

**Watershed Restoration Action Strategy (WRAS)
State Water Plan Subbasin 03G
Darby, Crum, Ridley, Chester and Cobbs Creeks Watersheds
(Delaware River Estuary)
Delaware, Chester and Philadelphia Counties**

Introduction

Subbasin 03G consists of 244 square miles within the Darby, Crum, Ridley, and Chester Creek watersheds and other tributaries that flow directly into the Delaware River Estuary from Tinicum downstream to Marcus Hook. Other major tributaries in the subbasin are Marcus Hook Creek and Naaman Creek in Delaware County. A total of 341 streams flow for 471 miles through the subbasin. The subbasin also includes the Delaware River Estuary from downstream of the confluence of the Schuylkill River to the PA/Delaware State line. The subbasin is included in **HUC Area 2040202**, Delaware River, a Category I, FY99/2000 Priority watershed in the Unified Watershed Assessment.

Geology/Topography

Most of the subbasin is within the Northern Piedmont Ecoregion, Piedmont Uplands (64c) section, an area of metamorphic and igneous rocks including gneiss, schist, mica slate and hornblende. Topography consists of low rounded hills and ridges, irregular plains and narrow stream valleys. Soils derived from these rocks have a moderate rate of water infiltration; slopes range from 15 to 20 percent.

The land adjacent to the Delaware River is in the Middle Atlantic Coastal Plain, Delaware River Terraces and Uplands (63a). Most of this section has been developed and paved and has a high runoff and flooding potential. The major streams in the subbasin experience a quick drop in elevation as they descend through the "Fall Line", the boundary between the uplands and the coastal plain. As an example, Chester Creek drops 200 feet through the Fall Line. In colonial times, mills were constructed on creeks at the Fall Line, where the natural drop in elevation provided water power to turn a mill wheel.

Land Use

Subbasin 03G includes primarily urban, suburban, and small rural areas with scattered woodlots. The most highly developed and highly populated area extends from the borough of Narberth at the northeastern edge of the basin, south through Philadelphia to Marcus Hook at the southwestern edge of the basin. The subbasin population was 767,000 in 1990. Population densities range up to 20 people per acre in the eastern half of the subbasin and as low as 1 per acre in the western rural portions. The southeastern third of the basin is completely urbanized and partially within the City of Philadelphia. The subbasin also contains the city of Chester and nine boroughs. Approximately 500,000 people live in the Darby Creek watershed, which includes Cobbs Creek, and comprises most of the eastern 1/3 of the basin. The Philadelphia International Airport is located in the southeastern corner of the subbasin.

I-476 (the Blue Route) was completed in the mid-1990's and connects I-95 in the southern part of the subbasin with the PA Turnpike (I-76). These highways traverse the Crum Creek, Ithan Run, and Darby Creek valleys. These and other major roads crossing the subbasin provide a transportation network that has facilitated expansion of residential, commercial and industrial development. Chester Creek watershed provides a good example of this development pressure. Seven major highways traverse Chester Creek watershed, U.S. 1, 202, 322, PA 3, 261, 452, and 926; I-95 crosses lower Chester Creek. Wetlands were filled in and streams were channelized and moved into culverts. The creeks became surrounded with housing developments, strip malls, dive-in banks, car dealerships, and office complexes.

Agriculture was once the dominant land use in the subbasin, but farming has dwindled to only a few farms in the upper reaches of the Chester, Ridley, Crum, and Darby Creek watersheds.

Natural/Recreational Resources:

- Tinicum National Wildlife Refuge, a coastal plain marsh west of the Philadelphia Airport.
- Ridley Creek State Park
- Tyler Arboretum
- Rose Tree and Smedley Parks (part of the Delaware County Park System)
- Many local historical sites that date to the late 1600's and early 1700's are preserved in the county's park system.
- Cobbs Creek Park, located in West and Southwest Philadelphia, contains the city's oldest golf course, two natural space centers, day/night recreation track, Ice Skate House, butterfly trails, two waterfalls and the new Cobbs Creek Community Environmental Education Center.

Fisheries:

- The subbasin contains several streams that are popular with local anglers. The PA Fish and Boat Commission annually stocks parts of the East and West Branches of Chester Creek, Ridley Creek, Darby Creek, Little Darby Creek and Ithan Run with trout. Several local sportsman organizations have also stocked parts of these streams.
- Naturally reproducing brown trout populations have been documented by DEP and the PA Fish and Boat Commission in the headwaters of Darby Creek and Crum Creek, the Rocky Run tributary to Chester Creek, the Dismal Run tributary to Ridley Creek, and the Ithan Run tributary to Darby Creek.
- Long Hook Creek, a tidal tributary to the Delaware River Estuary, supports populations of several sensitive fishes, including one proposed state endangered species.

DEP Chapter 93 High Quality (HQ) or Exceptional Value (EV) streams:

EV streams:

- None.

HQ Streams:

- Crum Creek, source to the Newtown-Edgemont-Willistown Townships border
- Ridley Creek, source to Media water intake
- Rocky Run

Water Supplies:

Four public water supply intakes and about 60 water supply wells are located in the subbasin.

