Report on Stream Health at Select Tributaries of Rock Creek in Washington, DC

2010-2018

Audubon Naturalist Society
Water Quality Monitoring Program

Cathy Wiss, Program Coordinator

December 2018

Table of Contents

I. Executive Summary

Volunteers with Audubon Naturalist Society (ANS) have been monitoring three tributaries of Rock Creek in Washington, DC, 3-4 times each year since the mid-1990s. We observe and record habitat conditions, water temperature and pH, and collect and count the aquatic organisms like insects and snails that live under the rocks in our streams—they are indicators of water quality because more sensitive organisms need cleaner water in which to live. Recently, we developed the award-winning Creek Critters app to help anyone with a smartphone learn about life in our streams. Our many years of stream health calculations and carefully-recorded observations form a treasure-trove of natural history data that we want the District government and Rock Creek Park officials to be aware of and use. We and our volunteers are passionate about observing and protecting these creeks, and we have gathered our last eight years of data together into the report below.

What have we found? That animals live in our streams! Even in these three heavily urbanized watersheds, there is an abundance of aquatic life, from mayflies to salamanders. We have even found eels! These streams are heavily utilized for recreation and form a critical part of the District's green infrastructure, providing critical habitat for wildlife and respite for people. They are a valuable part of our ecosystem and urban environment. Two of our streams have stable communities of aquatic organisms and one of these has shown improvement over time. The District and the Park Service should continue to work to protect all of these streams (including removing invasive plants) and manage them for the habitat they provide to these special species.

But we have also found problems. One stream, Melvin Hazen Run, formerly the healthiest of the three streams we have monitored long-term, has shown clear declines over the study period. Since 2009, we have seen the loss of a number of aquatic organisms— some of them particularly vulnerable to pollution—alongside indications of nutrient pollution in the stream, like excessive algae growth. With so few streams with the potential to host sensitive organisms, the District should make recovering them where their habitat does exist, a priority. We recommend adding these organisms to the Washington, DC, list of Species of Greatest Conservation Need, which guides wildlife conservation priorities. At this time, only some species of dragonflies and damselflies are on the list. Other aquatic insects that are becoming rare should be added to this list.

Stormwater management is critical. Despite benefits from stream restoration projects, several of these streams are still deeply affected by scouring water that gushes in from the storm drains during rain storms and by low flow during times of drought. We support the District's efforts at stream channel restoration, particularly where trees are left in place, but strongly encourage that any stream restoration be closely coupled with additional stormwater management higher in the watershed, to slow down and infiltrate the water before it ever hits the restored stream channel. Likewise, reconstruction of roads near streams should be designed not only to temper runoff but also to filter out oils and road salt to keep these pollutants from washing into streams.

More monitoring is needed. In the Sustainable DC 2.0 Plan, the District identifies the need for additional water quality and environmental monitoring. While the focus appears to be on bacteria, we recommend increased monitoring of other water quality characteristics: aquatic organisms at other sites, and nutrients and other forms of pollutants at our sites and others. Only through increased monitoring can we find out the cause of Melvin Hazen Run's decline in water quality and track the status of the District's Species of Greatest Conservation Need.

II. Introduction

Since the early 1990s, the Audubon Naturalist Society (ANS) has sponsored a volunteer water quality monitoring program in Washington, DC, and Montgomery County, Maryland, to increase the public's knowledge and understanding of conditions in healthy and degraded streams and to create a bridge of cooperation and collaboration between citizens and natural resource agencies concerned about water quality protection and restoration. We are pleased to offer this report of water quality data collected by our volunteer monitors in Washington, DC.

ANS has three permanent monitoring sites in Washington, DC, on tributaries of Rock Creek. All three are in sections of Rock Creek Park, administered by the National Park Service (NPS). Monitors visit these stream sites to collect and identify benthic macroinvertebrates;[1] to measure pH and air and water temperature; and to conduct habitat assessment surveys.[2] Site visits take place during the months of April, July, October, and optionally during the winter (December – February). To ensure the accuracy of our data, the Audubon Naturalist Society follows a quality assurance/quality control plan. Before sampling, monitors are offered extensive training in macroinvertebrate identification and habitat assessment protocols. The leader of each team must take and pass an annual certification test in benthic macroinvertebrate identification to the taxonomic level of family.

We opened our first monitoring site, on Pinehurst Branch just upstream of Beach Drive, NW, in 1995. David Cottingham has been leading this team since 2006. In 1997, we added two more sites, one on Melvin Hazen Run in North Cleveland Park and the other on Normanstone Run at Normanstone Drive and 30th Street, NW. Our Melvin Hazen Run site is monitored by Environmental Science students at Sidwell Friends School. This team has been led by teachers Paula Wang (1997-2013) and Emily Boyer (2014-present). The Normanstone Run team is co-led by Mike Kolian and Kathy Ferger.

This report gives background information on all three sites and summarizes our findings. Individual site reports are also available. They give more specific site information; charts of stream health since the beginning of monitoring; tables of all stream health scores; lists of macroinvertebrates found during each monitoring visit from 2010-2018; and habitat assessment survey data.

[1] Benthic macroinvertebrates are small invertebrates that live on the substrate, or bottom, of streams. These include aquatic worms, clams and snails, leeches, planarians, crustaceans like crayfish and scuds, and several taxonomic orders of aquatic insects. Because some organisms are more tolerant to pollution and other environmental stressors like high water temperature and low base flow, stream health can be determined by what taxa are found during sampling.

[2] ANS monitoring teams use the same habitat assessment forms as Montgomery County's Department of Environmental Protection (DEP). These include spring and summer habitat data sheets, based on forms devised for the Maryland Biological Stream Survey (MBSS), as well as DEP's Habitat Assessment Field Data Sheet for Riffle/Run Prevalent Streams, developed by the Environmental Protection Agency (EPA). ANS monitors are asked to fill out the latter at every site visit.

III. Site Descriptions

All three Washington, DC, streams monitored by ANS are located in forested stream valley parks surrounded by residential communities. Although the parks preserve the natural stream setting and buffer the effects of urban development within their watersheds, each of these streams exhibits characteristics of the urban stream syndrome: eroded stream banks, incised streambeds, and sediment deposition. They each are fed by storm sewers, which deliver runoff from the neighborhoods more quickly and with higher volume and velocity than under natural conditions. Even a minor rainfall can produce excessive flashiness. In the case of two of the streams, Pinehurst Branch and Normanstone Run, sanitary sewers underlie the streambed.

