'percent generalists, omnivores, and insectivores' scored 3. Two hundred forty two (242) individuals were captured, representing 14 species. The seven most abundant species are Bluegill (n=52), Pumpkinseed (n=44), American eel (n=40), Redbreast sunfish (n=30), Tessellated darter (n=23), White sucker (n=19), and Green sunfish (n=15). Some of the other species captured, though in small numbers include the Eastern silvery minnow, Yellow bullhead, Black crappie, and Channel catfish.

Figure 18. View looking downstream at 15. Northeast Branch.

Conclusions and Recommendations

From a technical perspective, we recommend further "data-mining" into other agency surveys and natural resource inventories to provide a more complete ecological dataset for these stream reaches. The 2015 survey provides a snapshot of conditions, but does not account for any inter-annual variability over the past 10-20 years. For example, both Prince George's County and the MBSS have close to 20 years' of bioassessment data. It is likely that some of the previous assessments are located within the targeted stream reaches, thus they would provide additional useful data for understanding site characteristics. More in-depth statistical analyses to evaluate associations among different stressors and the stream biota, and the sources of those stressors can lead to identification of causal factors, and inform additional restoration decisionmaking.

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Appendix A. Benthic macroinvertebrate sample results

Table A-1. Benthic macroinvertebrate sample data, including counts, tolerance values (TV), functional feeding group (FFG), and urban tolerance values (TV_Urb).

SiteID	Date	Family	Taxon (Final ID)	Count	TV	FFG	Habit	TV_Urb
01.Indian Creek-I95	04/21/15	Caenidae	*Caenis*	2	7	CG	Sprawler	2.1
01.Indian Creek-I95	04/21/15	Calopterygidae	*Calopteryx*	1	6	PR	Climber	8.3
01.Indian Creek-I95	04/21/15	Ceratopogonidae	*Bezzia/Palpomyia*	1	6	PR	Burrower	
01.Indian Creek-I95	04/21/15	Ceratopogonidae	*Culicoides*	1	10	PR	Burrower	5.9
01.Indian Creek-I95	04/21/15	Ceratopogonidae	*Dasyhelea*	1	6	CG	Sprawler	3.6
01.Indian Creek-I95	04/21/15	Ceratopogonidae	*Serromyia*	2	6	PR	Burrower	
01.Indian Creek-I95	04/21/15	Chironomidae	*Brillia*	1	5	SH	Burrower	7.4
01.Indian Creek-I95	04/21/15	Chironomidae	*Chaetocladius*	3	6	CG	Sprawler	7
01.Indian Creek-I95	04/21/15	Chironomidae	*Cryptotendipes*	1	8	CG	Sprawler	6.6
01.Indian Creek-I95	04/21/15	Chironomidae	*Diplocladius*	5	7	CG	Sprawler	5.9
01.Indian Creek-I95	04/21/15	Chironomidae	*Hydrobaenus*	2	8	SC	Sprawler	7.2
01.Indian Creek-I95	04/21/15	Chironomidae	*Limnophyes*	2	8	CG	Sprawler	8.6
01.Indian Creek-I95	04/21/15	Chironomidae	*Nilotanypus*	1	6	PR	Sprawler	6.6
01.Indian Creek-I95	04/21/15	Chironomidae	*Orthocladius/Cricotopus*	7	6	CG	Sprawler	
01.Indian Creek-I95	04/21/15	Chironomidae	*Pseudosmittia*	1	6	CG	Sprawler	6.6
01.Indian Creek-I95	04/21/15	Chironomidae	*Rheocricotopus*	2	6	CG	Sprawler	6.2
01.Indian Creek-I95	04/21/15	Chironomidae	*Stenochironomus*	1	5	SH	Burrower	7.9
01.Indian Creek-I95	04/21/15	Chironomidae	*Tanytarsus*	1	6	CF	Climber	4.9
01.Indian Creek-I95	04/21/15	Chironomidae	*Thienemannimyia*	1	6	PR	Sprawler	6.7
01.Indian Creek-I95	04/21/15	Chironomidae	*Zavrelimyia*	2	8	PR	Sprawler	5.3
01.Indian Creek-I95	04/21/15	Corbiculidae	*Corbicula*	2	6	CF	Burrower	6
01.Indian Creek-I95	04/21/15	Dytiscidae	*Neoporus*	1	5	PR	Swimmer	
01.Indian Creek-I95	04/21/15	Elmidae	*Dubiraphia*	1	6	CG	Clinger	5.7
01.Indian Creek-I95	04/21/15	Elmidae	*Macronychus*	2	4	OM	Clinger	6.8
01.Indian Creek-I95	04/21/15	Enchytraeidae	*Enchytraeidae*	3	10	CG	Burrower	9.1
01.Indian Creek-I95	04/21/15	Hydropsychidae	*Hydropsychidae*	1	4	CF	Clinger	5.7
01.Indian Creek-I95	04/21/15	Limnephilidae	*Ironoquia*	1	3	SH	Sprawler	4.9
01.Indian Creek-I95	04/21/15	Naididae	*Dero*	1	10	CG	Burrower	
01.Indian Creek-I95	04/21/15	Naididae	*Nais*	20	8	CF	Burrower	
01.Indian Creek-I95	04/21/15	Naididae	*Slavina*	1		CG		
01.Indian Creek-I95	04/21/15	Naididae	*Stylaria*	2				
01.Indian Creek-I95	04/21/15	Pisidiidae	*Pisidiidae*	1		CG		
01.Indian Creek-I95	04/21/15	Pisidiidae	*Pisidium*	2	8	CF	Burrower	5.7
01.Indian Creek-I95	04/21/15	Planorbidae	*Helisoma*	1	6	SC	Climber	7.6
01.Indian Creek-I95	04/21/15	Polycentropodidae	*Polycentropus*	1	5	PR	Clinger	1.1
01.Indian Creek-I95	04/21/15	Sciaridae	*Sciaridae*	1				

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01.Indian Creek-I95	04/21/15	Simuliidae	*Simulium*	2	7	CF	Clinger	5.7
01.Indian Creek-I95	04/21/15	Tetrastemmatidae	*Prostoma*	3		PR		7.3
01.Indian Creek-I95	04/21/15	Tipulidae	*Erioptera*	1	7	CG		4.8
01.Indian Creek-I95	04/21/15	Tubificidae	*Aulodrilus*	1	5	CG	Sprawler	
01.Indian Creek-I95	04/21/15	Tubificidae	*Bothrioneurum*	12				
01.Indian Creek-I95	04/21/15	Tubificidae	*Spirosperma*	4	10	CG	Clinger	6.6
01.Indian Creek-I95	04/21/15	Tubificidae	*Tubificinae*	1				
03.Northwest Br.	04/27/15	Baetidae	*Acentrella/Plauditus*	1			Swimmer	
03.Northwest Br.	04/27/15	Chironomidae	*Corynoneura*	1	7	CG	Sprawler	4.1
03.Northwest Br.	04/27/15	Chironomidae	*Eukiefferiella*	1	8	CG	Sprawler	6.1
03.Northwest Br.	04/27/15	Chironomidae	*Hydrobaenus*	2	8	SC	Sprawler	7.2
03.Northwest Br.	04/27/15	Chironomidae	*Limnophyes*	1	8	CG	Sprawler	8.6
03.Northwest Br.	04/27/15	Chironomidae	*Nanocladius*	2	3	CG	Sprawler	7.6
03.Northwest Br.	04/27/15	Chironomidae	*Orthocladiinae*	2	6	CG	Burrower	7.6
03.Northwest Br.	04/27/15	Chironomidae	*Orthocladius/Cricotopus*	15	6	CG	Sprawler	
03.Northwest Br.	04/27/15	Chironomidae	*Parachironomus*	1	10	PR	Sprawler	6.6
03.Northwest Br.	04/27/15	Chironomidae	*Polypedilum*	13	6	SH	Climber	6.3
03.Northwest Br.	04/27/15	Chironomidae	*Rheotanytarsus*	2	6	CF	Clinger	7.2
03.Northwest Br.	04/27/15	Chironomidae	*Tanytarsus*	5	6	CF	Climber	4.9
03.Northwest Br.	04/27/15	Coenagrionidae	*Enallagma*	1	8	PR	Climber	9
03.Northwest Br.	04/27/15	Elmidae	*Ancyronyx*	1	2	OM	Clinger	7.8
03.Northwest Br.	04/27/15	Lumbricidae	*Eiseniella*	1				
03.Northwest Br.	04/27/15	Naididae	*Chaetogaster*	2	6	PR		
03.Northwest Br.	04/27/15	Naididae	*Nais*	42	8	CF	Burrower	
03.Northwest Br.	04/27/15	Naididae	*Paranais*	3				
03.Northwest Br.	04/27/15	Naididae	*Stylaria*	1				
03.Northwest Br.	04/27/15	Tipulidae	*Antocha*	1	5	CG	Clinger	8
03.Northwest Br.	04/27/15	Tipulidae	*Tipulidae*	1	4	SH	Burrower	4.8
03.Northwest Br.	04/27/15	Tubificidae	*Bothrioneurum*	1				
03.Northwest Br.	04/27/15	Tubificidae	*Limnodrilus*	1	10	CG	Clinger	8.6
05.Paint Branch	04/22/15	Chironomidae	*Cladotanytarsus*	2	7	CG	Climber	6.6
05.Paint Branch	04/22/15	Chironomidae	*Cryptochironomus*	2	8	PR	Sprawler	7.6
05.Paint Branch	04/22/15	Chironomidae	*Krenosmittia*	1	1	CG	Sprawler	
05.Paint Branch	04/22/15	Chironomidae	*Nilotanypus*	1	6	PR	Sprawler	6.6
05.Paint Branch	04/22/15	Chironomidae	*Orthocladius/Cricotopus*	14	6	CG	Sprawler	
05.Paint Branch	04/22/15	Chironomidae	*Polypedilum*	26	6	SH	Climber	6.3
05.Paint Branch	04/22/15	Chironomidae	*Rheotanytarsus*	1	6	CF	Clinger	7.2
05.Paint Branch	04/22/15	Chironomidae	*Saetheria*	6	4	CG	Burrower	6.6
05.Paint Branch	04/22/15	Chironomidae	*Tanytarsus*	1	6	CF	Climber	4.9
05.Paint Branch	04/22/15	Chironomidae	*Thienemannimyia*	1	6	PR	Sprawler	6.7

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05.Paint Branch	04/22/15	Chironomidae	*Tribelos*	1	5	CG	Burrower	7
05.Paint Branch	04/22/15	Elmidae	*Ancyronyx*	1	2	OM	Clinger	7.8
05.Paint Branch	04/22/15	Elmidae	*Stenelmis*	1	6	SC	Clinger	7.1
05.Paint Branch	04/22/15	Empididae	*Hemerodromia*	15	6	PR	Sprawler	7.9
05.Paint Branch	04/22/15	Empididae	*Neoplasta*	1			Sprawler	
05.Paint Branch	04/22/15	Hydropsychidae	*Cheumatopsyche*	1	5	CF	Clinger	6.5
05.Paint Branch	04/22/15	Hydropsychidae	*Hydropsyche*	2	6	CF	Clinger	7.5
05.Paint Branch	04/22/15	Lebertiidae	*Lebertia*	1	8	PR		
05.Paint Branch	04/22/15	Naididae	*Nais*	15	8	CF	Burrower	
05.Paint Branch	04/22/15	Philopotamidae	*Chimarra*	1	4	CF	Clinger	4.4
05.Paint Branch	04/22/15	Philopotamidae	*Philopotamidae*	1	3	CF	Clinger	2.6
05.Paint Branch	04/22/15	Pisidiidae	*Pisidiidae*	1		CG		
05.Paint Branch	04/22/15	Sperchonidae	*Sperchon*	1	8	PR		
05.Paint Branch	04/22/15	Tetrastemmatidae	*Prostoma*	1		PR		7.3
05.Paint Branch	04/22/15	Tipulidae	*Antocha*	2	5	CG	Clinger	8
05.Paint Branch	04/22/15		*Veneroida*	1				
07.Paint Branch	04/21/15	Ceratopogonidae	*Bezzia/Palpomyia*	1	6	PR	Burrower	
07.Paint Branch	04/21/15	Chironomidae	*Cardiocladius*	1	6	PR	Burrower	10
07.Paint Branch	04/21/15	Chironomidae	*Cryptochironomus*	1	8	PR	Sprawler	7.6
07.Paint Branch	04/21/15	Chironomidae	*Dicrotendipes*	2	10	CG	Burrower	9
07.Paint Branch	04/21/15	Chironomidae	*Orthocladius/Cricotopus*	9	6	CG	Sprawler	
07.Paint Branch	04/21/15	Chironomidae	*Phaenopsectra*	1	7	SC	Clinger	8.7
07.Paint Branch	04/21/15	Chironomidae	*Polypedilum*	36	6	SH	Climber	6.3
07.Paint Branch	04/21/15	Chironomidae	*Pseudorthocladius*	1	0	CG	Sprawler	6
07.Paint Branch	04/21/15	Chironomidae	*Saetheria*	14	4	CG	Burrower	6.6
07.Paint Branch	04/21/15	Chironomidae	*Stenochironomus*	1	5	SH	Burrower	7.9
07.Paint Branch	04/21/15	Chironomidae	*Synorthocladius*	1	2	CG		6.6
07.Paint Branch	04/21/15	Chironomidae	*Tanytarsus*	2	6	CF	Climber	4.9
07.Paint Branch	04/21/15	Empididae	*Hemerodromia*	6	6	PR	Sprawler	7.9
07.Paint Branch	04/21/15	Enchytraeidae	*Enchytraeidae*	2	10	CG	Burrower	9.1
07.Paint Branch	04/21/15	Hydropsychidae	*Cheumatopsyche*	1	5	CF	Clinger	6.5
07.Paint Branch	04/21/15	Hydropsychidae	*Hydropsyche*	4	6	CF	Clinger	7.5
07.Paint Branch	04/21/15	Hydropsychidae	*Hydropsychidae*	1	4	CF	Clinger	5.7
07.Paint Branch	04/21/15	Hydroptilidae	*Hydroptilidae*	1	4	PI	Climber	4
07.Paint Branch	04/21/15	Lebertiidae	*Lebertia*	1	8	PR		
07.Paint Branch	04/21/15	Lumbricidae	*Lumbricidae*	1	10	CG	Burrower	
07.Paint Branch	04/21/15	Naididae	*Nais*	4	8	CF	Burrower	
07.Paint Branch	04/21/15	Naididae	*Pristina*	2	8	CG		
07.Paint Branch	04/21/15	Philopotamidae	*Chimarra*	1	4	CF	Clinger	4.4
07.Paint Branch	04/21/15	Simuliidae	*Simulium*	1	7	CF	Clinger	5.7

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07.Paint Branch	04/21/15	Tetrastemmatidae	*Prostoma*	1		PR		7.3
07.Paint Branch	04/21/15	Tipulidae	*Antocha*	5	5	CG	Clinger	8
07.Paint Branch	04/21/15	Tipulidae	*Tipulidae*	1	4	SH	Burrower	4.8
07.Paint Branch	04/21/15	Tubificidae	*Bothrioneurum*	1				
07.Paint Branch	04/21/15	Veliidae	*Veliidae*	1	8	PR	Skater	
09.Sligo Creek	04/22/15	Chironomidae	*Ablabesmyia*	3	8	CG	Sprawler	8.1
09.Sligo Creek	04/22/15	Chironomidae	*Brillia*	1	5	SH	Burrower	7.4
09.Sligo Creek	04/22/15	Chironomidae	*Chaetocladius*	1	6	CG	Sprawler	7
09.Sligo Creek	04/22/15	Chironomidae	*Dicrotendipes*	1	10	CG	Burrower	9
09.Sligo Creek	04/22/15	Chironomidae	*Hydrobaenus*	1	8	SC	Sprawler	7.2
09.Sligo Creek	04/22/15	Chironomidae	*Nilotanypus*	1	6	PR	Sprawler	6.6
09.Sligo Creek	04/22/15	Chironomidae	*Orthocladius/Cricotopus*	21	6	CG	Sprawler	
09.Sligo Creek	04/22/15	Chironomidae	*Pentaneura*	2	6	PR	Sprawler	6.6
09.Sligo Creek	04/22/15	Chironomidae	*Phaenopsectra*	1	7	SC	Clinger	8.7
09.Sligo Creek	04/22/15	Chironomidae	*Polypedilum*	24	6	SH	Climber	6.3
09.Sligo Creek	04/22/15	Chironomidae	*Saetheria*	14	4	CG	Burrower	6.6
09.Sligo Creek	04/22/15	Chironomidae	*Tanytarsus*	1	6	CF	Climber	4.9
09.Sligo Creek	04/22/15	Chironomidae	*Thienemannimyia*	1	6	PR	Sprawler	6.7
09.Sligo Creek	04/22/15	Coenagrionidae	*Argia*	1	8	PR	Clinger	9.3
09.Sligo Creek	04/22/15	Coenagrionidae	*Enallagma*	1	8	PR	Climber	9
09.Sligo Creek	04/22/15	Crangonyctidae	*Crangonyx*	1	4	CG	Sprawler	6.7
09.Sligo Creek	04/22/15	Enchytraeidae	*Enchytraeidae*	6	10	CG	Burrower	9.1
09.Sligo Creek	04/22/15	Lumbricidae	*Lumbricidae*	1	10	CG	Burrower	
09.Sligo Creek	04/22/15	Naididae	*Nais*	19	8	CF	Burrower	
09.Sligo Creek	04/22/15	Tetrastemmatidae	*Prostoma*	2		PR		7.3
09.Sligo Creek	04/22/15	Tubificidae	*Bothrioneurum*	1				
09.Sligo Creek	04/22/15	Tubificidae	*Limnodrilus*	1	10	CG	Clinger	8.6
09.Sligo Creek	04/22/15	Tubificidae	*Tubificinae*	2				
10.Chillum Rd Trib	04/21/15	Chironomidae	*Chironomini*	1	6	CG	Burrower	5.9
10.Chillum Rd Trib	04/21/15	Chironomidae	*Dicrotendipes*	2	10	CG	Burrower	9
10.Chillum Rd Trib	04/21/15	Chironomidae	*Glyptotendipes*	2	10	CF	Burrower	6.6
10.Chillum Rd Trib	04/21/15	Chironomidae	*Orthocladius/Cricotopus*	50	6	CG	Sprawler	
10.Chillum Rd Trib	04/21/15	Chironomidae	*Polypedilum*	6	6	SH	Climber	6.3
10.Chillum Rd Trib	04/21/15	Chironomidae	*Pseudosmittia*	1	6	CG	Sprawler	6.6
10.Chillum Rd Trib	04/21/15	Chironomidae	*Thienemannimyia*	4	6	PR	Sprawler	6.7
10.Chillum Rd Trib	04/21/15	Coenagrionidae	*Argia*	2	8	PR	Clinger	9.3
10.Chillum Rd Trib	04/21/15	Empididae	*Hemerodromia*	1	6	PR	Sprawler	7.9
10.Chillum Rd Trib	04/21/15	Enchytraeidae	*Enchytraeidae*	7	10	CG	Burrower	9.1
10.Chillum Rd Trib	04/21/15	Naididae	*Nais*	10	8	CF	Burrower	
10.Chillum Rd Trib	04/21/15	Naididae	*Paranais*	1				

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10.Chillum Rd Trib	04/21/15	Nepidae	*Ranatra*	1	7	PR	Climber	5.6
10.Chillum Rd Trib	04/21/15	Psychodidae	*Psychoda*	1	10	CG	Burrower	4
10.Chillum Rd Trib	04/21/15	Tetrastemmatidae	*Prostoma*	1		PR		7.3
10.Chillum Rd Trib	04/21/15	Tubificidae	*Limnodrilus*	2	10	CG	Clinger	8.6
10.Chillum Rd Trib	04/21/15	Tubificidae	*Tubificinae*	13				
11A.Indian Crk	04/28/15	Ancylidae	*Ferrissia*	1	7	SC	Climber	7
11A.Indian Crk	04/28/15	Baetidae	*Acentrella*	2	4	CG	Swimmer	4.9
11A.Indian Crk	04/28/15	Baetidae	*Baetis*	5	6	CG	Swimmer	3.9
11A.Indian Crk	04/28/15	Baetidae	*Plauditus*	1	5		Swimmer	
11A.Indian Crk	04/28/15	Chironomidae	*Brillia*	2	5	SH	Burrower	7.4
11A.Indian Crk	04/28/15	Chironomidae	*Cladotanytarsus*	10	7	CG	Climber	6.6
11A.Indian Crk	04/28/15	Chironomidae	*Cryptochironomus*	1	8	PR	Sprawler	7.6
11A.Indian Crk	04/28/15	Chironomidae	*Eukiefferiella*	1	8	CG	Sprawler	6.1
11A.Indian Crk	04/28/15	Chironomidae	*Nanocladius*	1	3	CG	Sprawler	7.6
11A.Indian Crk	04/28/15	Chironomidae	*Nilotanypus*	2	6	PR	Sprawler	6.6
11A.Indian Crk	04/28/15	Chironomidae	*Orthocladiinae*	1	6	CG	Burrower	7.6
11A.Indian Crk	04/28/15	Chironomidae	*Orthocladius/Cricotopus*	27	6	CG	Sprawler	
11A.Indian Crk	04/28/15	Chironomidae	*Polypedilum*	12	6	SH	Climber	6.3
11A.Indian Crk	04/28/15	Chironomidae	*Synorthocladius*	2	2	CG		6.6
11A.Indian Crk	04/28/15	Chironomidae	*Tanytarsus*	1	6	CF	Climber	4.9
11A.Indian Crk	04/28/15	Chironomidae	*Thienemannimyia*	2	6	PR	Sprawler	6.7
11A.Indian Crk	04/28/15	Coenagrionidae	*Enallagma*	2	8	PR	Climber	9
11A.Indian Crk	04/28/15	Dorylaimidae	*Nematoda*	5	6	PA		
11A.Indian Crk	04/28/15	Elmidae	*Dubiraphia*	1	6	CG	Clinger	5.7
11A.Indian Crk	04/28/15	Elmidae	*Stenelmis*	6	6	SC	Clinger	7.1
11A.Indian Crk	04/28/15	Empididae	*Empididae*	1	6	PR	Sprawler	7.5
11A.Indian Crk	04/28/15	Enchytraeidae	*Enchytraeidae*	1	10	CG	Burrower	9.1
11A.Indian Crk	04/28/15	Hydrobiidae	*Hydrobiidae*	3	8	SC	Climber	8
11A.Indian Crk	04/28/15	Hydropsychidae	*Cheumatopsyche*	2	5	CF	Clinger	6.5
11A.Indian Crk	04/28/15	Hydropsychidae	*Hydropsyche*	1	6	CF	Clinger	7.5
11A.Indian Crk	04/28/15	Leptoceridae	*Oecetis*	1	8	PR	Clinger	4.7
11A.Indian Crk	04/28/15	Naididae	*Nais*	7	8	CF	Burrower	
11A.Indian Crk	04/28/15	Philopotamidae	*Chimarra*	1	4	CF	Clinger	4.4
11A.Indian Crk	04/28/15	Pisidiidae	*Pisidiidae*	1		CG		
11A.Indian Crk	04/28/15	Planariidae	*Planariidae*	1	1	OM	Sprawler	8.4
11A.Indian Crk	04/28/15	Planorbidae	*Menetus*	1	8	SC	Climber	7.6
11A.Indian Crk	04/28/15	Polycentropodidae	*Polycentropus*	1	5	PR	Clinger	1.1
11A.Indian Crk	04/28/15	Sperchonidae	*Sperchon*	1	8	PR		
11A.Indian Crk	04/28/15	Tipulidae	*Antocha*	1	5	CG	Clinger	8
11A.Indian Crk	04/28/15	Tipulidae	*Tipulidae*	1	4	SH	Burrower	4.8

