Four Mile Run Watershed, Virginia
Section 905(b) (WRDA 86) Analysis

August 2002

US Army Corps of Engineers, Baltimore District

Four Mile Run Watershed, Virginia
Section 905(b) (WRDA 86) Analysis

Executive Summary: Due to frequent flash flooding in the 1960's and 1970's in the City of Alexandria and Arlington County, Virginia, the Corps initiated a feasibility study of Four Mile Run in 1969. In 1980, the Corps constructed a local flood protection (LFP) project on Four Mile Run providing protection from flood flows of 27,000 cubic feet per second (cfs) on Four Mile Run and fluvial and tidal backwater stages from the Potomac River. The project features levees and floodwalls with associated interior drainage facilities, an improved channel, and addition of and modification to several highway and railroad bridges.

In recent years, the non-Federal sponsors of the project, the City of Alexandria and Arlington County, have questioned the stage-frequency curves the Corps used for design of the Four Mile Run local flood protection (LFP) project. Based on the availability of a greater period of hydrologic flow data, they suggest that the project is "overdesigned" at present, providing a greater level of flood protection than necessary or justified. The city and county are interested in environmental enhancements to the flood protection project, and contend that environmental project modifications would not jeopardize the authorized project's level of flood protection.

In the Energy and Water Appropriations Bill of 2002, the Corps was authorized to undertake a reconnaissance study of flood control needs and environmental restoration opportunities within the Four Mile Run watershed. The purposes of this reconnaissance study are: (a) to determine whether there is a Federal interest in implementing a project or projects in the interest of environmental restoration, wetlands creation and protection, habitat improvement, and flood protection within the Four Mile Run watershed; (b) scope one or more project management plans focused on environmental enhancements and flood protection in the Four Mile Run watershed; and (c) negotiate a feasibility cost-sharing agreement(s) between the Corps and non-Federal sponsor(s) to cost-share the feasibility phase 50 percent Federal, 50 percent non-Federal.

Utilizing existing data, the following 905(b) analysis has determined that a potential Federal interest in participating in a project(s) does exist which will provide for environmental restoration within the Four Mile Run watershed and still meet flood control needs. The study team has emphasized a watershed approach in this assessment and has identified the following study goals for the project management plans: 1) restore the historic natural infrastructure of the watershed; 2) enhance, restore and create wetland and wildlife habitat throughout the watershed and improve nutrient removal functions; 3) improve in-stream habitat by restoring natural stream channels and removing fish blockages; 4) reduce incidental flood damages in conjunction with habitat improvement; 5) maintain the authorized level of flood protection provided by the existing Four Mile Run local flood protection project; and 6) determine the need, if any, for additional flood protection within the Four Mile Run watershed.

Alternatives to meet these goals that were identified and evaluated in the study are: wetland creation, restoration and enhancement, hydrologic and floodplain function restoration, in-stream habitat restoration and channel modification, beneficial use of dredged material, land acquisition, master planning for restoration, creation and protection of natural infrastructure, and flood protection and management.

Arlington County, VA and the City of Alexandria, VA have been identified as the non-Federal sponsors of the feasibility phase of this study and have agreed to jointly provide the 50 percent non-Federal share of feasibility costs.

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1. STUDY AUTHORITY

A study of Four Mile Run, Virginia, was authorized by Section 201 of the Flood Control Act of 1965 (Public Law 89-298), as modified by the River Basin Monetary Authorization Act of 1971 and Section 84 of Water Resources Development Act of 1974 (PL 93-251).

More recent authority for the study was given in the Energy and Water Appropriations Bill of 2002, which provided $100,000 "*for the Corps of Engineers to undertake a reconnaissance study of flood control needs and environmental restoration opportunities in Four Mile Run, Virginia*."

Note that the initial authorization for the local flood protection project used "Fourmile Run" to describe the project area. However, the current authorization for this study uses "Four Mile Run," which is also the name used by local governments when discussing this tributary. Therefore, to ensure consistency with the existing authorization and the non-Federal sponsor, the term "Four Mile Run" is used throughout this report.

2. PROJECT LOCATION AND CONGRESSIONAL DISTRICT(S)

The study area is defined as the Four Mile Run watershed, which is located in Northern Virginia and includes portions of four different local jurisdictions (see Figure 1). Four Mile Run rises near Brilyn Park in Arlington County, Virginia, and flows in a southeasterly direction for a distance of approximately 9 miles to the Potomac River. The total drainage area of the watershed is 19.1 square miles, of which 3.2 square miles are within the City of Alexandria, Virginia; 0.6 square miles in the City of Falls Church, Virginia; 13.2 square miles in Arlington County, Virginia; and 2.1 square miles in Fairfax County, Virginia. The Cities of Falls Church and Alexandria are independent communities not within any county.

The study authority is strongly supported by Senator John Warner (R), Senator George Allen (R), and Representative Jim Moran (D, VA-08).