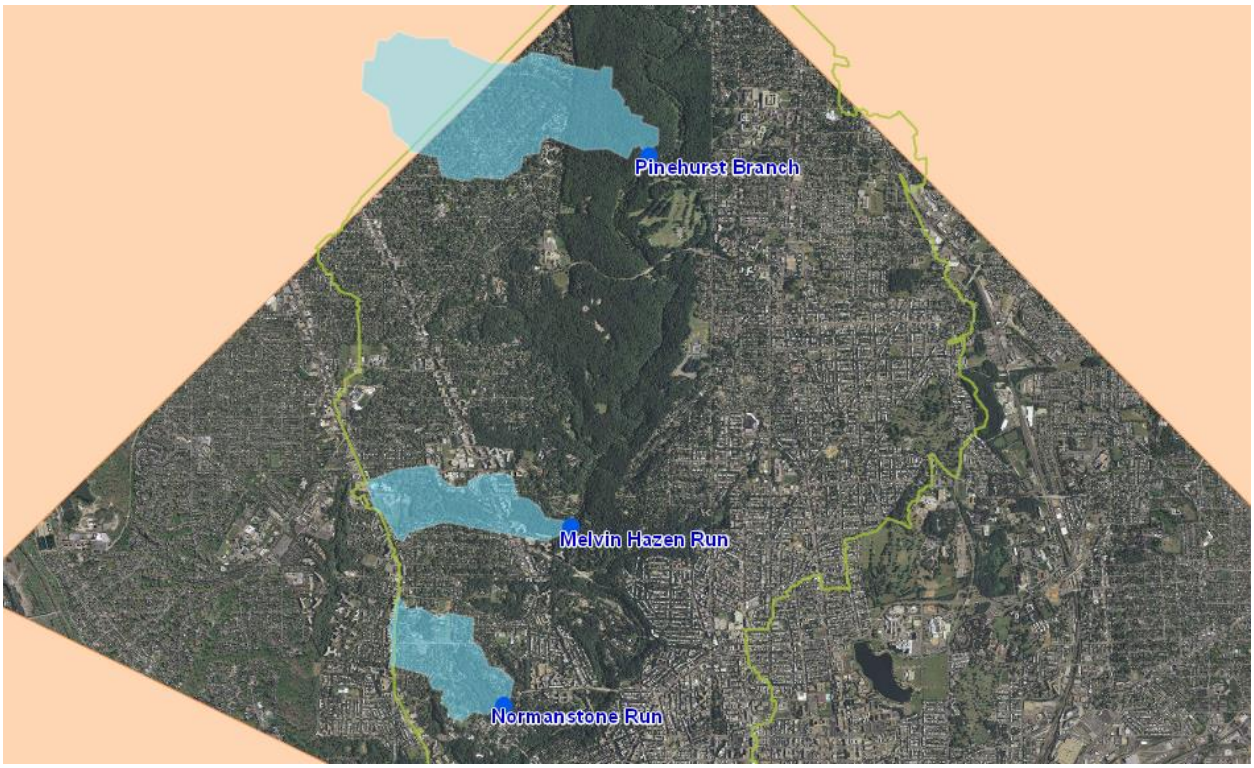


Figure 1: Map of ANS' three DC monitoring sites and their contributing watersheds. Basemap imagery from D.C. Office of the Chief of Technology Officer (OCTO) | DC GIS.

Pinehurst Branch

The 680-acre Pinehurst watershed encompasses residential neighborhoods in Chevy Chase, Maryland, and Chevy Chase, DC, as well as forested parkland that surrounds the stream. Stormwater from Chevy Chase, Maryland, is collected in sewers and conveyed under Western Avenue, where it empties into the stream at a large outfall just inside the DC line. Other storm sewers bring runoff from streets north of Beech Street, NW, to a smaller outfall not far downstream. Along Beech Street, which parallels the stream, stormwater runoff is channeled from the street into the stream valley through inlets in the curbs. These inlets are armored with riprap. A small tributary from Aberfoyle Place, NW, is channeled into a regenerative stormwater conveyance system before reaching the mainstem of Pinehurst Branch.

Residents of Beech Street report that Pinehurst Branch “roars” during storms because of the high volume of water it conveys. The effect of high flows can be seen in places where stream bank erosion is several meters high. Downstream, the edges of Oregon Avenue, which lack curbs, are severely eroded.

High flows not only erode sediment from the stream valley and stream banks, they undermine and carry away trees. Large amounts of gravel, sand, and tree debris are frequently deposited in the area just upstream of Beach Drive where ANS monitors. In between high flows, the ANS monitoring team frequently reports periods of low base flow.

Figure 2: Bank erosion at Pinehurst Branch. Photo credit: Cathy Wiss.

Figure 3: Pinehurst Branch monitoring site. Photo credit: Cathy Wiss.

The ANS monitoring site is in the lower section of Pinehurst Branch within a hilly wooded area of Rock Creek Park east of Oregon Avenue, NW. It is located not far from where Pinehurst Branch enters Rock Creek. A foot trail parallels the stream from Rock Creek to Western Avenue. Another foot/horse trail crosses the stream within the ANS monitoring reach.

Sanitary sewers underlie Pinehurst Branch. When leaks have been discovered, our team has notified the National Park Service, which has arranged for repairs with DC Water. DC Water has just completed reconstructing sewers along Oregon Avenue and Bingham Drive. As part of the reconstruction, sanitary sewers under part of Pinehurst Branch have been abandoned. Water quality may now improve.

After a thunderstorm on July 3, 2018, suds could be seen in the water downstream of the Oregon Avenue bridge. These may have come from residues on the road surface, a sanitary sewer leak, an improper sanitary connection to the stormwater system, or someone washing a car or heavy construction equipment nearby. Suds were again observed near the Western Avenue outfall that brings stormwater from Chevy Chase, Maryland, on a dry day in fall 2018. Water below the outfall was a milky blue, suggesting an improper sanitary sewer connection to the storm sewer system. We recommend continued monitoring for this type of discharge in order to determine its source and take corrective action.

Figure 4: Suds below the Oregon Avenue bridge on Pinehurst Branch, July 3, 2018. Photo credit: Cathy Wiss.

Melvin Hazen Run

Melvin Hazen Run has a smaller watershed than Pinehurst Branch. The stream originates in springs in and around Hearst Recreational Park west of Reno Road, NW. It then flows east through Melvin C. Hazen Park and enters Rock Creek downstream of Tilden Street, NW.

During storms, runoff from Hearst Recreational Park floods roads, walkways, and residential properties in the Springland Farm community. During one storm, residents filmed the runoff: https://youtu.be/zkSrDviYJ8w. The community has notified the DC Department of Parks and Recreation (DPR), Department of General Services (DGS), and Department of Energy and Environment (DOEE) about these issues and requested mitigation.

East of the Springland Farm community the stream flows through Melvin C. Hazen Park. Before reaching Connecticut Avenue, water is slowed by having to pass through a narrow pipe culvert under a parking lot and the avenue. Constricted by the culvert, the stream backs up and spreads out onto a broad floodplain, forming a pond. This allows groundwater recharge and slow percolation through the pipe. Ducks frequently are seen on the pond.

Figure 5: Melvin Hazen Run. Photo credit: Cathy Wiss.

East of Connecticut Avenue, the stream flows through a steeply-sloped and wooded valley. A natural surface footpath follows the course of the stream. Although apartment buildings and embassies are located at the crest of the hills just outside the park, they cannot be seen from the stream banks. Melvin Hazen Run is the least eroded of the three tributaries, but sheet runoff on these steep slopes with little understory has eroded the topsoil and exposed roots of several trees.

The ANS monitoring site is in this part of Melvin Hazen Run, near the stream's confluence with Rock Creek upstream (west) of the footbridge that crosses the stream for the Western Ridge Trail. Up-turned ledges of bedrock underlie the streambed, forming pools and small waterfalls.

The Sidwell Friends School environmental science students who monitored Melvin Hazen Run in 2008 wrote a report of their findings.[3] They reported that in 1990, 5,000 gallons of oil spilled into the stream from an underground storage tank at a nearby Connecticut Avenue apartment building. The oil was cleaned up.[4] In a 1993 assessment, the Biology Department at American University determined that life in Melvin Hazen Run was starting to recover.[5] Sidwell Friends students started monitoring Melvin Hazen Run in 1997. In 1998, they began to find greater biological diversity.

---

[3] Sidwell Friends School AP Environmental Science Classes. "Melvin Hazen Biological Survey, 1997-2008". (Unpublished, 2008).

[4] *Id*., 4, citing National Park Service, United States Department of the Interior. Case Incident Record #000177, January 2, 1990.

[5] *Id*., 4-5, citing Banta, William C., *Biological Water Quality of the Surface Tributary Streams of the District of Columbia*. Occasional Publications of the Department of Biology, American University; Vol. 1, num. 2, June 4, 1993.

The students also noted that several construction projects took place in the watershed from 1998 to 2001, including development of a 1.6-acre wooded tract along Springland Lane for homes in the late 1990s; construction of two embassies along Reno Road in 2000; and construction of Connecticut Avenue high-rise adjacent to the park in 2001. Our monitoring team reported that some of these projects had poor sediment and erosion control during construction. High deposition of sand and silt from upstream erosion has also been found by our team in subsequent years.

Unlike Pinehurst Branch and Normanstone Run, sanitary sewers do not underlie the streambed of Melvin Hazen Run, but a trunk sanitary sewer that runs along Rock Creek crosses Melvin Hazen Run near the footbridge for the Western Ridge Trail. From time to time a strong sewage smell can be detected.

In 1987, the District of Columbia's Water Hygiene Branch conducted a survey of Melvin Hazen Run and found that although it had signs of organic pollution, it had a "well balanced [aquatic] community, indicating fair to good water quality."[6] It received one of the higher ratings in the metropolitan area.[7]

Melvin Hazen Run continues to show signs of organic pollution. From 1997-2004, and again from 2008-2017, the ANS monitoring team reported finding long, thick filamentous green algae covering the streambed. In winter 2010, the team reported that the algae "was photosynthesizing like crazy, releasing lots of oxygen bubbles," something they had never seen before. The algae have persisted into summer, well after trees have leafed out and shaded the stream. Such widespread and persistent algae can indicate excess nutrients in the water. **We recommend a study to determine whether excess nutrients are present and if so, to find their source.**

Normanstone Run

Normanstone Run is the most urban of the ANS monitoring sites. It meanders alongside Normanstone Drive, NW, with the road crossing it in several places. North of the road are residential back yards in the Woodland Normanstone community. South of the road is wooded parkland, which stretches to Massachusetts Avenue, NW, and several embassy properties. The Woodland Normanstone neighborhood is covered by a Tree and Slope Protection Zoning Overlay.