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11A.Indian Crk	04/28/15	Tubificidae	*Bothrioneurum*	1				
11B.Indian Crk	04/22/15	Baetidae	*Plauditus*	5	5		Swimmer	
11B.Indian Crk	04/22/15	Chironomidae	*Cladotanytarsus*	7	7	CG	Climber	6.6
11B.Indian Crk	04/22/15	Chironomidae	*Cryptochironomus*	4	8	PR	Sprawler	7.6
11B.Indian Crk	04/22/15	Chironomidae	*Orthocladius/Cricotopus*	3	6	CG	Sprawler	
11B.Indian Crk	04/22/15	Chironomidae	*Polypedilum*	15	6	SH	Climber	6.3
11B.Indian Crk	04/22/15	Chironomidae	*Pseudorthocladius*	1	0	CG	Sprawler	6
11B.Indian Crk	04/22/15	Chironomidae	*Saetheria*	3	4	CG	Burrower	6.6
11B.Indian Crk	04/22/15	Elmidae	*Oulimnius*	1	2	SC	Clinger	2.7
11B.Indian Crk	04/22/15	Elmidae	*Stenelmis*	31	6	SC	Clinger	7.1
11B.Indian Crk	04/22/15	Empididae	*Hemerodromia*	9	6	PR	Sprawler	7.9
11B.Indian Crk	04/22/15	Empididae	*Neoplasta*	3			Sprawler	
11B.Indian Crk	04/22/15	Gomphidae	*Hagenius*	1	3	PR	Sprawler	2.2
11B.Indian Crk	04/22/15	Heptageniidae	*Maccaffertium*	1	4	SC	Clinger	4.6
11B.Indian Crk	04/22/15	Hydropsychidae	*Hydropsyche*	2	6	CF	Clinger	7.5
11B.Indian Crk	04/22/15	Hydroptilidae	*Hydroptila*	1	6	SC	Clinger	6
11B.Indian Crk	04/22/15	Lumbricidae	*Lumbricidae*	1	10	CG	Burrower	
11B.Indian Crk	04/22/15	Lumbriculidae	*Lumbriculidae*	1	10	CG	Burrower	6.6
11B.Indian Crk	04/22/15	Naididae	*Nais*	13	8	CF	Burrower	
11B.Indian Crk	04/22/15	Simuliidae	*Simulium*	1	7	CF	Clinger	5.7
11B.Indian Crk	04/22/15	Tetrastemmatidae	*Prostoma*	1		PR		7.3
11B.Indian Crk	04/22/15	Tipulidae	*Antocha*	1	5	CG	Clinger	8
11B.Indian Crk	04/22/15	Tubificidae	*Bothrioneurum*	1				
11B.Indian Crk	04/22/15	Tubificidae	*Limnodrilus*	1	10	CG	Clinger	8.6
12.Little Paint Br.	04/21/15	Baetidae	*Plauditus*	1	5		Swimmer	
12.Little Paint Br.	04/21/15	Chironomidae	*Ablabesmyia*	1	8	CG	Sprawler	8.1
12.Little Paint Br.	04/21/15	Chironomidae	*Cladotanytarsus*	2	7	CG	Climber	6.6
12.Little Paint Br.	04/21/15	Chironomidae	*Cryptochironomus*	2	8	PR	Sprawler	7.6
12.Little Paint Br.	04/21/15	Chironomidae	*Diamesa*	1	5	CG	Sprawler	8.5
12.Little Paint Br.	04/21/15	Chironomidae	*Dicrotendipes*	2	10	CG	Burrower	9
12.Little Paint Br.	04/21/15	Chironomidae	*Eukiefferiella*	2	8	CG	Sprawler	6.1
12.Little Paint Br.	04/21/15	Chironomidae	*Microtendipes*	2	6	CF	Clinger	4.9
12.Little Paint Br.	04/21/15	Chironomidae	*Orthocladius/Cricotopus*	28	6	CG	Sprawler	
12.Little Paint Br.	04/21/15	Chironomidae	*Polypedilum*	27	6	SH	Climber	6.3
12.Little Paint Br.	04/21/15	Chironomidae	*Rheotanytarsus*	5	6	CF	Clinger	7.2
12.Little Paint Br.	04/21/15	Chironomidae	*Saetheria*	6	4	CG	Burrower	6.6
12.Little Paint Br.	04/21/15	Chironomidae	*Tanytarsus*	2	6	CF	Climber	4.9
12.Little Paint Br.	04/21/15	Dorylaimidae	*Nematoda*	1	6	PA		
12.Little Paint Br.	04/21/15	Elmidae	*Stenelmis*	1	6	SC	Clinger	7.1
12.Little Paint Br.	04/21/15	Empididae	*Hemerodromia*	3	6	PR	Sprawler	7.9

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12.Little Paint Br.	04/21/15	Enchytraeidae	*Enchytraeidae*	1	10	CG	Burrower	9.1
12.Little Paint Br.	04/21/15	Hydrophilidae	*Berosus*	1	5	PR	Swimmer	4.1
12.Little Paint Br.	04/21/15	Hydropsychidae	*Cheumatopsyche*	1	5	CF	Clinger	6.5
12.Little Paint Br.	04/21/15	Hydropsychidae	*Hydropsyche*	5	6	CF	Clinger	7.5
12.Little Paint Br.	04/21/15	Hygrobatidae	*Hygrobates*	1		PR		
12.Little Paint Br.	04/21/15	Naididae	*Nais*	6	8	CF	Burrower	
12.Little Paint Br.	04/21/15	Pisidiidae	*Pisidium*	1	8	CF	Burrower	5.7
12.Little Paint Br.	04/21/15	Simuliidae	*Simulium*	1	7	CF	Clinger	5.7
12.Little Paint Br.	04/21/15	Tubificidae	*Limnodrilus*	1	10	CG	Clinger	8.6
13.Lower NW Br.	04/22/15	Baetidae	*Baetidae*	1	4	CG		2.3
13.Lower NW Br.	04/22/15	Chironomidae	*Brillia*	1	5	SH	Burrower	7.4
13.Lower NW Br.	04/22/15	Chironomidae	*Cardiocladius*	1	6	PR	Burrower	10
13.Lower NW Br.	04/22/15	Chironomidae	*Chaetocladius*	1	6	CG	Sprawler	7
13.Lower NW Br.	04/22/15	Chironomidae	*Cladotanytarsus*	2	7	CG	Climber	6.6
13.Lower NW Br.	04/22/15	Chironomidae	*Endochironomus*	1	10	SH	Clinger	6.2
13.Lower NW Br.	04/22/15	Chironomidae	*Orthocladius/Cricotopus*	12	6	CG	Sprawler	
13.Lower NW Br.	04/22/15	Chironomidae	*Phaenopsectra*	2	7	SC	Clinger	8.7
13.Lower NW Br.	04/22/15	Chironomidae	*Polypedilum*	15	6	SH	Climber	6.3
13.Lower NW Br.	04/22/15	Chironomidae	*Stenochironomus*	2	5	SH	Burrower	7.9
13.Lower NW Br.	04/22/15	Chironomidae	*Tanytarsus*	3	6	CF	Climber	4.9
13.Lower NW Br.	04/22/15	Chironomidae	*Thienemannimyia*	4	6	PR	Sprawler	6.7
13.Lower NW Br.	04/22/15	Chironomidae	*Zavrelimyia*	1	8	PR	Sprawler	5.3
13.Lower NW Br.	04/22/15	Corbiculidae	*Corbicula*	1	6	CF	Burrower	6
13.Lower NW Br.	04/22/15	Dorylaimidae	*Nematoda*	1	6	PA		
13.Lower NW Br.	04/22/15	Enchytraeidae	*Enchytraeidae*	2	10	CG	Burrower	9.1
13.Lower NW Br.	04/22/15	Hydropsychidae	*Hydropsyche*	1	6	CF	Clinger	7.5
13.Lower NW Br.	04/22/15	Hydropsychidae	*Hydropsychidae*	1	4	CF	Clinger	5.7
13.Lower NW Br.	04/22/15	Naididae	*Nais*	30	8	CF	Burrower	
13.Lower NW Br.	04/22/15	Physidae	*Physa*	1	8	SC		
13.Lower NW Br.	04/22/15	Tetrastemmatidae	*Prostoma*	1		PR		7.3
13.Lower NW Br.	04/22/15	Tubificidae	*Bothrioneurum*	3				
13.Lower NW Br.	04/22/15	Tubificidae	*Limnodrilus*	11	10	CG	Clinger	8.6
13.Lower NW Br.	04/22/15	Tubificidae	*Tubificinae*	11				
15.Northeast Br.	04/22/15	Chironomidae	*Ablabesmyia*	1	8	CG	Sprawler	8.1
15.Northeast Br.	04/22/15	Chironomidae	*Cladotanytarsus*	16	7	CG	Climber	6.6
15.Northeast Br.	04/22/15	Chironomidae	*Cryptochironomus*	6	8	PR	Sprawler	7.6
15.Northeast Br.	04/22/15	Chironomidae	*Dicrotendipes*	1	10	CG	Burrower	9
15.Northeast Br.	04/22/15	Chironomidae	*Orthocladius/Cricotopus*	5	6	CG	Sprawler	
15.Northeast Br.	04/22/15	Chironomidae	*Phaenopsectra*	4	7	SC	Clinger	8.7
15.Northeast Br.	04/22/15	Chironomidae	*Polypedilum*	54	6	SH	Climber	6.3

SiteID	Date	Family	Taxon (Final ID)	Count	TV	FFG	Habit	TV_Urb
15.Northeast Br.	04/22/15	Chironomidae	*Rheotanytarsus*	1	6	CF	Clinger	7.2
15.Northeast Br.	04/22/15	Chironomidae	*Saetheria*	4	4	CG	Burrower	6.6
15.Northeast Br.	04/22/15	Chironomidae	*Tanytarsus*	1	6	CF	Climber	4.9
15.Northeast Br.	04/22/15	Elmidae	*Stenelmis*	2	6	SC	Clinger	7.1
15.Northeast Br.	04/22/15	Enchytraeidae	*Enchytraeidae*	2	10	CG	Burrower	9.1
15.Northeast Br.	04/22/15	Gammaridae	*Gammarus*	1	6	OM	Sprawler	6.7
15.Northeast Br.	04/22/15	Hydropsychidae	*Hydropsyche*	1	6	CF	Clinger	7.5
15.Northeast Br.	04/22/15	Hygrobatidae	*Hygrobates*	1		PR		
15.Northeast Br.	04/22/15	Pisidiidae	*Pisidium*	2	8	CF	Burrower	5.7
15.Northeast Br.	04/22/15	Tetrastemmatidae	*Prostoma*	1		PR		7.3
15.Northeast Br.	04/22/15	Tipulidae	*Antocha*	1	5	CG	Clinger	8
15.Northeast Br.	04/22/15	Tubificidae	*Limnodrilus*	1	10	CG	Clinger	8.6
15.Northeast Br.	04/22/15		*Gastropoda*	1	7	SC		

Appendix B. Water Quality Results

Table B-1. *In situ* water quality measurements recorded at Anacostia watershed sites, 2015.

Site ID		Season	Temperature (◦C)	Dissolved Oxygen (mg/L)	pH	Conductivity (mS/cm)
01	Indian Creek-I95	Spring	14	9.6	7	0.880
		Summer	22.4	12.21	6.55	0.600
03	Northwest Branch	Spring	13.1	10.8	8	0.435
		Summer	24.3	6.92	6.37	0.440
05	Paint Branch	Spring	15.5	10	7.7	0.327
		Summer	29.6	10.55	8.42	0.550
07	Paint Branch	Spring	17	9.4	7.8	0.359
		Summer	25.1	9.35	7.8	0.407
09	Sligo Creek	Spring	12.3	10.8	7.3	1.290
		Summer	24.3	11.2	7.9	0.780
10	Chillum Rd Tributary	Spring	16.3	7.7	6.9	1.440
		Summer	22.1	10.1	6.5	0.690
11A	Indian Creek	Spring	14.1	11.1	7.4	0.435
		Summer	24.4	7.99	6.68	0.480
11B	Indian Creek	Spring	13.5	9.6	7.3	0.395
		Summer	24.3	8.57	7.26	0.400
12	Little Paint Br	Spring	16.3	9.83	7.59	0.476
		Summer	24.7	12.38	7	0.540
13	Lower NW Branch	Spring	13.9	10.5	7.3	0.990
		Summer	25.5	9.91	6.93	0.440
15	Northeast Branch	Spring	14.9	10.2	7.7	0.446
		Summer	24.6	9.15	7.18	2.475

Appendix C. Pebble Count

Table C-1. Substrate particle size distribution (percent) for all sampling sites (n=11). Estimates made using a modified Wolman 100 particle count.

Site ID	Silt/Clay	Sand	Gravel	Cobble	Boulder	Bedrock
01.Indian Creek-I95	1	12	84	3	0	0
03.Northwest Branch	13	44	11	3	29	0
05.Paint Branch	8	13	68	2	9	0
07.Paint Branch	0	21	31	24	19	5
09.Sligo Creek	3	30	39	11	16	1
10.Chillum Rd Tributary	8	41	46	5	0	0
11A.Indian Creek	11	23	56	7	3	0
11B.Indian Creek	6	26	68	0	0	0
12.Little Paint Br.	0	33	62	5	0	0
13.Lower NW Branch	0	29	60	11	0	0
15.Northeast Branch	0	29	52	10	9	0

Appendix D. Benthic Macroinvertebrate Metric Values and Scores

Table D-1. Benthic Index of Biological Integrity (B-IBI) metric values and converted metric scores for sites sampled within the Anacostia watershed

Site ID	Values							Scores						
	Number of Taxa	Number of EPT Taxa	Number of Ephemeroptera Taxa	Percent Urban Intolerant Taxa	Percent Ephemeroptera Taxa	Number of Scraper Taxa	Percent Climber Taxa	Number of Taxa	Number of EPT Taxa	Number of Ephemeroptera Taxa	Percent Urban Intolerant Taxa	Percent Ephemeroptera Taxa	Number of Scraper Taxa	Percent Climber Taxa
01.Indian Creek-I95	42	4	1	2.9	1.9	2	2.9	5	3	3	1	3	5	3
03.Northwest Branch	21	1	1	0.0	1.0	1	18.8	3	1	3	1	3	3	5
05.Paint Branch	24	3	0	1.0	0.0	1	28.7	5	3	1	1	1	3	5
07.Paint Branch	27	4	0	0.0	0.0	1	37.5	5	3	1	1	1	3	5
09.Sligo Creek	23	0	0	0.0	0.0	2	24.3	5	1	1	1	1	5	5
10.Chillum Rd Tributary	16	0	0	0.0	0.0	0	6.7	3	1	1	1	1	1	3
11A.Indian Creek	34	8	3	0.9	7.3	4	27.3	5	5	5	1	3	5	5
11B.Indian Creek	23	4	2	1.9	5.6	4	20.6	5	3	5	1	3	5	5
12.Little Paint Br.	25	3	1	0.0	1.0	1	29.8	5	3	3	1	3	3	5
13.Lower NW Branch	24	3	1	0.9	0.9	2	18.4	5	3	3	1	3	5	5
15.Northeast Branch	20	1	0	0.0	0.0	3	67.0	3	1	1	1	1	5	5

Appendix E. Visual-based Physical Habitat Quality Scores

Table E-1. Rapid Bioassessment Protocols (RBP) physical habitat assessment scores (PHAB) for Anacostia bioassessment sites, 2015, n=11. *Abbreviations*: O = optimal, S = suboptimal, F = fair, P=poor.

Site ID	Narrative Rating	Total PHAB Score	Bank Stability (Left Bank)	Bank Stability (Right Bank)	Channel Alteration	Channel Flow Status	Channel Sinuosity	Instream Cover/Epifaunal Substrate	Pool Substrate Characterization	Pool Variability	Riparian Vegetative Zone Width (Left Bank)	Riparian Vegetative Zone Width (Right Bank)	Sediment Deposition	Vegetative Protection (Left Bank)	Vegetative Protection (Right Bank)
01.Indian Creek-I95	O	**164**	8	8	19	15	13	17	18	16	10	10	12	9	9
03.NW Branch	S	**117**	7	8	12	19	5	9	13	14	3	4	9	7	7
05.Paint Branch	S	**123**	1	5	11	18	1	16	12	11	10	7	16	8	7
07.Paint Branch	S	**145**	7	9	20	17	6	16	13	11	10	9	13	6	8
09.Sligo Creek	S	**148**	7	8	13	15	7	15	16	16	9	9	14	9	10
10.Chillum Rd Trib	S	**120**	7	4	16	11	9	14	16	10	3	5	13	7	5
11A.Indian Creek	S	**128**	6	7	8	16	5	16	14	7	10	10	14	9	6
11B.Indian Creek	S	**128**	7	8	18	15	5	17	16	12	5	1	12	8	4
12.Little Paint Br.	S	**113**	9	7	14	19	1	16	11	3	2	1	13	9	8
13.Lower NW Branch	S	**146**	8	7	15	15	6	17	16	16	5	8	18	8	7
15.NE Branch	F	**97**	4	2	7	17	2	14	12	13	2	2	12	6	4

Appendix F. Physical Habitat Index (PHI) and Relative Bed Stability (RBS) results

Table F-1. Results from application of the MBSS Physial Habitat Index (PHI) and assessment of bottom substrate using Relative Bed Stability (RBS).

StationID	Physical habitat index (PHI)							Relative bed stability (RBS)						
	REMTE	SHAD	EPI	INSTRHAB	WOOD	BNKSTB	PHI	D50	Slope	Thalwg	Rbf	RBS	LRBS	Rating
01.Indian Creek-I95	53.9	95.8	96.9	96.4	100.0	86.6	88.3	20	0.025	0.337	0.02	0.12	-0.94	Impaired
03.Northwest Branch	32.3	80.2	37.4	28.0	43.7	80.6	50.4	0.375	0.005	0.895	0.04	0.00	-2.94	H. impaired
05.Paint Branch	32.3	64.8	90.4	68.0	12.5	59.2	54.5	20	0.005	0.349	0.02	0.02	-1.62	H. impaired
07.Paint Branch	64.6	96.4	94.7	74.7	19.9	89.5	73.3	56	0.005	0.491	0.02	0.09	-1.03	H. impaired
09.Sligo Creek	70.0	73.5	79.7	73.0	92.2	94.9	80.6	14	0.015	0.614	0.03	0.09	-1.05	H. impaired
10.Chillum Rd Trib	43.1	56.7	85.2	79.8	64.6	74.2	67.3	5	0.01	0.301	0.02	0.01	-1.99	H. impaired
11A.Indian Creek	37.7	60.6	73.6	74.5	22.3	83.7	58.7	20	0.025	0.499	0.02	0.17	-0.77	Impaired
11B.Indian Creek	32.3	100.0	79.8	69.7	35.0	83.7	66.7	20	0.005	0.737	0.04	0.05	-1.30	H. impaired
12.Little Paint Br.	86.2	36.3	100.0	79.0	24.6	86.6	68.8	20	0.0075	0.305	0.02	0.03	-1.50	H. impaired
13.Lower NW Branch	53.9	60.0	78.3	67.3	44.1	86.6	65.0	20	0.01	0.516	0.03	0.07	-1.15	H. impaired
15.Northeast Branch	32.3	56.1	57.0	55.7	2.0	54.8	43.0	28	0.005	1.447	0.07	0.14	-0.86	Impaired

Abbreviations and units: RMTE, remoteness; SHAD, shading; EPI, epifaunal substrate/instream habitat; WOOD, instream wood; BNKSTB, bank stability; PHI, physical habitat index; D50, millimeters; Slope, %; Thalweg, mean meters; Rbf, bankfull radius; RBS, relative bed stability; LRBS, Log10RBS; H. impaired, highly impaired

Appendix G. List of Fish Species Collected and Abundances

Table G-1. Fish species and abundances collected at Anacostia watershed stream sites (n=11)

Common Name	Scientific Name	Tolerance Level	01.Indian Creek-I95	03.Northwest Branch	05.Paint Branch	07.Paint Branch	09.Sligo Creek	10.Chillum Rd Trib	11A.Indian Creek	11B.Indian Creek	12.Little Paint Br.	13.Lower NW Branch	15.Northeast Branch
American eel	*Anguilla rostrata*	Tolerant	27	41	33	27	19	15	21	73	65	26	40
American shad	*Alosa sapidissima*				1								
Banded killifish	*Fundulus diaphanus*	Moderate	3	5	20		7	64			65	22	1
Black crappie	*Pomoxis nigromaculatus*	Moderate							1				1
Blacknose dace	*Rhinichthys atratulus*	Tolerant	27		37	141	48	72	7	7	275	94	
Bluegill	*Lepomis macrochirus*	Tolerant		27	20		12		56	3	8	10	52
Bluntnose minnow	*Pimephales notatus*	Tolerant		10	1	1	134	59	17	4	4	193	
Brown bullhead	*Ameiurus nebulosus*	Tolerant							3		1	2	
Channel catfish	*Ictalurus punctatus*	Moderate											1
Common carp	*Cyrpinus carpio*	Tolerant							1				
Creek chub	*Semotilus atromaculatus*	Tolerant	47			24		3		5	34	1	
Cutlips minnow	*Exoglossum maxillingua*	Moderate		1		4	2				2	25	
Eastern mudminnow	*Umbra pygmaea*	Tolerant									2		
Eastern silvery minnow	*Hybognathus regius*	Moderate		7	22	3	1		6			70	8
Fallfish	*Semotilus corporalis*	Moderate						11				6	
Fantail darter	*Etheostoma flabellare*	Moderate										1	
Fathead minnow	*Pimephales promelas*	Tolerant						1					
Gizzard shad	*Dorosoma cepedianum*	Moderate					1						
Golden redhorse	*Moxostoma erythrurum*	Moderate							2				
Golden shiner	*Notemigonus crysoleucas*	Tolerant							8				
Goldfish	*Carassius auratus*	Tolerant						1					

Common Name	Scientific Name	Tolerance Level	01.Indian Creek-I95	03.Northwest Branch	05.Paint Branch	07.Paint Branch	09.Sligo Creek	10.Chillum Rd Trib	11A.Indian Creek	11B.Indian Creek	12.Little Paint Br.	13.Lower NW Branch	15.Northeast Branch
Green sunfish	*Lepomis cyanellus*	Tolerant		8	1				2	3	16	2	15
Hybrid (Green Sunfish/Bluegill)	*Lepomis*				1								
Hybrid (Sunfish)	*Lepomis*		3										
Lamprey (sp)		Intolerant		13								3	
Largemouth bass	*Micropterus salmoides*	Moderate		1					4	3			2
Least brook lamprey	*Lampetra aepyptera*	Intolerant		3						2		6	
Longnose dace	*Rhinichthys cataractae*	Moderate	6		46	87	27	14	81	41	116	17	
Mummichog	*Fundulus heteroclitus*	Moderate	9						1	5	73	1	
Northern hogsucker	*Hypentelium nigricans*	Intolerant		3	5	3	3		6	7	1	87	
Pumpkinseed	*Lepomis gibbosus*	Moderate		9			5	1	52	6	1		44
Redbreast sunfish	*Lepomis auritus*	Moderate		108	8	17	81	2	15	43	33	109	30
Rosyside dace	*Clinostomus funduloides*	Intolerant	12			4							
Satinfin shiner	*Cyprinella analostana*	Moderate		23	8	14	38	74	27	10	26	59	
Sea Lamprey	*Petromyzon marinus*			3	2				1	6	4	9	
Slimy Sclupin	*Cottus cognatus*	Intolerant				2							
Smallmouth bass	*Micropterus dolomieu*	Moderate		2								1	
Spottail shiner	*Notropis hudsonius*	Moderate		18	35	5	143		55	17	10	328	2
Swallowtail shiner	*Notropis procne*	Moderate		45	43	8	40	167	19	17	98	213	
Tessellated darter	*Etheostoma olmstedi*	Moderate	4	52	88	8	30	4	46	43	26	67	23
White sucker	*Catostomus commersoni*	Tolerant	3	57	2	1	148	41	3	11		99	19
Yellow bullhead	*Ameiurus natalis*	Tolerant		14	10	26	8		11	3	15	7	4
Yellow perch	*Perca flavescens*	Moderate							2				
Species Richness (S)			**10**	**21**	**19**	**17**	**18**	**15**	**25**	**20**	**21**	**26**	**14**
Sum (total fish per site)			**141**	**450**	**383**	**375**	**747**	**529**	**447**	**309**	**875**	**1458**	**242**

A-4: Hazardous, Toxic, and Radioactive Waste Summary

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Hazardous, Toxic, and Radioactive Wastes Summary Report

As required by USACE Engineering Regulation 1165-2-132, the team facilitated early identification and appropriate consideration of hazardous, toxic, and radioactive waste (HTRW) in the study area. An extensive set of reports were generated for each project area to assess the likelihood of existing HTRW concerns. The reports generated are intended to meet EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312) and the ASTM Standard Practice for Environmental Site Assessments (E 1527-13). The search included evaluation of aerial photos, topographic maps, state and federal environmental databases, land records, and other relevant databases for the ten study sites considered (these include sites 1, 3, 5, 7, 9, 10, 11, 12, 13, and 15). A summary of the search for these sites is provided below; however, based on selection criteria discussed in the main report, only six sites, sites 3, 9, 13, 5, 11, and 15, are included in the plan recommending sites for detailed engineering design. These sites are denoted below with an asterisk (*).

Follow-up actions, primarily consisting of web searches and mapping, were performed to determine if HTRW concerns actually existed in close enough proximity to the study reaches to pose a concern. Additionally, coordination with agencies, including Maryland Department of the Environment for inquiries regarding potential groundwater wells in the area, and USEPA for information on the University of Maryland (UMD) landfills (described below) was conducted. A summary of the EDR reports is included below. Supporting documentation can be provided upon request.

Site Summary

Indian Creek, Site 1

There are six sites listed in the Environmental Data Resources (EDR) report that were identified as potentially posing an environmental risk. Upon further review, these sites were determined to have no impact on project activities. Individual sites were either located at too great a distance from the project reach to have an impact, or the environmental cases have been closed.

Paint Branch, Site 7 and Little Paint Branch, Site 12

Five sites were listed in the EDR report in the area of these two project sites. The Beltsville Agricultural Research Center (BARC) and U.S. Army Garrison, Adelphia Laboratory are both included in these sites as producers of hazardous waste. No sites near this reach are expected have an impact on the project, as they are either located too far away from the project reach, or the timeframe for possibly incurring an impact has passed.

