

White Clay Creek AND ITS TRIBUTARIES

WATERSHED MANAGEMENT PLAN WITH REFERENCE SECTIONS

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TABLE OF CONTENTS
EXECUTIVE SUMMARY
I. THE WATERSHED ENVIRONMENT
II. APPROACH TO MANAGEMENT
III. ADMINISTRATIVE FRAMEWORK
IV. LOCAL LAND-USE MANAGEMENT PROGRAM
V. RESOURCE MANAGEMENT
VI. EDUCATION AND OUTREACH
VII. AVAILABLE ASSISTANCE
APPENDICES
REFERENCE
MAPS
TABLES

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White Clay Creek Preserve - Pennsylvania
White Clay Creek State Park and Preserve - Delaware
White Clay Creek Watershed Association

EXECUTIVE SUMMARY

This management plan proposes a strategy for managing the White Clay Creek as a National Wild and Scenic River. It was prepared as part of a study to evaluate the White Clay Creek for inclusion in the National Wild and Scenic Rivers System. Legislation was introduced in 2000 Congress by Congressmen Michael Castle (DE) and Joseph Pitts (PA); and by Senators Joseph Biden (DE), William Roth (DE), Rick Santorum (PA), and Arlen Specter (PA) to designate the White Clay Creek and its tributaries into the National Wild and Scenic Rivers System. This legislation, P.L. 106-357, was passed by both houses of Congress and signed into law by President Clinton on October 24, 2000.

The White Clay Creek watershed is one of only a few relatively intact, unspoiled and ecologically functioning river systems remaining in the highly congested and developed corridor linking Philadelphia, Pennsylvania, with Newark, Delaware. The watershed drains 69,000 acres in southeast Pennsylvania and northwest Delaware, and some 95,000 people live within its boundaries. The proposed federally designated areas include all streams of the second order or higher. Under this proposal, the federal designation would include: White Clay Creek, from the confluence of the East and Middle branches in London Britain Township, Pennsylvania downstream to its confluence with the Christina River in New Castle County, Delaware; the East, Middle, and West branches within Pennsylvania; Middle Run, Pike and Mill creeks in Delaware; and all second order streams as shown on the Recommended Designated Area Map.

The plan describes the watershed's resources, identifying the major challenges that threaten them now, or may do so in the near future. The plan recognizes that the resources themselves are tightly twined with the problems that beset them, so that the improvement or deterioration of one watershed element bears directly on the condition of several others. In an obvious example: land use practices affect water quality well downstream.

The management plan makes a case for the value of the watershed, and presents a detailed plan for management. Because a successful bid for designation must demonstrate that the watershed can be managed feasibly, the plan includes summaries of current management strategies as well as recommendations for additional ones. It profiles all the agencies and their programs-public and private-currently involved in planning for or managing some aspect of the watershed and its resource base.

The management plan outlined in this document delineates a cooperative approach to resource management and protection. It involves landowners, citizens, private organizations, local, county, state and federal governments, business interests and others. The proposed two-tiered approach to watershed management acknowledges both the importance and preference for local leadership, and the additional protection afforded by federal wild and scenic designation. Watershed management will be coordinated by a Watershed Advisory Committee. The first management tier will focus on municipal, county and state governments. These entities will adopt and implement watershed management strategies contained in the Local Land Use and Resource Management sections of the plan. The second management tier designates certain areas of the watershed into the National Wild and Scenic Rivers System. There, in the designated areas, water-resources-related projects that involve federal loans, licenses or permits would be reviewed by the National Park Service for potential impact on outstandingly remarkable watershed resources.

I. THE WATERSHED ENVIRONMENT

Study and Planning Background

On December 11, 1991, President Bush signed into law the White Clay Creek Study Act, responding to the concern of citizens of Pennsylvania and Delaware who lived within the White Clay Creek watershed and who wanted the creek, together with its tributaries and watershed, evaluated for possible inclusion in the National Wild and Scenic Rivers System.



The Wild and Scenic Rivers Act states that designated rivers possess outstandingly remarkable natural, cultural and other values, and that they are to be preserved in free-flowing condition, and that they and their immediate environments are to be protected. A specific safeguard for designated rivers is that no federal authority will authorize or otherwise support any water resources project (including dams) that would have a direct adverse effect on the values for which a river was designated as Wild and Scenic.

As a first step toward designation, Congress directed the National Park Service (NPS) to convene a study task force comprising watershed residents, community organizations, state and local government officials and others in evaluating the eligibility and suitability of White Clay Creek for designation, and in developing a management plan for the watershed.

In January 1992, the task force was established. Members included watershed residents; landowners; private organizations; and representatives of local, county, state and federal governments. The group was charged with overseeing the preparation of a management plan, and with creating a forum for broad public involvement in which participants could voice opinions and suggestions, exchange ideas and proffer recommendations. To facilitate its work, the study task force established an advisory committee through which it communicated with the National Park Service.

The NPS, along with the Commonwealth of Pennsylvania; the State of Delaware; Chester County, Pennsylvania; and New Castle County, Delaware, and the thirteen affected municipalities, entered into a Memorandum of Understanding to work cooperatively to complete the congressionally authorized study of White Clay Creek for possible inclusion in the National Wild and Scenic Rivers System. All parties agreed to conduct the study with broad public involvement, and to stimulate the best possible exchange of ideas in the decision-making process.

As a framework for its watershed management plan, the study task force, in conjunction with the National Park Service, identified a series of tasks, the accomplishment of which would be milestones in the planning process. The tasks identified were:

1. Identification of high-priority watershed resources.
2. Identification of watershed-related needs, concerns and issues.
3. Establishment of goals for watershed resource conservation.
4. Identification of alternatives for resource protection and the resolution of issues.
5. Creation of a plan of action for watershed resource protection.

To allow in-depth analysis of important resources, and to focus potential management issues, the study task force organized itself into subcommittees that would meet throughout this phase of the management planning process.

The subcommittees are Natural Resources; Water Resources; Cultural Resources; Education; Land Use; Recreation; and Management, Governance and Funding.

To facilitate their work, the subcommittees held public workshops in Pennsylvania and Delaware in October 1993, and again in Pennsylvania in February 1994. News articles and fact sheets stimulated participation in the workshops. These sessions highlighted for the subcommittees the issues that mattered most to residents and policy makers in the watershed, and they yielded valuable information and insights members would not otherwise have had. The subcommittee's research and findings support the statements and recommendations made in this plan.

The subcommittees continued work through 1994, issuing the following reports pertinent to the management plan:

Resources and Issues Report (September 1994)

Landowner Survey (November 1994)

Draft Eligibility and Classification Report (November 1994)

Draft Management Goals and Actions (November 1994)

After the subcommittees had completed their studies, meetings and reports, the study task force organized a management planning committee to develop this plan for the White Clay Creek watershed study area. Work commenced in 1995.

In cooperation with the National Park Service, and in preparation for the management plan, the Water Resources Agency for New Castle County (WRANCC) prepared resource maps in the form of an overview of the watershed, using geographic information system (GIS) technology.

The management plan for the White Clay Creek watershed envisions a cooperative approach to resource management and protection. Landowners; citizens; private organizations; local, county, state and federal governments; businesses and others will be encouraged to work together to achieve the goals and take the actions recommended in this plan. Only through coordinated management and action will the level of resource protection envisioned in this plan be achieved.

White Clay Creek and Its Setting

The White Clay Creek watershed is one of only a few relatively intact, unspoiled and ecologically functioning river systems remaining in the highly congested and developed corridor between Philadelphia and Newark, Delaware. White Clay Creek drains more than 69,000 acres in southeastern Pennsylvania and northwestern Delaware ([Table 1](#)). A great deal of sediment from the rolling hills of Chester County, Pennsylvania, is eroded by water and other forces and is carried into the White Clay, probably accounting for the creek's name. For most of its course the creek runs through the rolling Piedmont region, dropping over the Fall Line to the Atlantic Coastal Plain near Newark before veering eastward to empty into the Christina River.

The Piedmont is physiographically and geologically distinct from the Atlantic Coastal Plain due to the weathered crystalline rocks, metamorphic and igneous, that underlie its surface. Most of the crystalline rocks are Paleozoic in origin. The ancient rocks were first deposited, then uplifted, folded, metamorphosed and over time eroded to their present level. This process produced the characteristic rolling hills, plateaus and stream valleys of today's Piedmont region.

The Atlantic Coastal Plain, a relatively flat area, is punctuated by large tidal wetlands. The coastal plain is underlain by layers of sedimentary deposits formed from marine sediments, glacial outwash and aeolian (wind-produced) materials.

Normal rainfall (averaging 44 inches per year) supplies enough water to support a mature deciduous forest and an extensive freshwater tidal wetlands system downstream. Its underlying stratum of Cockeysville Marble marks the White Clay Creek watershed as an important source of drinking water. The marble layer supports a high-yielding aquifer, which also supplies continuous and relatively high base flows in the stream.

The stream itself features forest-flanked steep banks and cobble-bottomed beds in some places, and dramatic gorges cleaving low-lying floodplain in others. In general, as the stream moves south and eastward from the upland regions in the north to the Christina River, its landscape evolves from successional meadows to agricultural fields and forested ridges, to large blocks of mature forest broken up by stretches of suburban and urban development.

A sweeping range of uses from urban through suburban to rural characterizes the watershed as a whole; patterns include residential, commercial, office, industrial, institutional, agricultural, utilities and others ([Table 2](#)). Development in the Pennsylvania portion of the watershed is largely rural with a few small towns and villages and some suburban clusters. In the Delaware portion, the City of Newark and rampant suburbanization characterize much of the watershed, but by contrast, several large tracts of public open space flank the river in this state as well.

Population In and Near the Watershed

Some 95,000 people actually live in the White Clay Creek watershed. The watershed encompasses a portion of the City of Newark (population 27,500) and its neighbors Wilmington (est. population 70,000). Close to a million people reside within the counties in which the watershed is located. The July 1990 census enumerated 376,396 people in Chester County, Pennsylvania (Projected 2020: 489,300); and 441,947 (Projected 2020: 539,503) in New Castle County, Delaware. Located right on the busy Northeast transportation corridor, the watershed can be reached in two hours or less by at least eight million people.

Environmental and Cultural Resources

This section highlights the vast array of environmental and cultural resources found within the White Clay Creek watershed. Included are the important and outstanding values that make this river eligible for designation into the National Wild and Scenic Rivers System. This management plan aims to protect and conserve these outstanding values.

Botanical Resources

The intrinsic botanical value of the White Clay Creek watershed is largely due to the many plants and plant communities that survive here, having virtually disappeared from many nearby river systems. White Clay Creek is in many ways a botanical oasis in a desert of creeping sprawl.

The complex geology of the watershed has produced a variety of soil types that support a diversity of native plants. The study area contains rich flora, comprising some 60 tree and shrub species, more than 20 ferns and more than 200 wildflowers, including nine native orchids.

The trees contribute most to the area's character, although the forest mix has changed since the chestnuts were blighted in the 1920s. Now, tall tulip trees, stark sycamores, massive beeches and oaks define the landscape. A fall shower of acorns, hickory nuts and black walnuts often pelts area roads and driveways.

Some of the watershed's plants represent rare species. In a survey of the White Clay Creek Preserve, 24 Delaware state "species of special concern" were identified, distributed fairly evenly between wetland, successional and woodland habitats. In the Pennsylvania portion of the watershed, one often sees species considered unusual elsewhere in Chester County.

Delaware has no formal listing of endangered, threatened or rare plant species, but Pennsylvania does. The Commonwealth has found three endangered, one threatened and two rare plant species in the watershed. The endangered species are the leather flower (*Clematis viorna*), the tawny ironweed (*Veronica glauca*) and elephant's foot (*Elephantopus carolinianus*). The threatened species is the fall witch grass (*Digitaria cognatum*). The rare species are the puttyroot orchid (*Aplectrum hyemale*) and the crane-fly orchid (*Tipularia discolor*).

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Fish and Wildlife Resources

Old fields, mature woodlands, streams, freshwater marshes, seeps and swamps, vernal pools, wooded floodplains, thickets and glades support a profusion of birds and animals. An estimated 93 species of birds nest in the watershed. Many are neotropical migrants that breed within the deep, continuous forests, hiding from predators among the trees. Migrants include the hooded and cerulean warblers, the latter a rare northern species that breeds in Delaware only in the Piedmont Plateau section of the White Clay Creek. Other neotropical birds found here are thrushes, vireos, orioles and grosbeaks. In addition to the nesters, more than 100 other species of birds live and feed in the area, or settle briefly as they skim the busy Atlantic flyway.

WHITE CLAY CREEK STUDY TASK FORCE



Cerulean Warbler

Bird life follows the seasons in the White Clay valley. Field ornithology groups often spot the "big" (pileated) woodpecker and hear the distinctive call of the barred owl. They glimpse red-winged blackbirds in the fields, and great blue herons along the creek. A bird-box installation program has attracted a healthy population of Eastern bluebirds, and the broad-winged hawk is a watershed resident as well. A famous avian landmark is the eerie flocking of vultures to cluster in the trees along the East Branch of the White Clay in Landenberg.

Thirty-three species of small mammals live in the watershed. Beavers, recent arrivals, can sometimes be seen swimming in the creek. More common sightings include opossum, raccoon, groundhog and red and gray foxes. Eastern gray squirrels, Eastern cottontail rabbits and whitetail deer are hunted every year. The big-eyed young of the nocturnal flying squirrel are occasionally discovered by local folk when females nest in their houses. On summer evenings, bats—red, big brown, little brown, hoary and Eastern Pipitrel—flutter skyward from daytime perches.

Twenty-seven species of reptiles and amphibians live in the watershed, among them the rare Muhlenberg's (bog) turtle (*Clemmys muhlenbergii*), which was recently added to the list of threatened species by the U.S. Fish and Wildlife Service. Spring arrives with the piping choruses of spring peepers, woodfrogs and American toads. The rare long-tailed salamander breeds in clean feeder streams and springs throughout the watershed. Also rare, the four-toed salamander breeds in local freshwater marshes.

The waters of the White Clay Creek support some 21 species of fish. This is Delaware's premier trout-fishing

JUDY SHULER



Bog Turtle

stream, stocked annually by both Delaware and Pennsylvania. Freshwater fisherman cast in its pools and riffles throughout the year. Although water quality is somewhat degraded downstream due to the impact of various human activities, the good health of the upstream portions of the creek is demonstrated by clouds of various insects, including mayflies and stoneflies (see Appendix for White Clay Watershed Association (WCWA) Stream Watch Program).

Water Resources

Flow conditions in White Clay Creek vary widely among drought, normal and flood. Flows measured at the City of Newark can vary between 15 cubic feet per second (cfs) or 10 million gallons per day (mgd) (a few inches deep) during droughts to 14,000 cfs or 9,000 mgd (15 feet deep) during 100 year flood events. Normal flows range between 30 and 100 cfs, which is ideal for fishing.

Existing Water Supply

New Castle County

The White Clay Creek watershed is a major source of drinking water for the residents of New Castle County. The major water purveyors are the City of Newark, Artesian Water Company and United Water Delaware. The utilities obtain water from surface, ground and interconnected supplies. Surface water from White Clay Creek accounts for 33 mgd of the overall production of water supply from the watershed. Minimum flow requirements (DRBC, 7Q10) are in place for aquatic habitat protection purposes along White Clay Creek at the surface-water intakes for the City of Newark and United Water Delaware. Groundwater supplies provide up to 1.8 mgd of water to the City of Newark from five wells in the watershed. The Artesian Water Company operates six wells which provide up to 1.9 mgd in the Cockeysville Formation near Hockessin. Additionally, a maximum of 6 mgd can be provided to the Artesian Water Company from a Pennsylvania interconnection with the Chester Water Authority at Limestone Road. [Table 3](#) provides a summary of existing public water supplies in the New Castle County portion of the White Clay Creek watershed.

Existing Water Supply

Chester County

The White Clay Creek watershed also provides drinking water for the residents of Chester County. Groundwater is the primary water-supply source, for which the Commonwealth of Pennsylvania does not issue water-supply allocations. [Table 4](#) provides a summary of existing water supply for the White Clay Creek watershed located in Chester County, Pennsylvania. The maximum supply capacities of the systems are not known.

Water Quality

The Pennsylvania Department of Environmental Protection (PADEP), the Delaware Department of Natural Resources and Environmental Control (DNREC) and the Delaware River Basin Commission (DRBC) have established formal water quality goals for their respective portions of White Clay Creek. PADEP goals are based on the traditional use approach, and they apply to water supply, aquatic life and recreation. Water uses to be protected are established for each stream, as well as specific water quality criteria necessary to

protect these uses. These criteria are used to establish waste-discharge permit limits.

In Pennsylvania, the protected use designations are based on the current conditions of the stream. The State of Pennsylvania has identified the East Fork of the East Branch, from the northern boundary of Avondale Borough to the headwaters, as "Exceptional Value Waters," (EV) The Exceptional Value Waters designation refers to streams that are relatively pristine, with little or no development or access, and constitute an outstanding natural resource. The rest of the East Branch protected use designation is "Cold Water Fisheries" (CWF). This protected use is for the maintenance and/or propagation of fish species, including the family Salmonidae (trout) and additional flora and fauna which are indigenous to a coldwater habitat.

The Middle and West branches have "Trout Stocking" protected use designations. This protected use is for the maintenance of stocked trout from February 15 to July 31, and for maintenance and propagation of fish species and additional flora and fauna which are indigenous to warm-water habitat.

The East Fork of the East Branch of White Clay Creek is also important for water quality monitoring and stream research. The Stroud Water Research Center, a field laboratory of the Academy of Natural Sciences of Philadelphia, has conducted ecological research and collected water quality data on the East Branch since 1968. Of prominent significance to research is the 1,800-acre "Stroud Experimental Watershed " located on the East Fork and maintained by the Stroud Water Research Center. Hypotheses and methods developed on White Clay Creek have been tested and applied in rivers and streams throughout North America. The National Science Foundation designated the experimental watershed an "Experimental Ecological Reserve" in recognition of the site as an outstanding example of a Piedmont stream ecosystem.