- Crum Creek: two water supply reservoirs owned by Philadelphia Suburban Water Company serve over 200,000 people in the region. The upper Crum Creek impoundment, Geist Reservoir (Springton Lake), and the Lower Crum Creek Reservoir make up the largest public drinking water supplies in Delaware County. A water treatment plant is located at the Lower Crum Creek Reservoir. Sedimentation and nutrient problems are becoming more prevalent in these reservoirs due to residential and commercial development in the upper watershed.
- West Chester Reservoir is located on upper East Branch Chester Creek

Water Quality Impairment

The subbasin is impaired by urban and stormwater runoff, stream bank erosion, combined sewer overflows (CSO), hydromodification, heavy industry, and commercial development. The South Branch of Naaman Creek and portions of Crum Creek are affected by poor agricultural practices. Streams in the most highly urbanized areas experience extreme flow fluctuations that severely limit aquatic life. The record rainfall during Hurricane Floyd resulted in substantial flooding along Darby Creek in Darby and Colwyn Boroughs in September 1999.

Urbanization and paving can have a severe effect on stream aquatic life. Studies by the Maryland Department of Natural Resources stated that a reduction in stream aquatic species diversity may begin with as little as 2% impervious cover. Maryland streams with above 15% impervious cover were rated fair to poor for aquatic species. When the impervious cover reached 25%, species diversity was significantly reduced. Riparian vegetation removal and paving affect both stream water temperature and habitat for aquatic species. Organisms most affected include many species of reptiles and amphibians, brook trout, and stoneflies. Stormwater runoff from paved areas can also wash out oil and grease and other pollutants into streams. The paved areas also restrict replenishment of groundwater and contribute to flash flooding during storm events and extreme fluctuations in stream water levels. Extreme flow fluctuations cause difficulties in the attachment of bottom dwelling organisms to the stream substrate and also cause a scouring of the substrate. Retention of riparian vegetation in unnamed headwater tributaries, known as first order streams, which may comprise as much as 50% of the streams in a watershed, can be especially critical to the protection of organisms in the downstream watershed.

The subbasin also suffers from point source discharges from industry and municipal sewage treatment plants. A large industrial area with many large oil storage tanks is located between southwest Philadelphia and Marcus Hook. Stream segments have been degraded with chlorine, chloroform, PCE, PCB, solids, nitrates, phosphates, ammonia, pipeline/oil spills or leaks. The remediation and clean up of a contaminated abandoned paper products manufacturing site the plant and waste lagoons in the lower part of the Crum Creek watershed (Smedley Park) was completed in 1994. The Delaware River has a fish consumption advisory for white perch, channel catfish, and American eel. These fish are not to be eaten if taken from the Delaware River.

Monitoring/Evaluation

The subbasin was assessed under the Department's unassessed water's program in 1998 and 1999. Out of 404.5 miles assessed, 127.6 miles or 32% are impaired and 276.9 miles are unimpaired and support their protected uses for aquatic life. Most of the impaired stream segments were in the lower portions of the individual watersheds. The most common sources of impairment are habitat modification and urban runoff/storm sewers that cause water and flow variability and sedimentation. Municipal point sources were also causing impairment. Ridley Creek is the only major watershed that was unimpaired throughout its entire length.

DEP biologists use a combination of habitat and biological assessments as the primary mechanism to evaluate Pennsylvania streams under the Unassessed Waters Program. This method requires selecting stream sites that would reflect impacts from surrounding land uses that are representative of the stream segment being assessed. The biologist selects as many sites as necessary to establish an accurate assessment for a stream segment. The length of the stream segment assessed can vary between sites. Several factors are used to determine site location and how long a segment can be, including distinct changes in stream characteristics, surface geology, riparian land use, and the pollutant causing impairment. Habitat surveys and a biological assessment are conducted at each site. Biological surveys include kick screen sampling of benthic macroinvertebrates, which are identified to family in the field, and an evaluation of their tolerances to pollution. Benthic macroinvertebrates are the organisms, mainly aquatic insects, that live on the stream bottom. Since they are short-lived (most have a one-year life cycle) and relatively immobile, they reflect the chemical and physical characteristics of a stream and chronic pollution sources or stresses. Habitat assessments evaluate how deeply the stream substrate is embedded, degree of streambank erosion, condition of riparian vegetation, and amount of sedimentation.

The table below shows the impairment sources for stream miles not meeting their protected aquatic life use. Sources of impairment were prioritized based upon the number of miles impaired for each source. The high priority sources (> 5% stream miles impacted) include urban runoff / storm sewers, habitat

modification, municipal point source, flow regulation/ modification, and fish consumption advisory (source unknown). The Philadelphia Water Department, as part of the Darby Partnership, is currently assessing baseflow and storm flow water quality within the Darby Basin to determine what chemical parameters may be causing aquatic life impairments or other designated water use impairments.