The ANS monitoring site is located at the intersection of Normanstone Drive and 30th Street, NW. One of the road bridges traverses the site. A dam upstream of the bridge protects the bridge abutments from the force of heavy runoff. Other structures along Normanstone Run have similar barriers.

Storm sewers convey runoff to the stream from the Woodland Normanstone neighborhood, as well as parts of Cleveland Park, Embassy Row, and Massachusetts Avenue Heights. Stormwater also enters the stream from Normanstone Drive and the bridge. The force of runoff from all sources has eroded the stream banks and undermined trees throughout the years. Yet, the streambed is well-cobbled – optimal substrate for benthic macroinvertebrates.

---

[6] *Id*., 4, citing District of Columbia Water Hygiene Branch. "Macroinvertebrate Census, 1987".
[7] *Id.*

Figure 7: Normanstone Run monitoring site and bridge. Photo credit: Cathy Wiss.

In 2010, the ANS monitoring team started noticing a sewage smell from the stormwater outfall at the upstream end of their reach. They described seeing a dark sediment on the rocks and an oily sheen on the water. They continued to notice a sewage smell and dry weather flow of gray soapy water from the culvert. In 2012, the ANS team reported the problem to the National Park Service. DC Water determined that an overflow pipe at a sewage lift station on the Naval Observatory property had been improperly connected to the storm sewer. Although the problem was corrected, the team has continued to notice gray, odorous dry weather discharge from the stormwater outfall as recently as November 12, 2018. That flow, shown in Figure 7, lasted 25 minutes.

Sanitary sewers underlie Normanstone Run, but the team has not reported sanitary sewer leaks. Currently part of the sanitary sewer line is being replaced.

Figure 6: Illicit discharge at Normanstone Run. Photo credit: Mike Kolian.

A gas pipeline is buried in the right-of-way for Normanstone Drive. It crosses under Normanstone Run at the ANS monitoring site. After repairs to the pipeline in 2010, both banks downstream of the bridge were armored with riprap. Nevertheless, stormwater has continued to flow over the banks, pushing some of the riprap into the stream.

The District Department of Transportation resurfaced Normanstone Drive in winter 2016 and is continuing to improve outmoded and deteriorating infrastructure. Through the Normanstone Drive/Fulton Street Culvert and Low Impact Development Project, the District Department of Transportation (DDOT) is installing bioretention ponds and bio-swales with catch basins along the roads to reduce runoff and prevent flooding.[8] Yet the project also includes spillways to channel runoff from the bridges and road, including oils and road salt, directly into the stream without treatment for water quality. One of the spillways can be seen on the middle left side of Figure 6.

Broad Branch

In 2014, a segment of Broad Branch was "daylighted", removed from stormwater pipes and recreated in its original streambed on the surface.[9] ANS does not have a long-term monitoring station on Broad Branch, but interns from ANS, Rock Creek Conservancy, and other organizations have visited the restoration site each of the past two years and taken order-level macroinvertebrate surveys using our Creek Critters app (see Section VII). Results from these surveys are detailed in Appendix D.

IV. Benthic Macroinvertebrate Monitoring

Since 2011, ANS has followed the benthic macroinvertebrate sampling protocol of the Maryland Biological Stream Survey (MBSS). Within a designated 75-meter reach, monitors use a 500-micron mesh D-net to take 20 one-foot square samples in the best available habitat for macroinvertebrates. Unlike the MBSS protocol, however, ANS teams identify benthic macroinvertebrates to the taxonomic level of family in the field. In some cases, they have the option to identify them to genus level. After they record their findings, they return most of the macroinvertebrates to the stream. Teams are asked to preserve and send in for identification and verification any macroinvertebrates that they are unable to identify, that cannot be identified with certainty in the field, or that are uncommon.

[8] For more information on the project, go to https://goo.gl/sr1vqk.

[9] For more information, *see* https://www.epa.gov/sites/production/files/2015-11/documents/dc_broadbranch.pdf; http://ecosystemrestoration.com/broad-branch/.

V. Stream Health Ratings

Data from each monitoring visit is analyzed using a benthic index of biotic integrity (BIBI) developed for the volunteer Maryland Stream Waders Program, which is based on identification of aquatic insects to the taxonomic level of family, like the ANS program. This BIBI gives a stream health score on a scale of 1 to 5, based on the following metrics to weigh taxa richness and preponderance of pollution-sensitive macroinvertebrates:

- total number of families;
- the number of EPT families (mayflies, stoneflies, and caddisflies – a traditional measure of stream health);
- the number of mayfly (Ephemeroptera) families;
- the number of true fly (Diptera) families;
- the percentage of mayflies in the sample;
- the number of intolerant families;
- and the number of families rated in Beck's Biotic Index (a sensitivity rating).

Traditionally, ANS has assigned each BIBI score into one of four categories: "excellent", "good", "fair", or "poor". These are the stream health categories used by the Montgomery County Department of Environmental Protection, and they are the ones we use in this report. They differ, however, from the categories and terms used by the MBSS, which rates streams "good", "fair", "poor", and "very poor". Because ANS uses the MBSS scoring system, a given score is the same regardless of the terminology used to describe it. Thus, a score of 1.50 can be interpreted as either "poor" (ANS) or "very poor" (MBSS), depending on which categorization scheme is used.[10]

ANS' three stream sites generally are in "poor" health: In general, streams in urbanized areas like Washington, DC, are more likely to show poorer water quality than those located in more rural, undeveloped areas. The most sensitive organisms -- dependent on cool, clean water and undisturbed habitat -- are less likely to be found in cities. This is what the National Park Service (NPS) found in its *Rock Creek Park Natural Resource Condition Assessment: National Capital Region Network,* published in May 2009.[11] The report concluded that Rock Creek and its tributaries were "very degraded" for benthic macroinvertebrates, based on sampling of six sites during 2000-2004. With an average BIBI score of 1.50, they failed to meet the established threshold BIBI score of >3.00 for adequate biodiversity, as would be expected at minimally impacted reference sites.[12]

---

[10] The respective categories break down as follows:

	ANS		MBSS
Excellent	4.4-5.0 (Blue)	Good	4.0-5.0
Good	3.2-4.3 (Green)	Fair	3.0-3.9
Fair	2.0-3.1 (Yellow)	Poor	2.0-2.9
Poor	1.0-1.9 (Red)	Very Poor	1.0-1.9

