

APPENDIX A

FINAL ENVIRONMENTAL ASSESSMENT

**LOCATION OF NATURAL RESOURCE RESTORATION
ARMY CREEK SUPERFUND SITE
New Castle County, Delaware**

Responsible Federal Agency: The Department of the Interior,
U.S. Fish and Wildlife Service
Department of Commerce,
National Oceanic And Atmospheric
Administration

For Further Information Contact:

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U.S. Fish and Wildlife Service
177 Admiral Cochrane Drive
Annapolis, MD 21401
(410) 573-4519

Trustees

The Department of the Interior,
U.S. Fish and Wildlife Service

Department of Commerce,
National Oceanic And Atmospheric Administration

State of Delaware
Department of Natural Resources
and Environmental Control

FINDING OF NO SIGNIFICANT IMPACT
LOCATION OF NATURAL RESOURCE RESTORATION
ARMY CREEK SUPERFUND SITE
NEW CASTLE COUNTY, DE.

The State of Delaware, the U.S. Department of Interior, and the U.S. Department of Commerce (the Trustees) have conducted an environmental assessment (EA) regarding the location of the restoration activities to restore, replace, and/or acquire the equivalent of the natural resources injured, destroyed or lost during operation of a municipal and industrial waste landfill at the Army Creek Superfund Site in New Castle County, Delaware (the Site).

The Trustees identified and considered the following three alternatives in the EA: (1) taking No Action, (2) restoration of natural resources at one or more sites outside the Army Creek watershed which contain resources equivalent to those injured or destroyed at the site, and (3) rehabilitation and replacement of wetland and upland habitats in the watershed of Army Creek, including the headwaters of Army Creek, Army Creek Pond adjacent to the Army Creek Superfund Site, and Lower Army Creek and marsh. The proposed action is the latter, to rehabilitate Lower Army Creek and marsh. Specific actions for this proposal are identified in a Restoration Plan subject to public review and comment.

The public was notified of the availability of the EA for review and comment on January 8, 1995, by publication in the Wilmington News Journal. Owners of property abutting the Army Creek Superfund Site were notified of the availability of the EA by mail on January 9, 1995. After a public comment period of 45 days, no comments were received.

I find that the proposed action does not constitute a major Federal action significantly affecting the quality of the human environment. Therefore, in accordance with Section 102 (2) (c) of the National Environmental Policy Act of 1969 and the regulations of the Council of Environmental Quality (40 CFR 1508.9), an environmental impact statement will not be prepared for the project.

for Gary Marshall
Rolland A. Schmitten
Assistant Administrator for Fisheries
National Marine Fisheries Service
National Oceanic and Atmospheric Administration

SEP 8 1995
Date

FINDING OF NO SIGNIFICANT IMPACT
LOCATION OF NATURAL RESOURCE RESTORATION
ARMY CREEK SUPERFUND SITE
NEW CASTLE COUNTY, DELAWARE

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The Trustees identified and considered the following three alternatives in the EA: (1) taking No Action, 2) restoration of natural resources at one or more sites outside the Army Creek watershed which contain resources equivalent to those injured or destroyed at the site, and 3) rehabilitation and replacement of wetland and upland habitats in the watershed of Army Creek, including the headwaters of Army Creek, Army Creek Pond adjacent to the Army Creek Superfund Site, and Lower Army Creek and Marsh. The third alternative will be referred to as the Proposed Action.

The public was notified of the availability of the EA for review and comment on January 8, 1995 by publication in the Wilmington News Journal. Owners of property abutting the Army Creek Superfund Site were notified of the availability of the EA by mail on January 9, 1995. After a public comment period of 45 days, no comments were received by the Trustees.

In implementing the Proposed Action, the trustees will restore natural resources in the Army Creek watershed through specific actions which will be identified in a Restoration Plan which shall be subject to public review and comment.

I find that the proposed action does not constitute a major federal action significantly affecting the quality of the human environment. Therefore, in accordance with the National Environmental Policy Act of 1969 and the regulations of the Council of Environmental Quality (40 CFR 1508.9), an environmental impact statement will not be prepared for the project.


Field Supervisor Date 7/10/95

UNITED STATES FISH AND WILDLIFE SERVICE

ENVIRONMENTAL ACTION MEMORANDUM

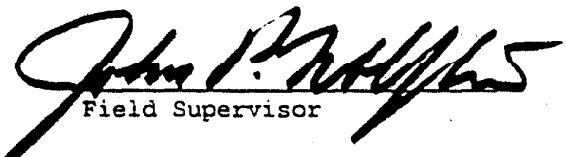
Within the spirit and intent of the Council of Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA) and other statutes, orders, and policies that protect fish and wildlife resources, I have established the following administrative record and have determined that the action of:

Restoring marsh and upland habitat in the Army Creek watershed to rehabilitate for injuries caused by the Army Creek Superfund Site.

- is a categorical exclusion as provided by 516 DM 6 Appendix 1. No further documentation will be made (see instructions on back).
- is found not to have significant environmental effects as determined by the attached Environmental Assessment and Finding of No Significant Impact.
- is found to have special environmental conditions as described in the attached Environmental Assessment. The attached Finding of No Significant Impact will not be final nor any actions taken pending a 30-day period for public review (40 CFR 1501.4(e)(2)).
- is found to have significant effects, and therefore a "Notice of Intent" will be published in the Federal Register to prepare an Environmental Impact statement before the project is considered further.
- is denied because of environmental damage, Service policy, or mandate.
- is an emergency situation. Only those actions necessary to control the immediate impacts of the emergency will be taken. Other related actions remain subject to NEPA review.

Other support documents:

Environmental Assessment


Field Supervisor

7/10/95
Date

FINAL ENVIRONMENTAL ASSESSMENT

**LOCATION OF NATURAL RESOURCE RESTORATION
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**Responsible Federal Agency: The Department of the Interior,
U.S. Fish and Wildlife Service
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For Further Information Contact:

**U.S. Fish and Wildlife Service
177 Admiral Cochrane Drive
Annapolis, MD 21401
(410) 573-4519**

Abstract:

The U.S. Environmental Protection Agency (EPA) has removed threats to human and environmental health under the Comprehensive Environmental Restoration, Compensation, and Liability Act at the Army Creek Superfund Site in New Castle County, Delaware. The federal and state natural resource trustees negotiated a settlement with several potentially responsible parties for injuries to natural resources associated with the Superfund site. This assessment describes three alternatives regarding a proposal to utilize these settlement monies to restore natural resources which were injured, destroyed, or lost due to operation of the Army Creek

Landfill and the remediation of the site. The assessment addresses the anticipated effects of implementing each alternative. The alternatives are: 1) No Action, 2) Restoration of natural resources at a site(s) outside of the Army Creek watershed which are equivalent to those which were injured or destroyed on-site, and 3) Restoration of the equivalent in injured or destroyed natural resources on site(s) in the Army Creek watershed. The proposed alternative is to perform restoration on-site in the Army Creek watershed.

FINAL ENVIRONMENTAL ASSESSMENT
 NATURAL RESOURCE RESTORATION PLAN
 ARMY CREEK SUPERFUND SITE
 NEW CASTLE COUNTY, DELAWARE
 TABLE OF CONTENTS

1.0	<u>Project Description</u>	A-6
2.0	<u>Purpose and Need</u>	A-7
	2.1 <u>Significant Issues</u>	A-9
2.2	<u>Issues Considered But Dismissed</u>	A-9
	2.3 <u>Permits Required</u>	A-12
3.0	<u>Description of the Proposed Action and Alternatives</u>	A-12
	3.1 <u>No Action</u>	A-12
	3.2 <u>Restoration Action Off-Site</u>	A-13
	3.3 <u>Restoration Action On-Site</u>	A-13
4.0	<u>Affected Environment</u>	A-15
	4.1 <u>Socioeconomics</u>	A-15
	4.2 <u>Geology-Hydrology</u>	A-16
	4.3 <u>Ecology</u>	A-18
	4.4 <u>Land Use</u>	A-23
5.0	<u>Environmental Impacts of the Proposed Action and Alternatives</u>	A-26
	5.1 <u>Socioeconomics</u>	A-26
	5.2 <u>Geology-Hydrology</u>	A-28
	5.3 <u>Ecology</u>	A-29
	5.4 <u>Land Uses</u>	A-33
6.0	<u>List of Organizations Consulted</u>	A-34
7.0	<u>Comments</u>	A-35