Sources of Impairment for Assessed Streams Based on Data Collected Through October 2000					
Protected Water Use	Source of Impairment	Miles Impaired	% Impaired of Total Miles	Data Source	Priority
Aquatic Life	Urban Runoff / Storm Sewers	107	23%	303d List	High
Aquatic Life	Habitat Modification	80	17%	303d List	High
Aquatic Life	Municipal Point Source	34	7%	303d List	High
Aquatic Life	Flow Regulation/ Modification	24	5%	303d List	High
Fishing	Fish Consumption Advisory	10	NA	303d List	High
Aquatic Life	Hydromodification	7	1%	303d List	Medium
Aquatic Life	Land Disposal	2	1%	303d List	Medium
Aquatic Life	Agriculture	1	<1%	303d List	Low
Aquatic Life	Package Plants	<1	<1%	303d List	Low

The Pennsylvania Lake Water Quality Assessment Program concentrates on “significant lakes”, lakes that are publicly owned or publicly accessible lakes with a retention time of 14 days or greater. Springton Reservoir, a water supply reservoir owned by Philadelphia Suburban Water Company (PSWC), is the only significant lake located in the Subbasin 03G. Lake impairment is typically related to trophic status or fish consumption advisories. Lake trophic status is based upon Carlson’s Trophic State Index, which is an index of nutrient enrichment, transparency and phytoplankton standing crop (Chl-a). Springton Reservoir is not listed as impaired, but has trophic status impairments. PSWC recently received a Source Water Protection Grant to assess the reservoir’s nutrient and sediment loading. Springton Reservoir was given a high priority because of the reservoir’s eutrophic status and importance as a water supply source.

Impairment Causes and Effects

Urban Runoff/Storm Sewers:

The subbasin has experienced a large increase in population growth since 1945. Residential, commercial and industrial land development in the watershed has substantially increased impervious areas including roads, parking lots, buildings, and driveways. Stormwater associated with development impacts both the quantity and quality of water entering streams. Hydrologic modifications associated with stormwater are important causes of aquatic use impairment in the subbasin. Increasing the frequency of bank-full storm events and overall storm flows causes streambank destabilization, increased sediment load, increased scour, and increased sediment deposition. Stream channels can widen or deepen causing a loss or alteration of aquatic habitat.

Many developed areas have impervious surfaces directly linked to streams through piping without stormwater controls. Other developed areas have stormwater controls that were created to attenuate peak discharges to predevelopment levels. These controls may help limit downstream flooding, but do little to protect aquatic life and habitat. Municipalities within the Darby Creek and Chester Creek Watersheds are developing Act 167 Stormwater Management Plans for the basins. These plans may address hydrologic and water quality aspects of new development in the watershed. Ridley Creek Watershed has an approved Act 167 Stormwater Management Plan. Plans will not require stormwater management for

areas that have been developed in the past and they typically do not protect channels from smaller bank-full storm events that shape aquatic habitat.

Many pollutants are deposited or placed on impervious areas and urban/suburban landscapes such as lawns, golf courses, and athletic fields. Pollutants include animal feces, oil, fertilizers, pesticides, antifreeze, and solids. These pollutants discharge directly to the stream in developed areas that lack stormwater pollution controls. Pollutant loadings associated with stormwater quality can cause stream eutrophication (extreme increases in nutrient loading). Chemical parameters associated with stormwater have not been extensively sampled in the subbasin and the magnitude of their effects is poorly understood. The Philadelphia Water Department has recently conducted stormwater sampling in the Darby Watershed as part of the Darby/Cobbs Watershed Partnership. Many of the municipalities located in the densely populated areas of the watershed will be required to obtain NPDES Stormwater Permits under Phase II of EPA's Stormwater Regulations. Installation of infiltration areas, vegetated detention basins, and retention ponds would help reduce the amount of pollutants entering streams.

Habitat Modification:

Habitat modifications within the subbasin are concentrated in densely populated areas and are the result of encroachment on streams by development. Lawns, parking lots, golf courses, athletic fields, roadways, buildings and modified streambanks have replaced the natural forested riparian buffers, especially those of 1st and 2nd order streams. Loss of streambank trees and shrubs destabilize banks by removing deep woody root structure. Grasses and other herbaceous vegetation have shallow non-woody root structures that predispose banks to sloughing and erosion. Loss of canopy increases light penetration to the stream. Buffer loss can increase pollutant loading (nutrients, sediment, oil) to the stream from the adjacent land. Riparian buffer loss also reduces the amount of organic inputs that serve as a secondary energy source for production in headwater streams. Historically, filling of floodplains and wetlands have exacerbated stormwater impacts by reducing the watershed's capacity for flood energy dissipation.

Land based habitat modifications primarily impact aquatic life by altering the physical instream habitat. Bank destabilization associated with forest buffer loss increases sediment load to streams and reduces heterogeneity of instream bank habitat for fish and macroinvertebrates (undercut banks, root wads). Settled sands, silts, and clays reduce macroinvertebrate habitat by filling interstitial areas between larger streambed substrates. This loss of macroinvertebrate habitat can cause a reduction in productivity and community diversity. Suspended silts and clays can reduce light needed for photosynthesis, interfere with foraging success of sight and filter feeders, and interfere with oxygen uptake. Additionally, storm event scour by suspended sands and silts can also reduce productivity and diversity of aquatic communities. Loss of organic inputs can alter macroinvertebrate community composition by removing particulate organic matter required by shredders and collectors in the aquatic ecosystem. Light penetration can exacerbate nutrient impairments by stimulating algal growth. Temperature increases have also been correlated to loss of riparian buffer.