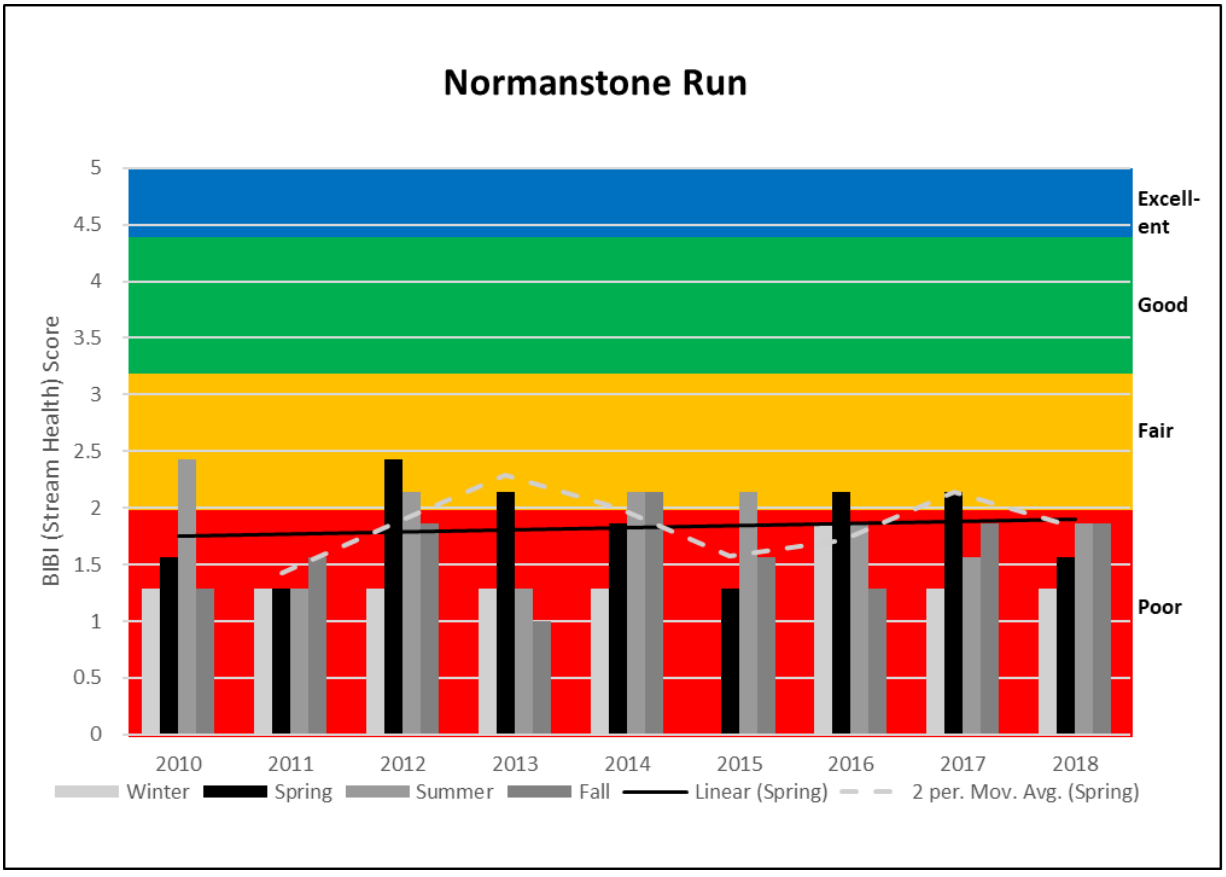
[11] Natural Resources Report NPS/NCRN/NRR – 2009/109, May 2009.

[12] *Id.*, 51, 69, 79.

For the most part, the NPS assessment holds true for the three tributaries monitored by ANS. More often than not, these tributaries rate "poor," (or "very poor"), although their BIBI scores frequently exceed 1.5. In only four instances: spring 1998, summer 2001, summer 2006, and fall 2009 -- all at Melvin Hazen Run -- did a monitoring session achieve a BIBI score of 3.00. And only once, in summer 2006, did the BIBI score of 3.57 at Melvin Hazen Run exceed the threshold for adequate biodiversity.

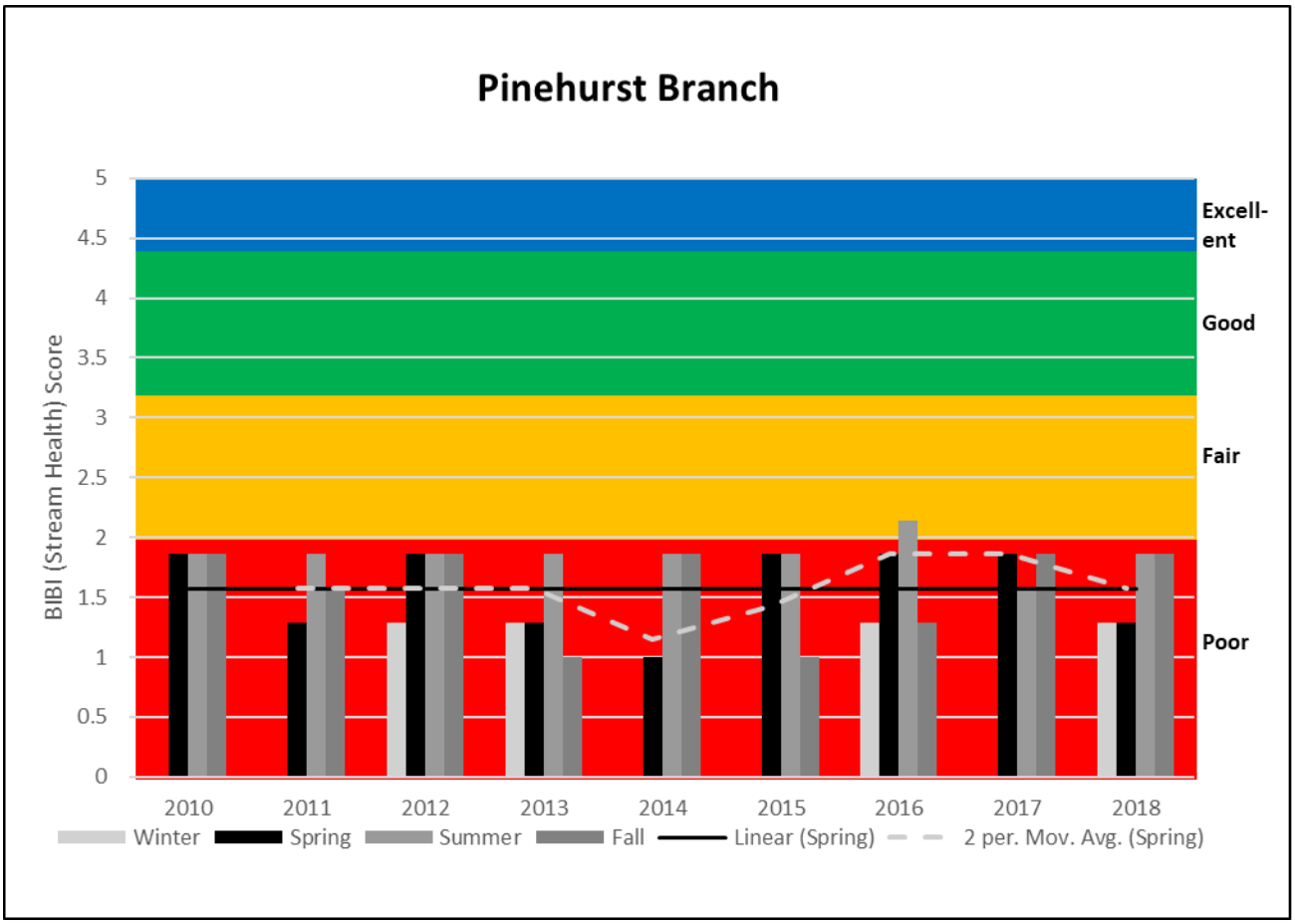
During the period 2010-2018, we have seen some changes. Stream health scores have improved at Normanstone Run, remained stable at Pinehurst Branch, but declined at Melvin Hazen Run. Even though most taxa found at these sites are relatively tolerant to pollution, higher numbers of taxa found during some site visits and the high percentage of mayflies in the samples helped increase stream health scores.

In fact, in most years from 2010-2018, Normanstone Run had at least one monitoring season in which water quality exceeded a BIBI score of 2.00. In general, stream health of Normanstone Run has improved over time. Team leader Mike Kolian analyzed the occurrence of the ten most commonly found macroinvertebrates from 1997-2016. He found that in recent years, the proportion of mayflies and caddisflies in the samples has increased.[13]