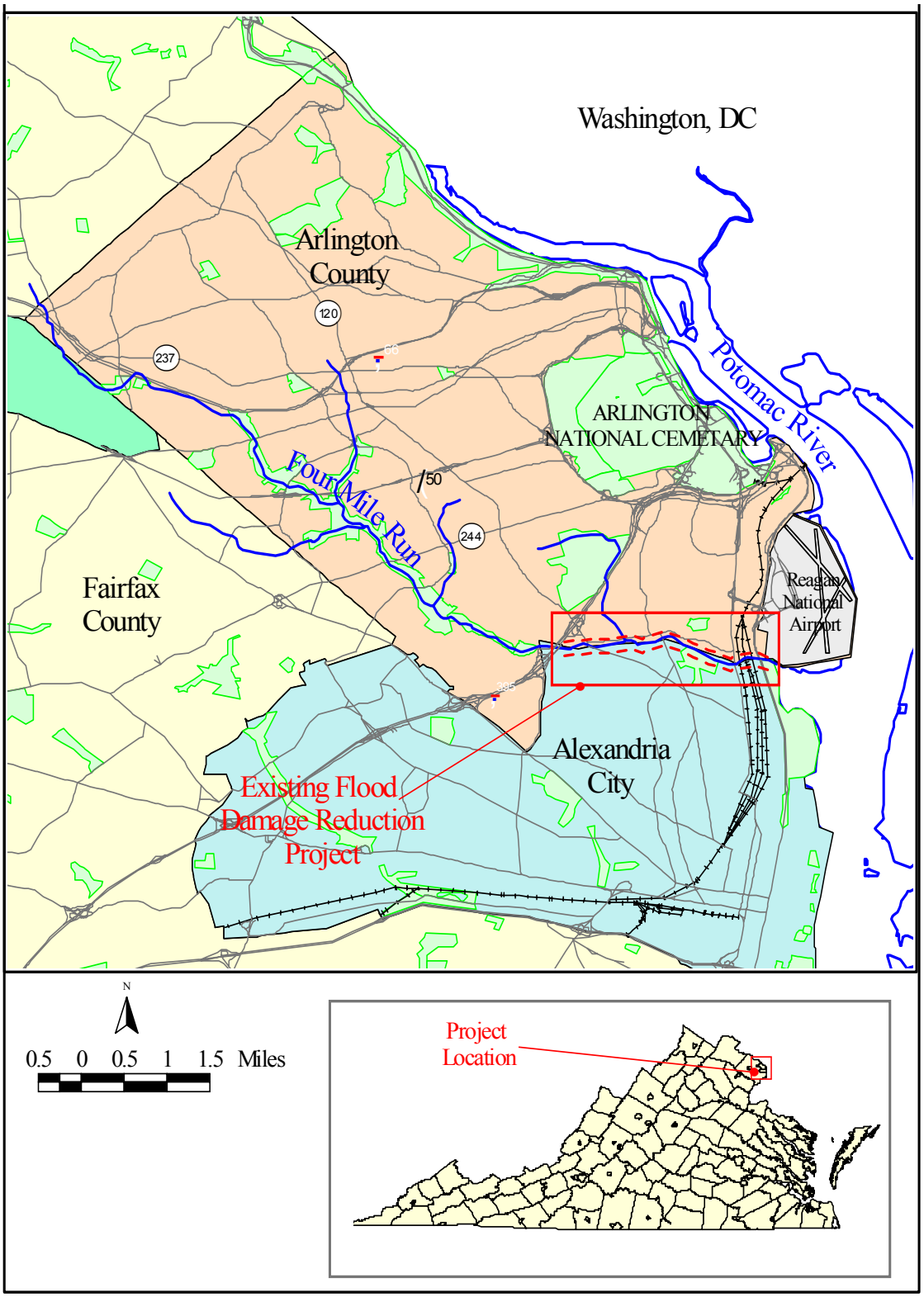

Figure 1- Four Mile Run Study Area

3. STUDY PURPOSE AND DESCRIPTION

The purposes of this reconnaissance study are: (a) to determine whether there is a Federal interest in implementing a project or projects in the interest of environmental restoration, wetlands creation and protection, habitat improvement, and flood protection within the Four Mile Run watershed; (b) scope one or more project management plans focused on environmental enhancements and flood protection in the Four Mile Run watershed; and (c) negotiate a feasibility cost-sharing agreement(s) (FCSA) between the Corps and non-Federal sponsor(s) to cost-share the feasibility phase 50 percent Federal, 50 percent non-Federal.

The Corps completed the existing Four Mile Run Local Flood Protection (LFP) Project in 1980. The project provides protection from flood flows of 27,000 cubic feet per second (cfs) on Four Mile Run and fluvial and tidal backwater stages from the Potomac River having a frequency of occurrence of once in 180 and 1,000 years, respectively. The project features levees and floodwalls, interior drainage facilities, an improved channel, and several highway and railroad bridge modifications.

The non-Federal sponsors for the project were Arlington County and the City of Alexandria. The non-Federal sponsors contend that the Four Mile Run LFP is "overdesigned" based on the greater period of hydrologic flow data now available and have suggested that environmental features could be incorporated into the project without jeopardizing the authorized level of protection. As a result of these findings, the Corps has been directed to investigate methods of restoring habitat within the Four Mile Run watershed, including the upper watershed and the levee corridor. This study will take a watershed approach towards identifying potential projects for the restoration of the environment, including habitat enhancement, restoration of natural hydrology, and improvements to water quality within the Four Mile Run watershed.

4. STUDIES, REPORTS, AND EXISTING PROJECTS

A. Studies and Reports

As previously mentioned, this report uses the name "Four Mile Run" to label the watershed, based on the current authorization for this study. However, the past study references 1 through 5 below reflect the initial authorization title for the watershed, "Fourmile Run."

(1) Fourmile Run, City of Alexandria & Arlington County, Virginia: Review Report on Flood Control. Department of the Army, Baltimore District, Corps of Engineers. September 1969.

(2) Fourmile Run Local Flood-Protection Project, Alexandria and Arlington County Virginia. Design Memorandum No. 1.: Hydrology and Hydraulic Analysis. Department of the Army, Baltimore District, Corps of Engineers, June 1972.

(3) Fourmile Run Local Flood-Protection Project, Alexandria and Arlington County Virginia. Design Memorandum No. 2.: Phase 1 General Design Memorandum. Department of the Army, Baltimore District, Corps of Engineers, August 1972.

(4) Fourmile Run Local Flood-Protection Project, Alexandria and Arlington County Virginia. Supplement to Final Environmental Statement. U.S. Army Engineer District Baltimore, April 1973.

(5) Four Mile Run Local Flood-Protection Project, Alexandria and Arlington County Virginia. Design Memorandum No. 2.: General Design Memorandum- Phase II- Project Design. Department of the Army, Baltimore District, Corps of Engineers, March 1974.

(6) Four Mile Run Local Flood-Protection Project, Alexandria and Arlington County Virginia. Supplement to Final Environmental Statement. U.S. Army Engineer District, Baltimore, March 1974.

(7) Annual Report, Four Mile Run Watershed Management Program. Northern Virginia Planning District Commission, October 1977.

This report summarizes the planning process of the Four Mile Run Watershed Management Program, established in response to the 1974 Federal Water Resources Development Act (PL93-251). It also includes a summary of cumulative flooding impacts from May 1975-March 1977 and projects identified to alleviate flooding conditions within the watershed.

(8) Four Mile Run Stormwater Management Program, 1990 Annual Report. Northern Virginia Regional Commission 1991.

(9) Four Mile Run Water Quality Report, April 1992-March 1993. Northern Virginia Regional Commission 1993.

(10) Arlington County Virginia Watershed Management Plan. Arlington Department of Environmental Services. 2001.

This watershed management plan provides a detailed analysis of all water resources and stormwater management practices within Arlington County and sets management goals based on existing stream conditions, current land use and future land use changes. The plan divides the county into 19 subwatersheds, including three in the Four Mile Run watershed.

