Oxon Run

Watershed Implementation Plan (WIP)

August 2010

District Department of the Environment
Office of Natural Resource
Watershed Protection Division

DDOE
DISTRICT DEPARTMENT OF THE ENVIRONMENT

Government of the District of Columbia
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1. DESCRIPTION OF OXON RUN

Oxon Run is a tributary of the Potomac River with a watershed measuring approximately 7,906 acres, or 12.4 square miles. Oxon Run's Potomac River confluence is marked by Oxon Cove, a feature located along the east bank of the Potomac River, just south of the District's southeastern boundary with Maryland Prince Georges County. Oxon Run begins its roughly eight mile course in the Oakland Area in Prince Georges County Maryland, north east of Pennsylvania Avenue, with the headwaters emanating from a storm drain pipe that drains a shopping center parking lot. From here, Oxon Run roughly parallels Pennsylvania Avenue up to the District line. Upon entering the District, Oxon Run flows naturally through National Park Service land. At 13th Street SE, an almost 1.5 mile section of concrete-lined channel begins. The stream, after crossing South Capitol Street, enters a natural reach that is bounded on either side by National Park Service and District Department of Recreation property, before crossing the Prince George's County line again. Oxon Run is tidally influenced from its mouth in Oxon Cove to a flood control drop structure in Prince George's County near the downstream border with the District.

The majority of the District's portion of Oxon Run flows through a trapezoidal concrete-lined channel, measuring up to 50 feet in width. Within the entire watershed, there are 15.3 miles of natural channel. Almost all of Oxon Run's feeder streams have been converted to subterranean stormwater pipes that discharge into the stream throughout its reach. Riparian forest buffer is essentially nonexistent along the channelized sections of Oxon Run's main stem. Approximately 33 percent of the Oxon Run watershed consists of impervious surface (USFWS, 2003). In the District portion of Oxon Run watershed, however, approximately 37 percent of the watershed is covered in impervious surface.

1.1. Geology and Soil Conditions

Oxon Run's geology and soils are typical of the coastal plain ecoregion. Stratified alluvial sand of the Patapsco formation and Arundel Clay sediments dominate the stream valley's lowest areas, while more gravel is found in the uplands (USFWS, 2003). The following is a list of all of the watershed's geological formations, in order of prevalence, with their associated geologic age:

Patapsco formation and Arundel Clay (Upper Cretaceous)
Brandywine Gravel (Pliocene)
Pamlico Formation and Recent Alluvium (Pleistocene/recent)
Wicomico Formation (Pleistocene)
Chesapeake Group (Miocene Coastal Plain)
Aquia Greensand (Eocene)
Monmouth Formation (Upper Cretaceous)

The soils found in the District's portion of the watershed are dominated by three major associations, that due to development, all contain a significant urban land component. Urban land consists of areas that are occupied by structures and works. Commonly, these soils have been cut or graded. Furthermore, the materials around building foundations generally consist of a mix of parent soil material from the surrounding area and construction and demolition debris (USDA, 1976).

Urban Land – Beltsville-Chillum:
The most prevalent general soil association in the District portion of the watershed is the Urban Land Beltsville-Chillum association. It is found perched above the valley floor on Oxon Run's broad uplands. These soils are deep, underlain by sandy or gravelly deposits and range from nearly level to steep, and from well drained to moderately well drained.

Urban Land – Christiana Sunnyside:
The Christiana-Sunnyside association is comprised of predominantly upland soils that are deep, well-drained, underlain by unstable clayey sediment and range from nearly level to steep.

Luka – Lindside Codorus:
Oxon Run's channel is cut through the soils of this association. These soils are deep, nearly level to moderately sloping, and somewhat excessively drained. Since they are part of sandy, old, unconsolidated terraces, they are also highly erodible.

The remaining soil associations of the Oxon Run watershed are listed below.

Urban Land – Galestown-Rumsford
Urban Land – Sassafras-Chillum
Udorthents
Landfill

1.2. Flow Characteristics

Within the entire Oxon Run watershed there are a total of 15.3 miles of natural channel amongst Oxon Run and its tributaries. This amount represents only about 60 percent of the natural channel found in the watershed prior to development. The remaining 40 percent has been relegated to either pipe or concrete-lined channel. As a result of this reduction in natural channel and the high percentage of impervious surface in the watershed, the stream tends to witness flashy, intense flows. Bankfull estimates made by the USFWS during their stream and watershed assessment range between 375 and 450 cfs for Oxon Run's lower District reach (USFWS, 2003).

In the District portion of Oxon Run, the majority of the watershed is comprised of piped stormwater sewers that are part of the District's Municipal Separated Storm Sewer System

(MS4). While there are some unpiped sections of the watershed, mainly in areas owned by the National Park Service, overland sheet flow during storm events in these areas is likely a minimal contributor to the overall flow regime for the stream. The MS4, on the other hand, is the most significant National Pollutant Discharge Elimination System (NPDES) permitted facility in the District portion of the Oxon Run watershed and the major contributor to degraded water quality in Oxon Run. There are no fewer than 38 stormwater outfalls on the District's portion of Oxon Run. A high ratio of impervious surface cover within MS4 areas is linked to the dense urban land use that characterizes the watershed. The radically altered flow regime, when compared with predevelopment hydrology, has contributed to down cutting, channel widening and stream bank erosion in the portions of the stream without channels. Surprisingly, certain sections of the concrete lined trapezoidal channel have been severely degraded, presumably due to persistent high volume and high velocity flows. This flow regime and the associated water quality degradation are typical of urban streams. (Urban Stormwater Management in the US, NRC 2008)


Eroded stream bank in Oxon Run

1.3. Water Quality

Environmental health information regarding Oxon Run's water quality is derived from the District's 2002 Clean Water Act §305(b) - Water Quality Report to U.S. EPA and Congress. Data used in the report was gathered and analyzed by the District Department of the Environment (DDOE) Water Quality Division. According to the report, pathogenic and toxic effects, delivered by urban runoff and stormwater discharges, have severely degraded Oxon Run's water quality, and as a result, the stream does not support any of its designated use "classes" (see Table 1). This non-support of use-classes led to Oxon Run's presence on the District of Columbia's 1998 through 2004 Section 303(d) List of Impaired Waters, which triggered the 2004 preparation of Total Maximum Daily Loads (TMDLs) for the pollutants responsible for this impairment.

Table 1: Designated Use "Classes" not supported by Oxon Run water quality (DDOE 305b, 2004)

Class	Use
A	Primary Contact Recreation (Recreation "in" the water)
B	Secondary Contact Recreation (Recreation "on" the water)
C	Protection and propagation of fish, shellfish, and wildlife
D	Protection of human health related to fish and shellfish consumption

While Oxon Run certainly has degraded water quality and wildlife habitat, it should be noted that there is a paucity of data to support the TMDL designations, in particular for organic pollutants. Due to a lack of data for total metals and organic pollutants, the Oxon Run TMDLs for these two pollutants where developed using fish tissue and sediment data collected in the Anacostia River. It was assumed that a relatively homogenous distribution of urban land located throughout the District would lead to similar pollutant loading rates between the Anacostia and Oxon Run. Pollutants associated with urban land uses, such as the application of coal tar sealants to parking lots (now banned under District law), vehicular traffic, and atmospheric deposition, are indeed similar between the two watersheds. The relative distribution of land uses is also similar between the two watersheds, however, in aggregate the Anacostia River watershed has many more historic and present day sources, of both point and non-point pollution. The Anacostia Watershed has a much larger land area and has historic industrial land uses (e.g., the Washington DC Navy Yard). In addition, the tidal Anacostia is dominated by low flow regimes with an estimated water residence time between 23 to 28 days, while the free flowing Oxon Run has a highly abbreviated water residence time that minimizes the possibility for the accumulation of contaminated sediments. In other words, Oxon Run TMDLs may be flawed, and at a minimum require more robust data collection to support the assumptions.

Monitoring data does exist, however, for bacteria and dissolved metals. Fecal Coliform and dissolved metals data were collected from 1990 to 2002 at a downstream monitoring station in Oxon Run. The Department of Health, Water Quality Division (later to become part of DDOE) used a modified version of the Interstate Commission on the Potomac River Basin small tributaries model. The DC Small Tributaries TMDL model is a simple mass balance model which predicts daily water column concentrations of each modeled constituent in Oxon Run. The model is composed of three sub-models: an organic chemicals sub-model, an inorganic chemicals sub-model, and a bacteria sub-model. Data incorporated into the model included: DDOE 1990 to 2002 fecal coliform and dissolved metals monitoring data for Oxon Run, the 1995 to 1996 ICPRB Anacostia River toxics study, District Water and Sewer Authority Long Term Control Plan outfall monitoring data, and MS4 outfall monitoring data. (DC Oxon Run TMDL, 2004) The only monitoring data actually collected on Oxon Run did not measure total metals or organics. Moreover, the Oxon Run monitoring data was collected at one downstream location and it is not clear whether this data was collected under wet or dry conditions. The downstream location also complicates the attribution of the bacteria waste load allocation to the MS4. There are no fewer than ten sewer line crossings throughout the District portion of Oxon Run, which may contribute to point sources of bacteria. During their watershed survey, US Fish and Wildlife Services (USFWS) noted broken sewer line crossings in Maryland Prince George's County that may also be point sources of bacteria, if they remain unrepaired. While the DDOE monitoring data is valuable, more robust and broad spectrum monitoring is required to help determine if the actual listed pollutants are affecting water quality and preventing the Oxon Run from achieving designated uses.

In addition to bacterial and chemical pollutants, there are other pollutants not included on the EPA 303(d) list, that affect water quality in Oxon Run and ultimately the Potomac River and beyond. One of these non-point sources of pollution in Oxon Run is sediment. As estimated in the US Fish and Wildlife Service's Oxon Run, Washington, DC Watershed and Stream Assessment (2003), stream bank erosion in the Oxon Run watershed contributes over 18,000 tons of sediment to the Potomac River every year, 6 percent of which comes from the District's portion. USFWS's complete estimates can be found in Table 2.

Degraded Sewer System infrastructure in Oxon Run

Table 2: Oxon Run watershed sediment production estimates (USFWS, 2003)

Watershed	Sediment Load
Oxon Run (DC)	1,032 tons/year
Oxon Run and tributaries (Prince George's County)	5,909 tons/year
Barnaby Run and tributaries	8,717 tons/year
Forest Heights Tributary	2,565 tons/year
Watershed Total	18,224 tons/year

Besides sediment, Oxon run is also impacted by trash. Investigators noticed high levels of litter distributed throughout the watershed and in the stream. Litter accumulates in catch basins and along streets, and is conveyed via the MS4 during storm events to the receiving water, in this case Oxon Run. Litter may also be blown by wind, or directly dumped into the stream. Levels of trash in the stream, deposited along stream banks or accumulated in snags, was observed to be very high. The elimination of trash from District waterways is a tangible indicator of water quality improvement. Trash free streams and rivers enhance both the aesthetic benefits and the environmental health of District waterways. In signing the Trash Free Potomac River

Plastic bottles and other debris entrained in a snag along Oxon Run

Treaty, the Mayor committed the District to the elimination of trash from the Potomac River by 2013. This goal also includes the elimination of trash from Oxon Run. Recently, the EPA has begun the process of regulating trash under the clean water act, and is in the process of issuing a trash TMDL for the Anacostia River. More investigation into the effects of trash on the designated uses of Oxon Run is warranted.
While no TMDLs exist for nitrogen, phosphorus, or total suspended solids (TSS) in the District portion of the Oxon Run watershed, the District is still committed to reducing these pollutants in accordance with the Chesapeake Bay Agreement. As the EPA moves to enforce the Chesapeake Bay TMDL, it is expected that load reductions for nitrogen, phosphorus and TSS will be assigned to the Potomac's tributaries, which may mean required reductions for Oxon Run. At this time, however, data for nitrogen and phosphorus appear to indicate that they do not impair water quality in Oxon Run.

1.4. Land Use

An analysis of the US Geological Survey's National Land Cover Data shows that developed lands (67.3 percent) and forest (23.9 percent) dominate the Oxon Run watershed (DDOE TMDL, 2004)(Appendix A, map 8). A closer examination of the watershed's developed areas shows high concentrations of intensely developed land in and around the District's Congress Heights neighborhood, as well as Forest Heights, Maryland. Despite valuable natural areas, especially in the stream corridor, much of the District's portion of the watershed is developed with an impervious cover of 37 percent (Appendix A, map 2). The watershed's forested areas are mostly found along Oxon Run and its tributaries (Appendix A, map 7), and forested areas are generally owned by city, county, and National Park Service (NPS). A more thorough breakdown of land use throughout the entire Oxon Run watershed, as well as the separate District and Maryland portions, can be found in Tables 3 and 4, below.

Table 3: Land Use Distribution in the Oxon Run Watershed (DDOE TMDL, 2004)

Category	Land Use	Total Acres	Percent of Watershed Land Area
Water/Wetlands	Open Water	6.8	0.1
	Woody Wetlands	26.5	0.3
	Emergent Herbaceous Wetlands	2.7	0.0
Developed	Low Intensity Residential	4,381.1	55.4
	High Intensity Residential	238.9	3.0
	Commercial/Industrial/Transportation	750.7	9.5
Agriculture	Pasture/Hay	7.9	0.1

Category	Land Use	Total Acres	Percent of Watershed Land Area
Forest	Deciduous Forest	1,328.9	16.8
	Evergreen Forest	80.9	1.0
	Mixed Forest	396.4	5.0
Other	Urban/Turf	657.0	8.3
Total		7,906	100

Table 4: Percent of Land Use in the District of Columbia and Maryland sections of Oxon Run Watershed (DDOE TMDL, 2004)

Category	Land Use	Percent in District	Percent in Maryland
Water/Wetlands	Open Water	0.1	0.1
	Woody Wetlands	0.9	0.1
	Emergent Herbaceous Wetlands	0.0	0.0
Developed	Low Intensity Residential	65.3	51.9
	High Intensity Residential	11.4	0.0
	Commercial/Industrial/Transportation	2.5	12.0
Agriculture	Pasture/Hay	Not present	0.1
Forest	Deciduous Forest	11.7	18.7
	Evergreen Forest	0.5	1.2
	Mixed Forest	2.6	5.9
Other	Urban/Turf	5.1	9.5
Total			0.5

1.5. City Infrastructure

The District of Columbia has two types of sewer systems, a combined sewer system (CSS) and a separated sewer system. Approximately one third of the city is covered by the former and two thirds by the latter. Fortunately, the Oxon Run watershed does not contain any portion of the city's CSS, so stormwater discharges in Oxon Run should be free of sanitary sewage from combined sewage overflow. The entire Oxon Run watershed is served by a separate storm sewer system. This system conveys stormwater directly to local waterways, and sanitary sewage directly to Blue Plains. Though preferable to a combined sewer system, a separated sewer system is not without its drawbacks. By the time stormwater runoff reaches a catch basin, it is far from clean, having picked up toxic chemicals, trash, sediment, nutrients, and other nonpoint source pollutants. In addition to this problem of stormwater quality, stormwater quantity is of equal concern. During storms, the sheer volume of runoff from the city's impervious areas creates a surge that damages stream channels, as evidenced by erosion in Oxon Run. According to WASA records, 38 storm sewer outfalls discharge directly into Oxon Run's District portion alone (USFWS, 2003). In addition, the "sewersheds" draining to these outfalls cover approximately 85 percent (1,766 acres) of Oxon Run's District watershed area (DDOE TMDL, 2004).

1.6. Terrestrial Habitat and Riparian Buffer

Prior to its development, the Oxon Run watershed contained some of the most unique ecosystems in the District and the region. This area is underlain by gravel terrace sediments that are highly acidic and composed of layers of well-drained gravel and sandy sediments over fine silt and clay layers. The underlying geology combined with rolling topography created an environment rich in springs and seeps, and composed of complex and diverse micro-ecosystems. These micro-ecosystems provided habitat for a diversity of wildlife species, many dependent on these environments for food, forage, and breeding habitat. Remnants of these ecosystems still exist in the Oxon Run watershed. These remnants are part of an important network of protected habitats spanning the District and surrounding region that support species of greatest conservation need such as the wood duck, red shouldered hawk, brown thrasher, gray fox, opossum, flying squirrel, box turtle, painted turtle, and queen snake. This network of habitats is also vital for the support of populations of more common wildlife such as the sharp-shinned hawk, downy woodpecker, white-tailed deer, red fox, grey squirrel, and raccoon.

The largest remnant habitats are within the National Park Service (NPS) portion of Oxon Run Park and the NPS portion of Bald Eagle Hill Park. Oxon Run Park contains one of the rarest and most unique ecosystems in the region, the Sweetbay Magnolia bog. These bogs only occur in gravelly sediments along the fall line within northern Virginia, the District and Central Maryland where hilly terrain abuts floodplain bottomlands, and where the porous gravelly soil is underlain by restricting clay layers. These conditions create numerous seeps and springs that feed together and spread across the floodplain, creating an extremely acidic (pH 4-5), low nutrient, bog environment. These bogs support a diversity of rare plant species and are home to much resident and migratory wildlife, such as frogs, toads, turtles, ducks, and invertebrates that depend on these wet areas for many aspects of their life functions. The copepod *Acanthocyclops columbiensis*, a small crustacean that lives in groundwater, is endemic to this habitat. A mix of tree species forms a diverse canopy with trees like sweetbay magnolia, sweetgum, American hornbeam, tulip poplar, river birch, and willow oak. The understory is dominated by shrubs such as possumhaw, huckleberry, blueberry, and swamp azalea. Sphagnum moss is ubiquitous throughout, growing at the bases of trees and forming small hummocks within the bog, where many rare herbaceous plant species are known to occur. This sphagnum moss is also prime micro-habitat for terrestrial salamanders, such as the redback (Designated by DDOE as a Species of Greatest Conservation Need) and four-toed salamander, to lay their eggs. Magnolia bogs are fragile ecosystems that are at risk from invasive plants, alterations in underlying hydrology from development, water quality degradation from stormwater runoff, and herbivory from white-tailed deer.

Bald Eagle Hill and the surrounding forested areas comprise another typical remnant of the gravel terrace communities. This habitat is dominated by towering specimens of white oak, chestnut oak, tulip poplar, eastern sycamore, and sweetgum. The canopy height is 100-120 ft and provides potential habitat for bats such as the small brown bat, large brown bat, and *Myotis* species that feed above the nearby meadows and streams. The understory contains a diversity of shrubs, including azalea species, blueberry species, greenbrier species, and other shrubs and herbaceous plants. This site also contains many springs and seeps, with more than a dozen converging and spreading out into the floodplain bordering Oxon Run. This site contains a diversity of wildlife habitats that range from dry forested slopes, to open meadows, to wet riparian forest, making this site a particularly rich for wildlife, especially forest birds, such as the belted kingfisher, yellow-billed cuckoo, red-eyed vireo, song sparrow, hermit thrush, white-eyed vireo, and warbler species.

Other smaller remnants of habitat remain along the slopes bordering the Suitland Parkway, and are dispersed in small patches throughout the watershed. The habitat along the Suitland Parkway varies considerably from highly altered and degraded to relatively intact forest. The intact forest is a typical gravel terrace forest dominated by mixed oaks with an understory of blueberry, azalea, and mountain laurel. One of the most intact remaining habitat patches is Hillcrest Park, adjacent to Alabama Avenue. This patch contains a small stream fed by ground water and runoff, and is composed of a typical gravel terrace forest with exposed cobles, a canopy of mixed oak, and an understory of mountain laurel, holly, winterberry, and azalea.

These unique and environmentally sensitive habitat fragments are of critical importance to the Oxon Run watershed. Continued encroachment from development, unmitigated stormwater flows into these areas, and invasive species all pose immediate threats to these areas. Conservation of the existing habitat, restoration of degraded areas, and the creation of wildlife corridors must be top priorities for these areas. In addition, the DDOE, in coordination with NPS, must do a better job of introducing area residents to the natural resources in their back yards. Without citizen support for conservation of these natural areas, future development pressure may destroy these important and irreplaceable natural resources.

Much of this important habitat lies within the stream corridor, and also provides a riparian buffer for Oxon Run. The riparian buffer, however, is variable. Within the stream corridor virtually all the land is publicly owned. The best riparian habitat tends to be within parcels owned by NPS. These areas include Oxon Run Expressway which contains the Magnolia Bogs and Bald Eagle Hill. District owned properties, including Oxon Run Park and Patricia R. Harris Education Center, are adjacent to the section of stream which has been channelized. The District owned portions of land adjacent to the stream are managed mainly as public parkland and consist mostly of mowed turf. Reforestation, managed no-mow zones and other riparian buffer enhancements are needed in this area of the stream corridor, yet may have limited water quality benefits since flows mainly discharge through the MS4 system. Improving forest cover and habitat will, however, help link otherwise fragmented areas important to wildlife.

1.7. Instream Habitat

Oxon Run's instream habitat is poor. In the nearly two-mile long section of the stream where there is a concrete lined trapezoidal channel, instream habitat for fish and benthic communities is virtually non-existent. In the non-channelized sections, USFWS noted, "most reaches have marginal bed feature development and do not have the riffle/pool sequences necessary to sustain an aquatic community typical of coastal plain streams" (2003). An American University Study drew similar conclusions stating, "Habitat degradation obviously is responsible for much of the impairment of this stream, but the low diversity and abundance of all animals suggests that toxic and organic pollution also may be important" (Banta, 1993). However, further monitoring is necessary to validate assumptions regarding pollutants.

Oxon Run's lack of well-defined bed features is due to the frequency of high stormwater flows, which mobilize the sediments that form these features. The associated bank erosion and channel widening exacerbates this habitat problem by decreasing average water depths. Stream bed and bank erosion, however, are not the only fish habitat problems in Oxon Run. Fish are prevented from entering the upper reaches of Oxon Run, in the District and beyond, because of a concrete drop structure built by the Army Corps of Engineers for flood control in the Forest Heights neighborhood. These flood control devices are located just outside the District border, in Prince George's County, Maryland. Upstream WASA sewer crossings, where the stream bed has down cut exposing the infrastructure, also create fish barriers. In addition the nearly two mile long concrete lined trapezoidal channel in the District portion of Oxon Run offers virtually no aquatic habitat and further degrades downstream habitat. Aquatic habitat and bed features are virtually non-existent throughout this entire two mile long stretch of concrete channel. The investigators noted elevated water temperatures on the downstream end of the concrete channel. Elevated temperature is a result of degraded riparian buffers and the accumulation of heat, from solar energy, in the concrete channel itself. Bank erosion and other effects of high intensity storm flows are also most severe on the downstream end of the trapezoidal channel.