Indian Creek College Park, Site 11*

The EDR report found four potential sites in the College Park section of Indian Creek. The environmental cases for two potential sites are closed and were determined to pose no risk. A portion of the BARC facility is just north of the project reach, but it is not likely to impact the project. There are water supply wells located close to the project streams, which will be considered and avoided during construction activities.

Paint Branch, Site 5* and Northeast Branch Calvert Road, Site 15*

The University of Maryland Environmental Services Facility manages hazardous waste and waste oil for the College Park campus. The university is responsible for several landfills, three of which are located near the project reach (Landfill Areas 1B, 1C and 3A). An EPA report for a remediation project at the University of Maryland is attached. The selected remedy for groundwater contamination is natural attenuation and no further remediation has been determined to be necessary. Activities such as excavation, grading and dewatering should be coordinated with the University prior to beginning the project. No residual soil or ground water contaminants present a risk to human or environmental health. See attachments for further information on remedial actions at this site. Based on the above, the design selected for Paint Branch includes in-stream work only (no floodplain work). Extensive research was conducted to determine if work in Paint Branch adjacent to the landfill will result in adverse impacts to the stream, selected remedy, or worker health.

A review of available data and reports obtained from EPA, including EPA's *Migration of Contaminated Groundwater Under Control, Environmental Indicator (EA) RCRIS code (CA750)*, indicates that groundwater contamination is contained on the landfill site and is not migrating to Paint Branch. The site's RCRA Facility Investigation (Buchart-Horn, 1997; ERM, 2001) documents that sampling of sediments, surface water and soil samples from Paint Branch did not show any release of Permit-list metals, volatile organic compounds (VOCs) or semivolatile organic compounds (SVOCs), as well as Permit-list VOCS or SVOCs in groundwater. Permit-list metals were reported in groundwater; however, in 1999 ERM re-sampled the Permit-list metals, including PCBs, toxins, and methane, to conclude that groundwater conditions beneath the Paint Branch Landfill Areas do not pose unacceptable risks to human health or the environment. More recent data (ERM, 2014), indicate low concentrations of MTBE at a monitoring well (PW-7) located near Paint Branch; however, these concentrations are significantly below the maximum contaminant level for drinking water. Additionally, concentrations of dissolved hydrocarbons have continued to decrease over time. Work within Paint Branch will not affect the corrective actions in place at the landfill, nor is there any indication that contaminants from landfill will negatively impact work within the stream.

This determination was sent to EPA with their concurrence. Previous coordination with EPA had indicated that work in this section of the stream would not impact the landfill or RCRA Corrective Action activities unless entering the UMD property boundary. Coordination with EPA can be found in Appendix C-6.

References:

Buchart-Horn, Inc. (1997). *Phase I RCRA Facility Investigation for University of Maryland at College Park, Maryland.* Prepared for USEPA, January 1997.

ERM, Inc. (2001). *RFI Addendum Report for the Paint Branch Road Landfill Areas and the Metzerott Road Landfill RCRA Corrective Action Permit MDD 980829873, College Park, Maryland.*

ERM, Inc. (2014). *Ground Water Monitoring at the Maryland Fire and Rescue Institute, University of Maryland, College Park.* Letter Correspondence from ERM to USEPA, Reference 0229558, dated 11 February 2014.

USEPA (2015). *RCRA Mid-Atlantic Corrective Action Fact Sheet: University of Maryland*. Available at http://www3.epa.gov/reg3wcmd/ca/md/webpages/mdd980829873.html. Accessed April 24, 2015.

USEPA (2001). *Migration of Contaminated Groundwater Under Control, Environmental Indicator RCRIS Code (CA750).* Signed February 2001.

Sligo Creek, Site 9*; Northwest Branch Hyattsville, Site 3*; and Chillum Road Tributary, Site 10

These three reaches contain three points of interest. These points include an underground storage tank with no known releases located at the apartment complex close to site 9. Near site 3, a release of heating oil occurred in 2007 that was remediated. Groundwater wells may be located in close proximity to the project reaches, and will be taken into account during project planning and construction.

Northwest Branch Riggs Road, Site 13*

There are several underground storage tanks with known past releases in close proximity to the stream reach. However, these incidents have been remediated per MDE requirements. Wells exist within a one mile radius and should be avoided during project construction.

University of Maryland

On This Page

Interactive Google Site Map EXIT Disclaimer

EPA ID:MDD980829873
Location:
3115 Chesapeake Building 338
College Park, MD 20742-3133
Property Area 1300 Acres
Congressional District: 3
Other Names: na
Final Update

You will need the free Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more.

Contacts

EPA Project Manager
Ms. Barbara Smith
U.S. Environmental Protection Agency Region 3
Mail Stop: 3LC20
1650 Arch Street
Philadelphia, PA 19103-2029
(215) 814-5786
Email: smith.barbara@epa.gov

Bulletin Board

Site Status

- Cleanup Status : Complete with Controls
- Human Exposure Controlled: YES
- Groundwater Controlled: YES
- Institutional -Engineering Controls : YES

Related Links

- Envirofacts Link for this Site
- Tell us how to better engage with your community.

Status

- In September 1991, EPA issued a Corrective Action permit to University of Maryland (UM). The permit required UM to investigate whether releases occurred from various Solid Waste Management Units (SWMUs). UM conducted soil and groundwater investigations at the SWMUs. Areas identified with soil contamination were remediated as follows: (1) soil was removed from the Pesticides Wash and Diesel Fuel Tank Areas; and (2) a Diesel Fuel Tank was removed and replaced. EPA determined that other areas did not require remediation. Groundwater investigations showed some low level dioxin and methane in the three Paint Branch Landfills and the Metzerott Road Landfill. EPA concluded that the low level dioxin and methane, coupled with the low risk of human exposure, would not pose a risk to human health and the environment under current conditions. Ground water underlying the University is not used for drinking water.

- In January 2007, EPA reissued the Corrective Action Permit to UM. UM completed work on all of the SWMUs, with remaining work to be completed at the Maryland Fire and Rescue Institute (MFRI) property located on campus. The permit requires a Corrective Measures Study (CMS) for MFRI, and also includes a Notice for Use Restriction (an institutional control) to prevent future use of groundwater beneath the former landfills (including MFRI) as a drinking water supply. EPA approved UM's CMS workplan in June 2007, and the Use Restriction was is recorded in Prince George County Land Records. Ground water monitoring for benzene, toluene, ethyl benzene, xylene, naphthalene and methyl tertiary-butyl ether (MTBE) will continue at MFRI for the natural attenuation remedy. The permit also requires EPA review for future development that requires excavation in the former landfills.
- The Environmental Indicator Forms discuss that current human exposure to site contaminants is under control, and any migration of contaminated ground water is also under control.

Background

- The University of Maryland at College Park is a state owned and operated higher education institution. The facility is comprised of a complex of academic and research buildings designed and used for performing the University's primary broad educational and research missions, complemented by residential, services, and support buildings.
- The surrounding land use is primarily residential property on the north, south and west property lines. The area east of the campus has been developed for light industrial/commercial business and residential uses. Surface water runoff is directed toward Paint Branch Creek located on the eastern margin of the campus. A portion of the eastern section of the campus is located in the 100-year floodplain. Based on landfill area studies, groundwater depth ranges from 2 to 15 feet and appears to flow south. Ground water beneath the campus is not used for drinking water purposes.

Contaminants and Risks

- Based on data from previous studies and clean-ups, any residual soil or ground water contaminants does not present a risk to human health and the environment. At the Maryland Fire and Rescue Institute, a limited area of petroleum related groundwater contamination has been delineated and benzene, toluene, ethyl benzene, xylene, naphthalene and methyl tertiary-butyl ether (MTBE) contaminants remain at low levels. Human exposure to contamination is prevented because most of the surface area is paved and groundwater contaminants are declining from natural processes over time.

Institutional - Engineering Controls

Institutional /Engineering Control Summary

Restrictions or Controls that Address:	Yes	No
Groundwater Use	X	
Residential Use		X
Excavation	X	
Vapor Intrusion		X
Capped Area(s)		X
Other Engineering Controls	X	
Other Restrictions	X	

The University registered a ground water use restriction with the County Land Use records, which prohibits ground water use for drinking water purposes. Also on the landfills certain activities, including but not limited to, excavation, grading, dewatering, sheeting or shoring, are prohibited without prior written approval in following areas:

- Point Branch Landfills : Area 1A :9.74 Acres; Area 1-B: 54 Acres; Area 1-C: .9 Acres; and Area 2: 1.01 Acres;
- Maryland Fire & Rescue Institue (MFRI - Landfill Area 3A): 10.86 Acres;
- Metzerott Roadd Landfill Area - 4.35 Acres

Also in MFRI (Landfill 3A) Area : Ground water monitoring for benzene, toluene, ethyl benzene, xylene, naphthalene and methyl tertiary-butyl ether (MTBE) will continue at MFRI for the natural attenuation remedy.

Documents and Reports

- Some of the site’s key documents of interest are accessible below:

- Corrective Action Statement of Basis [PDF, 5 pages, 70 KB, About PDF]
- Corrective Action Statement Permit Factsheet [PDF, 6 pages, 32 KB, About PDF]
- Corrective Action Statement Permit [PDF,21 pages, 7602 KB, About PDF]
- Environmental Covenant - Deed Restriction [PDF, 18 pages, 835 KB, About PDF]
- Institutional/Engineering Controls (IC/EC) Long Term Assessment- Site Visit (March 2014) [PDF, 16 pages, 3694 KB, About PDF]
- Environmental Indicator Determination - Human Exposures [PDF, 9 pages, 40 KB, About DF]
- Environmental Indicator Determination - Groundwater [PDF, 8 pages, 25 KB, About PDF]

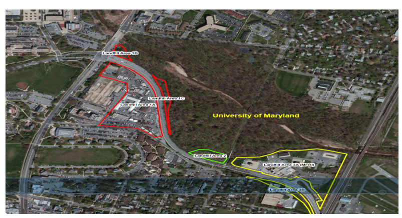
- All documents and reports regarding this facility also can be reviewed in person at these locations:

  U.S. EPA Region III
  Land & Chemicals Division - RCRA
  1650 Arch Street-11th Floor
  Philadelphia, PA 19103
  (215) 814-5786
  Call for an appointment.

- **Submit a FOIA Request**
  Get instructions on how to submit a FOIA request. Additional fee for requests over 100 pages.

Photos, Maps and Diagrams

University of Maryland



University of Maryland GeoSpatial PDF [PDF, 1.82 MB, 1 page, About PDF]

University of Maryland Metzerott Rd Landfill GeoSpatial PDF [PDF, 1.82 MB, 1 page, About PDF]

University of Maryland Landfill 3 GeoSpatial PDF [PDF, 1.82 MB, 1 page, About PDF]

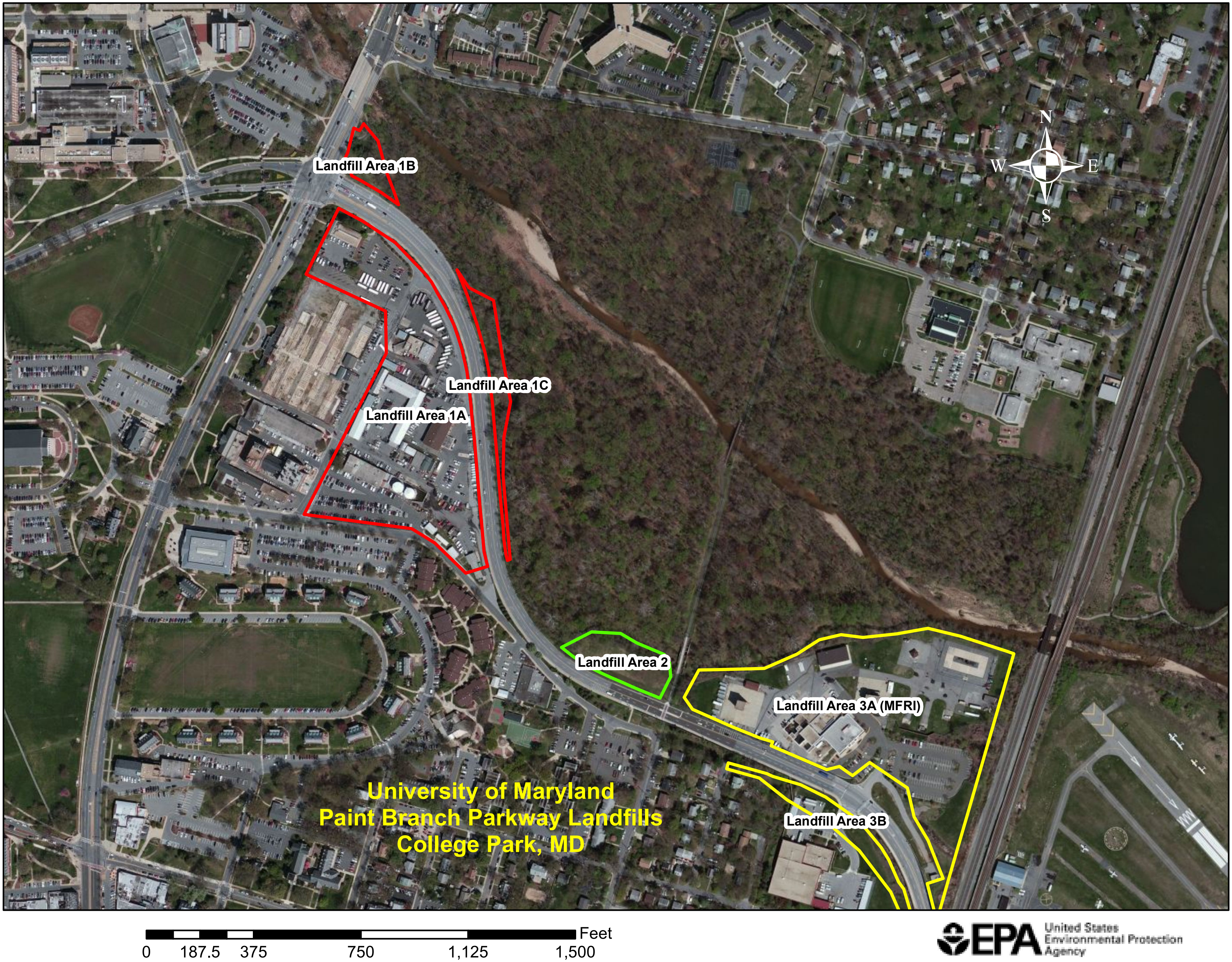
Click on a thumbnail to enlarge the photo or Geospatial PDF)

Reuse Information

- The facility is under continued use.

Questions

- The EPA is dedicated to providing you with timely and accurate information about our work at this site. If you have any questions or concerns, please contact the EPA Project Manager: Ms. Barbara Smith (215)-814-5786.


Landfill Area 1B
Landfill Area 1C
Landfill Area 1A
Landfill Area 2
Landfill Area 3A (MFRI)
Landfill Area 3B
N
S
E
W
University of Maryland
Paint Branch Parkway Landfills
College Park, MD
Feet
0
187.5
375
750
1,125
1,500
United States Environmental Protection Agency

GRASS AND TREES
FORMER HEATING
OIL UST
OIL/WATER
SEPARATOR
CREEK
BRANCH
PAINT
PW-8
PW-16
PW-7
PW-18
PW-17
FIRE PROP
BURN AREA
Landfill Area 2
GRASS
FORMER
AST
Landfill Area 3A (MFRI)
OIL/WATER
SEPARATOR
PW-19
B00-7
PW-15
PAINT BRANCH PARKWAY
Landfill Area 3B
0 50 100 200 300 400 500
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A-5: Cultural Resources Evaluation

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Selected Project Sites for Stream Restoration in Prince George's County, MD
Summary of Potential Effects to Historic Properties and Recommendations
August 2017

This document provides a summary of records review work performed for sites in the recommended plan. The Phase I-Level Cultural Resources Investigation report provides detailed information on these reviews and further investigations, including field work.

Prince George's County has rich cultural and natural resources within the Anacostia River watershed, particularly in the historic corridor created by the Washington-Baltimore Turnpike (predecessor to Route 1 in some areas) and the Route 1 corridor. The dendritic drainage pattern of the Anacostia watershed and its deep water access to the Potomac and the Chesapeake Bay had a profound impact on early settlement and subsequent land development. Highly productive ecotones such as well-drained areas adjacent to streams and wetlands were a focus of prehistoric settlement and resource extraction, and therefore have a high probability of containing significant archaeological sites. Those early linkages and their significance to Maryland history are reflected in the present day location of roadways, towns, protected historic landmarks, protected open spaces, and the Anacostia Tributary Trail System.

The County's Historic Preservation Ordinance protects three categories of properties that meet specific criteria of historical or architectural significance, all of which are listed in the Inventory of Historic Resources: historic sites, historic resources, and historic districts. The historic site and historic district designation process is codified in the ordinance in Subtitle 29-109, 29-118, 29-119, and 29-120.01. Properties can be added to the inventory through the process identified in the ordinance. In 2012, 413 historic sites, 136 historic resources, and three county-designated historic districts were listed for Prince George's County (MNCPPC, 2012). Additionally, there are 82 properties listed in the National Register of Historic Properties. These include historic properties along the Anacostia tributaries linked by the Anacostia Tributary Trail System, such as the College Park Airport and Aviation Museum, Adelphi Mill, the Rossborough Inn at the University of Maryland, and the George Washington House.

Under Section 106 of the National Historic Preservation Act of 1966 (as amended), federal agencies are required to take into account the effect of their proposed undertakings on properties listed in or eligible for inclusion in the National Register of Historic Places. In Maryland, the Maryland Historical Trust (MHT) serves as Maryland's State Historic Preservation Office (SHPO) and conducts Section 106 reviews. The federal agencies must notify the Advisory Council on Historic Preservation if a project will result in adverse effects to cultural resources.

A letter from the Maryland Historical Trust (MHT) (June 15, 2015) stated that their careful review of the ten initial stream segments/reaches indicates that the projects are unlikely to have an adverse effect on cultural resources within six of the ten reaches, therefore no archeological survey work would be recommended for these reaches for Section 106 purposes. However, further evaluation of four reaches, including Little Paint Branch (site 12), Lower Northwest Branch (Riggs Road, site 13), Northwest Branch Hyattsville (site 3), and Sligo Creek (site 9), was recommended to identify impacts to existing cultural resources. Of these reaches, sites 3, 9, and 13 are in the recommended plan. This letter and USACE response is included in Appendix C.

Following receipt of the letter from MHT, the area of potential effects (APE) was delineated based on site designs and further cultural review, including a search of MHT records and field visits, was performed for the sites in the recommended plan. In summary, the majority of the project work will be confined to the area in between the stream banks, and will not result in an adverse effect on cultural resources. Any access roads or staging areas will not include subsurface excavation and will be confined to previously disturbed areas when possible. As shown in Table 1 below, prior archaeological surveys and/or stream disturbance (including channelization by USACE in the 1970s) negated the need for field work at many of the stream reaches, including those recommended for further investigation by MHT. Effects and recommendations for two sites in the recommended plan (sites 11 and 15) where floodplain work will occur are described below and Phase I cultural resource surveys were performed for these sites. MHT has been notified of the above findings. Coordination with MHT is included in Appendix C.

Government-to-Government consultation was also conducted with a number of Native American Tribes in accordance with the Department of Defense American Indian and Alaska Native Policy. Consultation letters were sent to the following federally recognized tribal nations: Delaware Nation, Delaware Tribe of Oklahoma, Eastern Shawnee Tribe of Oklahoma, Pamunkey Indian Tribe, Seneca-Cayuga Nation, and Tuscarora Nation. None of these tribes requested further consultation. These coordination letters are included in Appendix C.

Table 1: Recommendations for field work at sites in the recommended plan.

Site	Notes	Recommendation
Northwest Branch		
#3 - Northwest Branch, Hyatsville	-Area above Highway 410 surveyed (USACE 1994) -Remaining area of the study reach was straightened and channelized by USACE in 1972. -Project area from Queen's Chapel Road to Highway 410 surveyed for Anacostia Tributaries Trail construction (Gibb and Creveling, 1993). -Area south of Chillum conference surveyed for construction of DC metro (Taylor 1980, Anderson 1981). -Significant disturbance (over-widening and shifting) from Chillum Tributary to downstream end of project reach.	No further work based on prior work and disturbance.
#9 - Sligo Creek	-Eastern bank of entire project reach already surveyed (USACE, 1994) -Work on western bank (within LODs shown on designs) will include only movement of vehicles (no excavation).	No work recommended based on prior survey and no excavation on western bank.
#13 - Northwest Branch, Riggs Rd.	-Entire project area surveyed by USACE, 1994.	No further work recommended based on prior survey.
Northeast Branch		

Site	Notes	Recommendation
#11 - Indian Creek, College Park	-Significant disturbance during channelization by USACE in 1972 up to Greenbelt Road. -Central portion recommended for surveys -Upstream work will be confined to channel due to rare plant.	Phase I archaeological investigation. See below.
#5 - Paint Branch	-Entire reach significantly disturbed by USACE channelization in 1972.	No field work recommended due to prior disturbance.
#15 - Northeast Branch	-Upper portion of reach disturbed by channelization -Further reconnaissance/surveys recommended at tributary where floodplain work will be performed.	Phase I archaeological investigation. See below.

Records Reviews

3. Northwest Branch, Hyattsville

Known Resources

Several archaeological surveys have been done on portions of the project area, though none completely encompass it. The portion of the study area north of Hwy 410 has already been surveyed in 1994 by USACE. The survey did not identify anything within the project area. Two Phase I archaeological surveys were completed for the construction of the Metrorail E Route (Green/Yellow Line) where it crosses the Northwest Branch, south of the Northwest Branch's junction with Sligo Creek (Taylor 1980, Anderson 1981). A prehistoric site, 18PR212 (Surface Collection C), was recorded during the survey nearby, but is not within the current project area. It is uncertain if this site has been evaluated for National Register eligibility. No historic or prehistoric sites were identified in the portion of the project area that is located within these survey areas. Finally, a 1993 survey was completed by Gibb and Creveling for the Anacostia Tributaries Trail construction. This survey covered the project area from Queens Chapel Rd to approximately Hwy 410. They identified one site, a bridge approach for the Washington, Westminster, and Gettysburg Railroad (18PR432). This 750ft early 20th century feature was for a bridge that was never constructed and is in the northern portion of the project area near Ager Rd. It is uncertain if this resource has been evaluated for National Register eligibility. There is one architectural resource in the project vicinity, WRC Radio Station (PG65-17), but it will not be affected by the proposed action because the proposed work will not be visible from the building. No record of National Register of Historic Places evaluation was found at MHT or in other records search for this building.

USACE and Gibb and Creveling found the stream to suffer from extensive erosion, run-off from increased development, utility line construction, and frequent flooding episodes before the flood control projects of the mid-20th century, all of which may have affected cultural resources along its banks.

5. Paint Branch

Known Resources

There is one historic architectural resource and one archaeological site adjacent to the project, and two archaeological sites in the project vicinity. The College Park Airport (PG66-4), located adjacent to the stream, is listed on the National Register. The Baltimore Goldfish Co. (18PR262) is also adjacent to the project site (Cheek 1985). There is an early 20th century power plant (18PR261; Cheek 1985) and a Late Woodland village site (18PR237; Potter 1980) near the proposed project area, but none of these resources will be affected by the proposed action because the proposed work will not be visible from the building, and the site will not be disturbed. Other than for PG66-4, no record of National Register of Historic Places evaluation was found at MHT or in other records search.

9. Sligo Creek

Known Resources

Gibb and Creveling (1993) surveyed the eastern bank of the project area for the Anacostia Tributaries Trail construction on Sligo Creek. They did not find any historic properties that could be affected. Evans (1978) did an archeological survey for Sligo Creek Relief Sewer construction, but the only sites it identified are outside of the proposed project area. The project is within the Sligo Creek Parkway historic site (PG65-25), which will need to be considered before the project is implemented. PG65-25 is a National Register eligible resource.

11. Indian Creek, College Park

Known Resources

There are no recorded archaeological sites or archaeological surveys in the project area, though there are two architectural resources nearby, the Graves-Keleher House (PG67-23) and the Kleiner-Dillon House (PG67-17). No record of National Register of Historic Places evaluation was found at MHT or in other records search. Neither of these resources would be affected by the proposed action, because the proposed work will not be visible from the buildings.

13. Northwest Branch, Riggs Rd

Known Resources

The USACE 1994 survey covers the entire proposed Project area. The survey found evidence of extensive scouring of the stream bed, erosion of the stream banks, and frequent flood episodes (especially before the flood controls of the 20th century). They found no prehistoric or historic sites located within the project area.

There is one prehistoric site (18PR417) divided by an intermittent stream north of Lyndon St (Simmons and Kassner 1991), a historic artifact scatter (18PR1035) (Proper 2012), and a Late Archaic short-term resource procurement site (18PR76) (Goldsmith 1971) near the project area, but these sites are far enough away to be unaffected by the proposed action. No record of National Register of Historic Places evaluation was found at MHT or in other records search.