(11) Bioengineering in Four Mile Run, Virginia. *Technical Note #43 from Watershed Protection Techniques, 1(4): 173-175*. 2000.

B. Projects

In March of 1974, Congress authorized the Corps to design and construct a project for flood protection on Four Mile Run "to accommodate flood flows of twenty-seven thousand cubic feet per second" (PL93-251, Section 84.) The Four Mile Run Local Flood Protection Project (LFP) was constructed in 1980. The LFP was designed to provide protection from flood flows of 27,000-cfs on Four Mile Run and fluvial and tidal backwater stages from the Potomac River having a frequency of occurrence of once in 180 and 1,000 years respectively. The project features levees and floodwalls, interior drainage facilities, an improved channel for flood capacity, and several highway and railroad bridge modifications. The project non-Federal cost-sharing sponsors were Arlington County, Virginia, and the City of Alexandria, Virginia (see Figure 2).

5. PLAN FORMULATION

A. Existing Conditions and Problems

The Four Mile Run watershed is one of the most heavily urbanized drainage basins in the Northern Virginia region. Within the 20-square mile watershed, 85 percent of land area has been developed and nearly 40 percent of the watershed is covered with impervious surfaces associated with this development. These impervious areas decrease groundwater infiltration and in turn increase the amount of surface water runoff into Four Mile Run. Typical of most urban settings, many of Four Mile Run's natural stream channels have been replaced with an elaborate network of storm sewers. These significant hydrologic changes within the watershed greatly affect the flow conditions and geomorphology of Four Mile Run and its tributaries, causing them to have significant initial flows during rain events. This behavior, common to most urban streams, is described as "flashy." The excessive stormwater runoff from the Four Mile Run watershed quickly makes its way into the Potomac River, and eventually drains into the Chesapeake Bay.

Frequent flash flooding occurred in the Alexandria section of the watershed prior to the completion of the Four Mile Run LFP in 1980 (see Figure 3). This frequent flash flooding has been attributed to the cumulative impacts of development from all four jurisdictions that share the watershed. Residential and commercial areas located between the Potomac River and Interstate 395 sustained over $40 million worth of property damages as a result of seven major floods that ravaged the watershed throughout the 1960's and early 1970's. In 1968, the highest recorded stage flood occurred in Four Mile Run, with an estimated flow of 14,600-cfs and two feet higher than any previous recorded flood in the region. This flooding event led to the initial flood control report for Four Mile Run in September 1969 and subsequent construction of the LFP in 1980. See Figure 4 for existing site conditions in the LFP project area.

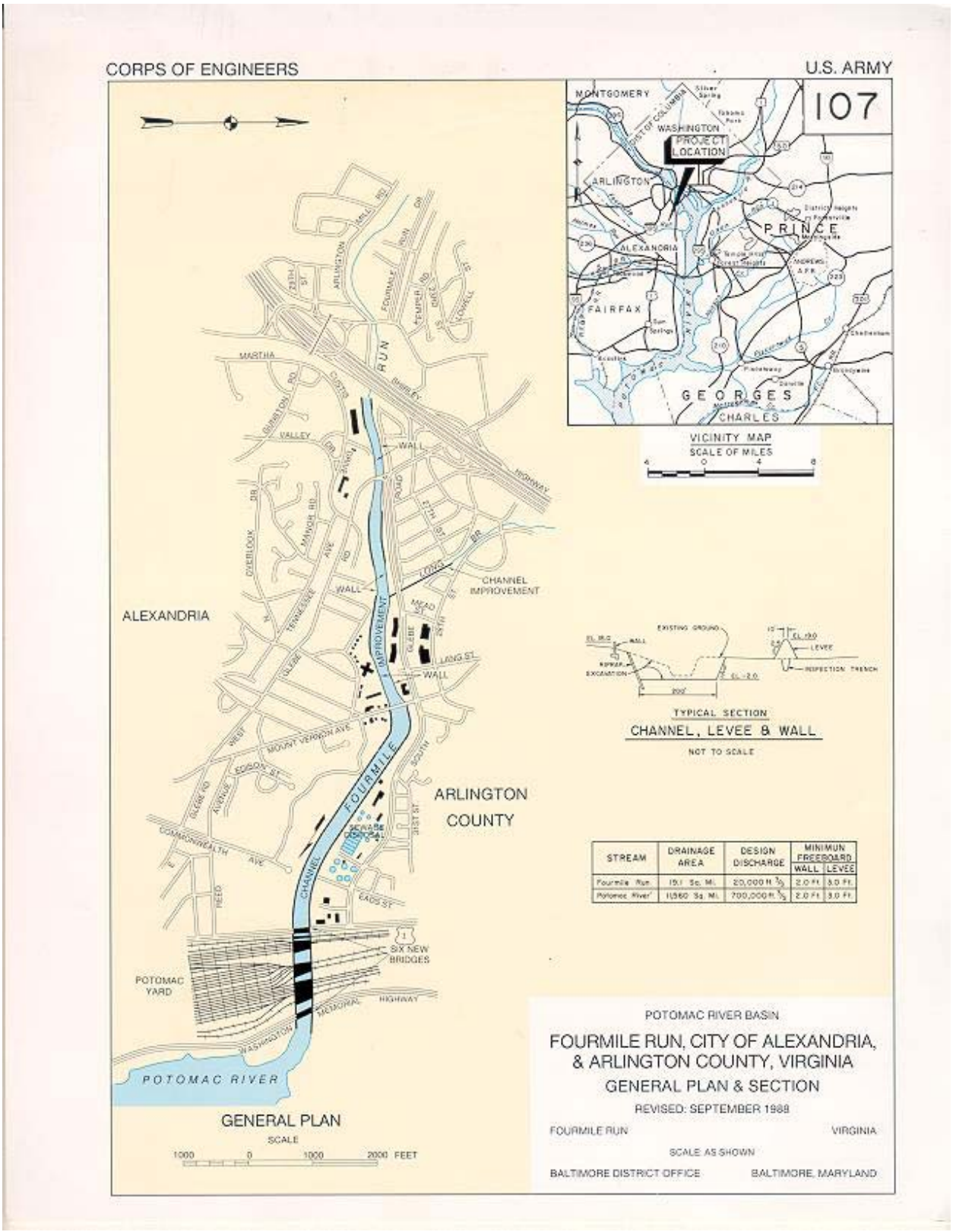

Figure 2 – Local Flood Protection Project General Plan, 1988

Figure 3 - Four Mile Run Flooding, 1975 (prior to Corps Levee Project)

Figure 4- Existing Levee Project Near Route 1

Since the construction of the Four Mile Run LFP, no significant flood damages have been incurred. However, the Four Mile Run watershed has experienced significant habitat degradation resulting from the flood protection project channelization and severe hydrologic changes due to development. The 2001 Arlington County Watershed Management Plan includes an assessment of stream chemical, biological and physical indicators, and rates all reaches within Four Mile Run as "fair" (the rating system consists of four categories: Excellent, Good, Fair and Poor). As a result, the entire Four Mile Run watershed is classified as most impacted. Physical in-stream habitat at Four Mile Run consists of few riffles and pools, little cover structure, and embedded substrate. Riparian habitat is much worse in all reaches, especially in the region of the Four Mile Run LFP, where bank vegetation and forest buffer are almost nonexistent and the streambed has been extremely altered from its original natural conditions. This change in pattern and profile has led to major sedimentation in the channel where Four Mile Run enters the LFP project area.