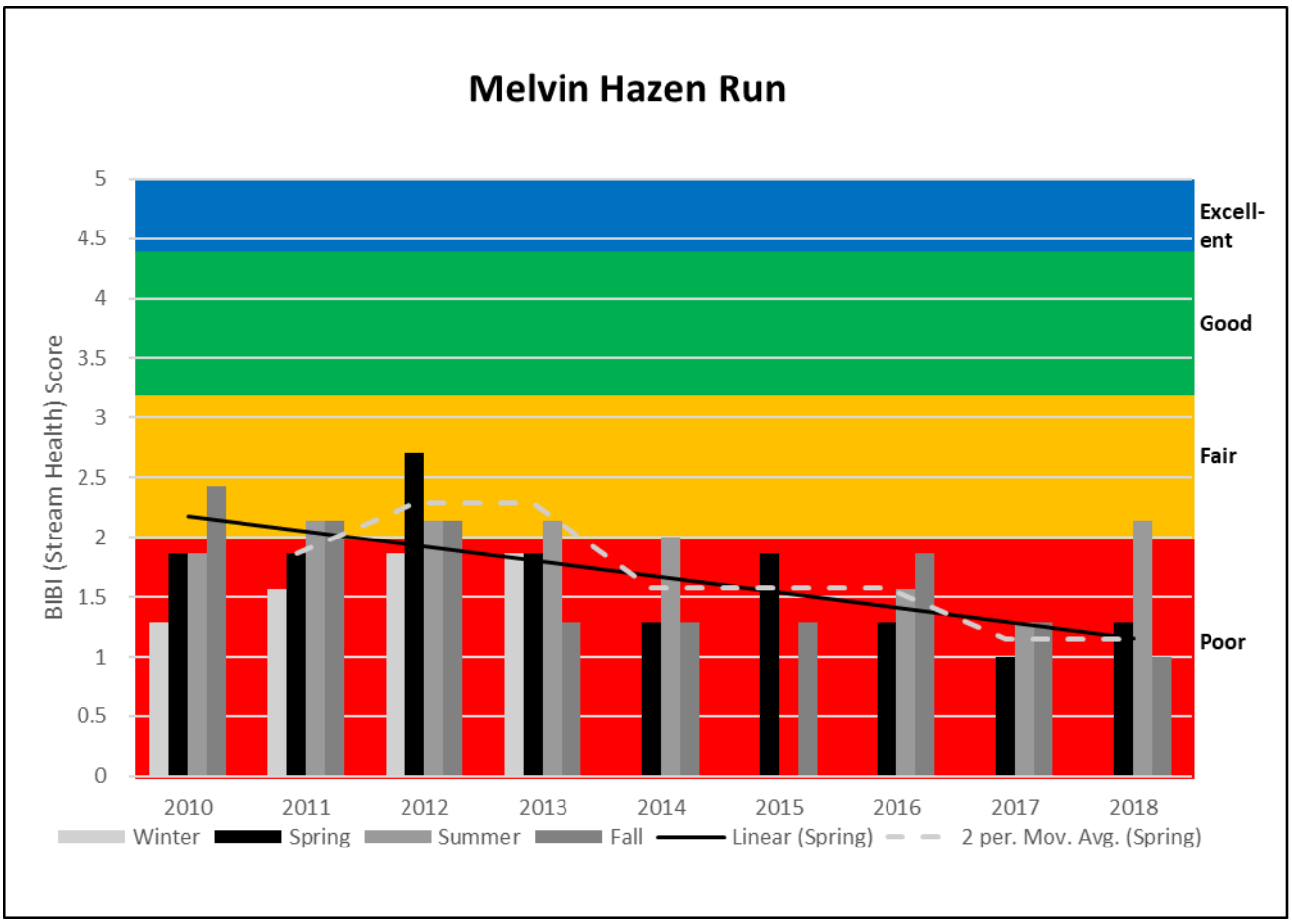
[13] *See* "Top Ten Taxa, 1996-2016" in the individual site report for Normanstone Run.

Stream health at Pinehurst Branch has been poor but stable, fluctuating just above and just below the NPS average of 1.50. Samples with high percentages of small minnow mayflies (Baetidae) led to higher BIBI scores.



But Melvin Hazen Run is in clear decline: In 1987, the District sampled Melvin Hazen Run (chart on next page) and rated it one of the best streams in the area, with a balanced aquatic community and fair to good water quality.[14] Melvin Hazen Run continued to improve after ANS started monitoring in 1997. The macroinvertebrate population at Melvin Hazen Run was especially diverse from 2005-2009, when 10-16 different families were often collected during a site visit, as well as a high percentage of mayflies. The average BIBI score for these years was 2.20. Yet, stream health has declined since 2010. Now, fewer families are being found, and mayflies make up a smaller percentage of the sample. Loss of diversity and sensitive taxa in recent years is evident.

[14] Sidwell Friends Students, "Melvin Hazen Biological Survey", citing District of Columbia Water Hygiene Branch, "Macroinvertebrate Census, 1987" (unpublished), 4.



VI. The Benthic Macroinvertebrate Community

For such an urban area, we have found a surprising diversity of life in our streams: These tributaries of Rock Creek harbor a diverse community of benthic macroinvertebrates. From 2010 to 2018, ANS teams found 33 taxa of benthic macroinvertebrates at these monitoring sites, including 21 insect families and 12 non-insect families (snails, clams, crustaceans, worms, leeches, and flatworms). The greatest diversity was recorded at Melvin Hazen Run, with 28 different taxa found during 2010-2018. Our Pinehurst team recorded 20 total taxa. Taxa found at Normanstone Run, our most urban site, totaled 16.

Our teams found representatives of all major aquatic insect orders: three mayfly families; one stonefly family; three caddisfly families; four beetle families; four true fly families; three Odonata families; one Megaloptera family; and two true bug families. Seventeen of these families were recorded at Melvin Hazen Run. A summary can be found at Appendix A.

The Maryland Department of Natural Resources has designated nine of these insect families as intolerant to pollution and environmental stress. These include darner dragonflies (Aeshnidae); ameletus mayflies (Ameletidae); Dobsonflies (Corydalidae); crayfish (Decapoda); predaceous diving

beetles (Dytiscidae); saddlecase maker caddisflies (Glossosomatidae); brushlegged mayflies (Isonychiidae); perlodid stoneflies (Perlodidae); and fingernet caddisflies (Philopotamidae). Three of these families -- Dobsonflies, crayfish, and fingernet caddisflies -- were found at all three ANS sites. Eight of the intolerant taxa were found at Melvin Hazen Run. A table of families found at each site appears at Appendix B.

But the diversity of organisms collected has been declining, especially of organisms intolerant to pollution: Of concern is the absence during the reporting period of several families previously collected by ANS teams, primarily at Melvin Hazen Run. Missing from our samples were ten families of mayflies, stoneflies, caddisflies, beetles, and dragonflies. Four of these families – spiny crawler mayflies (Ephemerellidae); flatheaded mayflies (Heptageniidae); spring stoneflies (Nemouridae); and common stoneflies (Perlidae) -- are also considered intolerant to pollution. Appendix C contains a list of the families that our teams have not found since 2009. Several species of one of these families, clubtail dragonflies (Gomphidae), are already on the District's list of species of greatest conservation need. **No other aquatic insect families are on the District's list, but their disappearance from our samples suggests that they should be.**

Furthermore, four intolerant families found only at Melvin Hazen Run early in the reporting period have not been collected since 2015.[15] No stoneflies have been collected since 2010. Only three families of caddisflies and mayflies – common netspinner caddisflies (Hydropsychidae), fingernet caddisflies (Philopotamidae), and small minnow mayflies (Baetidae) – are now being found. Hydropsychidae and Baetidae are relatively tolerant to pollution.

Yet, one intolerant-to-pollution family, Dobsonflies, has been increasing its range: Our data shows that Dobsonfly larvae (Corydalidae) have spread into all three tributaries during this time period. Although Dobsonfly larvae have been found in Rock Creek itself[16] and intermittently at Melvin Hazen Run since 1997, our teams at Normanstone Run and Pinehurst Branch had never collected them. The Normanstone team recorded finding five Dobsonflies in 2011. In 2015, they were also found at Pinehurst Branch. Dobsonflies are considered intolerant to pollution and environmental stress.[17]

During the reporting period, our teams found three new taxa: two true bug families -- shortlegged striders (Veliidae) and backswimmers (Notonectidae) -- and *Acentrella*, a two-tailed genus of small minnow mayflies (Baetidae). All are relatively tolerant, but if conditions are favorable, this shows that new taxa may start to colonize or recolonize Rock Creek and its tributaries.

And we are finding more macroinvertebrate families at Broad Branch: In fact, the number of families found by interns using our Creek Critters app almost doubled from 7 in 2017 to 13 in 2018.

---

[15] These are the mayflies Ameletidae and Isonychiidae; the stoneflies Perlodidae; and the caddisflies Glossosomatidae.

[16] From 2006-2010, members of the Friends of Rock Creek's Environment (FORCE), the precursor to Rock Creek Conservancy, monitored the mainstem of Rock Creek upstream of Broad Branch Road. They frequently found Dobsonfly larvae at their site. Dobsonfly larvae were also found during the May 2016 National Park Service BioBlitz at several locations in Rock Creek.

[17] The Maryland Department of Natural Resources assigns Corydalidae a "2" on a scale of 0-10, where "0" represents the most intolerant and "10" the most tolerant.

VII. Other Observations

Fish

Fish inhabit our streams, including American eels: Two of the ANS stream sites are populated by small fish. The Pinehurst Branch team reported finding Eastern blacknose dace *(Rhinichthys atratulus)* and other small fish during the entire reporting period (2010-2018). The team at Melvin Hazen Run reported finding schools of fish and sometimes fish eggs from 2010-2012. On the other hand, the Normanstone Run team has never reported finding fish at their site, perhaps because the dams to protect bridges and manholes along the stream prevent fish passage higher up into the watershed.