DNREC goals classify White Clay Creek from the Delaware state line to the dam at Curtis Paper as "exceptional recreational or ecological significance waters" (ERES). DNREC acknowledges as a goal the restoration of these waters, to the maximum practicable extent, to their natural condition. To achieve this goal DNREC must control, reduce or remove existing pollution, and divert new pollution away from the ERES waters.

In Delaware, Lamborn Run serves as the reference stream (the area's most pristine stream, by which the quality of others is judged) for the entire State of Delaware's water-quality monitoring efforts. It should be noted that recent benthic studies indicate the upper reaches of Lamborn Run are degraded due to high nutrient loads from water fowl and stream erosion.



England House Mill

The Delaware River Basin Commission (DRBC) goals are consistent with Pennsylvania goals. Where standards differ between DRBC and a state, the more stringent standard prevails. The water quality goals of Pennsylvania and DRBC differ from those of Delaware. A technical evaluation of the watershed as a whole has been initiated in order to determine appropriate levels of control for both point sources and nonpoint sources of pollution. Both states, DRBC, EPA, the Water Resources Agency for New Castle County (WRANCC), the Chester County Planning Commission, the Chester County Conservation District, U.S. Natural Resource Conservation Service (NRCS), U.S. Fish & Wildlife Service and U.S. Geological Survey are participating in this activity.

Levels of the bacteria *Enterococcus* exceed the Delaware water-quality criterion approximately half of the time over the entire Delaware portion of the White Clay Creek watershed. Consequently, people who swim in untreated water from the creek face an increased risk of gastroenteritis. Bacteria in the stream can come from agricultural nonpoint sources, urban runoff, wildlife, malfunctioning septic systems and publicly owned treatment systems.

The creek's levels of dissolved oxygen and its temperature are apparently able to support fish, aquatic life and wildlife. The reproducing trout population in the upper reaches of the East Branch strongly indicates

high water quality. However, data collected by the White Clay Watershed Association suggests that there is a decline in water quality as one proceeds from the headwaters down into Delaware (See Appendix). Since 1991 the White Clay Watershed Association (WCWA), with the guidance of the Stroud Water Research Center, has run a volunteer Stream Watch Program in White Clay Creek. The Stream Watch program and protocols are now viewed as models throughout the region and the country because of the breadth and scope of their biological survey.

Cultural Resources

The White Clay Creek watershed has been occupied by various peoples for more than 10,000 years. The indigenous Lenni-Lenapes or Delaware Indians lived along the banks of White Clay Creek, where abundant game and fertile lands provided the resources for intermittent village settlements.

European settlements by Dutch and Swedes began around 1625-1650 in Delaware and Pennsylvania. Between 1680 and 1705, land grants from the King of England were made to William Penn, who chartered the states of Delaware and Pennsylvania. Some of the first settlers to the White Clay area were the English, Irish and Scots, who were drawn to America by promises of peace, religious freedom and abundant land resources.

From the beginning, agriculture was an important industry in the rural and sparsely populated area. Early settlers cleared the land and planted wheat or corn or developed grass meadows for cows. Today, dairy farms, horse farms and mushroom farms dominate the local agricultural landscape.

Early settlers in Delaware built the first grist and saw mills on White Clay Creek in the late 17th century. The first grist and saw mills in Pennsylvania were built at the beginning of the 18th century. Water-powered production of paper, cotton and woolen goods was underway by the first few decades of the 19th century. Most of the early mills were small rural operations on farms, but some, such as the Curtis paper mill, Dean woolen mill, Roseville cotton factory and Landenberg woolen mills, were substantial businesses. Around the time of the Civil War the railroads arrived, bringing a ready supply of coal, which allowed many water-powered mills to be converted to the more reliable steam power. Still, many of the smaller mills continued to utilize water power well into the 20th century. Mills were located every mile or so along the mainstems of the branches of the creek and its tributaries - there were more than 70 mill sites in all. Mill sites were selected by the ease with which the necessary head and fall of water could be obtained. The better the site, the shorter the mill race. Early mills were a major influence on watershed development, as roads were built to reach them and small towns grew around some of them.

In the mid-19th century, populations increased and the first signs of urban sprawl crept outward from Philadelphia toward rural Chester County and northern Delaware. Such villages as Avondale, Landenberg and the Town of Newark began to serve as important commercial areas. The railroad influenced the development of these areas as mills capitalized on improved transportation. Inns, taverns and retail businesses flourished. With the advent of the automobile in the 20th century, settlement patterns in the White Clay Creek watershed began to change. Commercial centers and residential developments sprang up close to major highways and around the City of Newark, while a considerable part of the watershed remained rural.

Historic and architecturally important sites abound in the watershed. There are eight sites in Pennsylvania, including Primitive Hall and Lunn's Tavern, listed on the National Register of Historic Places (the federal listing of significant historic properties). Many other Pennsylvania properties are considered eligible for the

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Lord Tract Primitive Church

national register, but have not been nominated. In Delaware, 30 properties representing the fields of commerce, architecture, religion and agriculture are listed on the national register.

Open Space and Recreation

WHITE CLAY CREEK
STUDY TASK FORCE



The White Clay Creek watershed offers regional residents outstanding recreational opportunities. Fishing, hiking and jogging are three of the watershed's most popular sports. In addition, White Clay Creek is commonly used for swimming, and the valley for bird watching, picnicking, horseback riding, cross country skiing, skating, sledding, photography, nature observation and limited deer hunting. Because of the small size of watershed streams, canoeing is limited and not very popular. The only truly suitable canoeing area is the mainstem of the White Clay Creek in Delaware, and that area is limited by flow conditions.

White Clay Creek is the most heavily stocked and most heavily used put-and-take trout stream in the State of Delaware. More than 18,000 brown and rainbow trout were stocked along the White Clay in Delaware from March through April of 1993. They represent 68% of all of the stocked trout in the state. The White Clay Creek is also the most popular fly-fishing stream in the State of Delaware.

Several regulations govern fishing in the Delaware portion of the watershed. The half mile from the state line south is the only segment in the state limited to flies only. Here, the daily catch limit is four fish per person. The lower four-mile stretch of the White Clay Creek is open for all kinds of trout fishing. The daily catch limit here is six fish per person. There is no limit, anywhere along the Delaware section of White Clay Creek, to the size or number of fish that can be caught and released.

In 1993, 22,800 brown and rainbow trout were stocked in the Pennsylvania portion of the White Clay Creek. The Pennsylvania Fish and Boat Commission stocked 21,200 of these in the East Branch, Middle Branch and mainstem. The White Clay Creek Fly Fishers stocked 1,600 trout in the Middle Branch and in the Preserve.

Open space is a major recreation element in the White Clay Creek watershed. A cursory inventory found that 10% (or 7,096 acres) of the watershed is protected open space, suitable for a variety of recreational activities. More than two-thirds of the protected lands are in Delaware: they are managed by DNREC, New Castle County Department of Parks and Recreation, and the City of Newark. In Pennsylvania, open space is managed by DCNR and a few townships. The watershed features parks of several kinds. The White Clay Creek Preserve, managed by both Delaware and Pennsylvania, is maintained as a natural area accommodating passive recreation. Other parks are designed for heavier use, offering ball fields, basketball courts and picnic facilities.

Resource Management and Protection Issues

In the context of resource management and protection issues, land and water resources have been combined under the heading of natural resources. This was done because the two resource types share many of the same issues. Often, management strategies practiced on the land affect water resources, and vice versa. A good example of this is the issue of erosion. The conversion of land to impervious cover increases runoff rates and results in streambank erosion problems. The increase in sediment affects fish and other aquatic species. Conversely, when stream channels are modified by channelization, downstream riparian vegetation may be damaged by changes in the stream hydrology.

Natural Resources Issues

Land Use

Perhaps the overriding threat to the integrity of the watershed is the trend called "suburban sprawl." Problems inevitably follow people's movement into less congested rural areas with open space, wildlife, high-quality waters, forests, fields and other amenities. The White Clay Creek watershed, particularly within Pennsylvania, is just such a suburbanizing area, in transition from rural to urban. Unplanned regional or community development and site design standards which are not sensitive to environmental resources can result in dramatic loss of the very values that attracted people to the area in the first place.

The greatest imminent threats from suburbanization are non-point source pollution, flooding, erosion and loss of fish and wildlife habitat. Erosion, in particular, challenges both land and water resources. In addition to environmental concerns, erosion results in loss of valuable topsoil and can ravage streambanks, threatening houses, fences and other human investments.

Agricultural practices and recreational activities within the watershed also contribute to soil erosion. Prime agricultural soils are being lost due to such improper management practices as neglecting to plant cover crops on fallow land, and plowing against the contours of the land. Mountain biking, horseback riding and hiking in areas with steep slopes exacerbate erosion problems. When fishermen trample the streamside vegetation that holds streambanks in place, they also contribute to erosion. Best management practices (BMPs) should be implemented throughout the watershed to minimize soil loss through erosion. The use of vegetative buffers along streams would assist in trapping soil before it enters surface waters.

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When viewed collectively and cumulatively, the adverse impacts from suburbanization on water quality and habitat values are dramatic. The adverse impacts are the result of small but widespread development and unwise land-use practices, including: application of pesticides, herbicides and fertilizers at residences, golf courses, parks, farms, forests and other sites; cutting of streamside vegetation; use of improper or failed on-site sanitation systems; filling of floodplains and wetlands; faulty installation or maintenance of utility and transportation facilities; inadequate control of stormwater runoff, proliferation of impervious surfaces and reduction of groundwater infiltration rates; and so on.

An increase in impervious surfaces plagues the entire watershed. According to the Water Resources Agency for New Castle County Geographic Information System (GIS), 19% of the White Clay Creek watershed is currently under impervious cover. Recent work by DNREC indicates that the biological quality of streams in the Delaware Piedmont declines appreciably once watersheds reach 10% to 15% impervious coverage. White Clay Creek's impervious coverage, by sub-watershed, is as follows: White Clay Creek above

Newark, 7%; White Clay Creek below Newark, 43%; Mill Creek, 27%; Pike Creek, 26%; Middle Run, 9%.

The current uncoordinated patterns of development within the watershed could be corrected by better intermunicipal coordination. A future land-use plan for the watershed would be a tool for improving intermunicipal coordination. It is desirable to protect the quality and quantity of the land's natural resource base, because natural resources are important to the long-term economic and environmental viability of the area, and to the health and welfare of the residents.

Protection of Floodplains, Wetlands and Riparian Areas

Floodplains, wetlands and riparian vegetation zones are being adversely affected by land development. Wetlands are being filled, riparian vegetation is being cut down and there are encroachments in floodplains

throughout the watershed. The cumulative result is lessening of biodiversity.

Among the problems is an inconsistency in the municipal regulations designed to protect sensitive areas. In addition, development permits for projects in critical habitats are not well coordinated among federal, state and local governments. There is also need for more environmentally sensitive construction and engineering techniques, such as soil bio-engineering, in these areas.

Protection of Woodlands

Large interior forests are essential to the protection of many species of mammals and birds that need large blocks of forest to survive. Neotropical migrant birds, which nest in the White Clay Creek watershed, are among the species dependent on continuous woodlands. Landowners must come to understand how proper management practices ensure a healthy forest system. A system of interconnected public and private forested areas throughout the watershed must be promoted.

Decreasing Biodiversity / Protection of Rare, Threatened and Endangered Species

Biodiversity within the region is decreasing, as evidenced by the rising number of rare, threatened and endangered species in the White Clay Creek watershed. The watershed provides some of the remaining habitats in this part of Pennsylvania and Delaware for many of these imperiled species. It is essential that the remaining habitats within this watershed be protected.

Aquifer Protection

Withdrawals must be balanced against aquifer recharge rates. Reasonable rates must be set for pumping from the aquifer to guard against overpumping. Overpumping would decrease the amount of groundwater available for stream recharge during the dry months. A severe loss of baseflow in streams during the dry months would result in a loss of many species' habitats. Riparian vegetation would also suffer. Policies should be developed that increase the infiltration rates of stormwater into the aquifer.

Because of their porous formations, watershed aquifers are susceptible to contamination from land uses. The Cockeysville Marble formations, in particular, are very susceptible to damage from landfills, hazardous waste facilities, waste-oil collection sites, transfer stations, parking lots and high-density developments. These land uses should be prohibited on and near Cockeysville Marble outcrops.

New Castle County Water Supply Issues

Surface water supplies in the White Clay Creek watershed in New Castle County have been deemed "unreliable" by the Delaware River Basin Commission (DRBC). The drought of 1995 further highlighted the watershed's vulnerability to water supply deficits and the need for an additional water supply alternative in New Castle County. The State of Delaware and the Water Resources Agency for New Castle County (WRANCC) have been studying water needs and developing alternatives for achieving an additional supply.

The Water Resources Agency for New Castle County's WATER 2000 plan recommended the development of an additional 20-mgd water-supply reservoir in New Castle County. DRBC adopted portions of WATER 2000, including its proposal for a reservoir site at Churchman's Marsh or Thompson Station.

WRANCC proceeded with plans to develop the 20-mgd water-supply reservoir and sought approval from the Army Corps of Engineers for project construction. The Corps required an Environmental Impact Statement (EIS). The EIS process considered a variety of alternative future water-supply projects for New Castle County, including reservoirs, pipelines, wastewater reuse, desalinization and aquifer storage and recovery. The EIS purpose is to select the most reliable alternative to meet the 20-mgd deficit with the least environmental, social and economic impact.

The project management committee for the Water Supply Plan for New Castle County is conducting a screening analysis for the reservoir alternatives. Environmental field studies resulted in the elimination of the Churchman's Marsh and Corner Ketch alternatives. Focus then turned to the remaining reservoir alternative at Thompson Station. However, in the spring of 1997, both New Castle County and Artesian Water Company withdrew funding support for a Thompson Station Reservoir alternative. The State of Delaware withdrew additional funding for continuing environmental studies at the reservoir site. Studies at the reservoir site were suspended pending the completion of a re-evaluation of water-supply needs in New Castle County. It is not clear whether the EIS process will be completed, or whether New Castle County and the State of Delaware will pursue the other viable alternatives for meeting the water-supply needs of New Castle County.

Chester County Water Supply

There are no surface-water intakes for public water supply in the Chester County portion of the White Clay Creek watershed. At present, groundwater sources appear to be adequate to meet the needs of community and individual water supplies. However, as development continues in the region, the need for an allocation of the surface waters of White Clay Creek cannot be ruled out. No detailed study has been conducted to determine the comprehensive need for public water supply in the White Clay Creek watershed and southern Chester County. A water resources management plan addressing such issues will be prepared by the Chester County Water Resources Authority (CWA) in the near future.

One public water supply issue in the White Clay Creek watershed and southern Chester County is the major treated-water transmission main operated by the CWA. This main extends from the treatment works near the Pine Grove Dam on Octoraro Creek in eastern Lancaster County, all the way across southern Chester County into Delaware County and the City of Chester. The CWA has a relatively small number of direct retail customers in Chester County, and provides bulk water sales to institutions and other water suppliers in Chester and New Castle counties.



The CWA has surface-water allocations of 30 mgd from the Susquehanna River, and 30 mgd from the Octoraro Watershed above the Pine Grove Dam. Both sources are located entirely within the Susquehanna River Basin. The water used by many CWA customers represents a net interbasin transfer of 60 mgd from the Susquehanna Basin to the Delaware Basin. While the CWA has the capacity to serve a much larger population in southern Chester County than it does at present, this inter-basin transfer of water is being scrutinized by the Susquehanna River Basin Commission and others concerned with water-resource management.

Water Quality Goals

The water quality goals established for White Clay Creek in Delaware are higher than those established for Pennsylvania. All participants in the Christina Basin Management Program should continue to try to resolve the issue of inconsistent water quality goals between Pennsylvania and Delaware.

In-Stream Flow Maintenance and Stormwater Management

It is important to maintain adequate stream flows during warm, dry weather for water withdrawal, habitat maintenance, and aquatic fisheries. Due to steep topography in the upstream portions of the White Clay Creek watershed, storms produce runoff which rapidly produces hydrologic peaks; then those high discharges pass quickly through the watershed. Base flows are maintained through groundwater discharges. Wetlands along the floodplains are a source of constant recharge through their storage and release of rainwater.

Maintenance of base flows for aquatic habitat, fisheries and water-supply withdrawal purposes can be accomplished in the short term through open space, groundwater and wetland conservation programs. Stormwater management techniques that enhance groundwater recharge are necessary to achieve this goal. DNREC has established a multi-agency task force which concluded that the 7Q10 is adequate as a minimum instream flow standard to protect water quality and aquatic habitats along White Clay Creek at the United Water Delaware and City of Newark intakes.

In the lower half of the watershed, water is lost when it is drawn from wells and drained out of the watershed via sewers. In addition to wells, water is withdrawn directly from White Clay Creek and drained out of the watershed. Most of Northern New Castle County is serviced by one wastewater treatment plant that discharges to the Delaware Estuary. So White Clay Creek, even though it normally has abundant rainfall and copious aquifers, is severely challenged during dry weather to deliver the water supplies users need.

Cultural Resource Issues

The White Clay Creek watershed contains a wide variety of significant and unique cultural resources, all owing their existence to White Clay Creek. Many parts of the watershed remain relatively unspoiled by modern residential and industrial development, offering a quality of life difficult to match in the Mid-Atlantic region.

However, many cultural resources in the White Clay Creek watershed are threatened, and some are being lost to development, neglect and ignorance. Mill sites, historic bridges and archaeological sites may disappear or be aesthetically damaged by insensitive development. Other resources are being allowed to disintegrate and eventually to be lost. It is urgently important to identify cultural resources threatened by development and infrastructure improvements. The watershed has been continuously inhabited for more than 10,000 years. It is therefore essential that a comprehensive study of the culturally significant resources be undertaken, to identify and document them, and to promote their protection.

Identification

A comprehensive inventory should be made of all watershed cultural resources that may qualify as districts, sites, buildings, structures or objects eligible for protection under a watershed management plan. The inventory should not exclude cultural resources not deemed "outstandingly remarkable" under the Wild and Scenic River designation. All cultural resources should be documented for future study and to maintain the watershed's "sense of place."

Registration

The general population is not sufficiently aware of the extent of the watershed's cultural resources. Some landowners don't understand the importance of the cultural resources on their own property. Responsible stewardship will require greater public awareness of resources and their significance. Official recognition would encourage local zoning protection for cultural resources.