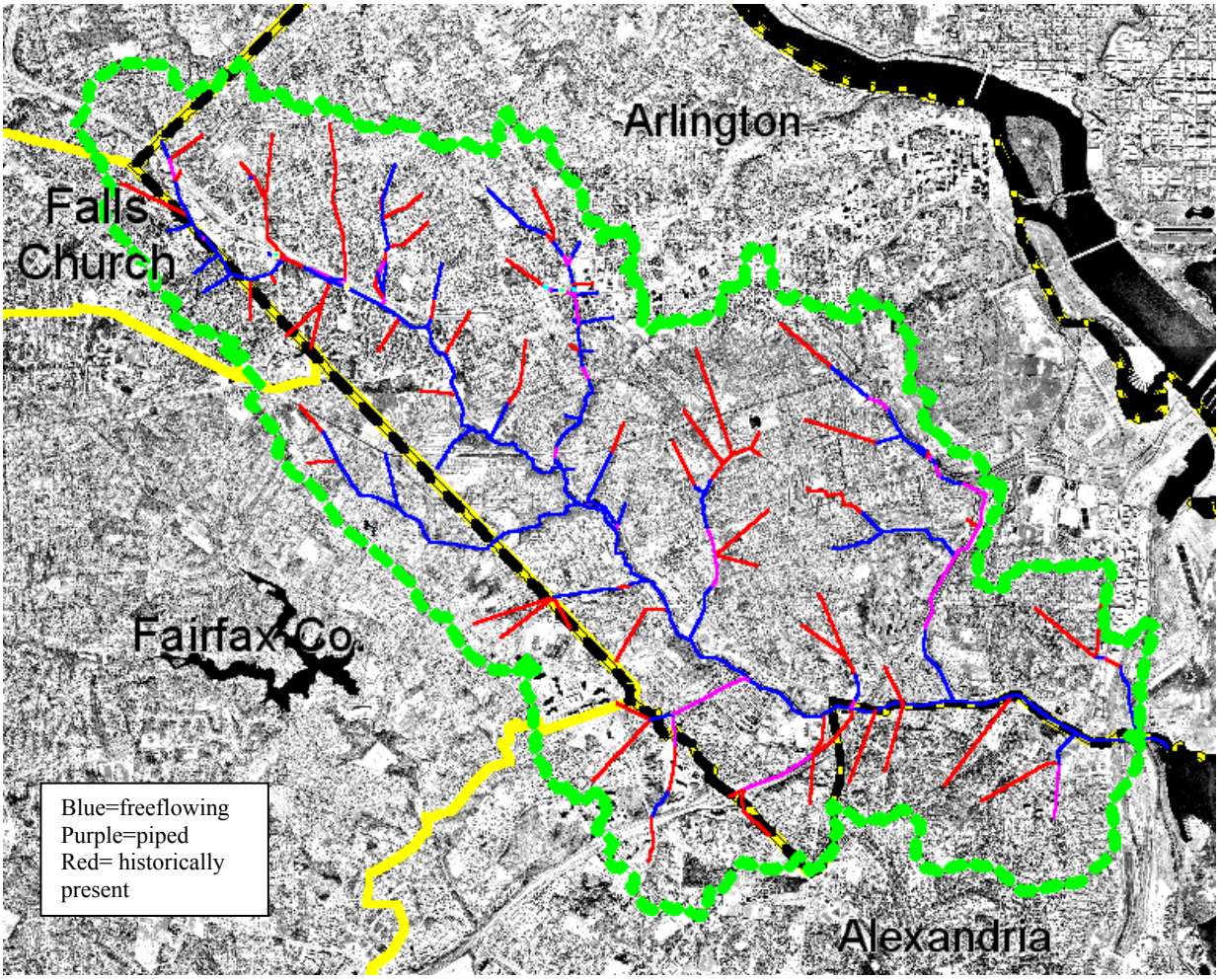

Figure 5 - Four Mile Run Aerial Photograph: Watershed and Piped Tributaries

The flow regime of Four Mile Run is typical of an urban system, with low base flow conditions and high concentrations of flow during large storm events. These variable flows have a severe impact on aquatic species living within the stream system due to streambank erosion, sedimentation, increases in temperature, contamination of the water column leading to a loss of sunlight, and the physical destruction of habitat. As a result, the biotic integrity of Four Mile Run has been severely impaired and will remain so without restoration of habitat and flow regime.

Based on site visits, literature review, and input from the non-Federal sponsors, the habitat concerns identified for the Four Mile Run watershed include the loss of migratory fish habitat, migratory bird habitat, and wetlands, both tidal and freshwater. Additional problems include a loss of tributary function due to urbanization and piping of the tributaries, as shown in Figure 5, and habitat loss as a result of hydrologic changes (See Figures 6) . The stream also suffers from a loss of riparian buffers, degraded water quality, and nutrient and sediment problems. Initial coordination with other agencies and groups involved in the restoration of Four Mile Run, have identified additional concerns regarding storm water management and land use planning.

Figure 6- Stormwater Impacts Resulting in Severe Channel Degradation

B. Expected Future Conditions

Without additional Federal, state, regional, and local agency intervention and cooperation, the impaired and stressed environmental conditions throughout the Four Mile Run watershed will prevail and are likely to become worse. There will continue to be a loss of migratory fish, migratory bird, and wetland habitat. Aquatic and wildlife habitat areas will continue to be degraded by dredging operations within the flood control project area. Without comprehensive restoration and protection, increased flows, erosion, sedimentation, streambank and streambed instability, and poor water quality from urban stormwater runoff, will continue to degrade the aquatic ecosystem. Biodiversity of the aquatic and riparian areas will continue to decline as urbanization continues and habitat features disappear and degrade.