One important finding was migration of American eels *(Anguilla rostrate)* into two of these watersheds in 2010. In the spring, our Melvin Hazen Run team netted three American eels. In the fall, construction workers repairing the gas pipeline adjacent to Normanstone Run told the monitoring team that they, too, had seen a large eel below the bridge. In July 2018, our Melvin Hazen Run monitoring team again found an American eel, showing their return to or continued presence in the watershed.

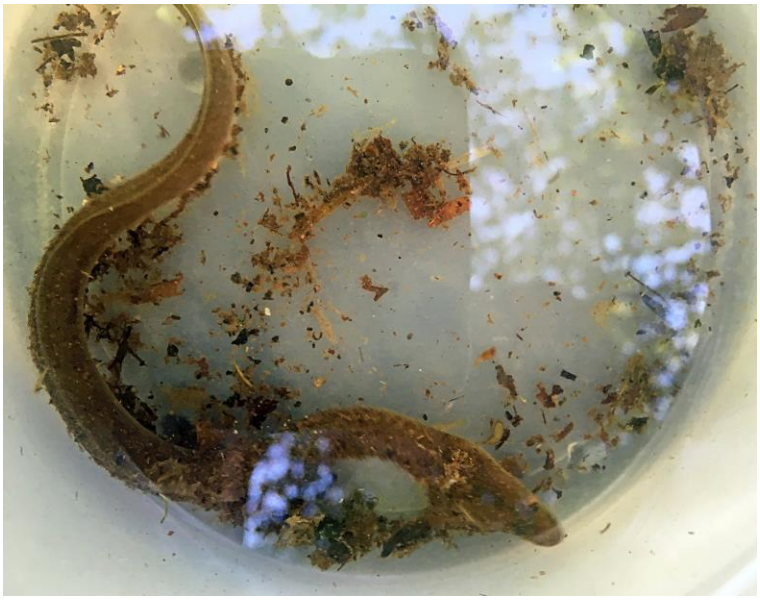


Figure 8: American eel found at Melvin Hazen Run. Photo credit: Cathy Wiss

Eels are an important component of a healthy watershed. Not only are they top order predators within the ecosystem, eels serve as primary hosts for the early life stage of the Eastern elliptio mussel *(Elliptio complanata).* Without eels, the mussels cannot successfully reproduce. The eel population has declined precipitously since the early twentieth century, and along with them the mussels. Mussels, too, hold an important place in the watershed. They filter nutrients and sediment from the water. **Although the US Fish and Wildlife Service has not listed American eels as endangered, the District has listed them as a species of greatest conservation need. Documenting their presence and taking steps to increase their population should be priorities. We recommend that DOEE continue to monitor the eel population in Rock Creek tributaries.**

Salamanders

We regularly find salamanders at all three streams, but particularly at Normanstone Run above fish blockages: Despite the lack of fish, or perhaps because of it, the Normanstone team consistently finds salamanders during most site visits, most probably Northern two-lined salamanders *(Eurycea bislineata)*.[18] Fish are predators of salamanders and benthic macroinvertebrates. Their absence in this stream segment may have created a small urban refuge for salamanders and benthic macroinvertebrates.

The Pinehurst Branch team also found Northern two-lined salamanders in winter 2012 and summer 2017. At Melvin Hazen Run, both Northern two-lined salamanders and Northern dusky salamanders *(Desmognathus fuscus)* were found in fall 2010.

The District has listed both Northern two-lined salamanders and Northern dusky salamanders as species of greatest conservation need, ones that could benefit from habitat management and restoration. **We recommend that places like Normanstone Run, where salamanders thrive, be managed as special salamander refuges and that all stream valley parks in the District be managed to sustain and increase their salamander populations.**

Invasive Plants

Invasive plants are prevalent throughout our three sites: Monitors survey the surrounding landscape for invasive plants. Invasive plants can alter soil structure through root exudates and modify the availability of soil nutrients. They can crowd out and displace native plants that wildlife depends on for food. Vines like kudzu and English ivy can overgrow and weaken trees.

English ivy was found at all three monitoring sites, as were Japanese stiltgrass, multiflora rose, and garlic mustard. Growth of English ivy was reported as extensive at Normanstone Run. Bamboo and barberry are also present at Normanstone Run primarily adjacent to residential properties. Kudzu proliferates at Melvin Hazen Run, but was not reported at the other sites. Efforts to remove invasive plants by volunteer groups like the NPS Weed Warriors program and Rock Creek Conservancy help improve stream habitat, as do tree plantings to replace them.

The draft Sustainability DC 2.0 plan targets removal of invasive plants as a way to protect, restore, and expand land ecosystems. We believe that removal of invasive plants benefits aquatic ecosystems, as well. **We recommend that DC recognize these stream valley parks and others like them as critical habitats for invasive removal in the forthcoming strategic management plan.**

Effect of High and Low Flows

The ecological effects of high storm flows are clearly visible: The metropolitan area experienced severe weather during this period, including "Snowmaggedon" in 2010, followed by a dry summer and fall; Hurricane Irene and Tropical Storm Lee in 2011; Hurricane Sandy in 2012; and several short, but intense storms in 2013 and again in late spring and summer 2014. ANS teams in both Washington, DC, and Montgomery County noted significant changes to their streams as a result, with high flows undermining riparian trees, collapsing stream banks, changing stream channels, and

[18] In fall 2016, three salamanders at Normanstone Run were found dead of unknown causes.

depositing sediment on point bars. Loss of riparian trees was particularly severe at Normanstone Run, but was also noted at Pinehurst Branch. Residents near the headwaters of Melvin Hazen Run report frequent flooding of their properties and streets during storms.

Despite higher flows following storms, our teams have also found low base flow during dry periods, usually in the summer and fall, but occasionally in spring. This has been the case at Pinehurst Branch.

High stormwater runoff and subsequent low base flow are characteristics of urbanization. Extreme flows have an adverse effect on the benthic macroinvertebrate community. **Managing stormwater runoff to reduce volume and velocity can mitigate erosion and loss of trees, prevent damage to property and infrastructure, as well as replenish groundwater.**

Stream Restoration

Stream restoration projects' current status is mixed: Efforts have been made at each of these streams to control runoff and restore riparian buffers. At Pinehurst Branch, a regenerative stormwater conveyance system has been installed at a small tributary entering from Aberfoyle Place, NW. Across Pinehurst Parkway on Beech Street, NW, inlets have been cut in the curb to allow stormwater to flow into the stream. Slopes downhill from the inlets are armored with riprap. Casey Trees has planted trees in the upper reaches of the park. Volunteers flag native seedlings and remove invasive plants. DOEE is planning additional stream restoration for Pinehurst Branch. Indeed, more needs to be done. Erosion is severe in places. Large amounts of sand, gravel, and tree debris scoured from upstream banks are deposited downstream where ANS monitors. Yet any future restoration must be planned and conducted carefully. Much of Pinehurst Branch is deep within the forest. Access roads for restoration equipment would of necessity require removing many trees, and disturbance could introduce invasive plants.

In 2014, Casey Trees planted saplings and native plants on the banks of Melvin Hazen Run within a deer exclosure. By 2016, they were growing well. Yet runoff in the headwaters from Hearst Recreational Park still needs to be addressed.