Information about officially recognized cultural resources of local, regional and national significance should be accessible to the public. Public suggestions favored designating a single publicly accessible site, such as a museum or library, where collections of documents, artifacts and memorabilia would be housed. Information housed there might spark interest and awareness and form a base for further research and for educational and interpretive programs. The archive site could also serve as a "trail head" for a self-guided regional tour.

Treatment/Preservation

The ultimate preservation goal is the maintenance of the watershed's cultural resources in a manner that would sustain their current form and integrity. Key actions should be coordinated and local zoning made uniform throughout the watershed to protect culturally significant sites. Criteria are needed to guide the consistent designation and management of cultural resources. For example, a local ordinance could require that an applicant for land development provide a plan for evaluating and conserving eligible resources. This would not strip the landowner's property rights, but it would consider cultural resources in land-use planning. The cumulative effect of such an ordinance would be the promotion of responsible stewardship.

Local zoning ordinances, particularly in Pennsylvania, must be coordinated with county, state and/or federal guidelines to ensure consistent treatment, and planning and zoning boards must become more attuned to cultural resource protection. For example, Pennsylvania township planning and historic commissions should be familiar with the "Archeological Site Categorization Criteria" outlined by the Commonwealth of Pennsylvania. The City of Newark Historic Preservation Regulations might serve as a model for municipal regulatory bodies. The majority of historic architectural resources in the White Clay Creek watershed are houses associated with agriculture and industry, with strong potential for preservation. Buffer



zones should be created for significant or remarkable cultural resources, and zoning should be sensitive to site aesthetics and context.

Demolition

Some governments in the watershed do not require historic commission review for demolition permits. Without such a process and without the formulation of alternatives that could avoid their loss, cultural resources can disappear without notice. The existing permitting process should be extended to require demolition permits based on historic commission or planning board review in order to promote preservation of registered cultural resources. However, the only reasonable treatment for some archeological sites may be the careful documentation of their existence.

There does not seem to be a consistent mechanism for ensuring that government projects, particularly those financed without federal monies, do not contribute to the loss of cultural resources throughout the watershed. Departments and entities not directly charged with cultural resource preservation do not always include cultural resource protection considerations in their planning. A specific example raised at one of the public meetings was the possibility that the historic Landenburg Bridge might be lost during a planned road-widening project.

Government-Funded Projects

Government-funded projects within the watershed should require a cultural resource impact analysis before inception. All cultural resource inventories should be utilized in this review. Ideally, significant or remarkable resources would be left undisturbed by government-funded projects, but when this is not possible, projects should mitigate their impact on the resources. Qualified researchers should be allowed a limited amount of time to study cultural resource areas to be disturbed or destroyed by government-funded projects. Discovery of previously unknown cultural resources during the course of such projects should trigger a sufficient delay in the project to allow a determination of significance by qualified researchers. If the cultural resources discovered are determined to be significant or remarkable, then the project should be altered to mitigate its impact on the resources.

Living History/Folklife

The intangible cultural resources embodied in the living history and memories of local residents are significant. They attest to the existence of tangible, physically identifiable resources, present-day culture, and the intangible quality of the life of the watershed, and they should be documented. Information gleaned from oral histories can be used as a guide to managing the identified resources.

Education

Access to culturally and historically significant sites and structures can help awaken public interest in the unique cultural characteristics of the watershed area. Educational initiatives might include the establishment of a watershed museum or library, the publication of self-guided tour brochures and pamphlets on cultural topics and the development of educational and interpretive programs.

Recreational Resource Issues

Generally, open space and the active and passive recreational opportunities in the watershed are considered adequate according to guidelines established by the National Recreation and Park Association (NRPA). The adequacy of the open space and recreational facilities, however, is often challenged by the public. In fact, the regional balance of active and passive recreational lands does appear to be weighted in favor of the population centers, despite the need for such lands in the watershed's rural and moderately developed areas.

Open Space and Recreation

There is a need for active recreational opportunities within the watershed, but new recreation areas may have a detrimental effect on the remaining "wild and primitive" lands. Local residents do not want to see development within White Clay Creek State Park (formerly Walter S. Carpenter State Park), but do support increased use of its trails.

There is debate among park users as to what the "park experience" should be. Some park users felt that



*On the banks of White Clay Creek
Mckees Park, City of Newark*

the "experience of nature" was gone or disappearing, while those seeking developed recreation opportunities felt that the present facilities should be expanded beyond NRPA standards. This issue must be addressed by both states at all levels of government, because the entire watershed is affected. Future action should include regionally balanced recreation opportunities that include developed active areas as well as undeveloped natural areas, and wild and primitive areas. Recreation regulations must be better enforced to prevent adverse impacts to resources.

Greenways linking Pennsylvania townships would provide open space and recreation opportunities while protecting riparian areas within the watershed and improving water

quality downstream in Delaware. Although an open space plan for Chester County recommends protection of stream valleys, there is no mandatory or encompassing plan to implement recommendations county-wide at the township level. It is important that all levels of government in Pennsylvania work together to implement a coordinated open-space acquisition and management plan. Chester County has several grant programs administered by the Parks Department that enable municipalities and conservancies to acquire open space for preservation and/or recreation. Delaware has an active greenway program administered by DNREC, Division of Parks & Recreation. Several greenways have already been established in the White Clay Creek valley, linking parks, wildlife refuges, historic and natural sites and other open-space areas.

Trails

It is often difficult to find information about the location of trails, access points, trail lengths, parking and other pertinent details. A coordinated, user-friendly system of trail marking should be developed incorporating enough signs to permit users to follow the trail but not clutter the land with too much signage. Such a system should utilize blazes on trees or small signs on posts. Trail restrictions should be prominently displayed at trailheads and intersections. Each trailhead should display maps, and clear, informative, giveaway fold-up trail maps should be readily available. A trail-use guide would help divert some trail users to underutilized trails and other areas.

Most watershed trails were not designed to accommodate the wide variety of today's trail activities. Horseback riders and off-road bicyclists have now joined hikers and nature-trail walkers. Some trails cannot support multiple uses, so conflicts and concern for the safety of trail users have become increasingly common.

A complete inventory of existing trails should be undertaken, providing data on numbers, routes, length, and conditions of all trails. An integrated system of trails, avoiding sensitive natural and cultural resources, should connect publicly owned lands within the watershed. This system should have trails to provide for all trail-based activities.

Bicycling

Both recreational bicycle riders and commuters use the roads in the White Clay Creek watershed. Bikers favor roads with the fewest cars, which tend to be narrow, two-lane and twisting, often with blind curves. Road shoulders range from nonexistent to wide and smooth. There are hills with both short and steep, and long and slow grades. More "Share the Road" signs are needed to remind motorists to watch for cyclists. Where appropriate, as on paved roads commonly used by cyclists, adequate road shoulders should be paved and routinely maintained.

Mountain biking or off-road biking is a relatively new recreational activity in this area, and the demand for off-road biking is likely to increase as these bikes outpace others in sales. There are few mountain-bike areas in Delaware, and many trails do not allow this activity. A loop or network of trails connecting public lands

within the watershed could be developed to accommodate mountain-bike riding. With some education on trail use and etiquette, hiking, bicycling and mountain biking could comfortably coexist.

Horseback Riding

Horseback riding has always been popular in the watershed, and it must be accommodated in a way that will not harm the environment. Equestrians' concerns include the accessibility and suitability of bridle paths, and the closing of certain previously available trails.

Hunting

The White Clay Creek watershed provides a variety of hunting opportunities in both Delaware and Pennsylvania, although hunting on public lands is currently limited to the White Clay Creek Preserve and White Clay Creek State Park. Opportunities for hunting in Chester and New Castle counties have declined due to expanding development, so hunters from these areas tend to use large undeveloped tracts elsewhere. The states, as well as private landowners, are interested in reducing the deer population. Hunters can continue to play a key role in deer herd management.

As the deer-hunting seasons differ between Delaware and Pennsylvania, the state lines in the White Clay Creek Preserve should be clearly marked with signs warning recreationists that hunters may be nearby. The states should consider coordinating their deer-hunting seasons within the watershed so that the deer won't move from one state to another to escape hunters.

Currently, more deer roam the watershed than it can support, and hunters are a good control. Additional lands should be made available for hunting. The states should work with landowners to help ensure a safe and effective hunt. The states should work toward consistency in hunting regulations within the watershed.

Each state has limited staff overseeing its park land, and park agencies do not receive compensation for hunting on their lands. To administer the hunting season, state park staff have to set aside other responsibilities at these times. Both states should consider adopting hunting fees and using hunters as volunteers to help offset the administrative burden of hunting on state park lands.

Fishing

The White Clay Creek watershed provides many opportunities for fishing. Water quality is the most important factor in sustaining a healthy and viable fish population. Each spring, both states stock White Clay Creek for a special trout season. While fishing along White Clay Creek appears to be sporadic, the number of fishermen dramatically increases during April, when the creek is stocked.

With fish habitat and production largely dependent on water quality, siltation is thought to be the worst problem threatening the fishery resources of White Clay Creek and its tributaries. Siltation is evident in the sandbar formations and in noticeably shallower depths in some areas. Aggressive enforcement of sediment control requirements for new development will help combat siltation. People should be made aware of the need for controls.

The trout season, particularly its first two weekends, brings traffic congestion and parking problems to Delaware. State park staff should work with transportation officials to develop a strategy that more effectively manages traffic during this time of the year.

Trout fishermen sometimes inadvertently trespass on private lands to get to White Clay Creek and its tributaries. To reduce this unintentional trespassing, the boundaries of public land and private lands should be clearly marked.

WHITE CLAY CREEK STUDY TASK FORCE



Existing Management Responsibilities

River and watershed management responsibilities form a complex web of overlapping, sometimes conflicting, jurisdictions and authorities involving municipal, county, state and federal entities. This web of rules and powers is often more complex than the river ecosystem it is designed to protect.

Most direct land, water, and resource management responsibilities belong to government, with municipal, county, state and federal entities participating under various kinds of legislation and programs. In addition, an array of private organizations and joint government agencies, such as the Delaware River Basin Commission, also manage resources within the watershed.

The existing Management Responsibilities Tables in the Appendix summarize each managing entity's area and level of responsibility for each of the major watershed resource categories (fish and wildlife, threatened and endangered species, cultural resources, etc.). "Primary" responsibility (P) as designated on the table means that the agency or entity takes the initiative on the issue cited, often having a legal mandate to do so. An entity with "secondary" responsibility (S) assists the lead agency, reporting or commenting to the primary partner, or assuming an advisory role. Several patterns emerged from the development of these Management Responsibility Tables, indicating current management strengths and weaknesses, and suggesting directions for the future.

In every resource category, the Pennsylvania municipalities, New Castle County and the City of Newark have some management role, often a primary one. No other managing entity, with the exception of the White Clay Creek Preserve Council, has so many management responsibilities.

The management roles of the two states focus on the aquatic environment and the management of individual plant and animal species. The states take the lead on recreation management, with New Castle County and the City of Newark close behind. The states annually stock the creek with fish, and they co-manage the White Clay Creek Preserve, which is the center of recreation activity in the valley.

The federal government's role in White Clay Creek focuses on water resources and species management. It does not own or manage any land in the watershed. Many of the region's private organizations provide direct stewardship of resources through land ownership and conservation easements. The private sector contributes to management by inventorying, monitoring, restoring or enhancing natural, cultural and recreational resources, and by providing education and interpretation. Individual landowners exercise stewardship of the lands and waters under their control, thereby providing a level of protection to the many values within the watershed.

DRBC takes the lead in water-resource management, sharing that responsibility with the counties, the states and the federal government.

Existing Resource Protection Measures

Background

One of the purposes of this management plan is to demonstrate that White Clay Creek is suitable for designation into the National Wild and Scenic River's System. To demonstrate that the watershed is suitable for designation, it must be shown that the creek's outstanding qualities and resources can be protected through feasible strategies as described in the management plan. This section of the report highlights resource protection strategies currently practiced within the watershed and in its two-state region.

Rivers and streams are strongly affected by land uses in the watersheds that supply them. It is thus clear that, for creeks and rivers that run through land that is mostly in private ownership, individual stewardship and local land-use regulations offer the greatest opportunities for protection. This is particularly true for the White Clay Creek watershed, in which 90% of the land is in private hands.

The following summary of existing resource protection focuses primarily on the municipal level in Pennsylvania, and on the county level in Delaware, which governments are vested with the authority to regulate local land use. The summary also describes state and federal agencies and programs with provisions that affect White Clay Creek. The protection strategies described in this section are by no means the only ones available. The ones highlighted here are most likely to be directly applicable to the future management of the White Clay Creek watershed.

Local Planning and Zoning

Pennsylvania

Chester County's municipalities have primary jurisdiction over land use and development activities under the Pennsylvania Municipalities Planning Code (MPC; Act 247). Municipalities include townships, boroughs and cities; each of these governments is empowered to engage in comprehensive planning and to enact zoning, subdivision and planned residential development ordinances. Twelve municipalities have land in the White Clay Creek watershed (the townships of East Marlborough, West Marlborough, Kennett, New Garden, London Grove, Franklin, London Britain, Londonderry, Penn and New London; and the boroughs of Avondale and West Grove). All of these municipalities have comprehensive plans, zoning ordinances and subdivision and land development ordinances in effect.

Pennsylvania counties are considered "municipalities" under the MPC, with the ability to plan and, when municipalities do not do so, to zone. All counties must (MPC, Section 301.4) prepare comprehensive plans, which are strictly advisory in nature.

Local municipalities must (MPC, Section 304) submit many proposed actions to the Chester County Planning Commission for review. Counties use their comprehensive plans to guide review and comment on local zoning and subdivision ordinances, and on proposals for development.

Counties have primary responsibility for stormwater and solid-waste planning. Plans are required for these activities, and state permitting and funding is tied to the plans. The Stormwater Management Act of 1978 (Act 167) requires that counties develop plans on a watershed basis, consulting with municipalities in the watershed. The Municipal Waste Planning, Recycling and Waste Reduction Act of 1988 (Act 101) establishes a county-wide basis for planning for municipal waste collection, treatment and disposal.

The power to plan, zone and approve land development rests with a township's board of supervisors or a borough council. Planning commissions are generally appointed by boards of supervisors or borough councils, and are usually advisory. Zoning hearing boards decide on zoning variances and special exceptions. Historic commissions may be appointed by the supervisors or councils, and are strictly advisory.



The MPC empowers Pennsylvania municipalities, through master plans and ordinances, to achieve water-resource and environmental-protection goals. Among the issues which may be addressed through local plans and ordinances are:

- water supply and water-supply protection
 - protection and preservation of natural resources and agricultural land and activities
 - preservation of natural, scenic and historic values and preservation of forests, wetlands, aquifers and floodplains
- management of stormwater from developed areas and new land developments.

Because each municipality creates and enforces its own plans and ordinances, goals and strategies differ.

Of special note are the Ground Water Protection District in the East Marlborough Township Zoning Ordinance, and the London Grove ordinance protecting Cockeysville Marble. These zoning overlay districts protect the aquifer contained in the Cockeysville Marble geologic formation underlying parts of the townships. Their provisions aim to safeguard the aquifer against depletion due to increased demand from new land development, against wastewater pollution that threatens its quality, against exorbitant surface cover that would diminish its recharge capability, and against increased danger of land subsidence and sinkholes. While the Cockeysville formation extends into other municipalities with land in the White Clay Creek watershed, the cited ordinances are the only ones known to have been specifically written to protect this aquifer. London Grove Township also has a comprehensive stormwater ordinance which encourages infiltration to maintain streamflow.

Delaware

Land use planning and zoning are county responsibilities in New Castle County, which has had a comprehensive plan and zoning ordinances since the 1950s. The City of Newark has had zoning regulations in place since 1949. New Castle County's zoning powers are derived from the Delaware Code (Title 9, Chapter 26, Sections 2601-2611), which enables New Castle County to regulate land use and zoning in areas outside incorporated municipalities. The county also has a groundwater protection ordinance.

County planning authority is also derived from the Delaware Code (Title 9, Chapter 13, Sections 1341-1353). Under this law, the county executive appoints a seven-member planning board to review the comprehensive development plan prepared by the county department of land use. Approved by the board, this plan is reviewed and adopted by the county council.

New Castle County's subdivision and land-development powers are derived from The Delaware Code (Title 9, Chapter 30, Sections 3001-3012). The county has had subdivision and land-development regulations since 1967. The county planning department reviews and approves subdivision and land-development plans, then forwards them to the county council for final approval.

Zoning decisions are appealed to a five-member board of adjustment, appointed by the county executive. This board may grant special exemptions and variances, and may reverse or affirm a decision made during a prior hearing.

The Water Resources Agency for New Castle County provides regional water supply and water-quality management and planning for the county, including the White Clay Creek watershed. The agency is directed by a policy board comprising representatives of the City of Newark, the City of Wilmington, New Castle County and the State of Delaware. Water-resources planning activities are achieved through several programs including the Water Supply Plan for New Castle County and the Water Resource Protection Area (WRPA) Program.

The Watershed in Local Planning

In the late 1960s, in order to address planning issues within the White Clay Creek watershed in Pennsylvania, the Avon-Grove Regional Planning Commission convened the White Clay Creek watershed communities of Avondale Borough, West Grove Borough, Franklin Township, London Britain Township, London Grove Township, New London Township and Penn Township. In 1969 the coalition issued a regional comprehensive plan. Other work of the Regional Planning Commission includes Regional Data Inventory (1987); Route 41 Corridor Planning Study: A strategy for transportation and land use (1988); Regional Community Facilities Plan (1990); and Regional Future Land Use Plan (1991).

County Protection Measures

New Castle County

Water Resource Protection Area Program (WRPA). The New Castle County Department of Land Use, with technical assistance from the Water Resources Agency for New Castle County, administers a WRPA Ordinance as an overlay district to the zoning code. WRPAs include the Cockeysville Formation, Surface Water, Wellhead, and Recharge areas. The purpose of the WRPA program is to protect the quality and quantity of ground and surface water for water-supply purposes. The ordinance provides minimum lot density

and maximum percent impervious coverage for new residential, commercial and industrial development in the WRPAs. (See Appendix: WRPA Districts Land Use Regulation Table.) The City of Newark has water resource protection regulations very similar to those in New Castle County for its Wellhead Resource and Aquifer Resource Protection areas.