15. Northeast Branch

Known Resources

There are two historic resources adjacent to the project area, the Maryland-National Capital Park and Planning Commission: Department of Parks & Recreation Regional Headquarters (PG68-101) and College Park Airport (PG66-4). No record of National Register of Historic Places evaluation was found at MHT or in other records search. Both sites are far enough away that they will not be affected by the proposed action.

Cheek (1985) conducted a Phase-I archaeological survey for the relocation of Calvert Rd which crossed the Northeast Branch. It identified 18PR256, Walker-Cross Mill, at the confluence of Brier Creek and Paint Branch on the east bank. All that is left of the site is a potential mill race which should be near the proposed project area. There was also a Washington East MHT Quad File Note (3) that, as of 1973, many small finds had been identified in gardens and in the park in the vicinity of the Calvert Rd Bridge. No record of National Register of Historic Places evaluation was found at MHT or in other records search.

References Cited:

Anderson, Elizabeth
1981 Historic and Prehistoric Archaeological Survey of the S-Curve Alignment Metrorail E Route Prince Georges County, MD, Project Number 490-10020. Wilmington Cultural Resources Branch, Earth Systems Division, Soil Systems, Inc.

Cheek, Charles D., Richard Meyer, David A. Dashiell III, and Thomas L. Struthers
1985 A Phase I Cultural Resources Survey for the Calvert Road Relocation, Prince George's County, Maryland. John Milner Associates, Inc.

Evans, June
1978 Archaeological Reconnaissance Survey of Sligo Relief Sewer, Montgomery and Prince George's Counties, MD (Contract 73CT5707 A and B). Department of Anthropology, The American University.

Gibb, James G. and Donald K. Creveling
1993 A Phase I Archaeological Survey of the Proposed Anacostia Tributaries Trail in Hyattsville-Baldensburg, Prince George's County, MD. Maryland, National Capital Park and Planning Commission, History Division.

Goldsmith, Liz
1971 University of Maryland College Park, visited the site 18PR76 and reported it to Wayne Clark, Maryland Geologic Survey.

Maryland-National Capital Park and Planning Commission (MNCPPC)

2012 *Land Preservation, Parks and Recreation Plan for Prince George's County, Maryland*. Available at http://www.mncppcapps.org/pgparks/vision_framework_print.pdf

Potter, Stephen R.
1980 A Review of Archeological Resources in Piscataway Park, Maryland.

Proper, Earl E., Danae Peckler, Heather Dollins, Sally Stephens, Kerry Gonzalez, and John Stiteler
2012 Phase IB Archeological Survey of Light Rail Alignment Areas Associated with the Purple Line Project, Montgomery and Prince George's Counties, Maryland. Dovetail Cultural Resource Group.

Simmons, Scott E. and Nancy J. Kassner
1991 Phase I Archaeological Survey of the Lyndon Street Stormwater Retrofit Project Area, Prince George's County, MD. Greenhorne & O'Mara, Inc.

Taylor, Randolph, Antonio V. Segovia, John Foss, and William M. Gardner
1980 Archaeological, Geological and Pedological Archival Investigations of the Proposed Washington Metropolitan Transit Authority's Greenbelt Route in Prince George's County, MD.

USACE
1994 A Phase I/II Cultural Resource Survey for the Anacostia River Basin Environmental Restoration Project, Montgomery and Prince George's Counties, MD, and Washington, D.C. Planning Division, Baltimore District.

Washington East Quad File Note 3
1973 Maryland Historical Trust.

Maryland Historical Trust Site Forms:

Baltimore Goldfish Co. (18PR262)
The Beltsville Agricultural Research Center (PG62-14)
College Park Airport (PG66-4)
Graves-Keleher House (PG67-23)
Kleiner-Dillon House (PG67-17)
Maryland-National Capital Park and Planning Commission: Department of Parks & Recreation Regional Headquarters (PG68-101)
Sligo Creek Parkway (PG65-25)
WRC Radio Station (PG65-17)

PHASE I-LEVEL CULTURAL RESOURCE INVESTIGATION
ANACOSTIA WATERSHED RESTORATION PROJECT
PRINCE GEORGE'S COUNTY, MARYLAND

Prepared By:

U.S. Army Corps of Engineers
Baltimore District
10 S Howard Street
Baltimore, Maryland, 21201

September 2017

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ABSTRACT

The Baltimore District of the U.S. Army Corps of Engineers (USACE) is proposing to restore stream habitat utilizing natural channel design principles and to remove fish blockages within portions of the Anacostia River watershed in Prince George's County, Maryland. The recommended plan will restore degraded aquatic ecosystem structure and function within stream segments in Northeast Branch, Sligo Creek, Northwest Branch, Paint Branch, and Indian Creek. Primary project objectives include restoring in-stream physical habitat in the selected stream reaches and enhancing aquatic ecosystem resilience by restoring fish passage and longitudinal connectivity of in-stream habitat. The recommended plan will restore approximately 6.9 miles of in-stream habitat on six stream reaches, approximately 4.3 miles of fish passage, and connect a network of approximately 13.5 miles of restored habitat.

The majority of the project work will be confined to the area in between the stream banks, and will not result in adverse impacts to cultural resources. Any work done outside the stream banks will be concentrated in previously disturbed areas or within areas previously surveyed for archeological sites. Any access roads or staging areas will not include subsurface excavation and will be confined to previously disturbed areas when possible.

The proposed action at each stream reach in this study was evaluated for its potential to affect historic properties under Section 106 of the National Historic Preservation Act of 1966 (as amended). Out of the six stream reaches chosen for further evaluation for this study in the recommended plan, the proposed actions at two stream reaches prompted further archeological investigations to identify unknown historic properties. This report briefly discusses the background research for all six reaches and summarizes the findings of the archeological investigations at Site 11 Indian Creek, College Park and Site 15 Northeast Branch.

No new historic properties were identified during these investigations, and USACE recommends no further cultural resource investigations at this time.

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PHASE I CULTURAL RESOURCE INVESTIGATION
ANACOSTIA WATERSHED RESTORATION PROJECT
PRINCE GEORGE'S COUNTY, MARYLAND

The Baltimore District of the U.S. Army Corps of Engineers (USACE) is proposing to restore stream habitat utilizing natural channel design principles and to remove fish blockages within portions of the Anacostia River watershed in Prince George's County, Maryland (Figure 1). The recommended plan will restore degraded aquatic ecosystem structure and function within stream segments in Northeast Branch, Sligo Creek, Northwest Branch, Paint Branch, and Indian Creek. This study is being conducted under the authority of a 1988 resolution of the House Committee on Public Works and Transportation to evaluate watershed improvements. In 2014, USACE entered into a Feasibility Cost Sharing Agreement with the Prince George's County to conduct this study.

Under Section 106 of the National Historic Preservation Act of 1966 (as amended), federal agencies are required to take into account the effect of their proposed undertakings on properties listed in or eligible for inclusion in the National Register of Historic Places. In Maryland, the Maryland Historical Trust (MHT) serves as Maryland's State Historic Preservation Office (SHPO) and conducts Section 106 reviews.

A letter from the Maryland Historical Trust (MHT) (June 15, 2015) stated that their careful review of the ten initial stream segments/reaches indicates that the projects are unlikely to have an adverse effect on cultural resources within six of the ten reaches, therefore no archeological survey work would be recommended for these reaches for Section 106 purposes. However, further evaluation of four reaches, including Little Paint Branch (Site 12), Lower Northwest Branch (Riggs Road, site 13), Northwest Branch Hyattsville (Site 3), and Sligo Creek (Site 9), was recommended to identify impacts to existing cultural resources. Of these reaches, Sites 3, 9, and 13 are in the recommended plan for actual construction.

A preliminary examination of areas of potential project impact in the Anacostia River Watershed in Prince George's County was undertaken in 2014 and 2015. As part of the Phase 1a-level investigation, Maryland state databases were searched for known archeological and built historic resources in the project vicinity. Based on these searches, as well as field visits and information received from MHT, some historical properties and/or archaeological sites were identified in the vicinity of the projects, but no known sites would be affected by the proposed actions.

Out of the original ten stream reaches (Figure 2), six were chosen for the recommended plan for actual construction (Figure 3). The proposed actions at two stream reaches, Site 11 Indian Creek, College Park and Site 15, Northeast Branch, Calvert Road prompted further investigation. In the summer of 2017, USACE conducted a Phase 1b-level archaeological investigation of the project area to determine the presence or absence of archaeological resources within the project's area of potential effect. The area of potential effect for this project is defined as the location of all ground-disturbing activities outside the edges of the stream bank. The archaeological investigation included both background research and field investigation, and this report was prepared including final conclusions and determinations regarding the presence of potential archaeological resources.

DESCRIPTION OF UNDERTAKING

Primary project objectives include restoring in-stream physical habitat in the selected stream reaches and enhancing aquatic ecosystem resilience by restoring fish passage and longitudinal connectivity of in-stream habitat. The recommended plan will restore approximately 6.9 miles of in-stream habitat on six stream reaches, approximately 4.3 miles of fish passage, and connect a network of approximately 13.5 miles of restored habitat. The plan removes fish blockages on Northwest Branch and Sligo Creek providing anadromous fish species of concern access to their historical range on Northwest Branch and facilitating the migration of fish to higher quality habitat upstream of Northwest Branch.

Restoration of in-stream physical habitat will utilize natural channel design principles. Stream corridors will be restored through the placement of in-stream structures, such as J-hooks, cross vanes, W-weirs, and step pools for grade control and riffle/pool restoration. Nested cross vanes will be used to ameliorate fish blockages. In-stream restoration is expected to result in increased reconnection of the streams with their floodplains, potentially aiding wetland reestablishment. The majority of the project work will be confined to the area in between the stream banks. Any access roads or staging areas will not include subsurface excavation, and the ground surface in these areas will be protected by geo-textile fabric. Work in these areas will be confined to previously disturbed areas when possible. Figures 4-10 show the locations of design structures at each stream reach.

Work in the floodplain along the stream bank could result in an adverse effect to previously unidentified archaeological resources. Floodplain settings often have a high probability for containing archaeological sites from both the prehistoric and historic periods, so it is possible that archaeological materials exist within project areas with proposed subsurface excavations in the floodplain. For this reason, proposed design features outside the stream banks are located in previously disturbed areas, or within areas that have been surveyed and no archeological resources were identified.

ENVIRONMENTAL SETTING

Physiographic Setting and Geology

The Anacostia River Watershed spans two physiographic provinces, the Piedmont Plateau and the Atlantic Coastal Plain, which reflect differences in geological composition and topography. The Prince George’s County portion of the watershed primarily lies within the Coastal Plain Province. The stream segments selected for study in this project are primarily within the Coastal Plain Province.

The Atlantic Coastal Plain Province is comprised of sedimentary rocks of fluvial, deltaic, estuarine, and marine origin, deposited since the beginning of the Cretaceous Period, 144 million years ago (MDDNR, 1987). These generally unconsolidated sediments, including gravel, sand, silt, and clay, form a wedge that thins out onto the crystalline Piedmont to the west, and thickens eastward to more than 8,000 feet in thickness at the Atlantic Ocean coastline (Csato, et al., 2013; MGS, 2014). The Coastal Plain Province has flatter topography and lower gradient streams with finer bed materials. Thicker soil zones than in the Piedmont, tend to be present. The highest elevation in the Coastal Plain is 400 feet above mean sea level (AWRP, 2010), and slopes in the Coastal Plain are usually less than 8 degrees (USGS, 2007). River valleys are incised into the Coastal Plain alluvium. The river valleys consist of gently dipping beds, and locally-present Tertiary terraces on either side of the main channels (USGS, 2007).

Soils

Soil types were specifically looked at for the two stream reaches where further archeological testing was conducted. The soils in the project area for Site 11 are primarily frequently flooded Zekiah and Issue soils, while the soils in the project area for Site 15 are primarily Codorus and Hatboro soils that are frequently flooded with a mica-bearing loamy alluvium parent material. (USDA 2017)

Vegetation

The native vegetation of the region during the Mid- to Late Holocene was a hardwood forest in which white oak, sweetgum, and yellow poplar were probably dominant (Kirby et al. 1967:4). This climax forest was cut down during the past three centuries. The present vegetation of the project areas consist of both young and mature trees.

PREHISTORIC PERIOD CONTEXT

The prehistoric cultural sequence for Prince Georges County generally conforms to that defined for other areas in the Middle Atlantic region, although there was some divergent regional development in later prehistory. In the following discussion, this sequence is divided into seven periods: Paleoindian (9000 to 8000 BC), Early Archaic (8000 to 6500 BC), Middle Archaic (6500 to 3000 BC), Late Archaic (3000 to 1200 BC), Early Woodland (1200 BC to AD 300), Middle Woodland (AD 300 to AD 1000), and Late Woodland (AD 1000 to AD 1600). In the nearby Patuxent drainage to the east, these regionally attested periods have been subdivided by Steponaitis (1980) into a series of 23 local phases, based primarily on temporally diagnostic point types.

Paleoindian (9000 to 8000 BC; 11,000 to 9500 cal BC) and Early Archaic (8000 to 6500 BC, 9500 to 7500 cal BC)

The earliest convincingly attested occupants of the Middle Atlantic region were Paleoindian hunters, who arrived around 11,000 cal BC (9000 BC). They came at a time of radical climate change at the end of the Wisconsin glacial, as spruce-dominated boreal vegetation was replaced by the northward expansion of deciduous forest, and animals migrated to new ranges or were driven to extinction. The diagnostic Paleoindian artifact is the basally fluted, lanceolate Clovis point; typically associated tools include scrapers and gravers for working hides and bone. Jasper, chalcedony, and chert were the preferred lithic materials for the manufacture of Paleoindian stone tools; quarries may have been a focal point in the annual settlement round of Middle Atlantic Paleoindians (Gardner 1989).

In the High Plains of the western United States, Clovis points have been found at kill sites alongside the skeletons of mammoths; east of Missouri, however, there is no unequivocal evidence of mammoth or mastodon hunting by Eastern Paleoindians, even though radiocarbon dates show that mastodons persisted in the East at least as late as 9000 BC (Custer 1984:46, but see Dent 1991:129; Meltzer and Mead 1985). The few odd bits of identifiable calcined bone that have been recovered from Eastern Paleoindian sites suggest hunting of caribou or other cervids by the more northern bands (Gramly and Funk 1990); deer may have been a staple in the diet of more southern groups. Finds at the Shawnee-Minisink Site in the Delaware Valley show that the Paleoindian diet also included fish and berries and fruits (Dent 1991).

Population density must have been very low, perhaps on the order of 0.0125 to 0.0250 persons per square mile (Turner 1989:84). In Maryland, state files record surface finds of about 120 fluted points, the great majority from the Coastal Plain. Most of the rest were found along the Potomac. Ebright (1992:30) suggests a settlement focus on rivers, rather than quarries, in this region. In Montgomery County, Paleoindian material was found in a cultivated field at the Pierpoint Site (18M041). Small fluted points, chipped from jasper, and other tools were found in eroded beach deposits on Tilghman Island in the Chesapeake (Lowery 1989). In Anne Arundel County, Paleoindian artifacts, including two basal fragments of Clovis points, made of quartz, were found in subsurface contexts at the Higgins Site (18AN489) (Ebright 1992).

Stylistic variations in fluted points suggest gradual change and regional differentiation over time, from an original ubiquitous Clovis or Early Paleo type, through the Mid-Paleo Quad, Cumberland, and Debert types, to the Late Paleo Dalton and Hardaway types (Gardner 1989). The small number of Dalton points in Virginia and Maryland may indicate a population collapse between 8500 and 8000 BC (Gardner 1989:39); this might be related to the sudden relapse to a cold glacial climate during the Younger Dryas episode (9000-8000 BC, 11,000-9600 cal BC).

After 8000 BC (9600 cal BC), the regional population rebounded rapidly. A marked stylistic change is evident in the projectile points of the early Archaic (8000-7300 BC); the diagnostic types are corner-notched (Palmer, Kirk, Decatur, and Amos) or side -notched (e.g., Thebes, Bolen, Warren, Big Sandy, and Kessell) instead of basally thinned (Egloff and McAvoy 1990). The meaning of this change in hafting technique is unclear; since the spear thrower or atlatl was probably already used by Paleoindians, the new point styles cannot indicate its introduction, as was formerly speculated (Gardner 1974). Although high-quality lithic materials were preferred, Early Archaic groups also began to exploit local lithic materials, such as quartz and quartzite. In the Patuxent drainage, Palmer and Kirk Corner-Notched points were most often made of quartzite or quartz, with minor use of rhyolite; however, almost half of the later Kirk Stemmed points were made of rhyolite, which had to be imported from the Blue Ridge (the closest rhyolite source is the Highland Outcropping on Catoctin Mountain [Geasey and Ballweber 1991]). Throughout the Middle Atlantic region, Early Archaic sites, which frequently occur on large river terraces or upland surfaces, are more numerous than Paleoindian sites (Johnson 1986).

There are no 14C dates for the Early Archaic in Maryland, and only a few stratified sites containing Early or early Middle Archaic artifacts are known. At the Indian Creek V Site (18PR94), located in Prince George's county, two miles east of the LTS Building project area, Palmer and Kirk points, as well as early Middle Archaic St. Albans, LeCroy, and Kanawha points, were excavated

(LeeDecker and Koldehoff 1991). However, the early artifacts were not stratigraphically separated from Late Archaic components. In the Patuxent drainage, Early Archaic I (Palmer) sites are rare, and occur on terraces north of Hall Creek and along Collington Branch (between Upper Marlboro and Bowie). Early Archaic II (Kirk Corner-Notched and Kirk Stemmed) components are located along the Patuxent, south of Priests Bridge, and along Collington Branch, but the diagnostic points are not found at sites lying between the rivers (Steponaitis 1980:20).

Middle Archaic (6500 to 3000 BC; 7500 to 3800 cal BC)

The Middle Archaic period corresponds to a climatic episode (the "Hypsithermal" or Mid-Holocene) marked by rising temperatures, decreasing precipitation, and the development of a more seasonally variable climate. An oak-hemlock-hickory forest dominated the region, and deer became the dominant large mammal. This period is characterized by a shift in subsistence settlement patterns and an increasing human population. These changes are indicated by an increase in the number, size, and functional diversity of sites. During the Middle Archaic period, sites begin to appear in locations which had been previously ignored, e.g., upland swamps and interior ridgetops (Gardner 1987), ponds, marshes, and springheads (Stewart 1989; Wall 1990). However, base camps were still located primarily in the floodplains of major drainages. The appearance of new tool types specifically designed for woodworking, seed-grinding, and nutcracking (e.g., axes and adzes, mauls, grinding slabs, and nutting stones) and the location of sites in previously unutilized locations indicate an increasing emphasis on plant foods.

During the Middle Archaic period, procurement of high-quality lithic material was no longer an important component of the settlement pattern, as most artifacts were manufactured from locally available lithic materials. This change may reflect increasing circumscription of band territories as a growing population "filled in" available environments and restricted movement. Use of the rhyolite quarries in western Maryland intensified at the beginning of the Middle Archaic, however, as indicated by bifurcate points found at lithic processing sites (Stewart 1989:7). A noteworthy technological change is the shift from carefully made and curated unifacial scrapers to the expedient tools found in Middle Archaic and later assemblages (Gardner 1989).

Diagnostic projectile points of the early Middle Archaic period are bifurcated base types (St. Albans, LeCroy, Kanawha), dating from 6800 to 6000 BC (Broyles 1971); many archaeologists (e.g., Steponaitis 1980) would still classify them as Early Archaic. At the UMBC Site (18BA75), in Baltimore County, two LeCroy points and one Kanawha point were found beneath eight Kirk Stemmed points (Vitelli 1975). Ninety-one points of this period have been recognized in collections from the Patuxent drainage. They are made of quartz, rhyolite, quartzite, and chert; this demonstrates use of both local materials and stone obtained in the Blue Ridge and western Piedmont (Steponaitis 1980:21).

Later Middle Archaic types include Stanly (6000-5000 BC), Morrow Mountain (5000-4500 BC), and Guilford (4500-4000 BC) (Coe 1964). Stanly points are very poorly represented in Maryland (Ebright 1992:33). Only one point from the Indian Creek V Site was typed as a Stanly (LeeDecker and Koldehoff 1991:113), although several others classified as Kanawha points could as easily have been regarded as Stanly points. Only two Stanly points were tentatively identified in Patuxent drainage collections; both came from Site 18AN56 (Steponaitis 1980:22). Seventy-seven Morrow

Mountain points were recognized in this region; more than half were made of rhyolite. The distribution of these components is not significantly different from that of early Middle Archaic diagnostics. They cluster in two areas near large present-day freshwater swamps, at the junctions of the Patuxent and Little Patuxent and Western Branch, respectively. The great majority of the 138 Guilford points recognized in the Patuxent drainage were made of locally available quartzite. This shift in raw material sources was accompanied by a change in site distributions; Guilford components, unlike Morrow Mountain, are located along Collington Branch as well as along the Patuxent (Steponaitis 1980:22). A few Morrow Mountain points were found at the Indian Creek V Site, but no Guilford points, leading the excavators to infer that the site was not occupied between 5500 and 4000 BC (LeeDecker and Koldehoff 1991:269).

The terminal phase of the Middle Archaic period (4000-3000 BC) is marked by the appearance of Brewerton Side-Notched and Eared-Notched projectile points. Otter Creek points, whose center of distribution in this period is far to the northeast (Ritchie 1965:84), have recently been found at the Higgins site in Anne Arundel County (Ebright 1992:193). The same type is present at Indian Creek V (LeeDecker and Koldehoff 1991:114). Otter Creek and Brewerton points are also reported from the Russett 221 (18AN685) site (Polglase et al. 1990). Twelve Otter Creek points and 160 points assigned to various Brewerton styles have been identified in Patuxent drainage collections (Steponaitis 1980:24). The Maryland points assigned to the Otter Creek type may actually belong to a much earlier (ca. 7500 BC) side-notched horizon related to the Southeastern type, Taylor points (compare Michie 1996:252, 255).

Piscataway points are ascribed to the Middle Archaic period by Steponaitis (1980), but the repeated association of this lithic type with Accokeek or Elk Island pottery indicates a much later date, in the first millennium BC (Mouer 1991). As this is a very common type (577 noted) in the Patuxent drainage, its temporal position obviously has major implications for the interpretation of population and settlement trends in the region.

Late Archaic (3000 to 1200 BC; 3800 to 1450 cal BC)

During the Late Archaic period, subsistence-settlement patterns and projectile point technology changed significantly. Initially, Piedmont Archaic people who manufactured stemmed points (Bare Island or Holmes, Lamoka, Poplar Island) and side-notched points (Halifax or Vernon) probably maintained a "sylvan" adaptation (Mouer 1991) to the eastern deciduous forest, focusing on nut-bearing trees; deer and turkey probably provided most of the meat in their diet.

In the Patuxent drainage, Vernon Corner -Notched points are a common type of the early Late Archaic, numbering 551 in local collections. Even more frequently found are long, narrow, stemmed Holmes points (N=629). "Despite the moderate number of components, the Holmes is the most abundantly represented point in the Patuxent drainage" (Steponaitis 1980:25).

A major change in settlement pattern is associated with the appearance of Savannah River points, which mark the onset of a "Transitional" or "Terminal Archaic" sub-phase (Steponaitis's Late Archaic IV-VI). These large, broad-bladed stemmed points were typically made of quartzite. Their function has been much debated. Were they projectile points, or specialized knives for fish-processing or some other task (McLearen 1991). Although broadspears are sometimes found in ritual mortuary contexts, they apparently were utilitarian objects, as shown by occasional breakage and edge attrition. If broadspears can be shown to be special-purpose tools grafted onto an existing Late Archaic toolkit, the case for indigenous development would be supported. On the other hand, if broadspears are interpreted as general-purpose points and knives, replacing comparable tools of the preceding Late Archaic cultures, the case for Savannah River as an intrusive culture from the coastal plain of Georgia and the Carolinas would be strengthened. The evidence for a radical change in settlement and subsistence patterns circa 2200 BC is more consistent with the intrusion/migration hypothesis. People adapted to the estuarine environments of the southern coast, newly created circa 3000 BC as the rate of sea level rise slackened, moved northward to occupy similar resource-rich zones. Continued northward expansion of the broadspear-makers beyond Maryland is indicated by the appearance of Lehigh/Koens-Crispin points in Pennsylvania and New Jersey, and Snook Kill points in New York (Kinsey 1972). Around 1700 BC, the Susquehanna and Perkiomen broadspear point types were probably developed from the northern Savannah River variants, and were then spread back, by diffusion or migration, into parts of northern Virginia such as the Potomac Valley (for example, they were found in Zone V of the Monocacy Site, at a level dated as earlier than 1000 BC [Gardner and McNett 1971]). At the Shepherds Field Site (46JF325), on the south bank of the Potomac in West Virginia, rhyolite Susquehanna and Perkiomen points and preforms were associated with hearths and other features dated to circa 1300-1700 BC (Fiedel and Galke 1996). Isolated clusters of Perkiomen points in Virginia, on the margins of the Dismal Swamp and in the northern Shenandoah Valley, appear to represent intrusive populations from Pennsylvania or New Jersey (McLearen 1991:104; Mouer 1991:14).