Surface water runoff entering the stream may have increased pollutant loads because buffers that trap sediment and oils, and adsorb or transform nutrients have been removed. Water quality benefits of aquatic buffers in urban/suburban areas are diminished because stormwater conveyance systems concentrate and transport stormwater directly to the stream, bypassing any buffers.

Municipal Point Sources:

The subbasin has 88 permitted sewage dischargers and 32-permitted industrial waste dischargers. Municipal point source impairments have been identified for Goose Creek (an unnamed tributary to Chester Creek), Chester Creek and Cobbs Creek. Impairments in Goose Creek and Chester Creek are associated with West Chester's Goose Creek Sewage Treatment Plant, a large treatment plant on a small watershed that overwhelms the streams capacity to assimilate treated effluent. The Philadelphia Water

Department maintains 38 Combined Sewer Overflows (CSOs) within the Cobbs Basin. CSOs periodically release untreated sewage and industrial wastes to the stream during storm events when combined sewers serving Philadelphia's Southwest Sewage Treatment Plant become hydraulically overloaded. The cause of municipal point source impairments for the Chester and Cobbs catchments is unknown. Suspected causes include nutrients (Chester Creek) and organic enrichment (Cobbs Creek).

Nutrients can adversely impact stream aquatic life. Increasing nutrients associated with treated sewage effluents can cause excessive algal growth and cause large daily dissolved oxygen swings. Low oxygen associated with algae blooms and changes in algae species can alter macroinvertebrate and fish populations.

Organic enrichment increases instream biological oxygen demand as complex organic molecules are broken down into organic molecules. High oxygen demand can create dissolved oxygen sags downstream from sewage discharges, however this effect may be reduced in the nontidal Cobbs Creek because organic discharges occur during high flows and provide good flushing. Low dissolved oxygen associated with sewage solids can alter the aquatic community by reducing numbers of organisms sensitive to organic pollution and increasing numbers of organisms tolerant to organic pollution.

Flow Regulation/Modification:

Flow regulation impairments within subbasin are primarily associated with flow diminution in Crum Creek below the Philadelphia Suburban Water Company (PSWC) lower reservoir and water intake. The Springton Reservoir outlet works regulates flow in the lower Crum Creek. PSWC is not required to maintain a conservation flow. Depending upon water release from Springton Reservoir and water intake at PSWC's Crum Creek Filtration Plant the lack of a conservation release creates dry riffle areas and stagnant pools in the 3rd order stream directly downstream from the intake. Additionally, lack of flushing flows below a dam may cause a buildup of fine silts and clays on the streambed. Baseflow diminution can also be caused by reduced groundwater recharge associated with impervious surfaces in suburban/urban land uses.

Flow diminution reduces or eliminates riffle habitat by exposing substrates that would typically be utilized by periphyton, macroinvertebrates and fish. Stagnant pool habitats can create unacceptable temperature levels or dissolved oxygen concentrations that limit fish populations.

Future threats to water quality

The same water quality issues will likely continue to affect the subbasin. As public awareness increases through the efforts of the many citizens groups, the potential for remediation and water quality improvement should increase. The subbasin needs better, more effective stormwater management.

Restoration and Protection Initiatives

Pennsylvania Growing Greener:

- \$31,380 (FY2002) to the Friends Central School to educate teachers and promote water quality testing with students. The project will also include stream restoration and planting.
- \$35,430 (FY2002) to The Natural Lands Trust for development of the Crum Creek Land Conservation Plan.
- \$63,367 (FY2002) to the Wayne Art Center for an innovative stormwater management demonstration using stormwater retrofit, porous pavement, rain gardens, and signage developed by the art students.
- \$187,160 (FY2001) to the Cobbs Creek Community Environmental Education Center for the Cobbs Creek Watershed Stewards Initiative.
- \$108,036 (FY2001) to Swarthmore College to continue restoration activities of the Crum Creek Watershed Partnership.

- \$168,423 (FY2001) to East Goshen Township for a streambank restoration demonstration on Chester Creek.
- \$99,847 (FY2000) to Willistown Township for a watershed assessment and restoration/ protection plan for upper Crum Creek.
- \$25,500 (FY2000) to the City of Chester for an improvement study of Ridley and Chester Creeks.
- \$1,047 (FY2000) to Delco Anglers and Conservationists for riparian restoration in Darby Creek.
- \$938 (FY2000) to Delco Anglers and Conservationists for stream improvement of Dismal Run.
- \$68,225 (FY2000) to Marple Township for streambank stabilization of Darby Creek at Lawrence Road.
- \$18,700 (FY1999) to Cheyney University of Pennsylvania to restore the portion of Chester Creek on the university property. Streambank buffers will be restored to protect the stream corridor.
- \$30,000 (FY1999) to the Pennsylvania Resources Council for the Ridley Creek restoration project. The project will include development of an educational model of watershed management practices in a suburban/urban landscape, an educational pilot project and installation of a bioretention system.
- \$28,844 (FY1999) to the Pennsylvania Environmental Council to develop a riparian restoration and streambank stabilization plan for Ridley Creek.
- \$25,000 (FY1999) to Darby Borough for restoration of streambanks and riparian buffers at a public park using various bioengineering techniques.
- \$7,449 (FY1999) to Delco Manning Chapter Trout Unlimited to address stormwater problems in Ridley Creek watershed through a series of stream improvement projects and by restoring riparian habitat. Local organizations will help to implement these projects.
- \$261,202 (FY1999) to Tinicum Township to replace an existing manually operated Tide Gate with a self-regulating gate located adjacent to the John Heinz Wildlife Refuge.