Drainage Code. The New Castle County Department of Public Works administers a drainage code designed to control the quantity and quality of stormwater from new developments. The code contains provisions for stormwater detention, buffer areas, soil erosion and sediment control. Administration of the code is financed through developer fees and the county operating budget. Copies of the drainage code can be obtained from the New Castle County Department of Public Works.

Riparian Buffer Area. New Castle County will consider a Riparian Buffer Area (RBA) ordinance in 1997. The ordinance will protect a corridor not less than 100 feet wide on each side of streams and around lakes within the county. The buffer area may be wider than 100 feet where necessary to protect such environmentally sensitive areas as floodplains, wetlands, steep and erosion-prone slopes and Critical Natural Areas.

Water Supply Plan. The water supply plan for New Castle County (Environmental Impact Statement) guides the search for additional supplies to meet existing and future water needs. The EIS is funded by the entities that form a five-member committee consisting of New Castle County, State of Delaware, Artesian Water Company, United Water Delaware and the City of Newark. The Water Resources Agency for New Castle County coordinates the committee. Results of the EIS analysis indicate that five alternatives are still under consideration. These are: Thompson Station Reservoir, Desalination, Philadelphia Pipeline, reuse of wastewater and the Chester Water Authority Pipeline. Two of these alternatives - the reservoir and the CWA pipeline - would be in the White Clay Creek watershed.

Delaware Stormwater and Sediment Regulations. DNREC, Division of Soil and Water Conservation has adopted stormwater and sediment regulations, last revised in 1993. The state has delegated to certain governments such as New Castle County and the City of Newark the authority to administer the state stormwater regulations. The purpose of these regulations is to reduce runoff and improve the quality of stormwater from new developments. The City of Newark administers stormwater management regulations and a drainage code within municipal boundaries.

Chester County

Water Supply Planning. The Chester County Water Resources Authority, and to a lesser extent the County Planning Commission, provide water-resources planning for Chester County. The County Planning Commission and County Water Resources Authority are both directed by nine-member volunteer boards, which are in turn appointed by the County Board of Commissioners. Water-resources planning activities are achieved through several programs, including the County Comprehensive Plan, a cooperative program with the U. S. Geological Survey and the Plan for the Brandywine as approved under P.L. 566. Under PA acts 247 and 537, the Planning Commission has mandated responsibilities for reviewing and commenting on land and sewage facilities plans proposed in the municipalities.

Regulation of Wells and Septic Systems. The Chester County Health Department has regulatory powers with respect to permitting wells and septic systems. The department also conducts an annual stream sampling program which probably includes White Clay Creek because of the mushroom agriculture in the area.

Acquisition of Parkland. The Chester County Parks and Recreation Department has several programs which provide incentives and funding to municipalities for the acquisition and protection of open space for use as parks and greenway segments.

Erosion and Sedimentation Regulation. The Chester County Conservation District (CCD) has both regulatory and outreach responsibilities related to the White Clay Creek watershed. Under state sedimentation and erosion regulations, CCD may act on applications. Through education and grant programs, CCD promotes conservation practices which include BMPs affecting stormwater management and mushroom agriculture.

Chester County's 1996 Comprehensive Policy Plan (Landscapes); Key Comprehensive Plan Goals.

Objectives and Policies. Landscapes compares the current trend in Chester County - toward undifferentiated suburban sprawl - with a commonly held vision of development concentrated in centers supported by resource preservation, open space and reduced motor-vehicle congestion. The plan articulates goals, objectives and policies in the following areas: Land Use, Resources, Economic Development, Transportation, Community Facilities, Utilities, Housing, Human Services, Public Health and Planning and Coordination. Those goals, objectives and policies most likely to affect the White Clay Creek watershed are found in the areas of Land Use, Resources and Community Facilities and Utilities.

Municipal Participation in Comprehensive Plan Implementation

In Pennsylvania, municipalities regulate their own zoning codes. Nevertheless, the county's comprehensive plan includes many strategies that can protect and enhance the White Clay Creek watershed. Municipal participation in comprehensive plan implementation is voluntary through the "Vision Partnership Program," which provides financial and other incentives for municipalities that execute memoranda of understanding and join the partnership.

Christina Basin Management Program

The Delaware River Basin Commission (DRBC) coordinates this bi-state program which includes the watersheds of White Clay Creek, Red Clay Creek, Brandywine Creek and the Christina River. The headwaters of all three creeks are located in Chester County, and the creeks eventually flow into the Christina River in New Castle County, Delaware. The program, a five-year effort to address both point and non-point sources of pollution, is intended to protect and improve the water quality of all the streams and rivers in the Christina Basin so the basin's waters can accommodate recreation as well as fish and other aquatic life. The project is funded by the United States Environmental Protection Agency and by the states of Pennsylvania and Delaware. Other participants in the program are the Water Resources Agency for New Castle County, the Chester County Conservation District, the Chester County Planning Commission, the federal EPA, the U. S. Fish and Wildlife Service, Natural Resource Conservation Service and U.S. Geological Survey.

State Statutes and Programs

Pennsylvania Rivers Conservation Program

This program conserves and protects river resources through the development and implementation of locally initiated plans. It provides technical and financial assistance to municipalities and river-support groups so that they can carry out planning and implementation activities. A registry is established to recognize local river-conservation efforts. The program consists of five components: planning grants, technical assistance, river registry, implementation grants and acquisition and development grants. Local planning and support are prerequisites for any grant or recognition from this program, which is funded in part by the Keystone Recreation, Park and Conservation Fund Act of 1993.

Planning grants are awarded for detailed studies to identify significant natural, recreational and cultural resources. Issues, concerns and threats to these resources are also investigated at this stage, and methods are recommended to conserve, enhance and restore river resources.

Technical assistance is provided to support communities and organizations undertaking studies and projects with their own resources. A clearinghouse for technical and resource information will be maintained and kept available to all engaged in river-conservation activities.

Implementation grants are awarded to carry out project activities recommended and included in an approved river conservation plan. Project proposals can be for single or multiple-year installation periods.

The rivers registry recognizes communities that have undertaken and completed river-conservation projects. The registry also supports local initiatives by recognizing them formally in a statewide program. To be placed on the registry, a river must have an approved plan and local municipal support.

Acquisition and development grants are awarded to carry out project activities recommended and included in an approved river-conservation plan.

Funding and eligibility. The Keystone Recreation, Park and Conservation Fund Act of 1993 allows for river-conservation use of up to 10 percent of the Department of Environmental Resources share of the realty transfer tax. Grants range from \$2,500 to \$50,000. Planning and implementation grants require a 50 percent match of the costs of the approved project. The local share can be provided through direct payment or in-kind services (which can include professional and volunteer labor). Any municipality or appropriate organization with 501(c)(3) status is eligible for the grants.

Rivers designated by the Pennsylvania legislature for inclusion in the Pennsylvania Scenic Rivers System, or designated under the Federal Wild and Scenic Rivers Act, with approved management plans, can be included on the Pennsylvania Rivers Conservation Registry.

Pennsylvania Scenic Rivers Program

The Department of Conservation and Natural Resources (DCNR) administers the Pennsylvania Scenic Rivers Act (P.L. 1277, Act 283, 1972, as amended). The act authorizes a Scenic River System comprising river segments with outstanding aesthetic and recreational values, and provides for the protection and administration of the designated segments.

When a river segment is nominated for Scenic Rivers designation, the nominating entity submits a comprehensive study documenting important river-related resources; recommending resource management and environmental protection alternatives; evaluating environmental, economic and social impacts; and recommending any legislation necessary to implement the designation, which requires an act of the state legislature. Once designated, the river segment is classified as wild, scenic, pastoral, recreational or modified recreational.

The key benefit of Scenic River designation is the consistency achieved by the coordination of commonwealth agencies planning actions that affect the designated river. Designation also supports the enactment of municipal protective zoning ordinances.

Pennsylvania Ground Water Source Drinking Water Protection

In October 1994 the Pennsylvania Department of Environmental Resources (PADER, now PADEP) published new wellhead protection regulations that went into effect October 9, 1995. These regulations require any new or expanding community water system to demonstrate that it owns or controls all the land in the Wellhead Protection Area Zone 1 before a permit can be issued. Zone 1 is the immediate area surrounding the well, which may range from 100 to 400 feet depending on the pumping rate of the well and the type of aquifer the well is tapping. This allows the water supplier to prohibit activities in this zone which could adversely impact the well. It is not known whether any water suppliers in the White Clay Creek watershed have had to comply with these regulations since they were adopted.

Pennsylvania Erosion and Sedimentation Control

In Pennsylvania, two divisions of PADEP have jurisdiction over the quality and quantity of stormwater flows. The Division of Stormwater Management and Sediment Control works with counties and municipalities to prepare and implement watershed stormwater management plans under Act 167. There is no Act 167 stormwater management plan in place for the White Clay Creek watershed. The division is also responsible for statewide erosion and sediment-control regulations, and for issuing National Pollutant Discharge Elimination System (NPDES) permits for certain kinds of stormwater discharges. Many other aspects of the statewide permitting and inspection program for new land developments have been delegated to the Chester County Conservation District. The PADEP Division of Nonpoint Source Management is responsible for working with various regional, county and local agencies to improve the quality of stormwater runoff. Much of the funding for projects in this office is through federal grants under the Clean Water Act.



*Reconstructed Native American Artifact,
Middle Run Natural Area, New Castle County*

Delaware's Greenway Program

Delaware's Greenway Program preserves and protects open-space links among parks, refuges, historic and natural sites and other open-space areas. Greenway funding is granted to municipalities and counties on a 50% matching basis by the Delaware Land & Water Conservation Trust Fund, and the greenway program is managed by the Department of Natural Resource & Environmental Control, Division of Parks & Recreation. The Delaware Greenway Program has initiated several greenway projects in the White Clay Creek valley, and will thus have an important role in the management strategy for the creek.

Northern Delaware Greenway

The Northern Delaware Greenway includes the following components:

- **Mill Creek Greenway** uses a system of public lands, suburban streets and private open space to link White Clay Creek State Park, Middle Run Natural Area, White Clay Creek Preserve and the Delcastle Recreation Area, with Middle Run - to - Delcastle its primary focus.
- **The 800-acre Middle Run Natural Area**, part of the New Castle County park system, is managed as a nature preserve accommodating passive recreation. The scenic Middle Run trail system will eventually link White Clay Creek State Park (to the west) with the Mill Creek Greenway (to the east).

- **The White Clay Creek Middle Run Land**

Bridge has been envisioned since the 1980s as the connector between the White Clay Creek Preserve and the Middle Run Natural Area. The State of Delaware has acquired all of the parcels needed to complete the most extensive greenway system in New Castle County. When the project is complete, almost nine and a half miles of riparian habitat in White Clay Creek State Park, White Clay Creek Preserve and the Middle Run Natural Area will permanently be protected.

Delaware's Designated Watershed Program

Delaware's Designated Watershed Program is administered under the Delaware Stormwater & Sediment regulations.

Delaware's Open Space Program

Authorized by the 1990 passage of the Delaware Land Protection Act, the Open Space Program of DNREC Division of Parks and Recreation coordinates and administers the acquisition of parks, fish and wildlife areas, forest, nature preserves and cultural sites.

The Open Space Council designated White Clay Creek as one of 20 State Resource Areas, a list of lands containing natural and cultural resources significant to the state. The identification of resource areas provides the state with a blueprint for future land acquisitions that will provide permanent resource protection.

The funding for this program comes from land and water conservation bonds, a portion of the realty transfer tax and legislative appropriations. To date, the program has issued bonds totaling approximately \$50 million. Program funds are used exclusively for land acquisition in State Resource Areas.

White Clay Creek Preserve and White Clay Creek State Park

In 1984 the Dupont Company donated land in the White Clay Creek valley north of Newark, Delaware, for a natural preserve to be managed jointly by Delaware and Pennsylvania. The preserve holds important natural and cultural resources, including freshwater wetlands, mature forests, rare plant and animal habitats, geological formations and archaeological sites. The preserve is managed for natural resource preservation and passive recreation.

The 1,800 acres in White Clay Creek Preserve are managed by the Pennsylvania Bureau of State Parks and the Delaware Division of Parks & Recreation. With the neighboring 1,752-acre White Clay Creek State Park,

WHITE CLAY CREEK STUDY TASK FORCE



the protected land along White Clay Creek totals some seven miles of riparian corridor.

The park and preserve section of White Clay Creek has been placed on the Nationwide Rivers Inventory (NRI), which lists rivers and river sections with potential for designation as National Wild and Scenic Rivers. The resources justifying the listing include rare and diverse biological habitats, and recreation opportunities within close proximity to urban areas.

Both park and preserve are managed for passive and low-intensity recreation and natural-resource conservation. White Clay Creek in the area of the preserve is stocked with fish several times a year and is considered one of the best trout streams in the area. Other activities in the park and preserve include hiking, bicycling and horseback riding.

The White Clay Creek Preserve Council was established along with the preserve in 1984 (Delaware HB 720 of the 132nd General Assembly, and House Resolution No. 250 of the 1984 Session of the General Assembly of Pennsylvania). The 12-member council advises the directors of the Delaware Division of Parks and Recreation and the Pennsylvania Bureau of State Parks on recreation and conservation issues. Council membership balances representation among state and local governments in Delaware and Pennsylvania, and includes citizen interest groups.

Executive Order: Governor, Commonwealth of Pennsylvania, Number 1989-2

In 1989 Governor Casey of Pennsylvania signed an executive order requiring that state agencies involved in land management act consistently with the goals, policies and objectives of the Upper Delaware National Scenic and Recreational River Management Plan. The order applies to all administrative departments, independent administrative boards and commissions, and stipulates that each agency notify the Department of Conservation and Natural Resources Division of Conservation Partnerships of any activity that will affect Delaware River resources. The order remains in full force as long as the management plan is in effect. Similar executive orders from the governors of both Pennsylvania and Delaware should be sought for the White Clay if it is designated into the National Wild and Scenic Rivers System.

Federal Statutes and Programs

Delaware River Basin Commission

In 1961 the federal government and the states of New York, New Jersey, Pennsylvania and Delaware, recognizing the river basin's regional and national significance, created the Delaware River Basin Commission (DRBC). The commission adopts and promotes coordinated policies for water conservation, control, use and management in the basin. The commission's authority to plan and regulate water conservation and use gives it a central river-management role, particularly for water supply and quality issues.



DRBC maintains a comprehensive plan that guides development of the basin's water resources and serves as a management and regulatory mechanism. The plan codifies administrative decisions governing water-resource use, development and conservation. In 1991 DRBC included in its comprehensive plan two proposed water-supply projects within the White Clay Creek watershed, the reservoirs at Churchman's Marsh and Thompson Station.

The Water Code of the Basin (March 1994) establishes policies on water conservation and utilization, and water-quality standards. The policies require that new users demonstrate efficiency in water usage. They also establish water-use priorities in times of drought. The code requires that interstate waters maintain high water quality, although special ("no measurable change") standards apply to designated

waters with high scenic, recreational, ecological and/or water-supply values.

The DRBC establishes minimum instream flows. The 7-consecutive-day, 10-year-return period low flow (7Q10), established to protect the aquatic environment, is the minimum flow that will ensure the survival of aquatic resources for a river or river section.

The DRBC's Water Resources Program (1995-1996) is an important river-management tool. It gives an overview of water resources and presents the commission's six-year water-resource program. The current planning programs are:

1. Continuing inventory and evaluation of water supply.
2. Analysis of population and demands for land and water.
3. Analysis of recreation, fish, and wildlife demands.
4. Analysis of power potential.
5. Investigation of projects proposed by others.
6. Water quality management and pollution control.
7. Comprehensive plan and water resources program.
8. Flood loss reduction.
9. Basin operations.

USDA Natural Resources Conservation Service.

USDA Forest Service: Watershed Protection Plan for Red and White Clay Creeks

In 1996 the Natural Resources Conservation Service (NRCS) and the Forest Service (FS), in cooperation with the Chester and New Castle county conservation districts and the Brandywine Conservancy, issued a draft watershed protection plan for the Red Clay Creek and White Clay Creek watersheds. Its primary focus is on watershed protection and water-quality improvement. This plan falls under the authority of the Watershed Protection and Flood Prevention Act (P.L. 83-566, amended 16-USA-1001-1008).

The watershed protection plan addresses many of the issues raised during this study of White Clay Creek. Problems identified by NRCS include degraded water-based recreation, toxin levels in edible fish, adverse impacts to aquatic life, impaired drinking water supplies, objectionable odors, damage to cropland and damage to transportation and water conveyance facilities.

Recommendations include accelerated land treatment and the acquisition of conservation easements. NRCS would support these recommendations by providing technical assistance and matching grants through a voluntary watershed protection program. NRCS will provide up to 65% of the costs for property owners who propose enduring land treatments and up to 50% of the costs for purchasing conservation easements. Grants will be available, on a competitive basis, to landowners in both the Red and White Clay Creek areas.

NRCS identified the following Red/White Clay creeks watershed land-treatment practices as eligible for support:

• **AGRICULTURAL WASTE MANAGEMENT**

- Waste Management Systems
- Waste Storage Facilities
- Nutrient Management Plans
- Livestock Concentration Treatments
- Milkhouse Waste Treatments
- Runoff Controls

• **CROPLAND TREATMENT**

- Cropland Erosion Control
- Nutrient Management
- Pest Management
- Convert Cropland to Hayland
- Convert Cropland to Trees

• **RIPARIAN AREA TREATMENT**

Riparian Forest Buffer or Filter Strips
Wetland Restoration
Livestock Exclusion from Streams
Streambank Stabilization/Restoration

Delaware Estuary Program

In 1988, the governors of Pennsylvania, Delaware and New Jersey nominated the Delaware estuary to the National Estuary Program administered by the Environmental Protection Agency. White Clay Creek is a tributary of the Delaware estuary. Inclusion in the National Estuary Program established the Delaware estuary as an important natural resource in an area of intense human activity, challenged by complex issues. In 1996 a management conference developed a Comprehensive Conservation and Management Plan for the estuary.