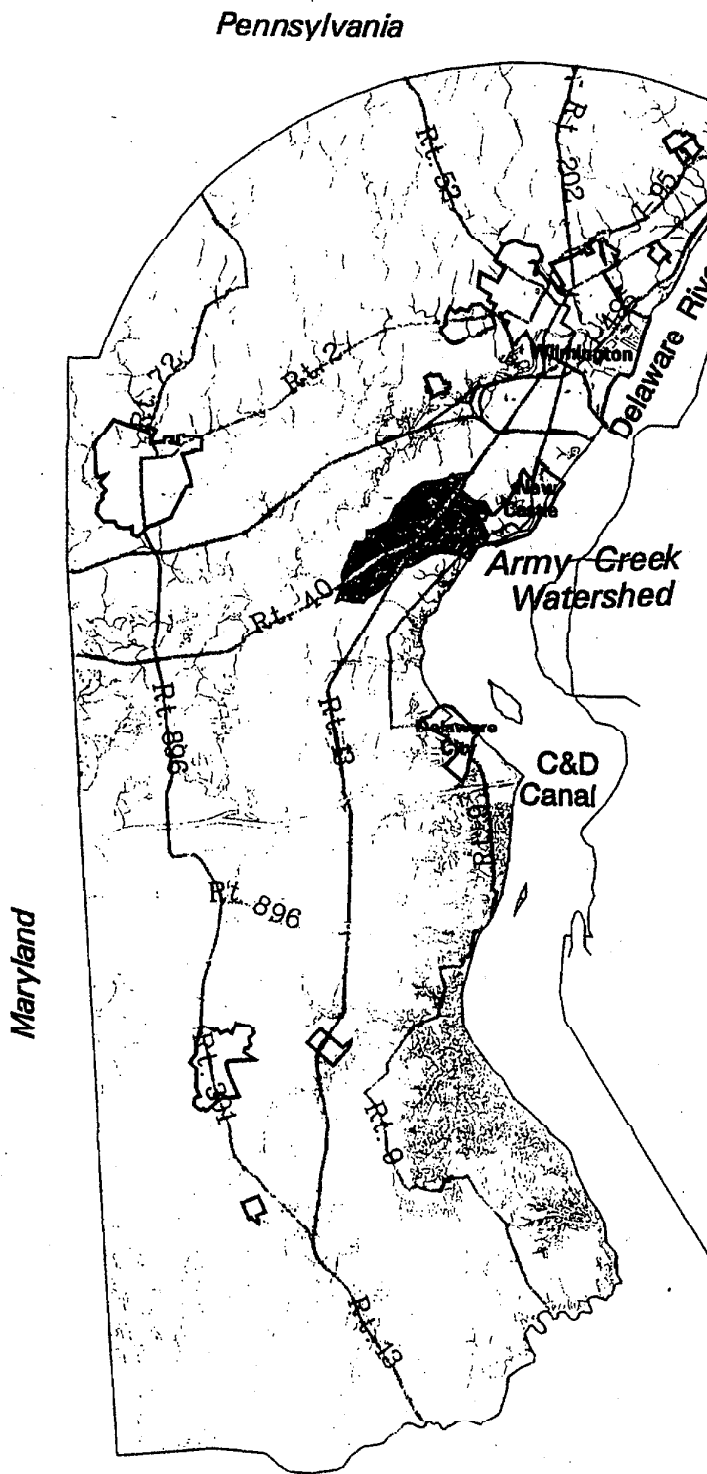
8.0 <u>List of Staff Preparing Environmental Assessment</u>	A-36
9.0 <u>References Cited</u>	A-37
Attachment A <u>UPLAND ACQUISITION PROCESS</u>	A-39
Attachment B <u>REPORT ON ARMY CREEK CONTAMINANT ISSUES</u>	A-52

1.0 Project Description

The State of Delaware, the U.S. Department of the Interior, and the U.S. Department of Commerce are designated natural resource trustees (Trustees) for the Army Creek Superfund Site under the Comprehensive Environmental Restoration, Compensation, and Liability Act (CERCLA). The State of Delaware delegated authority to the Department of Natural Resources and Environmental Control (DNREC). The Fish and Wildlife Service (USFWS) is serving as lead trustee representative for the U. S. Department of the Interior. The U.S. Department of Commerce delegated authority to the National Oceanic and Atmospheric Administration (NOAA).

The Trustees entered into a settlement with a group of responsible parties for damages resulting from the injury to, destruction of, or loss of natural resources at the Army Creek Superfund Site (Site) located in New Castle County, Delaware. Releases or threats of release of hazardous substances at the Site resulted in injury to, destruction of, or loss of natural resources under Section 107(a)(C) and (f) of CERCLA, 42 U.S.C. 9607(a)(C) and (f). The settlement provided a total of \$600,000 to be used by the Trustees to jointly restore natural resources injured, destroyed, or lost during operation of a municipal and industrial waste landfill at the Site. The settlement also provided that an additional \$200,000 of the funds were to be utilized solely by Delaware for restoration activities associated with injuries to ground water resources.

The 60-acre Army Creek Landfill is located in New Castle County (Figure 1) approximately 2 miles southwest of the city of New Castle, Delaware. Operation of the landfill and subsequent remediation caused loss of use of, or injuries to fish populations, migratory birds, and wildlife habitats. Vegetation had recolonized the landfill surface to produce low quality upland and wetland habitat after cessation of disposal activities. Prior to remediation, approximately 3.3 acres of wetland existed on the surface of the landfill. On-site contaminants were migrating to existing pond and creek sediments, and surface water. The Focused Remedial Investigation for Operable Unit 2 identified possible detrimental effects on biota from contact with the contaminated ground water or surface water. The likely effects of contaminant releases from the Site included mortality, and decreases in reproduction and food availability for migratory and resident



New Castle County, Delaware

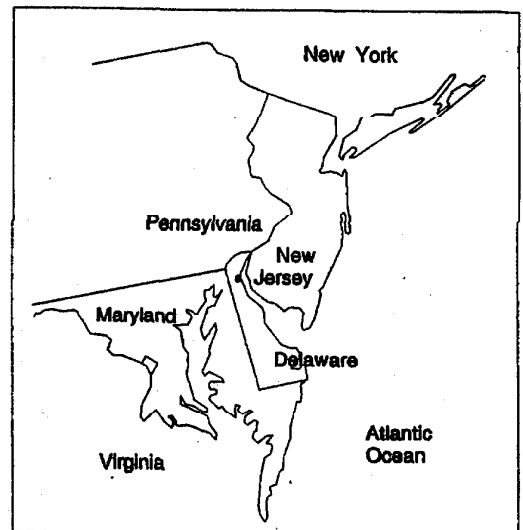


Figure 1. Army Creek site location

fish.

Remediation of the Site destroyed 60 acres of low quality mixed upland/wetland habitat which was distributed over the surface of the landfill. Capping the landfill resulted in the loss of wetland and upland migratory bird habitat that will not be recreated. The cap has been planted with a mixture of grasses, wildflowers, and low growing shrubs whose roots will not penetrate the impermeable layer of the constructed cap. Certain habitat restoration measures were incorporated into the remedial actions selected by the U.S. Environmental Protection Agency (EPA) and accepted by the settling parties. These measures included:

- o Planting species beneficial to wildlife (e.g., shrubs and upland plants) but not interfering with the integrity of the landfill cap to restore some upland plants and shrubs for cover. Maintenance of cap vegetation to minimize disturbance to wildlife uses encouraged by the selected vegetation, and;
- o Constructing small sedimentation basins to manage erosion during cap construction. With completion of the cap (December 1993) these basins are being allowed to revert to wetlands. A Phragmites control program will be implemented in these sedimentation basins by the responsible parties as part of the remedial action and is expected to enhance habitat values through a return to native wetland vegetation.

All remedial activities except monitoring the success of remedial design are complete.

For the purposes of this environmental assessment, "on-site" is defined as the watershed of Army Creek shown on Figure 2 and includes the headwater area of the creek, Army Creek Pond adjacent to the Army Creek Superfund Site, and Lower Army Creek and Marsh.

2.0 Purpose and Need

The intent of the natural resource damage provisions of CERCLA is to insure that natural resources which are injured, destroyed, or lost are

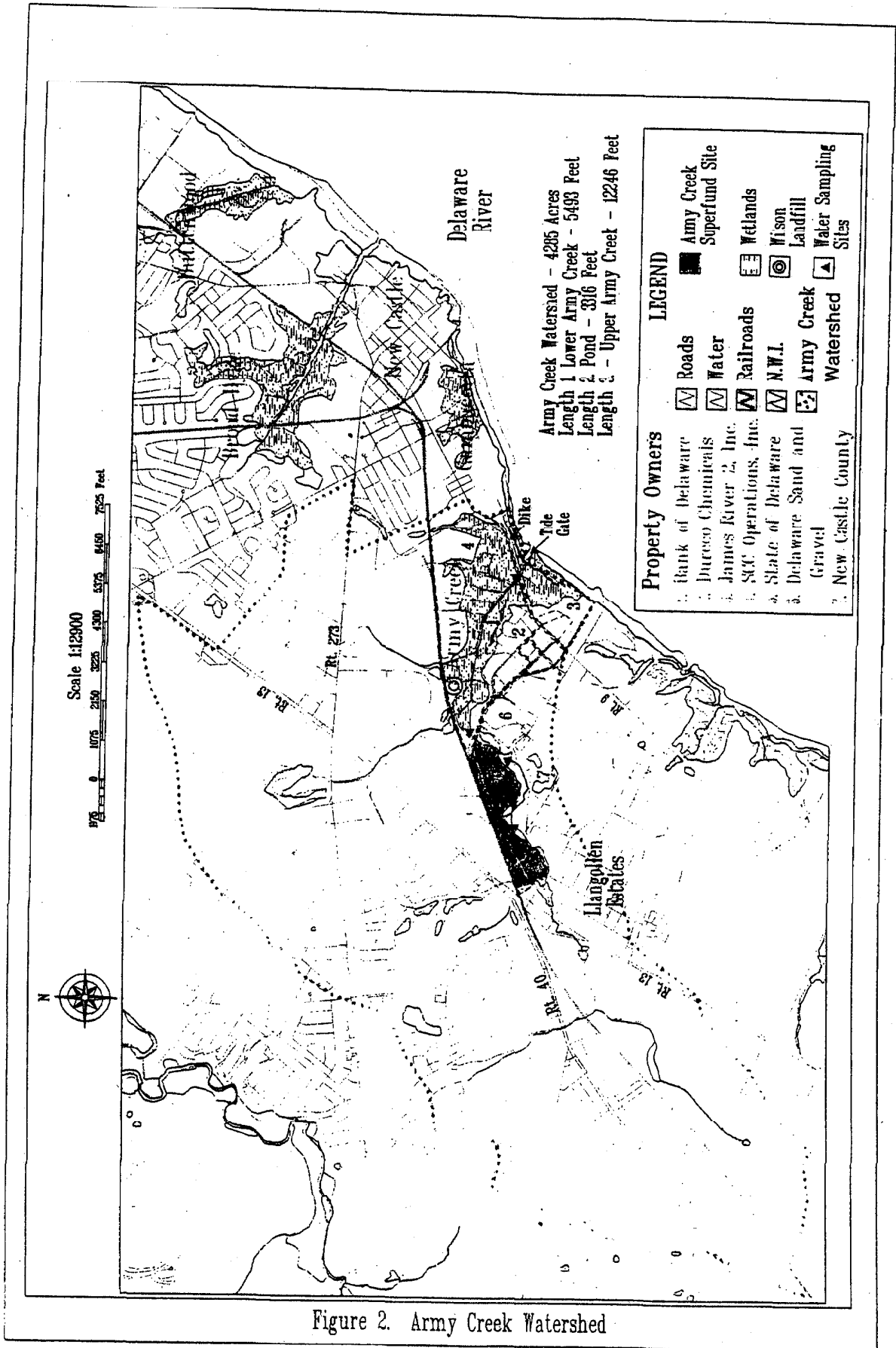


Figure 2. Army Creek Watershed

restored, rehabilitated, or replaced with equivalent resources. The preferred alternative is that restoration occur on-site. The purpose of this document is to determine whether or not on-site restoration is appropriate.