U.S. EPA Clean Water Act Section 319 Grants:

- \$66,902 (FY2000) to Swarthmore College for a watershed assessment of Crum Creek to develop a decision support system for a community based partnership for restoration and conservation of the watershed.
- \$108,342 (FY1999) to Delaware CD for a Crum Creek Watershed Assessment to measure and rank sources of NPS pollution and develop a strategic plan to implement controls.
- \$120,000 (FY2000) and \$92,000 (FY1999) to the Fairmount Park Commission to restore streambanks along Cobbs Creek that are impacted by urban runoff.
- Coastal Zone Management Nonpoint Source projects in Ridley Creek (1997).

Pennsylvania Watershed Restoration Assistance Program (WRAP):

- \$25,000 (FY1999) to Darby Borough Council for streambank restoration, erosion control and riparian planting in the soon to be developed Bartram Memorial Park. The project will also coordinate efforts to develop a DCNR rivers conservation plan and complement a large FEMA grant awarded to raise the utilities of 38 houses out of the downstream floodplain.
- \$24,470 (FY1998) to Radnor Township to restore 100 feet of streambank in Little Darby Creek
- \$1,000 (FY1998) to Delco Anglers and Conservationists for riparian enhancement of Darby, Ridley and Goose Creeks
- \$1,522 (FY1998) to Chester Ridley Crum Watershed Association for a seminar on improving Tanguy Run (East Branch Chester Creek)

Department of Conservation and Natural Resources (DCNR) Rivers Conservation Grants:

- \$19,500 (2000) to the PA Environmental Council to prepare a riparian and streambank restoration plan for a portion of Ridley Creek.
- \$48,000 (1995) to Chester Ridley Crum Watershed Association/Greenspace Alliance to develop a conservation and implementation plan for Ridley Creek
- \$60,000 (1996) to Chester Ridley Crum Watershed Association/Greenspace Alliance to develop a conservation plan for restoring, maintaining, and enhancing Chester Creek

- \$69,000 (1997) to Darby Creek Valley Association and DelCo Anglers and Conservationists to develop a river conservation plan for Darby Creek
- \$19,500 to the PA Environmental Council to prepare a riparian and streambank restoration plan for a portion of Ridley Creek.

Pennsylvania Stormwater Management Act 167 Plans:

- Delaware County has petitioned DEP for funds to develop a stormwater management plan for the county.
- Approved plans for Ridley Creek; plans under development for Chester Creek and Darby Creek.
- Darby and Cobbs Creeks have an agreement with the Department and have started developing an ACT 167 Plan.

PENNVEST:

- \$184,950 loan (1998) to Upland Borough, Delaware County, to construct collection and conveyance facilities to eliminate ponding, flooding, and icing that cause property damage and public safety hazards.
- \$5 million loan to the Delaware County Regional Water Control Authority to upgrade the central Delaware County area pump station and construct force mains to divert flow to the treatment plant in Chester.

League of Women Voters (WREN) Mini-grants:

- \$2,810 to the Partnership for the Delaware Estuary to develop a traveling educational display which will highlight the relationship between human behavior and the quality of the community's drinking water source, the Delaware River.

DEP Coastal Zone Management Program (CZM):

- \$7,941 (FY2002) to Springfield Township for riparian restoration along West Rolling Creek.
- \$80,561 (FY2002) to the partnership for the Delaware Estuary, Inc. for the Clean Water Theater.
- The Chester-Ridley-Crum Watersheds Association received a grant to map what portions of Chester, Ridley, and Crum Creeks are lacking riparian buffers. Additional funding was received from Pennsylvania Stream ReLeaf. The Heritage Conservancy completed the assessment of Chester Creek in 2000.

Other:

- Nether Providence Township has implemented projects aimed at improving the water quality of Crum Creek through streambank plantings and parking lot runoff control structures.
- Delaware County Conservation District mini grants for restoration of streambanks in Thornberry Township to:
 - Delco Anglers for planting native trees and shrubs on a section of East Branch Chester Creek upstream of Locksley Road. The grant amount was matched by the Township to purchase more plantings.
 - Tanguy Homesteads for plantings to protect eroded portions of the otherwise the high quality East Branch Tanguy Creek.