In some areas, Transitional populations seem to have been much more numerous than their Late Archaic predecessors. Although some upland sites are known, most occur in riverine settings. Large sites (one-half acre to more than 5 acres) that probably represent macroband encampments to exploit seasonal fish spawning runs are known in the James River Piedmont and Coastal Plain. Smaller sites of about 5,000 square feet, which may represent single-band camps, are a more common site type in the Piedmont; very small microband camps are also known (Mouer 1991). Apart from broadspears, Transitional assemblages include two other significant new artifact types: grooved groundstone axes, which replace earlier chipped-stone forms, and carved soapstone bowls. Soapstone was quarried in the west-central Piedmont, primarily between Charlottesville and Lynchburg; quarrying is also well-attested in the Washington, D.C., area (Holmes 1897:125-128; Luckenbach et al. 1975). Vessels were carved at the quarries, and transported, probably by canoe, in finished form. Soapstone pots were clearly used for cooking; but it is not yet known what foods (fish, meat, seeds, tubers?) they were used to process, nor why such containers suddenly became necessary or desirable.

In the Patuxent drainage, Steponaitis (1980:25) recognized 47 Savannah River points, 89 Koens-Crispin points, 44 Susquehanna points, and 12 Perkiomen points. Most components were located close to the Patuxent or its major tributaries, with fewer upland sites than in earlier periods. This distribution tends to confirm the riverine focus observed elsewhere, but also seems to imply a local population decline in this area, possibly caused by stressful adaptation to a warm, dry climate (Steponaitis 1980:25).

Early Woodland (1200 to 500 BC; 1450 to 600 cal BC)

The Early Woodland in the Middle Atlantic region begins with the adoption of ceramic technology. The earliest modeled clay vessels of the Marcey Creek type (ca. 1200 to 800 BC) imitate the shapes of flat-bottomed soapstone pots, including lug handles, and are even-tempered with bits of soapstone. A brief period of experimentation with ceramic technology ensues, resulting in the creation of several new types. Flat-bottomed vessels resembling Marcey Creek ware, but tempered with grit or sand instead of soapstone pieces, were produced in Delaware (Dames Quarter type) and on the lower Potomac (Bushnell Plain type) by 1000 BC or earlier (Bushnell Plain ware is associated with a 14C date of 1110±75 BC at the White Oak Point Site [Waselkov 1982]). Selden Island (1000 to 750 BC) ceramic vessels, although steatite-tempered like Marcey Creek ware, were conoidal and were constructed by coiling; these attributes (probably imitative of basketry prototypes) are characteristic of pottery in the Northeast and interior Piedmont. Accokeek pottery (Stephenson and Ferguson 1963) is a thin-walled, cordmarked, sand- or grit-tempered, conical or round-bottomed ware, found in the Potomac basin circa 1000 to 300 BC. Similar ceramics from the James River Piedmont have been classified as Elk Island 1 and 2 (900 to 600 BC) (Egloff and Potter 1982; Mouer 1991). Elk Island 3, estimated to date from 600 to 200 BC, is characterized by ceramics which appear transitional to Popes Creek wares, and points resembling Rossville and Adena types.

Marcey Creek sites appear to represent short-term camps of small bands in riverine settings in the Piedmont and Fall Line zones. The Selden Island type-site on the Potomac was a large site, with probable storage pits indicative of an occupation of some duration. An Accokeek component at the 522 Bridge Site in Front Royal, Virginia, 14C-dated to circa 900 BC, includes storage pits, pieces of burnt daub, and traces of nine oval houses. Flotation of pit contents yielded carbonized seeds of amaranth, Polygonum, mustard, and grape (all wild plants) (McLearen 1991). Large Elk Island sites seem to represent semipermanent villages in the floodplain; smaller foray camps, used while harvesting nuts and hunting deer and turkey, occur in upland and Inner Coastal Plain settings (Mouer 1990, 1991).

Small Savannah River points, Dry Brook points (a narrow-bladed Susquehanna variant), Orient Fishtail points, and Calvert points are found in association with Marcey Creek pottery, demonstrating the *in situ* transformation of Transitional into Early Woodland cultures. Point types associated with other Early Woodland ceramics in Maryland include Piscataway/Rossville, Teardrop or ovoid, Calvert, and possibly Clagett and Vernon (Ebright 1992:38).

In the Patuxent drainage, Steponaitis (1980:26) lists 77 Orient Fishtail points and 25 Dry Brook points, and 82 sherds of Marcey Creek pottery. Accokeek pottery is quite common (578 sherds) as are the probably associated Calvert Stemmed points (N=421). The Accokeek settlement pattern is dramatically different from those of preceding phases in three respects: (1) an increased number of components; (2) an increased amount of artifactual material; and (3) the presence of shell midden sites adjacent to the estuarine zone of the river (Steponaitis 1980:29). During the Early and Middle Woodland, sites adjacent to the Patuxent estuary were probably occupied for longer periods during the yearly seasonal round than were interior sites; this inference is based on greater percentages at estuarine sites of ceramics and of tools used for manufacture or repair. Interior upland sites, with less diverse assemblages dominated by projectile points, were probably used for short-term resource procurement (Steponaitis 1983). Large seasonal base camps, oriented toward fishing, were located on major drainages; they were complemented by small foray camps, situated on lower-order streams (Ebright 1993).

Middle Woodland (500 BC to AD 900; 600 cal BC to cal AD 1000)

Based primarily on ceramic chronology, two phases of the Middle Woodland period have been distinguished in the Coastal Plain and adjacent Piedmont: the earlier (Middle Woodland I) characterized by sand-tempered Popes Creek and related ceramics (500 BC-AD 200), and the later (Middle Woodland**)** by shell-tempered, net-impressed Mockley pottery (AD 200-900) (Stewart 1992).

During the Middle Woodland, the regional population grew, as bands became more sedentary and participated in regional exchange networks. Continuity in site location between the Early and Middle Woodland periods implies that earlier subsistence-settlement systems persisted in most areas. Some early Middle Woodland societies in the Middle Atlantic region practiced elaborate mortuary rituals (e.g., the stone burial mounds of the Shenandoah Valley [Gardner 1982:71] and the Delmarva Adena cemeteries [Custer 1982:30-33, 1984:113-130]) and may have developed ranking of the "big man" type. Based on the absence of mortuary elaboration or concentrations of exotic trade items comparable to Delmarva Adena, it appears that groups in the Potomac River valley did not develop ranked societies. However, some Middle Woodland I sites in this area, such as Popes Creek, expanded into macro-band centers which may have functioned as nodes in integrated, possibly ranked social systems (Gardner 1982).

Lithic artifacts made from Ohio Valley flint, and other exotic items such as tubular pipes, gorgets, and copper beads, occur in Delmarva Adena mortuary caches circa 400 BC to AD 100. These items have been attributed to a "focused" exchange network, involving individuals or groups that initiated contact with external trade networks and hoarded the trade goods they acquired (Stewart 1992:20). At the same time that acquisition of exotic items peaked in Middle Woodland I, "broad-based," or "down-the-line" exchange of lithics procured within the region declined. However, after the collapse of the Adena focused exchange system around AD 100-200, intraregional exchange of lithic materials, such as transport of rhyolite from the Blue Ridge province of Maryland and Pennsylvania to the Virginia Coastal Plain, intensified between AD 200 and 800 (Stewart 1992). After AD 800, however, lithic exchange falls off dramatically in the Late Woodland period, for reasons that have yet to be elucidated.

The florescence of the Hopewell interaction sphere in the Ohio Valley seems to have had little discernible impact on contemporaneous Middle Atlantic societies. After the collapse of Hopewell (around AD 400), an exchange network, linking Michigan, Ohio, Ontario, central New York, and New England, circulated items such as steatite platform pipes, moose antler combs, and Jack's Reef points. These trade goods sometimes occur in mortuary caches, such as the Island Field cemetery in Delaware (Custer et al. 1990), which dates to circa AD 700-900. An isolated burial cache, including two typical antler combs, was found by Fowke in 1894, in the Bowman mound near Linville in Rockingham County, Virginia (Ritchie 1965:249). A virtually identical comb has recently been found in a mortuary ceremonial cache at the Whitehurst Freeway Site near the Potomac in southwestern Washington, D.C. (Crowell 1999).

Piscataway/Rossville points frequently occur on early Middle Woodland sites in Virginia and Maryland. In the Patuxent drainage, the local Mockley-related phase is termed "Selby Bay" (Steponaitis 1980:15). Selby Bay lanceolate points (probably used as knives), which are often associated with Mockley pottery, closely resemble the Fox Creek points of New York and New England. Selby Bay side-notched forms seem more localized. Significant amounts of imported lithic materials—blue rhyolite, purple argillite, and green, yellow, and brown jasper—occur in Selby Bay phase components. Two-holed elliptical gorgets and three-quarter-grooved axes are also characteristic.

The predominance of Popes Creek and Mockley wares in the Coastal Plain, while crushed-rock temper, thickened rims, pinching, cord decoration, and fabric-impression became more common in the contemporaneous and later Potomac Piedmont ceramics (Albemarle, Clemson Island, and Shepard wares) (Hantman and Klein 1992), suggests that the Fall Line began to demarcate a sharp stylistic and ethnic boundary in the Middle Woodland (Egloff 1985). The Fall Line marked the boundary between mutually hostile Coastal Algonquians and Piedmont Siouan speakers in northern Virginia at the end of the Late Woodland period. Whether a similar boundary existed in Maryland is unclear, because ethnohistoric data are very limited and difficult to correlate with the archaeological record (Moore 1993:122). Linguistic data suggest that Algonquian-speakers, originating from the Great Lakes region, intruded into the coastal zone, from the Canadian Maritime Provinces southward to North Carolina, between circa 600 BC and AD 800 (Fiedel 1987, 1990, 1991; Luckenbach et al. 1987).

Triangular points resembling the Levanna point of New York and the Yadkin type of the Carolina Piedmont may occur as early as AD 350, which would imply introduction of the bow and arrow prior to the Late Woodland period. Jack's Reef Corner-Notched points occur in small numbers circa AD 600 to 900.

Late Woodland (AD 900 to AD 1600; cal AD 1000 to 1600)

Around AD 900, maize horticulture was adopted by Middle Atlantic groups. Although actual remains of cultigens are very rare (Turner 1992:106-107), the importance of farming is clear from early historic accounts of native lifeways. Hunting, gathering, and fishing provided important dietary supplements. Initially, the availability of cultigens may have fostered a more dispersed settlement pattern in the early Late Woodland than in the last centuries of the Middle Woodland (Potter 1993:101; Turner 1992:113). However, storage of surplus crops later permitted the establishment of small permanent hamlets and larger villages after AD 1300. Prior to AD 1300/1400, settlements were not stockaded, suggesting that inter- and intra-group hostilities did not play a significant role in the settlement pattern. Around AD 1300 to 1400, throughout the Middle Atlantic region, population density increased, nucleated settlements and stockade villages were established, and there is evidence of population movement and displacement.

The dramatic increase in the number of small villages, and the deep cultural deposits and numerous storage pits found at these sites, suggest that Late Woodland populations were not only sedentary, but also were expanding both spatially and in absolute numbers. In response to population growth, establishment of sedentary villages, and availability of food surpluses, more complex sociopolitical structures developed during this period. Thus, the middle Late Woodland period is characterized by the emergence, or in some cases the reappearance, of ranked societies. These ranked societies developed into the complex tribes and chiefdoms encountered by the Europeans in the late sixteenth and early seventeenth centuries (Turner 1976, 1992).

The Late Woodland period within the Patuxent drainage basin consists of two phases, based primarily on ceramic traditions: the Little Round Bay phase (AD 800-1250) and the Sullivan Cove phase (AD 1250-1600). Diagnostic pottery of the Little Round Bay phase is thin-walled and shell -tempered, with complex incised designs; it is classified as Rappahannock Incised or Townsend Incised (Steponaitis 1980:16). Rappahannock Fabric-Impressed ware is also found in this phase, in great quantity (N=2,394 sherds). Both Jack's Reef and Levanna triangular projectile points are associated with these ceramics. Neither type is very numerous; 131 Jack's Reef Pentagonal, only two Jack's Reef Corner-Notched, and 40 Levanna points are reported (Steponaitis 1980:32).

Rappahannock Incised pottery continues into the later Sullivan Cove phase, but with simpler incised designs consisting of horizontal lines. Rappahannock Fabric-Impressed ware probably lasted through this phase as well. A new type, introduced circa AD 1350, is Townsend Corded-Horizontal; this ware is shell-tempered and fabric-impressed, and decorated along the rim with horizontal bands made by cord -marking. Another ceramic type of this period is Sullivan ware, a fine cord-marked ware with extremely compact paste. The later ceramics are sometimes associated with Madison (or small Levanna) points. This point type is very numerous in the Patuxent drainage (N=507) (Steponaitis 1980:32). Potomac Creek pottery, a cord-impressed, sand- or quartz-tempered ware made by contemporaneous groups living to the south and west of the Patuxent drainage, occurs in small amounts (337 sherds) in the latter area (Steponaitis 1980:32). Whether this Potomac Creek presence indicates population intrusion (Clark 1976; MacCord 1984) or trade (Steponaitis 1980:34) is a matter of dispute.

HISTORIC PERIOD CONTEXT

Contact and Early Settlement (AD 1500 to AD 1750)

The Contact period was characterized by the interactions of Native American groups and a transition from the hegemony of those groups and their concerns to one dominated by Europeans. The transition was made at the expense of the integrity of the native populations and proceeded to an era wholly controlled by immigrant social institutions.

By about the fourteenth century, the Chesapeake Bay area of Maryland was occupied by Algonquian-speaking groups, the Piscataway on the western shore and the Nanticokes on the eastern shore (Stephenson and Ferguson 1963). Up the Susquehanna River resided the Susquehannocks, who controlled the key route of communication and trade between the Chesapeake Bay region and the Iroquois in New York. The first documented European contact with Chesapeake Bay natives dates to 1585, when John White visited the area and made drawings of the local people. In 1608, John Smith traveled around the Chesapeake, mapping natural features and the locations of native villages, including the chief village of the Piscataway on Accokeek Creek.

Permanent settlement of Maryland by Euro-Americans began in 1634, when two ships of British immigrants established St. Mary's City at the mouth of the Potomac River. The settlement was on land granted on the north side of the Potomac to the first Lord Baltimore, George Calvert. The presence of the English adjacent to the waterways forced the Piscataway to move north. The Piscataway allied themselves with the English settlers in hopes of gaining power against groups of Massawomecks and Susquehannocks that claimed part of their territory. There was a series of engagements between alliances of the Chesapeake Bay Native American groups and the English against the Susquehannocks (Kent 1984). By 1676 the Susquehannocks were destroyed as a result of being caught between the Iroquois and the Maryland Colony. The Piscataway were granted a reservation around Mattawoman Creek, Piscataway Creek, and Timothy Branch, and efforts were made by the Jesuits to Christianize them. The boundaries of the reservation were not respected by European settlers, however, and the Piscataway were much reduced in population by disease. Remnants moved onto a succession of Potomac River islands and finally by 1700 joined Native American groups in Pennsylvania. Within 20 years of the founding of St. Mary's, the presence of the native population of Prince Georges County was negligible (Beauregard et al. 1995 II: 8).

Calvert's son Cecil oversaw the settlement of the colony of Maryland after his father's death in 1632. Generous land grants were made to all settlers who paid their way across the Atlantic, while those who could not pay worked as indentured servants for a set number of years, after which they could purchase land (Kellock 1962:6). George Calvert had converted to Catholicism and it was his dream that his colony promote religious tolerance. His children carried out his vision, and the colony of Maryland attracted a diverse population from England, Wales, Scotland, Ireland, and France. Early settlements were located along the navigable waterways of the Chesapeake Bay area. Settlements around the mouth of the Patuxent River were established by Jesuit missionaries in the late 1630s, and by the 1650s land was being taken up along that river in what is now Prince Georges County.

The early settlers of the area were from a variety of backgrounds, primarily drawn from the British Isles but including also some families of French descent. Most were engaged in farming on some level, but many supplemented their income by pursuing a variety of trades such as coopering, smithing, carpentry, and trading with England, other settlers, and the Native American population. A few settlers were also lawyers and doctors.

From its earliest years, tobacco was the reason for the success of the Maryland colony. It was grown by large and small farmers alike and the fortunes of all rested on tobacco prices. The largest fortunes were not built entirely on tobacco, however. The wealthiest planters in Maryland were also merchants, who purchased their neighbors' tobacco in exchange for imported goods shipped to their stores from Britain, the Caribbean, and elsewhere (Carr n.d.:5- 6). River landings of wealthy plantation owners became de facto towns during the seventeenth and early eighteenth centuries in Maryland.

An individual farmer with the help of his family could only tend to a few acres of tobacco, which required a great deal of attention during the growing process. During the seventeenth century, cheap labor was plentiful in the form of indentured servants, the numerous dispossessed of England who were willing to endure servitude for a chance at a new life in the colonies. By the early years of the eighteenth century, however, the supply of indentured servants from England had dwindled, and Maryland farmers turned to slaves for reliable and inexpensive labor (Touart 1990:34; Virta 1991:38).

Rural Agrarian Intensification (AD 1680 to AD 1815)

Initially, the land around the Patuxent River was part of Calvert County. By 1695, approximately 1600-1700 people lived along the Patuxent and Potomac rivers (Stone 1987:11; Virta 1991:28-31). By 1695 a post road extended from Annapolis to Upper Marlboro, and from about 1700 until the end of the Colonial period, lands north of Mattawoman Creek were cleared and put into cultivation. Maryland Governor Francis Nicholson and the General Assembly agreed that a new county should be formed, and on St. George's Day, April 23, 1696, the county was established. It was named for Prince George of Denmark, the husband of Princess Anne, heir to the throne of England. Prince Georges County stretched north to the border with Pennsylvania and represented Maryland's western frontier until 1748, when surrounding counties were established (M-NCPPC 1992:49). Charles Town, about 3 miles southeast of the present county seat of Upper Marlboro, served as the center of Prince Georges County government until 1721. The population of the county did not see a significant increase until after the Civil War, as those who were not members of aristocratic families moved on to find greater opportunity elsewhere (Beauregard et al. 1995 n: 10; Virta 1991:40-41; Walker 1872).

The investments in land and slaves necessary to generate great wealth worked to stratify Maryland society during the Colonial period. Well-connected families passed their accumulated wealth on to their children, and it became more and more difficult for a common farmer to buy land. The unavailability of good land also contributed to the decline of indentured servitude as a source of cheap labor. Land was often the payment given for service, and as it dwindled, fewer such contracts were negotiated. Slavery offered a lifetime of labor, but required a greater initial outlay of capital. As a result, plantations were further concentrated into the hands of the largest and wealthiest landholders, who had the resources and credit to acquire a large slave labor force. Slaves counted for a major percentage of the population increase during the first three-quarters of the eighteenth century. Slaves, who made up only 18.1 percent of the population of the state in 1712, represented nearly half of the population (44.7 percent) by 1782. By 1750 as many as half of the residents of Prince Georges County owned slaves, although most owned only a few (Virta 1991:38). The presence of this large and distinct ethnic group influenced not only politics and the social order, but cuisine, music, and literature as well.

The middle of the eighteenth century is often regarded as the "golden age" of the tobacco culture. Tariff protection by Britain and a burgeoning market for tobacco on the Continent contributed to a rise in prices after a 30-year slump that began in 1670. In addition, improved agricultural methods increased yields and reduced labor costs. Again, the largest landholders benefited from the turnaround in the market, as they had been best able to weather the difficult times (Beauregard et al. 1995 II: 11-12). Although tobacco was the principal cash crop in the region during the eighteenth century, farmers did develop other regimes to supplement the income from tobacco. Other items produced for export on Prince Georges County's farms during this period included corn, wheat, pork, and lumber. Nevertheless, tobacco remained the chief concern of farmers in this part of Maryland.

Community life in eighteenth century Maryland centered largely on clusters of plantations. Much trade was conducted at river landings and small crossroads settlements. Upper Marlboro, in the heart of a rich tobacco-growing region, developed as Prince Georges County's only major town. Artisans, innkeepers, merchants, and professionals established themselves there, and locals and visitors enjoyed horse racing, theater, and music. Supplies for the farm, including slaves, could be purchased in town. By 1718, it had become such an active center that the county residents petitioned to have the county court meetings held there (M-NCPPC 1992:50). The county seat was moved to Upper Marlboro in 1721.

In 1747, tobacco inspection warehouses were established by the state in six towns to help standardize the tobacco trade and encourage the growth of towns. These towns did prosper as a result, but much of Prince Georges County life still took place at the rural churches, stores, mills, blacksmith shops, and taverns scattered in the countryside (Virta 1991:39-40). In 1748 there were 10 settlements of note in Prince Georges County, and two were already on the decline (Virta 1991:54). A map of the state in 1794 (Griffith 1794) indicates that there were only a few towns in Prince Georges County at that time. Besides towns, churches and mills provided centers for social interaction.

During the American Revolution, British ships harassed the Maryland shoreline and made foraging trips inland, but no significant battles were fought in the area. Most residents of Prince Georges County supported the American Revolution, although little changed in terms of the social order by independence (Virta 1991:41). The region was part of action associated with the War of 1812. A British flotilla defeated a contingent of U.S. ships in the Patuxent River, and secured a landing there. Troops then marched overland to Upper Marlboro, which served as a staging area for the British attacks on Washington, D.C.

Tobacco and agricultural production in general continued to dominate the local economy. Prince Georges County produced more tobacco and had a larger slave population than any other county in the state. As technological and economic changes in the first half of the nineteenth century began to alter the character of Maryland, the Western Shore region remained agricultural and aristocratic.

Agricultural/Industrial Transition (AD 1815 to AD 1870)

Tobacco remained the principal product of the region. Prince Georges County produced more than 37 percent of the state's output in 1840 (Payne and Baumgardt 1990:8). Although it persisted, by the nineteenth century tobacco was in decline and was stagnating the local economy. As early as the 1790s, soil erosion had silted in the Patuxent and Port Tobacco rivers, closing the ports of Upper Marlboro and Port Tobacco. Soil exhaustion and low prices made tobacco farming increasingly unprofitable. At mid-century the white population of the county was over 25 percent less than it had been in 1790, and the overall population of the county had also declined as a result of soil exhaustion, low tobacco prices, lack of cheap land, and greater opportunities to the west (Pogue 1972; Beauregard et al. 1995 II: 12). The predominance of the plantation system and the control of local politics by old-money families had a stifling effect on commercial and industrial development.

At the beginning of the Civil War, black slaves outnumbered whites in the county, although less than half of the county's households had slaves. In Prince Georges County, most slave-holders held less than 10 slaves, but almost 6 percent held more than 50 slaves, accounting for 20 percent of the slave population. The common experience of living on a plantation with a large slave population permitted the development of a rich African-American culture (Virta 1991:88).

The nation's capital was created from a portion of Prince Georges County and Virginia in 1790, and, although it did not achieve cosmopolitan status until after the Civil War, Washington, D.C., did begin to affect the development of the county. In 1835, one of the first railroads in the country opened between Baltimore and Washington, passing through Bladensburg and giving birth to the town of Beltsville, which became a thriving trading center. Another change in the first half of the nineteenth century was the appearance of large-scale industry. Nicholas Snowden's large gristmill on the Patuxent River was converted to a cotton mill in the 1820s, and with the arrival of the railroad a decade later, a sizable community known as Laurel grew around the mill. Laurel was the first town in the county to owe its existence to industry (Virta 1991:86-87). Most of this development was in the northern part of the county in the corridor between Washington and Baltimore, however. Railroads were not extended to Upper Marlboro until after the Civil War, and many of the communities in the region today developed after the construction of the Baltimore & Potomac Railroad beginning in 1868 (Beauregard et al. 1995:II:13). Martenet's 1861 map of Prince Georges County shows little industrial development in the region.

Sentiment in Prince Georges County was primarily with the Confederacy at the outbreak of the Civil War, but the residents realized that proximity to Washington meant that their farms would be a battleground if they chose to secede. Several proposals to secede were defeated. Throughout the war most residents of the county tried to remain neutral, although they rejected any attempts to abolish slavery. Marylanders served in both armies. Many slaves escaped to Washington, D.C., after slavery was abolished there or enlisted in the Union army to secure their freedom (Virta 1991:120-122).