2.1 Significant Issues

Significant issues (i.e., potential environmental impacts of actions) (Table 1) include:

1. the potential for post-remedial contaminant levels to cause continued injury to trust resources on-site;
2. the possible rise in water table level at the Army Creek Superfund Site when ground water pumping ceases;
3. the continued input of heavy metals into the Army Creek watershed from road runoff;
4. the impact of restoration activities on DNREC mosquito control programs.

2.2 Issues Considered But Dismissed

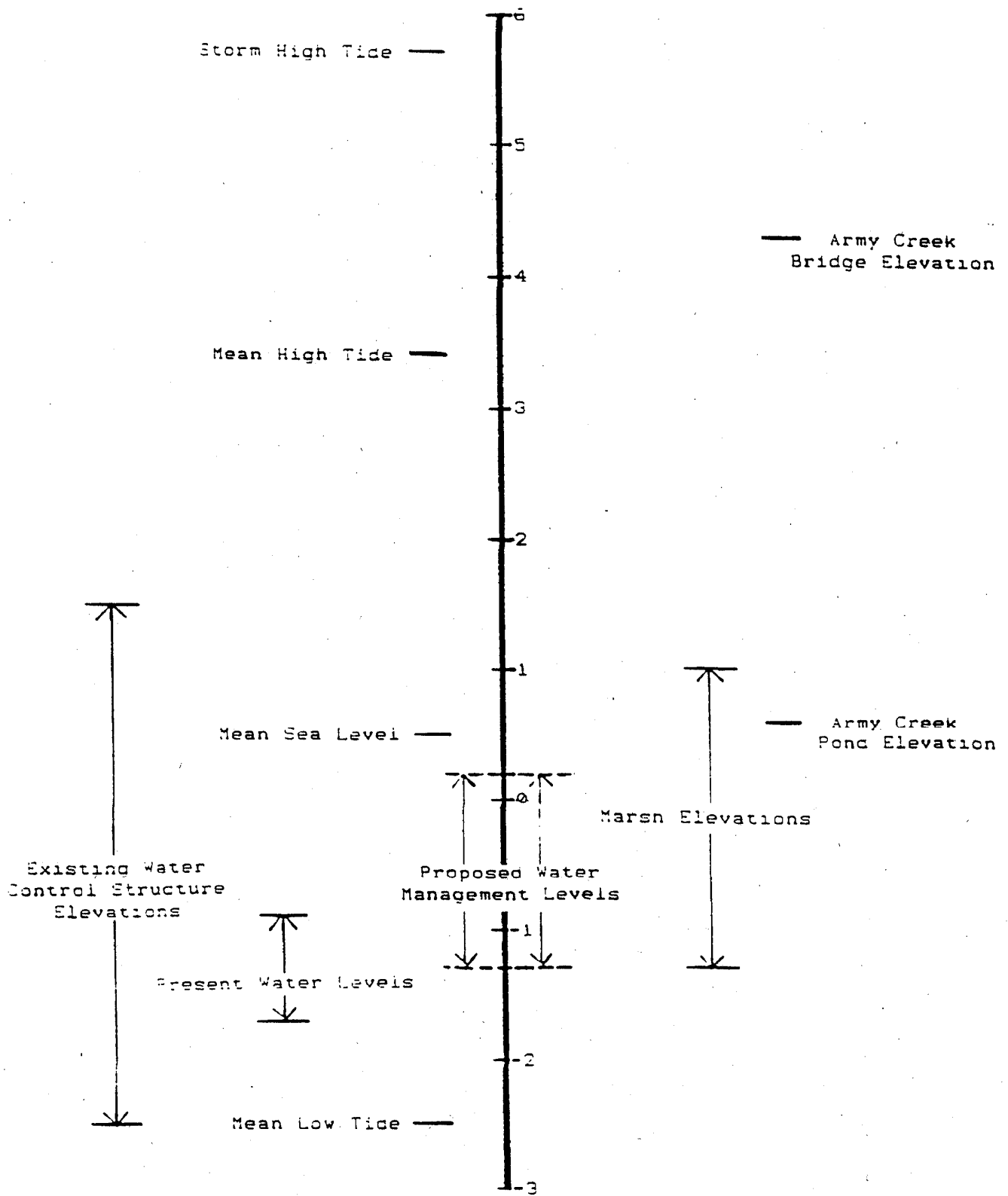
1. Trustees considered whether reintroducing tidal fluctuation in Army Creek Marsh would have an effect on the remediated landfill. Water level elevations in Lower Army Creek Marsh that would be produced by introduction of tidal flow to this ecosystem would not be great enough to affect surface water hydrology at the Army Creek Superfund Site (Figure 3).
2. Trustees considered whether restoration should be delayed pending review of EPA's Five Year Remedial Evaluation (FYRE). From information summarized in Attachment B, Trustees determined that Lower Army Creek Marsh received input of contaminants from the landfill over approximately twenty years. Contaminant exposure pathways from the landfill to Army Creek habitats existed and were influenced by surface water runoff within the watershed or lateral leachate from the landfill (Attachment B, Section 2.5). Contamination of

habitats within the Army Creek watershed probably reached an equilibrium during the period that the landfill acted as a source. These exposure pathways are being controlled or eliminated by Superfund site remedial activities and through the efforts of Delaware Department of Transportation such that source control will reduce transport of contaminants to Army Creek habitats. Trustees conclude from these actions that conditions in the creek and marsh will be no worse in the future and should improve over time because sources of leachate and ground water contamination will be controlled. Trustees believe that restoration of aquatic and terrestrial habitats should begin as soon as possible to limit further injuries or loss of services of natural resources in the watershed.

3. Trustees considered the potential consequences that lateral leachate may have on restoration decisions. Trustees do not know of any pathway between ground water and the lower marsh which transported contaminants from the Site to the marsh. Available data indicate that the predominant flow in the stream and marsh is via surface water and that ground water recharge of the marsh does not occur. Additionally, the Record of Decision for Operable Unit Two requires that the responsible parties remedy contaminant problems resulting from lateral leachate.
4. The concept of holding funds for later use was considered. This concept involves combining funds from the Army Creek settlement with future settlements which would then be spent on appropriate restoration activities for the benefit of resources similar to those affected by the Army Creek Landfill. This option would consider use of combined settlement funds to complete restoration within or outside the Army Creek watershed. However, this concept would delay, for an unacceptable period of time, any ecological benefits derived from restoration.

FIGURE 5-1

NGVD ELEVATION (FEET)



2.3 Permits Required

Permits under Section 10 of the River and Harbor Act and Section 404 of the Clean Water Act are required when certain works are performed in waters of the United States. This would be the case if the proposed alternative to perform on-site restoration is selected.

3.0 Description of the Proposed Action and Alternatives

This chapter identifies and describes the feasibility of on-site restoration actions and alternatives applicable to the Army Creek Superfund Site. After review and consideration of public comment on this environmental assessment, the Trustees will decide where restoration will be implemented. At that time Trustees will develop a restoration plan. This plan will present more specific details of selected restoration actions and the effects that these actions have on affected environments.

Potential alternatives that will be considered by this environmental assessment are:

- o No Action;
- o Restoration Action Off-Site;
- o Restoration Action On-Site (Preferred Alternative).

3.1 No Action

This alternative is not acceptable since CERCLA mandates that funds obtained pursuant to Section 107 must be used for restoration purposes. In addition, upland and wetland habitat would not be restored or replaced at a level equivalent to what was injured or lost if this alternative is chosen. In the absence of restoration in the Army Creek watershed, lost ecological functions will continue to impair fish and wildlife populations. The No Action alternative would not replace habitat values of resident and migratory fish populations which were reduced by alteration of the Army Creek tidegate, or the losses of food, cover, and resting areas for migratory birds that were lost through remediation of the Site. The No Action alternative would not replace upland habitat that was present on the landfill surface before remediation activities began.

3.2 Restoration Action Off-Site

This approach to restoration related to wetlands, uplands, and/or aquatic areas would be adopted if alternatives within the watershed are not feasible or fail to replace equivalent resources. Similar habitat selection, enhancement, and protection measures would be applied to appropriate lands to restore maximum natural resource value with the money available. An optimum mix of the following actions would be selected to replace equivalent wetland, upland, and aquatic habitats or their functions outside the Army Creek watershed:

- o enhancement of existing wildlife management or natural areas;
- o enhancement of new areas protected by easement;
- o enhancement of acquired or donated lands; and
- o enhancement of wetland or aquatic areas.

3.3 Restoration Action On-Site (Preferred Alternative)

On-site restoration would improve fish and wildlife habitat in the same watershed where habitat losses occurred as a result of site contamination and remediation. Trustees acknowledge the importance and necessity of water quality and diverse habitats to fish and wildlife populations in the vicinity of the remediated Site. Proposed restoration actions within the watershed will be developed which replace or improve the resource values around the Site but within the same watershed. In this alternative, restoration within the watershed would be carried out as rapidly as planning and construction allow once a restoration plan is developed and the environmental effects of the proposed action are evaluated.