C. Opportunities for Environmental Restoration

The legislative authority for this study allows for a holistic approach to providing environmental restoration while maintaining or enhancing flood damage protection within the Four Mile Run watershed. For example, measures to modify the existing flood damage reduction project can be combined with measures to provide aquatic stream restoration.

The study team will emphasize a watershed approach to address the following study goals:

- Restore the historic natural infrastructure of the watershed;
- Enhance, restore and create wetland and wildlife habitat throughout the watershed and improve nutrient removal functions;
- Improve in-stream habitat by restoring natural stream channels and removing fish blockages;
- Reduce incidental flood damages in conjunction with habitat improvement;
- Evaluate the authorized level of flood protection provided by the existing Four Mile Run local flood protection project; and
- Determine the need, if any, for additional flood protection within the Four Mile Run watershed.

Specific objectives may include, but are not limited to:

- Analyze the hydrology of Four Mile Run to include data since completion of the existing Corps project;
- Verify the level of flood protection provided by the existing Corps project;
- Identify critical variables and stressors to the Four Mile Run ecosystem;
- Identify potential solutions to avoid or minimize adverse impacts from flood damage reductions measures at Four Mile Run; and

During the feasibility study, the team will develop a set of criteria to screen restoration and flood damage reduction solutions based on the study goals and objectives. These criteria will also be applied to watershed assessments already conducted by the local sponsor. The study objectives are comprehensive and based on the problems and opportunities within the study area during the course of the study, as well as results of studies conducted by other agencies as initiatives sponsored by Federal, state, regional, and/or local interests. Such objectives could include reduction of excess sediment that degrades freshwater aquatic ecosystems, creation of stream buffers, and other ecosystem and habitat improvements, in conjunction with maintaining or

enhancing the authorized level of flood protection at Four Mile Run. A multi-objective solution would integrate some or all of these various objectives. The criteria that could be used for screening site-specific solutions include determining if the technique meets several objectives, is environmentally feasible, requires low maintenance, meets stakeholder and public expectations, and is cost-effective.

D. Planning Constraints

Unlike planning objectives that represent desired positive changes, planning constraints represent restrictions that should not be violated. The planning constraints identified in this study include the following:

- Restrictions on potential restoration opportunities due to the local cooperation agreement (operation and maintenance) between the non-Federal sponsors and the Corps for the existing LFP project,
- Future plans for Potomac Yard portion of watershed, and
- Maintenance of authorized level of flood protection.

E. Identification and Evaluation of Alternatives

By taking a watershed approach, several broad alternatives have been identified for environmental restoration and flood protection that will potentially meet the planning objectives and constraints above. The alternatives can be grouped into the following categories: wetland creation and restoration; hydrologic and floodplain function restoration; in-stream habitat restoration and channel modification; beneficial use of dredge material; land acquisition; master planning for restoration, creation and protection of natural infrastructure; and flood protection and management. A more detailed discussion of each alternative is provided below.

(1) Wetland Creation, Restoration and Enhancement

The types of wetlands that can be created, restored, or enhanced in the Four Mile Run watershed include freshwater tidal wetlands, riparian wetlands, and vernal pools. The non-Federal sponsors' watershed restoration plan identifies a variety of riparian wetland sites for restoration, and the reconnaissance study has identified existing tidal and riparian wetlands in the watershed that could be enhanced. Creation of additional tidal or riparian wetlands, or vernal pools, would provide further habitat benefits, and potentially, floodwater attenuation.

(2) Hydrologic and Floodplain Function Restoration

Hydrologic function can be restored throughout the watershed by reducing imperviousness, increasing infiltration, decreasing the volume of runoff and flows, and expanding stream buffers in the floodplains of the watershed. Opportunities for restoration exist in the current parklands along the stream corridor, as well as within the LFP project. The non-Federal sponsors have identified additional areas for potential hydrologic and floodplain function restoration.

(3) In-Stream Habitat Restoration and Channel Modification:

A variety of stream restoration and channel modification techniques can be used to restore in-stream habitat throughout the watershed. They include daylighting streams, removing blockages

to allow anadromous fish passage, expanding forest buffers, removing invasive species, and addressing channel erosion. The non-Federal sponsors have surveyed 236 sites in the watershed and identified potential stream restoration projects. In addition, the Corps study team members have surveyed the LFP project corridor, and believe that some channel modifications can be done that will restore habitat while maintaining the authorized level of flood protection.

(4) Beneficial Use of Dredged Material

Prior to the channel modifications, the tidal portion of Four Mile Run supported a variety of wetland habitats. The beneficial placement of dredged material from local sources would potentially allow for the creation of freshwater tidal wetlands by raising elevations from 1.9 to 2.8 feet to support the growth of wetland plant species. Some tidal wetlands have already been forming within the local flood protection project area due to sedimentation within the channel. The number and/or size of tidal wetlands within the watershed could potentially be expanded under this alternative.

(5) Land Acquisition

In some cases, the only methods for meeting the designs and objectives may be to acquire land. The non-Federal sponsors have identified areas to expand existing parkland, to improve infiltration, and reduce stormwater impacts, primarily in the headwaters. Land acquisition could be recommended as a project alternative for non-Federal implementation, or potentially Federal participation, depending upon real estate requirements.

(6) Master Planning for Restoration, Creation and Protection of Natural Infrastructure

This alternative would focus on the creation of a comprehensive watershed plan for the Four Mile Run watershed. It would identify ecosystem restoration opportunities for creation and restoration of altered landscapes and habitat, and would reevaluate the level of flood protection required throughout the watershed. This alternative would build upon existing plans developed by the non-Federal sponsors.

(7) Flood Protection and Management

This alternative would verify the level of flood protection provided by the existing Four Mile Run Local Flood Protection Project, and would identify the need, if any, for additional flood damage protection within the watershed. This alternative would identify whether the existing LFP project provides flood protection above the authorized level of protection, based on a greater number of years of hydrologic data for the watershed. Should the project provide less than the authorized level of protection, the study could determine the economic feasibility of modifying the project to regain the full authorized level of protection. Should the project provide more than the authorized level of protection, this information could be used in the evaluation of environmental restoration features that could be incorporated or retrofitted into the LFP project design. This alternative could also examine non-structural and bio-engineering methods to provide enhanced flood damage protection, including measures to reduce negative environmental impacts associated with excessive storm water runoff.