1.8. Tributaries

The Oxon Run watershed contains a number of subwatersheds. These subwatersheds are primarily located in Prince George's County. Though outside of District jurisdiction, the USFWS did conduct basic assessments of these tributaries during their Oxon Run watershed assessment (2003). Summaries of these findings are provided below:

Suitland Parkway Tributary

The USFWS traced the headwaters of the "Suitland Parkway Tributary" to an outfall that drains the Suitland Federal Center. Throughout its 9,128 ft. length, the tributary exhibits a diversity of reaches, including a gabion-lined reach, a natural channel reach, and a "restored" reach that contains boulder grade control features, fiber mats, willow stakes, and riprap. Overall, USFWS designated the Suitland Parkway Tributary a C4 stream type, with some evidence of bank erosion.

Barnaby Run

Barnaby Run connects Oxon Run to two perennial tributaries, which are unofficially named Glasmanor Tributary and Owens Road Tributary. With a subwatershed covering approximately 40 percent of Oxon Run's total watershed area (mostly in Prince George's County), Barnaby Run is Oxon Run's largest tributary. While assessing Barnaby Run's upper, natural channel sections, USFWS documented areas of instability, lateral migration, 12-20 ft. high banks, high sediment supply, and a sanitary sewer break. In the vicinity of the District Maryland border, Barnaby Run parallels Southern Avenue in a pipe, and further downstream in an open concrete channel. After crossing Route 210, and before meeting Oxon Run, Barnaby Run enters a channelized, natural stream bed that features some concrete block revetments. USFWS characterized this reach as an unstable F4 stream type, with very high sediment supply and poor recovery potential.

Barnaby Run During a rain event

Glassmanor Tributary

Glassmanor's headwaters originate from a stormwater pipe behind Roscroft Village Circle, and from a sub-tributary at the end of Alice Avenue. USFWS found both headwater segments to be sites of active headcutting and high sediment supply. The main stem of Glassmanor is also unstable despite its wide (75-500 ft.) riparian buffer. From Kennebec Street downstream to Glassmanor's confluence with Barnaby Run, the channel is concrete-lined.

Owens Road Tributary

The upstream reaches of the Owens Road tributary, just below the intersection of Woodland Boulevard and Boulder Drive, are either piped or concrete-lined. Although the tributary features a natural stream bed throughout the remainder of its length, it was concluded that the stream has mostly converted, via head cutting, from a stable C4 type to an unstable F4 type. Most of the remaining C4 reaches are being sustained by utility crossings, which currently provide grade control.

Forest Heights Tributary

The Forest Heights Tributary is the final tributary to join Oxon Run before it empties into Oxon Cove. Unofficially named after its surrounding neighborhood, the tributary runs along

Livingston Road for much its 10,057-foot length. USFWS classified the Forest Heights Tributary's non-piped/concrete-lined reaches as unstable F4 channels with poor recovery potential. A concrete drop structure, part of USACE's Forest Heights flood control project, is located in the Forest Heights Tributary, just before its confluence with Oxon Run. A larger drop structure, also part of this project, is located in Oxon Run, just upstream of this confluence.

2. CURRENT AND PROPOSED MANAGEMENT MEASURES

General Management Measures

General management measures are tasks that are taking place throughout the watershed. These measures are generally non-structural best management practices (BMPs), which seek to reduce pollutants before they enter Oxon Run. Non-structural BMPS include legal regulation, construction plan review and regulation, public education, illicit discharge detection and enforcement, and the management of the District's solid waste through street sweeping, trash collection, catch basin cleaning, and floatable reduction as primary means to control pollutants. General management measures also include programs to encourage the installation of structural BMPs through voluntary measures on private lands.

Plan review activities for new construction and redevelopment, public education, and demonstration of technologies for abating non-point sources of pollution are funded by the Environmental Protection Agency non-point source management grant and Chesapeake Bay grant. DDOE also coordinates pollution abatement activities through the Stormwater Management Division. The Stormwater Management Division is an office within the DDOE Office of Natural Resources and administers the District's MS4 permit. The city has imposed an impervious rate fee to offset the cost of compliance with the NPDES MS4 permit and ultimately to protect and restore the District's waterways. The fee is collected by WASA, but the rate for the impervious surface fee and the fund (known as the Stormwater Enterprise Fund) are administered by DDOE Stormwater Management Division. Although DDOE is the lead agency for administering the stormwater permit several agencies are also responsible for meeting permit obligations. These agencies are named in the DC Comprehensive Stormwater management Enhancement Amendment Act of 2008 and include: WASA, District Department of Public Works, District Department of Transportation and Office of Planning. Funds and technical resources are shared among these agencies via intra District Memorandums of Understanding. The Act mandates that a Stormwater Advisory Panel, composed of agency heads, meet twice a year to coordinate MS4 related activities. In addition, a MS4 task force, comprised of lower level managers, meets monthly to coordinate efforts.

2.1. Pollution Prevention Plans

Pollution Prevention Plans (P3) are low-cost, effective tools for reducing organics and metals into Oxon Run. DC Village, a large municipal multi agency facility located in the south east corner of the Oxon Run Watershed, is an important example of a facility that is administered by the District government within this watershed. As a part of the District's MS4 permit, the permit stakeholder agencies are developing P3s for each facility under their control. These plans detail procedures to avoid the accidental spill of hazardous materials and provide guidance on how to properly clean up a spill should one occur. The Department of Public Works has completed their P3 and many other agencies are currently in the process of inventorying their facilities and current practices so that they can update and/or create P3s. DDOE is offering technical assistance and quality assurance for the agencies.

DC Village is a municipally owned site in the south eastern corner of the DC portion of the Oxon Run watershed. The site used to house a large public hospital long since closed and is still utilized for temporary emergency housing for homeless families. Multiple agencies, however, utilize this sprawling site. Two of the most important agencies are DC Department of Real-estate Services, the branch of government charged with managing all municipally owned properties, and Department of Public Works. This site has no visible signs of pollution prevention, despite the industrial uses of the facilities. DPW asserts that this site is serviced by blue Plains Municipal Waste Water Treatment Facility. DPW has an impoundment lot with no visible pollution prevention measures, poor housekeeping practices, and loose aggregate ground cover that does not prevent motor oil and other contaminants from polluting soil. Pavement tailings are also stockpiled on the site, as are discarded District vehicles. Finally, industrial chemicals are haphazardly stored throughout the facility. This site is need of an overhaul. DDOE inspectors should coordinate with counterparts in EPA and sister agencies within District government to ensure that improperly stored chemicals are removes, vehicles are properly disposed of or stored, and that Best Management Practices are immediately instituted.

2.2. Catch Basin Cleaning

Catch basin cleaning is a significant BMP to remove pollutants from the MS4 before they are flushed into receiving waters. Catch basin cleaning has proven to be one of the most cost effective methods to capture and remove gross pollutants in urban areas.

Catch basin sumps such as those used in the District trap substantial quantities of debris, sediment, and particulate pollutants. Catch basins with a baffle or siphon attached to the outlet can also trap significant amounts of floatable debris and oil and grease. Either mechanical equipment or a vacuum truck is used to remove sediment and pollutants on a regular schedule. WASA seeks to clean each of the District's 25,000 catch basins once every six to twelve months through annual clean outs and in response to public comments.

More efficient and frequent cleaning of the catch basins will remove solids and pollutants, and prevent overfilling of the sumps and subsequent washout to receiving waters. Improved catch basin containment and removal of pollutants near the source will be a major benefit toward TMDL compliance. Primary pollutants of concern removed during catch basin cleaning are nutrients, BOD, TSS, metals and other pollutants adsorbed to particulate matter, and oil and grease in catch basins with a baffle or siphon device.

Between 2007 and 2009 WASA performed a pilot project to document the gross amount of pollutants removed during catch basin cleaning and to optimize the frequency of catch basin cleaning to maximize the removal of pollutants of concern. Based on the evaluation of the pilot program, including a cost-benefit analysis, the recommended cleaning methods and frequency will be expanded into the Oxon Run MS4 area.

2.3. Street Sweeping

Street sweeping has also been identified as one of the most cost-effective methods of removing particulate debris from streets and roadways. Street sweeping with high efficiency sweepers that are able to collect particulate and fine material are especially effective for removal of TSS and other pollutants, such as metals that are commonly attached or collocated with organic and particulate material.

Street sweeping removes particulate pollutants from District roadways before they are introduced to the MS4 by runoff events. It has been documented that the removal of fine particulate will also remove many pollutants including metals that are associated with particulates (Schueler and Holland, 2000).

Traditionally, street sweeping has focused on removal of litter, leaves, and other large, visible trash. The benefit of street sweeping for removal of pollutants of concern in the MS4 system is the collection and disposal of fine particulate matter that is hardly noticeable by visual inspection. Improved collection of the fine particulates in street sweeping activities is the focus of this component of the implementation plan.

Compared with traditional mechanical street sweepers, modern regenerative air and high efficiency vacuum assisted sweepers can remove up to 60 percent and 35 percent more TSS and nitrogen, respectively (Sutherland, 2004). Heavy metals (copper, lead, and zinc) are also removed more effectively. The use of vacuum assisted and/or regenerative air sweepers greatly increases the removal efficiency of the fine particulate matter and the particulate pollutants and pollutants that may bind to particulate matter.

The District Department of Public works currently cleans all streets several times a year. The mechanical street sweeping program currently operates from March to November. The District, through funding made available from the Stormwater Enterprise Fund, has already initiated a program to accelerate the purchase of high-efficiency street sweepers. This program will result in improved pollutant removal from street sweeping throughout the District and in the Oxon Run watershed. In addition, DPW has recently completed a study of all regularly scheduled and signed street sweeping routes. The results of this study suggest that through improved route efficiency, on existing signed routes, DPW can expand mechanical sweeping, so called environmental sweeping, to other parts of the District. For purposes of our load reduction model we consider various street sweeping scenarios for total area of streets in the MS4 areas of Oxon Run.

2.4. Public Roads and Alleyways

The District Department of Transportation (DDOT) is responsible for maintaining streets, roads, alleyways and sidewalks in the city. DDOT has begun to adopt the use of Low Impact Development (LID) strategies to control stormwater and stormwater pollution. The city is currently demonstrating many types of LID including:

- Infiltration tree box planters – tree boxes that accept runoff from sidewalks and roadways to treat the stormwater and provide water for the trees.
- Silva Cells, structural soils, and other tree root expansion techniques – These tools help expand the space available for the growth of tree roots which allows for a larger and healthier tree and the greater potential for the uptake of stormwater and stormwater pollutants.
- Bioretention – This can take the form of standard bioretention cells or bump outs into the street that are generally placed near intersections. These bump outs provide a safer crossing area for pedestrians by reducing the street area that they have to cross; they slow traffic by narrowing the road; and they accept runoff and treat stormwater pollution.
- Permeable pavements – Permeable pavements take many forms including paving stones, porous concrete, and porous asphalt. The District is testing different permeable pavements in different applications such as alleyways, sidewalks, and roadways to determine which are appropriate and cost effective.

DDOT is also working to reduce pollutants to the city's waterways by encouraging commuters to use alternative forms of transportation. DDOT is expanding the number of bike lanes in the city, installing bike-share racks, creating trolley and high speed bus lanes, and operating lower polluting hybrid and natural gas powered busses for its "Circulator" routes.

For purposes of our load reduction model we propose that the public right of way will be retrofitted with LID at a rate consistent with the "aggressive" assumptions of Green Build-Out Model (GBOM) – a model of the potential LID practices to control stormwater in the District of Columbia that was funded by the EPA and created by LimnoTech. The GBOM "aggressive" model assumes that 50 percent of all potential sites will have bump outs installed and 10 percent will install infiltration tree boxes.

2.5. Catch Basin Inserts and Screens and Water Quality Catch Basins

Catch basin inserts are devices designed to remove oil and grease, trash, debris, and sediment can improve the efficiency of catch basins. Some inserts are designed to drop directly into existing catch basins, while others may require retrofit construction. Catch basin inlet screens are placed at the mouth of a catch basin and are effective at collecting trash and debris, but less effective at removing oil, grease and sediment. DDOE in partnership with the Department of Public Works and Department of Transportation is currently piloting the use of catch basin inserts and screens to reduce trash and pollutant loads to our local waterways.

Water quality catch basins are three-chambered catch basins specifically designed to reduce trash, collect sediment and trap oil, grease, and other metals and organics. The District Water and Sewer Authority and the District Department of Transportation currently retrofit existing catch basins with water quality catch basins whenever major road or sewer work is undertaken.

2.6. Leaf Collection

DPW conducts curbside vacuum collection of leaves from residences in the District. Residents are mailed a flyer prior to leaf collection, and DPW leaf vacuum trucks make a minimum of two passes per year on each District street. The collection of leaf litter helps keep catch basins from clogging which allows them to work efficiently to remove solids and pollutants. Leaf litter collection also collects some pollutants. Primary pollutants of concern removed during leaf collection are nutrients, TSS, metals and other pollutants sorbed to particulate matter. Due to lack of reduction information, leaf collection was not modeled for load reductions.

2.7. RiverSmart Homes Program

Over the past three years DDOE has slowly developed and matured an LID retrofit program aimed at single family homes. The program started with eight demonstration sites – one in each Ward of the city. It then expanded to a pilot program in the Pope Branch watershed of the city. The program is now open city-wide.

Volunteers plant a raingarden with native plants at a Riversmart Homes demonstration site

Through this program, DDOE performs audits of homeowner's properties and provides feedback to the homeowners on what LID technologies can be safely installed on the property. The city also offers up to $1,600 to the homeowner to help cover the cost of installation of any LID the homeowner chooses. Currently the program offers five different landscaping items including shade trees, native landscaping to replace grass, rain gardens, rain barrels and permeable pavement.

The District has recognized the importance of targeting homeowners for pollution reduction measures because the residential property is the largest single land use in the city and is the slowest of all construction areas to be redeveloped, and hence fall under new and stricter stormwater regulations. (See Appendix B for Educational materials)

2.8. Rain Leader Disconnect Program

Under old construction codes in the District, new or reconstructed houses were required to connect the rain leaders from rooftop drainage to the Combined Sewer System (CSS) or into the street, which then drains to local waterways. The District has revised the District's Construction Codes Supplement to encourage downspout disconnection where feasible and infiltrate runoff before it enters the storm sewer system. Furthermore the city has revised its codes to allow this work to be done by anyone – not just licensed plumbers as was previously required.

DDOE has begun a pilot program to encourage downspout disconnection by a) paying homeowners to do the work themselves and/or b) paying non-profit organizations to disconnect the downspouts of interested property owners. This pilot program is based on a highly successful downspout disconnection incentive program by the city of Portland, Oregon. Rain leader disconnection has been shown to be one of the most cost effective methods for reducing stormwater thereby reducing pollutants such as metals and organics that are commonly attached or collocated particulate material. Based on the success of the pilot project, DDOE may expand this project to the Oxon Run Watershed.

2.9. Green Roof Retrofit Program

For the last three years the District has offered a rebate for installation of a new green roof or the retrofit of an existing roof. This program, offered through DDOE, provides $5 a square foot for the installation of a green roof on a new structure or existing roof less that 2,000 square feet in size (up to $20,000) and $7 a square foot for the retrofit of a green roof on older roofs over 2,000 square feet in size (no maximum dollar limit).

Additionally the city has been aggressively retrofitting their existing rooftops with green roofs and installing vegetated roofs on new city-owned buildings. As a result of this push, Washington, DC is second only to Chicago in the square footage of green roofs installed. We envision that the city will continue this trend and we have adopted the assumptions of the "aggressive" GBOM model for our long term pollutant load reduction. GBOM calls for green roofs on 50 percent of rooftops with over 2,000 square feet to have green roofs.

2.10. Permeable Pavement

As noted earlier, the District is testing different permeable pavements to determine which are appropriate and cost effective for the public right of way. In addition to the use of permeable pavement in roads, alleys, and sidewalks, this technology has promise in commercial parking lot applications. Our model adopts the "aggressive" assumptions proposed in the Green Build Out Model of a 90 percent adoption rate for this technology in parking lots. We predict a high rate of acceptance for this land use partly because of the new storm water fee that has gone into effect in the last year. Previously parking lots did not pay a stormwater fee because the fee was assessed as a part of water use. Now the stormwater fee has been tied to impervious cover – something that greatly impacts parking lots. In the coming year property owners that undertake retrofits to reduce impervious surfaces will be able to reduce their stormwater fee by up to 50 percent.

2.11. Education of Public on Pet Wastes/Enforcement of Pet Waste Regulations

DDOE has developed educational materials such as fliers and videos that inform citizens of their legal obligations to manage pet waste, proper application and disposal of fertilizers, and the use of landscaping to control storm water runoff. These materials are regularly distributed at public events such as community meetings, Earth Day celebrations, and community cleanup days. Furthermore this information is distributed door to door in communities where storm drain marking is taking place. Finally this information is available on the DDOE website.

The District has also begun installing dog parks in communities throughout the city. These dog parks are placed and designed to reduce the impact of pets on the environment while allowing dogs to play and exercise. Dog parks reduce TSS, nitrogen, phosphorous, and harmful bacteria flowing to Oxon Run through their design and by the concentrating the impact of dogs in one area, bags for the collections of dog waste are also provided. Finally dog parks increase the compliance with pet waste regulations through peer pressure from other dog owners. There is limited space for Dog Parks in the Oxon Run watershed, but DDOE should coordinate with the Department of Parks and Recreation to locate appropriate locations for dog parks in the watershed. Dog parks should not be located in Oxon Run Park because it is directly adjacent to the stream.

Example of a bag dispenser for pet waste pickup and disposal.

DDOE must also do a better job of outreach on this issue to communities in Oxon Run. Outreach should be done in two phases. The first phase should determine where in the watershed the need is the greatest for additional outreach. This will be done as part of the process for gathering public feedback for this report. Initial outreach should also include distributing literature too, and informational tabling events at, community centers, senior centers, recreation centers, and large apartment buildings. The second phase of this program can take information gathered during the first phase and help determine good locations for dog parks, and Mutt Mitt dispensers so that it is easy for dog owners to do the right thing and "scoop the poop."

Although education is important, enforcement of existing laws can be a stronger tool for reducing pet borne fecal coliform. Currently enforcement of pet waste and leash laws has been lax. DDOE will work with law enforcement agencies to step up enforcement efforts.

2.12. Household Hazardous Waste Collection and Disposal

In the past, the District promoted the collection and disposal of household hazardous waste through twice annual collection days when residents may bring hazardous wastes for proper disposal. In the past year, DPW stepped up the household hazardous waste program and now residents can drop their hazardous wastes off at the Fort Totten waste transfer station any Saturday. This program is funded through the Stormwater Enterprise Fund. The frequent and convenient collection of household hazardous waste is a low-cost and effective way to reduce organics and metals into Oxon Run.

Unfortunately Fort Totten is a long drive from Oxon Run neighborhoods and a secondary location that was closer was recently closed due to budget cuts. The Department of Public Works should sponsor a day or two a month when District residents in this part of the city can come and drop off house hold hazardous waste at a convenient location close to their homes. The collection of household hazardous waste was not modeled for pollutant load reductions, although it likely does help to reduce organic and metals pollution.

2.13. Integrated Pest Management and Nutrient Management

DDOE has developed an education and outreach program on Integrated Pest Management (IPM) and Nutrient Management. (See Appendix B for educational handouts) The purpose of the program is to better inform the public on the proper use and disposal of common house hold pesticides and on the use of safer alternatives. The program provides education and outreach activities designed to property owners and managers about environmentally sound practices with regard to the use of pesticides in the yard or garden and the introduction of "good" pests into the landscape. Through DDOE's Nutrient Management Program, the property owners receive education regarding the proper amount of fertilizer to use on a lawn. In addition to fertilizer use, this program addresses the proper way to mow, use of mulch, and the effects of applying too much mulch.

This management area focuses on the control of storm water pollutants originating from the use of pesticides, herbicides, and fertilizers within the District. Emphasis is placed on educational and training programs provided for both District property managers and private residents.

Furthermore the DDOE Pesticide Management Program trains commercial applicators in the legal and safe appliance of pesticides and herbicides. Commercial applicators must receive a certification through the program to legally apply pesticides and herbicides in the District. A part of this program involves the use of IPM.

The District Department of Real Estate Services, the District Agency that manages all District owned office buildings, has committed to utilize IPM and nutrient management on their properties and other District and Federal agencies are exploring similar efforts.

2.14. Tree Planting

The District of Columbia has been called "The City of Trees." It has a tree canopy cover of 35 percent, which is high for a dense urban environment. The Urban Forestry Administration (UFA) maintains the city's street trees pruning and planting to manage trees in a harsh environment of power and sewer lines, impervious surfaces, road salt, and punishing summer heat. UFA plants an average of 4,150 trees annually, maintains the thousands of existing city trees, and works to improve growing conditions for street trees by removing unneeded impervious areas, experimenting with new tree box technology such as structural soils and Silva cells, and watering trees and pruning trees.

In addition, DDOE with help from non-profit partners such as Casey Trees and Washington Parks and People help plant trees on private, federal, and other District lands. Casey Trees, a non-profit dedicated solely to expanding and caring for the District's tree canopy is an especially important partner. Casey runs community tree planting programs, a tree rebate program, and plants trees for RiverSmart Homes. Additionally Casey leads classes in the identification and care of trees and performs monitoring and modeling of canopy cover.

In 2009 the District committed to expand its canopy cover over the next 30 years. For the purposes of this WIP, we have adopted the assumptions of the "aggressive" GBOM model for our long term pollutant load reduction.