In 2011, riprap was installed on both banks and the streambed of Normanstone Run by the bridge where our team monitors. Runoff is still so heavy, though, that some of the riprap has washed downstream. Although **DDOT's current project to install bioretention ponds and bio-swales along Normanstone Drive and Fulton Street, NW, may well reduce runoff and flooding, new spillways from the bridges and roads will channel some runoff directly into the stream without any treatment for pollutants like oils and road salt.**

VIII. Creek Critters App & Program

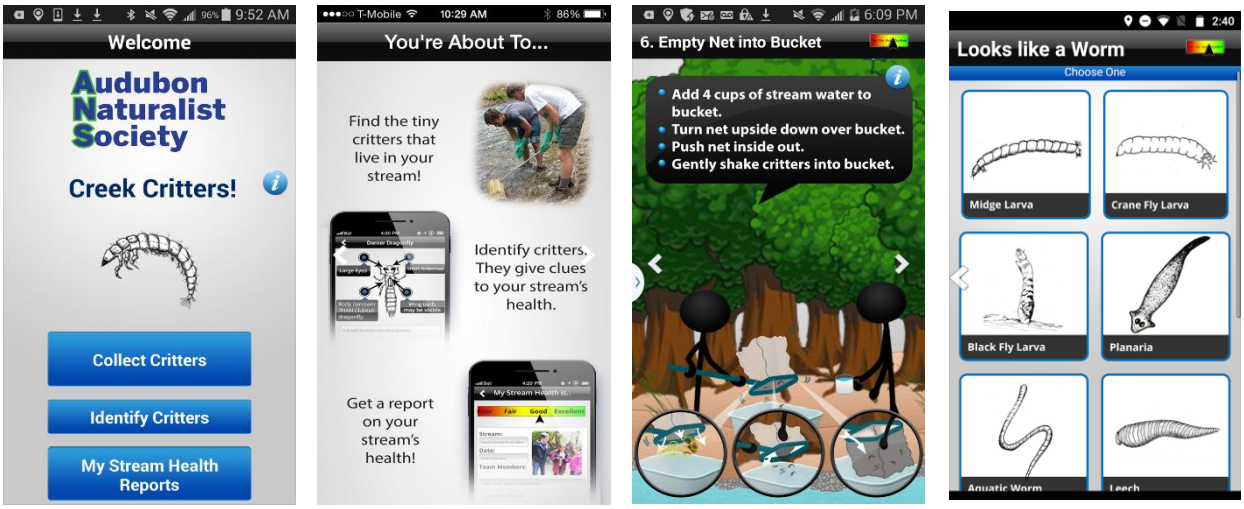


Figure 9: Screenshots from ANS' Creek Critters app.

Building on our 26 years of benthic macroinvertebrate monitoring experience, in 2015 ANS debuted our *Creek Critters* app for iOS and Android. Designed in partnership with our funder at the Raines Family Foundation, *Creek Critters* makes learning about the creek environment easy for anyone with a smart phone. The app not only walks users through the process of hunting for and identifying stream organisms, but makes sure they understand the role of macroinvertebrates in a healthy stream and points them to resources to help them improve the water quality of their local stream.

In the past three years we have engaged nearly 8,800 people with the *Creek Critters* app, primarily in the Rock Creek, Anacostia, and Potomac watersheds in DC. Through partnerships with Live It Learn It, Groundwork DC, the Anacostia Watershed Society, Rock Creek Conservancy, and many DCPS schools, we have made stream monitoring more accessible to hundreds of District residents and connected them to their local streams. **We welcome partnership with DOEE and NPS to make *Creek Critters* a regular part of community outreach around stream health.**

Figure 10: Students in Groundwork DC's youth programs use ANS' Creek Critters app to see what lives in Watts Branch, summer 2016. Photo credit: ANS.

IX. Summary and Recommendations

Biodiversity

DC's streams are urbanized and in poor biological health; however even in these circumstances there is life in the streams: Our long-term monitoring at three tributaries of Rock Creek in Northwest DC has given us a picture of stream health over time, as well as the opportunity to consider factors that may be affecting their health. We have seen that a diverse community of benthic macroinvertebrate families -- from aquatic insects to crayfish and other crustaceans, snails and clams, worms, and leeches – has made these streams their home.

Historically, the aquatic community at Melvin Hazen Run has been remarkably diverse for an urban stream. Since the site was opened in 1997, student monitors have found 38 families of benthic macroinvertebrates. Although Melvin Hazen Run still has the highest diversity of all three streams, 10 families have not been found since 2009, including four considered intolerant to pollution. Four more sensitive mayfly, stonefly, and caddisfly families have not been found since 2013. Stream health since 2013 has been poor.

The benthic communities at Pinehurst Branch and Normanstone Run are comprised mostly of tolerant taxa, as is to be expected in an urban setting. Yet they have been stable since ANS started monitoring these streams. Stream health, although for the most part poor, has shown some improvement over the years at Normanstone Run. Both streams have high abundance of benthic macroinvertebrates.

Despite the disappearance of macroinvertebrate families in recent years, we have seen some positive changes. Dobsonflies have increased their range. This sensitive family has now been collected not only at Melvin Hazen Run and the Rock Creek mainstem, but also at Normanstone Run and Pinehurst Branch. Two new true bug families and a new genus of mayfly, *Acentrella*, have been collected in the last few years. And the number of macroinvertebrate families colonizing the recently-daylighted segment of Broad Branch almost doubled from 2017 to 2018.

During our monitoring we have found fish at Melvin Hazen Run and Pinehurst Branch, including Blacknose dace. In 2010 and 2018, our teams found American eels in Melvin Hazen Run. Their presence is encouraging, as eels are bioindicators of healthy streams and serve as hosts for the early life stage of Eastern elliptio mussels.

At the same time, we have found salamanders at all three streams. In particular, Normanstone Run above the 30th Street bridge has become a small refuge for salamanders. It appears that the bridge support and others like it prevent passage of fish – their predators -- farther upstream.

Study and Management Recommendations for biodiversity: In its 2009 *Rock Creek Park Natural Resource Condition Assessment*, the National Park Service concluded that biodiversity data for invertebrates, amphibians, and fish was lacking, especially in tributaries. Inventories and distribution maps of these populations were recommended to fill in data gaps, gain a better understanding of these communities, and formulate Park management strategies to protect these

vulnerable communities.[19] **We encourage both the National Park Service and District Department of the Environment to use our data toward inventorying and mapping these populations.**

We plan to continue monitoring these streams to determine stream health and to look for trends. **We urge NPS and DOEE to engage in benthic macroinvertebrate monitoring, as well. Only by collecting data regularly and systematically from streams throughout the District can one develop a better picture of how aquatic populations are faring and determine how best to improve stream conditions.**

Recent articles report that insects worldwide are in decline.[20] Our data has shown a decline in aquatic insect families, especially ones intolerant to pollution**. We urge that DOEE include in the District's list of species of greatest conservation need all aquatic insects that appear to be in decline.**

We are encouraged by discovery of American eels at Melvin Hazen Run. **We urge that DOEE take steps to monitor eels and to improve aquatic habitat for these species of greatest conservation need.**

Despite the proximity of Normanstone Run to Normanstone Drive, our team routinely finds salamanders in its waters. **We encourage the District to manage this stream segment and others like it as refuges for salamanders.**

Managing Human Infrastructure Associated with Streams

We are concerned that excess nutrients may be affecting the health of these streams. Older sanitary sewers underlie many streams in the District, including Pinehurst Branch and Normanstone Run. Over time, these sewers have been known to leak wastewater into the streams. A major sewer reconstruction project is now underway to divert sanitary sewers in the lower portion of Pinehurst Branch to Bingham Drive. DDOT is currently replacing 111 feet of sanitary sewer line along Normanstone Drive. As we continue monitoring, we will look for effects of these sewer reconstruction projects. **We urge DOEE to do the same.**

Yet improper connection of sanitary sewer service to stormwater pipes does occur, as we have found at Normanstone Run and most likely at Pinehurst Branch. In 2012, the Normanstone team's observance of dry weather flow from a stormwater outfall led to the discovery and correction of an improper sanitary sewer hookup at the Naval Observatory. In fall 2018, odorous gray dry weather discharge was again flowing from the same stormwater outfall. Likewise, suds have been observed on Pinehurst Branch, and the pool below the Western Avenue outfall was an uncharacteristic milky blue on a dry day in fall 2018. **We request that DC Water, DOEE, and the Washington Suburban Sanitary Commission (WSSC) seek the sources of these illicit discharges and ensure that they are corrected**.

---

[19] *NPS Natural Resources Report,* 83, 88-89.