F. Evaluation of Alternatives

Each of the seven alternatives discussed above could result in significant aquatic ecosystem benefits while maintaining or enhancing the authorized level of flood protection within the watersheds. These projects have the potential to create hundreds of acres of wetlands, to restore multiple miles of stream, enhance multiple miles of riparian habitat, and indirectly restore hundreds of acres of natural infrastructure. Several of the alternatives could substantially improve water quality by slowing, filtering, and removing non-point source pollutants, thereby improving ecosystem habitat.

The feasibility study will further evaluate the water resources needs and opportunities within the watershed, and develop a holistic restoration and flood damage reduction strategy for the watershed. This information will be supplemented with additional data collection, alternatives, and detailed evaluations to satisfy the requirements of the National Environmental Policy Act (NEPA). The alternative development, evaluation, and analysis will be documented in the feasibility report and accompanying NEPA documents.

At this time, site selection and site-specific solutions have not been developed for the Four Mile Run watershed. However, two key areas have been identified for analysis. The first is the existing levee corridor, running through the City of Alexandria. Based on the non-Federal sponsors' preliminary hydrologic model results, there may be existing excess flood control capacity within the levee system as compared to the authorized level of protection. If there is "excess" flood control capacity, this may facilitate options for environmental restoration techniques that could be implemented within the stream corridor, for example, allowing in-stream channel restoration, riparian planting, and wetland creation.

The second area for detailed analysis and evaluation is the watershed outside of the levee corridor, focusing on the restoration of hydrologic function and reducing the 'flash' flood nature of the river. This evaluation will occur during the feasibility phase once a detailed watershed assessment has been completed. The detailed watershed assessment will primarily be completed using existing and updated data in a geographic information system.

G. Real Estate

The Four Mile Run watershed includes a variety of land uses, ranging from undeveloped wetlands to commercial and industrial areas. The feasibility study will determine the minimum lands, easements, rights-of-way, relocations, and disposal areas (LERRDs) necessary, and estimated acquisition and LERRD costs specific to each recommended site for initial implementation, as well as future non-Federal sponsor(s) operation and maintenance. Potential examples are conservation easements to protect a wetland or streambank areas, road easements for implementation access and future maintenance, temporary work area easements for staging areas, relocation of utilities, or in some instances fee simple as determined necessary due to the project use. The non-Federal sponsors will be responsible for acquiring all of the necessary LERRDs for the approved project(s) prior to implementation. A significant portion of these lands may have been acquired by the non-Federal sponsors for implementation of the Four Mile Run LFP and will be identified during the development of the project management plan (PMP)

as outlined in Attachment B. Only lands not acquired for the implementation of the Four Mile Run LFP will be credited for cost-sharing purposes in this study.

6. FEDERAL INTEREST

In accordance with the study authorization and as a result of initial investigations, there are substantial opportunities for environmental restoration within the Four Mile Run watershed, both within the local flood protection project and throughout the watershed. Opportunities abound for the restoration of fish and wildlife habitat, the development of riparian and shoreline habitat, and the improvement of stream conditions and aquatic habitat. It is anticipated that there will be substantial habitat improvements and economic benefits, and that those benefits will justify the project costs. In addition, there is an outstanding question regarding the level of protection provided by the existing Corps flood protection project, based on the additional years of historic hydrologic data available since project construction, and the increased development within the watershed and its associated impacts on stormwater runoff. Therefore, there is a need to review and update the LFP design analysis, to verify that the project provides the authorized level of protection. This analysis is also required to identify whether the Corps flood protection project could be modified to incorporate measures for environmental enhancement or restoration and still maintain the authorized level of protection along Four Mile Run.

Implementation of environmental enhancement measures within the Four Mile Run watershed would ultimately provide beneficial effects to the Potomac River and Chesapeake Bay. Potential improvements to the Potomac River and Chesapeake Bay can be realized through the upland solutions and collaborative efforts with other ongoing restoration projects. As each restoration project is implemented, cumulative benefits would accrue that ultimately affect and enhance the quality of the Chesapeake Bay. The Corps has an interest, mission, and commitment to improving the natural environment for flora, fauna, and community development. Restoration within the Chesapeake Bay watershed meets the Corps missions and is in the Federal interest. In addition, the Corps has an interest, mission, and commitment to providing flood damage reduction measures where there is a national economic development benefit that justifies Federal participation. The Corps has constructed a flood protection project at Four Mile Run and has a Federal interest in assuring that this project provides the authorized level of flood protection while avoiding or minimizing adverse impacts to the surrounding community or environment. A review of the project is appropriate to determine whether the project could be modified to be more environmentally acceptable, and yet meet today's Corps design standards for flood protection projects in urban settings.

7. PRELIMINARY FINANCIAL ANALYSIS

Arlington County, Virginia and City of Alexandria, Virginia, have been identified as the non-Federal sponsors for the feasibility phase of study. Arlington County and the City of Alexandria have provided a joint letter of intent (Attachment A) expressing their understanding of feasibility and construction cost-sharing responsibilities, and their willingness to enter into negotiations for the feasibility phase of study. Various Arlington County and City of Alexandria personnel have been actively involved in the meetings and field investigations that have led to the development

of this document. Both Arlington County and the City of Alexandria have indicated an understanding of feasibility and construction cost sharing responsibilities and willingness to enter into negotiations for the feasibility phase of the investigation.

Additional information about the sponsors' financial capability and current working relationship is provided in a Memorandum of Understanding (MOU) between Arlington County and the City of Alexandria (Attachment A). The Federal grant funds referenced in the MOU would not be allowed or credited as part of any non-Federal cost-sharing contribution towards the Four Mile Run Watershed feasibility phase study without the expressed statutory authority of the granting agency.

8. **FEASIBILITY PHASE MILESTONES ***

MILESTONE	DATE *	DESCRIPTION	QC ACTION
Initiate Feasibility Study	Mar 03		None
P-6	May 03	Study initiation meeting	Participate
Technical Review Team (TRT) review Read Ahead Material (RAM) for P-7	Jul 04	Quality Control review	Review
RAM due to North Atlantic Division (NAD)	Jul 04		None
P-7	Aug 04	Formulation briefing with Higher Authority	Participate
TRT review of RAM for P-8	Feb 06	QC review	Review
RAM due to NAD	Feb 06		None
P-8	Mar 06	Draft report to Corps higher authority	Review
Feasibility Review Conference (FRC)	May 06	Review feasibility report and resolve issues	Participate
P-9	Aug 06	Final report & QC	Review
P-10	Sept 06	Division Engineer's (public) notice	None

*The dates in the table above are subject to change based on agreement with the non-Federal sponsors, the Baltimore District, North Atlantic Division, and Corps Headquarters. The schedule will be refined at the P-6 meeting.