2.15. Erosion and Sediment Control

Erosion and Sediment Control programs, which are funded by an EPA grant from the Chesapeake Bay Program, come in two forms – strict regulations and inspection and enforcement. The District already has strong erosion and sediment control regulations in place – requiring that any land disturbance over 50 square feet apply for an erosion and sediment control permit. In comparison, local other jurisdictions require these permits be filed when more than 5,000 square feet of soil are disturbed. Furthermore, DDOE has published the District of Columbia Soil Erosion and Sediment Control Standards and Specifications and the DC Storm Water Management Guidebook. These documents are used by DDOE in the plan review process for new construction.

Federal facilities within the District are required to comply with District regulations under the Soil Erosion and Sediment Control Act. The US General Services Administration (GSA) and

Investigators traced sediment that was discharging into Oxon Run to a construction site in the watershed

DDOE signed a consent agreement in fiscal year (FY) 2000 that requires work under contracts through GSA to comply with the same sediment and erosion control requirements as commercial, residential, and industrial operations in the District. In the same year, DDOT and WASA signed agreements, in an MOU between District agencies, requiring their contractors to comply with the same sediment and erosion control requirements as commercial, residential, and industrial operations in the District.

The District also has a strong Inspection and Enforcement branch that inspects construction sites throughout the District to make sure they are incompliance with District regulations. The need for expanded inspection and enforcement will be continually evaluated. DDOE also regularly inspects existing stormwater management facilities to ensure that they are in proper working order. These measures are especially important in the Oxon Run Watershed were significant redevelopment of old and dilapidated housing stock is still under way.

2.16. Illicit Discharge and Industrial Facility Inspection and Enforcement

The District has already evaluated and expanded inspection and enforcement activities industrial facilities. The District will continue to evaluate and expand other inspection and enforcement activities to ensure compliance with District regulations and to minimize pollutant discharges to the Oxon Run watershed from these sources. The District is currently revising the MS4 outfall maps so that inspectors know exactly what land area drains to a particular outfall. Outfalls are classified as high, medium and low priority and are inspected on an annual, biannual or five year basis, respectively, for dry weather flow and conducting field evaluation of any flows observed. Inspectors record water temperature, pH, dissolved oxygen, and conductivity at each outfall.

The expanded inspection program will result in the identification of a number of sites or facilities that are sources of pollution to the MS4 program. Owners of the sites or facilities will be required voluntarily or through enforcement actions to correct these sources of pollution. After a source of pollution is corrected, there is no further cost, and with the pollutant source removed, the benefit is continuous and cumulative each year. Removing polluting sources can collectively represent significant progress toward TMDL compliance.

Inspectors routinely visit auto service shops, dry cleaners, and car washes in the District to ensure compliance with Water Pollution Control Act regulations. Witnessing Water Pollution Control Act violations during an inspection, however, is rare. For this reason, education and outreach is an important component of this program. Inspectors work closely with these businesses to develop better housekeeping practices and ensure compliance with existing regulations. (See Appendix B for educational materials)

Improperly stored chemicals at an auto repair shop in the Oxon Run watershed

The District's illicit discharge elimination program will be evaluated to identify potential improvements using the Center for Watershed Protection Guidance Manual for Illicit Discharge Detection and Elimination. This manual considers eight major components for developing an effective illicit discharge detection and elimination program. The eight major components are:

1. Audit existing city resources and programs
2. Establish responsibility, authority, and tracking
3. Complete a desktop assessment of illicit discharge
4. Develop program goals and implement strategies
5. Search for illicit discharge problems in the field
6. Isolate and correct discharges
7. Prevent illicit discharges
8. Evaluate the program

After completing the evaluation of the illicit discharge elimination program, resources will be directed toward increased inspection and enforcement activities as necessary to reduce pollutant loading and towards compliance with the WLA in the TMDL documents.

2.17. Coal Tar Ban

Oxon Run has a listed TMDL for several types of organic chemicals including three classes of polycyclic aromatic hydrocarbons (PAHs) with a total reduction of 98 percent required for all three classes. One major source of PAHs throughout the Oxon Run watershed are coal-tar based pavement sealants. Coal-tar based pavement sealants have PAH concentrations that are 1,000 times greater than alternative asphalt-based sealants. Coal-tar sealants are applied to asphalt and pavement surfaces ostensibly to extend the life of that surface. The sealant, however, flakes off with ware and is washed away by stormwater or otherwise mobilized by winds.

To address this issue the DC Council passed Comprehensive Stormwater Enhancement Amendment Act of 2008 that bans the sale and use of coal-tar based sealants within the District of Columbia. DDOE has mailed informational fliers about the ban to all District business that may sell these products and local and regional contractors who may use it. DDOE is in the process of hiring a full time inspector to augment the enforcement staff and focus on the coal-tar ban.

2.18. Skip the Bag Save the River

Although Oxon Run does not have a TMDL for trash, trash is an issue in Oxon Run. One major component of trash in the stream is plastic bags. In an attempt to abate the amount of plastic bags reaching the District's waterways the District Council passed the Anacostia River Clean Up and Protection Act of 2009 which levies a 5 cent fee on each disposable paper and plastic bag sold at any business that sells food. The retailer retains 1 cent for administration and transfers the remaining 4 cents the Anacostia Restoration Fund, which is administered by DDOE. These funds are meant to pay for restoration activities along the Anacostia and other impaired waterways in the District. Although the law has only been in effect since January 1, 2010, some businesses have reported over a 50 percent decline in the sale of disposable bags.

Plastic bags entrained on a moped in Oxon Run

3. PUBLIC OUTREACH AND EDUCATION

In addition to the management measures described in section two, which are a mix of enforcement and education activities, DDOE also has public outreach and education staff. The goals of the public outreach program are to mobilize the community and increase public awareness of storm water pollution issues and to stop or prevent pollution where it occurs. Public outreach may include education, training, and promotion of volunteer activities, as well as private and community projects to reduce pollutants of concern in Oxon Run. Projects include pet waste control, reduction of fertilizer and pesticide application, hotline reporting of dumping, proper use and care of trash receptacles and dumpsters, and pollution prevention through public awareness such as storm drain marking and school programs.

The major benefit of public outreach is to prevent pollutants from being discarded or deposited to the ground and entering Rock Creek. By educating the public on methods to reduce the generation of pollutants, public participation can reduce the quantity of oil and grease, bacteria, BOD, pesticides, fertilizers, and other pollutants introduced into the MS4. Public outreach is a major component of the District's efforts to control the source of pollutants towards compliance with the TMDL for Rock Creek.

The District's public education efforts entail a mixture of programs emphasizing the city web sites, education and outreach activities, household hazardous waste collection events, the pesticide, fertilizer and pet waste programs, industrial and construction site operator's programs, and cooperative programs with other agencies. Many of these programs are both pollution control activities and public outreach opportunities.

Furthermore DDOE has developed several outreach programs targeted to teachers, environmental educators and students throughout the District. These programs are:

- **Environmental Education Resource Center** – This center provides resources and materials that teachers and other environmental educators may use to enhance the classroom curriculum and implement conservation projects.
- **Conservation Education (Project Learning, Project Water Education for Teachers, Project WILD)** – These internationally recognized programs are utilized to train educators in innovative techniques for exploring a wide range of environmental concepts with students and teaching critical thinking skills that lead to environmental stewardship (grades K-12).
- **Teacher Training Workshops** – These workshops assist teachers in meeting their teaching and learning standards while helping students develop environmental ethics and responsible stewardship.
- **RiverSmart Schools** – RiverSmart schools works with applicant schools to install Low Impact Development (LID) practices to control stormwater. These practices are specially designed to be functional as well as educational in order to fit with the school environment. Additionally schools that take part in the RiverSmart Schools program receive teacher and site manager training on how to use the sites to teach to curriculum standards and how to properly maintain the site.
- **The District of Columbia Environmental Education Consortium** – DDOE helps to organize a network of environmental educators throughout the city so that ideas and resources can be shared among them. DCEEC provides opportunities for networking, event coordination and program partnering among its members. They also facilitate professional development and educational opportunities that support required learning standards. The members provide environmental expertise, professional development opportunities, curricula and resources, and hands-on classroom and field studies to District schools.
- **Aquatic Resources Education Center (AREC)** - Located in Anacostia Park, AREC has a variety of live exhibits of fish and other aquatic species from local rivers and surrounding environment. This unique partnership between the National Park Service, the Fish and Wildlife Service and DDOE affords school groups, teachers, and District Residents to learn about the Aquatic Resources in the District. Stewardship of natural resources is a key component of the AREC curriculum.

DDOE also performs outreach to industrial and construction facilities through workshops, brochures, and site inspections. DDOE personnel use inspections to promote awareness of the proper methods of facility maintenance for stormwater regulation compliance. To aid facilities in ensuring proper maintenance of storm water management facilities, DDOE has established and published guidelines for their proper maintenance.

Table 5: Summary of Education and Outreach Materials (also see Appendix B)

Education and Outreach Materials	Audience	Dissemination Method
Automotive Guidelines Poster	Shop Owners and Workers	DDOE Inspectors Deliver Posters & Internet
Automotive Repair Brochure	Shop Owners and Workers	DDOE Inspectors Deliver Posters & Internet
BayScaping Fact Sheet	District Residents	Inspectors Deliver to Residents During Stormwater Audit & Internet
Care Sheet for Rain Barrels	District Residents	District Residents Who Have This Feature Installed On Their Property Will Get Mailed This Information & Internet
Down Spout Disconnection Fact Sheet	District Residents	Inspectors Deliver to Residents During Stormwater Audit & Internet
Fertilizer Fact Sheet	District Residents	Inspectors Deliver to Residents During Stormwater Audit & Internet
Integrated Pest Management Fact Sheet	District Residents	Inspectors Deliver to Residents During Stormwater Audit & Internet
Pervious Pavers Fact Sheet	District Residents	Inspectors Deliver to Residents During Stormwater Audit & Internet
Rain Barrel Fact Sheet	District Residents	Inspectors Deliver to Residents During Stormwater Audit & Internet
Rain Garden and BayScaping Care Sheet	District Residents	District Residents Who Have This Feature Installed On Their Property Will Get Mailed This Information & Internet

Education and Outreach Materials	Audience	Dissemination Method
Rain Garden Fact Sheet	District Residents	Inspectors Deliver to Residents During Stormwater Audit & Internet
RiverSmart Homes Overview	District Residents	Inspectors Deliver to Residents During Stormwater Audit & Internet
Shade Tree Fact Sheet	District Residents	Inspectors Deliver to Residents During Stormwater Audit & Internet
Shade Tree Care Sheet	District Residents	District Residents Who Have This Feature Installed On Their Property Will Get Mailed This Information & Internet
RiverSmart Homes Poster	DDOE Partner Organizations and District Residents	Displayed at Public Events
BMPs for Soil Erosion and Sediment Control	District Residents Living Near Development	Nonprofits and Community Groups
Stormwater Controls for Your Yard	District Residents	Nonprofits and Community Groups

4. LOAD REDUCTIONS

Oxon Run is listed on the District of Columbia's 1998 through draft 2004 Section 303(d) Lists of Impaired Waters. Oxon Run's TMDLs and associated documents can be viewed online at http://www.epa.gov/reg3wapd/tmdl/dc_tmdl/Oxon Run. Oxon Run is listed on the Section 303(d) list as impaired for fecal coliform, metals, and organics.

Reaching the necessary Total Maximum Daily Loads (TMDLs) end points for metals, bacteria, and organics for the Oxon Run watershed will require considerable pollutant source reductions. In an urbanized watershed like Oxon Run, the majority of these source reductions will take years, and come at a high cost. For example, a bacteria problem in a rural watershed may simply require BMP implementation on the part of a handful of cattle ranchers. However, the bacteria problem in Oxon Run is likely to involve the reconstruction of thousands of feet of sewer lines. Since most of the urban environment in the watershed has already been developed almost all the projects proposed will be retrofits to existing infrastructure, which is more costly than new construction

District of Columbia recognizes the environmental importance of these load reductions; however the District is also required by law to meet the TMDL standards. DDOE will work to implement the management measures outlined in this WIP to address the impaired status of Oxon Run and the watershed's pollution sources. The expected load reductions that can be achieved by implementing the projects presented in this document are outlined in the following sections. Discussions of nutrient reduction, in accordance with Chesapeake Bay Agreement and TMDL commitments, are also included. Further data and calculations can be found in Appendices D, E and F. Hopefully, as research involving water quality, LID, and stormwater BMP techniques progresses, the means for addressing these load reductions will become more feasible and apparent.

4.1. Methodology for Achieving Load Reductions

Reductions were calculated for metals, organics, and bacteria using the annual pounds removal per acre for each Best Management Practice, as reported in the **Rock Creek Watershed Total Maximum Daily Load Allocation Implementation Plan** written in August 2005 by the District of Columbia Stormwater Administration. The TMDL loads in the District portion of Oxon Run watershed are assigned to the MS4 portion of the watershed. (DOH, TMDL 2004) In the District rain events ≤ 1 inch represent 90 percent of all storm events. These smaller rain events, typically, only generate runoff from impervious surfaces and transport with them the first flush of contaminants. Paved surfaces, e.g. roads and parking lots, due to vehicular traffic, application of pavement sealants, atmospheric deposition, etc., will hold the bulk of listed contaminants. Small rain events will generate a first-flush of these contaminants into the MS4 and ultimately the receiving water, in this case Oxon Run. Due to the contaminated runoff generated by impervious surfaces load reductions were calculated for just for total impervious surface in the District portion of the Oxon Run watershed.

Pollutant load reductions will be achieved by augmenting or enhancing existing best management practices or implementing new stormwater management projects or programs, e.g. Low Impact Development (LID), pollution prevention, reforestation, remediation of illegal dumping sites, increased enforcement, sanitary sewer repair, stream restoration, and improved environmental education and outreach activities.

Nearly 170 retrofit opportunities were identified by DDOE investigators for LID, regenerative stormwater conveyance, and constructed wetland projects throughout the District portion of the Oxon Run watershed. The total treatment area of these sites is 287 acres or 11 percent of the watershed. The list of projects along with a short description and photographs of each site can be found in Appendix C.

The load reductions were first calculated using the identified projects.   Collectively, the identified projects reach percent reductions between 0.2 and 22 percent, short of the targeted load reductions stipulated in the TMDL report.

Reduction tables were developed for each management practice for organic and metal constituents. The reduction tables list removals that will be expected for each pollutant and each Best Management Practice when treating incrementally larger portions of the watershed, from 10 percent to 100 percent. The management practices (bioretention, extended detention shallow wetland, porous pavement, tree boxes, and vacuum sweeping) were chosen for their cost benefit, ease of implementation, and environmental benefit. The reduction tables found in Appendix D report the pounds and percent change of pollutant reductions one can expect to achieve by using a particular management practice for a given area of the watershed. These tables were then used to determine the optimal mix of stormwater and other pollution management practices that could be employed to reach reduction goals for metals and organics.

Removal efficiencies and pound removal per treatment acre for each management practices were obtained from the Rock Creek Watershed Total Maximum Daily Load Waste Load Allocation Plan report written in August 2005 by the District of Columbia Stormwater Administration within the DC Department of Health.

Oxon Run watershed is not listed as impaired for nutrients or sediment. Because the proposed stormwater volume controls will likely result in reductions in these pollutant loads as well, reductions were calculated for the identified projects in Appendix C to illustrate that the work in Oxon Run will have much larger quality benefits than just reductions in pollutants listed in the TMDL. The reductions were calculated using the Simple Method. The Simple Method estimates stormwater runoff pollutant loads for urban areas. The technique requires inputs of subwatershed drainage area, impervious cover, stormwater runoff pollutant concentrations, and annual precipitation. Land use was broken up into residential, commercial, industrial, and roadway and annual pollutant loads were calculated for each type of land. The nutrient reductions can be found in sections 4.5-4.7.

4.2. Metals

Although metals originate from natural sources, such as minerals in rock, vegetation, sand, and salt, urban nonpoint sources are primarily responsible for Oxon Run's elevated levels. Man-made sources of this pollutant include exhaust from engines, worn automotive parts such as tires and brake linings, rust, and weathered paint. Particles from these sources deposit on roads and other impervious surfaces, and are eventually transported to streams during storm events via the storm sewer system and overland flow. Once transported, metals have a tendency to persist in aquatic environments as they readily adsorb to sediment particles. It should be noted, however, that free flowing Oxon Run with a significant portion of the channel lined with concrete, bears little resemblance to the Anacostia River, on which the TMDLs for Oxon Run are based. Monitoring is required to determine which metals, if any, impact Oxon

Run. There is no monitoring data for total metals available for Oxon Run. Metals, if present, do pose a toxicity threat to fish and other aquatic life, as well as to humans.

Metals criteria are specified in §1104 of the DC Municipal Regulations (DDOE, 2003). Based on these regulations and Oxon Run water quality sampling data, zinc, lead, copper, and arsenic were identified as pollutants of concern in Oxon Run. Oxon Run's TMDLs represent the sum of an allocated point source load (WLA), an allocated nonpoint source load (LA), and a 1 percent margin of safety (MOS), as expressed in the following equation:

$$TMDL = WLA + LA + MOS$$

Load allocations and existing loads are modeled annual averages based on average concentrations measured in stormwater and stream base flow monitoring data. The District's approved TMDLs for metals can be seen in Table 10, while Maryland's allocations and reductions can be seen in Table 11. Loads are allocated to both Maryland and the District based on the proportion of Oxon Run watershed area found in each jurisdiction, although Maryland allocations are seen as a single load. Percent reductions needed for TMDL compliance are also provided.

4.2.1. Metals Reductions

Required load reductions for Oxon Run from EPA's 303(d) list for Arsenic, Copper, Lead, and Zinc can be found in Table 6.

Table 6: Oxon Run (DC), Average Annual Existing Metals Loads and TMDLs (lbs./year)

Metals Parameter	Existing Load (DC)	TMDL	WLA	LA	MOS (1%)	Percent Reduction
Arsenic (total)	6.3	2.0	0.02	1.8	0.2	68%
Copper (total)	237.4	76.0	0.8	67.8	7.4	68%
Lead (total)	115.4	25.4	0.3	22.7	2.4	78%
Zinc (total)	706.4	706.4	7.1	631.3	68.1	0%

Table 7: Oxon Run (MD), Existing Loads and Necessary Reductions (lbs./year)

Metals Parameter	Existing Load (MD)	Allocated Load	MOS (1%)	Percent Reduction
Arsenic (total)	16.54	5.29	0.05	68%
Copper (total)	610.95	195.50	1.96	68%
Lead (total)	294.95	64.89	0.65	78%
Zinc (total)	1812.28	1812.28	18.12	0%

As stated in section 4.2 metals reductions were calculated in two stages, first, using the sum of the treatment areas for the projects found in Appendix C and then the remain. The total impervious area treated with these projects is 31%.

The associated reductions achieved with the identified projects are found in Table 8. Reduction of zinc is the only target met, as the TMDL load allotment is equal to the existing load. For the remaining three metals, approximately 20% reduction was achieved, far short of the targets of 68% for arsenic and copper and 78% for lead.

Table 8: Load Reductions for Metals from Identified Retrofit Projects

	Area (acres)	% Total Impervious Area	Load Reduction (lbs/year)			
			Copper	Zinc	Arsenic	Lead
Bioretention	88.7	9.7%	24.0	62.3	0.4	10.6
Extended Detention Shallow Wetland	169.2	18.4%	32.0	52.5	0.6	16.9
Porous Pavement	8.5	.9%	2.21	5.7	0.4	1.1
Total Reduction			**58.2**	**120.5**	**1.4**	**28.6**
% Change			**-24.5%**	**-17.1%**	**-22.2%**	**-24.8%**

* These reduction values rest on the assumption that 100% of the metals loads are generated on impervious area.

To determine the area of treatment needed to meet the difference in load, metals reductions were calculated for increasing areas of the watershed for five management practices. The reduction charts indicate the area that would need to be treated to reach a particular load reduction for each management practice. The charts can be found in Appendix D; an example of the bioretention chart is found in Table 9.

Table 9: Example of Metals Reduction Chart for Bioretention

Area Treated		Bioretention							
		Copper		Zinc		Arsenic		Lead	
Acres	% Total Area	Load Reduction	% Change	Load Reduction	% Change	Load Reduction	% Change	Load Reduction	% Change
89	10%	24.0	-10.1	62.3	-8.8	0.4	-6.6	10.7	-9.3
184	20%	49.7	-20.9	128.8	-18.2	0.9	-13.7	22.1	-19.1
276	30%	74.5	-31.4	193.2	-27.3	1.3	-20.5	33.1	-28.7
368	40%	99.4	-41.9	257.6	-36.5	1.7	-27.3	44.2	-38.3
460	50%	124.2	-52.3	322.0	-45.6	2.2	-34.2	55.2	-47.8
551	60%	148.8	-62.7	385.7	-54.6	2.6	-40.9	66.1	-57.3
643	70%	173.6	-73.1	450.1	-63.7	3.0	-47.8	77.2	-66.9
735	80%	198.5	-83.6	514.5	-72.8	3.4	-54.6	88.2	-76.4
827	90%	223.3	-94.1	578.9	-82.0	3.9	-61.4	99.2	-86.0
919	100%	248.1	-104.5	643.3	-91.1	4.3	-68.3	110.3	-95.6

Knowing the area treated and the management practice, one can then use the reduction charts to determine that the load reductions. Using copper for an example, the reduction in loads due to the projects outlined in Appendix C will be 58.2 pounds per year (or approximately 24.5%) of the target reduction of161.4 pounds per year). A summary of reductions in copper loadings associated with the projects identified in Appendix C can be found in Table 10. Green roof reductions were not included assuming that the majority of metals loading would originate on roadways and only a negligible amount would be generated on the rooftops of buildings.

Table 10: Expected Copper Load Reductions from Identified Retrofit Projects

	Area (acres)	% Total Impervious Area	Load Reduction (lbs/year)
Bioretention	88.7	9.7	24.0
Extended Detention Shallow Wetland	169.2	18.4	32.0
Porous Pavement	8.5	0.9	2.21
		Total Reduction	58.2 lbs/year

The copper reduction of 24.5% does not achieve the target of 68% reduction. The reduction chart found in Table 9 and in Appendix D can then be utilized to determine the additional area of treatment needed to ultimately reach the reductions as stated in the TMDL. The blue highlighted numbers in Table 9 indicate the point at which the required reductions would be met using bioretention. To attain the target load for Copper, 70% of the roadway would need to be treated with bioretention.