Activities considered to be suitable for replacement or restoration of injuries within the Army Creek watershed include:

- o restoring tidal influence to Army Creek Marsh;

- o managing tidal exchange to provide optimum marsh water levels that promote use of Army Creek Marsh by migratory and resident species of fish and waterbirds;
- o acquiring easements or purchase land adjacent to the Site, within or along the edge of Army Creek Marsh, or within the Army Creek watershed along Delaware Bay; and
- o providing a more diverse marsh plant community that offers food, shelter, and resting habitats for fish and wildlife.

This alternative proposes actions to restore lost function to the 225 acre marsh downstream of the Army Creek Superfund Site and to restore upland habitat injuries caused by installation of the landfill cap using upland areas within the watershed. Approximately 94 acres of upland area adjacent to the Army Creek Superfund Site or the lower marsh exist and may be available for restoration. However, if acreage within the watershed is insufficient, additional acreage will be sought off-site.

Army Creek Marsh will be enhanced by restoring tidal influence and migratory fish access to Army Creek habitats upstream of Route 9. This action will restore the role of the marsh as a nursery for migratory fish, improve waterbird habitat, and improve biological control of mosquitoes in the marsh. A water management plan will be developed which will include replacement of the existing tidegate just downstream of the Route 9 bridge over Army Creek. A vegetation management plan for elimination or control of Phragmites in Army Creek Marsh will be initiated by the trustees to further improve the quality of habitat for wildlife. This plan will result in replacement of Phragmites with vegetation having high wildlife value (e.g., rushes, sedges, smartweeds, emergents, etc.).

Land acquisitions within the watershed will be made if funds are available. Criteria for acquisition of land for restoration as upland habitat have been developed by Trustees (Attachment A). Improvements to upland habitat will be planned to provide food and cover to migratory birds and other wildlife, as well as to improve the quality of waters flowing from these lands.

4.0 Affected Environment

This chapter describes the baseline conditions of the natural resources and socioeconomics of the New Castle County.

4.1 Socioeconomics

New Castle County is the northernmost of Delaware's three counties, and contains approximately 36% of the State's population. Wilmington is the State's largest city and is located almost at the mid-point of the Boston-Richmond "Megalopolis." It is estimated that 30% of the United States population lives within a 350-mile radius of Wilmington. This strategic location provides Wilmington with an excellent transportation network including highways, passenger and freight rail, and the Wilmington and Philadelphia International Airports. In addition, the Port of Wilmington, which ranks within the top 10% of total tonnage handled in the United States, is the closest Delaware River port to the Atlantic Ocean.

New Castle County, including the City of Wilmington, has continued to grow for the last 2 decades. Projections show that the growth rate for New Castle County is expected to increase in the coming years. From current census data, the Delaware Population Consortium (January 30, 1989 Series) projected population growth through the year 2010 as follows.

	Population Growth		
	<u>1980</u>	<u>1989</u>	<u>Annual Change</u>
State of Delaware	594,338	662,350	1.27%
New Castle County	398,115	434,500	1.02%
	<u>1990</u>	<u>2010</u>	
State of Delaware	673,500	815,600	2.34%
New Castle County	440,300	513,750	1.85%

Statistics indicate a population in Wilmington of approximately 70,000 with an additional 40,000 persons comprising the weekday commuting work force. Projections by the planning departments of New Castle County and the City of Wilmington show a growth to 89,900± by the year 2000.

While not showing dramatic changes, growth in New Castle County and the City of Wilmington has been and is projected to continue at a steady pace. New Castle County contains a substantial portion of the area's commercial office and retail establishments, and this proportion can be expected to continue.

Manufacturing is strong in the Wilmington region. The largest employer is E.I. duPont de Nemours & Co., Inc., followed by Chrysler Corporation, Hercules, Inc., General Motors, and ICI United States, Inc.

4.2 Geology-Hydrology

Physical setting

The Army Creek Superfund Site varies in elevation from mean sea level to +51 feet NGVD. It is underlain by two water-bearing formations, the Columbia and the Potomac. The Columbia, the uppermost aquifer beneath the landfill, is of Pleistocene Age and is from 10 to 60 feet thick at the site. The silt and clay units of the Columbia are discontinuous and do not form confining units.

The Potomac Formation of Cretaceous Age underlies the Columbia Formation and is generally separated from it by a confining clay layer at the Site. The Potomac Formation dips to the southeast, is up to 600 feet thick, and the formation is divided into upper and lower units, which are separated by a thick confining clay unit. The upper Potomac Formation silts and clays are discontinuous and non-uniform; in some places, the sands of the Columbia and Potomac are in contact. The Potomac Formation is used as an aquifer for drinking water.

The Columbia and Potomac aquifers were contaminated by the Army Creek Superfund Site and the Delaware Sand and Gravel Superfund Site (DS & G). The DS & G is situated next to the south shoreline of Army Creek and

contributed to contamination of ground water in this watershed (Attachment B, Section 2.5.1). Ground water remediation of these aquifers produces 1.4 million gallons of water per day that are released to Army Creek. Ground water releases will continue until monitoring shows that ground water is no longer contaminated by wastes from the superfund sites.

Army Creek, including the Upper Creek (approximately 2.3 miles in length), Army Creek Pond (approximately 0.6 mile in length), and the Lower Creek (approximately 1 mile in length), is about 3.9 miles long, 9 to 40 feet in width, and from less than 1 foot to 4 feet deep. Its drainage area is approximately 6.7 square miles. The Upper Creek and Pond are fresh. The salinity of the Lower Creek ranges from fresh to slightly oligohaline. The mean tide range in the Delaware River adjacent to Army Creek is 5.6 feet. The mean tide level of the Delaware River at New Castle is 0.5 ft NGVD with a tidal period of 12.25 hours. A tidegate at the mouth of Army Creek limits exchanges of water and biota between the Delaware River and Army Creek. The tidegate was replaced in 1986 to prevent flooding of Route 9 and lands adjacent to the marsh. The tidegate consists of five one-way flap gates, each 48 inches in diameter, that prohibit tidal inflow and allow outflow of accumulated upland runoff when hydraulic head, in relation to the tide, is sufficient to open the flap gates.

Army Creek Pond, oriented parallel to the southern boundary of the landfill, is ellipsoid in shape and approximately 175 feet wide, and 1 foot deep. The Pond is formed by a gravel stream crossing. Storm water runoff from Upper Army Creek and the Site, as well as flows from the ground water recovery wells at the Site, are collected in this pond. Downstream of the pond, the creek is enlarged by the flow from the recovery wells, which averages 1.4 million gallons per day. Compared to flows upstream of the pond, downstream flows are much more constant as a result of the recovery well input.

4.3 Ecology

4.3.1 Wetland Areas

In the upper portion of the Army Creek system, two wetland habitats were identified by Rudis and Andreasen (U.S. DOI, Fish and Wildlife Service 1988). The first is a shallow, muck bottom pond (Army Creek Pond) with scattered emergent vegetation comprised of pickerelweed (Pontedaria cordata), spatterdock (Nuphar luteum), cattail (Typha latifolia), and other species along the margin. The pond is encircled by a forested or shrub dominated wetland extending from its western end to the western margin of the Site. Dominant species include pin oak (Quercus palustris), red maple (Acer rubrum), and black willow (Salix nigra).

Adjacent to and east of Army Creek Landfill another large wetland complex exists. Lower Army Creek water flows through this wetland to the Delaware River. This wetland, a freshwater to low salinity emergent wetland of approximately 225 acres (91 hectares), is dominated by common reed (Phragmites australis) and jewelweed (Impatiens pallida).

A recent characterization (Cole and Fabean 1992) of lower Army Creek Marsh, performed by the Delaware Division of Fish and Wildlife (DFW) with support from the Delaware Coastal Management Program, updated the information base on this degraded wetland. Of the 225 acre wetland defined by DNREC below the Pond, 210 acres (93.3%) are covered by dense stands of Phragmites. 2 acres (0.9%) are mixed freshwater emergents (e.g., rice cut-grass, rose mallow, spatterdock, jewelweed, switchgrass, arrow arum, smartweed), and 13 acres (5.8%) are open water areas (e.g., main channel, side channels, shallow pannes). The Delaware Natural Heritage Inventory (DNHI), in cooperation with the DFW, identified 52 plant species in a floral survey of the Lower Army Creek marsh, with greater diversity occurring toward the upper end of the marsh. One plant species of special concern was found, Torrey's rush (Juncus torreyi). The DNHI designates Torrey's rush as an "S1" species (i.e., State Species of Special Concern [1= most concern]), found to date by DNHI in five or fewer places in Delaware; however, it is not a federally threatened or endangered species. This species is found in open, moist to wet sites, commonly colonizing ditches from Massachusetts to Saskatchewan, south

to Alabama and Texas, west to California and northern Mexico (Godfrey and Wooten 1979). This rush has been found at only two other locations in Delaware, both of which are also believed to be disturbed sites. No federally listed threatened or endangered plants have been recorded in the Army Creek area (Trew, DNHI, pers. comm. 1989).

4.3.2 Fish and Wildlife

A review of information on the presence of species which are Federally listed or proposed for listing as endangered or threatened in the project area was performed in accordance with Section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.). Except for occasional transient individuals, no Federally listed or proposed endangered or threatened species are known to exist in the Army Creek watershed.

4.3.2.1 Wildlife

Six of the eight mammals observed on the Site are game species. They are:

Eastern cottontail rabbit, Sylvilagus floridanus;
White-tailed deer, Odocoileus virginianus;
Muskrat, Ondatra zibethica;
Raccoon, Procyon lotor;
Northern gray squirrel, Sciurus carolinensis; and
Woodchuck, Marmota monax.