Five goals were established by the Delaware Estuary Program:

- Provide for the restoration of living resources of the Delaware estuary and protect their habitats and ecological relationships for future generations;
- Reduce and control point and non-point sources of pollution, particularly toxic pollution and nutrient enrichment, to attain the water-quality conditions necessary to support abundant and diverse living resources in the Delaware estuary;
- Manage water allocations within the estuary to protect public water supplies and maintain ecological conditions in the estuary for living resources;
- Manage the economic growth of the estuary in accordance with the goal of restoring and protecting the living resource of the estuary; and
- Promote greater public understanding of the Delaware estuary and greater participation in decisions and programs affecting the estuary.

The Delaware Estuary Program is voluntary, and it relies on cooperation among constituents. The program itself will act as leader and facilitator, providing a watershed focus, defining sustainable development, and working with local communities to achieve regional perspective on issues. The Program will disseminate information and progress reports, and it will provide incentives for appropriate actions. Efforts to protect White Clay Creek should be coordinated with the Delaware Estuary Program.

The Comprehensive Conservation and Management Plan is being implemented through periodic coordinating conferences. Two such conferences were held in 1997. The conferences are led by a steering committee which comprises the environmental secretaries of Delaware, New Jersey and Pennsylvania; the regional administrators of EPA regions II and III (sharing one vote); and a representative of the Partnership for the Delaware Estuary, Inc.

The Partnership for the Delaware Estuary, Inc., raises money in the public and private sectors and provides funding and incentives for projects designed to protect and enhance the estuary. It also promotes, through public education and outreach, conservation of natural resources and increased understanding and appreciation of the Delaware estuary and its tributaries.

Army Corps of Engineers

The Army Corps of Engineers (ACE) regulates the discharge of dredge and fill material into U. S. waters (including wetlands) through the use of permits. Two classes of permits are issued: Nationwide and Individual. (Section 404, 33 U.S.C. §1344; 40 C.F.R. Part 320 and 231; and 33 C.F.R. Parts 320, 323, and 330, Federal Clean Waters Act . Also Section 10, Rivers and Harbors Act of 1899, 33 U.S.C. 401 *et seq.*)

Nationwide Permits are utilized when the Corps finds the impact of 40 categories of activities to be insignificant. Nationwide Permit categories include activities related to the construction of outfall and intake structures, discharges of materials for backfill or bedding for utility lines, streambank stabilization activities for erosion prevention, and discharges of dredged fill material into headwaters and isolated water causing loss of not more than three acres of waters, including wetlands.

When issuing Individual Permits, the Corps must follow EPA regulations that evaluate the environmental impacts of the discharge or fill. These regulations (404 [b][1] guidelines) require that the Corps consult the United States Fish and Wildlife Service, the EPA, the State Historic Preservation Office, and the administrative agency for National Wild and Scenic Rivers.

Pennsylvania State Programmatic General Permits (PASPGP) were issued by the Corps to avoid duplicating another permitting process at the state level. In issuing a PASPGP, the Corps certifies that the dominant permit meets the standards of Section 404 of the federal Clean Water Act. The PASPGP places PADEP in the lead for processing approximately 80 percent of state and federal permit applications. In Pennsylvania, permits for the following activity types are still issued by ACE: activities impacting more than one acre of a body of water, including wetlands; activities impacting more than 250 linear feet of streams; activities involving dams, weirs, fill, stream channelization or relocation in the Juniata and Susquehanna Rivers; activities in French Creek, LeBoeuf Creek, Conneauttee Creek or Conneaut Outlet; activities impacting more than five acres of water or wetlands and activities in rivers under study for, or designated as, National Wild and Scenic Rivers. Under current regulations Nationwide Permits may be issued for activities within rivers under study for, or designated as, National Wild and Scenic Rivers.

Other Types of River and Watershed Protection

While local laws and regulations are the primary means of protecting rivers and watersheds, other mechanisms exist. Land acquisition, voluntary landowner action and physical barriers to land development may also work to protect watershed qualities.

Land acquisition and ownership for conservation ensures the long-term protection of rivers and their resources. Public parks, open space, conservation easements and even school yards offer permanent and predictable opportunities for river-resource conservation. Land ownership for conservation works because the owner is in charge, guaranteeing land use compatible with watershed preservation.

Landowners - corporations, businesses, farmers and residents - within a watershed can take voluntary action to protect their river or creek. Many private, nonprofit organizations and government agencies offer information on conservation and stewardship, and other kinds of support as well. When landowners willingly protect the rivers and streams in their own backyards, they become 24-hour-a-day guardians. That kind of full-time, primary protection is indispensable.

Many common landscape features such as wetlands, floodplains and steep slopes often make land adjacent to rivers difficult or impossible to develop, although burgeoning market pressure tends to overcome undesirable landscape features in the name of growth. However, municipal, county and state construction standards can severely limit construction on certain kinds of watershed land, including steep slopes, wetlands and floodplains.

II. APPROACH TO MANAGEMENT

Study Area: White Clay Creek Watershed

Because the watershed is embedded into the fabric of its surroundings, and because it is subject to influences from every precinct of its setting, the watershed would not be wisely managed through the use of traditional Wild and Scenic River strategies that concentrate on a narrow corridor bracketing bed and banks. A study area shaped by corridors simply tracing the watershed's major tributaries would not encourage the devising of management strategies well suited to protecting a fragile and intricate headwater ecosystem.

This sensitive aquatic environment needs a broader approach, one that considers its complex network of streambeds and diverse settings as a coherent system.

A headwater watershed typically consists of a dense network of very small perennial and nonperennial streams. More than 54% of the White Clay Creek watershed is made up of these "first order," or smallest-category streams. Most first-order streams are only a few feet wide and carry small volumes of water.

RICK DARKE



White Clay Creek in Winter

Because their low volumes lack the capacity to dilute pollutants, small headwater streams are very susceptible to nonpoint-source contamination. They can also be unbalanced dramatically by changes in surrounding land uses. Even apparently insignificant shifts in use can cause severe fluctuations in temperature, nutrient composition, and ultimately the biodiversity of headwater streams.

Recognizing the factors that distinguish this watershed, Congress directed the National Park Service to consider the entire White Clay Creek watershed when devising a management plan. This comprehensive approach allowed inventory, analysis and recommendations that address all of the conditions and potential

threats that face this complex, sensitive and influential river system.

Devising an Approach

Legislative Direction

The Wild and Scenic Rivers Act (P.L. 90-542, as amended) provides the legal foundation and overall guidance for the National Wild and Scenic Rivers System. The following sections are particularly relevant to the development of this resource management and protection plan and its administrative framework.

Section 1(b) summarizes the intent of the Act:

It is hereby declared to be the policy of the United States that certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations.

Section 5 (a) (113) specifies the area to be studied for possible designation, which has been broadened to include the entire watershed of White Clay Creek: White Clay Creek, Delaware and Pennsylvania - The headwaters of the river in Pennsylvania to its confluence with the Christina River in Delaware, including the East, West, and Middle branches, Middle Run, Pike Creek, Mill Creek, and other main branches and

tributaries as determined by the Secretary of the Interior.

Section 5 (b) (11) (A) directs the National Park Service to prepare a management plan for White Clay Creek as part of the study: In carrying out the study, the Secretary of the Interior shall prepare a map of the White Clay Creek watershed in Delaware and Pennsylvania, and shall develop a recommended management plan for the White Clay Creek. The plan shall provide recommendations as to the protection and management of the White Clay Creek, including the role the state and local governments, and affected landowners, should play in the management of the White Clay Creek if it is designated as a component of the National Wild and Scenic Rivers System.

Section 10 (a) specifies how designated rivers should be managed: Each component of the National Wild and Scenic Rivers System shall be administered in such manner as to protect and enhance the values which caused it to be included in said system without, insofar as is consistent wherewith, limiting other uses that do not substantially interfere with public use and enjoyment of these values. In such administration primary emphasis shall be given to protecting its esthetic, scenic, historic, archaeological, and scientific features. Management plans for any such component may establish varying degrees of intensity for its protection and development, based on the special attributes of the area.

Section 7 (a) describes the specific protection provided to designated rivers: The Federal Power Commission [Federal Energy Regulatory Commission] shall not license the construction of any dam, water conduit, reservoir, powerhouse, transmission line, or other project works under the Federal Power Act . . . on or directly affecting any river which is designated . . . and no departments or agency of the United States shall assist by loan, grant, license, or otherwise in the construction of any water resources project that would have a direct and adverse effect on the values for which such river was established... No department or agency of the United States shall recommend authorization of any water resources project that would have a direct and adverse effect on the values for which such river was established...

Existing Land Development and Critical Areas

Among the first steps the Management Planning Committee took toward developing an approach to managing the White Clay Creek watershed were an analysis of existing land uses and development patterns, and an inventory of critical resource areas. (See resource maps and critical resource map.)

From the outset it was clear that the White Clay Creek watershed is a complex mosaic of land uses. The watershed represents a fairly typical cross section of the Mid-Atlantic seaboard region, showcasing dense highway commercial strips, industrial corridors and tiny agricultural crossroads villages. In and around the intense land uses flourishes a more hidden natural world where plants and animals thrive and tiny streamlets flow toward the creek.



To date, the municipal, county and state authorities within the watershed have managed fairly well to balance the region's growth with the protection of sensitive resources. But demographic trends show that population in the watershed and surrounding area continues to burgeon, and development pressure will inevitably increase. Many municipalities currently work with older ordinances, and few local and regional governments utilize all the conservation tools now available for watershed protection purposes. New Castle County is developing new environmental ordinances including a riparian buffer ordinance to improve water quality, reduce erosion in the watershed and promote the development of watershed management plans.

Drinking Water Protection

Drinking water is perhaps White Clay Creek's most important resource. Residents of New Castle County, Delaware, depend on White Clay Creek for much of their water supply; even so, the surface water flowing through the creek does not consistently meet the demand. During times of drought, especially, the drinking-water supply can shrink to critically low levels. The water supply drawn from the creek is currently supplemented by wells replenished by the watershed's groundwater supply.

As development continues in Chester and New Castle counties, demand for drinking water - much of it drawn from new wells fed by the watershed - will certainly grow.

The Management Planning Committee recognized that the management approach selected must give a very high priority to protecting the quality and quantity of drinking water within the watershed.

Management Principles

The Management Planning Committee established the following set of principles to guide the development of management strategies for the watershed.

No Federal Land Acquisition: The National Park Service (NPS) will not acquire land within the White Clay Creek watershed for the purpose of protecting outstandingly remarkable resources.

Local Management: Management of White Clay Creek resources will be based primarily on the actions of local government in cooperation with landowners, the business community, individual citizens and county and state agencies. The role of the federal government will be minimal.

Use Of Existing Statutes, Ordinances And Programs: Every effort will be made to utilize only existing authorities, statutes, ordinances and programs to protect the important resources of White Clay Creek and its watershed. A set of recommended guidelines for local resource management and protection are part of this plan.

Protection Of Landowner Rights: Any strategy to conserve the resources of White Clay Creek and its watershed should simultaneously ensure that the property rights of landowners are protected.

Consistency With Local Plans: The existing range and pattern of agricultural, residential, commercial and industrial land uses should be consistent with adopted comprehensive development plans at the local and county levels.

Existing/Future Public Water Facilities: The plan will recognize the existing and future water-supply uses and wastewater treatment facilities in the White Clay Creek watershed. Existing uses include the surface water supply intakes for the City of Newark and United Water Delaware and wastewater treatment plants in the Boroughs of Avondale and West Grove. Wild and Scenic designation within the 500-year floodplain of White Clay Creek and its second-order tributaries should not restrict the existing operations or future modification to the water intakes, water treatment or wastewater treatment plants of the City of Newark, United Water Delaware or the Boroughs of Avondale and West Grove. The properties on which these facilities are located are recommended not to be included in the federal Wild and Scenic River designation. The Churchman's Marsh reservoir alternative has been deleted from further consideration as a water-supply alternative. Future water uses may include the Thompson Station reservoir alternative, which is to be located on Lamborn Run. Lamborn Run, along with the property on which the intake structures for the Thompson Station Reservoir will be located, should not be designated for Wild and Scenic status pending the completion of the federal Environmental Impact Statement (EIS). If the federal EIS is not completed, or if it determines the Thompson Station reservoir site is practicable and the site remains on the DRBC Comprehensive Plan, then the Thompson Station reservoir site would remain unsuitable for federal Wild and Scenic status.

Existing Publicly Owned or Operated Water or Wastewater Collection, Conveyance and Treatment

Systems: Operation, maintenance, repair, rehabilitation and replacement of existing publicly owned or operated water or wastewater collection, conveyance or treatment systems, including incidental clearing and land disturbance activities which are performed in conformance with state laws, local ordinances and applicable U.S. Army Corps of Engineers nationwide permits should not significantly or adversely impact White Clay Creek and its tributaries and therefore shall not be subject to application of this management plan by the White Clay Creek Watershed Management Committee.

Adoption Of Recommended Land-Use Management Protection Guidelines: The Land Use Management Guidelines should offer a range of alternatives for meeting resource-protection goals. Local governments should adopt into their local ordinances and plans those areas of the guidelines not currently addressed in their local ordinances. Landowners should be encouraged to adhere to the management guidelines in the stewardship of their own properties.

Comprehensive Strategy For Resource Protection And Conservation: The plan recognizes that no one group, organization or level of government can protect all of the resources of the White Clay Creek watershed. The actions of local governments will be a cornerstone of the plan. However, the successful protection of resources will require a coordinated approach and application of conservation easements, land trusts, education programs, best management practices, reforestation projects, etc.

Advisory Board Or Commission: An advisory board or commission representative of all watershed interests should be created to coordinate the long-term implementation of the Watershed Management Plan. The advisory board or commission should assist and guide local governments and landowners in their efforts to implement the overall watershed management plan as well.

Mission

The White Clay Creek Watershed Management Plan will foster cooperation between private landowners, business and industry, non-profit organizations, educational and research institutions, recreationists, historians and all governmental units including: the State of Delaware, Commonwealth of Pennsylvania, Delaware River Basin Commission, Chester County, New Castle County, City of Newark, Avondale Borough, East Marlborough Township, Franklin Township, Kennett Township, London Britain Township, Londonderry Township, London Grove Township, New Garden Township, New London Township, Penn Township, West Grove Borough and West Marlborough Township.

Goals

- Improve and conserve water quality and water quantity.
- Conserve open space, woodlands, wetlands and geologic features.
- Protect native plant and animal species.
- Preserve cultural, historical and archaeological sites.
- Enhance outdoor recreation opportunities.
- Encourage environmental education and watershed awareness.

Objectives

The following objectives support the mission and goals of the White Clay Creek Watershed Management Plan:

1. Maintain stream flow and maintain or improve water quality to revitalize fisheries and enhance recreational and scenic qualities, while accommodating legitimate demands for water supply, waste assimilation, commercial, industrial and agricultural uses.
2. Foster the protection, enhancement and stewardship of the natural, cultural and recreational resources of the watershed for the benefit and enjoyment of present and future generations.
3. Encourage coordination and consistency among existing levels of government, businesses, organizations and individuals to facilitate implementation of the management plan, without creating a new regulatory agency.
4. Promote public recognition of the White Clay Creek watershed as a place with its own identity, continuing history and a future to be shaped by its residents.
5. Manage growth to protect the watershed's special qualities, while emphasizing the rights of property owners and existing local control.

A Two-Tier Approach

A two-tier approach to the management of the White Clay Creek watershed acknowledges both the importance and preference for local leadership and the additional protection afforded by federal Wild and Scenic River designation.

The first management tier will focus on the watershed's municipal and county governments, with the cooperation of state agencies in both Pennsylvania and Delaware, and with the DRBC. Participants in this tier will begin to adopt and implement watershed-management strategies contained in the Local Land Use Management and Resource Management sections of the plan. Cooperation across state and county lines will foster consistency throughout the entire watershed area.

The second management tier will involve the federal government through the National Wild and Scenic Rivers System. Federal action will center on the designation of major White Clay Creek tributaries into the system. Federal authority will center on reviewing the impacts on outstanding watershed resources of water-resource projects involving federal loans, licenses or permits within the designated area.

This approach to management recognizes that existing federal and state agencies and the Delaware River Basin Commission will continue to exercise their authorities over state and federal permits and other regulations affecting the river environment of the White Clay Creek.

Federal Designation Boundary

A key issue addressed by the Management Planning Committee during the management planning process was the size and shape of the land area it would recommend for federal designation into the National Wild and Scenic Rivers System. Federally sponsored or permitted projects within those land and water areas included within the designated boundaries would be subject to National Park Service review via Section 7 of the Wild and Scenic Rivers Act. Generally, designation boundaries envelop outstandingly remarkable resources and provide enough land area to buffer the waterway from incompatible land uses. The designated area may not exceed more than 320 acres per river mile, on average. Some members of the Study Task Force favored federal designation of the entire area drained by White Clay Creek and its tributaries; others favored designation only for areas that would protect resources while relying on the municipalities in Pennsylvania, the City of Newark and New Castle County to continue to regulate the remainder of the

watershed's lands.

A determination of compatible and incompatible land uses for the proposed designated river and associated designated land areas traditionally accompanies the designation process. Local jurisdictions and citizens are asked to define those land uses during the planning process. In essence, local participants working with state, county and federal participants determine, from a resource-protection standpoint, which land uses are appropriate and which are not appropriate within designated areas.

The Management Planning Committee debated the appropriateness of extending the protection conferred by designation over the entire White Clay Creek watershed. The committee had particular concern about the appropriateness of conferring the same type and level of protection on the watershed's urban areas as on its undeveloped portions. A considerable portion of the White Clay Creek watershed within City of Newark municipal boundaries is intensively developed, including a large portion of the city's central business district. These areas will be developed or redeveloped and should not be included in the federally designated area.

III. ADMINISTRATIVE FRAMEWORK

Wild and Scenic Designated Area

The White Clay Creek Wild and Scenic Rivers System Act (P.L. 106-357) designated the following tributaries or river segments of White Clay Creek into the National Wild and Scenic Rivers System: White Clay Creek, from the confluence of the East and Middle Branches in London Britain Township, Pennsylvania, downstream to its confluence with the Christina River in New Castle County, Delaware; the East, West and Middle Branches within Pennsylvania; Middle Run and Pike and Mill Creeks in Delaware; and all other second-order streams as shown on the Designated Area Map.