[20] *See* Jarvis, Brooke. "The Insect Apocalypse Is Here." *New York Times Magazine*, 27 Nov. 2018. https://www.nytimes.com/2018/11/27/magazine/insect-apocalypse.html

Algae blooms at Melvin Hazen Run may indicate similar improper connections even though no sanitary sewers underlie that stream. The Audubon Naturalist Society is pleased to be participating in the volunteer bacteria monitoring project, as part of a consortium led by Anacostia Riverkeeper, and we will use our knowledge of the Rock Creek tributary sites described in this report to guide our involvement in that project. In a September 2018 pilot study for the bacteria monitoring project, Anacostia Riverkeeper reported that all three tributaries, including Melvin Hazen Run, had unacceptable levels of *E. coli* for recreational use.[21] **We recommend that DOEE and DC Water conduct a study to determine the source of excess nutrients present in Melvin Hazen Run and take corrective measures.**

We are encouraged by the District's investment in stream restoration, including the early indications of success to date on the regenerative stormwater conveyance technique used at Pinehurst Branch and Broad Branch. However, it is critical that stream restoration using any technology be closely coupled with upland stormwater retrofits, as called for in the draft Sustainable DC 2.0 plan. If the volume and velocity of stormwater are not reduced before flowing into a stream channel, we are concerned that over time the stability of the restoration itself will be at risk—as exemplified by the riprap installed at Normanstone Run that has been pushed downstream by continued excessive stormwater flows. This risk will only increase, not lessen, in the future as climate change is expected to continue generating more intense storms in our region. **DOEE must couple stream restoration projects with intensive investments in up-watershed stormwater retrofits in order to ensure the long-term success of the stream restoration. This should include working with Chevy Chase, Maryland, to reduce the volume of stormwater flows entering Pinehurst Branch from that jurisdiction through the culvert at Western Avenue.**

We are disappointed that the goal of the Fulton Street/Normanstone Drive restoration project is solely to reduce water *quantity* and not to improve water *quality*. Newly constructed spillways are designed to channel stormwater directly from the bridges and road into the stream without measures to remove oils and road salt it may be carrying. Admittedly, much of the space between the road and stream is limited, but lack of any treatment of runoff for water quality could devastate the stable macroinvertebrate and salamander communities that make Normanstone Run their home. The District has declared that salamanders are species of greatest conservation need, requiring elevated levels of protection. **We request that DDOT and DOEE find a better solution than spillways to treat runoff from the bridges and road. We also urge that DDOT include measures to improve water *quality* in future road restoration projects in close proximity to streams.**

---

[21] The most probable number of colony-forming units in the samples for each tributary were:

Pinehurst Branch	547.5
Melvin Hazen Run	365.4
Normanstone Run	727

The EPA threshold is ≤126. *See* https://www.foodsafetynews.com/2003_06_19_beaches_local_statrept%5B1%5D.pdf

Appendix A: Summary of Taxa Found at Each ANS Monitoring Site, 2010-2018

Taxa	Pinehurst	Hazen Run	Normanstone	All Sites
Total taxa found, 2010-2018	20	28	16	33
Total non-insect taxa found	8	11	7	12
Crayfish	1	1	1	1
Scuds	1	1	1	1
Aquatic sowbugs	0	1	1	1
Snail families	4	3	1	4
Clam families	0	2	0	2
Leeches	0	1	1	1
Aquatic worms	1	1	1	1
Flatworms	1	1	1	1
Total insect families found	12	17	9	21
Mayfly families	1	3	1	3
Stonefly families	0	1	0	1
Caddisfly families	2	3	2	3
Beetle families	1	4	0	4
True fly families	4	3	4	4
Damselfly families	1	2	0	2
Dragonfly families	1	0	0	1
Megaloptera families	1	1	1	1
True bug families	1	0	1	2
Total EPT families (Mayflies, stoneflies, caddisflies)	3	7	3	7
Total intolerant taxa found	4	8	3	9
Number of taxa per visit	6.4	9.4	7.8	7.9
Most found	10	16	11	16
Least found	4	5	4	4
Average (mean)	6.4	9.2	7.8	7.8

Appendix B: Benthic Taxa Found at Each Monitoring Site, 2010-2018

Taxa	Pinehurst	Melvin Hazen	Normanstone
*Aeshnidae – Darner dragonflies	X		
*Ameletidae - Ameletus mayflies		X	
Amphipoda - Scuds	X	X	X
Asellidae - Sowbugs		X	X
Baetidae - Small minnow mayflies	X	X	X
Baetidae, genus *Acentrella*			X
Calopterygidae - Broadwinged damselflies	X	X	
Chironomidae - Midges	X	X	X
Coenagrionidae - Narrowwinged damselflies		X	
Corbiculidae - Asiatic clams		X	
*Corydalidae - Dobsonflies/fishflies	X	X	X
Culicidae - Mosquitoes	X		X
*Decapoda - Crayfish	X	X	X
Dryopidae - Long-toed beetles		X	
*Dytiscidae - Predaceous diving beetles		X	
Elmidae - Riffle beetles	X	X	
*Glossosomatidae - Saddlecase maker caddisflies		X	
Hirudinea - Leeches		X	X
Hydrophilidae - Water scavenger beetles		X	
Hydropsychidae - Common netspinner caddisflies	X	X	X
*Isonychiidae - Brushlegged mayflies		X	
Lymnaeidae - River/pond snails	X	X	
Notonectidae – Back swimmers			X
Oligochaeta - Aquatic worms	X	X	X
*Perlodidae - Perlodid stoneflies		X	
*Philopotamidae - Fingernet caddisflies	X	X	X
Physidae - Pouch snails	X	X	X
Planariidae - Planarians/flatworms	X	X	X
Planorbidae - Planorbid snails	X	X	
Pleuroceridae – Gilled/operculate snails	X		
Simuliidae - Black flies	X	X	X
Sphaeriidae - Fingernail clams		X	
Tipulidae - Crane flies	X	X	X
Tipulidae, genus *Antocha*		X	X
Tipulidae, genus *Tipula*			X
Veliidae - Shortlegged striders	X		

* Taxa designated as intolerant to pollution by the Maryland Department of Natural Resources

Appendix C: Aquatic Insects Found at Melvin Hazen Run before 2010, but not since Then

Aquatic Insect Family	First Collected	Last Collected
Mayflies:		
*† Flatheaded mayflies (Heptageniidae)	1998	2007
* Spiny crawler mayflies (Ephemerellidae)	2006	2009
Stoneflies:		
* Common stoneflies (Perlidae)	2009	2009
* Spring stoneflies (Nemouridae)	1998	2008
Caddisflies:		
Micro caddisflies (Hydroptilidae)	2001	2008
† Northern case maker caddisflies (Limnephilidae)	2006	2007
Beetles:		
Ptilodactylid beetles (Ptilodactylidae)	1999	2005
Water pennies (Psephenidae)	2007	2008
Whirligig beetles (Gyrinidae)	1998	2004
Dragonflies:		
Clubtail dragonflies (Gomphidae)	1998	1998

* Taxa designated as intolerant to pollution by the Maryland Department of Natural Resources
† Heptageniidae were also collected at Pinehurst Branch in 2008. Limnephilidae were found in the mainstem of Rock Creek from 2006-2010 by monitors with FORCE.

Appendix D: Aquatic Insects Found at Broad Branch Restoration Site Using Creek Critters App

As described in Section VIII of the report, above, the Creek Critters app allows identification to the order level, and in several cases to the family level, of the most commonly-found macroinvertebrates in our region. It uses a simple protocol of three rock-rubbing collections into an aquarium net at a riffle. Below are results from summer 2017 and summer 2018 surveys.

AUGUST 8, 2017
Survey conducted by ANS Intern Sarah Becker and Rock Creek Conservancy (RCC) Intern Dani Churchill.

Macroinvertebrates Found
- Pouch snails (Physidae)
- Midge fly larvae (Chironomidae)
- Black fly larvae (Simuliidae)
- Leeches (Hirudinea)
- Common netspinner caddisflies (Hydropsychidae)
- Darner dragonfly larvae (Aeshnidae)
- Narrowwinged damselfly larvae (Coenagrionidae)

AUGUST 9, 2018
Survey organized by ANS intern Christiana Glabb, RCC Intern Marek (last name not known).
Survey conducted by 8 interns from ANS, RCC, Anacostia Watershed Society, Friends of Cabin John Creek – and ANS Creek Critters Program Manager Gregg Trilling & RCC Program Manager John Maleri.

Macroinvertebrates Found
- Pouch snails (Physidae)
- Gilled/operculate snails (Pleuroceridae)
- Midge fly larvae (Chironomidae)
- Black fly larvae (Simuliidae)
- Leeches (Hirudinea)
- Aquatic worms (Oligochaeta)
- Mosquito larva (Culicidae)
- Adult beetle (water scavenger beetle/Hydrophilidae)
- Common netspinner caddisflies (Hydropsychidae)
- Darner dragonfly larvae (Aeshnidae)
- Small minnow mayfly (Baetidae)
- Water boatmen (Corixidae)
- Broad-shouldered/short-legged striders (Veliidae)