The Site has been described by Weston (Biological Assessment of Army Creek Llangollen Landfill, Dec. 30, 1982) as, "...strewn with shot-gun shells, suggesting some hunting activity." Small mammal trapping in early May 1992, in the Lower Creek marsh collected meadow voles (Microtus pennsylvanicus), white-footed mice (Peromyscus leucopus), and house mice (Mus musculus), with almost all captures occurring in dense Phragmites habitat (Cole and Fabean 1992). Additionally, muskrat (Cole and Fabean 1992), beaver (R. Wooten, pers. comm.), and beaver-cut trees (J. Thomas, NOAA, pers. obs.) have been observed. Many of these species are considered residents of the area. No threatened or endangered

mammals have been recorded in the Army Creek area.

Sixty-five species of birds were observed in or near the Army Creek Site between 1973 and 1988 (Weston 1986; U.S. Department of the Interior 1988; EPA 1988; and investigators for the 1990 FRI [See Table 3-4 in 1990 FRI]). The list includes: four upland gamebirds (two doves, ring-necked pheasant (Phasianus colchicus), bobwhite quail (Colinus virginianus); 11 species of marsh and shorebirds (four herons, one sandpiper, three egrets, glossy ibis (Plegadis falcinellus), killdeer (Charadrius vociferus), least bittern (Ixobrychus exilis); five species of waterbirds (three ducks, one goose, one gull); five species of birds of prey (two hawks, kestrel, osprey (Pandion haliaetus), vulture); and 40 species of songbirds (blackbirds, warblers, sparrows, etc.). Although not federally listed, osprey are considered a species of special concern by the State of Delaware (Trew, DNHI, pers. comm., 1989 In 1990 FRI). Within the list of 65 species of birds are nine species of game birds (including the 4 species of upland gamebirds) that have been observed on the Site (black duck (Anas rubripes), mallard (Anas platyrhynchos), wood duck (Aix sponsa), Canada goose (Branta canadensis), bobwhite quail, ring-necked pheasant, mourning dove (Zenaida macroura), rock dove (Columbia livia), and common crow (Corvus brachyrhynchos). Nearby landowners report successful duck hunting in the area, and shotgun shells were found on and adjacent to the Site.

Additionally, Cole and Fabean (1992) conducted three field trips (October 1991, and March and April 1992) to observe birds in Lower Creek marsh, but recorded only 6 species (with total numbers) in the lower marsh: wood duck (6), green-winged teal (Anas crecca) (24), blue-winged teal (Anas crecca) (3), great blue heron (Ardea herodias) (4), double-crested cormorant (Phalacrocorax auritus) (1), and northern harrier (Circus cyaneus) (1).

Amphibians and reptiles known to occur at the Army Creek Landfill are:

American toad, Bufo americanus
Fowlers toad, Bufo woodhousei fowleri
Bullfrog, Rana catesbeiana
Northern leopard frog, Rana pipiens

Eastern painted turtle, Chrysemys picta
Eastern mud turtle, Kinosternon subrubrum
Spotted turtle, Clemmys guttata
Snapping turtle, Chelydra serpentina
Northern water snake, Nerodia sipedon
Northern black racer, Coluber constrictor

The bullfrog and snapping turtle are considered game species, and turtle traps were found on the Site. None of these amphibians or reptiles are state or federally listed as endangered or threatened.

4.3.2.2 Fish

Twenty-two species of fish have been identified in Army Creek from the reaches upstream of the pond, the pond itself, or downstream of the pond (Focused Remedial Investigation 1990; Cole and Fabean 1992, and Attachment B).

Four of the species of fish found in Army Creek are listed as "rare" in the State of Delaware (Attachment G of Focused Remedial Investigation 1990). They are:

Smallmouth bass, Micropterus dolomieu
Striped bass, Morone saxatilis
White crappie, Pomoxis annularis
Yellow bullhead, Ictalurus natalis.

In addition, a federally listed endangered species, the shortnose sturgeon (Acipenser brevirostrum), is found in coastal waters of the Atlantic, Delaware Bay, and the Lower Delaware River (i.e., adjacent to or near Army Creek) (Dadswell et al. 1984, O'Herron et al. 1993, and Attachment B). It appears that the lower Delaware estuary is used by adult sturgeon for feeding and/or overwintering. Based on available data, it is not likely that shortnose sturgeon will enter Army Creek, except as an occasional transient.

Seven species of fish (including yellow perch and largemouth bass) found in Army Creek are considered to be gamefish. Other species such as carp

and bullhead are known to be caught in Army Creek and consumed by humans on occasion. Most are tolerant of turbid conditions, with the exception of smallmouth bass, and feed on fish, insects, or crustaceans (Collins 1959). Carp (Cyprinus carpio) and brown bullheads (Ictalurus nebulosus) are bottom feeders and tend to be omnivorous (Collins 1959). The tidegate at the mouth of Army Creek prevents or limits entry of migratory and estuarine species from the Delaware River.

Fish sampling of Lower Army Creek by Cole and Fabean (1992) shows limited diversity. Seine and gill net sampling for fishes, conducted in December 1991, April 1992, and June 1992, collected only 16 individuals amongst 9 species: pumpkinseed (Lepomis gibbosus), bluegill (Lepomis macrochirus), mosquitofish (Gambusia gambusia), mummichog (Fundulus heteroclitus), black crappie (Pomoxis nigromaculatus), carp, brown bullhead, Atlantic menhaden (Brevoortia tyrannus), and white mullet (Mugil curema).

Lower Army Creek was surveyed by the Delaware Division of Fish and Wildlife in May 1992, to determine its present habitat suitability for migratory fish spawning. Water velocity is extremely slow throughout the entire length of Lower Army Creek. The absence of hard substrate and low freshwater inputs suggests that Lower Army Creek would not be conducive for successful migratory fish spawning (C. Shirey, pers. comm.).

Adjacent to Army Creek, based on a series of beach seine surveys along the Delaware River at Augustine Beach, Delaware and at Penn's Grove, New Jersey (south and north of Army Creek, respectively) in 1958, deSylva et al. (1960) identified 30 fish species. Schuler (1973) collected 37 species during 1973, at Augustine Beach, Delaware and Sunken Ship Cove, New Jersey in the Delaware River near Artificial Island, using 10-, 25- and 225-foot seines and a 16-foot trawl (Attachment B, Section 2.4.2.6).

Upstream of the pond, Army Creek is a low volume seasonal stream, largely dependent on storm runoff. In 1988, the Delaware Division of Fish and Wildlife surveyed the Upper Creek from the pond to Route 13 for fishes and macroinvertebrates. This portion of the stream is degraded by residential development and highway

runoff, and serves primarily as a drainage ditch for surrounding areas. Stream width ranges from 9 to 15 feet (3-5 meters), and maximum depth is 2 feet (61 cm). The bottom sediments are soft and unconsolidated, supporting low numbers and diversity of macroinvertebrates. Minimal water flow and decomposing leaf litter act to suppress dissolved oxygen levels, explaining the very low numbers and diversity of fish. Lack of freshwater flow, suitable substrates, and tide would prevent successful spawning of migratory fishes upstream of the pond.

4.4 Land Use

An initial review of area land use through New Castle County Department of Parks and Recreation information shows that generally the area is zoned industrial or commercial. The area to the north of the Army Creek Superfund Site is a mixed commercial/residential strip development, with some areas identified as future industrial parks. Several parcels, adjacent to the Army Creek Superfund Site or in the lower portion of the watershed, are composed of degraded upland habitat that could be acquired for restoration purposes. The DS & G is located adjacent to Army Creek in proximity to the Army Creek Superfund Site (Figure 2). The DS & G consists of 4 areas in which wastes were disposed. However, none are located in the floodplain of Army Creek (Attachment B). Remedial actions at the DS & G include removal and disposal of buried drums, contaminated soils, and pumping and treating ground water. Although the impact of DS & G on Army Creek and pumped recovery well water is not separable from Army Creek Landfill based on available information, remedial activities to remove the threat of the DS & G site to Army Creek will not affect the restoration activities proposed in this Environmental Assessment. A second degraded parcel, the Wilson site, is adjacent to the marsh on the north side of the upper end of Lower Army Creek. This site is not in the floodplain of Army Creek. Between 1960 and 1976, the Wilson Contracting Company disposed of construction debris on the site. Trustees reviewed information available on disposal practices and contaminants present on the parcel. The effects of the Wilson site are highly localized and are of little consequence to Lower Army Creek Marsh (Section 2.5.2, Attachment B).

Residential developments are located south, southwest and northwest of

the Army Creek Superfund Site. In addition there are scattered residences east of the Site. Residential development in the area directly south of the Site is expected to increase the population in the future.

Designated uses of Army Creek are secondary contact recreation, fish and wildlife propagation, and agricultural water supply. The soils surrounding Army Creek and upstream of the Site are considered prime agricultural soils, although they are not currently used for agriculture. There is no prime farmland downstream of the Site.

In summary, the Army Creek watershed is a degraded system with low flow except for augmentation from pumped ground water and occasional runoff from storm events. The ecosystem is isolated from the Delaware River by prohibiting tidal inflow through a tidegate at the mouth of Army Creek. Upland and wetland habitats in the watershed are degraded by two superfund sites and intense human development. Fish and wildlife utilize the area but at reduced levels because of habitat limitations. The habitat limitations are, at least, in part, a result of operation of the landfill and subsequent remediation. Degraded habitats exist in the watershed that are identified as candidates for restoration actions.