It is not realistic to treat 70% of impervious area by bioretention alone. Implementation of a number of management practices will be necessary. The reduction charts for porous pavement, vacuum sweeping, tree boxes, and constructed shallow detention wetlands can then be used to determine the optimal mix of management practices to meet TMDL load allocations. As seen in Table 10, if the treatment areas for bioretention, extended detention shallow wetland, and porous pavement are kept constant, but the additional practices of vacuum sweeping and treatment of stormwater in tree boxes are adopted to each treat 30% of roadway and parking area, the copper reductions stated in the TMDL will be met. Monthly street sweeping of 276 acres of roadway and the capturing of stormwater in tree boxes from 276 acres will increase copper reduction from 54.1 lbs to 181.6 pounds, putting us well above the target reduction.

4.2.2. Metals Conclusion

The identified projects will achieve roughly one third of the target reductions, but a combination of projects can be arranged using the reduction charts to achieve the necessary reductions as stated in the TMDL. Copper was used as an example for illustrative purposes, but the reductions for the remaining metals constituents are calculated the suggested scenarios found in Section 3.8. The Suggested Scenarios section lists the recommended mix of pollution management practices that will reach TMDL goals and the load reductions associated with them.

4.3. Bacteria

The District of Columbia measures bacteria presence in its surface waters using fecal coliform as an indicator. Fecal coliform bacteria reside in the intestines of warm-blooded mammals, and are excreted in feces. Although fecal coliform is not necessarily a highly dangerous agent of disease, concentrations are roughly proportional to the amount of fecal matter dissolved in water, indicating the likely presence of other types of bacteria. In urban settings, such as Oxon Run, fecal coliform from humans enters streams via wastewater treatment discharges, CSO, and failed septic systems and sewer lines. There are no CSO outfalls in Oxon Run, and no septic systems in Oxon Run. Waste from pets and wildlife are also substantial sources.

District and Maryland sewers are likely the largest source of bacteria loading in Oxon Run. The District operates the only combined sewer system within the Anacostia watershed. The system's outfalls are located along the main stems of the Anacostia and Potomac Rivers, as well as Rock Creek. Although no CSO outfalls discharge directly into Oxon Run, the tidally influenced portion of the stream is still affected by CSO from these outfalls. It should be noted, however, that there is no tidal influence in the District portion of Oxon Run. Elevated fecal coliform levels in non-tidal Oxon Run are likely the result of sanitary sewer leakages. In their 2003 assessment of Oxon Run, USFWS noted that many of the sanitary pipes paralleling Oxon Run have been exposed as Oxon Run's channel has widened and incised. Severe breaks, as well as evidence of leaks were documented in 6 specific Maryland and District locations (USFWS, 2003). During the course of field work, investigators noted degraded sewer line infrastructure. In one location the top of a manhole cover had been shorn off by high flows exposing flowing raw sewage. Since this section of sanitary sewer is no longer supposed to be in operation it, was unclear where the sewer line was tied in. WASA and the DDOE Water Quality Divisions were notified and an investigation is ongoing.

Exposed sewer line infrastructure

In order for Oxon Run to achieve its bacteria TMDL, fecal coliform loads must be reduced by 90%, from both District and Maryland sources (DOH TMDL, 2004). The District's TMDL and allocations can be seen in Table 11, while Maryland's necessary reductions are listed in Table 13. District implementation of its TMDL almost completely depends upon WASA's ability to address its sanitary sewer leaks. Fortunately, WASA has launched a citywide sanitary sewer system investigation. The activities under this program aim to eliminate infiltration of sanitary sewage to the storm water system. In addition to this investigation, WASA is also conducting a citywide trunk sewer assessment. As part of this work, direct sanitary sewer leaks to Oxon Run will be identified and resolved. WASA has plans to reroute the upper Oxon Run trunk sewer and abandon much of the lower Oxon Run trunk sewer in the first mile of District's portion of Oxon Run. It is DDOE's hope that these commitments will ensure that Oxon Run will not be compromised by WASA utilities in the future.

Table 11: Oxon Run (DC), Average Annual Existing Bacteria Loads and TMDL (MPN/year)

Bacteria Parameter	Existing Load (DC)	TMDL	WLA	LA	MOS (1%)	Percent Reduction
Fecal Coliform	1.10E+15	1.10E+14	9.82E+13	1.03E+13	1.10E+12	90%

Table 12: Oxon Run (MD), Existing Bacteria Loads and Necessary Reductions (MPN/year)

Bacteria Parameter	Existing Load (MD)	Allocated Load	MOS (1%)	Percent Reduction
Fecal Coliform	7.87E+14	7.87E+13	7.87E+11	90%

4.3.1. Bacteria Reductions

Rather than attributing the load generated to impervious surface, the chief sources of bacteria were identified to be faulty sewer crossings, sewer main leakage, and pet waste. The bacteria reductions were calculated using the Simple Method. The Simple Method estimates stormwater runoff pollutant loads for urban areas. The technique requires inputs of subwatershed drainage area, impervious cover, stormwater runoff pollutant concentrations, and annual precipitation. Land use was broken up into residential, commercial, industrial, and roadway and annual pollutant loads were calculated for each type of land. Again, pollutant reductions were first calculated using just the treatment area of the 170 projects identified. Next, pollutant reductions were calculated for projects identified for community greening and stormwater management, namely the Green Build-Out model aggressive scenario for stormwater control, RiverSmart Homes implementation, and more frequent street sweeping.

4.3.2. Sanitary Sewer Main Repair

There are ten sanitary sewer crossings on Oxon Run, varying in diameter from 24” to 42”. After conducting a visual assessment of the sewer crossing infrastructure it was evident that the sanitary sewer pipes are the major contributor of bacteria in Oxon Run stream. While obvious sewer line breaches where not observed inspectors did locate, and report to WASA, open manhole covers in the stream with sewage running through them, it was unclear to the inspectors if this sewage was entering the stream. Inspectors also found sewer crossings that are in need of replacement, including one pipe that was no longer supported by the stream bed leaving the crossing totally free standing. We predict a load reduction of 90% for bacteria will be met by replacing and rerouting the ten sanitary sewer lines that intersect the stream; however additional opportunities for stormwater volume reduction, reforestation, pet waste pick-up educational programs, increased enforcement, enforcement and vacuum sweeping were identified and reductions calculated.

4.3.3. Bacteria Reductions through Identified Projects

Reducing the volumes of stormwater flow and improving tree canopy cover using the projects outlined in Appendices C will only achieve a small fraction of the desired reduction loads. As seen in Table 15, the projects will achieve a reduction of 10%. Target loads are 90%. Bacteria reductions for green roofs were not calculated because given the sources of bacteria; it was assumed that they would remove a negligible amount of bacteria.

A reduction tables were utilized to create a recommended scenario for removal of metal and organic pollutants. This scenario, called Scenario 2, is outlined in Table 21 within section 4.5

Reduction Scenarios.   The result will be a reduction of 6.4E14 MPN/year, or 66% of total reductions needed.   Through extensive field data, a major source of bacteria has been traced back to the ten sewer crossings that traverse the stream bed. Many of these sewer lines are faulty and badly in need of repair. It is assumed that the repair and rerouting of these sewer lines will result in the final 24% reduction needed.

Table 13: Bacteria Reductions from Projects Identified in Appendix C

Management Practice	Area Treated	Expected Reductions (MPN/year)
Bioretention	88.7	4.16E+13
Extended Detention Shallow Wetland	169.2	6.78E+13
Porous Pavement	8.5	8.42E+11
Total Reductions		1.1E+14
% Change		**-10.0%**

4.3.4. Bacteria Conclusion

Bacteria reductions through the projects outlined in Appendix C and the additional practices described in section 3.3.5 will only achieve a reduction of 10%. The mix of Best Management Practices recommended for the removal of metal and organic constituents (as outlined in section 4.5) will reach 66%.   The main source of bacteria has been traced back to the ten sewer crossings that traverse the stream bed. It is assumed that the repair and rerouting of these sewer lines will result in a reduction of bacteria by 90%. WASA has at least one sanitary sewer main repair and rerouting scheduled for Valley Terrace housing complex for June 2011. Schedule for the replacement and rerouting of the 10 sewer main crossings has been requested from DCWASA.

4.4. Organics

DDOE has prepared TMDLs for eight different organic compounds in Oxon Run. These EPA approved TMDLs can be seen in Table 14, along with load allocations for the average year. Given that the Oxon Run watershed is split between Maryland and the District, for the District to achieve its metals TMDLs, Maryland's own load allocations (see Table 17) must also be met.

Table 14 : Oxon Run (DC), Average Annual Existing Organics Loads and TMDLs (lbs./year)

Metals Parameter	Existing Load (DC)	TMDL	WLA	LA	MOS (1%)	Percent Reduction
Chlordane	4.26E-2	7.24E-3	6.51E-3	7.03E-4	7.24E-5	83%
DDT	1.89E-1	5.66E-3	5.02E-3	6.40E-4	5.66E-5	97%
Dieldrin	4.04E-3	8.48E-4	7.29E-4	1.19E-4	8.48E-6	79%
Heptachlor Epoxide	6.63E-3	9.94E-4	8.73E-4	1.22E-4	9.94E-6	85%
PAH1	3.91E-0	3.91E-0	3.51E-0	4.01E-1	3.91E-2	0%
PAH2	2.29E+1	3.89E-1	3.51E-0	3.81E-2	3.89E-3	98%
PAH3	1.45E+1	2.91E-1	2.63E-1	2.82E-2	2.91E-3	98%
TPCB	3.65E-1	3.65E-4	3.28E-4	3.78E-5	3.65E-6	99.9%

Table 15: Oxon Run (MD), Existing Organics Loads and Necessary Reductions (lbs./year)

Metals Parameter	Existing Load (MD)	Allocated Load	MOS (1%)	Percent Reduction
Chlordane	1.10E-1	1.87E-2	1.87E-4	83%
DDT	5.03E-1	1.51E-2	1.51E-4	97%
Dieldrin	1.15E-2	2.41E-3	2.41E-5	79%
Heptachlor Epoxide	1.81E-2	2.71E-3	2.71E-5	85%
PAH1	1.02E+1	1.02E+1	1.02E-1	0%
PAH2	5.88E+1	9.99E-1	9.99E-3	98%
PAH3	3.73E+1	7.46E-1	7.46E-3	98%
TPCB	9.52E-1	9.52E-4	9.52E-6	99.9%

The load reductions of organic chemicals were calculated similarly to metals; however it was not assumed that the loads were generated on impervious surface, but rather throughout the entire District portion of the watershed. The organic chemical reduction charts found in Appendix D list the reductions for each pollutant expected given a particular treatment area of the watershed. Taking the identified projects in Appendix C alone, the only organic constituents that will be consistently removed through the bioretention, porous pavement, and constructed wetland projects outlined in Appendix C are PAH1, PAH2 and TPCB. The remaining organic pollutants will require treatment of a larger area and/or additional treatment practice.

The projects in Appendix C treat approximately 10% of the entire area of the watershed. These projects achieve reductions of approximately 0.6-22% of target reductions. Anticipated load reductions can be found in Table 16.

Table 16: Expected Load Reductions for Projects Identified in Appendix C

Organics Parameter	Bioretention	Porous Pavement	Extended Detention Shallow Wetland	
	Reductions (lbs/year)			% Reduction
Chlordane	3.25E-03	1.39E-04	6.20E-03	-22.5
DDT	0.010	0.001	0.015	-14.2
Dieldrin	7.69E-06	1.05E-06	1.47E-05	-0.6
Heptachlor Epoxide	2.94E-04	2.98E-05	4.28E-04	-11.3
PAH1	0.067	0.007	0.100	-4.5
PAH2	0.012	0.116	1.682	-7.9
PAH3	0.874	0.088	1.279	-15.5
TPCB	0.013	0.001	0.019	-9.3

The combination of stormwater and pollution management practices and associated treatment areas needed to achieve reduction goals can be obtained by using the organics reduction chart, as were metals. Taking DDT as an example, one can use the organics reduction charts to determine what combination of management practices would need to be implemented over what area to achieve a reduction of 97%. As seen in the hypothetical scenario described in Table 19, treating 50% of the roadways with pervious pavement, 100% of road with monthly vacuum sweeping, and 50% of the area of the total watershed with bioretention, a decrease of 0.17 pounds of DDT per year will be reached, well over the 97% target, could be achieved. The suggested

Table 17: Expected DDT Removal Rates

Removal of DDT			
	% Area	**Area (acres)**	**Reduction (lbs/year)**
Bioretention	50%	1,174	0.08
Porous Pavement	50%	1,174	0.03
Vacuum Sweeping	100%	2347	0.06
	Total Reduction		0.17
	% Change of TMDL		110%

The treatment areas are rather large and may not seem feasible; however, the area needed for treatment by the five practices for which the reduction charts were developed could be much lower since majority of organic loads could be addressed through cleanup of illegal dumping sites and greater enforcement of pollution prevention plants. A number of illegal dumping and areas with poor pollution prevention were identified while conducting a watershed assessment. The exact source of the organic constituents for which the Oxon Run TMDL addresses is unknown; however the dumping of electronics such as computers, televisions, and radios may contribute organic chemicals into the surrounding soil and water. Evidence of dumping was observed at several points in the stream bed. Several sites were identified throughout the watershed that exhibited very poor pollution prevention practices, specifically automotive repair facilities and an impoundment lot run DC Department of Public Works. The clean-up of these dumping sites (many with discarded electronics) and enforcement of better pollution prevention plans on District Department of Public Works facilities and auto mechanics will result in a reduction in organic loading rates. A listing of identified pollution prevention and illegal dumping sites can be found in Appendix E. For the cleanup of the sites found in Appendix E the District will rely on volunteer groups and both summer employment programs for District youth that focus on the environment, Green Summer Jobs and Mayor's Conservation Corps. Between these two programs, thousands of youths are employed to clean up the city. This workforce can be employed to address many of the dumping sites found in Appendix E. Additionally, many environmental nonprofits watershed based organizations hold regular cleanups each year.

Finally, by banning coal-tar sealants from use in the District, a reasonable assumption can be made that the PAH loads, which are very concentrated in coal-tar sealants, will decrease over time. Investigators discovered coal-tar based sealants on a school playground in the Oxon Run watershed. It is likely that there are numerous locations throughout the watershed where coal tar has been applied. Identifying and remediating these sites will be necessary to protect aquatic and human health. DDT and Cholorodane are also illegal for sell or use in the District and no new sources of these pollutants are being introduced to the watershed.

4.5. Nitrogen

LID bioretention can help reduce nitrogen loading by filtering it from runoff, storing it, and using it for plant growth. Unfortunately, LID filtering efficiencies for nitrogen (below 50%) leave much to be desired. However, recent studies have shown that raising the height of the underdrain can create an anaerobic zone that boosts denitrification rates (Coffman and Winogradoff, 2002).

Through its overall LID initiative, DDOE will work to incorporate the most recent LID technology throughout the Oxon Run watershed. According to the efficiencies listed in Appendix E, if the

DDOE were able to implement all of the proposed Oxon Run LID sites listed in Appendix D, in addition to the USFWS's stream restoration, 17 pounds of nitrogen would be removed from Oxon Run, annually. Further reductions can be expected from stormwater best management practices, as well as potential stream restoration.

4.6. Phosphorous

As with nitrogen, LID bioretention techniques filter phosphorous from runoff, store it in soil, and assimilate it via plant growth. Fortunately, bioretention has proven to be more effective in the removal of phosphorous than it has nitrogen. Removal rates of 60-80% from runoff can be expected. Given 100% implementation of the proposed LID sites found in Appendix D, 84 pounds of phosphorous would be removed from Oxon Run on an annual basis.

4.7. Total Suspended Solids (TSS)

The erosion of Oxon Run's banks accounts for the greatest proportion of the stream's TSS load. US FWS estimates that the unchanalized reaches of the stream contribute a load of 1,032 tons/year of sediment. Therefore stream restoration and accompanying bank stabilization would have the greatest impact on reducing TSS loads in Oxon Run. LID retrofit projects would also reduce TSS by reducing the volume and speed, and hence the erosive speed of stormwater reaching the stream, and would help to capture non-point sources of sediment, e.g. particulate matter on roadways. If DDOE can implement all of the LID sites proposed in Appendix D, TSS loads would be reduced by 1.66 tons. Oxon Run is not listed on the EPA's 303(d) list for phosphorus, nitrogen, or TSS, but the reduction loads for these substances were modeled because of the high correlation between the reduction of nitrogen, phosphorus, TSS and other pollutants such as metals, organic chemical, and bacteria. The projects outlined in Appendix C and the additional projects described in Section 3.3.5 will achieve the reductions of 60%, 53% and 84% for Total N, Total P, and TSS, respectively. The reductions seen for the reforestation projects are 67%, 60% and 61% for Total N, Total P, and TSS, respectively. A breakdown of load reductions for N, P, and TSS for identified projects in Appendix C and reforestation projects can be found in Tables 19 and 20.

Table 18: Load Reduction from Projects Identified in Appendix C.

	Total N	**Total P**	**TSS**
Load (lbs/year)	571.00	104.00	25995.00
Load Reduction (lbs/year)			
Total Reduction	384.00	62.40	15840.00
New Load	187.00	41.60	10155.00
% Change	67%	60%	61%

Table 18: Load Reductions due to Reforestation Projects

	Total N	Total P	TSS
Load (lbs/year)	1499.60	249.93	74979.89
Load Reduction (lbs/year)			
Total Reduction	904.44	133.42	62688.77
New Load	595.15	116.51	12291.11
% Change	60%	53%	84%

Nutrient and TSS reductions are not specifically addressed in the Oxon Run TMDL; however there is a strong correlation between sediment and nutrient removal rates, and those of metals and organic chemicals. The high degree of nutrient and sediment removal expected indicates a significant decrease in the loading rates of metals and organic chemicals as well.

4.8. Reduction Scenarios

Three scenarios of pollutant management practices for reaching the pollutant limits outlined in the TMDL are seen in the tables below. These scenarios outline the reductions expected for metal and organic constituents using various combinations of management practices. The first scenario models a situation in which a moderate amount (10-20%) of the watershed is treated with structural stormwater controls and an intensive amount (60%) treated with vacuum sweeping. This scenario will achieve reductions in all constituents but Dieldrin. The second scenario models a case where structural stormwater practices were used to treat an intensive amount of the watershed (20-30%) and a moderate amount (10%) with vacuum sweeping. The number of pollutant concentrations that fall below the TMDL threshold in Scenario 2 is identical to Scenario 1, with Dieldrin as the only pollutions not reaching the load allocation set forth in the TMDL. The third case modeled was one in which both intensive structural stormwater controls (20-30%) and intensive vacuum sweeping (60%) would be implemented. Again, all reduction targets were reached in Scenario 3, except for Dieldrin. The reductions expected for each pollutant can be found in Tables 20-22.

The recommended scenario is Scenario 2 because reductions are met with the least amount of area that would require treatment. Scenario 2 is preferable to Scenario 1 because it calls for increased area to be treated with plant material such as trees and wetland plants, which have an added benefit of providing habitat for wildlife and beautification of the watershed.

Bacteria reductions associated with Scenario 2 can found in Table 25. The result will be a reduction of 6.4E14 MPN/year, or 66% of total reductions needed. Through extensive field data, a major source of bacteria has been traced back to the ten sewer crossings that traverse the stream bed. Many of these sewer lines are faulty and badly in need of repair. It is assumed that the repair and rerouting of these sewer lines will result in the final 24% reduction needed.

While identifying stormwater retrofit projects in Oxon Run watershed, over 50 acres identified as good candidates for reforestation and riparian planting as well as 20 acres of green roof installations and stream restoration. These best management practices we not modeled in the scenarios above because it is assumed that the reduction efficiencies for metal and organic constituents would be small; however the cumulative effect of the implementation of these projects would certainly have a positive impact on water quality and will contribute to reaching target reductions.