Citizen/Conservation groups:

- Chester Ridley Crum Watersheds Association is actively leading conservation and restoration efforts in these watersheds. They publish a newsletter twice a year and conduct annual watershed snapshots as part of Earth Day celebrations.
- Darby Creek Valley Association is a 100-member volunteer organization dedicated to the protection and enhancement of the resources of the Darby Creek watershed, including water, wildlife and historic sites, and public education. They are setting up a volunteer monitoring "Stream Watch" network to reach out to local schools and streamside landowners. More information is available on their website at <http://www.dcva.org/>.
- Delco Anglers and Conservationists
- Delaware County Field and Stream Association

- Crum Ridley Chester Volunteer Water Monitors have been regularly measuring water quality parameters since 1990.
- Friends of Crum Creek, a new group formed in 1999
- Chester Creek Watershed Association
- Springton Lake/Crum Creek Conservancy
- Delaware Riverkeeper
- The Friends of Smedley Park
- Environmental advisory committees in Swarthmore Borough, Nether Providence Township and Springfield Township
- Cobbs Creek CEEC
- Friends of Cobbs Creek Park
- Rocky Run Area Watershed Association
- Willistown Conservation Trust
- Crum Creek Watershed Partnership was formed in April 2000. The Partnership includes representatives of virtually all municipalities in the watershed, several businesses and institutions and other watershed associations. Their aim is to improve and protect Crum Creek watershed.
- The Heritage Conservancy is a nonprofit organization located in Bucks County, PA, dedicated to the preservation of our natural and historical heritage. They have received grants from DEP and DCNR for their preservation and conservation activities. They assist local conservation groups in southeastern Pennsylvania in assessment of streams conditions and with other conservation projects. More information is available on their website at <http://www.heritageconservancy.org/>.
- Headwaters of Darby Creek Watershed Association

Public Outreach

Watershed Notebooks

DEP's website has a watershed notebook for each of its 104 State Water Plan watersheds. Each notebook provides a brief description of the watershed with supporting data and information on agency and citizen group activities. Each notebook is organized to allow networking by watershed groups and others by providing access to send and post information about projects and activities underway in the watershed. The notebooks also link to the Department's Watershed Idea Exchange, an open forum to discuss watershed issues. The website is www.dep.state.pa.us. Choose Subjects/Water Management/Watershed Conservation/Watershed and Nonpoint Source Management/Watershed Notebooks.

Crum Creek 2001 Conference and Workshop

Over 100 people attended the annual conference held in March 2001 at Swarthmore College. Topics discussed during the sessions included stormwater management, nonpoint source pollution control, watershed protection programs, and watershed assessments methods. A panel discussion was held to discuss "What's Next", the process underway to identify improvement and protection priorities. The attendees also visited the Swarthmore College biostream and experimental constructed wetland projects.

Reports on three watershed assessments were presented:

- The Chester County Water Resources Authority's Watershed Conservation Plan
- The Delaware County Conservation District's Source Water Assessment Project
- The Swarthmore College Department of Engineering's Lower Crum Creek Watershed Assessment Project

Water Quality Improvement Projects:

The Fairmount Park Commission, with the assistance of the Academy of Natural Science of Philadelphia (ANSP), developing a master plan for each of their parks. The ANSP has been conducting assessments of the plants and animals of terrestrial and aquatic habitats in the park. Major restoration plans include

control of exotic species, increasing riparian buffers, reducing the amount of mowed areas, construction of new wetlands and expansion of existing wetlands, removing dams, reopening existing covered and channelized streams, stabilizing streambanks, and constructing berms and buffer strips to control stormwater runoff. More information on their activities can be found on their website at <http://www.nlreep.org/>.

The park commission's Natural Lands Restoration and Environmental Education Program (NLREEP) has several restoration projects underway or planned for Cobbs Creek Park in Philadelphia. Activities include creation of a 2-acre wetland in a meadow near the confluence of Cobbs Creek and Naylor's Run, repairing areas of severe erosion in tributaries of Cobbs Creek, excavating sediment from the floodplain and constructing rock vanes and planting trees and shrubs. Youth from the City of Philadelphia and the Brother Rousseau Academy have been helping to plant trees and remove trash in city parks. Through these activities inner city youth are becoming more aware of the natural world.

Another project is at the Whitby Avenue Planting/Infiltration area at Cobbs Creek Park. This work includes three different sites near the intersection of Cobbs Creek Parkway and Whitby Avenue. Activities included: planting 1960 herbaceous plants in a 0.18 acre marsh, planting over 200 shrubs and over 100 herbaceous plants in a previously mowed acre upland area, repairing, stabilizing and planting a deeply-eroded stormwater gully, including constructing a water infiltration trench and berm.

Funding Needs

The total dollars needed for addressing all nonpoint source problems in the watershed is undetermined. Stream assessments have been conducted and TMDLs will be developed for impaired waters in the subbasin. Watershed restoration plans developed for impaired waters will help determine what Best Management Practices (BMPs) are necessary to reduce pollution sources and provide estimates of restoration needs.

Funding sources available to support the development of site-specific implementation plans and remediation projects that address the sources of water quality impairment include the EPA Clean Water Act Section 319 grant program and the newer Pennsylvania funded Growing Greener program which target reductions in nonpoint source pollution. Pennsylvania has generally placed more emphasis on funding projects slated for implementation on water bodies where TMDLs have been completed or where water quality impairments have been documented.

Restoration Needs:

The highest restoration needs in this subbasin are the restoration of riparian buffers, streambank stabilization, and stormwater runoff controls. Municipalities in Delaware County are developing stormwater management plans under the Department's Act 167 for Crum Creek, Chester Creek, Darby Creek.