Industrial/Urban Dominance (AD 1870 to AD 1930)

After the war, the newly freed blacks generally went to work as farm laborers, sharecroppers, or tenants on the now broken-up plantations. A few had the resources to purchase land; still others left the county in search of opportunity elsewhere, particularly in Washington, D.C. or Baltimore. Meanwhile, the old aristocracy tried to rebuild their lives and fortunes without the help of slave labor. Many of these families never recovered their lost wealth, and in general the agricultural life no longer held the promise of a life of opulent leisure. Instead, most farmers worked modest acreage with the help of their family or tenants. As in other areas where slaves had formed the basis of the agricultural system before the war, after the war the number of farms increased while their average size decreased significantly. Agricultural production improved after a period of crisis following the war. Although tobacco remained the county's most important crop, truck farming increased as a viable alternative, particularly in the northern part of the county. Transportation improvements permitted a variety of farm products to be more easily shipped and sold in the growing urban markets of Washington, Baltimore, and New York. Village life characterized much of the county, as small towns grew to accommodate the needs of the surrounding farmers. A public school system was established, which eventually attracted students from well-to-do families away from the private schools and served to create a more egalitarian atmosphere. Laurel remained the only town in the county to be supported primarily by industry rather than agriculture and trade (Virta 1991:136-137). Processing plants such as fruit and seafood canneries did become important industries in small towns along the railroad lines in Prince Georges County. The first such cannery in the country opened in La Plata in 1883 (Beauregard et al. 1995 n: 14).

As Washington, D.C., grew in the years after the Civil War, the notion of suburban living began to surface among the city's developers. Real estate within the city was prohibitively expensive for modest government clerks and others employed in the city, and gradually houses to accommodate these classes were constructed outside the city. The earliest of these were within the limits of the old Washington County, D.C., beyond Florida Avenue. By the 1870s and 1880s, promoters had begun to sell the charm of small towns that had grown up along the Baltimore & Ohio Railroad in the northern part of the county-Bladensburg, Hyattsville, and Beltsville. In those towns were already established schools, churches, stores, and community life that attracted city residents who desired the advantages of country life without the isolation. Not all of the residents of these towns were commuters, as banks, stores, and other businesses were needed to serve the new residents. After 70 years of stasis, the white population of the county nearly doubled in the last four decades of the nineteenth century. After the turn of the century, streetcar lines were constructed east of the District along railroad lines originally constructed to serve the summer resort traffic to the beaches of eastern Maryland, and the expansion of the federal government during World War I accelerated the pace of suburbanization. Suburban development was generally contained in the corridors north and east of Washington until after World War II. Most of the suburban development accommodated whites, although several black communities existed. The black population of Prince Georges County declined from nearly 50 percent of the total to less than 5 percent in 1960 (Virta 1991:191-193, 203).

Despite the growth along this suburban corridor, the southern part of Prince Georges County, comprising much of the study area, remained rural in character, dotted with small towns and crossroads communities. Most of the residents of this area continued to make their living from agriculture or providing services to farmers into the twentieth century (Virta 1991:190-191). Tobacco remains an important crop even today.

Modern Period (AD 1930 to Present)

A second wave of suburbanization followed the growth of the federal government brought about by the New Deal, but the most important changes for outlying areas of Prince Georges County involved transportation improvements. Route 301 and the Potomac River Bridge were completed in 1940, creating a corridor used by tourists and truckers between New York and Florida, and contributing to commercial development along the route. Use of the Route 301 corridor declined after the construction of I-95 in the late 1960s. Andrews Air Force Base, originally known as Camp Springs Army Air Field, opened in 1943, attracting permanent residents to the area. The base was expanded in the 1960s and again in the 1970s.

The current trend is towards decreased agricultural and increased residential use of the county. Large tracts of land, formerly agricultural, have been sold to developers in the last few years, and many others in the area are for sale. Numerous new suburban neighborhoods are planned, in progress, or recently completed.

BACKGROUND RESEARCH

Site 3, Northwest Branch, Hyattsville

Several archaeological surveys have been done on portions of the project area, though none completely encompass it. The portion of the study area north of Hwy 410 has already been surveyed in 1994 by USACE. The survey did not identify anything within the project area. Two Phase I archaeological surveys were completed for the construction of the Metrorail E Route (Green/Yellow Line) where it crosses the Northwest Branch, south of the Northwest Branch's junction with Sligo Creek (Taylor 1980, Anderson 1981). A prehistoric site, 18PR212 (Surface Collection C), was recorded during the survey nearby, but is not within the current project area. It is uncertain if this site has been evaluated for National Register eligibility. No historic or prehistoric sites were identified in the portion of the project area that is located within these survey areas. Finally, a 1993 survey was completed by Gibb and Creveling for the Anacostia Tributaries Trail construction. This survey covered the project area from Queens Chapel Rd to approximately Hwy 410. They identified one site, a bridge approach for the Washington, Westminster, and Gettysburg Railroad (18PR432). This 750 ft early 20th century feature was for a bridge that was never constructed and is in the northern portion of the project area near Ager Rd. It is uncertain if this resource has been evaluated for National Register eligibility. There is one architectural resource in the project vicinity, WRC Radio Station (PG65-17), but it will not be affected by the proposed action because the proposed work will not be visible from the building. It is uncertain if the building has been evaluated for National Register eligibility.

USACE and Gibb and Creveling found the stream to suffer from extensive erosion, run-off from increased development, utility line construction, and frequent flooding episodes before the flood control projects of the mid-20th century, all of which may have affected cultural resources along its banks.

Site 5, Paint Branch

There is one historic architectural resource and one archaeological site adjacent to the project, and two archaeological sites in the project vicinity. The College Park Airport (PG66-4), located adjacent to the stream, is listed on the National Register. The Baltimore Goldfish Co. (18PR262) is also adjacent to the project site (Cheek 1985). There is an early 20th century power plant (18PR261; Cheek 1985) and a Late Woodland village site (18PR237; Potter 1980) near the proposed project area, but none of these resources will be affected by the proposed action because the proposed work will not be visible from the building, and the site will not be disturbed. It is uncertain if any of these resources, other than PG66-4, have been evaluated for National Register eligibility.

Site 9, Sligo Creek

Gibb and Creveling (1993) surveyed the eastern bank of the project area for the Anacostia Tributaries Trail construction on Sligo Creek. They did not find any historic properties that could be affected. Evans (1978) did an archeological survey for Sligo Creek Relief Sewer construction, but the only sites it identified are outside of the proposed project area. The project is within the Sligo Creek Parkway historic site (PG65-25). *PG65-25 is a National Register eligible resource.*

Site 11, Indian Creek, College Park

There are no recorded archaeological sites or archaeological surveys in the project area, though there are two architectural resources nearby, the Graves-Keleher House (PG67-23) and the Kleiner-Dillon House (PG67-17). It is uncertain if either of these resources have been evaluated for National Register eligibility. Neither of these resources would be affected by the proposed action, because the proposed work will not be visible from the buildings.

Site 13, Northwest Branch, Riggs Road

The USACE 1994 survey covers the entire proposed project area. The survey found evidence of extensive scouring of the stream bed, erosion of the stream banks, and frequent flood episodes (especially before the flood controls of the 20^{th} century). They found no prehistoric or historic sites located within the project area.

There is one prehistoric site (18PR417) divided by an intermittent stream north of Lyndon St (Simmons and Kassner 1991), a historic artifact scatter (18PR1035) (Proper 2012), and a Late Archaic short-term resource procurement site (18PR76) (Goldsmith 1971) near the project area, but these sites are far enough away to be unaffected by the proposed action. It is uncertain if any of these sites have been evaluated for National Register eligibility.

Site 15, Northeast Branch

There are two historic resources adjacent to the project area, the Maryland-National Capital Park and Planning Commission: Department of Parks & Recreation Regional Headquarters (PG68-101) and College Park Airport (PG66-4). It is uncertain if either of these resources have been evaluated for National Register eligibility. Both sites are far enough away that they will not be affected by the proposed action.

Cheek (1985) conducted a Phase I archaeological survey for the relocation of Calvert Rd which crossed the Northeast Branch. It identified 18PR256, Walker-Cross Mill, at the confluence of Brier Creek and Paint Branch on the east bank. All that is left of the site is a potential mill race which is outside the project area. There was also a Washington East MHT Quad File Note (3) that, as of 1973, many small finds had been identified in gardens and in the park in the vicinity of the Calvert Rd Bridge. It is uncertain if either of these resources have been evaluated for National Register eligibility, but neither will be affected by the proposed action.

BACKGROUND RESEARCH RESULTS

Site 3, Northwest Branch, Hyattsville

Proposed work for Site 3 is the restoration of approximately 1.25 miles of stream channel using 22 in-stream structures and remediation of fish passage obstructions (Figure 4). The southernmost third of Site 3 near the West Hyattsville metro station was channelized by USACE in the 1970's (USACE 1968). Any subsurface excavation on the banks of Site 3 will be confined to areas surveyed by Gibb and Creveling (1993) or areas channelized by USACE in the 1970's. Therefore no further cultural resource investigations are recommended at Site 3.

Site 5, Paint Branch

Proposed work for Site 5 involves the restoration of 1.19 miles of stream channel using 25 in-stream structures (Figure 5). While a systematic archeological survey has not been completed for Site 5, the entirety of Site 5 was channelized in the 1970's (USACE 1968). Therefore no further cultural resource investigations are recommended at Site 5.

Site 9, Sligo Creek

Proposed work for Site 9 includes the restoration of 0.47 miles of stream channel using 13 in-stream structures, including removal of one fish passage obstruction (Figure 6). All subsurface work on the banks will be confined to the area on the eastern side surveyed by Gibb and Creveling (1993). Sligo Creek and its surrounding floodplains are two components of the National Register listed Sligo Creek Parkway. Restoration of the stream will result in an effect on the Sligo Creek Parkway historic site, but the effect will not be adverse since the stream bank will be protected, preserved, and returned to more of its natural state. Therefore no further cultural resource investigations are recommended for Site 9.

Site 11, Indian Creek, College Park

Proposed work for Site 11 includes restoration of 1.74 miles of stream channel using 31 in-stream structures, the deepening of two ponds, and potential excavation in the western floodplain to enhance stream/floodplain connection (Figures 7 and 8). A portion of Site 11 south of Highway 193 was channelized by USACE in the 1970's (USACE 1968). Both of the ponds are man-made and associated with previous gravel mining in the area. The proposed site design for Site 11 includes some alterations of the channel flow affecting a portion of the western floodplain. For this reason, archaeological investigations were conducted in this area, as there was no previous archeological survey area or recordation of disturbance. Discussion of this field investigation is provided in the next section. The floodplain at Site 11 is heavily disturbed and contains recent alluvium with little to no potential for significant archaeological resources. No further cultural resource investigations are recommended for Site 11.

Site 13, Northwest Branch, Riggs Road

Proposed work for Site 13 includes the restoration of 1.53 miles of stream channel using 48 in-stream structures (Figure 9). Any stream bank subsurface excavation at Site 13 will be located in areas surveyed by USACE (1994) and Simmons and Kassner (1991). Therefore no further cultural resource investigations are recommended at Site 13.

Site 15, Northeast Branch

Proposed work for Site 15 involves restoration of 0.89 miles of stream using 17 structures, and improvement of fish passage (Figure 10). While the majority of the work at Site 15 is between the active stream banks, there is some proposed contouring along a small section of the western bank. In addition, some potential work involving revegetation of a tributary of the west bank of the stream may take place. Because no archeological surveys or recordation of previous disturbance have been done for the area, archaeological investigations were conducted. Discussion of this field investigation is provided in the next section. The floodplain of the tributary at Site 15 is heavily disturbed from flooding and erosion and has little to no potential for significant archaeological resources. The section of the western bank of Northeast Branch at this location is composed of relict stream channel deposits, also with little to no potential for significant archaeological resources. No further cultural resource investigations are recommended for Site 15.

FIELD INVESTIGATION METHODOLOGY

The Phase I-level archaeological survey fieldwork followed the Standards and Guidelines for Archaeological Investigations in Maryland produced by the Maryland Historic Trust (Shaffer and Cole 1994) and Prince George's County Guidelines for Archeological Review (adopted May 12, 2005).

The archaeological investigation involved the manual excavation of shovel test pits (STPs) at intervals of approximately 50 feet. The STPs were 35 cm in diameter and were dug to the depth of culturally sterile subsoil. Soils from the STPs were sifted on tarps, and the soil was replaced upon completion of the STP excavation. The ground surface was restored to its original condition.

All identified features were profiled, sampled, and analyzed using Munsell readings and USDA soil typology. All soil was screened through 1/4" mesh. The STPs were recorded through the use of plans and profiles, and their locations identified on the project plans.

RESULTS OF FIELD INVESTIGATION

Site 11, Indian Creek, College Park

A visual inspection of Site 11 showed that the active floodplain of Indian Creek is scored with numerous flood chutes and vernal pools separated by narrow, rounded, interstream divides, with fringe areas of palustrine forest and wetlands. During high-water events, Indian Creek becomes a braided stream at this location, which may be a result of increased run-off from surrounding urban development. The floodplain is broad with a low gradient and no evidence of levees or distinct terraces, other than the pronounced outer wall. Point bars are located within the active stream channel, and along some of the flood chutes. Erosional processes such as flooding, scouring, and bank erosion have severely disturbed the horizontal and vertical contexts at Indian Creek, although the upper soil deposits appear to be recent alluvium.

A total of 19 STPs were laid out at 50’ intervals along the centerline of work to be conducted in the northern portion of the floodplain (Figure 11). The total area tested is 2.2 acres in size. The southern portion of the floodplain area is mapped as reclaimed gravel pits and was not investigated. Table 1 describes the STPs excavated at Site 11. Two of the STPs #5 and #8 were not excavated because they were located in the bottoms of flood chutes where the ground surface had eroded to expose sand, gravel, and cobbles from a former stream channel.

Soils observed in the STPs were consistent with the Zekiah and Issue series mapped for this location (USDA 2017). Zekiah and Issue soils are very deep, poorly drained, frequently flooded soils found on floodplains and formed in loamy alluvial sediments. Typical profiles for these soils include interspersed A horizons (surficial and buried) and alluvial C horizons, with little pedogenic development. In STP #3, stream channel soils were observed at 35.5 cm below ground surface (Table 1).

A single artifact was recovered from Site 11. A fragment of tinfoil was found in Level 2 (5 cm – 30 cm below surface) of STP #3, the upper C horizon of this STP.

Site 15, Northeast Branch

The current floodplain at Site 15 along the west bank of the Northeast Branch is considerably narrower than the floodplain at Indian Creek, with significantly steeper banks along the inside of the meander (Figure 12). The topography of the west bank suggests that this area has been flooded in the past, but streambank armoring in this location may have prevented or constricted more recent flooding. An unnamed tributary on the west bank of Northeast Branch has also caused significant erosion through meandering across its floodplain. One linear area of higher ground along and parallel to the west bank did not appear to have been eroded. Since this area of higher ground is slated for landscape contouring, it was subjected to archaeological investigation.

Due to the small size of the area of higher elevation, only three STPs at 50’ intervals were excavated at Site 15. The area tested is approximately 0.25 acres in size. Table 2 describes the STPs excavated at Site 15. Soils at this location are mapped as Codorus and Hatboro soils, frequently flooded (USDA 2017). These soils are poorly to moderately drained loamy alluvium found in floodplains and flood channels. Typical profiles include A–Bg–Cg and A–Bw–Bg horizons.

Soils in the three STPs only somewhat resembled those mapped for the area. The soil profiles in STPs #1 and #2 contained a shallow A horizon above a weakly-formed B horizon consisting of a light brown (10YR6/3) loamy sand with approximately 1% gravel. In STP #3 this soil was more of a sandy loam. Below these soils in all three STPs was a C horizon consisting of relict stream channel remnants composed of unsorted coarse micaceous sand with approximately 20% gravel and cobbles up to 20 cm in diameter. No artifacts were recovered from any of the STPs in Area 15.

SUMMARY AND RECOMMENDATIONS

The Phase I-level cultural resource survey investigated the locations of six areas of proposed stream restoration projects. All of the proposed work will be located below the top of the stream and floodplain banks in all six project areas and will only be visible from areas directly adjacent to the project area. At Site 9, Sligo Creek and its surrounding floodplains are part of the National Register listed Sligo Creek Parkway. Although the some of the proposed work may be visible at this location, restoration of the stream will not have an adverse effect on this historic property, because the stream will be protected, preserved, and returned to more of its natural state. There are no other historic properties adjacent to any of the proposed project areas. Therefore, there will be no visual effects to surrounding historic properties from implementation of the proposed projects.

With the exception of the Sligo Creek Parkway historic district mentioned above, there are no architectural resources and no known archaeological resources located in the area of direct effects of each of the six projects. The majority of the proposed work in all six project areas will be conducted within the existing stream channels, in areas that have been so heavily disturbed that they have little to no potential for containing archaeological resources. In four of the six project areas (Sites 3, 5, 9, and 13), minor construction work may occur outside of the stream channels, but only in areas that have been previously disturbed through past channelization, or where previous archaeological investigations have not found significant archaeological resources. Phase I-level archaeological investigations were conducted at Sites 11 and 15 as part of this project, in areas outside the stream channel that had not had archaeological investigations and showed a potential for undisturbed soils. Both investigations determined the area of potential effect at Sites 11 and 15 have been eroded through stream channel migration and/or flood erosion and scouring, and soils in these areas consist of recent alluvial deposits. Neither location has the potential to contain significant archaeological resources. No additional cultural resource investigations are recommended at any of the project areas associated with the Anacostia Stream Restoration Project.

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FIGURES

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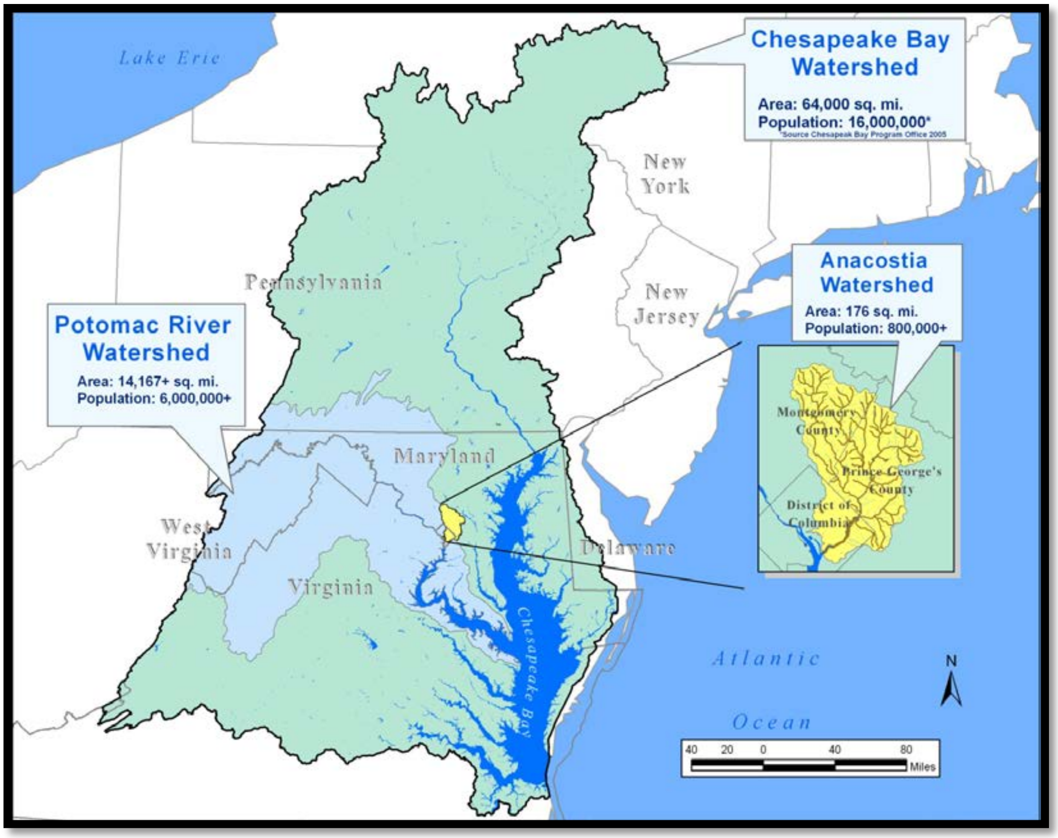

Figure 1: Location of the Anacostia River Watershed within the Chesapeake Bay Watershed

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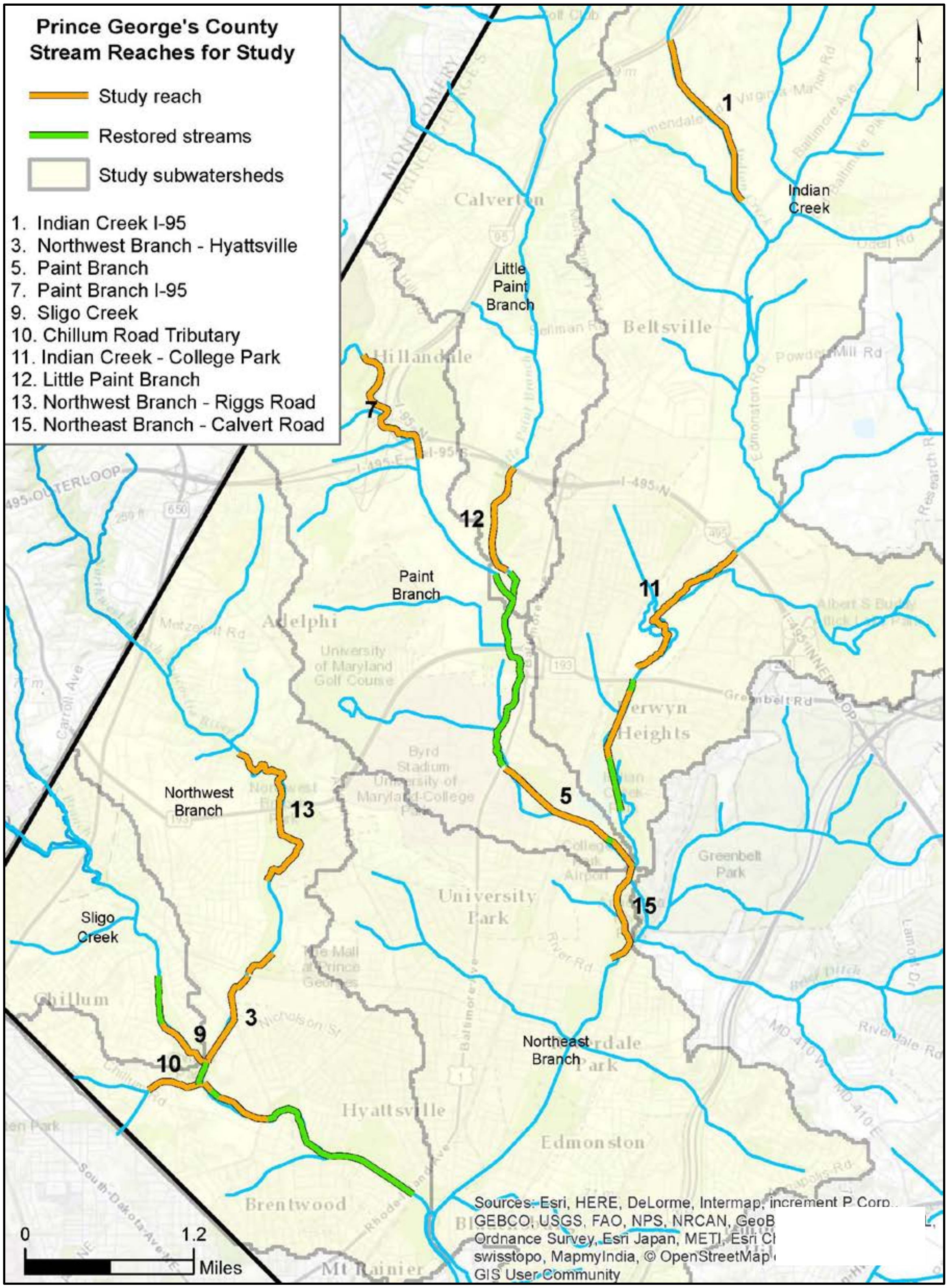