Table 19: Scenario 1 - Moderate Stormwater Control and Extensive Vacuum Sweeping

Management Practice	Bioretention	Porous Pavement	Wetland	Tree Boxes	Vacuum Sweeping	Reduction Needed (lb/year)	Reduction Achieved (lbs/year)
% Area Treated	20%	10%	10%	10%	60%		
Pollutant	Reductions Expected (lbs/year)						
Copper	49.70	23.1	16.9	20.5	137.8	161.4	248
Zinc	128.80	59.6	27.6	53.4	341.6	0	611
Arsenic	0.90	0.4	0.3	0.4	2.7	4.3	4.7
Lead	22.10	11.6	8.9	9.8	55.1	90	107.5
Chlordane	0.012	0.0038	0.008	0.0004	0.0244	0.035358	0.0486
DDT	0.055	0.0290	0.020	0.03	0.1732	0.18333	0.3076
Dieldrin	5.21E-05	2.90E-05	1.99E-05	2.55E-05	1.56E-04	3.19E-03	2.83E-04
Heptachlor Epoxide	1.55E-03	8.07E-04	5.82E-04	7.25E-04	4.83E-03	5.64E-03	8.49E-03
PAH 1	0.36	0.19	0.14	0.17	1.11	0	1.97
PAH 2	6.10	3.15	2.29	2.83	18.7	22.442	33.07
PAH 3	4.62	2.39	1.74	2.16	14.4	14.21	25.31
TPCB	0.07	0.04	0.26	0.03	0.22	0.36	0.62

Table 20: Scenario 2 - Intensive Stormwater Control and Moderate Vacuum Sweeping

Management Practice	Bioretention	Porous Pavement	Wetland	Tree Boxes	Vacuum Sweeping	Reduction Needed (lb/year)	Reduction Achieved (lbs/year)
% Area Treated	30%	20%	20%	30%	10%		
Pollutant	Reductions Expected (lbs/year)						
Copper	74.50	47.8	35.0	63.5	22.3	161.4	243.1
Zinc	193.20	123.3	57.0	165.6	55.2	0	594.3
Arsenic	1.30	0.9	0.7	1.2	0.4	4.3	4.5
Lead	33.10	23.9	18.4	30.4	8.9	90	114.7
Chlordane	0.018	0.0077	0.017	0.012	0.004	0.035358	0.0587
DDT	0.083	0.0591	0.040	0.08	0.0283	0.18333	0.2905
Dieldrin	7.28E-05	5.80E-05	4.07E-05	7.82E-05	2.55E-05	3.19E-03	2.75E-04
Heptachlor Epoxide	2.33E-03	1.65E-03	1.19E-03	2.22E-03	7.89E-04	5.64E-03	8.18E-03
PAH 1	0.53	0.38	0.28	0.51	0.18	0	1.88
PAH 2	9.15	6.43	4.67	8.66	3.1	22.442	32.01
PAH 3	6.94	4.88	3.55	6.61	2.30	14.21	24.28
TPCB	0.10	0.07	0.54	0.10	0.04	0.36	0.85

Table 21: Scenario 3 - Intensive Stormwater Control and Intensive Street Sweeping

Managemet Practice	Bioretention	Porous Pavement	Wetland	Tree Boxes	Vacuum Sweeping	Reduction Needed (lb/year)	Reduction Achieved (lbs/year)
% Area Treated	30%	20%	20%	30%	60%		
Pollutant	Reductions Expected (lbs/year)						
Copper	74.50	47.8	35.0	63.5	137.8	161.4	358.6
Zinc	193.20	123.3	57.0	165.6	341.6	0	880.7
Arsenic	1.30	0.9	0.7	1.2	2.7	4.3	6.8
Lead	33.10	23.9	18.4	30.4	55.1	90	160.9
Chlordane	0.018	0.0077	0.017	0.012	0.0244	0.035358	0.0791
DDT	0.083	0.0591	0.040	0.08	0.1732	0.18333	0.4354
Dieldrin	7.28E-05	5.80E-05	4.07E-05	7.82E-05	1.56E-04	3.19E-03	4.06E-04
Heptachlor Epoxide	2.33E-03	1.65E-03	1.19E-03	2.22E-03	4.83E-03	5.64E-03	1.22E-02
PAH 1	0.53	0.38	0.28	0.51	1.11	0	2.81
PAH 2	9.15	6.43	4.67	8.66	18.7	22.442	47.61
PAH 3	6.94	4.88	3.55	6.61	14.4	14.21	36.38
TPCB	0.10	0.07	0.54	0.10	0.22	0.36	1.03

Table 23: **Bacteria Reductions Expected for Scenario 2**

Expected Bacteria Reductions (MPN/year)						Reductions Needed (MPN/year)	Reductions Achieved (MPN/year)
BMP	Bioretention	Pervious Pavement	Wetland	Tree Boxes	Vacuum Sweeping		
% Area Treated	30%	20%	20%	30%	10%		
Load Reduction	3.3E+14	4.6E+13	1.9E+14	6.2E+13	2.3E+13	9.90E+14	6.5E+14

5. IMPLEMENTATION STRATEGY

The ultimate measure of success for Oxon Run goes beyond meeting numeric values for TMDL endpoints. For Oxon Run to become whole again the damage caused because of altered stream hydrology from urbanization will need to be repaired. The concrete channel will need to be naturalized and fish blockages will need to be removed so that stream can once again support diverse populations of migratory fish species. Most importantly, the community will need to become engaged in the stewardship of the stream and be invited to utilize Oxon Run as the valuable aquatic resource that it is.

Approximately 1.5 miles of Oxon Run, within the District, is a concrete lined channel

In the face of these challenges, and the very high implementation costs, a strategy that sets short term, intermediate and long-term goals is needed. Near term goals will address areas of immediate water quality impairment, take advantage of development opportunities to demonstrate the use of LID technologies in this watershed, and engage the public in caring for and advocating for the watershed. Medium term goals will deal with degrading infrastructure in the stream channel, stream bank stabilization and restoration of in-stream habitat, removal of fish blockages, and riparian and wildlife restoration in the stream corridor. Long term goals will include the retrofitting of the storm sewer system to reduce stormwater volumes through onsite retention of stormwater, pollution prevention through improved catch basin and end of pipe BMPs, implementation of expanded street sweeping, and coordination with Prince Georges County to address upstream sources of pollution. The implementation phases and time line are listed in Table 26.

Table 24: Implementation Strategy Phases and Timeline

Near Term	0 – 5 years
Medium Term	0 – 15 years
Long Term	0 – 30 years

Table 22: Temporal Implementation Strategy

Near Term	Targeted enforcement of likely sources of water quality impairment;
	Low Impact Development demonstration projects in the watershed;
	Stepped up community outreach and engagement; and
	Riparian and wildlife corridor improvements.
Medium Term	Stream restoration and fish blockage removal;
	Sewer line infrastructure repair; and
Long Term	Stormwater volume reductions through onsite retention and LID retrofits on public lands and in the public right of way;
	Expanded street sweeping; and
	Retrofitting of the MS4 system with catch basin and end of pipe BMPs.

5.1. Stakeholders

The District Department of the Environment has identified many key stakeholder organizations that are currently or may be involved in activities to help restore Oxon Run. DDOE will distribute this draft WIP to stakeholders which include, District of Columbia government agencies, Federal agencies, neighborhood groups and nonprofit advocacy groups. It is hoped that these stakeholders will identify additional specific and general projects to achieve further pollutant load reductions in Oxon Run. Since DDOE does not administer any lands within the District it is also hoped that some of the agencies will take it upon themselves to initiate some of these projects. Once comments have been received they will be evaluated and incorporated into this document, if appropriate.

Because DDOE does not have direct jurisdiction over any land, and since many of the identified projects are on public land, the most important component of the outreach process is to work across agencies to identify projects that can be implemented. DDOE has several venues for accomplishing this task. The MS4 technical working group is a multi agency task force that deals with issues surrounding the implementation of the provisions set forth in the Districts MS4 permit from the EPA. WPD staff will present the findings from this report, in additions to specific project sites and descriptions by agency, to all the members of the task force that represent the various agencies. DDOE will also present the findings of this report to the various nonprofit and advocacy groups listed below. For agencies that have a particularly large role to play in the improvement of water quality in the Oxon Run Watershed DDOE will schedule direct meetings to go over the various projects proposed on the agencies lands. Finally, DDOE will also schedule direct meetings with the National Park Service National Capital East and the District of Columbia Water and Sewer Authority (DC Water). Below is a table that summarizes this outreach strategy.

Table 236: Outreach Priority Agencies and Timeline

Agency	Outreach Type	Completed By	Notes
District Department of Parks and Recreation	Agency Specific Meeting and MS4 technical working group	December 2010	DPR is an vital partner for stream restoration and protection of sensitive natural areas
DC Water	Agency Specific Meeting and MS4 technical working group	July 2010	DC Water is responsible for upkeep of the storm system infrastructure and also maintains sewer line infrastructure in the stream valley that will affect an stream restoration plans
NPS National Capital Parks East	Agency Specific Meeting	December 2010	NPS NCPE is a vital partner in protecting sensitive natural areas and stream restoration
District Department of Transportation	Agency Specific Meeting and MS4 technical working group	December 2010	DDOT is responsible for public right of way which makes up a large percentage of the impervious surface area within the watershed (DDOE is already coordinating with DDOT on a bike trail project that is in the planning stages and will include LID features)
DC Public Schools and Office of Public Education Facilities Modernization	Agency Specific Meeting and MS4 technical working group	December 2010	There are several schools in the stream valley where school grounds can be used to infiltrate stormwater while also providing outdoor learning opportunities

5.1.1. EPA Chesapeake Bay Program

The District Department of the Environment's goals for Oxon Run are closely aligned with those of the Chesapeake Bay Program. Oxon Run restoration efforts will support the agreement's goals of: "Living Resource Protection and Restoration" for fish passage; "Water Quality Protection and Restoration" through reduction of nutrient and sediment loads and for the protection of priority urban waters; and "Sound Land Use" by helping to promote stewardship of natural resources through public education and community engagement. While the goals of nutrient and sediment load reductions are not directly linked to existing Oxon Run TMDLs, the pollutant load reduction strategy will have contemporaneous benefits for these pollutants.

The Chesapeake Bay is listed as impaired for nitrogen, phosphorous, sediment. As noted earlier, while no TMDLs exist for nitrogen, phosphorus, or total suspended solids in District portion of the Oxon Run watershed, the District is still committed to reducing total nitrogen, phosphorous, and total suspended solids loads in accordance with the Chesapeake Bay Agreement. As the EPA moves to enforce the Chesapeake Bay TMDL it is expected that load reductions for nitrogen, phosphorus and TSS will be assigned to the its tributaries which may mean required reductions for Oxon Run.

The Chesapeake Bay Program has moved to utilizing specific two-year restoration actions with five and ten year load reduction targets. It is expected that the activities laid out in this WIP will inform the specific restoration actions and the more long-term load reduction targets.

5.1.2. District Department of the Environment

The Department of Environment Watershed Protection Division is responsible for watershed management planning within the District of Columbia. The division manages DC watersheds according to three types of actions that occur within their boundaries:

1. Scheduled, mandated actions
2. Scheduled, "voluntary" actions
3. Unscheduled and unanticipated events

The DDOE's Watershed Protection Division manages these actions in accordance with its mission to conserve the soil and water resources of the District of Columbia and to protect its watersheds from nonpoint source pollution. The Branches within the Watershed Protection Division are responsible for the following activities:

Planning and Restoration Branch – In addition to being responsible for all watershed planning within the District, this branch also fulfills a number of other mandated responsibilities. The first of these responsibilities is to encourage pollution prevention by carrying out information and education campaigns, and increasing involvement in cleanup efforts in the District of Columbia watersheds and the Chesapeake Bay. Second, the Watershed Protection Division Planning and Restoration Branch sponsors activities that protect and restore river, stream, and wetland habitats in DC, increase the DC and Chesapeake Bay watershed's ecological diversity, and protect the health, welfare, and safety of our residents. Lastly, the branch's education segment sponsors teacher-training workshops in environmental education using nationally accredited environmental curriculums. These curricula provide teachers with continuing education credits, and provide students with meaningful environmental experiences via outdoor activities, and events. The Watershed Protection Division's developed its RiverSmart Homes and RiverSmart Schools programs to combine all three missions of the branch.

Sediment and Stormwater Technical Services Branch – This branch has developed and enacted storm water management and sediment and erosion control regulations for construction sites. The branch reviews construction and grading plans for stormwater management, erosion and sediment control, and flood plain management considerations. As required by EPA regulations regarding new construction permits, all new construction in the District must have Storm Water Pollution Prevention Plans (SWPPPS) that "identify all potential sources of pollution which may reasonably be expected to affect the quality of storm water discharges from the construction site."

Through the work of this branch, many BMPs are installed every year through the plan review process. All construction that disturbs over 5,000 square feet requires a stormwater certification from WPD review engineers. This regulatory process is one that is under a mandate to ensure that post-development flows mimic pre-development stormwater runoff. WPD is currently establishing new regulations that will encourage the development community to focus on the installation of LID. Efficiency percentages for LID practices are higher and will remove a greater percentage of nutrients and sediments. The current focus of WPD is to install LID where appropriate and strongly encourage developers to incorporate this stormwater management technique.

Inspection and Enforcement Branch – Following up on these plan reviews, the Inspection and Enforcement Branch makes construction site visits to enforce compliance with the District of Columbia's sediment control and storm water management laws and regulations. In the process, they also inspect Best Management Practices (BMPs) to ensure they are adequately maintained. Lastly, the branch is also responsible for investigating citizen complaints relating to soil erosion and drainage problems, and recommending appropriate solutions.

District Department of the Environment, Stormwater Management Division - The Stormwater management division has already been mentioned is section 2 above. It is, however, a very important partner and helps to fund and coordinate much of this work through the Stormwater Management Division. The Stormwater Management Division is an office within the DDOE Office of Natural Resources, as is the Watershed Protection Division, and administers the District's MS4 permit. The city has imposed an impervious rate fee to offset the cost of compliance with the NPDES MS4 permit and ultimately to protect and restore the District's waterways. The fee is assed to all district property owners who have impervious surface on their property. The fee applies to non-profit organizations and Federal agencies. The fee is based on the equivalent residential unit (ERU), which is equal to 1,000 square feet, at a rate of $2.57 per an ERU per a month. The annual revenue from this fund is approximately $13,000,000. Most revenue is given, via an intra-district MOU, to the various agencies responsible for the implementing activities that are prescribed in the MS4 agreement with EPA. These agencies are named in the DC Comprehensive Stormwater management Enhancement Amendment Act of 2008, which established the impervious rate fee, and include: WASA, District Department of Public Works, District Department of Transportation and Office of Planning. The Act mandates that a Stormwater Advisory Panel, composed of agency heads, meet twice a year to coordinate MS4 related activities. In addition, a MS4 task force, comprised of lower level managers, meets monthly to coordinate efforts.

WPD participates in the MS4 working group. In addition WPD gets money from the Stormwater Enterprise fund to implement various pollution mitigation activities in the MS4 areas of the District. These activities include: low impact development projects, green-roof incentive programs, and end of pipe BMPs.

5.1.3. DC Department of Parks and Recreation (DPR)

DPR supervises and maintains area parks, community facilities, swimming pools and spray parks, and neighborhood recreation centers, as well as coordinates a wide variety of recreation programs. DPR is a crucial partner in the implementation of this WIP in that it manages large blocks of city land with the potential to manage stormwater. DPR is responsible for the operation of Oxon Run Park, the largest District owned parks within the city. Due to a chronic lack of funding for parks and open space DDOT has not been able to invest much money for Capital improvements in Oxon Run Park. Initial conversations between DDOE and DPR have shown a willingness on the part of DPR to allow end of pipe BMPs, such as stormwater wetlands, to be constructed on their land.

In addition to Oxon Run Park DPR manages the Bald Eagle Recreation Center and the Hillcrest Recreation Center. Both of these facilities are adjacent to important terrestrial habitat, Bald Eagle Hill and Hillcrest Park respectively. Coordination between DPR and DDOE to address runoff from DPR facilities and to use DPR land for stormwater mitigation will be critical for improving water quality in Oxon Run.

5.1.4. DC Public Schools (DCPS) and Office of Public Education Facilities Modernization (OPEFM)

Similar to the recreational facilities, the DCPS and OPEFM oversee, maintain, and modernize the City's public schools. There are over a dozen schools in the Oxon Run watershed, many of which are slated for renovation. These renovations offer an opportunity to incorporate LID and providing outdoor learning areas for environmental education. Three schools are located in the floodplain and adjacent to Oxon Run itself. These schools are well placed for combining stormwater mitigation with outdoor learning activities. School grounds are also good sites for tree planting and in many instances, the removal of impervious surfaces. Current school modernization programs can also be leveraged to minimize the buildings stormwater footprint through the use of LID technologies. In short, schools in general, and in the Oxon Run watershed in particular, are excellent locations for stormwater mitigation coupled with education and stewardship opportunities.

5.1.5. DC Department of Transportation (DDOT)

The District Department of Transportation (DDOT) is responsible for maintaining streets, roads, alleyways, sidewalks and trails in the city. DDOT has begun to adopt the use of Low Impact Development (LID) strategies to control stormwater and stormwater pollution. The city is currently demonstrating many types of LID including:

- Infiltration tree box planters – tree boxes that accept runoff from sidewalks and roadways to treat the stormwater and provide water for the trees.
- Silva Cells, structural soils, and other tree root expansion techniques – These tools help expand the space available for the growth of tree roots which allows for a larger and healthier tree and the greater potential for the uptake of stormwater and stormwater pollutants.
- Bioretention – This can take the form of standard bioretention cells or bump outs into the street that are generally placed near intersections. These bump outs provide a safer crossing area for pedestrians by reducing the street area that they have to cross; they slow traffic by narrowing the road; and they accept runoff and treat stormwater pollution.
- Permeable pavements – Permeable pavements take many forms including paving stones, porous concrete, and porous asphalt. The District is testing different permeable pavements in different applications such as alleyways, sidewalks, and roadways to determine which are appropriate and cost effective.

DDOT is also working to reduce pollutants to the city's waterways by encouraging commuters to use alternative forms of transportation. DDOT is expanding the number of bike lanes in the city, installing bike-share racks, creating trolley and high speed bus lanes, and operating lower polluting hybrid and natural gas powered busses for its "Circulator" routes.

The District Department of Transportation also houses the City's Urban Forestry Administration (UFA). The Urban Forestry Administration (UFA) maintains the city's street trees pruning and planting to manage trees in a harsh environment of power and sewer lines, impervious surfaces, road salt, and punishing summer heat. UFA plants an average of 4150 trees annually, maintains the thousands of existing city trees, and works to improve growing conditions for street trees by removing unneeded impervious areas, experimenting with new tree box technology such as structural soils and Silva cells, and watering trees and pruning trees.

DDOT is in the planning stages of a major trail realignment and rehabilitation for Oxon Run Park. The plan calls for improved pedestrian crossings at intersections near the park, better trail alignments, adding solar powered lighting to the trail, rehabilitating bridges that cross the stream, improved pedestrian and bicycle access to the two nearby metro stations, and connectivity to a bicycle path network in Maryland that runs through Oxon Cove Park, an NPS property. This work on its own will do a tremendous amount to improve the social and recreational value of the park. In addition, DDOT and DDOE have been coordinating on the planning to include LID elements that will treat roadway runoff and infiltrate stormwater. These projects will take the form of infiltration tree boxes, bioretention cells, permeable pavement, and possibly stormwater treatment wetlands.

5.1.6. District Department of Public Works (DPW)

The Department of Public Works provides a number of public services that affect the Oxon Run watershed. DPW oversees solid waste collection, the collection of hazardous wastes, recycling, leaf collection, and street and alley cleaning programs. These programs help to mitigate the impacts of trash, hazardous waste, pollutants and roadway sediments on Oxon Run. In addition DPW leads the Solid Waste Education and Enforcement Program (SWEEP) which provides the tools for District residents to combat illegal dumping, clean up vacant lots, and support neighborhood clean-ups.

One of the most important DPW functions, as far as reaching TMDL endpoints, is mechanical street sweeping. DDOE SWD has paid for enhanced street sweeping by purchasing regenerative air sweepers and continues to help pay for the continued upkeep of these machines. Regenerative air sweepers do a better job of collecting fine partials, to which metals and other pollutants tend to bind. (ESSPRS, 2008) While DPW cleans all district streets, the frequency of mechanical street sweeping varies considerably across the city. In the Oxon Run watershed there are only a few routes that are regularly swept. In order to reach required TMDL endpoints DPW will need to expand street sweeping in Oxon Run Watershed.

5.1.7. DC Water and Sewer Authority (DC Water)

WASA is responsible for the maintenance of the waste water and storm water infrastructure in the District. WASA is currently in the planning stages of a large sewer main rerouting, in the western most reach of the stream, which will replace one of the ten aging sewer crossings in Oxon Run. Repair, replacement and/or removal of all the sewer crossings will be necessary to ensure that bacteria TMDL end points are reached. In addition stream bank stabilization will be needed in areas to protect lateral sewer line pipes that run parallel on either side of the stream for much of its length. Finally, any stream restoration work will need to happen in coordination with WASA both to repair WASA infrastructure and to ensure that that it is protected.

5.1.8. National Park Service (NPS) National Capital Parks East (NCPE)

The National Park Service manages a great deal of the federally-controlled lands in the Oxon Run watershed. NPS NCPE is composed of 13 parcels which include parks, National Historic Sites, and parkways both in the District of Columbia and Maryland. NPS controls large contiguous portions of land adjacent to Oxon Run that straddle the DC Maryland border. Oxon Cove Park and Oxon Run Expressway (an area that contains the Magnolia Bogs) are two examples. Along with DPW and WASA, NPS NCPE is among the most important government entity with which DDOE must coordinate stream restoration projects.

5.1.9. Washington Parks and People (WPP)

For nearly twenty years Washington Parks and People has been advocating for the District's neglected parks. Key to WPP mission is linking the issues of public health, public safety, and environmental justice to adequate open space for all of District residents. WPP has worked tirelessly to improve and revitalize Marvin Gaye Park, which is adjacent to Watts Branch, a major tributary to the Anacostia. In recent years WPP has turned its attention to Oxon Run Park. Last year WPP partnered with DDOE to field a group of Green Summer Youth, a summer youth employment program run by DDOE, to help maintain and revitalize the park. WPP is an important partner in helping to bring attention and resources to Oxon Run Watershed.

5.1.10. Casey Trees

Casey Trees is a non-profit organization dedicated to expanding and caring for the District's tree canopy. As a part of this effort, Casey runs community tree planting programs, a tree rebate program, and plants trees for DDOE's RiverSmart Homes program. Additionally Casey leads classes in the identification and care of trees and performs monitoring and modeling of canopy cover. Casey has an active and knowledgeable cadre of volunteer "citizen foresters" that aid its paid staff in their mission. Casey Trees, will be an important partner in helping increase tree canopy in the watershed as a whole and in riparian areas.

5.1.11. Neighborhood Advisory Commissions (ANC)

The Advisory Neighborhood Commissions are elected bodies that weigh in on issues that affect their neighborhoods. ANCs consider a wide range of policies and programs affecting their neighborhoods, including traffic, parking, recreation, street improvements, liquor licenses, zoning, economic development, police protection, sanitation and trash collection, and the District's annual budget. In each of these areas, the intent of the ANC legislation is to ensure input from an advisory board that is made up of the residents of the neighborhoods that are directly affected by government action. The ANCs are the body of government with the closest official ties to the people in a neighborhood. The ANCs present their positions and recommendations on issues to various District government agencies, the Executive Branch, and the Council. They also present testimony to independent agencies, boards, and commissions.

There are four ANCs in the Oxon Run watershed (ANCs 8B, 8C, 8D, 8E). In the course of preparing this plan DDOE met with representatives from these commissions. As a next step in the community engagement process DDOE will bring the projects and findings from this report to the various ANC commissions. ANC partners will be critical partners in helping to galvanize community support for restoration activity.

5.1.12. Oxon Run Community Alliance (ORCA)

Oxon Run Community Alliance is a recently formed advocacy group. ORCAs mission is to bring attention and resources to the Oxon Run watershed and the parks that are adjacent to the

Local Youth help out at an Oxon Run Cleanup

park. DDOE partnered with ORCA to help lead a cleanup in Oxon Run Park. Hundreds of people came out on a Saturday to remove 30 cubic yards of garbage from stream valley. DDOE will continue to work with ORCA to promote water quality improvements in the Oxon Run Watershed.