9. FEASIBILITY PHASE COST ESTIMATE

Based on agency coordination and the preliminary project management plan, the feasibility phase estimate is currently $2,000,000, which will be cost-shared 50 percent Federal and 50 percent non-Federal. The non-Federal share of project costs is anticipated to be provided as 100 percent in-kind services, or a combination of cash and in-kind services. The specific cost-sharing arrangements will be determined during project management plan scoping sessions and prior to the Corps and the non-Federal sponsors executing the feasibility cost sharing agreement (FCSA). The exact feasibility study tasks and costs will be determined in negotiations with the

non-Federal sponsors. The study is targeted for completion within 42 months of receipt of non-Federal and Corps funds. Attachment B presents the general project management plan strategy for the feasibility phase.

10. Potential Issues Affecting Initiation of the Feasibility Phase

Project management plan scoping is well underway with the City of Alexandria and Arlington County, Virginia. Much of the feasibility study will rely on analysis and data generated by the non-Federal sponsors. Actions within the levee corridor are expected to be "sponsored" by the City of Alexandria, while upstream actions are expected to be "sponsored" by Arlington County, Virginia. FCSA and PMP negotiations are continuing with both parties to develop a coordinated approach that meets the needs of all interests.

11. Views of Other Resource Agencies

Based on agency coordination meetings held during the reconnaissance phase, the restoration of Four Mile Run has wide support among interested Federal and non-Federal agencies, including the Virginia Department of Environmental Protection, the U.S. Fish and Wildlife Service and the Environmental Protection Agency. The goals of this project are consistent with the Chesapeake Bay 2000 Agreement, which was endorsed by the Governors of Virginia, Maryland, and Pennsylvania, and the Mayor of the District of Columbia.

12. Project Area Map

See Figures 1 and 2.

13. Recommendations

It is recommended that the Four Mile Run, Virginia, 905(b) (WRDA 86) Analysis be approved as a basis for developing the project management plan, finalizing the FCSA with the non-Federal sponsors, and continuing into the feasibility phase of study to address environmental restoration and flood protection within the Four Mile Run watershed. There are sufficient indications that solutions to Four Mile Run watershed problems and threats can be formulated that accrue cost-effective environmental benefits, and that maintain or enhance the authorized level of flood protection along Four Mile Run. The potential solutions are consistent with Army and budgetary policies and the project will meet criteria for Corps participation in project implementation.

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Charles J. Fiala, Jr.
Colonel, Corps of Engineers
District Engineer

ATTACHMENT A

FOUR MILE RUN WATERSHED, VIRIGINA
905(B) (WRDA 86) ANALYSIS

LETTERS OF INTENT AND SUPPORT

Col. Charles J. Fiala, Jr.
USACE, Baltimore District
Executive Office
P.O. Box 1715
Baltimore, MD 21203-1715

Dear Colonel Fiala:

Arlington County and the City of Alexandria, both of Virginia, (County and City) are interested in providing non-federal support to the U.S. Army Corps of Engineers (USACE) for the initiation of a feasibility study under its "Four Mile Run Watershed" project.

The County and City understand the USACE is seeking non-federal sponsors to partner with and provide cost-sharing for this effort. The County and City are interested in being non-federal sponsors, depending on the cost and scope of the project. We also recognize that there may be other non-federal entities interested in participating as well, which could enhance a successful implementation and completion of the project.

The cost-sharing for non-federal sponsors is 50 percent of the total study cost subject to the execution of the Feasibility Cost Sharing Agreement. The County and City understand that in-kind services of all non-federal sponsors are allowable as a match.

We look forward to working with you on this important project. If you have any questions or need additional information, please contact Erik Beach, with Arlington County, at (703) 228-3318 or Aime Vosper, with the City of Alexandria, at (703) 838-5041.

Sincerely,

Ron Carlee
County Manager
Arlington County, VA

Sincerely,

Philip Sunderland
City Manager
City of Alexandria, VA

Cc: Toni Hubbard, Director, Arlington County DPRCR
Sandra Whitmore, Director, City of Alexandria DRPCA

Memorandum of Understanding between County
Board of Arlington County, Virginia and the
City of Alexandria, Virginia

March 25, 2002

In consideration of the United States Environmental Protection Agency having awarded Arlington County, Virginia ("Arlington County") and the City of Alexandria, Virginia ("City of Alexandria") joint grant funding related to the study and improvement of the Four Mile Run, Arlington County agrees to be the recipient of any awarded federal funds and to make expenditures from such grant funding to carry out grant activities, pursuant to the Memorandum of Understanding, March 25, 2002.

Description

In July of 2001, Arlington County and the City of Alexandria jointly submitted an application to the United States Environmental Protection Agency ("EPA") for funding appropriated to that agency by the United States Congress for Arlington County and the City of Alexandria for the demonstration of environmental improvements to the Four Mile Run. Arlington County and the City of Alexandria will undertake a joint study of the United States Army Corps of Engineers flood control channel on the lower Four Mile Run. This study will examine the flood control channel and potential improvements to the Four Mile Run based on the outcome of the examination of the flood control channel. A demonstration of environmental improvements, as recommended by the study, may also be designed and constructed.

In order to conduct the study of the Four Mile Run and design and construct the environmental improvement demonstration, Arlington County will with the agreement of the City of Alexandria as described below, develop Request for Proposals (RFP) and enter into and manage contracts for consultants and design and construction services to carry out grant activities.

Cooperation

Arlington County and the City of Alexandria agree to cooperate in the endeavor of studying and improving the Four Mile Run. The study and improvement of the Four Mile Run will be based upon the final joint grant application for funding as accepted by the EPA. Decisions regarding, but not limited to, process, contracts, use of funds and other such decisions will be made jointly by Arlington County and the City of Alexandria.

In the event that consensus cannot be reached through the established staff and community processes, the Arlington County Manager and Alexandria City Manager or their designees will resolve to deliberate the issue and attempt to reach a mutually agreeable course of action.

Management of Funds

Upon award of any federal grant funds, Arlington County agrees to act as chief manager of

those funds, specifically the Department of Parks, Recreation and Community Resources will act as the managing unit within Arlington County.