Figure 2: Location of Stream Reaches Originally Proposed for Study

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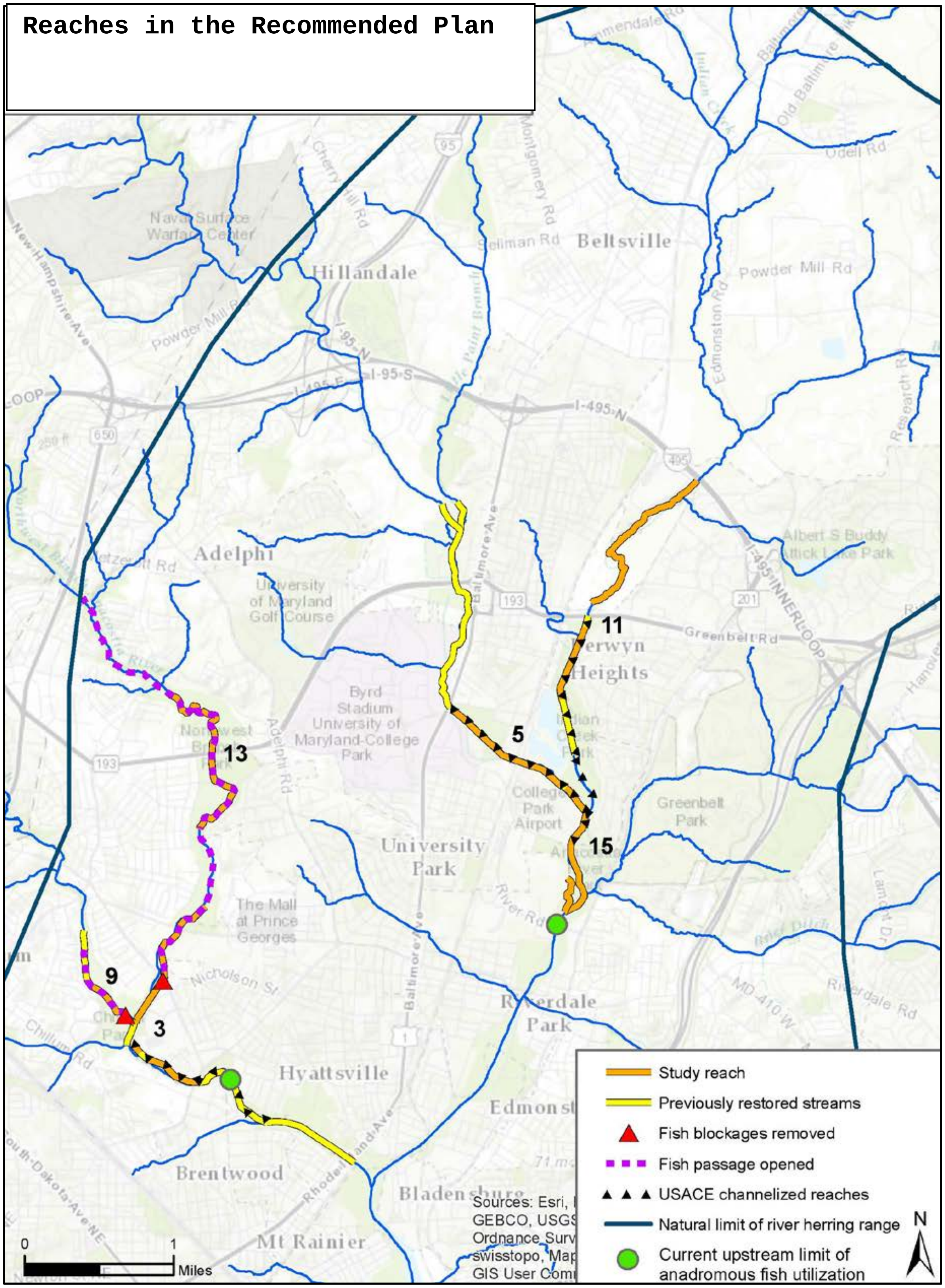

Figure 3: Stream Reaches in the Recommended Plan

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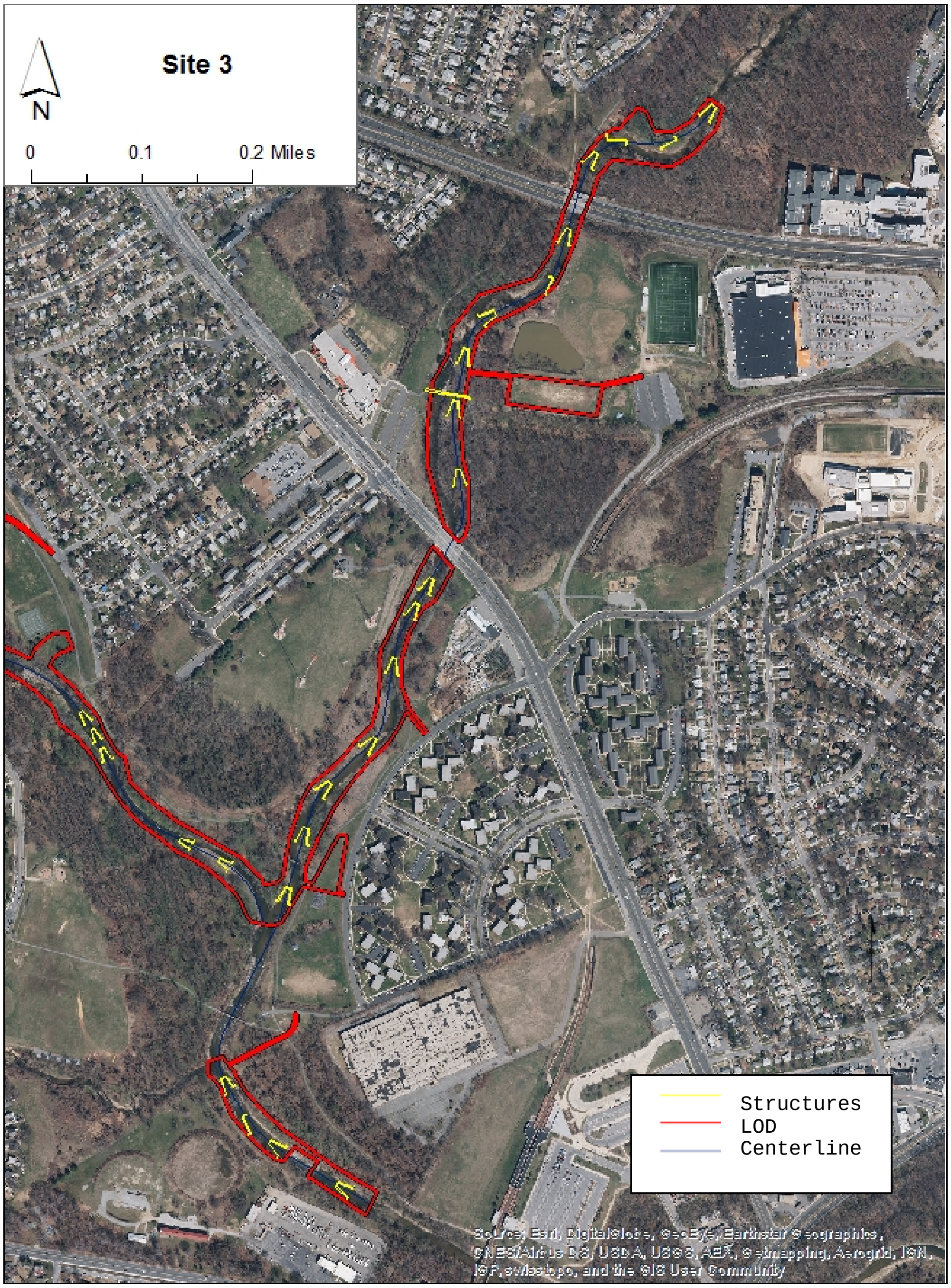

Figure 4: Site 3 Design

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Figure 5: Site 5 Design

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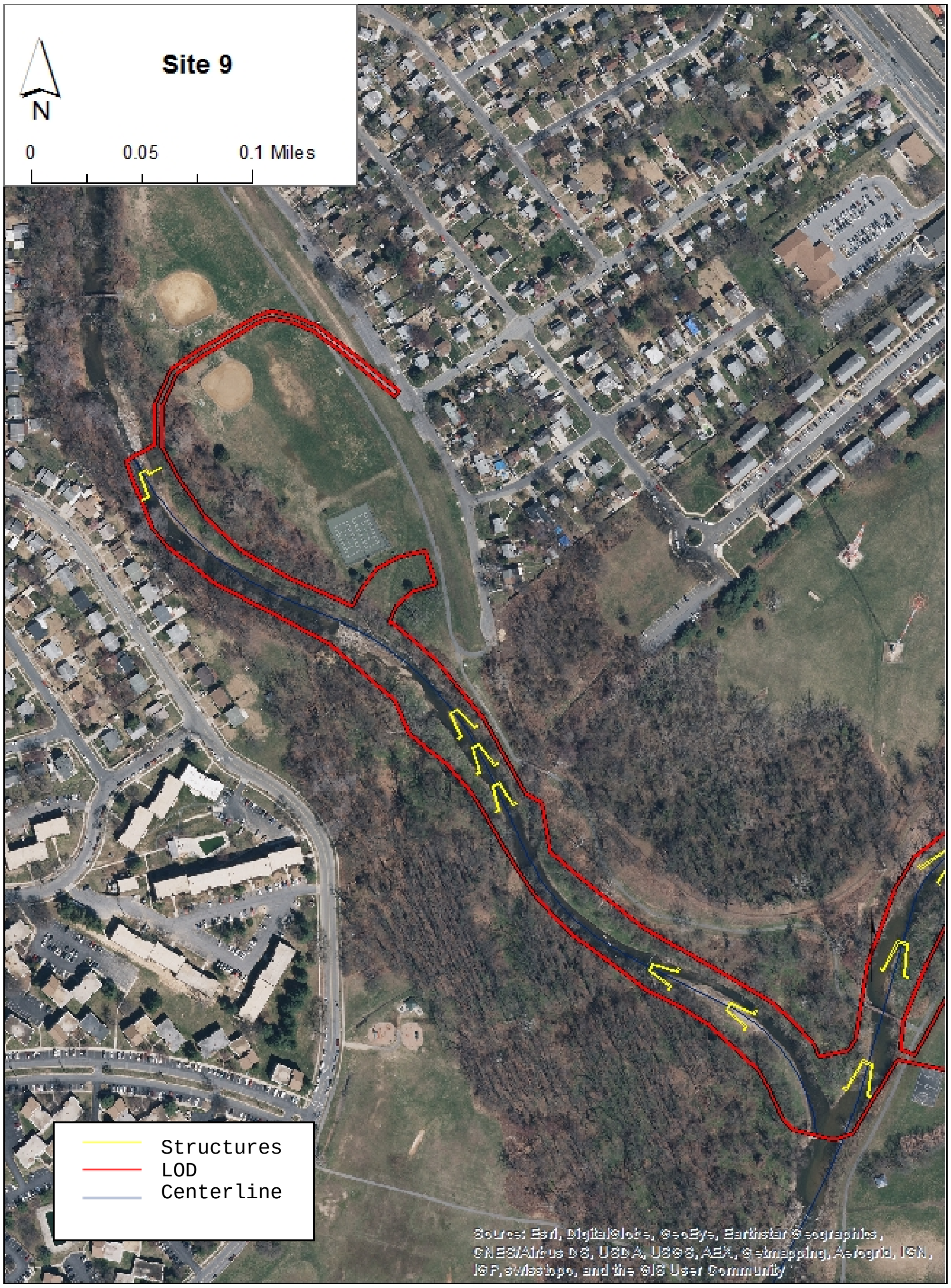

Figure 6: Site 9 Design

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Figure 7: Site 11 Design

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Figure 8: Section of Site 11 Design

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Figure 9: Site 13 Design

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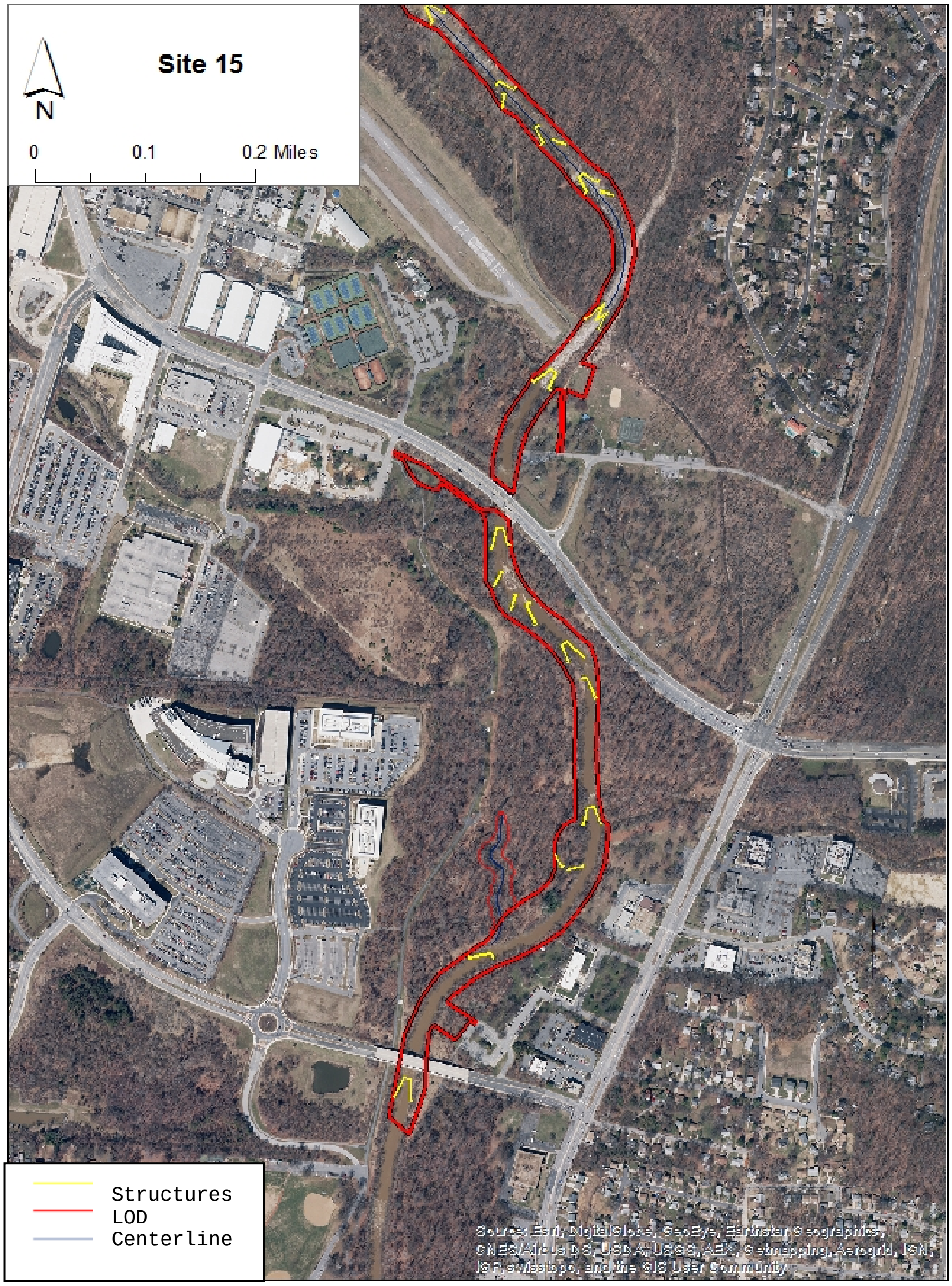

Figure 10: Site 15 Design

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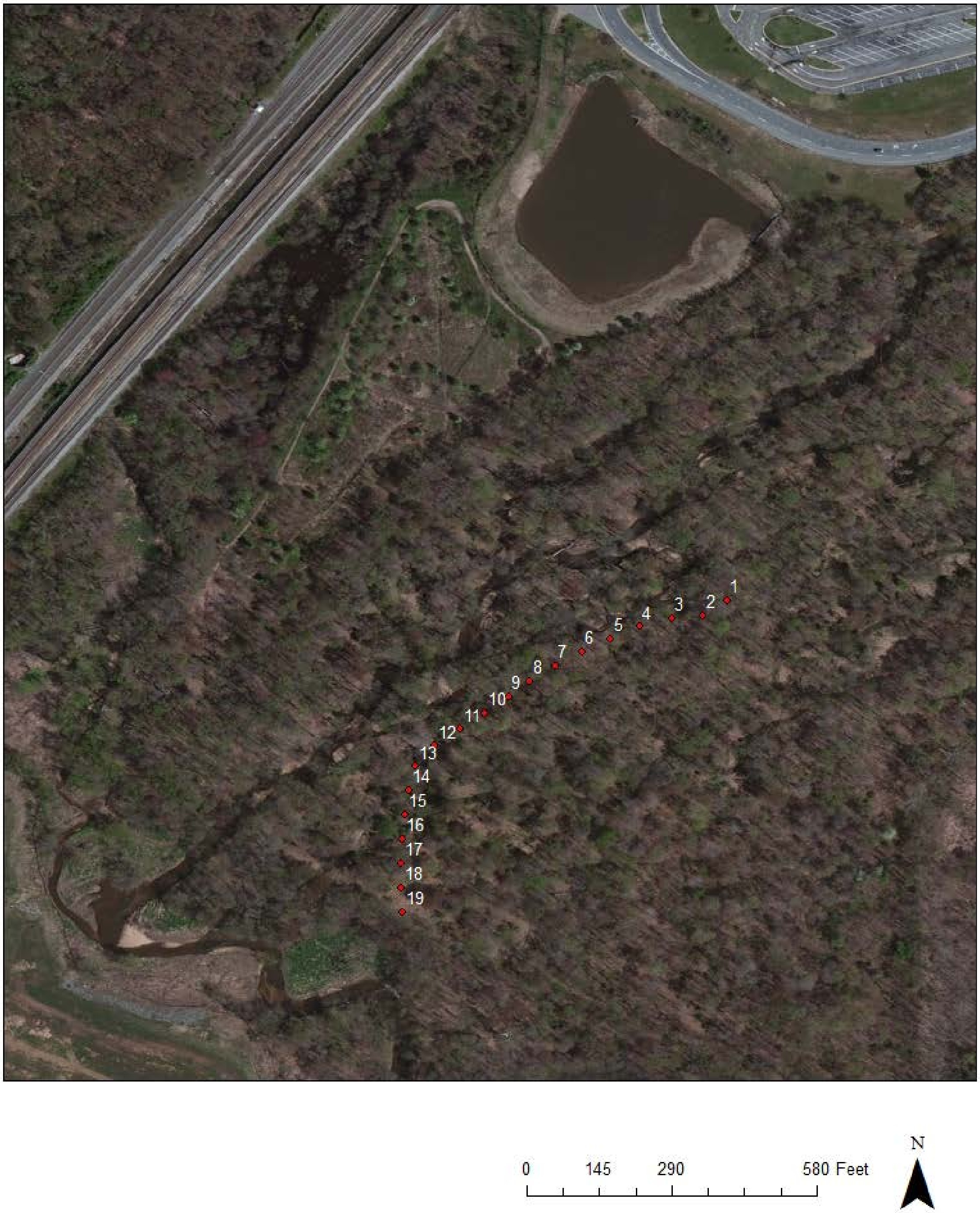

Figure 11: STP Locations for Site 11

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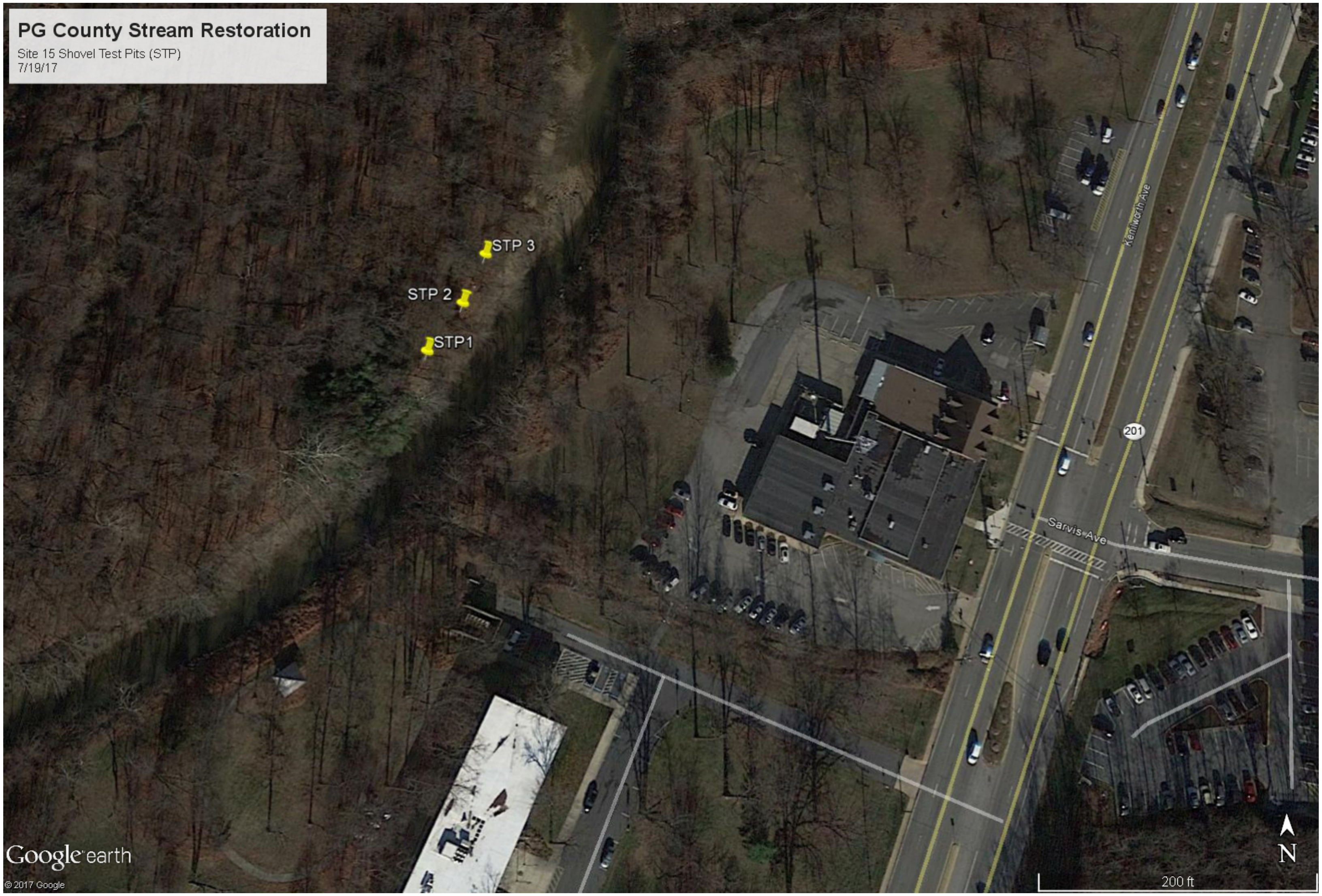

Figure 12: STP Locations for Site 15

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TABLES

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Table 1: Shovel Test Pit Table for Site 11

STPs			
STP #	**Depth (cm)**	**Soil Description**	**Artifacts Recovered/Comments**
STP 1	0 – 5cm	Dark brown (10YR5/6) silt loam: A horizon	
	5 – 22.5cm	Yellowish Red (5YR5/8) with Grey Mottles (10YR5/2) loamy silt, friable: C horizon	
	22.5 – 38cm	Yellowish Red (5YR5/8) with Grey Mottles (10YR5/2) loamy silt, compact: IIC horizon	
	38 – 76cm	Brown (10YR4/3) fine sand with thin silt layers: IIIC horizon	38 – 76cm not excavated; spoon probe
STP 2	O – 5cm	Dark brown (10YR5/6) silt loam: A horizon	
	5 – 15cm	Yellowish Red (5YR5/8) with Grey Mottles (10YR5/2) loamy silt, friable: C horizon	
	15 – 30cm	Brown (10YR4/3) sand with decaying leaves and twigs: Ab horizon	
	30 – 76cm	Brown (10YR4/3) fine sand: IIC horizon	34 – 76cm not excavated; spoon probe
STP 3	0 – 5cm	Dark brown (10YR5/6) silt loam: A horizon	
	5 – 35.5cm	Yellowish Red (5YR5/8) with Grey Mottles (10YR5/2) loamy silt, friable: C horizon	Aluminum foil
	35.5 – 46cm	Brown (10YR4/3) fine sand with thin silt layers: IIC horizon	
STP 5			Not excavated; in flood channel
STP 6	0 -5cm	Dark brown (10YR5/6) silt loam: A horizon	
	5 – 30cm	Yellowish Red (5YR5/8) with Grey Mottles (10YR5/2) loamy silt, friable: C horizon	
	30 – 46cm	Yellowish Red (5YR5/8) with Grey Mottles (10YR5/2) loamy silt, compact: IIC horizon	
STP 7	0 – 5cm	Dark brown (10YR5/6) silt loam: A horizon	
	5 – 28cm	Yellowish Red (5YR5/8) with Grey Mottles (10YR5/2) loamy silt, friable: C horizon	
	28 – 41cm	Yellowish brown (10YR5/6) silt loam: IIC horizon	
	41 – 63.5cm	Yellowish Red (5YR5/8) with Grey Mottles (10YR5/2) silt loam, compact: IIIC horizon	
STP 8			Not excavated; in flood channel
STP 9	0 – 5cm	Dark brown (10YR5/6) silt loam: A horizon	
	5 – 35.5	Yellowish Red (5YR5/8) with Grey Mottles (10YR5/2) loamy silt, friable: C horizon	Root obstruction at 35.5 cm below surface
STP 10	0 – 5cm	Dark brown (10YR5/6) silt loam: A horizon	
	5 – 35.5	Yellowish Red (5YR5/8) with Grey Mottles (10YR5/2) loamy silt, friable: C horizon	
	35.5 – 51cm	Yellowish Red (5YR5/8) with Grey Mottles (10YR5/2) loamy silt, compact: IIC horizon	
STP 11	0 – 5cm	Dark brown (10YR5/6) silt loam: A horizon	