Comparison of Alternatives and Significant Issues

SIGNIFICANT ISSUES

Alternatives	Potential for Continued Injury Post Remediation	Change in Water Table After Pumping Ceases	Contaminant Input from Road Runoff and Landscape	Mosquito Control
On-Site Restoration	Enhances ecological diversity by meeting goals of Appendix B earlier. Lower Creek slightly contaminated, opening creek may further decrease contamination. Lessens injuries.	Not sure what water table will do after cessation of pumping. Lateral leachate from landfill may (but not likely) affect the pond. EPA will remediate if lateral leachate affects pond. A gravel crossing impounds the pond minimizes potential adverse effects on Lower Army Creek.	New Castle is in the process of developing a plan to treat runoff. Acquiring land in watershed will allow stormwater treatment technologies to be used.	Earlier restoration reduces chemical control of mosquitoes.
No Action	No Change; Site injuries continue and may never be addressed.	Water table level in Army Creek independent of alternative.	No control of landscape inputs. Continued metals input into Army Creek watershed because the county or DELDOT may not address.	No change from current control.
Restoration Outside Watershed	Replaces natural resources with equivalent elsewhere (i.e. not at site). Site injuries continue and may never be addressed.	Not affected by site geo-hydrology	Continued metals input into Army Creek watershed because the county or DELDOT may not address.	No change from current control in Army Creek. Could enhance mosquito control elsewhere.

5.0 Environmental Impacts of the Proposed Action and Alternatives

5.1 Socioeconomics

5.1.1 No Action

Under this alternative, natural resources at the Site will remain in a degraded state with no replacement of habitat or improvement in resource value. In the absence of restoration the area is likely to have limited recreational or educational opportunities and is unlikely to attract the interest of groups that could serve as land stewards. Without restoration, services provided by the watershed (e.g., nursery habitat for fish, resting habitat and food for migratory birds, and improved water quality) will be available but very limited. Also, with no restoration, the state must continue mosquito control in Lower Army Creek using a chemical-intensive control strategy.

5.1.2 Restoration Action Outside of the Watershed

Restoration actions outside the watershed would involve enhancement of existing wildlife management or natural areas. These enhancements would be protected by easements. The effects will be similar to those for restoration actions within the watershed (Section 5.1.3), but would occur in a different location chosen using upland selection criteria in Attachment A. Restoration may enhance areas where this activity occurs, but would not benefit or correct deficiencies in habitat or services that they provide in the Army Creek watershed. Restoration outside of the watershed would not enhance water quality in the Army Creek watershed. This alternative produces little or no economic benefits at Army Creek.

5.1.3 Restoration Action Within the Watershed

Choosing this alternative provides for the most rapid rehabilitation of habitats, and fish and wildlife populations affected by Army Creek Superfund Site. On-site restoration activities, such as providing bird nesting boxes would attract wildlife, and opportunities for wildlife observation and photography in the watershed. Such actions would be

likely to increase the aesthetic value of the area and may result in nearby residential areas becoming more desirable places to live.

Restoration activities might result in local environmental, educational, or neighborhood groups taking an interest in the property and providing stewardship and management for the area.

The restored area could serve as a fish nursery and provide increased food and cover for migratory birds and mammals and perhaps some increases in the Delaware Bay fishery. The majority of marsh acreage along the Delaware River between the C & D Canal and the Pennsylvania border have tidegates. By retrofitting the Army Creek tidegate, Army Creek will be open to migratory fish use, thus eliminating another impassable barrier to fish use along this portion of the river. The economic value of the contribution to the fishery from Army Creek is unknown, but probably very small. However, an increase in nursery area in Delaware has potential to increase the current level of fish production in the bay.

Rehabilitating Army Creek will enhance biological control of mosquitoes in 225 acres of marsh, reduce release of pesticides to the environment, and reduce costs of chemical control. By retrofitting the tidegate to allow managed tidal flooding in addition to ebb flow, control of water levels in Army Creek Marsh is expected to increase the fish population in the marsh which will eliminate many parts of the marsh as mosquito breeding habitat. Managing marsh water levels (Figure 3) will increase the ability to control mosquito populations without relying heavily on chemical insecticides. Flooding the wetland should not be considered the final act of restoration. The introduction of biological controls and a more diverse marsh ecosystem will help to control potential mosquito problems. Use of biological controls will reduce the cost of state mosquito control programs and the adverse effects of pesticides on non-target natural resources.

Increases in the wetland areas regularly flooded by restoration activities should not limit the use of the surrounding land or affect changes in present land uses. Managed maximum pool level could be kept at a level below 100% marsh surface inundation (Figure 3), thus not affecting adjacent uplands. Planning to accommodate flood events will determine tidegate design.

5.2 Geology-Hydrology

5.2.1 No Action

Trustees anticipate no effects on the geo-hydrology in the absence of on-site restoration activities.

5.2.2 Restoration Action Outside of the Watershed

Effects would occur in other watersheds and would depend on types of restoration activities being considered. However, the injuries in the Army Creek watershed would remain.

5.2.3 Restoration Action Within the Watershed

On-site restoration will involve upland and wetland habitats and will not involve earth-moving. Trustees anticipate no effects on the geo-hydrology as a result of restoration activities. Prior to high-volume pumping of ground water, initiated in 1973, Army Creek was receiving water from both the Columbia and upper Potomac aquifers (Dunn Geoscience Corp. 1987, as referenced in Focused RI [Jan. 1990]). Pumping has lowered ground water levels in the vicinity of the Site and, as a consequence, 88-93% of Army Creek flow recharges ground water through its channel bed (Focused Remedial Investigation 1990). This conclusion, which is thought to be too high by DNREC, is based on the net difference of surface water inflow (0.0345 cfs), imported ground water discharge (1.784 cfs), surface runoff (0.15 to 0.23 cfs), surface water outflow from the pond (0.109 cfs), and evaporation (0.033 cfs).

The ground water-wetland connection between the Site and Lower Army Creek Marsh is not defined (Attachment B). Trustees do not know of any pathway between ground water and the lower marsh which transported contaminants from the Site to the marsh. Available data indicate that the predominant flow in the stream and marsh is via surface water and that ground water discharge to the marsh does not occur. The lower marsh has no tidal influence at this time. This alternative will return tidal influence and slightly increase the salinity of the marsh. Because

managed elevations of marsh levels produced by the tide must be less than the elevation at the Site, Trustees do not anticipate a problem from salt water intrusion.

5.3 Ecology

5.3.1 No Action

In the absence of wetland restoration, there will not be a return of tidal flow to the Army Creek system. Therefore, the system will continue to be unavailable as nursery and feeding habitats for migratory and estuarine fishes. While the ground water remedy continues (pump and treat), freshwater flow in the creek and marsh will be fairly constant except after storm events. After the pump and treat remedy ends, the marsh will become more stagnant because flow in Army Creek is intermittent.

Without restoration, services such as nursery habitat for migratory and estuarine species of fish will not be available; and resting habitat and food for migratory birds, and improved water quality will be very limited. The natural resources of this watershed will be very limited and contribute very little to the Delaware Bay ecosystem.

In the absence of upland restoration, capping and maintenance of the cap will produce a simplified grassland on approximately 60 acres of land in the watershed. The services of forest buffers along Army Creek could moderate water temperatures of the stream and filter runoff from surrounding lands. These services would not develop in this alternative. The question of stewardship of these lands to control future activities in this watershed is uncertain because interest in promoting active stewardship would be much lower in an unrestored watershed. This alternative should have no effect on ground water. If lateral leachate problems develop after remediation, EPA is committed to address these problems with follow-up remediation. At present, natural resource values in the Army Creek ecosystem are limited and will not increase without active restoration. In this alternative, the Army Creek watershed would remain a simplified, partially isolated community that does not fulfill its potential role in the Delaware River drainage basin. At this time, no other restoration plans for the Army Creek watershed are planned.

Mosquito production will probably remain the same as present. State-of-the-art mosquito control technologies will continue with reliance on chemical insecticides, that may be detrimental to non-target wildlife species.

5.3.2 Restoration Action Outside of the Watershed

In this alternative, areas outside the Army Creek watershed would experience effects (benefits to fish and wildlife) similar to those produced by restoration within the Army Creek watershed. Upland restoration undertaken adjacent to existing protected lands/wildlife habitat might increase the diversity of the forest community. Wetland restoration actions outside of the Army Creek watershed will be designed to benefit fish and wildlife in ways that are similar to those in the proposed action. To acquire easements or fee title to lands off-site, monies from the Army Creek settlement will be needed. However, Trustees will need to establish that the contaminants status of the site is suitable for restoration which reduces the monies available for actual restoration of resources.

Acquisition in such areas might increase the productivity and stability of the habitat that is restored. Selection of areas outside the Army Creek watershed might reduce the potential exposure of wildlife to residual contaminants. However, in this alternative, the Army Creek watershed would remain a simplified, partially isolated community that provides natural resource habitat and services at less than its full potential to the Delaware River drainage basin. At this time, no other restoration plans for the Army Creek watershed are planned.

5.3.3 Restoration Action Within the Watershed

Existing data were reviewed by technical staff to ascertain the condition of fringe wetland between the cap and Army Creek, Army Creek Pond, Lower Army Creek itself, and Lower Army Creek Marsh and potential risks to biota from contaminants related to the Army Creek Superfund Site. Trustees concluded that levels of site-related contaminants in Lower Army Creek and Lower Army Creek Marsh were not injurious to fish and

wildlife and that restoration of these habitats could occur (Attachment B). However, Trustees concluded that the levels of some site-related contaminants are potentially injurious to fish and wildlife in fringe wetland between the cap and Army Creek Pond, and in Army Creek Pond; therefore, Trustees decided that it is inadvisable to conduct restoration in these fringe wetlands and Army Creek Pond at this time (Attachment B). This decision is based on the fact that attracting wildlife to a restored area with unacceptable levels of contaminants is undesirable.