5.1.13. Prince Georges County Department of Environmental Resources

The mission of the Department of Environmental Resources is to protect and enhance the natural and built environments of Prince George's County by enforcing Federal, State and County laws to create a healthy, safe and aesthetically pleasing environment for all residents and businesses of the County. Successful restoration and protection of the Oxon Run watershed will require coordination with Prince Georges County.

5.1.14. Washington Suburban Sanitary Commission (WSSC)

The WSSC provides sanitary services to approximately 1.6 million residents in Prince George's and Montgomery counties. Similar to efforts by WASA and other District agencies, the WSCC works to minimize the chances of sewage overflows and to maintain stormwater and sewer infrastructure in the upstream portions of the Oxon Run watershed. In 2005 WSSC entered into a consent decree with the EPA where WSSC is required to implement over 14 years numerous reporting, monitoring, inspection, maintenance, repair and replacement remedial measures for its sewer collection system in order to eliminate sewer overflows.

5.2. Specific Projects

In the development of this Watershed Implementation Plan, DDOE staff spent the equivalent of several work weeks in the field searching for appropriate locations for the installation of Low Impact Development practices to reduce stormwater pollution to Oxon Run. DDOE's investigators focused their efforts on LID on public land, in the public right of way and on quasi public land, e.g. churches, and highly visible private property. Some additional projects on private property were added when the size of the property or its proximity to Oxon Run elevated its importance. An inventory of the identified projects is found in the appendix of this document. The majority of these projects focus on three major pollution reducing practices: low impact development installation, stream restoration, and reforestation. Investigators also noted businesses and government facilities where pollution prevention or enforcement activities where required. In addition, other projects that benefit fish and wildlife were identified. These projects include removal of barriers to fish passage, trash reduction projects, and the installation or rehabilitation of wetlands. Many of the projects identified in this inventory will be among the first projects installed through the WIP effort, however not all the project identified will be installed in the coming years. Some projects will be found to be infeasible due to costs or unseen barriers to installation such as buried infrastructure or unwilling land owners. Furthermore, it is possible that some of these projects will overlap with the general management measures described above. Nevertheless, for the purposes of the WIP analysis, it was assumed that all projects will be installed.

5.2.1. Low Impact Development

Low Impact Development are design techniques that mimic a site's predevelopment hydrology and infiltrate, filter, store, evaporate, and detain runoff close to its source. Investigators focused on three types of LID technology: bioretention cells, retrofit of vegetated (green) roofs and installation of pervious pavers. Below, Table 24 details the area treated by specifically identified projects, area treated and projected cost.

Bioretention - A bioretention cell is a shallow depression with porous soils and planted with native plant species that can tolerate a range of conditions. Stormwater runoff is directed into the cell where water pollutants are taken up by the plants, the soil mixture, and the microbes that they contain. Bioretention differs from stormwater ponds in that they are generally smaller, treat a more localized source of stormwater, and are more efficient in their uptake of pollutants.

Green Roofs - Green roofs are rooftops that are partially or entirely covered by vegetation. There are two types of green roofs: intensive and extensive green roofs. Intensive green roofs are roofs with thick layers of soil or growing media that are able to support deeper rooting plants such as perennials, shrubs and sometimes trees. Intensive roofs are less common than the extensive roofs. Extensive roofs are green roofs with very shallow, light growing media. These types of green roofs support only the most drought tolerant, shallow rooted vegetation. Green roofs extend the life of roofs, conserve energy, and create habitat. Most importantly green roofs reduce stormwater volume and peak flows and capture pollutants.

Permeable Pavement - Permeable pavements take many forms including paving stones, porous concrete, and porous asphalt. These pavements are underlain by varying depths of compacted, washed, angular gravel. The angular gravel provides void space for rain water to filter down and eventually infiltrate into the soil while also creating a stable base for the paving surface. The depth of the angular gravel base will vary depending on the amount of stormwater the permeable pavement system will receive as well as the weight of the vehicles it must support and the frequency of the pavement’s use.

Investigators identified 167 individual LID projects in the Oxon Run watershed. All told, these projects could treat 87.9 acres, or 9.7%, of the total impervious area within the District portion of Oxon Run watershed. Appendix A includes a map of the LID projects that we identified in our survey and Appendix C contains details about each individual project.

5.2.2. Stream Restoration

Stream restoration is the act of modifying the current channel of a stream in an attempt to improve the environmental health and habitat of the waterway. Urban streams face immense pressure from high stormwater flows due to runoff from impervious surfaces. The erosion we see in urban streams is the stream's way of adjusting to accommodate the new (geologically) flow regime it is experiencing. Stream restoration attempts to create a new channel that is in stasis with the flows it experiences.

The District now prefers the use of natural channel design techniques that protect stream banks, reduce erosion, and provide habitat for fish and wildlife. These techniques are preferred over bank hardening such as the use of rip-rap, gabion baskets, and cement culverts. There are, however cases where high flows, human infrastructure, and threats to safety sometimes limit the use of natural stream channel design. Restoration in Oxon Run is complicated by the presence of District infrastructure in the stream valley. Roadway bridges, water mains, sanitary sewers, and storm sewers and their associated outfalls constrain designs by limiting potential meander bends and producing erosion hazards. The US Fish and Wildlife Service, 2004, surveyed the entire Oxon Run watershed and developed two stream restoration concepts for representative reaches of the District portion of Oxon Run, i.e. natural unlined reach and the concrete lined reach.

The concrete lined portion of Oxon Run, running between South Capitol and 13th Streets, SE, a 7,920 foot long stretch, is perhaps the most difficult section to restore. For their representative reach, USFWS chose the 2,520-foot stretch bound by Wheeler Road and 4th Street. This section, like the rest of the concrete lined length, is surrounded by DPR's Oxon Run Park property, which is mostly open parkland that was created with fill. In this section, USFWS designs call for removal of the channel's concrete lining and the installation of a natural stream channel with an increased length of 2,660 feet. Site constraints in this part of the stream included: two sanitary sewers on either side of the channel, five storm sewer outfalls, and the Wheeler Road and 4th Street bridges. To accommodate this infrastructure, the concept designs route Oxon Run through both bridges, but call for the crossing of the 42-inch sanitary sewer that bounds the current channel to the north. To protect this sewer line, designs call for the installation of a concrete line encasement, as well as rock grade control downstream and possibly in front of the line. To address storm water outfalls, USFWS proposed backing the outfalls away from the channel by creating a series of treatment areas that address trash collection, settling for large sediment, and infiltration. DPR's surrounding parkland provides ample opportunity for pond and wetland features, and would provide opportunities for environmental education in addition to their obvious water quality benefits. To accommodate the 100-year flood, the designs include significant excavation to reduce elevations in the fill areas near Wheeler Road.

The natural channel portion of Oxon Run that the USFWS chose as a representative reach lies not far downstream of the District border along Southern Avenue. The representative qualities of this reach include its location within the wooded NPS Oxon Run Parkway, its entrenched and over-widened channel, and its degraded instream habitat. To correct Oxon Run's problems in this reach, while also managing NPS's concerns over forest disturbance, USFWS designs essentially keep Oxon Run within its current channel, but make modifications to this channel. These modifications mainly include decreasing the stream's width, creating a lower, more accessible floodplain, and installing rock cross-vanes and J-hooks. Cross-vanes and J-hooks are structures that help direct hydraulic forces away from stream banks and into the center of the channel, where they help create and maintain streambed habitat features. A key improvement will be an increase in Oxon Run's flood prone width, which will reduce shear stress and sediment transport for discharges greater than bankfull. During times of lower flows, J-hooks and cross vanes (constructed, but seemingly natural rock features) will help to redirect shear stress away from stream banks, and toward the center of the channel. Lastly, USFWS designs will include a new meander pattern, or planform, for Oxon Run. In general, Oxon Run's new planform will replace long, tight meander curves with shorter and looser ones. These new curves will provide Oxon Run with the stable geometry that the stream is currently trying to achieve through bank erosion. (USFWS, 2004)

Stream restoration of Oxon Run to help accommodate the urban hydrology regime is extremely ambitious. Yet, as already mentioned, stream restoration may be the only way to meet the spirit, if not the rule, of the Clean Water Act. Restoring Oxon Run, and in the process Oxon Run Park, would improve the both the environmental and social aspects of the stream corridor. Stream restoration, would allow for the reestablishment of benthic communities in the stream. It would also provide a tremendous educational, recreational, and ecological resource for the communities of South East DC. Stream restoration would be a capstone to the long positive trend of redevelopment in this once forgotten, but still underserved area. The monetary costs associated with this project, however, will be high. The USFWS, in 2004, estimated that stream restoration in the DC portion of Oxon Run would cost $6,888,888 and stormwater treatment wetlands would cost an additional $1,094,000. This is a rough estimate and may be low, the rising cost of materials, and the technical difficulty of this project will likely inflate the cost.

5.2.3. Reforestation and Riparian Buffers

Urban trees have many known and quantified benefits. They have recently been touted as valuable tool for carbon sequestration. They are known to improve air quality, to cool their surroundings, to reduce energy consumption, and to provide valuable food and habitat for wildlife. Trees have documented human health benefits as well – from reducing asthma rates to improving mental health.

From the standpoint of this plan however, we focus on trees' ability to reduce pollution. Trees reduce topsoil erosion, prevent harmful land pollutants contained in the soil from getting into our waterways, slow down water run-off, and help ensure that our groundwater supplies are continually being replenished. For every 5% of tree cover added to a community, stormwater runoff is reduced by approximately 2% (Coder, 1996). Along with breaking the fall of rainwater, tree roots remove nutrients harmful to water ecology and quality. Trees act as natural pollution filters - keeping particulate matter out of the flow toward the storm sewers and reducing the flow of stormwater.

Trees that make up a healthy riparian buffer also stabilize stream banks – reducing erosion caused by stormwater flows. They also cool streams – reducing the thermal shock streams can experience with stormwater flows. Finally riparian buffers provide valuable habitat to wildlife – especially in urban environments.

Investigators located 66 sites for tree planting in the Oxon Run watershed adding tree canopy equivalent to approximately 59 acres. This does not include riparian restoration. Tree planting in urban environments often requires planting more costly older trees that can resist mowers, weed-eaters and other human impacts. While the overall cost of these projects may be high, there are ample opportunities for tree planting throughout the watershed and tree planting is a great activity for engaging citizens. A map of the tree planting project locations can be found in Appendix A and details about each project can be found in Appendix D.

5.2.4. Wetland Creation and Rehabilitation

Wetlands provide exceptional habitat and pollution reduction value. They are homes to hundreds of species; play an important role in the breeding lifecycle of some fish, reptiles, amphibians, and insects; and are a vital stopover for migrating birds and bats. Wetlands are sometimes called "nature's sponge" for their abilities both to hold water and prevent flooding and for their ability to sop up pollutants.

Unfortunately, wetlands and urban areas do not mix well. A combination of development, stream channelization, and flashy stormwater conditions have reduced wetland areas nation-wide by over 50 percent. Wetlands in the District have fared worse. While no estimates of wetlands in Oxon Run are available it is thought that the magnolia bogs once extended to Oxon Cove. Fortunately there is ample room in Oxon Run Park to restore stormwater wetlands. The advantage of stormwater wetlands is that they can treat stormwater runoff from a relatively large land area and also provide a great deal of wildlife benefit.

Middleton Elementary School Stormwater wetland, Charles County Maryland

Investigators identified four areas where stormwater wetlands could be placed, however, more detailed engineering is required to determine the size and number of stormwater treatment areas that can be installed in the stream corridor. A map of the wetland project locations and details about each project can be found in Appendix A and D respectively. USFWS in their stream restoration designs also identified areas for wetland creation, restoration.

5.2.5. Removal of Barriers to Fish Passage

Throughout their ranges on the East Coast of the United States, migratory fish stocks are on the decline. Part of the reduction in fish population is due to increased pollution loads in streams and rivers, but part of their decline is due to the loss of habitat. Even if the District is successful in reducing pollutant loads to levels safe for aquatic life, if they do not have access to local streams, populations may continue to decline. Barriers to fish passage in the District can be addressed with stream restoration. USFWS designs for Oxon Run will result in a narrower, deeper channel that allows for fish passage even during normal, or baseflow, conditions. Currently, much of Oxon Run is too wide and does not provide adequate depth during baseflow periods. In addition to narrowing Oxon Run, USFWS designs will greatly enhance the stream's riffle-pool streambed features. Oxon Run's current fish habitat features are either poorly defined or absent altogether, leading to limited area for food production, feeding, and cover. Downstream a USACE flood prevention drop structure would need to be reengineered to allow for fish passage.

Sewer line crossings can be barriers to fish passage

5.2.6. Trash Removal

Trash removal is an excellent activity for involving the public in restoration work and in generating watershed stewards, and as already mentioned trash is a major issue in the watershed. Trash may also be a source of water quality impairment. During the course of field investigations various electronic and automobile parts where identified, these components very likely leach toxic chemicals that will eventually find their way into Oxon Run. While these sources may only constitute a tiny fraction of the overall pollutant load, investigators identified locations throughout the watershed where trash removal is needed, not least of which

Illegal dumping and areas with accumulated litter are located throughout the watershed in the stream itself. A map of trash removal sites is located in Appendix A.

5.3. Implementation Schedule

The specific projects, outlined above and in Appendices C and D, have been prioritized. Investigators, while conducting field work, used three criteria to asses each project: the potential for the project to have a public education value, the relative ease with which the project could be implemented, and an estimate of the environmental benefit. Each of these three factors where ranked high, medium or low. The high, medium and low scores were each assigned a numerical value as was the total treatment area. The scores from all categories were then added together – the highest possible score is 15 and the lowest possible score is 5. A summary of ranking factors, and assigned numerical scores, is given in Table 27 and a breakdown of the cumulative score groupings is given in Table 28. Based on the scores projects where grouped into the Medium Term and Long Term implementation phases. Near term projects are based on the criteria listed above in Table 25, e.g. projects which have already been incorporated into the design of capital improvement projects. Pollution prevention sites and trash pickup sites will be targeted for enforcement or cleanup respectively, over the near term.

Table 27: Project Prioritization cumulative Score Groupings

Cumulative Score	Implementation Phase
Projects Based on Current Planning	Near Term
10 – 15	Medium Term
5 – 9	Long Term

Table 28: Ranking Factors for Project Prioritization and Assigned Numerical Values

Potential Educational Benefit	Numerical Score	Maximum/Minimum Score
High	3	3/1
Medium	2	
Low	1	
Potential Environmental Benefit		
High	4	4/2
Medium Low	3	
Low	2	
Estimated Ease of Implementation		
High	3	3/1
Medium	2	
Low	1	
Treatment Area (acres)		
≤ 0.09	1	5/1
0.10 – 0.19	2	
0.20 – 0.49	3	
0.50 – 0.99	4	
≥ 1.00	5	
	Maximum/Minimum Score	15/5

The next step will be for DDOE to provide the list of projects to our sister agencies and stakeholders for vetting. Based on redevelopment plans from sister agencies like DDOT and DPW, and community preferences DDOE will reevaluate the implementation priorities to see if other projects can be moved into the near term, or medium term categories. DDOE will also take into account community input and priorities in order to reassess the implementation strategy. A list of projects and project ranking is found in Table 29.

This being said, the District Department of the Environment is not a landholder in the city. It relies on the willingness of those that do own or manage land in the city to provide access to install pollution management measures. Moreover, approximately 1/3 of the land in the District is federally controlled, which requires an additional burden of coordinating with a second level of bureaucracy. Because of this, and because of the limited financial resources available on an annual basis, it is difficult to lay out an exact implementation schedule or include many projects in the near term implementation goals.

Table 29: Project Priority List

SITE LOCATION	PROJECT NUMBER	Project Description	Estimated Cost	Priority Ranking
13TH STREET SE AND VALLEY AVENUE SE	OR_LID_103	Bioretention	$51,726	**Near Term**
915 VALLEY AVENUE SE	OR_LID_105	Bioretention	$55,062	**Near Term**
601 MISSISSIPPI AVENUE SE	OR_LID_106	Bioretention	$30,475	**Near Term**
401 MISSISSIPPI AVENUE SE	OR_LID_111	Rain Gardens	$168,286	**Near Term**
2ND STREET SE FROM WAYNE PLACE SE TO XENIA STREET SE	OR_LID_112	Bioretention	$110,710	**Near Term**
WHEELER ROAD SE AND VALLEY AVENUE SE	OR_LID_104	Bioretention	$29,289	**Near Term**
VARNEY STREET SE AND COLE BOULEVARD SE	OR_LID_158	Pavement Removal	$17,273	**Near Term**
1ST STREET SE AND ATLANTIC STREET SE	OR_LID_159	Pervious Pavement	$21,029	**Near Term**
BURNS STREET SE AND BOWEN ROAD SE	OR_LID_3	Bioretention	$23,680	**Medium Term**
BARKER STREET SE AND SOUTHERN AVENUE SE	OR_LID_4	Green Street District Curb Alternative	$40,359	**Medium Term**
1400 41ST STREET SE	OR_LID_5	Bioretention	$57,731	**Medium Term**
1400 41ST STREET SE	OR_LID_6	Bioretention and pine fine trenches	$90,793	**Medium Term**
PENNSYLVANIA AVENUE SE AND ALABAMA AVENUE SE	OR_LID_10	Bioretention	$60,671	**Medium Term**
HIGHVIEW TERRACE SE AND 34TH STREET SE	OR_LID_15	Bioretention	$25,088	**Medium Term**
CAMDEN STREET SE AND 32ND STREET SE	OR_LID_17	Bioretention	$16,662	**Medium Term**
ERIE STREET SE AND 30TH STREET SE	OR_LID_18	Bioretention	$92,869	**Medium Term**
3001 ALABAMA AVENUE SE	OR_LID_20	Bioretention	$13,054	**Medium Term**
NAYLOR ROAD SE AND ERIE STREET SE	OR_LID_22	Bioretention	$224,453	**Medium Term**
NAYLOR ROAD SE AND 30TH STREET SE	OR_LID_23	Bioretention	$31,167	**Medium Term**
ALABAMA AVENUE SE AND GAINESVILLE STREET SE	OR_LID_25	Bioretention	$17,181	**Medium Term**

SITE LOCATION	PROJECT NUMBER	Project Description	Estimated Cost	Priority Ranking
2465 ALABAMA AVENUE SE	OR_LID_26	Pervious pavment & Bioretention	$31,192	**Medium Term**
2709 ALABAMA AVENUE SE	OR_LID_31	Bioretention	$70,358	**Medium Term**
KNOX STREET SE AND KNOX TERRACE SE	OR_LID_32	Bioretention	$52,764	**Medium Term**
23RD STREET SE AND SAVANNAH STREET SE	OR_LID_33	Bioretention	$73,274	**Medium Term**
23RD STREET SE AND ALABAMA AVENUE SE	OR_LID_34	Asphalt removal & Bioretention	$37,172	**Medium Term**
SAVANNAH STREET SE AND 23RD STREET SE	OR_LID_35	Bioretention	$46,240	**Medium Term**
SAVANNAH STREET SE AND 25TH STREET SE	OR_LID_36	Curb bump-outs bioretention	$135,495	**Medium Term**
VALLEY TERRACE SE AND SOUTHERN AVENUE SE	OR_LID_38	Curb bump-outs bioretention	$105,842	**Medium Term**
13TH STREET SE AND SOUTHERN AVENUE SE	OR_LID_39	Bioretention	$94,525	**Medium Term**
13TH STREET SE AND WAHLER PLACE SE	OR_LID_40	Bioretention	$80,217	**Medium Term**
1310 SOUTHERN AVENUE SE	OR_LID_41	Bioretention	$259,715	**Medium Term**
1310 SOUTHERN AVENUE SE	OR_LID_42	Bioretention	$180,320	**Medium Term**
1380 SOUTHERN AVENUE SE	OR_LID_44	Bioretention	$17,453	**Medium Term**
1380 SOUTHERN AVENUE SE	OR_LID_45	Bioretention	$37,789	**Medium Term**
1310 SOUTHERN AVENUE SE	OR_LID_46	Bioretention	$188,029	**Medium Term**
1310 SOUTHERN AVENUE SE	OR_LID_47	Bioretention	$144,020	**Medium Term**
ALABAMA AVENUE SE FROM 15TH PLACE SE TO STANTON ROAD SE	OR_LID_48	Bioretention	$34,182	**Medium Term**
1345 SAVANNAH STREET SE	OR_LID_49	Rain Gardens	$32,007	**Medium Term**
MISSISSIPPI AVENUE SE AND 15TH STREET SE	OR_LID_50	Bioretention	$98,577	**Medium Term**
14TH PLACE SE AND SAVANNAH PLACE SE	OR_LID_51	Bioretention	$95,612	**Medium Term**