	5 – 20cm	Yellowish Red (5YR5/8) with Grey Mottles (10YR5/2) loamy silt, friable: C horizon	
	20 – 30cm	Dark brown (10YR5/6) silt: Ab horizon	
	30 – 35.5cm	Yellowish Red (5YR5/8) with Grey Mottles (10YR5/2) loamy silt, friable: IIC horizon	
	35.5 – 46cm	Brown (10YR4/3) fine sand with thin silt layers: IIIC horizon	
STP 12	0 – 5cm	Dark brown (10YR5/6) silt loam: A horizon	
	5 – 35.5cm	Yellowish Red (5YR5/8) with Grey Mottles (10YR5/2) loamy silt, friable: C horizon	
	35.5 – 46cm	Reddish brown (5YR4/4) silt loam, compacted: IIC horizon	
STP 13	0 – 5cm	Dark brown (10YR5/6) silt loam: A horizon	
	5 – 25cm	Yellowish Red (5YR5/8) with Grey Mottles (10YR5/2) loamy silt, friable: C horizon	
	25 – 41cm	Reddish brown (5YR4/4) silt loam, compacted: IIC horizon	
STP 14	0 – 7.5cm	Dark brown (10YR5/6) silt loam: A horizon	
	7.5 – 28cm	Yellowish Red (5YR5/8) with Grey Mottles (10YR5/2) loamy silt, friable: C horizon	
	28 – 33cm	Dark brown (10YR5/6) silt: Ab horizon	
	33 – 46cm	Reddish brown (5YR4/4) silt loam, compacted: IIC horizon	
STP 15	0 – 5cm	Dark brown (10YR5/6) silt loam: A horizon	
	5 – 22.5cm	Yellowish Red (5YR5/8) with Grey Mottles (10YR5/2) loamy silt, friable: C horizon	
	22.5 – 28cm	Dark brown (10YR5/6) silt: Ab horizon	
	28 – 38cm	Reddish brown (5YR4/4) silt loam, compacted: IIC horizon	
STP 16	0 -5cm	Dark brown (10YR5/6) silt loam: A horizon	
	5 – 17.5cm	Yellowish red (5YR5/8) with Grey Mottles (10YR5/2) loamy silt, friable: C horizon	
	17.5 – 28cm	Brownish yellow (10YR6/8) loamy silt, compacted: IIC horizon	
	28 – 51cm	Reddish brown (5YR4/4) silt loam, compacted: IIIC horizon	
STP 17	0 – 28cm	Yellowish red (5YR5/8) with Grey Mottles (10YR5/2) loamy silt, friable: C horizon	
	28 – 46cm	Reddish brown (5YR4/4) silt loam, compacted: IIC horizon	
STP 18			Not excavated, standing water
STP 19	0 – 3cm	Dark brown (10YR5/6) silt loam: A horizon	
	3 – 30cm	Yellowish red (5YR5/8) with Grey Mottles (10YR5/2) loamy silt, friable: C horizon	
	30 – 46cm	Reddish brown (5YR4/4) silt loam, compacted: IIC horizon	

Table 2: Shovel Test Pit Table for Site 15

STPs			
STP #	**Depth (cm)**	**Soil Description**	**Artifacts Recovered/Comments**
STP 1	0 -5cm	Dark brown (10yr5/6) silt loam and root mat: A horizon	
	5 – 15cm	Light brown (10YR6/3 loamy sand, 1% gravel: C horizon	
	15 – 71cm	Light brown (10YR6/3) micaceous sand, 15% gravel, with cobbles at lower portion of profile: IIC horizon	51 – 71cm not excavated; spoon probe. Cobbles up to 20cm in diameter
STP 2	0 – 5cm	Dark brown (10YR10YR4/35/6) silt loam and root mat: A horizon	
	5 – 17.5cm	Light brown (10YR6/3 loamy sand, 1% gravel: C horizon	
	17.5 – 43cm	Light brown (10YR6/3) micaceous sand, 15% gravel, with cobbles at lower portion of profile: IIC horizon	
STP 3	0 – 5cm	Dark brown (10YR5/6) silt loam and root mat: A horizon	
	5 – 30cm	Brown (10YR4/3) sandy loam: C horizon	

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A-6: Anacostia Restoration Plan Candidate Restoration Projects (CRPs)

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Anacostia Restoration Plan Candidate Restoration Projects

As part of the Anacostia Restoration Plan, a provisional restoration project inventory of potential restoration opportunities was completed for each of the 14 primary subwatersheds and tidal river reach. Restoration opportunities, including stream, wetland and riparian restoration options; fish blockage concerns; stormwater retrofits; and trash reduction opportunities were identified. A provisional restoration project inventory was cataloged based on these restoration strategies. The effort included a systematic evaluation of existing information using GIS and as well as field verification. Over 3,000 potential restoration opportunities were identified (for more information on these projects and plan formulation see http://www.anacostia.net/maps/Data_download.php).

Of the projects identified, 396 potential aquatic ecosystem restoration projects in Prince George's County were considered as potential restoration opportunities that USACE could implement. USACE evaluation focused on the potential for connecting restored stream segments, wetland restoration, and amelioration of fish blockages, the results of which would be systematic stream restoration with cumulative benefits. Although the projects evaluated in this feasibility study were formulated primarily for aquatic habitat restoration and fish blockage removal, wetland restoration/creation and invasive species removal are considered secondary benefits. Stream restoration will reconnect streams with their floodplain, thereby restoring the functional processes required for the reestablishment of wetlands. In addition, the project will capitalize on opportunities to remove invasive species and restore riparian forests as appropriate. The plan recommended in this feasibility report addresses 14 Anacostia Restoration Plan (ARP) candidate restoration projects (CRP). A brief description of each of these projects is found below.

ARP CRP ID	USACE Project Site	General Description
NW-L-02-SR-2	3	Stream channel morphology restoration, in-stream habitat enhancement
NW-L-04-F-10	3	Fish blockage removal
PB-L-03-W-2	5	Wetland enhancement
PB-L-02-SR-10	5	Stream channel morphology restoration
PB-L-02-SR-6	5	Stream channel morphology restoration
SC-L-04-F-1	9	Fish blockage removal/riffle grade control removal - ~12 inch high sheet pile weir
SC-L-03-W-1	9	Wetland creation
SC-L-03-W-2	9	Wetland creation
IC-L-02-SR-5	11	Soft bottom channel creation, in-stream habitat enhancement
IC-M-05-R-2	11	Invasive species removal
IC-L-03-W-3	11	Vernal pool creation/enhancement
IC-L-02-SR-1	11	Stream channel morphology restoration, in-stream habitat enhancement
IC-L-05-R-5	11	Riparian reforestation
IC-L-05-R-6	11	Riparian reforestation

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A-7: Indian Creek Site Visit Summary for *Stellaria Alsine* Reconaissance

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Indian Creek (Site 11) Site Visit
Anacostia Watershed Restoration
Greenbelt, Prince George's County, MD

Date of visit: July 15, 2016
Attendees: Kathy McCarthy (MD DNR), Jacqui Seiple (USACE), Dan Cockerham (USACE), Angie Sowers (USACE), Ben Soleimani (USACE), Louis Snead (USACE), Andy Layman (USACE)

Purpose: The purpose of the site visit to Indian Creek was to locate and identify the occurrence of *Stellaria alsine* (common names include bog stitchwort, bog chickweed, and trailing stitchwort), a State of Maryland endangered and highly state rare species (http://www.marylandbiodiversity.com) which was previously identified at this site by Maryland DNR during a 2010 survey. Additionally, the visit allowed for further evaluation of the proposed stream restoration site for engineering design purposes.

Background on *Stellaria alsine*: *S. alsine* (family Caryophyllaceae) is a relatively small flowering herb with simple opposite leaves. Native to eastern N. America, it is found along streams, springs, swamps, pools, and in wet ditches. It produces a white, radially symmetrical, five petal flower that is a distinguishing feature needed for positive visual identification.

Field Observations:

- Indian Creek Site 11 is a braided channel system within a forested area with relatively open understory. The terrain is generally flat, sloping towards the southwest where the Creek meets Paint Branch to form the Northeast Branch of the Anacostia River.
- The banks of the side and main channels are experiencing active erosion. Around bends and in other low flow areas, suspended sediment greatly reduced visibility in the side channels.
- In total, four observations of species closely matching *Stellaria alsine* were identified. The plants were small, approximately 5 cm or less in height. None were in full flower, so could not be positively identified and were labeled as one of two categories; possible or likely.
- Three of the above possible *Stellaria alsine* were located in braided side channels and were generally found within the channel bed on wet (but not submerged), medium-grain gravel bars.
- One instance of the plant, identified as likely, as it did have a small flower bud, was found in the mud (silt, clay) of a 1-2m wide, damp side channel.
- Only a small section of the main channel was walked, however no instances of the species of interest was observed. Due to the shallow root structure and high energy flow events in the main channel, it is unlikely the plant would be able to establish.
- Initially, a species found that was mostly submerged except for the leaves, was considered to be *S. alsine* (see Figure 8), however it was later concluded that because of its prevalence in that area and presence in flowing water that it was not the species of interest.
- Terrestrial plants of interest were as follows:

- Native:
  - American beech
  - Sweetgum
  - Swamp chestnut
  - Red maple
  - N. red oak
- Invasive:
  - Japanese stiltgrass (heavy understory)
  - Asiatic tearthumb
  - Reed canary grass
  - Japanese barberry
  - Beefsteak plant
  - Honeysuckle (Japanese and bush)
  - Phragmites
  - Japanese knotweed

Discussion

- Areas where stream restoration activities would be performed/structures were discussed with MDNR while in the field. It was generally decided that the focus of stream restoration effort would be mainly on the main channel. This will reduce instances of disturbance to the local *S. alsine* population, due to the fact that the high energy flow events in the main channel already prevent the plant from establishing.
- Difficult to positively ID *S. alsine* without the plant in bloom. MDNR plans to return in a few weeks to confirm the species while in bloom (??)
- GPS coordinates were taken with low accuracy, as satellites could not be reached due to canopy cover. Coordinates of plants will be hand located on a map.
- The observed plants have small, shallow root systems. Seeds are likely transported downstream to these identified sites from upstream and are also stored within the stream bed. Plants can be mobilized by flow and may reroot, although this species is not believe to survive in high energy flow environments.

Map of Previously Identified Plant Locations:

Photos:

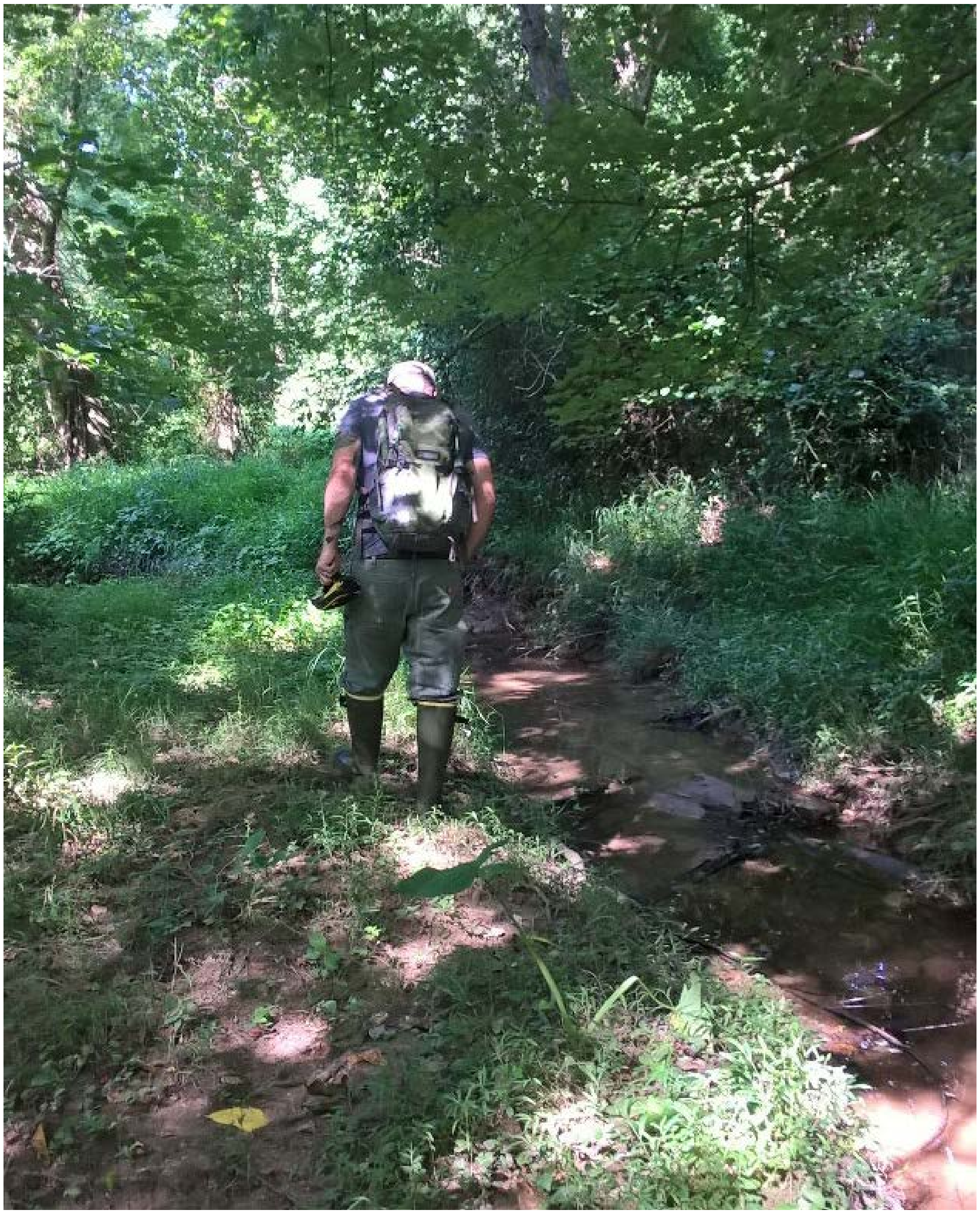

Figure 1: Small side channel of Indian Creek


Figure 2: Small side channel of Indian Creek

Figure 3: Side channel

Figure 4: Gravel bar in the area that the species was originally found in the 2010 survey


Figure 5: Field team looking for S. alsine within a side channel


Figure 6: Possible S. alsine, found on a sand/gravel bar within the channel

Figure 7: A second instance of a possible S. alsine

Figure 8: A floating plant which appears similar in some characteristics to S. alsine

Figure 9: Deep low flow bend just after a section of small riffles and sand/gravel bars were some instances of possible S. alsine were observed

Figure 10: Pen placed for scale; species of interest is directly below the center of the pen

Figure 11: Main channel, Indian Creek (Site 11)

Figure 12: Large depositional gravel bar in main channel. No instances of S. alsine observed in main channel


Figure 13: Gravel bar in main channel

Figure 14: Gravel bar in main channel. No instances of S. alsine observed in main channel

Figure 15: Large mature swamp chestnut tree located a few hundred yards from main channel


Figure 16: Exposed / eroded roots found in seasonal / flood channels. Instances of compacted aggregations of forest debris indicate flooding in these areas

Figure 17: The only observed instance of the suspected species with a small flower bud; this specimen was labeled as "likely" S. alsine due to this bud. A return visit in 2-3 weeks is planned to verify the flowers. This was located in moist mud in an otherwise dry side channel

Figure 18: Potential S. alsine

Figure 19: Mature eastern box turtle found in forest foraging on fungus

A-8: Field Report for Wetland Assessments, November 2017

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ANACOSTIA PRINCE GEORGE'S COUNTY, MARYLAND
WETLAND FIELD DELINEATIONS

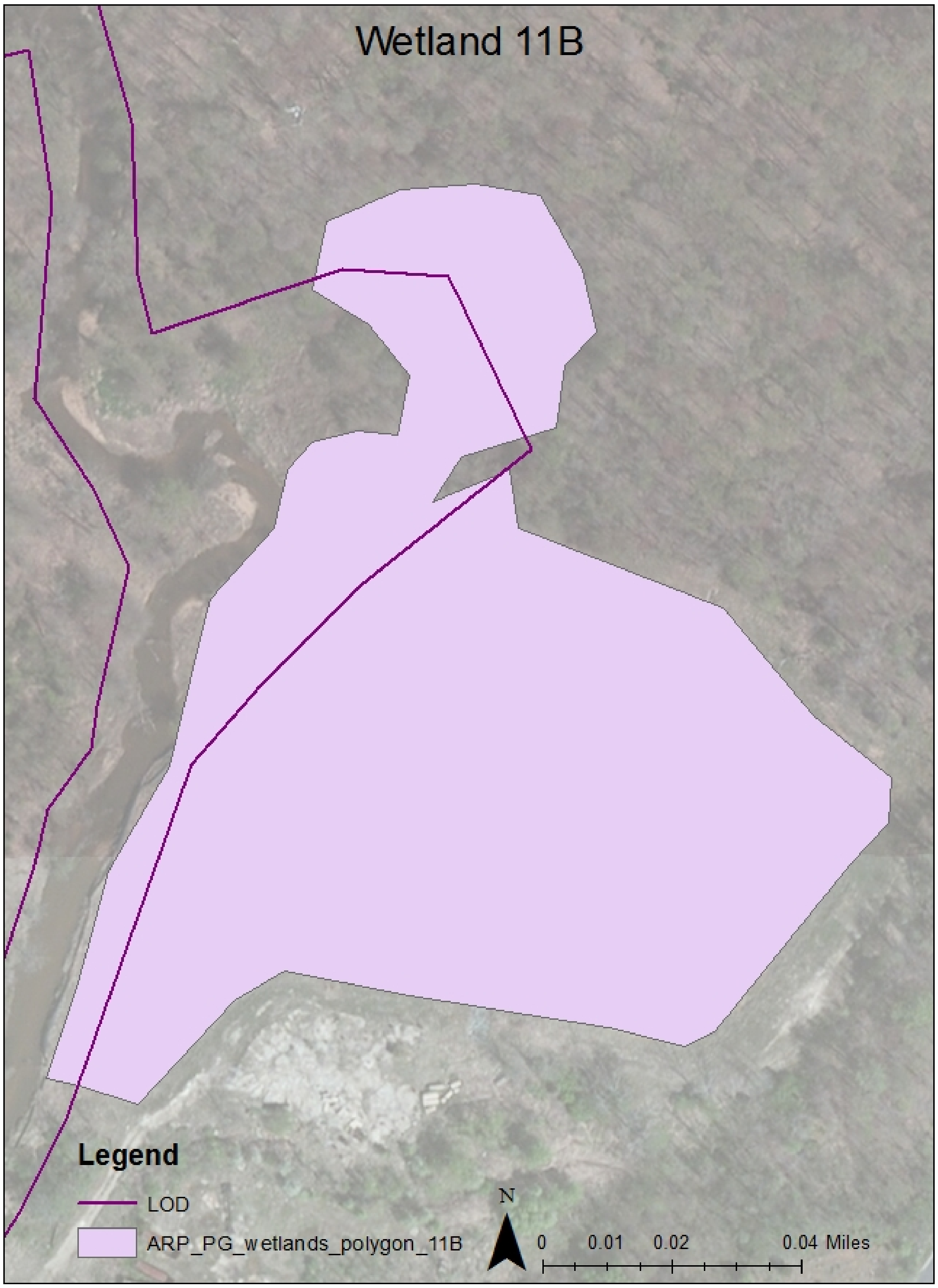
NOVEMBER 2017

Team Members:
Steve Harman (USACE Regulatory)
Seth Keller (USACE Planning)
Ben Soleimani (USACE Engineering)

Scope: USACE employees traversed stream reaches 9, 13, 15, 5 and 11, to evaluate wetland indicators. Indicated wetlands with the possibility to be within the project limits of disturbance were mapped in their entirety using GPS. Photos of these wetlands were taken to capture the average appearance of each wetland. A cursory functional assessment was completed for observed wetlands.

Findings: No wetlands were observed at stream reaches 9, 13, 15, and 5. Three wetland systems were observed at site 11. Maps and photos below illustrate the location and conditions of these wetlands. Following the identification of wetlands, the LODs were redrawn at wetlands 11-A and 11-C to avoid wetland impacts. Because wetland 11-B has low functionality, with monospecies *Phragmites australis* growing to heights of eight feet, it was determined that project activities would result in an improvement of wetland quality at wetland 11-B.


Wetland 11A
Legend
LOD
ARP_PG_wetlands_polygon_11A
0 0.015 0.03 0.06 Miles
N


Wetland 11B
Legend
LOD
ARP_PG_wetlands_polygon_11B
N
0
0.01
0.02
0.04 Miles

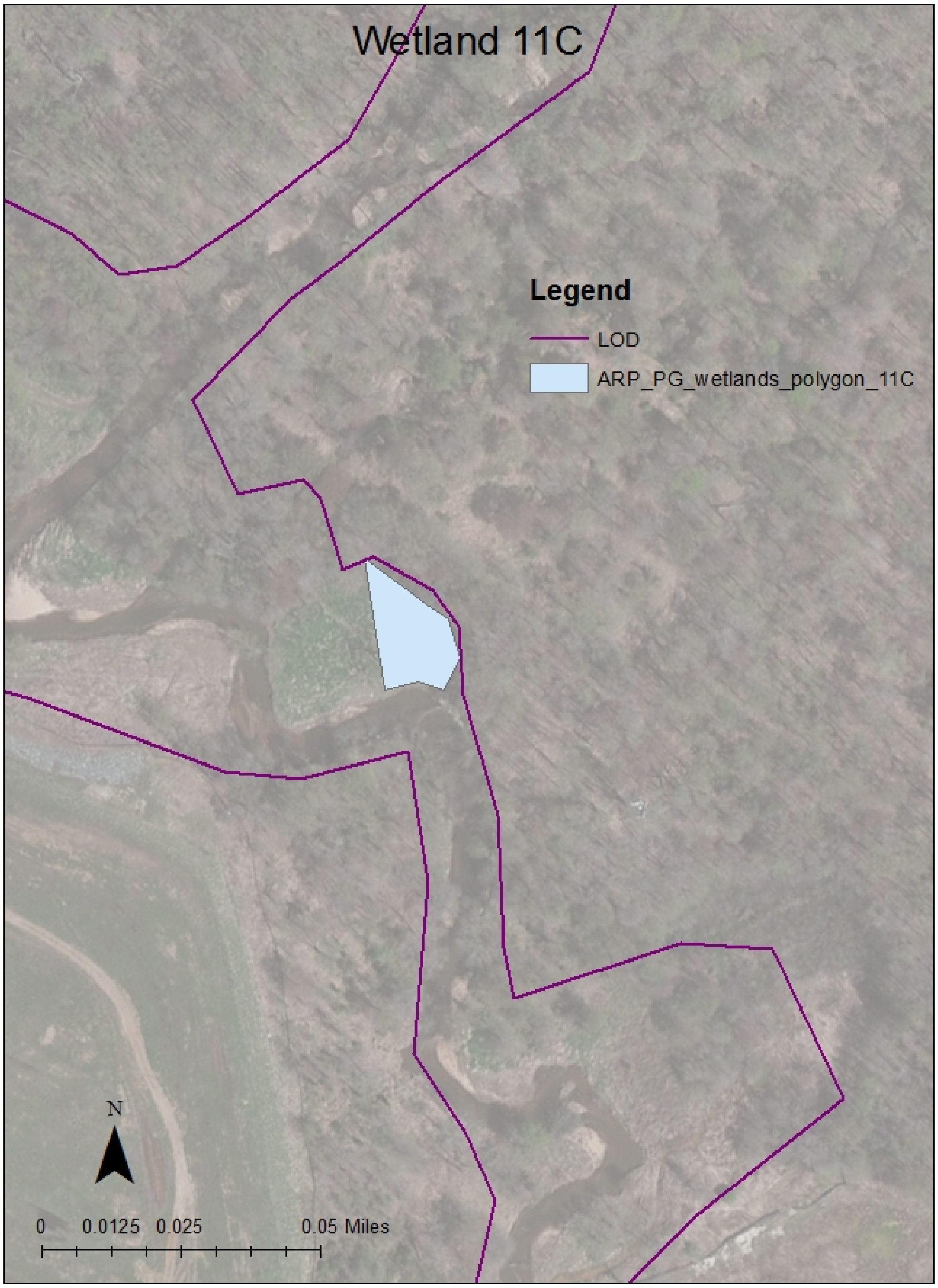

Wetland 11C
Legend
LOD
ARP_PG_wetlands_polygon_11C
N
0
0.0125
0.025
0.05 Miles


Photo 1: Wetland 11A. Depressional PFO next to roadway and proposed staging area.


Photo 2: Wetland 11A. Depressional PFO next to roadway and proposed staging area.

Photo 3: Wetland 11B. PEM with monospecies *Phragmites australis* growing to heights of eight feet. Lots of ponding and hydrology in this wetland.


Photo 4: Wetland 11B. PEM with monospecies *Phragmites australis* growing to heights of eight feet. Lots of ponding and hydrology in this wetland.

Photo 5: Wetland 11B. PEM with monospecies *Phragmites australis* growing to heights of eight feet. Lots of ponding and hydrology in this wetland.

Photo 6: Wetland 11C. PEM located on riverbank. The wetland was a small depression.