The following tributaries or river segments were found eligible but not suitable for federal Wild and Scenic River designation: Lamborn Run (along with the properties on which the intake structures and pipelines for the Thompson Station Reservoir will be located; Lamborn Run will remain unsuitable until such time as it is removed from the Delaware River Basin's Comprehensive Plan as a potential reservoir location); the East Branch from the point at which it enters New Garden Township at the Franklin Township line, approximately 10,500 feet, to the point at which it exits New Garden Township at the London Britain Township line; Egypt Run and its unnamed tributary; the East Branch within the Borough of Avondale, 500 feet north of the Borough of Avondale wastewater treatment facility and south of the Borough of Avondale wastewater treatment facility to the London Grove Township line; the Middle Branch within London Grove Township, 500 feet north and south of the Borough of West Grove wastewater treatment facility; and the properties on which are located the surface water intakes, water treatment and wastewater treatment facilities of the City of Newark and United Water Delaware and the Borough of West Grove and Avondale; Churchman's Marsh is deemed not suitable until such time as it is removed from the Delaware River Basin Commission's Comprehensive Plan as a potential reservoir location.

The Management Planning Committee concluded that the inclusion of riparian corridors in the designated area is wise, as most of the issues raised in the White Clay Creek watershed involve the protection and restoration of those corridors for the benefit of wildlife and the enhancement of water quality. The White Clay Creek Wild and Scenic Rivers System Act (P.L. 106-357) defined the lateral boundaries as 250 feet from the ordinary high-water mark on both sides of all segments designated by the act.

White Clay Creek Watershed Management Committee

A key principle of the administrative framework described here is that existing institutions and authorities will play the primary roles in the long-term protection of the White Clay Creek watershed. Municipalities, counties, states and federal agencies, together with private organizations and landowners, will participate in maintaining the high quality of the White Clay Creek watershed. To bind these diverse interests together in common purpose, a permanent committee representing all of them should be convened. This proposed White Clay Creek Watershed Management Committee will utilize and carry forward the work of the White Clay Creek Wild and Scenic River Study Task Force.

Host Organization for the White Clay Creek Watershed Management Committee

The White Clay Creek Watershed Management Committee will be supported by a National Park Service employee (or employees) serving as coordinator and as liaison among the Committee and the state and local agencies and organizations that participate in its activities. The Committee will not be located within the structure of a permanent "host" organization. A procedure for special meetings that may not be on the annual schedule will also be established.

The NPS employee acting as staff to the White Clay Creek Watershed Management Committee will provide a contact between the Committee and the public and act as a clearinghouse for distributing information. He or she will answer questions and relay issues to the Committee. Other entities might provide limited, meeting-related clerical staff assistance to the Committee.

Purpose

The White Clay Creek Watershed Management Committee is directed to promote the long-term protection of the White Clay Creek watershed in Pennsylvania and Delaware and to support, coordinate and facilitate the implementation of the White Clay Creek and Its Tributaries Watershed Management Plan dated May 1998 (as amended). To do this, it will:

- 1) bring together the major watershed interests on an annual basis;
- 2) stimulate cooperation among the major interests;
- 3) provide a forum for discussing and resolving issues; and
- 4) promote and facilitate the implementation of this watershed management plan.

Function

The White Clay Creek Watershed Management Committee will be advisory in nature; it will have no regulatory or land-acquisition authority. The committee may provide advice to agencies and institutions with management or regulatory authority, but it will not have the power to necessitate or enjoin the actions or decisions of any of those entities.

Responsibilities

The White Clay Creek Watershed Management Committee will assume the following responsibilities:

Promote Implementation of the White Clay Creek Watershed Management Plan. The committee will assist appropriate agencies, organizations and the public in understanding the purpose, intent and implications of the Plan within the context of the National Wild and Scenic Rivers designation, and in understanding the actions and activities needed to implement the Plan. The Committee will promote the Plan and efforts within the watershed that are consistent with the Plan and will foster the implementation of this Plan. The Committee will serve to assist with coordination and communication among the entities responsible for implementing the Plan.

Address Watershed-Related Issues. The Committee will establish a public forum for issue discussions, it will help raise awareness of important issues, and it will stimulate action by appropriate authorities.

Monitor the Watershed. The Committee will monitor watershed activities and proposals that might affect the watershed's overall quality or pose potential impacts to important resources and will comment to appropriate authorities. Such Committee review could be initiated by a request from the public; by a local, county, state or federal official; or at the Committee's own discretion. Proposals and projects that might be reviewed

include, but are not limited to: zoning changes; development projects adjacent to White Clay Creek or its tributaries; applications for state permits such as point source discharges or water withdrawals; changes to state programs or policies; applications for federal permits such as Army Corps Section 404 permits; and other federal projects such as pipeline or road crossings or electrical transmission lines, etc.

Promote Watershed Enhancement Initiatives. The Committee may support, upon the consensus of its membership, watershed enhancement projects initiated by its members or by other organizations. When necessary and appropriate, the Committee will coordinate its members' volunteer participation in enhancement efforts. The Committee may initiate its own cooperative enhancement projects.

Carry Out Education and Outreach. The Committee will support the efforts of other agencies and entities in conducting watershed stewardship education and outreach. The Committee may initiate its own educational or outreach programs as resources permit.

Update the White Clay Creek Watershed Management Plan. The Committee will be responsible for reviewing and recommending changes to the management plan. The Plan will be reviewed by the Committee every five years. Recommended changes to the Plan will be submitted to the National Park Service upon approval of the Committee (see *Decision-making* under Procedures).

Make Status Reports. The committee will prepare a brief twice-annual report on the status of the implementation of the Plan and other aspects of the overall protection of the designated areas of the watershed designated into the National Wild and Scenic Rivers System.

Membership

The White Clay Creek Watershed Management Committee will seek members from the Commonwealth of Pennsylvania and the State of Delaware. The Committee will strive to maintain membership that is representative of, but not limited to, state, county and local governments, citizens, citizen groups, non-profit organizations and private interests. The Committee will also seek membership representing technical expertise in the fields of cultural and/or historical resources, archaeology, geology, agriculture, water resources, wildlife biology, fishery biology, watershed management or recreation management.

Watershed organizations will be encouraged to appoint a representative to the membership of the White Clay Creek Watershed Management Committee. Municipal governments will be represented by an individual appointed by township boards of supervisors and/or borough or city councils. County members may be appointed by New Castle and Chester Counties' elected officials. Unaffiliated interested citizens may also become members.

Current Members. A current list of the members of this Committee will be maintained. The member list will be updated on a regular basis by the National Park Service staff liaison. The current members list will be used for distribution of notices and information regarding meetings and issues.

Procedures

The following procedures are established for the operations of the Committee:

Meetings. The Committee will meet twice annually, convening the membership for updates on activities and/or plans that will affect the watershed. All meetings will be open to the public. These meetings will be publicized in advance to encourage all interested entities/individuals to attend. Special meetings, in addition to the two annual meetings, to discuss specific issues may be convened at the request of the Co-Chairs of the Committee. All meetings will be conducted using Roberts Rules of Order. The Committee may meet more frequently initially.

Officers. The Committee will elect two Co-Chairs, one from the Commonwealth of Pennsylvania and one from the State of Delaware, from among its members. The term of each Co-Chair shall be three years. The

National Park Service will act as recording secretary for the Committee.

Decision-making. The preferred method of decision-making and actions is through consensus. When consensus cannot be reached, the Co-Chairs of the Committee shall prepare a report reflecting the diverse views of the Committee members. The report from the Co-Chairs shall become part of the minutes. Minority opinions may also be attached to the minutes.

Rules and Procedures. The Committee will review the Rules and Procedures periodically and amend or enact new rules and procedures as needed (see *Amendment of These Rules and Procedures* below).

Staffing. The Committee will rely on a combination of in-kind services (as available) provided by the states, the counties and the municipalities and funded staff support from the National Park Service for fulfilling its responsibilities as detailed in the Plan and the Committee's general operations.

Funding. The Committee will not receive nor will it solicit funding for its operations or other special projects. Rather, when funding arrangements are required to carry out projects related to the implementation of the Plan, the Committee will identify potential funding sources and assist in coordinating access of those funds through a membership entity or the National Park Service. Staffing for the general operations of the Committee will rely on in-kind services and support from the National Park Service (see *Staffing* above).

National Park Service Role. The National Park Service (NPS) will serve as the key federal representative in the implementation of the Plan and the federal Wild and Scenic Rivers designation. The agency's principal role will be to represent the Secretary of the Interior in reviewing federal projects as required by Section 7(a) of the Wild and Scenic Rivers Act and to serve as a coordinator and liaison among the members and participants of the Committee.

State, County and Local Governments' Role. State, county and local governments and other interested organizations may contribute staff time and other types of assistance to the Committee if they choose; however, no such involvement will be required of any state, county or local government or any other organization.

Amendment of These Rules and Procedures. The Rules and Procedures can be revised at any time by majority vote of the membership. Prior to a vote for adoption of any amendments, the final proposed amendments must be publicly announced and read to the membership at a regular meeting of the Committee and will be announced in advance of that meeting. The final vote to adopt changes will be made at the next regular meeting and will be announced in advance of that meeting.

IV. LOCAL LAND-USE MANAGEMENT PROGRAM

Introduction

The local land-use element is the heart of this watershed management plan. This section articulates and explains a series of resource-protection objectives, designed to improve water quality and fish and wildlife habitat. For each objective, the plan suggests a series of actions municipalities can take to enhance resource protection within their community. Municipalities can review and revise their land-use ordinances so that the following objectives may be achieved. Local governments should adopt into their ordinances and plans those areas of the guidelines that they do not currently address in their ordinances. The guidelines present alternatives for meeting each objective. It is up to each municipality to decide which alternative (or alternatives) best fits its particular situation.



A major goal of the overall watershed program is to guard against the indiscriminate urban-sprawl types of development patterns within the watershed which serve to destroy or otherwise impact the very values which make the White Clay Creek watershed an attractive place to live and work. The key to success in this effort is coordination among local communities and other watershed citizens, which can best be realized through active participation in and support of the White Clay Creek Watershed Management Committee.

Resource Protection Guidelines

The resource-protection objectives are designed to ensure the quality and quantity of the water resources, as well as to protect cultural, historical and recreational resources. As individual properties, situations and organizations vary, the numbers and percentages cited below are not absolute. Each government will determine its own objective-satisfying performance standards.

Objective A:

***Protect and improve base flows and stream habitat through recharge.
Protect Cockeysville Marble recharge areas from contamination.***

Base flows affect the availability of drinking water and the diversity of stream species. Local governments can limit new impervious surfaces, particularly in areas of Cockeysville Marble; encourage wetland preservation; encourage the maintenance and upgrading of stormwater management structures; and support low-impact development techniques that preserve natural features.

1. Establish stormwater infiltration performance standards to minimize increases in stormwater runoff volume due to development. Discourage design standards requiring excessive impervious surfaces in development. Encourage the preservation of existing wetlands, and where appropriate, the creation of artificial wetlands and the use of infiltration trenches and swales.
2. Limit impervious surfaces to 10% in residential areas and 20% in commercial/industrial areas where recharge areas of the Cockeysville Marble formation occur. Greater impervious surface may be

acceptable only where soil permeability is already low, or where infiltration techniques allowing groundwater discharge are used.

3. Outside the Cockeysville Marble area, limit impervious surfaces to less than 10% in rural areas, less than 35% in suburban areas, and less than 50% in commercial/industrial and high-density areas. In all cases, the use of retention and recharge techniques should be encouraged if not required.
4. Encourage the maintenance of stormwater management structures and the retrofitting of extant structures that are inadequately designed; investigate the development of a stormwater management public utility as a means of doing this.
5. Encourage and support the use of low-impact development techniques, including cluster development approaches, to facilitate on-site recharge through the use of existing natural-resource features.

Objective B:

Protect and improve water quality and stream habitat through floodplain and wetland protection.

Excessive nutrients (including nitrogen and phosphorus) and excessive sediments (soil particles) are pollutants particularly detrimental to streams and rivers and to the plants, animals and fish that depend on them for survival. High levels of nutrients in a stream cause increased algal growth and a subsequent reduction in dissolved oxygen. Many kinds of fish that normally thrive in streams cannot tolerate low oxygen levels.

A large volume of sediment damages a stream system by suffocating fish and aquatic insects and by filling crevices between rocks where fish and invertebrates live and hide. Suspended sediment clouds otherwise clear stream water, occluding sunlight and limiting the growth of aquatic plants.

Wetlands and floodplains filter the water flowing in streams and the groundwater entering them. Sediments are filtered and nutrients are absorbed and transformed, providing substantial benefits to downstream users. This filtering improves the quality of downstream drinking-water supplies, enhances the fishery by reducing pollutants and suspended sediments, and improves the scenic qualities of a stream. Wetlands and floodplains also are vital to the ecosystem, providing food for many species and homes or nesting grounds for countless migratory and native species. Wetlands and floodplains also play a vital role in flood reduction.

1. Establish flood hazard districts according to FEMA requirements that prohibit land uses in the floodplain which cause flooding and potential contamination of streamside properties. No new development should be permitted within the 100-year floodplain of White Clay Creek or its tributaries. Land uses which increase computed flood elevations and/or impair the ecological functioning of the floodplain should be prohibited, as should those that cause flooding and/or pollution.
2. Protect jurisdictional wetlands by requiring delineation on all development plans. Establish policies to minimize direct impacts and to establish a minimum buffer of 25 feet or more between the wetland and development activities. Using existing wetlands for stormwater management should be discouraged except where they are highly degraded and when a mitigation program is included.
3. Protect jurisdictional wetlands by encouraging cooperation to use best management practices (BMPs) in and near wetlands.

Objective C:

Protect and improve water quality and stream habitat through riparian forest buffers.

The single most important natural system critical to maintaining the integrity of the White Clay Creek watershed is the riparian forest buffer (RFB). Riparian forest buffers are extremely important to the maintenance of stream health. RFBs are complex ecosystems that can help to provide optimum food and

habitat for stream communities as well as mitigate or control nonpoint source pollution. Naturally vegetated stream corridors provide food, nesting areas and migration routes for wildlife. According to the USDA Soil Conservation Service (Technical Release #55), forest buffers can reduce the quantity of stormwater runoff by 30% over non-wooded areas.

Forested and vegetative buffers remove nutrients from runoff while trapping sediment. They have been called "living filters." A well-maintained forest buffer on each side of the stream can remove the majority of phosphorus, nitrogen and sediment from surface and subsurface runoff.

Riparian forest buffers provide the food sources necessary for a healthy aquatic community, and the shade essential for keeping streams cool. Leaf litter, snags and tree roots in RFBs provide the habitat necessary for a thriving ecosystem. RFBs filter pollutants from overland runoff, reducing sediment and phosphorus loads. RFBs can also lower levels of nitrate in groundwater before it enters streams, reducing algal growth in reservoirs and improving the quality of downstream drinking-water supplies.

1. Establish land-use management policies that preserve existing RFBs. Identify where RFBs occur and develop land-use management standards to preserve these buffers. Standards should include the establishment and maintenance of an RFB tied to review of a site's existing and proposed development along with its natural features, including soil characteristics and capability, slope, runoff patterns and the presence of wetlands and floodplains. A minimum RFB of 100 feet as measured from the top of all streambanks should be maintained.

The depth of the riparian forest buffers on public lands may need to be increased in order to protect fragile riverbanks from the impacts of public use, to maintain biodiversity, to protect aesthetics in park and preserve areas and to enhance protection to songbirds (especially neo-tropical migratory species), cavity dwellers, large mammals and threatened and endangered species.

2. Establish, identify and develop land-use management policies to create new RFBs.

Objective D:

Protect and improve water quality and stream habitat through sediment and stormwater management.

Excessive and uncontrolled or untreated runoff can wreak havoc on water levels - it can cause flooding, which threatens human life, erodes land and damages property. When water levels are low, aquatic life is threatened and pollutants are concentrated, intensifying water-quality problems. Further, runoff carries such pollutants as nutrients from lawn and agricultural fertilizers, pesticides, road salts, oil products, fecal wastes and toxic chemicals. In addition, heavy loads of sediment, swept into the stream by runoff, greatly impact the viability of stream ecosystems, destroying fish and wildlife habitat and otherwise degrading downstream water supplies.

This objective recommends a stormwater management plan for the White Clay Creek watershed, as envisioned in Pennsylvania's Act 167, prepared by the White Clay Creek Watershed Management Committee in concert with all the watershed municipalities, Pennsylvania's DEP, and Delaware DNREC. The general goals of the plan should include:

1. preservation of water quality in the watershed's streams, wetlands and groundwater resources;
2. maintenance and improvement of water flows in all streams and watercourses;
3. protection and sustenance of natural stream channels, and maintenance of flood-carrying capacity of streams;
4. limiting modification to the natural terrain and alteration to existing stream channels and other drainageways;
5. maximizing recharge of groundwater and encouragement of infiltration to sustain groundwater supplies and stream flow;

6. control of runoff, erosion and sedimentation through measures that are on site or situated as close as possible to where stormwater is produced;
7. promotion of innovative stormwater management techniques which focus on groundwater recharge and stormwater quality;
8. protection of persons and property from serious harm and significant damage from flooding caused by excessive runoff;
9. ensuring that each residential, commercial, industrial or public development home and yard is constructed with adequate drainage;
10. designing and constructing public drainage facilities and water courses so as to require minimum maintenance;
11. minimizing soil erosion and sedimentation; promotion of delayed runoff by requiring the use of on-site retention; and
12. promotion of groundwater recharge techniques where feasible.

Widespread use of Best Management Practices (BMPs) will substantially reduce sediments and contaminated runoff from construction sites, on-site domestic sewage systems, and other land-modifying activities. Communication and application of BMPs should be accomplished cooperatively, with the White Clay Creek Watershed Management Committee working with volunteer organizations, private landowners, conservation districts, municipalities and the cooperative extension services.