SITE LOCATION	PROJECT NUMBER	Project Description	Estimated Cost	Priority Ranking
3200 6TH STREET SE	OR_LID_54	Bioretention	$215,063	**Medium Term**
SAVANNAH STREET SE AND 6TH STREET SE	OR_LID_55	Bioretention	$21,752	**Medium Term**
MARTIN LUTHER KING JR AVENUE SE AND ALABAMA AVENUE SE	OR_LID_56	Bioretention	$37,690	**Medium Term**
3400 MARTIN LUTHER KING JR AVENUE SE	OR_LID_57	Bioretention	$35,121	**Medium Term**
3400 MARTIN LUTHER KING JR AVENUE SE	OR_LID_58	Bioretention	$23,358	**Medium Term**
3400 MARTIN LUTHER KING JR AVENUE SE	OR_LID_59	Bioretention	$46,512	**Medium Term**
3500 MARTIN LUTHER KING JR AVENUE SE	OR_LID_61	Bioretention	$21,283	**Medium Term**
2ND STREET SE AND UPSAL STREET SE	OR_LID_63	Bioretention	$24,446	**Medium Term**
2ND STREET SE AND UPSAL STREET SE	OR_LID_64	Green Street District Curb Alternative	$172,437	**Medium Term**
3401 4TH STREET SE	OR_LID_65	Bioretention	$116,962	**Medium Term**
3999 8TH STREET SE	OR_LID_66	Bioretention	$57,434	**Medium Term**
3999 8TH STREET SE	OR_LID_69	Bioretention	$16,884	**Medium Term**
908 WAHLER PLACE SE	OR_LID_70	Bioretention	$49,972	**Medium Term**
908 WAHLER PLACE SE	OR_LID_71	Bioretention	$179,331	**Medium Term**
BARNABY ROAD SE AND 7TH STREET SE	OR_LID_73	Bioretention	$54,420	**Medium Term**
BARNABY ROAD SE AND SOUTHERN AVENUE SE	OR_LID_74	Bioretention	$38,185	**Medium Term**
SOUTH CAPITOL STREET AND LIVINGSTON ROAD SE	OR_LID_75	Bioretention	$46,685	**Medium Term**
SOUTH CAPITOL STREET AND LIVINGSTON ROAD SE	OR_LID_76	Bioretention	$31,241	**Medium Term**
4600 LIVINGSTON ROAD SE	OR_LID_77	Bioretention	$42,707	**Medium Term**
4600 LIVINGSTON ROAD SE	OR_LID_78	Bioretention	$31,093	**Medium Term**
4275 4TH STREET SE	OR_LID_79	Bioretention	$52,196	**Medium Term**
4275 4TH STREET SE	OR_LID_80	Bioretention	$73,298	**Medium Term**
4275 4TH STREET SE	OR_LID_81	Bioretention	$25,113	**Medium Term**

SITE LOCATION	PROJECT NUMBER	Project Description	Estimated Cost	Priority Ranking
4TH STREET SE AND LIVINGSTON TERRACE SE	OR_LID_82	Bioretention	$19,479	**Medium Term**
6TH STREET SE AND CHESAPEAKE STREET SE	OR_LID_83	Bioretention	$31,809	**Medium Term**
6TH STREET SE AND CHESAPEAKE STREET SE	OR_LID_84	Bioretention	$41,471	**Medium Term**
4399 SOUTH CAPITOL TERRACE SW	OR_LID_87	Bioretention	$39,272	**Medium Term**
100 JOLIET STREET SW	OR_LID_89	Bioretention	$67,047	**Medium Term**
100 JOLIET STREET SW	OR_LID_90	Bioretention	$59,386	**Medium Term**
100 JOLIET STREET SW	OR_LID_91	Bioretention	$41,965	**Medium Term**
SOUTH CAPITOL STREET AND XENIA STREET SW	OR_LID_93	Bioretention	$25,706	**Medium Term**
XENIA STREET SW AND SOUTH CAPITOL STREET	OR_LID_94	Bioretention	$28,943	**Medium Term**
MISSISSIPPI AVENUE SE AND ATLANTIC STREET SW	OR_LID_95	Bioretention	$34,305	**Medium Term**
SOUTH CAPITOL STREET AND CHESAPEAKE STREET SE	OR_LID_96	Rain Gardens	$19,849	**Medium Term**
4601 MARTIN LUTHER KING JR AVENUE SW	OR_LID_97	Bioretention	$65,688	**Medium Term**
4601 MARTIN LUTHER KING JR AVENUE SW	OR_LID_98	Bioretention	$28,424	**Medium Term**
OVERLOOK AVENUE SW AND CHESAPEAKE STREET SW	OR_LID_99	Bioretention	$40,186	**Medium Term**
4201 MARTIN LUTHER KING JR AVENUE SW	OR_LID_100	Bioretention	$149,926	**Medium Term**
CHESAPEAKE STREET SW FROM MARTIN LUTHER KING JR AVENUE SW TO 2ND STREET SW	OR_LID_101	Bioretention	$51,380	**Medium Term**
POTOMAC JOB CORPS VISITOR'S CENTER	OR_LID_102	Bioretention	$86,420	**Medium Term**
601 MISSISSIPPI AVENUE SE	OR_LID_107	Constructed wetland	$126,130	**Medium Term**
701 MISSISSIPPI AVENUE SE	OR_LID_109	Bioretention	$139,473	**Medium Term**
VALLEY AVENUE SE AND 4TH STREET SE	OR_LID_110	Bioretention	$19,800	**Medium Term**
4700 SHEPHERD PARKWAY SW	OR_LID_114	Bioretention	$51,182	**Medium Term**

SITE LOCATION	PROJECT NUMBER	Project Description	Estimated Cost	Priority Ranking
DC VILLAGE BUILDING 5	OR_LID_115	Rain Gardens & Bioretention	$179,529	**Medium Term**
4700 SHEPHERD PARKWAY SW	OR_LID_116	Bioretention	$48,440	**Medium Term**
4700 SHEPHERD PARKWAY SW	OR_LID_117	Bioretention	$200,236	**Medium Term**
Mississippi Ave SE and 13th St SE	OR_LID_137	Regenerative stormware Outfall	$6,490,570	**Medium Term**
101 ATLANTIC STREET SE	OR_LID_138	Stormwater Treatment Wetland	$1,356,867	**Medium Term**
LIVINGSTON ROAD SE AND ATLANTIC STREET SE	OR_LID_139	Stormwater Treatment Wetland	$1,062,821	**Medium Term**
ATLANTIC STREET SE AND VALLEY AVENUE SE	OR_LID_140	Stormwater Treatment Wetland	$654,871	**Medium Term**
Yuma St SE and 1st St SE	OR_LID_141	Stormwater Treatment Wetland	$951,212	**Medium Term**
Mississippi Ave SE and 13th St SE	OR_LID_142	Stormwater Treatment Wetland	$2,559,504	**Medium Term**
3100 ERIE STREET SE	OR_LID_145	Pavment Removal, Permeable Pavment & Biortention	$71,982	**Medium Term**
1351 ALABAMA AVENUE SE	OR_LID_149	Pavment Removal & Permeable Pavment	$51,274	**Medium Term**
908 WAHLER PLACE SE	OR_LID_150	Pavment Removal	$44,948	**Medium Term**
908 WAHLER PLACE SE	OR_LID_151	Pervious pavment	$56,834	**Medium Term**
6TH STREET SE AND CHESAPEAKE STREET SE	OR_LID_153	Pervious pavment	$61,183	**Medium Term**
100 JOLIET STREET SW	OR_LID_154	Pervious pavment	$77,665	**Medium Term**
CHESAPEAKE STREET SW AND SOUTH CAPITOL STREET	OR_LID_155	Pervious pavment	$65,384	**Medium Term**
CHESAPEAKE STREET SW AND SOUTH CAPITOL STREET	OR_LID_156	Pervious pavment	$53,622	**Medium Term**
650 SAVANNAH STREET SE	OR_LID_157	Pervious pavment	$20,534	**Medium Term**
DC VILLAGE BUILDING 5	OR_LID_160	Pervious pavment	$168,995	**Medium Term**
100 JOLIET STREET SW	OR_LID_161	Regenerative stormware Conveyance	$74,972	**Medium Term**
Stanton Road and Mississippi Ave. SE	OR_LID_163	Regenerative stormware Conveyance	$361,243	**Medium Term**

SITE LOCATION	PROJECT NUMBER	Project Description	Estimated Cost	Priority Ranking
1901 Mississippi Ave SE	OR_LID_164	Regenerative stormware Conveyance	$64,593	**Medium Term**
Livingston and South Capitol St SE	OR_LID_165	Regenerative stormware Conveyance	$159,754	**Medium Term**
1st St SW and South Capitol St	OR_LID_166	Regenerative stormware Conveyance	$79,766	**Medium Term**
650 SAVANNAH STREET SE	OR_LID_167	Regenerative stormware Conveyance	$73,909	**Medium Term**
1380 SOUTHERN AVENUE SE	OR_LID_43	Bioretention	$25,434	**Long Term**
4339 BOWEN ROAD SE	OR_LID_1	Rain Gardens & Bioretention	$15,105	**Long Term**
4323 BOWEN ROAD SE	OR_LID_2	Bioretention	$12,510	**Long Term**
1400 41ST STREET SE	OR_LID_7	Pine Fine Trench	$40,087	**Long Term**
42ND PLACE SE AND FORT DUPONT STREET SE	OR_LID_8	Curb bump-outs bioretention	$24,767	**Long Term**
PENNSYLVANIA AVENUE SE AND ALABAMA AVENUE SE	OR_LID_9	Lined biorentention to address hydrocarbon content in runoff.	$23,383	**Long Term**
3859 PENNSYLVANIA AVENUE SE	OR_LID_11	Bioretention	$23,877	**Long Term**
38TH STREET SE AND SUITLAND ROAD SE	OR_LID_12	Curb bump-outs bioretention	$28,869	**Long Term**
HIGHVIEW TERRACE SE AND DENVER STREET SE	OR_LID_13	Bioretention	$25,088	**Long Term**
HIGHVIEW TERRACE SE AND 34TH STREET SE	OR_LID_14	Green Street District Curb Alternative	$24,297	**Long Term**
BANGOR STREET SE AND 32ND STREET SE	OR_LID_16	Bioretention	$15,154	**Long Term**
30TH STREET SE AND ALABAMA AVENUE SE	OR_LID_19	Bioretention	$13,054	**Long Term**
3100 DENVER STREET SE	OR_LID_21	Bioretention	$13,104	**Long Term**
30TH STREET SE AND HARTFORD STREET SE	OR_LID_24	Bioretention	$10,287	**Long Term**
KNOX CIRCLE SE AND KNOX TERRACE SE	OR_LID_27	Bioretention	$22,395	**Long Term**
2435 ALABAMA AVENUE SE	OR_LID_28	Bioretention	$192,329	**Long Term**
2435 ALABAMA AVENUE SE	OR_LID_29	Bioretention	$44,066	**Long Term**
HARTFORD STREET SE AND ALABAMA AVENUE SE	OR_LID_30	Bioretention	$28,770	**Long Term**

SITE LOCATION	PROJECT NUMBER	Project Description	Estimated Cost	Priority Ranking
24TH STREET SE FROM SAVANNAH STREET SE TO SOUTHERN AVENUE SE	OR_LID_37	Green Street District Curb Alternative	$155,263	**Long Term**
14TH PLACE SE AND SAVANNAH PLACE SE	OR_LID_52	Curb bump-outs bioretention	$30,129	**Long Term**
STANTON TERRACE SE FROM TUBMAN ROAD SE TO ALABAMA AVENUE SE	OR_LID_53	Bioretention	$30,178	**Long Term**
3500 MARTIN LUTHER KING JR AVENUE SE	OR_LID_60	Bioretention	$11,967	**Long Term**
SAVANNAH STREET SE AND 2ND STREET SE	OR_LID_62	Bioretention	$24,421	**Long Term**
3999 8TH STREET SE	OR_LID_67	Bioretention	$15,377	**Long Term**
3999 8TH STREET SE	OR_LID_68	Bioretention	$17,551	**Long Term**
9TH STREET SE AND WAHLER PLACE SE	OR_LID_72	Bioretention	$44,931	**Long Term**
6TH STREET SE AND CHESAPEAKE STREET SE	OR_LID_85	Bioretention	$26,225	**Long Term**
4399 SOUTH CAPITOL TERRACE SW	OR_LID_86	Rain Gardens	$37,172	**Long Term**
4399 SOUTH CAPITOL TERRACE SW	OR_LID_88	Bioretention	$19,899	**Long Term**
1ST STREET SW AND JOLIET STREET SW	OR_LID_92	Bioretention	$12,708	**Long Term**
601 MISSISSIPPI AVENUE SE	OR_LID_108	Bioretention	$31,711	**Long Term**
YUMA STREET SE AND 1ST STREET SE	OR_LID_113	Pervious Pavment	$43,374	**Long Term**
2435 ALABAMA AVENUE SE	OR_LID_146	Pavment Removal	$20,806	**Long Term**
ALABAMA AVENUE SE AND HARTFORD STREET SE	OR_LID_147	Permeable Pavement	$21,498	**Long Term**
ALABAMA AVENUE SE AND 18TH STREET SE	OR_LID_148	Permeable Pavement	$18,113	**Long Term**
CHESAPEAKE STREET SE AND 6TH STREET SE	OR_LID_152	Pavement Removal	$18,311	**Long Term**

5.4. Indicators for Tracking Progress

The projects detailed above amount to small percentage of the total treatment needed to remove Oxon Run from the 303d list of impaired water bodies. These projects were reflect the management practices as the recommended scenario (Scenario 2, found in Table 21) for rehabilitating Oxon Run; the remaining treatment areas were divided over Near, Medium, and Far term project phases. A breakdown of area planned to be treated in each phase can be found in Table 30. The reductions in metal and organic constituents that will be achieved in the Near, Medium, and Far term project phases can be found in Tables 30-33. Bacteria reductions for each phase can be found in Table 34. . To track progress effectively, the monitoring program will use these expected reductions as benchmarks for the adaptive monitoring plan.

Table 30: Percentage of Watershed Treated Per Project Phase

	Near		Medium		Far		Cumulative	
BMP	Acres	% of Watershed	Acres	% of Watershed	Acres	% of Watershed	Total Acres	% of Watershed
Tree Boxes	46.94	2%	187.76	8%	422.46	18%	704.10	30%
Porous pavement	46.94	2%	187.76	8%	234.7	10%	469.40	20%
Bioretention	46.94	2%	234.7	10%	422.46	18%	704.10	30%
Vacuum Sweeping	46.94	2%	70.41	3%	117.35	5%	234.70	10%
Constructed Wetland	0	0%	234.7	10%	234.70	10%	469.40	20%

* Project phases indicate the implementation of Scenario 2- treating 30% of watershed with bioretention, 20% with porous pavement, %20 in wetlands, 30% in tree boxes and 10% by vacuum sweeping.

Table 31: Load Reductions Associated with Near Term Projects

	Near							
	Reductions Expected (lbs/year)					Reductions Expected for Near Term Projects (lbs/year)	Cumulative Reductions Expected for Near (lbs/year)	Overall Load Reductions Needed (as stipulated in TMDL) (lbs/year)
BMP	Bioretention	Pervious Pavement	Wetland	Tree Boxes	Vacuum Sweeping			
Acreage	**46.94**	**46.94**	**0**	**46.94**	**46.94**			
Copper	4.97	4.78	0	4.23	4.46	18.44	31.91	161.4
Zinc	12.88	12.34	0.00	11.03	3.68	39.93	66.98	0
Arsenic	0.09	0.09	0.00	0.08	0.03	0.28	0.48	4.3
Lead	2.21	2.39	0.00	2.02	0.59	7.22	12.23	90
Chlordane	1.20E-03	7.70E-04	0.00	7.99E-04	2.67E-04	3.04E-03	4.87E-03	0.035358
DDT	5.54E-03	5.91E-03	0.00	5.33E-03	1.89E-03	1.87E-02	3.18E-02	0.18333
Dieldrin	4.85E-06	5.80E-06	0.00	5.21E-06	1.70E-06	1.76E-05	3.03E-05	3.19E-03
Heptachlor Epoxide	1.55E-04	1.65E-04	0.00	1.48E-04	5.26E-05	5.21E-04	8.86E-04	5.64E-03
PAH 1	0.04	0.04	0.00	0.03	0.012	0.12	0.20	0
PAH 2	0.61	0.64	0.00	0.58	0.207	2.04	3.46	22.442
PAH 3	0.46	0.49	0.00	0.44	0.153	1.54	2.63	14.21
TPCB	0.01	0.01	0.00	0.01	2.67E-03	0.02	0.04	0.36

* Project phases indicate the implementation of Scenario 2- treating 30% of watershed with bioretention, 20% with porous pavement, %20 in wetlands, 30% in tree boxes and 10% by vacuum sweeping.

Table 32: Load Reductions Associated with Medium Term Projects

	Medium							
	Reductions Expected (lbs/year)					Reductions Expected for Medium Term Projects (lbs/year)	Cumulative Reductions Expected for Medium (lbs/year)	Overall Load Reductions Needed (as stipulated in TMDL) (lbs/year)
BMP	Bioretention	Pervious Pavement	Wetland	Tree Boxes	Vacuum Sweeping			
Acreage	234.7	187.8	234.7	187.8	70.41			
Copper	24.83	19.12	17.50	21.17	6.69	89.31	107.75	161.4
Zinc	64.40	49.32	28.50	55.20	16.56	213.98	253.91	0
Arsenic	0.43	0.36	0.35	0.40	0.12	1.66	1.95	4.3
Lead	11.03	9.56	9.20	10.13	2.67	42.60	49.81	90
Chlordane	6.00E-03	3.08E-03	8.50E-03	4.00E-03	1.20E-03	0.02	0.03	0.035358
DDT	2.77E-02	2.36E-02	2.00E-02	2.67E-02	8.49E-03	0.11	0.13	0.18333
Dieldrin	0.00	0.00	0.00	0.00	7.65E-06	1.02E-04	1.19E-04	3.19E-03
Heptachlor Epoxide	0.00	0.00	0.00	0.00	2.37E-04	3.01E-03	3.53E-03	5.64E-03
PAH 1	0.18	0.15	0.14	0.17	0.05	0.69	0.81	0
PAH 2	3.05	2.57	2.34	2.89	0.93	11.77	13.81	22.442
PAH 3	2.31	1.95	1.78	2.20	0.69	8.93	10.48	14.21
TPCB	0.03	0.03	0.27	0.03	0.01	0.38	0.40	0.36

* Project phases indicate the implementation of Scenario 2- treating 30% of watershed with bioretention, 20% with porous pavement, %20 in wetlands, 30% in tree boxes and 10% by vacuum sweeping.

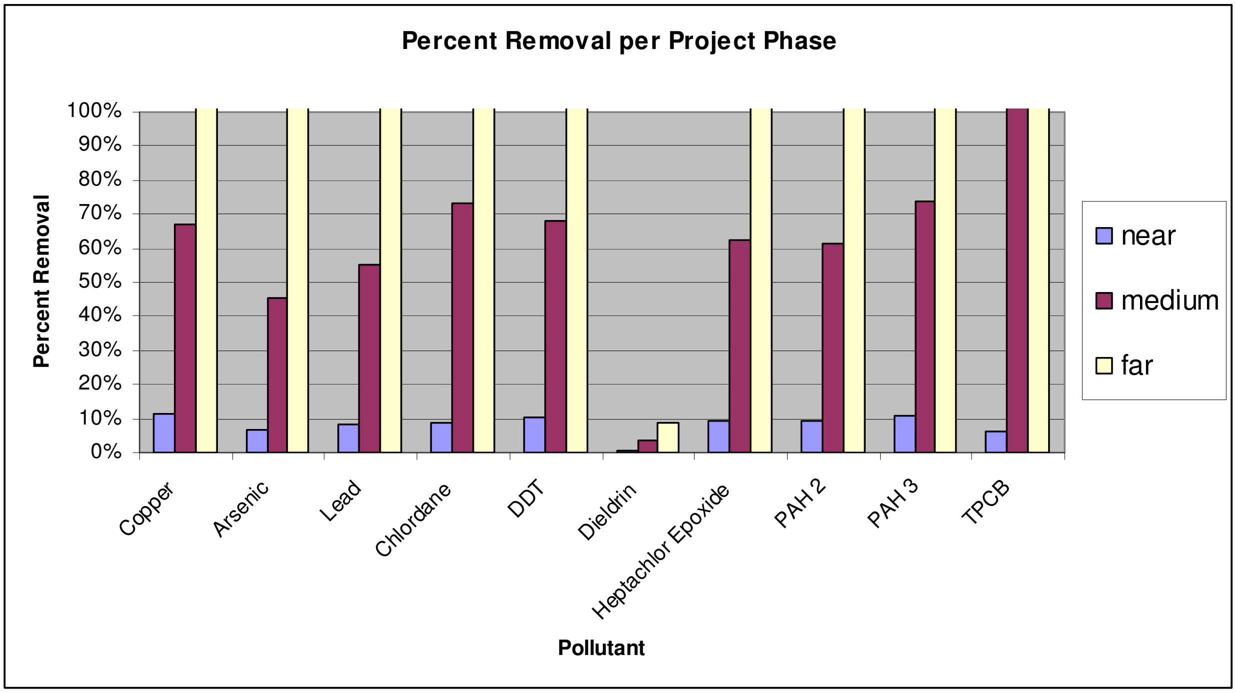
Table 243: Load Reductions Associated with Far Term Projects and Cumulative Reductions

BMP	Far							
	Reductions Expected (lbs/year)					Reductions Expected for Far Term Projects (lbs/year)	Cumulative Reductions Expected at Far (lbs/year)	Overall Load Reductions Needed (as stipulated in TMDL) (lbs/year)
	Bioretention	Pervious Pavement	Wetland	Tree Boxes	Vacuum Sweeping			
Acreage	433.26	234.7	234.7	422.46	117.85			
Copper	44.70	23.90	17.50	38.10	11.16	135.36	243.11	161.4
Zinc	115.92	61.65	28.50	99.36	27.64	333.07	586.97	0
Arsenic	0.78	0.45	0.35	0.72	0.20	2.50	4.45	4.3
Lead	19.86	11.95	9.20	18.24	4.46	63.71	113.52	90
Chlordane	1.08E-02	3.85E-03	8.50E-03	7.20E-03	2.00E-03	0.03	0.06	0.035358
DDT	4.99E-02	2.96E-02	2.00E-02	4.80E-02	1.42E-02	0.16	0.29	0.18333
Dieldrin	4.37E-05	2.90E-05	2.04E-05	4.69E-05	1.28E-05	1.53E-04	2.72E-04	3.19E-03
Heptachlor Epoxide	1.40E-03	8.25E-04	5.95E-04	1.33E-03	3.95E-04	4.55E-03	8.07E-03	5.64E-03
PAH 1	0.32	0.19	0.14	0.31	0.09	1.04	1.86	0
PAH 2	5.49	3.22	2.34	5.20	1.55	17.79	31.60	22.442
PAH 3	4.164	2.44	1.78	3.97	1.15	13.50	23.97	14.21
TPCB	0.06	0.035	0.27	0.06	0.02	0.45	0.84	0.36

* Project phases indicate the implementation of Scenario 2- treating 30% of watershed with bioretention, 20% with porous pavement, %20 in wetlands, 30% in tree boxes and 10% by vacuum sweeping.