The decision to delay restoration in fringe wetland between the cap and Army Creek Pond, and Army Creek Pond is in agreement with a decision made by EPA and the responsible parties regarding the need to remediate Army Creek Pond now. Monitoring the success of remediation actions (the Five Year Remedial Evaluation) is planned, at which time EPA will decide on the need for further remedial cleanup. However, remedial measures may not address contamination problems for fish and wildlife in Army Creek Pond and might leave levels of contamination that the Trustees consider unacceptably high in Army Creek Pond.

Additional upland restoration must occur at other upland sites in the watershed. Trustees will plan to acquire property interests (fee or easements) in appropriate parcels. These sites will have the potential to provide restoration opportunities equivalent to those injured at the Site. Upland restoration activities, such as placing bird nesting boxes on-site, planting trees, and stream stabilization will result in increases in habitat value. It is possible that restoration activities would result in local stewardship of the land, and additional benefits to wildlife. It is unlikely that on-site contaminants will affect upland habitats because they should be contained beneath the cap and, therefore, be inaccessible to wildlife. Restoration of upland habitat in the Army Creek drainage basin could improve water quality in the Army Creek watershed by buffering the marsh and stream, and improve storm water retention.

A water management plan that returns tidal exchange to Lower Army Creek will be developed. The combined effect of ground water pumping during remediation and replacement of the tidegate will slightly increase salinity in the wetland. One plant species of concern to Delaware Natural Heritage Inventory, Torrey's rush (Juncus torreyi) is found in Army Creek

marsh. The DNHI designates Torrey's rush as an "S1" species (i.e., State Species of Special Concern [1= most concern]), found to date by DNHI in two other locations in the state, both of which are also believed to be disturbed sites. Although the proposed water level management for Army Creek Marsh may adversely affect Torrey's rush, the maximum proposed water level increase is modest (about 1 foot above present average marsh water level). The increase in water level has potential to create habitat elsewhere in the watershed similar to lost rush habitat allowing this plant to persist locally.

A vegetation management plan will be developed to control Phragmites and replace it with native salt marsh vegetation with high value for fish and wildlife in the portion of the marsh with tidal flow. Phragmites is an exotic species with low resource value which displaces native species. With adequate volume, marsh water levels, and riverine tidal exchanges, Lower Army Creek may provide valuable nursery and feeding habitats for both resident and migratory fishes, such as striped bass, white perch, largemouth bass, yellow perch, black crappie, catfish, weakfish, and spot. Several of these species occur in the Delaware River but not in Army Creek at present (Attachment B). These species would have increased access to Army Creek. Increases in fish populations and vegetation management will increase available food for birds, mammals, and reptiles. These restoration activities should benefit ospreys, a species of special concern to the State of Delaware, by increasing both the quality and quantity of their foraging habitats. Also, this would increase/expand long-term productivity of the restored marsh. Tidal exchanges may result in slight decreases in the freshwater fish community and spawning areas for amphibians. The Proposed Alternative is not likely to affect the shortnose sturgeon which may visit the Lower Army Creek marsh occasionally (Attachment B).

Replacement of the current tidegate will allow for greater control of mosquitoes by nonchemical means. Fish populations are expected to increase and to have greater access to those areas of the marsh where mosquitoes breed. Rehabilitating Army Creek will enhance biological control of mosquitoes in 225 acres of marsh and reduce costs of chemical control and reduce release of pesticides to the environment. The introduction of biological controls and a more diverse marsh ecosystem will help to control potential mosquito problems.

Roadside runoff contamination of the marsh may continue if it is not abated, thus exposing animals attracted to the restored area to runoff contaminants (Attachment B). Management of roadside runoff will be necessary to prevent further degradation of wetland/stream areas.

5.4 Land Uses

5.4.1 No Action

In the No Action alternative, land use at the Site and in the Army Creek drainage may not change from the current state in which land in the marsh is in low quality uses. Several areas in proximity to the Site are zoned industrial or commercial and are left in an unmaintained state. It is likely that these areas will continue to degrade. In some cases, these sites are degraded by misuse of the land and impair the natural resources of the watershed.

Land use in surrounding areas is unlikely to change. However, development within the land use categories may continue. Aesthetics and quality of life in this area would not improve as long as current land use in the watershed allows for a slow transformation to more degraded conditions. No long term stewardship is likely for the Site and the surrounding area if restoration is not conducted.

5.4.2 Restoration Action Outside of the Watershed

The effects of restoration actions outside the watershed are likely to be similar to the effects of restoration within the watershed, but will occur in a different location.

5.4.3 Restoration Action Within the Watershed

In this alternative, land use changes will be necessary to allow for restoration to proceed. The scope of this alternative calls for re-introducing tidal flows in Lower Army Creek marsh and for developing upland habitats in the Army Creek watershed. An early step to restore the marsh requires refitting the tidegate downstream of Route 9. Control of

water levels with this tidegate will cause changes in vegetation and increase the resource values of the marsh. This action will change surface hydrology of the marsh itself but should not change present land uses. Upland restoration actions require that Trustees gain landowner cooperation for the ability to change these habitats and control the use of these lands in perpetuity to restore natural resource losses at this Site.

6.0 List of Organizations Consulted

William Rector, New Castle County Department of Parks and Recreation,
New Castle, Delaware

Robert Hossler, William Meredith, Chester Stachecki, Delaware
Department of Natural Resources and Environmental Control, Dover,
Delaware

Timothy Goodger, James Thomas, Kirsten Erickson, National Oceanic and
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John Organ, Ralph Abele, Daniel Murphy, Fish and Wildlife Service
Marcia Gittes, U.S. Department of the Interior, Newton Corner, MA
Dr. John Cairns, Jr., Virginia Polytechnic Institute and State University,
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7.0 Comments

8.0 List of Staff Preparing Environmental Assessment

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ATTACHMENT A

UPLAND ACQUISITION PROCESS

The following outline presents the land acquisition process to be used for acquiring upland or wetland property, to help meet natural resources compensation needs identified by the Army Creek Natural Resources Damages Trustees. The procedure is based upon the process used by the Delaware DNREC to acquire public property, and incorporates guidance criteria developed by the Army Creek NRD Trustees. The Trustees' guidance criteria are to help evaluate and select property for acquisition, rehabilitation, and protection, in order to help compensate for natural resource losses caused by contamination problems (and their remediation) at the Army Creek Superfund Site.

1. Determine ownership of potential parcels.
 - A. Complete GIS mapping showing tax parcels for each potential acquisition site.
 - B. Complete ownership list for each tax parcel.
 - C. Prepare preliminary list of potential acquisition sites, considering guidance criteria developed by Army Creek NRD Trustees, i.e., size, location, natural resources, utilization, etc.
2. Select sites for acquisition negotiations.
 - A. Visit each potential site on potential list.
 - B. Rate individual properties in accordance with the attached guidance criteria developed by the Army Creek NRD Trustees.
 - C. Select site(s) for acquisition after consideration of several factors, including but not limited to: 1) Trustees' guidance criteria to address environmental

compensation needs; 2) willingness of owner to negotiate or sell; 3) willingness of a public agency or private conservation group to assume the primary responsibility for a site's long-term management needs; 4) value for the dollar in meeting Trustees' compensation criteria and other public needs related to environmental resources (i.e. return on investment); etc.

3. Commence negotiations.

A. Not less than one appraisal report shall be furnished for the site being negotiated.

(1) Each Appraisal must be completed in accordance with Uniform Appraisal Standards for Federal Land Acquisitions.

(2) Owner may also obtain an appraisal that meets

Rating Criteria for Upland Site Selection

Trustees have considered different mechanisms for replacing upland habitat lost at Army Creek. These options include purchase of the land or purchase of easements so that restoration or rehabilitation activities can take place. The goal of replacing upland habitat is to replace the equivalent function of the losses that resulted from remediation activities on-site. Purchase of the land or easements on the land will allow us to begin rehabilitation or restoration activities. A conservation easement is the most cost effective way to replace the upland habitat that was destroyed with a similar habitat with equivalent functions.

According to the U.S. Department of the Interior Natural Resource Damage Assessment; Notice of Proposed Rulemaking, 43 CFR Part 11 (1991), there are three options that are available to the trustees to mitigate damaged ecosystems. They are, in descending order of importance, restoration, rehabilitation, and replacement/acquisition of the equivalent of the damaged resource. In many cases, successful mitigation involves taking some combination of these actions rather than only one.

The Army Creek Natural Resources Trustee Committee has considered the option of upland habitat restoration as part of the overall restoration plan for the Army Creek Superfund Site (Site). Trustees used specific characteristics to define upland habitat. The soils of upland habitat are dry or moist but not wet during most of the year (Rodgers et. al., 1976). Upland habitat is an area of residence for an animal or plant species or community of species. Types of upland habitat include ridges, upper slopes, mid slopes, lower slopes, and well drained stream terraces.

Trustees considered several options for restoration of upland habitat destroyed during remediation of the Site:

Restoration on-site, which would return the site to its original undisturbed condition;

Rehabilitation on-site, which would restore some of the functions and species of the original upland habitat; and

Replacement/acquisition, which would involve the acquisition of the equivalent of the damaged upland habitat elsewhere.

In order to devise a means to select upland habitat, the committee developed criteria to be used in judging the value and suitability of habitat to the restoration process. The criteria represent an untried method that was developed from appropriate literature and through consultation with restoration ecologists. This methodology represents a logical, decision based process that serves as the basis that the committee will use to select an upland habitat site. To develop this method as proven technology will require deliberate unbiased application of all criteria included in the method. Results of application of this method will need to be tested to develop a consensus on the value, strengths and weaknesses of this selection process.

All combinations of the options listed above were considered for the mitigation of Army Creek Superfund Site. The remediation alternative, a grassy RECRA cap, has altered the ecosystem so that any further restoration or rehabilitation of upland habitat is impossible. Consequently, a decision was made to consider acquiring and

rehabilitating a habitat that is similar to the original upland habitat.