In addition, municipalities within the watershed should consider the following provisions for adoption:

1. Require stormwater management and soil-erosion and sedimentation control plans for all development activities.
2. Require that the flow of water on a parcel of property not be harmful to streamside vegetation, creeks and streams, lakes and ponds, aquatic life and adjacent properties.
3. Prohibit discharge of roof drains, foundation drains, sump pumps into a street, roadway or other impervious surfaces.
4. Prohibit post-development runoff that exceeds the natural volume and velocity experienced prior to construction.
5. Prohibit the disturbance during development of such natural drainage areas as wetlands, marshes and swales.
6. Require that surface runoff control measures be designed to protect surface stream water quality, and restrict volume and peak-rate stormwater runoff during and after development to levels similar to or less than those prior to development. The cumulative impacts of similar developments should be considered in reviewing proposals.
7. Permit grading and vegetation removal only from actual building areas; require the replacement of such vegetation after construction is complete.
8. Adopt a runoff-reduction hierarchy that operates under the following priority sequence:
 - a. minimize impervious surfaces to reduce runoff volume and decrease stormwater pollution loads;
 - b. preserve natural drainage swales, overland flow paths and depressional storage areas;
 - c. convey runoff via vegetated filter swales in new development or where natural swales do not occur;
 - d. infiltrate runoff on-site where soil permeability favors this.

Objective E:

Protect and improve water quality and stream habitat through slope protection.

Disturbance of steep slopes creates and escalates erosion and sedimentation of streams. Strict performance standards limiting the nature, extent, type and timing of earth disturbances on slopes are needed to protect against erosion and sedimentation and the resulting loss in water-quality values. Local governments can restrict development on steep slopes, regulate development on precautionary slopes,

establish standards for grading and stabilization, require sediment and erosion control plans for slope development, encourage steep-slope BMPs in farming and forestry and enact tree ordinances.

1. Establish steep-slope districts severely restricting development of 20 percent or greater slopes. Permit only minimally disturbing activities thereon. Permit activities with potential to cause erosion, such as disturbance for access, only after detailed engineering review and with careful construction monitoring.
2. Establish precautionary-slope districts restricting extent of development on slopes of 15 to 20 percent. Permit development activities thereon only after detailed engineering review and with thorough construction monitoring.
3. Establish performance standards to limit the extent of disturbance and impervious surfaces permitted on precautionary slopes. Include standards for grading and stabilization.
4. Require sediment-and erosion-control plans for all development activities on all slope districts and within 500 feet of any creek, stream or run. Monitor construction activities to ensure compliance with plans.
5. Encourage use of steep-slope BMPs in farming and forestry activities.
6. Encourage the enactment of a tree ordinance.

Objective F:

Sustain biodiversity through habitat linkage and management.

Development is shrinking and isolating the watershed's stands of mature forest, which represent some of the last vestiges of native habitat in the watershed. Communities can plan such open-space links between forest segments as greenways, riparian forest buffers and other protected lands. They can monitor critical habitat areas and the wildlife in them, and establish programs to protect threatened species.

1. Establish planning and monitoring programs for critical habitat areas.
2. Establish programs to protect existing habitat and wildlife communities.
3. Establish programs to preserve threatened and endangered species and critical habitats.
4. Establish and expand programs to link critical habitats through riparian buffers, protected lands and greenways.

Objective G:

Encourage dedication, purchase and stewardship of open space.

Maintaining open spaces for agriculture, forest and recreational purposes helps to support natural ecosystems and enhances the quality of life for residents of the White Clay Creek watershed. Some important functions of open space include protection of water quality, protection of water supplies by recharging aquifers, control of erosion and sedimentation, maintenance of fish and wildlife populations and provision of areas for active recreation.

Programs to dedicate open space by agreement, easement or purchase help to achieve this objective. Ongoing programs should continue and expand, focusing on such stream resources as floodplains, riparian areas and wetlands, in addition to areas with steep slopes or significant ecological features.

1. Work in concert with government agencies, property owners and watershed associations to create an open-space management program that encourages public and/or conservancy ownership of open-space parcels where appropriate.
2. Promote and support the use of restrictions, conservation easements, purchase of development rights, and similar innovative voluntary techniques for protection of open space on private land.

3. Encourage open-space programs for wetlands, floodplains, riparian areas, mature forest stands and steep slopes where appropriate, and link open spaces via riparian stream buffers and greenways.
4. Encourage and facilitate stewardship of private lands.

Objective H:

Protect historic, cultural and archaeological resources in the White Clay Creek watershed.

Part of the essential nature of White Clay Creek is the remnant of earlier inhabitants, another is the culture and tradition of people now living nearby. An essential component of any Wild and Scenic River plan is the maintenance of the record of past and present, especially for those resources that are directly related to the stream itself.

1. Develop a historic, cultural and archaeological inventory.
2. Develop a program to monitor the use of historic structures.
3. Promote adaptive reuse of structures through local ordinances.
4. Preserve sensitive archaeological sites by working in concert with state and county archaeological preservation programs and local historical commissions.
5. Include historical commissions in the development process.
6. Promote and support the use of deed restrictions, conservation easements, purchase of developments rights and similar voluntary techniques for protection of historic, cultural and archeological resources on private land.

V. RESOURCE MANAGEMENT

Introduction

This section of the plan describes the challenges of the watershed's major resource groups, delineates the responsibilities of each government agency and other entities involved in their management, sets goals and recommends actions that would enhance the conservation and quality of each resource.

Water Resources

Management Challenge

The White Clay Creek watershed usually receives abundant rainfall. Nevertheless, due to accelerated real-estate development in recent decades, demand has outpaced supply, creating a shortage of water, especially during periods of drought. A sustainable, consistently high-quality water supply is critically important.

Roles and Responsibilities

The Pennsylvania Department of Environmental Protection (PADEP), the Delaware Department of Natural Resources and Environmental Control (DNREC), the Delaware River Basin Commission (DRBC), the Environmental Protection Agency (EPA) and the Army Corps of Engineers (ACOE) are the primary governmental units responsible for the management of water resources within the White Clay Creek watershed.

Goals and Key Actions

The following sections set forth goals and suggest key actions the White Clay Creek Watershed Management Committee, in conjunction with the primary agencies responsible for water resource management, might take to achieve the goals.

Drinking Water Supply - Goals

- Conserve and maintain the quantity and quality of White Clay Creek's stream flow.
- Protect the Cockeysville Marble formation.
- Ensure a sustainable water supply that can accommodate future demand.
- Provide reliable water flows in New Castle County; resolve questions relative to the Thompson Station reservoir project.
- Ensure minimum instream flow standards along White Clay Creek.

Drinking Water Supply - Key Actions

- Monitor the Hockessin, Delaware, wells of the Artesian Water Company to ensure that production does not contaminate or reduce the recharge rates of the Cockeysville Marble formation aquifer.
- Encourage groundwater recharge to increase base flow in the streams for existing water supply purposes.

- Establish limits for withdrawals from all Cockeysville Marble formation aquifer recharge areas.
- Determine the need for a future surface-water allocation for White Clay Creek for Pennsylvania communities.

Aquatic Life - Goals

- Protect a fully functional and diverse ecosystem supported by White Clay Creek.

Aquatic Life - Key Actions

- Base state and federal regulations implementing the Federal Clean Water Act (1987) upon water-quality criteria that ensure the survival and propagation of both sport fish and aquatic invertebrates.

Education and Research - Goals

- Achieve a better understanding of the impact on biodiversity of various watershed uses.
- Protect the qualities that make the White Clay Creek watershed a "living laboratory" for education and research.
- Ensure access to watershed streams for education and research.

Education and Research - Key Actions

- Conduct new research on the effects of new and traditional uses on watershed biodiversity.
- Protect valuable research areas from the introduction of exotic species, particularly the 1,800-acre Experimental Watershed managed by the Stroud Water Research Center located on the East Fork of the East Branch of White Clay Creek.
- Promote the continuation of, and seek increased funding for, educational programs and volunteer monitoring.

Water Quality - Goals

- Achieve consistency between the water-quality goals set by Delaware and Pennsylvania.

Water Quality - Key Actions

- Base water-quality goals for each state on a technical evaluation of the watershed as a whole.

Existing Water Quality - Goals

- Correct inadequacies in existing data about dissolved oxygen, toxins and temperature.
- Reduce risk of gastroenteritis to people who swim in untreated water from the Delaware portion of White Clay Creek.
- Reduce levels of nutrients (nitrate and phosphorus) in the creek.
- Reduce turbidity in the creek.
- Assess and control the impact on aquatic life of zinc, PCBs and DDT.
- Address cumulative impacts of excessive runoff and earth disturbance.

Existing Water Quality - Key Actions

- Conduct field studies of photosynthesis/respiration to determine whether dissolved oxygen levels are

sufficient to support fish, aquatic life and wildlife.

- Develop strategies to reduce the levels of Enterococcus bacteria in the Delaware section of White Clay Creek (potential sources include agricultural nonpoint sources, urban runoff, wildlife, malfunctioning septic systems and publicly owned treatment systems).
- Develop strategies, in conjunction with the Natural Resource Conservation Service (NRCS), to control sources of nitrate nitrogen and soluble ortho-phosphorus concentrations in White Clay Creek, especially agricultural non-point sources, wastewater treatment plants (especially in drought conditions), lawn fertilizers and atmospheric deposition (primarily for nitrogen).
- Develop strategies, in conjunction with NRCS and municipalities, to reduce soil erosion into the streams, which comes from construction disturbance, urban runoff, agricultural nonpoint sources and streambank erosion.
- Conduct tissue analysis on fish and invertebrates to discover whether the presence of zinc, PCBs and DDT represents a health risk to people and animals who consume the fish.
- Confirm sources of the chemical pollutants zinc (possibly the former NVF plant in Newark), chlorinated pesticides (agriculture, including mushroom culture) and PCBs (unknown).
- Increase the stringency of chemical application and licensing procedures to protect water quality.

Land-Use Effects - Goals

- Mitigate the contaminating effects of runoff on the White Clay Creek.

Land-Use Effects - Key Actions

- Work with communities and NRCS to develop innovative strategies for stormwater management, groundwater infiltration, control runoff and elevation of stream temperatures.
- In conjunction with NRCS, establish wooded stream buffers to moderate temperatures, control floodwaters, stabilize streambanks, purify water, filter out sediments and contaminants and recharge groundwater.
- Improve controls on point and non-point source pollution.
- Encourage the use of site-specific BMPs for on-site sewage treatment and the evaluation of the cumulative impact of such developments.
- Improve the management of landfills to reduce adverse impact on groundwater quality by monitoring surface runoff and leachate.

Water Balance - Goals

- Maintain quality groundwater during dry seasons and reduce flooding.
- Ensure adequate recharge of the aquifers.
- Maintain water balance as close as possible to natural conditions.

Water Balance - Key Actions

- Minimize new impervious coverage and vegetation loss to encourage adequate infiltration.
- Develop innovative strategies for increasing infiltration rates within the watershed.

Inputs and Withdrawals - Goals

- Minimize adverse impacts of wastewater treatment, including on-site domestic systems, on water quality in the White Clay Creek watershed.
- Ensure adequate water quantity for intensive agricultural activities.

Inputs and Withdrawals - Key Actions

- Monitor the creek's capacity to assimilate discharges from sewage treatment plants and industrial wastewater.

Droughts, Floods and Flow Maintenance - Goals

- Maintain adequate stream flows during warm, dry weather for water withdrawal, habitat maintenance and aquatic fisheries.
- Reduce high peak flows and flooding.

Droughts, Floods and Flow Maintenance - Key Actions

- Design and carry out open space, groundwater and wetland conservation programs to maintain base flows adequate for aquatic habitat, fisheries and water-supply purposes.
- Work with municipalities and landowners to enhance infiltration rates within the watershed.
- Require and enforce stormwater management regulations that enhance groundwater recharge.
- Promote artificial maintenance of creek base flows, especially during drought conditions, from any future (proposed) reservoir project.

Fish and Wildlife

Management Challenge

Because of its physiographic and geologic features, the White Clay Creek watershed contains an abundance of diverse and high quality habitat types that support a wide variety of species. Other watersheds in the region once resembled the White Clay Creek watershed, but these have been irreversibly altered. Fish and wildlife are being threatened by development activity in the watershed.

Roles and Responsibilities

Most of the primary responsibility for managing fish and wildlife belongs to the states. Within the White Clay Creek watershed, the states administer a trout-stocking program, provide direct management of wildlife in the White Clay Creek Preserve and administer programs that enhance wildlife habitat. The states also inventory and monitor fish and wildlife through their Natural Heritage Inventory programs.

The federal government does not directly manage any fish or wildlife resources within the watershed, but it does provide inventory and monitoring services, and it administers habitat enhancement programs that may be appropriate for the watershed.

Private landowners, local governments and private organizations will play an increasingly important role in the management of the watershed's wildlife resources. As these entities acquire and improve more extensive wildlife habitat areas, they will become important managers of wildlife. In addition, they provide a volunteer workforce for the inventory and monitoring of fish and wildlife.

Goals and Key Actions

Goals

- Protect fragile wildlife habitats including floodplains, wetlands and riparian vegetation.
- Increase fish and wildlife diversity within the watershed.
- Establish interconnected greenways and wildlife migrant corridors within the watershed.
- Expand the White Clay Creek Preserve.
- Preserve and protect mature forests within the watershed.

Key Actions

- Establish guidelines for proper maintenance of fish and wildlife habitat, eliminate inconsistencies and recommend consistent policies at the local, county and state levels.
- Provide technical assistance to municipalities, landowners and private organizations seeking to protect and conserve floodplains, wetlands, mature forests, meadows, riparian vegetation zones, hedgerows and other fish and wildlife habitats.
- Develop a process involving landowners, private organizations and municipal, county and state governments to foster the creation of an interconnected system of greenways and wildlife corridors within the watershed.
- Promote the acceptance of conservation easements by municipalities and private land trusts and conservancies in Pennsylvania.
- Work with the U.S. Fish and Wildlife Service and state Natural Heritage Inventory programs to update the rare, threatened and endangered species list for the White Clay Creek watershed.
- Work with the U.S. Fish and Wildlife Service and state Natural Heritage Inventory programs to develop habitat profiles for rare, threatened and endangered species.
- Develop habitat maps for the entire White Clay Creek watershed, locating potential habitats for rare, threatened and endangered species.
- Develop educational materials promoting the value of biodiversity and of rare, threatened and endangered species.
- Inform communities of the existence and the significance of rare, threatened and endangered species' habitats in their municipalities.
- Monitor development proposals within the watershed and foster advocacy for the protection of rare, threatened and endangered species' habitats during the approval process.
- Work with Natural Resource Conservation Service on its "566" Watershed Protection Plan for the Red Clay and White Clay creeks to identify restoration projects that will benefit rare, threatened and endangered species' habitats within the watershed.
- Work with the National Park Service to review Army Corps of Engineers water-resource permit applications for potential impacts to rare, threatened and endangered species' habitats.

Watershed Restoration

Management Challenge

The need for repair of eroding streambanks, enhancement of water quality and restoration of fish and wildlife habitat throughout the watershed has been well documented. The Natural Resources Conservation Service (NRCS) of the U.S. Department of Agriculture has prepared a Watershed Protection Plan and Environmental Assessment for Red and White Clay creeks. While not as severely as Red Clay Creek, the White Clay watershed is also experiencing non-point pollution and habitat loss. The NRCS Plan cites erosion, runoff, sedimentation, inadequate riparian vegetation and loss of wetlands as the major factors contributing to the phenomenon.

Examples of activities that may be necessary and appropriate (when applied judiciously) include, but are not limited to, the following:

- streambank stabilization
- in-stream and streambank fish habitat improvement structures
- installation and recruitment of large woody debris

- fish stocking
- implementation and maintenance of erosion and sedimentation control measures
- removal of "tree dams" and other obstructions
- placement of spawning gravel
- revegetation / reforestation
- wetland restoration or construction of new wetlands
- fencing of livestock away from the water's edge
- construction of livestock watering areas
- redirection and/or treatment of runoff
- maintenance of old-growth areas
- purchase of conservation easements
- purchase and transfer of development rights

Roles and Responsibilities

Streambank stabilization, water-quality enhancement and restoration of fish and wildlife habitat should be approached on an integrated, comprehensive watershed-wide basis. As such, a voluntary partnership for White Clay Creek watershed restoration should be formed to inventory and prioritize problem sites, develop an overall watershed restoration plan, provide public education, seek funding for implementation and provide support to agencies, companies, private landowners and others in their efforts towards restoration and revitalization. The partnership should include representatives of as many watershed interests as possible.

Many watershed restoration activities, including streambank stabilization, installation of fisheries habitat structures and other restoration activities are considered water-resource projects. As such, they are subject to review by the National Park Service under authority of Section 7 of the Federal Wild and Scenic Rivers Act (see detailed discussion later in this chapter).

Goals and Key Actions

Goals

- Address streambank stabilization, water-quality enhancement and restoration of fish and wildlife habitat on an integrated, comprehensive watershed-wide basis.
- Design, construct and maintain habitat improvement structures to ensure the maintenance of the free-flowing character of the river and protection of the outstandingly remarkable values of the watershed.
- Provide restoration and habitat improvement projects which are necessary for protection, conservation, rehabilitation or enhancement of river area resources, including the protection of structures on public and private property.
- Provide restoration or habitat improvement projects at a location, scale, intensity and frequency dictated by the ecological characteristics of the landscape.
- Use materials for bank stabilization which maintain and enhance the natural and aesthetic qualities of the Wild and Scenic River area. The use of natural wood and live vegetation is the preferred method.
- Ensure that activities will not result in additional adverse impacts.
- Ensure that habitat improvement structures do not create unusually hazardous conditions, or substantially interfere with current and legal recreational use of the streams.

Key Actions

- Initiate discussions toward formation of a partnership for the White Water Creek watershed restoration.
- Seek funding for a detailed inventory of water quality and habitat concerns and the identification of problem sites.

- Conduct a broad-based public information and education program.
- Actively seek public input into resource issues and concerns centering on rehabilitation of water quality and habitat resources.
- Develop alternatives for watershed restoration and revitalization.
- Establish priorities for treatment.
- Seek funding for implementation of needed treatments.
- Support landowners, utilities, public agencies and non-profit organizations in their efforts toward restoration and revitalization of water quality and habitat resources within the White Clay Creek watershed.
- Review water resource project proposals under Section 7(a) of the Wild and Scenic Rivers Act to ensure they meet the goals of this section and other provisions of the White Clay Creek Watershed Management Plan.

Cultural Resources

Management Challenge

While many watershed areas remain relatively unchanged in modern decades, other portions are experiencing development and infrastructure improvements on a vast scale. There is an urgent need, therefore, to identify, document and protect those sites and structures that survive.