All metals and organic constituent loading (with the exception of Dieldrin) will be reduced to meet load allocations stipulated in the 2004 TMDL report for Oxon Run watershed by the end of the final project phase. A load reduction of over 70% will be seen by the end of the second project phase, namely Copper, Zinc, Arsenic, Lead, and PAH2. Figure 1 illustrates the percent reductions achieved for organic and metal constituents for each project phase.

Figure 1: Projected Pollutant Reductions



Bacteria load reductions associated with each project phase can be found in Table 34: Bacteria Reductions per Project Phase. As with metal and organic pollutants, these numbers will serve as benchmarks for water quality in the adaptive monitoring plan as outlined in Section 6: Monitoring.

Table 34: Bacteria Reductions per Project Phase

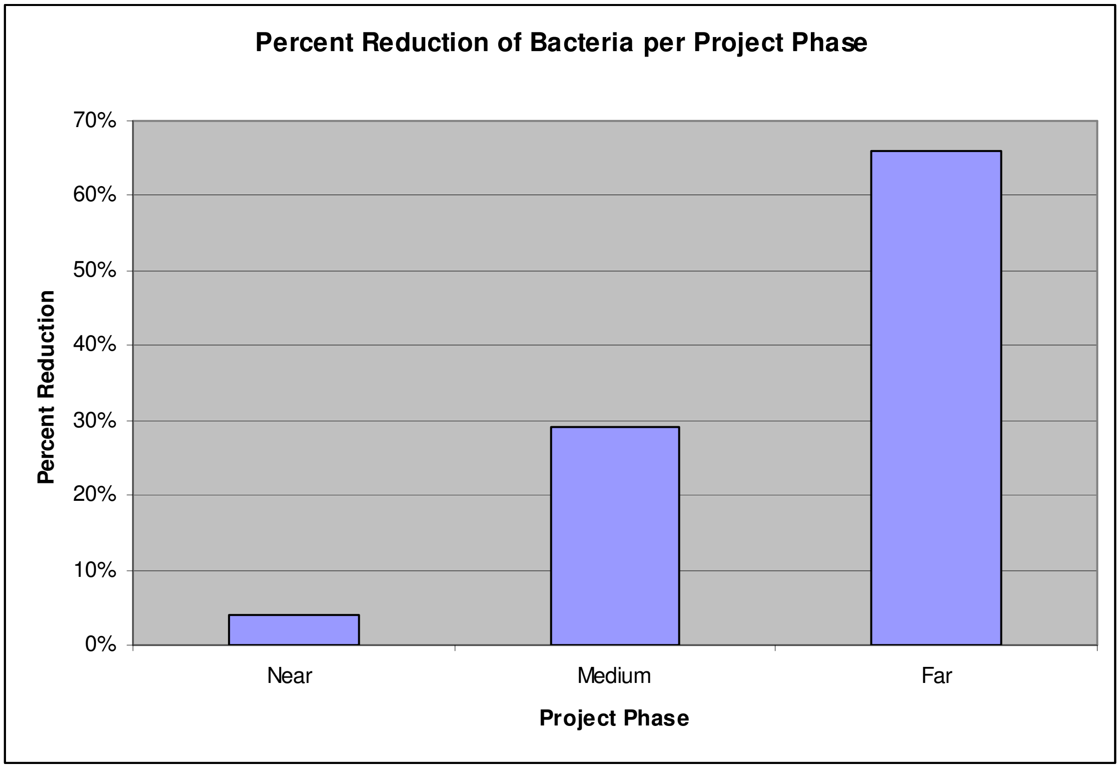
	Near							
	Reductions Expected (MPN/year)					Reductions Expected for Near Term Projects (MPN/year)	Cumulative Reductions Expected (MPN/year)	Reductions Needed (from TMDL) (MPN/yr)
BMP	Bioretention	Pervious Pavement	Wetland	Tree Boxes	Vacuum Sweeping			
Acreage	53.12	47.48	0	47.14	47.14			9.90E+14
Bacteria	5.57E+13	1.40E+13	0.00E+00	1.25E+13	1.40E+13	9.62E+13	9.62E+13	

	Medium							
	Reductions Expected (MPN/year)					Reductions Expected for Medium Term Projects (MPN/year)	Cumulative Reductions Expected (MPN/year)	Reductions Needed (from TMDL) (MPN/yr)
BMP	Bioretention	Pervious Pavement	Wetland	Tree Boxes	Vacuum Sweeping			
Acreage	371.38	240.99	303.06	235.7	235.7			9.90E+14
Bacteria	3.46E+14	7.10E+13	3.63E+14	6.23E+13	6.96E+13	9.11E+14	1.01E+15	

	Far							
	Reductions Expected (MPN/year)					Reductions Expected for Far Term Projects (MPN/year)	Cumulative Reductions Expected (MPN/year)	Reductions Needed (from TMDL) (MPN/yr)
BMP	Bioretention	Pervious Pavement	Wetland	Tree Boxes	Vacuum Sweeping			
Acreage	518.29	419.33	403.99	424.26	424.26			9.90E+14
Bacteria	5.44E+14	1.25E+14	4.84E+14	1.12E+14	1.25E+14	1.39E+15	2.40E+15	

Bacteria reductions seen as a result of the implementation of the proposed Best Management Practices in Scenario 2 can be found in Figure 2.

Figure 2: Percent Reductions of Bacteria per Project Phase (MPN/yr)



5.5. Financial and Technical Resources Needed for Management Measures

The total cost of implementing all the identified implementation projects from the Watershed Implementation Plan over the anticipated 30-year timeframe is $145,115,143. This amount does not include the cost of trash removal projects or targeted enforcement of sites in need of better pollution prevention. These additional management measures, while not without cost, are omitted because they can be incorporated, over time, into existing programs. Trash removal can be done using volunteer labor. A summary of costs is available in Table 35.

The overall implementation amounts to $4.837,171 per year, not adjusted for inflation. The budget for reducing stormwater pollution throughout the District of Columbia annually is approximately $13,000,000. These funds come from stormwater fees collected for the administration of the MS4 program, an annual grant from the EPA Chesapeake Bay Program, an annual grant from the EPA Non-point Source Pollution Program, and District budget appropriations. These funds are spread to activities throughout the District – not just in the

Oxon Run watershed. When allocated by percent land area in Oxon Run, the annual amount is equivalent to approximately $1,066,000.

Table 35: Cost of Implementing Identified Restoration Projects and Projects Suggested in Scenario 2.

Indentified Project Type	Cost of Implementation
Green Roof Projects	$18,223,118
Permeable Pavement	$4,442,826
All Other Low Impact Development Projects	$21,043,671
Regenerative Stormwater Conveyance	$285,640
Stream Restoration	$10,000,000
Riparian Reforestation	$243,298
General Reforestation	$1,579,500
Total Cost	**$55,818,053.00**

Project Type Suggested in Scenario 2	Cost of Implementation
Bioretention	$13,908,040
Pervious Pavement	$50,238,100
Constructed Wetland	$7,970,910
Tree Boxes	$17,180,040
Vacuum Sweeping	$656,221/year
Total Cost	**$89,297,090.40**

Cost of Identified Projects and Projects Suggested in Scenario 2	**$145,115,143**

In reality, however, the District allocates a greater percent of funds to the Anacostia because its pollution impairments are much worse than other District tributaries and not all funds are used for implementation. Some of the funds are used for salaries and program administration. These factors combine to make the actual amount of funds being allocated toward Oxon Run watershed far below the levels needed to complete these projects.

In order to restore Oxon Run, even over a 30 year time frame, additional funds will be needed. Some potential sources of additional funds have been identified. These include:

- Increasing the stormwater fee that District residents pay for the administration of the MS4 permit;

- Allocating funds from the recently implemented fee on shopping bags; and
- Being more efficient with existing funds through better coordination with other District agencies to ensure stormwater mitigation components are included in new development, redevelopment and infrastructure projects.

Despite any additional funds that the District is able to dedicate to the restoration of Oxon Run, there will still be a need for additional support from the federal government. The District of Columbia is unique in that 1/3 of its lands are held by the federal government. This effectively reduces city revenues because the federal government does not pay taxes and occupies valuable lands that could generate revenue for the city. The federal government provides annual appropriation to the District, but it is difficult to budget for these funds because appropriation is not automatic.

In addition to further funding, as a local government, we are in need of additional technical resources. Although we have a strong and knowledgeable staff, we are still a small staff that is required to fulfill the obligations of both a state and local agency. DDOE and EPA Region III have recently signed a Performance Partnership Agreement and was developed under the auspices of the National Environmental Performance Partnership System. The vision of this agreement includes the goals of "improve[ing] the quality of life in the District of Columbia through the protection and enhancement of human health and the environment… and [topromote greening of neighborhoods." Under the auspices of this agreement, or through some other means, EPA and DDOE should coordinate monitoring activities that will comprehensively evaluate water quality impairments in Oxon Run. Similarly, EPA can assist in the multijurisdictional coordination that is needed to address water quality issues in the Oxon Run watershed in both Prince Georges County and the District.

A final, and important, area where the District requires technical assistance is working with federal landholders, i.e. National Park Service. A number of the proposed projects, most notably stream restoration, are located on federal lands. To date the Federal agencies have been reticent to allow the District access to their lands to treat stormwater pollution or do stream restoration. The District could use the weight of a federal agency supporting our efforts and negotiating on our behalf with the major federal landholders – the military services, the Government Services Administration, and the Architect of the Capitol would all be included. The most notable agency, however, as already mentioned, is the National Park Service, since any stream restoration work done on Oxon Run would impact, and ultimately benefit, the National Park Service.

6. MONITORING

On a biannual basis DDOE Water Quality Division, an office within the Office of Natural Resources, prepares the Integrated Report to the Environmental Protection Agency. This report, which was last prepared in 2008, satisfies the listing requirements of §303(d) and the reporting requirements of §305(b) of the federal Clean Water Act (P.L. 97-117). This report provides water quality information on the District of Columbia's surface and ground waters that were assessed during 2008 and updates the water quality information as required by law. Monitoring data for this report came from two assessments. Monitoring took place in the downstream reach closest to the Maryland border. The purpose of monitoring at the downstream reach was to ensure that a cumulative effect of all pollution sources would be registered.

The Water Quality Division uses the D.C. Surface Water Quality Standards for evaluating surface waters. The percentage of time a selected standard is out of compliance at a monitoring station or group of monitoring stations over a selected span of time determines whether a water body supports a particular use. As already mentioned, Oxon Run is designated for class A – D uses. (DC Integrated Report, 2008) The District determines overall use support for water bodies with multiple uses according to EPA guidance. A water body fully supports its designated uses when all its uses are fully supported. When one or more uses are not supported, then the water body is not supporting. (DC Water Quality and Assessment Strategy, 2004) In summary the Oxon Run findings in the 2008 Integrated Report are as follows:

> While not providing a specific score, the report notes that there is a low Hilsenhoff Biotic Index score. The report, again without noting actual numbers, suggests that there is a high percentage of EPT. The dominant taxa were Coenagrinidae. Collected macroinvertebrates were assed as tolerant species. The D.O. (0.0%-Violation), pH (5.0%-violation) and temperature (0.0%) fully supported the aquatic life use. Based on surface fecal coliform samples Oxon Run was not in compliance for its swimmable use and was not in compliance for its secondary contact use at 81.2% of the time. Oxon Run did not support the consumption of fish due to an EPA fish advisory on the Potomac River.

In short, Oxon Run did not meet its designated uses for the monitoring period (see the table below for designated use indicators). The assumption, however, that Oxon Run is impaired for toxics is not substantiated by enough data to make any clear assertions on the type of or concentrations of toxic compounds, if any. Degraded habitat, low dissolved oxygen and/or thermal massing from the concrete lined channel may preclude the presence of all but the most tolerant species and explain low macroinvertebrate counts on the downstream end of Oxon Run. As mentioned is section 1.3 better monitoring data is necessary to ascertain the types, concentrations, and sources of listed pollutants of concern.

The other source of water quality data for Oxon Run is stormwater outfall monitoring done for the MS4 Discharge Monitoring Report. In an attempt to get a representative sample of stormwater discharge to Oxon Run three wet samples and one dry sample are taken once every three years from a stormwater outfall to Oxon Run. The samples are analyzed for over 150 parameters. The sample collection method is “grab sample” for analysis of some parameters and “time/flow weighted” for other analyses as required by the federal 40 CRF 122.26. The data for Oxon Run is contained in MS4 Discharge Monitoring Reports (DMR) that is prepared for the Potomac River watershed and can be found on the DDOE website, ddoe.dc.gov. A summary of the most recent storm water outfall findings for Oxon Run can be found in Appendix F.

To ensure that the monitoring program helps to inform the Oxon Run restoration effort and to ensure that the restoration effort has a measurable impact on improved water quality, DDOE will carry out a comprehensive monitoring regiment for Oxon Run. Monitoring data will form an information feedback loop that allows planners to adjust the implementation strategy as new information becomes available. Most importantly monitoring data will help ensure that the outcome of a clean and healthy water body, which can be enjoyed by the Districts residents, is met.

Table 256: Designated Use Indicators

Designated Use	Indicators Used to Determine Use Support
Primary Contact Recreation (Class A)	Pathogen
Secondary Contact Recreation (Class B)	Pathogen
Protection & Propagation of Fish, Shellfish & Wildlife (Class C)	Stream Survey Assessment (benthic macroinvertebrates, fish assessment, ambient monitoring and habitat assessment)
Protection of Human Health Related to Consumption of Fish and Shellfish (Class D)	Fish Tissue Study and EPA Fish Advisory

- Adapted from 2004 District of Columbia Water Quality Monitoring and Assessment strategy

6.1. Current Monitoring Strategy

The 2008 DC Integrated Report Reads as follows:

> The D.C. Water Quality Monitoring Regulations (Title 21, Chapter 19 - District of Columbia Municipal Regulations) were developed to provide for accurate, consistent, and reproducible water quality monitoring data for decision making purposes. Data used must have been collected in the actual water body that is being assessed. If a designated use is not supported, then a water body or water body segment is listed for the pollutant associated with the applicable criteria. In order for a water body to be listed the data evaluated for water quality standard attainment must have been collected from that specific water body. Only relevant data should be used to make the attainment determination. This stipulation is necessary as development of a TMDL is a major time and monetary investment for the parties involved. The Water Quality Division must ensure that the funds expended for TDML purposes are used in an efficient manner and will result in

maximum water quality benefits. For example, the Anacostia River cannot be listed for copper if there is no copper data available from water samples collected in a segment of the Anacostia River to indicate that impairment. MS4 data from an outfall to a tributary of the Anacostia River cannot be used to list a segment of the Anacostia River.

In other words DDOE is committed to gathering comprehensive and relevant water quality data for Oxon Run. The monitoring strategy will build upon ongoing monitoring in Oxon Run. The goal for the monitoring strategy is to asses Oxon Run water quality under a variety of conditions including wet and dry weather and to also examine point source discharges that contribute to water quality impairment, namely the MS4 system. A summary of ongoing monitoring is found in Table 37. A fairly comprehensive monitoring strategy has already been implemented, however, as mentioned elsewhere in this report, there are gaps in the available data for Oxon Run that will need be addressed.

DDOE Water Quality Division sets an annual schedule of monitoring activities that are outlined in the Table below. Dates for water quality are set in advance and in-stream water quality monitoring takes place in all weather conditions. Moreover, quarterly water quality monitoring ensures that samples are representative of the various seasons. DDOE also collects wet weather water quality samples at outfalls in compliance with the Districts MS4 permit. The data from this monitoring is reported to the EPA in the biennial Discharge Monitoring Report to the EPA and is posted on the DDOE website. Finally, DDOE monitors for biological activity in Oxon Run. When streams with both conventional pollutant data and biological data are evaluated, the biological data are the overriding factor in aquatic life use decisions. Tributary assessments are based on the Maryland 2001 Biological Stream Survey (MBSS) for benthic macroinvertebrates which are used as a reference. Aquatic life use support is based on the relationship between observed stream biological conditions as compared to the reference stream condition producing a percent of reference stream biological condition. This scale rates “impaired” at 0-79%, and “non-impaired at 80-100%” of reference condition. U.S. EPA 305(b) guidelines on criteria for aquatic life use support classification recommend designation of “not supporting” if impairment exists, and “fully supporting” if no impairment exists. Coastal Plain tributaries are assessed using reference condition data from Montgomery and Prince George’s Counties, Maryland. DDOE uses the most up-to-date assessment techniques when conducting bio-assessments for Oxon Run.

Table 37: Summary of Current Monitoring Activities

Parameters Monitored	Frequency	Type of Sample
Bacteria (E. Coli)	Quarterly	Grab Sample
Temperature, Salinity, Dissolved Oxygen %, Dissolved Oxygen Concentration, pH, Turbidity, Chlorophyll, and Hardness	Quarterly	In Situ

Parameters Monitored	Frequency	Type of Sample
Dissolved Metals (Zinc, Lead, Copper, Aresenic)	Quarterly	Grab Sample
Outfall Monitoring (150 Parameters See Appendix F)	Three Wet Weather Events And One Dry Weather - Biennial	Time/Flow Weighted & Grab Samples
Benthic Macroinvertebrates	Annually	District of Columbia Stream Survey (adapted from Maryland Biological Stream Survey)
Habitat Assessment	Annually	District of Columbia Stream Survey (evaluate in-stream habitat, channel morphology, and structural features of bank and riparian vegetation)
Fish Assessment	Annually	Index of Biotic Integrity

Current monitoring practices, however, are not sufficient for monitoring all the water quality indicators and benchmarks as described in section 5.4 above. DDOE has not focused monitoring efforts on TMDL end points per se. Monitoring protocols, as currently conceived, are focused on making use determination based on the water bodies designated uses and on complying with the Districts MS4 permit from EPA Region III. On the other hand, the data currently collected by DDOE is a valuable source of information that establishes a baseline of for most pollutants in Oxon Run and can help determine the presence and concentration of those pollutants. Some enhancements are needed to gain a better picture for the sources of impairment and to accurately measure progress toward delisting Oxon Run.

6.2. Enhanced Monitoring Strategy

To ensure that the monitoring program helps to inform the Oxon Run restoration effort and to ensure that the restoration effort has a measurable impact on improved water quality, DDOE will develop an enhanced monitoring regiment for Oxon Run. By leveraging existing data and monitoring efforts the enhanced monitoring program will measure progress toward near, medium, and long term benchmarks as outlined in section 5.4. Monitoring data will form an information feedback loop that allows planners to adjust the implementation strategy as new information becomes available. Most importantly, monitoring data will help ensure that the outcome of a clean and healthy water body, which can be enjoyed by the Districts residents, is met.

The enhanced monitoring strategy will have the following key components:

- Monitor for organic pollutants;
- Monitor at multiple locations; and,
- Gather both dry and wet weather samples.

These additions to current monitoring activities will give a comprehensive picture of existing conditions and establish a baseline from which progress toward TMDL endpoints can be measured. Establishing a monitoring station at an upstream reach near the District and Prince Georges County border, in addition to the downstream location, will allow planners to more accurately depict pollutant loads coming from upstream sources outside the District's borders. Wet weather samples, in addition to outfall monitoring, and dry weather samples, will further enhance DDOE's understanding of the water quality impairment contributed via stormwater.

The most glaring gap in the current suite of water quality information available for Oxon Run is the lack of direct sampling for organic pollutants. To close this gap DDOE proposes a dual strategy of intensive biological monitoring and continuous in situ water quality monitoring. Biological monitoring will examine fish tissue samples to ascertain the presence of organic pollutants that are harmful to human health. The in situ monitoring will be done using a Continuous Low-Level Monitoring device, or CLAM.

The CLAM is a submersible extraction sampler, using EPA approved SPE (Solid Phase Extraction) media to sequester Pesticides, Herbicides, PAH's, TPH, and other trace organics from water. The device uses low flow rate extraction sampling (5-60 ml/minute), where water is drawn continuously through the extraction media. The CLAM provides an extraction event that can be hours, days or weeks long, allowing capture of trace pollutants from illicit and episodic events. Standard grab sampling only provides a few second snap shot in time, of a changing dynamic system, and a liter sample to take to the laboratory for extraction and analysis.

The CLAM actually extracts the water in-situ, with the same technology the labs use on the bench. It provides a pre-extracted quantitative sampling event representing up to a hundred liters of water, lowering the laboratories detection limits a hundred fold. The small dry extraction disk is all that is sent to the laboratory for solvent elution and analysis. This saves the costs of extraction, expensive cooler shipments of sample bottles, and seven day holding time requirements. The testing methods for the extraction disc would utilize EPA method 8081 pesticides, and the 8270 PAH's. Rather than extracting from a water sample, the lab will only elute the sample from the sampling disk. The expense of shipping out liter bottles is avoided. In addition the CLAM filter disk represents up to 100 liters of extracted water and many aliquots can be taken from the extract for many different semi-volatile methods, the lab only needs to perform one simple solvent elution instead of having to run multiple solvent extractions. Finally, the clam can be deployed strategically to sample before, during, and after storm events.

Sampling protocol for the CLAM would be established in accordance with EPA Quality Assurance Project Plan guidance. Sampling would begin at the lowest reach in the District Portion of Oxon Run. Subsequent upstream samples would help to pinpoint the source(s) of organic pollution, if any. Similarly, fish tissue analysis would follow quality assurance protocol.

Fish samples from upper and lower reaches would be taken. Bioaccumulation, if any, of organic and metals pollutants in fish tissue which may be harmful to human health if consumed would be tested for. The enhanced monitoring strategy is in keeping with the D.C. Water Quality Monitoring Regulations (Title 21, Chapter 19 - District of Columbia Municipal Regulations) that data used to for TMDLs be gathered from the impaired stream in Question.

This monitoring strategy will allow DDOE to measure progress toward the bench marks established in section 5.4. It will also allow DDOE to track the effectiveness of various management techniques that have been outlined in this report. For example, stream restoration initiatives should have a dramatic benefit for benthic macroinvertebrate populations or water quality wetlands should dramatically decrease metals concentrations at the stormwater outfall. The ultimate questions that monitoring should be answering are: is the stream impaired? If so, what are the impairments? And are control measures effective for removing those impairments? The objective is to have a healthy stream that supports both aquatic life uses and human uses while contributing to the overall health and well being of the community.

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