The following stream segments are impaired and in need of restoration:

- Darby Creek:
 - The lower 10.9 miles of Darby Creek and 3.55 miles of unnamed (UNTs) are impaired by habitat modification, siltation and water/flow variability from urban runoff and storm sewers.
 - The lower 1.73 miles of Little Darby Creek watershed are impaired by water/flow variability, urban runoff/storm sewers and habitat modification.
 - The entire Cobbs Creek watershed is impaired by urban runoff/storm sewers and habitat modification.

- Langford Run, Whetstone Run, Hermesprot Creek, Muckinipattis Creek and Stoney Creek watersheds are impaired by water/flow variability, urban runoff/storm sewers and habitat modification.
- Crum Creek:
 - The lower 7.62 miles of the main stem and 3.3 miles of 3 UNTs are impaired due to stormwater, water/flow variability and habitat modifications and excessive algae from agriculture.
 - Little Crum Creek: The entire 3.68 miles is impaired by water/flow variability, urban runoff/storm sewers and habitat modification.
- Chester Creek:
 - The lower 12.4 miles of the main stem and 2.88 miles of UNTs are impaired.
 - Green Creek: 0.36 miles of one UNT is impaired by organic enrichment, low dissolved oxygen, nutrients, and suspended solids from package plants.
- South Branch Naaman Creek is impaired by nutrients from agriculture.
- Marcus Hook Creek watershed is impaired by metals from land disposal and siltation from urban runoff/storm sewers.

The Media Wetlands Area

The Media Wetlands is located on Ridley Creek in Delaware County, directly upstream of the Ridley Creek water treatment plant. At over 20 acres, it is one of the largest in the county and provides a scenic complex of meadow, shrub, and forested wetlands. The wetland supports a diverse assemblage of plants and provides a much-needed refuge for wildlife. The existence of the wetland in the densely developed suburbs of the county is remarkable. The wetland had been preserved through long-term ownership by the Borough of Media and the Elwyn Institute. The wetland has a potential for development by the private landowners. The Natural Resources Conservation Service (NRCS) developed a five-year plan for conservation of the wetland through redesigning public access, replanting eroded areas, stabilizing and protecting wetlands, and improvement of upland buffers. Exotic plant species also need to be eradicated. Local groups, municipalities, agencies and industry are working together to expand the permanently protected area around the wetland.

Stream buffers:

The Heritage Conservancy conducted an analysis of stream 1,200 miles in Southeastern Pennsylvania in 2000. They developed a computerized map of riparian buffer hot spots to help local conservation groups and municipalities target areas for riparian buffer restoration. The project was funded under a grant through the DEP Coastal Zone management and Stream ReLeaf programs. The Chester Creek watershed was one of 4 watersheds studied. The method used was a helicopter fly-over and recording the streambanks with a sky-cam and GPS unit. ARC View GIS maps were produced that show the areas needing buffers. Topographic maps and aerial photos were printed and given to leading river conservation associations. Workshops were also held to explain the results of the study. Maps can be clipped and overlaid on tax parcel maps to determine which landowners to contact about riparian buffer restoration. The maps can be used as a tool to prioritize restoration activities and to track future gains and losses. A total of 127 miles were assessed in Chester Creek watershed. The study showed that 17.7 miles were lacking buffers on one side, 18.9 miles lacking on 2 sides, for a total of 36.6 miles or 28.8 percent of assessed miles without buffers. Data is available through PASDA, the Pennsylvania Spatial Data Access website at <http://www.pasda.psu.edu/>.

References/Sources of information

- State Water Plan, Subbasin 3, Lower Delaware River. Department of Environmental Protection, July 1983
- USGS Topographic Maps
- 319 project proposals and summaries

- DEP: Watershed Notebooks, Unified Assessment Document, and information from databases.
- Map of Draft Level III and IV Ecoregions of Pennsylvania and the Blue Ridge Mountains, Ridge and Valley, and Central Appalachians of EPA Regions III
- From the Mountains to the Sea: The State of Maryland's Freshwater Streams. Maryland Department of Natural Resources and U. S. Environmental Protection Agency. EPA Publication EPA/903/R-99/023. 1999.
- Environmental Futures Planning, Assessment of Indicators 1, 9, 12 and 14 for SWP 03G. Department of Environmental Protection, Southeast Regional Office. 2001.
- Chester Creek- Its Use, Abuse and Future Promise. Chester-Ridley-Crum Watersheds Association. 1993.
- Newsletter and website of the Fairmount Park Commission's Natural Lands Restoration and Environmental Education Program.