Following is a brief discussion of the proposed criteria for choosing sites for acquisition with rehabilitation. These discussions help to describe specific characteristics that distinguish between desirable and undesirable attributes. These discussions present the optimal characteristics for each criteria. It is expected that some criteria at each site will not be satisfied. Sites will be evaluated to determine whether they do not satisfy, partially satisfy, or totally satisfy a given criteria. Results will be tallied using the criteria table. The site with the highest resulting score will be chosen if possible - if not available, the site with the next highest score that is available will be chosen.

The area chosen for rehabilitation should be located within 5 miles of other preserved mature upland areas to which it is connected by a mature upland corridor or an area through which upland interior species can safely permeate (Schroeder *et al.* 1992), such as an early successional forest or a bottomland forest which can serve as sources to replenish species lost at the site (Table I, 1) (Cairns and Pratt 1992). Corridors or high permeation areas can supply mechanisms for easy transportability of spores, eggs, larvae, seeds, flying adults, walking adults, etc. from unaffected areas to the newly rehabilitated area (Cairns and Pratt 1992). There should be a low probability of present and future disturbances to the habitat by human influences (Table I, 2) (Usher 1986). The area should not be totally surrounded by highways and housing developments or designated in the local (county) master plan for future intense commercial, industrial, or residential development.

The acquired lands should be large enough to be relatively self-supporting and sustain diverse populations of interior as well as edge species after rehabilitation (Table I, 3) (Usher 1986). The disturbed area at Army Creek Landfill encompasses approximately 60 acres. In a model for bottomland forests Schroeder *et al.* (1992) suggested that hardwood tracts of up to 40 acres contain no interior dwelling bird species (Blake and Carr 1984), hardwood tracts of greater than 40 acres but less than 250 acres regularly contain interior dwelling bird species (Blake and Carr 1984), areas with between 250 acres and 7400 acres showed at least an 87% frequency of occurrence of some interior bird species (Temple 1986)

(Blake and Carr 1984), and at least 7400 acres are needed to contain all interior breeding birds in the mid-atlantic region (Robbins et al. 1989). While the habitat of concern at Army Creek is upland forest, the bottomland hardwood forest model can be applied when discussing the relationship between self-supportiveness, tract size, and species richness. Any lands acquired should encompass at least 60 acres in the aggregate. Individual tracts of less than 60 acres may be acquired if the total area of all tracts equals 60 acres.

The area should be circular rather than oblong in order to have a large interior area that is removed from outside disturbances which can affect the health and well being of many species and meet the habitat requirements of interior dwelling species (Table I, 3) (Diamond 1975). However, shape may be irrelevant for interior species if the site is not a few hundred hectares in size (the Army Creek disturbed upland area is 60 acres or approximately 24 hectares) (Organ 1993).

The loss of upland habitat adjacent to Army Creek removes functions of riparian habitat that buffer the stream and improve its water quality. Replacing these functions in the stream system is an important consideration (Table I, 4). Army Creek eventually flows into the Delaware Bay. Improving and maintaining the water quality in Army Creek is important to overall water quality and to anadromous fish (fish which ascend rivers to spawn) that live and spawn in the Delaware Bay watershed.

The original Army Creek upland habitat contained small pockets of wetlands. The acquired and rehabilitated lands should contain wetland pockets similar to those that existed on the Army Creek Superfund Site prior to the disrupting force. The total resulting wetland area should be equivalent to what was lost (Table I, 5).

The general condition of the habitat that resulted from the action of a damaging force should be good enough to insure successful rehabilitation (Table I, 6) (Cairns and Pratt 1992). Residual toxicants and other human induced stresses should exist at minimal levels if at all (Cairns and Pratt 1992). The chemical and physical condition of the habitat should be healthy enough to insure recolonizing by plant and animal species to

effect a quick and efficient recovery of the damaged ecosystem (Cairns and Pratt 1992). Terrestrial soils, surface and ground water, and aquatic sediments should meet criteria or descriptors contained in documents like Evaluating Soil Criteria (Beyer 1990), Quality Criteria for Water (EPA 1986), and The Potential For Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program (Long and Morgan 1991).

There should be a low probability of undesirable side effects of rehabilitation (Table I, 7) (Cairns 1985). If not carefully designed, rehabilitation efforts can have further detrimental effects on the damaged lands as well as the surrounding lands. An effort should be made to use rehabilitation methods that have been proven to work with this type of habitat in the past. Prior to the initiation of the rehabilitation process, planners should be able to explicitly state the goals of the rehabilitation and scientifically predict the results (Cairns 1985).

A damaged ecosystem can be rehabilitated so that it aids in the restoration of a locally or regionally endangered species (Table I, 8) (Cairns 1986). The small-whorled pogonia is a woodland plant that is rare in Delaware that could benefit from the acquisition and rehabilitation of an area to upland woodland habitat.

Rehabilitation should be controlled by a management structure or organization with responsibility for monitoring the state of the system through time and introducing species or assisting in colonization (Table I, 9) (Cairns and Pratt 1992). The development of a rehabilitation plan and identification of the parties responsible for the rehabilitation should occur prior to initiation of the on-site rehabilitation procedures. The cost of rehabilitation and future monitoring and maintenance should be realistically affordable and acceptable (Cairns 1990).

Army Creek is an important tributary of Delaware Bay. Upland habitat provides an inherent benefit to a stream system by buffering it from outside interferences. Because of the loss of upland habitat adjacent to Army Creek and the buffering that it affords, there may be direct adverse effects on the water quality of the creek and Delaware Bay. This increases the possibility of deleterious effects on many species of

wildlife including anadromous fish. The trustees place highest priority on acquisition and rehabilitation candidates within the Army Creek watershed and will use the criteria in the table to choose a replacement for upland habitat that was lost as a result of remedial activities.

The following table contains the criteria for Acquisition with Rehabilitation which are discussed above. This list can be used to rank the various candidates for possible acquisition and rehabilitation. Zero (0) indicates that a candidate does not satisfy the criteria, the second number signifies that the candidate partially satisfies the criteria, and the third number signifies that the candidate completely satisfies the criteria. The more important criteria have been assigned higher numbers than secondary criteria. The scores for each criteria are totalled at the bottom of the table to determine whether a site falls into the good, moderate, fair, or poor ranges. The site that successfully satisfies the most criteria will score the highest.

The Council chose a relatively simple ranking scale based loosely on those developed by Cairns in several papers. A site with the highest total score will be considered to satisfy 100% of the criteria. The remaining sites will proportionately ranked by dividing by the numerical rating of the site with the highest score. A score in the good range is equivalent to a grade of 80% of the highest score or better. Moderate scores fall between 60% and 80% of the highest score. Fair scores are between 40% and 60% and poor scores are less than 40%. No sites that score below the moderate range (60th percentile) will be considered for acquisition and rehabilitation by the Council.

Table I. Criteria to be used in selection of a site for acquisition with rehabilitation.

<u>CRITERIA</u>	<u>RANK</u>		
1. The area is no further than 5 miles from unaffected areas that can serve as species sources with opportunities for transport of propagules and dissemules (spores, eggs, larvae, seeds, flying adults, etc.) to the site through corridors or high permeability areas.	0	2	4
2. There is a low probability of present or future disturbance.	0	2	4
3. The size and shape of area is: -60 acres or more -circular rather than oblong	0	2	4
The habitat is located on or adjacent to Army Creek and, therefore, aids in water quality and maintenance of anadromous fish populations.	0	2	4
5. Wetlands pockets. The site contains small wetlands pockets similar and equivalent to those existing on the Army Creek Superfund Site prior to degradation.	0	1	2
6. The chemical and physical condition of habitat following the damaging force is acceptable based on the appropriate criteria.	0	1	2
7. There is a low probability of undesirable side effects of rehabilitation.	0	1	2

8. The habitat can be rehabilitated in such a way as to help endangered species. 0 1 2
9. Organizational capabilities exist for immediate and direct control of the restoration effort and the cost of rehabilitation and future monitoring is affordable and acceptable. 0 1 2

Total: >20 = Good, 16-20 = Moderate, 10-15 = Fair, <10 = Poor

Table II. Criteria to be used in selection of a site for acquisition.

<u>CRITERIA</u>		<u>RANK</u>		
1.	The diversity of the site contributes to regional and/or national species and habitat diversity.	0	2	4
	-species and genetic richness	0	2	4
	-variation of species function	0	2	4
	-number and inter-connectivity of trophic levels	0	2	4
2.	The size and shape of the area is:			
	-60 acres or more	0	2	4
	-20 to 59 acres	0	2	
	-Circular rather than oblong	0	2	4
3.	The geographic location is:			
	-On or adjacent to a wetland or riparian area	0	2	4
	-On or adjacent to migratory corridors of waterfowl	0	2	4
	-On or adjacent to endangered species habitat			
	-On or adjacent to wildlife habitat	0	2	4
	-Adjacent to other protected areas	0	2	4
	-On or adjacent to Army Creek	0	2	4
4.	Purpose. The area serves the desired purpose in spite of any future intense development in the area surround the site.	0	2	4
5.	Naturalness. There is no human disturbance originating on or off site.	0	2	4
6.	Representativeness. The site provides mature upland wildlife habitat.	0	2	4
7.	Rarity. Rare, endangered, or unusual species			

and/or habitat on the area:

-Federally listed rare and endangered species

0 2 4

-Species of state concern

0 2 4

-Rare habitat

0 2 4

8. Management. The site is easily managed to limit degradation for the future:

-By existing management nearby

0 2 4

-By potential for management

0 2 4

9. Wetlands pockets. The site contains small wetlands pockets similar and equivalent to those existing on the Army Creek Superfund Site prior to degradation.

0 2 4

Total

>68 = Good, 50-67 = Moderate, 34-49 = Fair, <34 = Poor

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