Roles and Responsibilities

Cultural resource inventories are maintained by the Chester County Parks Department and the New Castle County Planning Commission. The Pennsylvania and Delaware State Historic Preservation Offices (SHPO) and the New Castle County Planning Commission direct nominations to the National Register of Historic Places and review the impact of publicly funded projects on registered cultural resources. The Delaware State Parks Cultural Resources section continues to be a strong steward of cultural resources in White Clay Creek State Park and the White Clay Creek Preserve.

Goals and Key Actions

Resource Management - Goals

- Foster a general awareness of the value of cultural resources.
- Protect and preserve the existing form and integrity of watershed cultural resources.
- Ensure the review of publicly funded projects for negative impact on watershed cultural resources.

Key Actions

- Coordinate cultural resource inventory activities among private, municipal, county and state governments to develop and maintain a comprehensive resource list that includes all levels of significance.
- Encourage watershed-wide thematic nominations to the State and National Registers of Historic Places.
- Encourage municipalities to enact historic district legislation to promote awareness of and protection for locally significant cultural resources, particularly those in private ownership.
- Coordinate local zoning regulations with state and federal guidelines to ensure consistency of treatment.
- Provide buffer zones for significant cultural resources.

- Extend municipal/county permitting process to require demolition permits, thereby "flagging" threats to the survival of resources.
- Require that all publicly funded projects within the watershed include a cultural-resources impact review before construction begins.
- Record the recollections of living people that reflect tangible cultural resources and present-day regional culture.
- Promote public awareness of resources and unique watershed characteristics through such activities as self-guided tours, presentations, school programs and displays

Recreation Resources

Management Challenge

In general, open space acreage and opportunities for passive recreation within the watershed are adequate, according to the guidelines of the National Recreation and Park Association (NRPA). However, public opinion does not support the finding of adequacy, and there is a regional imbalance in the location of active and passive recreational lands in favor of the dense population centers. In addition, park and trail maintenance is inconsistent, and numerous conflicts have been identified between parkland uses and the preservation of natural qualities and resources.

Roles and Responsibilities

Some 10% of the watershed's total acreage is preserved as open space and parkland. In Delaware; the majority of these protected lands are managed by DNREC, New Castle County and the City of Newark. In Pennsylvania, the protected open space is managed by DCNR and a few townships. The 1,800-acre White Clay Creek Preserve is managed jointly by the states of Delaware and Pennsylvania.

Goals and Key Actions

Open Space and Recreation - Goals

- Protect "wild and primitive areas" within the watershed.
- Achieve compatibility among park uses.
- Link open lands throughout the watershed to increase open space and recreation opportunities and to protect riparian areas to improve water quality.
- Distribute visitation among parks.

Open Space and Recreation - Key Actions

- Implement an open-space land-acquisition, management and recreation plan that a) forges collaboration among Pennsylvania and Delaware counties and municipalities, b) addresses conflicts in use regulations, c) maps potential greenway linkages and d) balances active and passive recreational uses with conservation of natural areas and resources.
- Identify and map undeveloped ("wild and primitive") spaces.
- Identify and map existing protected lands (public and private) to locate "gaps" between links.
- Publish a comprehensive park/activity guide to direct visitors to the activity centers and uses accommodated in each watershed park.

Trails and Roads - Goals

- Provide an integrated system of trails that avoids sensitive natural and cultural resources and connects publicly owned lands in the watershed.
- Provide a system of non-motorized trails within the watershed that meets the needs of such user groups.
- Promote safety for recreational users of park roads.
- Encourage trail users to stay on trail routes

Trails and Roads - Key Actions

- Inventory all existing trails noting route, length, condition and appropriate uses.
- Assign appropriate uses to all trails.
- Realign old trails to avoid sensitive habitats.
- Mark trail routes with "blazes" or signage.
- Determine the number of new trails needed to accommodate all user groups, including horseback and mountain-bike riders, by assessing overall need, site compatibility and economic conditions.
- Work with DOT on "Share-the-Road" signs for cyclists.
- Publish a comprehensive trail/recreational-road guide for the watershed.

Hunting and Fishing - Goals

- Control the deer population in and around the watershed.
- Resolve conflicts in hunting regulations between Pennsylvania and Delaware.
- Increase watershed land area open to deer hunting.
- Improve stream quality to support trout population.
- Relieve fishing-season traffic and parking problems.

Hunting and Fishing - Key Actions

- Work with landowners to add acreage to watershed hunting areas.
- Coordinate state hunting seasons and permitted weaponry.
- Design and implement a signage program delineating hunting and fishing areas and warning recreationists of the presence of hunters.
- Aggressively enforce sediment-control requirements for new development.
- Coordinate state park and transportation officials to manage traffic during trout season.

Guidelines for Water Resource Projects, Including Public Utilities and Transportation and Recreational Facilities

Facilities providing transportation, energy resources, communications, water supply, waste disposal, education and recreation are critical public services provided to citizens living and working in or visiting the White Clay Creek watershed. However, if improperly located, designed, constructed or maintained, such facilities have the potential of destroying or severely damaging natural and cultural resource values and adversely affecting the quality of life within the watershed. The cumulative impact of multiple corridors and stream crossings can magnify these problems.

Section 7 Provisions

For these reasons, the United States Congress, in Section 7 of the Federal Wild and Scenic Rivers Act (P.L. 90-542, as amended), directed that within the boundaries of designated National Wild and Scenic Rivers, the proposed location, design and construction of water-resource projects, where any kind of federal assistance is provided, should be reviewed to determine if there is the potential of affecting the free-flowing character of wild, scenic or recreational rivers. The key terms are defined below:

Water Resources Project

Any dam, water conduit, reservoir, powerhouse, transmission line or other project works under the Federal Power Act (FPA), or other construction of developments which would affect the free-flowing characteristics of a wild and scenic or congressionally authorized study river. In addition to projects licensed by the Federal Energy Regulatory Commission (FERC), water-resource projects may also include dams; water diversion projects; fisheries habitat and watershed restoration or enhancement projects; bridges and other roadway construction; bank stabilization projects; channelization projects; levee construction; recreation facilities, such as boat ramps and fishing piers, and activities that require a permit from the Army Corps of Engineers (ACOE), pursuant to the Rivers and Harbors Act or Section 404 of the Clean Water Act.

Federal Assistance

Any assistance by an authorizing agency before, during or after construction. Such assistance may include, but is not limited to: a license, permit, preliminary permit, or other authorization granted by FERC; or a license, permit or other authorization granted by the Army Corps of Engineers. Assistance also includes federal funding of projects such as highways, roads and bridges; environmental and recreational facilities; and community development activities.

Free-flowing

Defined in the Wild and Scenic Rivers Act in Section 16(b) as "existing or flowing in natural condition without impoundment, diversion, straightening, rip-rapping, or other modification of the waterway."

Procedures

The vast majority of these activities are subject also to review and approval by other federal, state and local agencies. No new permits are required under Section 7. However, the section does require that the federal agency assisting with the project consult with the National Park Service before a project is actually begun. Project proponents are encouraged to consult very early in the siting and project-design process to avoid delays and costs associated with projects that cannot be approved under Section 7.

Section 7 states, in part, that no department or agency of the United States shall assist by loan, grant, license or otherwise in the construction of any water-resource project that either:

- would have a direct and adverse impact on the values for which the river was established (for projects located on a designated river); in the case of White Clay Creek and its tributaries, this includes hydrogeology, water quality and quantity, certain botanical, fish and wildlife resources, and historic and cultural values; or
- invade the area or unreasonably diminish the scenic, recreational, fish and wildlife values present in the area at the time of designation (for projects above or below designated rivers or on a non-designated tributary).

It is the intent of this section to provide the National Park Service, the White Clay Creek Watershed Management Committee, landowners and public service providers with better guidance on how to plan, review and provide such needed facilities in the future. The National Park Service should conduct its Section 7 reviews in consultation with affected federal, state and local agencies, as well as the White Clay Creek Watershed Management Committee, and other appropriate citizens and organizations. Such review also will be conducted following the assessment procedures outlined in "Appendix C: Evaluation Procedure Under 'Direct and Adverse'" of the Wild and Scenic Rivers Reference Guide and the guidance which follows.

Review Criteria

Transportation, recreation and utility corridors and facilities, and other water resource projects, should be designed to protect the free-flowing character and outstandingly remarkable values of the White Clay Creek watershed through application of the following:

I. Assessment of:

- A. Impacts on the outstandingly remarkable values of the White Clay Creek watershed for which the area was designated as a component of the National Wild and Scenic Rivers System.
- B. Effect on related environmental factors and ecological systems involved, including adjacent lands, waters, aesthetics, fisheries, recreational, floodplain, wildlife, vegetation and historic and archeological values.
- C. Cumulative impacts.
- D. Alternatives available to the applicant.
- E. Secondary effects likely to be caused or encouraged by the project.
- F. Economic factors, including the need for resource protection measures in the approximate area in the future.
- G. Other relevant factors.

II. In addition to the general assessments described above, the following specific items need to be considered:

A. For all projects:

1. The facility should be located to take advantage of existing topography and vegetation.
2. The facility should be located, constructed and maintained so that it does not lead to accelerated bank erosion or degradation of streams and related resources.
3. Removal of trees, shrubs and other vegetation should be kept to a minimum for the protection of water quality, fish and wildlife habitat, visual quality and related values.
4. Only minimal filling of wetlands and floodplains should occur.
5. Construction should incorporate the use of materials that blend with the natural setting.
6. During construction, strict erosion-control measures should be taken to prevent sediment from reaching the river. Only minimal clearing of existing vegetation, clearing, grubbing and grading should be performed.
7. The construction area should be restored to as natural a condition as possible immediately following construction.
8. Following construction, special measures may be needed to restore the natural appearance of the area, stabilize riverbanks, discourage damaging off-road vehicle or other recreational use or enhance fish and wildlife habitat.
9. Materials used for bank stabilization following construction should maintain and enhance the natural and aesthetic qualities of the Wild and Scenic River area.
10. Biodegradable materials such as burlap, jute netting or blankets made from coconut fiber should be used to hold vegetative plantings in conjunction with slope stabilization and other erosion and sedimentation control measures.
11. Specifications regarding stabilization efforts and revegetation should be consistent with the goals of maintaining stream width as near as possible to the original width and to provide early revegetation of the area.
12. If revegetation is required within the riparian forest buffer, native plant materials commonly found in that area should be used.
13. The time and method of planting native vegetation should occur in a manner that ensures maximum survival and growth of plant species.
14. Work should be performed at the time of year when the stream is experiencing low flow conditions to minimize impacts to fish and macroinvertebrate populations.

B. For corridors and rights-of-way:

1. Planning for new rights-of-way should identify existing nearby rights-of-way which the proposed facility might share or be located adjacent to.
2. Establishment of new corridors should anticipate future needs in that area and attempt to accommodate those needs so that additional future intrusions into designated areas will be

minimized.

3. The narrowest width right-of-way necessary to facilitate construction and maintenance of the facility should be used.
4. The low points of approach on the corridor should be far enough landward of the water's edge to direct runoff to a vegetated area away from any stream.
5. Upon reaching the riparian forest buffer during clearing operations for overhead transmission or communication lines, tall-growing tree species may selectively be removed. Shrubs, low-growing tree species with a mature height of less than 20 feet and other vegetation should be left as natural as possible.
6. Management of trees, shrubs and other vegetation for maintenance of all rights-of-way should be done manually in the riparian forest buffer. However, appropriate herbicides may be applied by hand to stumps of selectively cut trees, where establishing and maintaining a low-growing shrub community in this zone will further the objectives of the Wild and Scenic River designation. Selective hand application of certain pesticides to control insect or disease infestations is acceptable.

C. Stream Crossings

1. Bridge and culvert structures. In order to safeguard the free-flowing character of designated streams and protect scenic, recreational and fish and wildlife values:
 - a. Bridges should be:
 - i. Clear-span structures (means spanning the entire width of the waterway and having no piers, piles, abutments or other structures located below the ordinary high-water mark).
 - ii. Low profile and constructed of materials which blend with the natural surroundings as much as feasible.
 - iii. Where watercraft and/or fisherman passage is required, a vertical clearance of 5 feet between the ordinary high watermark and the bottom of the bridge is desired.
 - b. Culverts should provide for a natural streambed under the structure, either by using a bottomless structure or by recessing the culvert bottom a minimum of 12 inches below the stream bottom.
 - c. There should be no reduction of the total waterway area passing through the bridge or culvert.
2. The stream should be crossed by a method which minimizes disruption to the streambed. Streams should be crossed at the point and time least damaging to fishery resources and aquatic organisms and generally at right angles.
3. If aerial crossings are used, they should be designed to accommodate safe recreational use of the river in addition to protection of the streambanks.
4. A single-span stream crossing is preferred wherever possible, maintaining proper vertical clearance over the waterway and proper structure height for minimal adverse visual impact.
5. Underground installation is preferred for all new utility lines except: power lines of greater than 35 KV; where new lines are to be placed on existing poles, towers or bridges; or where burying is proven to be infeasible because of geologic constraints.
6. Directional boring will be the preferred method of crossing stream channels. Open-cut construction across the stream is discouraged, except for large-diameter installations such as a sewer or water main.
7. Towers and poles should be removed when elimination of existing above-ground facilities occurs.
8. The width of the streambed should not be altered.

D. Other Structures

Except as provided for in B and C above, and in the section on Watershed Restoration, structures associated with water-resource projects should be located in such a manner as to protect and enhance the outstandingly remarkable values of the White Clay Creek watershed. Generally, the following should be observed:

1. Follow all general provisions outlined in A above.
2. Meet setback and other siting guidelines described in Chapter IV, Local Land-Use Management program.

VI. EDUCATION AND OUTREACH

Management Challenge

Education and outreach are mutually reinforcing tools for inspiring public appreciation and stewardship for the watershed and its resources, and for engaging public participation in conservation activities. As such, they must be included in a comprehensive management strategy. Local governments, landowners, business leaders, citizens and young people need to know about the watershed's important resources and to understand what they can do to enjoy and protect them. Both Delaware and Pennsylvania have full-time interpretive and environmental educational programs in the White Clay Creek Park and Preserve, and each maintains a building dedicated to educational use. Additional programming is presented by New Castle County, the Tri-state Bird Reserve, the White Clay Creek Watershed Association, the Delaware Nature Society and others. The long-term success of this management plan is dependent on:

- Knowledgeable and motivated community leaders who incorporate the objectives of the management plan into the ongoing process of local government.
- Well-informed citizens and landowners who work to achieve the objectives of the plan at home and within their communities.
- Environmentally aware children and young people who will provide the next generation of leadership and stewardship for the watershed.

DELAWARE NATURE SOCIETY



Roles and Responsibilities

The states should take the lead in implementing watershed education. This is currently the responsibility of state agencies, and their efforts are complemented by numerous environmental organizations in and near the watershed. The states regulate curricula within local districts, and they will continue to do so. Should a state decide not to take on this responsibility, the state could defer to the White Clay Creek Watershed Management Committee. The Committee's focus should be upon the promotion of and support for outreach activities among various environmental organizations and agencies operating within the watershed.

Components of an Outreach and Education Program

The program for education and outreach consists of a two-pronged approach: informal education and training for adults, and more formal, curriculum-based education for students in kindergarten through high school.

Informal Education and Training for Adults

Goals

- Increase general awareness of the watershed and its issues
- Increase general awareness of and appreciation for the natural, cultural and recreational resources of

the watershed.

- Provide education and information to municipalities throughout the watershed to support municipal implementation of the management plan.
- Familiarize residents with Best Land Management Practices (BMPs) to protect and enhance the resources of the White Clay Creek watershed.
- Inform residents and local officials of the latest research findings and recommendations for resource protection and water-quality improvement.
- Foster a sense of the watershed as a "community;" instill a sense of watershed pride in residents and local officials.
- Provide residents with practical suggestions for their own domestic sites, including guidance in such areas as septic-system care, the use of swales, and landscaping for recharge and for control of invasive exotic plant species.

Key Actions

- Designate an Education and Outreach subcommittee to plan and oversee educational activities.
- Sponsor educational and information-disseminating activities throughout the watershed through appropriate media and events, including newspaper, radio, television, the Internet, maps, brochures, tours, festivals, special events, speakers bureau, environmental seminars and workshops.
- Publish a regular newsletter featuring articles and reports on resources, management activities, best management practices, etc.

Formal Education for Children and Youth (K - 12)

Goals

- Instill in children a sense of stewardship and pride in the White Clay Creek watershed.
- Arouse young people's interest in and curiosity about the resources of the White Clay Creek watershed.
- Provide children the means and opportunity to learn about the watershed in area schools.
- Create opportunities for children and young people to explore, enjoy and experience the White Clay Creek watershed.

Key Actions

- Incorporate material on watershed resources, issues and problems/solutions in the curricula of grades K-12.
- Organize school field trips designed to acquaint youngsters with watershed flora and fauna, history and ecological functions.
- Involve school groups in practical watershed management exercises such as plant and animal surveys, river cleanups and water quality monitoring.
- Provide "hands-on" experience for all school children, while solving environmental problems associated with school yards and grounds.
- Work with teachers to develop "home stewardship projects" in which students identify and resolve environmental problems in their own backyards.
- Work with school districts and teachers to design watershed-related curricula, projects, civic activities, contests and other educational and recreational activities that will instill in students a sense of pride in and stewardship for the White Clay Creek watershed.

Adopt-a-River Program

A volunteer citizen program for regular stream cleanups should be initiated as part of the watershed's

education and stewardship program. Such a program could be independent, or linked with adopt-a-highway or with stream water-quality monitoring programs. Technical assistance is available from PADEP, DNREC, NPS and other national organizations.

VII. AVAILABLE ASSISTANCE

A wide range of technical and financial assistance is currently available to private landowners, local governments, business and industry, agriculture and forestry and non-profit organizations to assist in implementing many of the recommendations contained in this plan. Such things as cost-sharing, low-cost loans, grants, income and property tax benefits and planning and management expertise are offered from state and federal agencies and from some non-profit organizations.

The National Park Service shall prepare a detailed inventory and analysis of such program within two years after designation of White Clay Creek as a National Wild and Scenic River.

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