Streams in Subbasin 03G: 303d/305b listings

Stream	Stream Code	Drainage area square miles	Miles Impaired	Miles Attained	Impairment Causes/ Sources/ Comments
1-Delaware River	00002		10.36 main stem		Pesticides & priority organics from Unknown sources
2-Darby Creek	00742	77.2	10.09 of main stem; 3.55 of 4 UNTs	10.01 of upper main stem; 12.01 of 16 UNTs	Siltation & water/flow variability from URB & HAB
3-Little Darby Creek	00800	3.61	1.73	1.01	Water/flow variability from URB
4-Julip Run	00803	0.66		1.16	
4-Abrahams Run	00802	0.32		0.7	
4-Wigwan Run	00801	0.32		0.64	
3-Camp Run	00798	0.26		0.72	
3-Miles Run	00796	0.24		0.57	
3-Foxes Run & 2 UNTs	00793	1.49		3.49	
3-Ithan Creek & 2 UNTs	00777	7.39		4.93	
4-Browns Run & one UNT	00787	0.33		1.01	
5-Hardings Run	00789	1.16		0.98	
4-Kirks Run	00783	0.50		0.92	
4-Meadowbrook Run & 3 UNTs	00778	2.37		3.58	
5-Valley Run	00781	0.60		1.07	
4-Langford Run	00773	1.41	1.73		Habitat alterations, siltation, water/flow variability from HAB & URB
3-Whetstone Run & one UNT	00769	1.10	1.46		Habitat alterations, siltation, water/flow variability from HAB & URB
3-Cobbs Creek & 4 UNTs	00758	22.3	18.75		Habitat alterations, siltation, water/flow variability from HAB, URB & municipal point sources

4-Indian Creek	00762	3.96	0.66		Habitat alterations, siltation, water/flow variability from HAB & URB
5-East Branch Indian Creek	00764	1.75	2.64		Habitat alterations, siltation, water/flow variability from HAB & URB
5-West Branch Indian Creek	00763	1.75	2.72		Habitat alterations, siltation, water/flow variability from HAB & URB
3-Hermesprot Creek	00753	1.83	2.15		Habitat alterations, siltation, water/flow variability from HAB & URB
3-Muckinipattis Creek & 2 UNTs	00750	4.29	7.30		Habitat alterations, siltation, water/flow variability from HAB & URB
3-Stony Creek & one UNT	00744	2.97	6.04		Habitat alterations, siltation, water/flow variability from HAB & URB
2-Crum Creek	00692	38.3	7.62 of main stem; 3.30 of 3 UNTs	13.81 of upper main stem; 27.4 of 32 UNTs	Excessive algal growth from AG; Siltation & flow/water regulation/modification from URB & HAB <i>HQ-CWF upper basin</i>
3-Preston Run	00713	0.68		1.42	
3-Hunter Run & 2 UNTs	00709	1.60		3.51	
3-Trout Run & 4 UNTs	00700	2.79	5.45		Habitat alterations, siltation, water/flow variability from HAB & URB
3-Hotland Run	00698	1.01	0.32 of main stem; 0.9 of one UNT	0.77 of one UNT	Habitat alterations, siltation, water/flow variability from HAB & URB
3-Dicks Run	00695	0.90		2.01	
3-Little Crum Creek	00693	3.30	3.68		Habitat alterations, siltation, water/flow variability from HAB & URB
2-Ridley Creek & 60 UNTs	00621	37.9		75.64	<i>HQ-TSF upper basin</i>
3-Hunters Run	00674	1.76		1.51	<i>HQ-TSF</i>

3-Dismal Run & 2 UNTs	00642	1.63		3.67	<i>HQ-TSF</i>
3-Spring Run at Media & 1 UNT	00637	0.79		1.79	
3-Vernon Run & one UNT	00629	0.79		2.31	
2-Chester Creek	00520	66.4	12.4 of main stem; 2.88 of 5 UNTs	8.79 of main stem; 22.64 of 26 UNTs	Habitat alterations, siltation, water/flow variability from Flow regulation/ modification, Municipal point source & URB
3-Waln Run & one UNT	00612	1.18		2.26	
3-East Branch Chester Creek & 7 UNTs	00604	35.6		17.15	
3-Rocky Run & 4 UNTs	00579	3.13		6.27	<i>HQ-CWF</i>
3-West Branch Chester Creek & 25 UNTs	00542	19.1		28.95	
4-Green Creek	00546	4.18	0.36 of one UNT	3.52 of main stem; 5.75 of 7 UNTs	Organic enrichment/low DO, nutrients, suspended solids from Package plants
3-Chrome Run & 4 UNTs	00536	1.78		4.89	
3-Baldwin Run	00523	1.85			
2-Stoney Creek	00517	0.80		2.83	
2-Marcus Hook Creek & 5 UNTs	00511	5.22	10.21		Metals from Land disposal; Siltation from URB
2-Naaman Creek & 2 UNTs	00487	7.88		4.94	
3-Spring Run at Gardendale	00507	0.95		1.78	
3-East Branch Naaman Creek & one UNTs	00504	1.82		4.57	
3-West Branch Naaman Creek & one UNT	00501	1.78		3.94	
3-South Branch Naaman Creek	00490	0.81	0.29		Nutrients from AG

Streams are listed in order from upstream to downstream. A stream with the number 2 is a tributary to a number 1 stream, 3's are tributaries to 2's, etc. Delaware River=1, etc.

UNTs= unnamed tributaries, AG= agriculture, DO= dissolved oxygen, URB= Urban runoff/storm sewers, HAB= Habitat modifications/ alterations

The subbasin was assessed in 1998 and 1999.