Arlington County shall issue RFPs, select consultants and undertake procurements using standard Arlington County practices. The City of Alexandria and Arlington County will jointly determine the design of RFPs, selections of contractors, and decisions regarding procurements which utilize any federal grant funding awarded by the EPA for the study and improvement of Four Mile Run associated with the July, 2001 grant application. Arlington County will manage any federal grant funds according to standard accounting procedures and under any federal grant compliance requirements.

Termination of Memorandum of Understanding

This Memorandum will be terminated upon the expenditure of all federal funds awarded to Arlington County and the City of Alexandria related to the study and improvement of Four Mile Run. This Memorandum may be terminated at any time by agreement between Arlington County and the City of Alexandria.

Miscellaneous

This Memorandum of Understanding represents the entire agreement between the County Board of Arlington County, Virginia and the City of Alexandria, Virginia and supersedes all prior negotiations, representations or agreements, either written or oral.

This Memorandum of Understanding shall be governed by, and interpreted in accordance with, the laws of the Commonwealth of Virginia.

WITNESS these signatures:

THE COUNTY BOARD OF ARLINGTON, ARLINGTON COUNTY, VIRGINIA	THE CITY OF ALEXANDRIA, ALEXANDRIA VIRGINIA
AUTHORIZED SIGNATURE	AUTHORIZED SIGNATURE
_____	_____
NAME AND TITLE	NAME AND TITLE
DATE: ATTEST:	DATE: ATTEST

ATTACHMENT B

FOUR MILE RUN WATERSHED, VIRGINIA
905(B) (WRDA 86) ANALYSIS

PROJECT MANAGEMENT PLAN STRATEGY

FOUR MILE RUN WATERSHED, VIRGINIA
905(B) (WRDA 86) ANALYSIS

PROJECT MANAGEMENT PLAN STRATEGY

A. FEASIBILITY STUDY PROCESS

This section provides an overview of the study and will be the framework to guide the study team throughout the feasibility phase. The information presented in this section includes an overview of the (1) study goal and objectives; (2) products; and (3) preliminary data requirements and plan formulation. The feasibility phase will be completed within 36 months.

1. Study Goal and Objectives

As part of the reconnaissance study and preparation of the project management plan (PMP), broad feasibility study goals, problems, and objectives were established between the Corps and stakeholders. The study team will emphasize a watershed approach to address the following study goals:

- Restore the historic natural infrastructure of the watershed;
- Enhance, restore and create wetland and wildlife habitat throughout the watershed and improve nutrient removal functions;
- Improve in-stream habitat by restoring natural stream channels and removing fish blockages;
- Reduce incidental flood damages in conjunction with habitat improvement;
- Maintain the authorized level of flood protection provided by the existing Four Mile Run local flood protection project; and
- Determine the need, if any, for additional flood protection within the Four Mile Run watershed.

Specific objectives may include, but are not limited to:
- Analyze the hydrology of Four Mile Run to include data since completion of the existing Corps project;
- Verify the level of flood protection provided by the existing Corps project;
- Identify critical variables and stressors to the Four Mile Run ecosystem;
- Identify potential solutions to avoid or minimize adverse impacts from flood damage reductions measures at Four Mile Run; and

During the feasibility study, the team will develop a set of criteria to screen restoration and flood damage reduction solutions based on the study goals and objectives. These criteria will also be applied to watershed assessments already conducted by the local sponsor. The study objectives are comprehensive and based on the problems and opportunities within the study area during the course of the study, as well as results of studies conducted by other agencies as initiatives sponsored by Federal, state, regional, and/or local interests. Such objectives could include

reduction of excess sediment that degrades freshwater aquatic ecosystems, creation of stream buffers, and other ecosystem and habitat improvements, in conjunction with maintaining or enhancing the authorized level of flood protection at Four Mile Run. A multi-objective solution would integrate some or all of these various objectives. The criteria that could be used for screening site-specific solutions include determining if the technique meets several objectives, is environmentally feasible, requires low maintenance, meets stakeholder and public expectations, and is cost-effective.

2. Products

Two major products will be produced from this feasibility study. They include (1) a feasibility report and NEPA document, including concept and detailed designs for identified habitat improvement measures (65% complete), and (2) the PMP for the final implementation phases (plans and specifications, and construction). The feasibility report, NEPA document, and designs will be the culmination of environmental, cultural, economic, engineering, and real estate assessments and analyses. Combinations of project benefits, costs, and impacts will be evaluated and compared in order to select the recommended restoration plan.

Finally, a PMP for the final implementation phases will be developed. This document will document final design and construction schedules and any additional analyses or surveys needed. All the products from the feasibility phase are focused on comprehensive implementation of environmental enhancement measures and management alternatives that meet flood protection requirements; emphasizing long-term land stewardship ethics; and creating opportunities for future restoration and preservation.

3. Preliminary Data Requirements and Plan Formulation

Preliminary data requirements for the feasibility study and the plan formulation process are based on the existing data from the original Corps project and the model maintained by the Arlington County. Plan formulation in the feasibility phase must use existing data to design measures that will not influence the effectiveness of the levee project. Use of the Four Mile Run watershed model is expected to be extensive, with field calibration and ground verification conducted as necessary. Monitoring data is essential to calibrate the models. Monitoring data is also critical to developing management strategies over the long-term because the ecosystem is dynamic and will change

For Plan formulation, two scales of analysis will be conducted, one within the existing levee and second at a watershed level. The formulation initiatives are discussed below:

Watershed Level: Plan formulation will focus on the Four Mile Run tributary system and hydrological regime, emphasizing stormwater and water quality best management practices, and increasing upstream riparian and wetland habitat. Key tasks to be completed are:

- Identify problems and opportunities: including sites for habitat restoration, low impact development techniques, and establishment of hydrologic regimes that are environmentally sustainable;

- Identify structural and non-structural alternatives to identified problems.
- Formulate costs and benefits of the proposed solutions;
- Develop feasibility-level designs for the proposed solutions;
- Develop real estate costs and identify needed properties; and
- Develop an implementation plan that includes Corps projects, local efforts, and future management options.

Levee Corridor: Plan formulation will develop a mechanism within the levee corridor that increases the habitat quality for migratory fish and other aquatic organisms while maintaining authorized levels of flood protection. Key tasks to be completed are:

- Analyze the existing levee to determine the amount of capacity within the levee corridor for restoration;
- Analyze channel modification techniques within the footprint of the levee, including the restoration of floodplain function, wetland plantings, and creating wetlands;
- Propose modification measures within the corridor and evaluate costs and benefits of the proposed solutions;
- Develop feasibility-level designs for the proposed solutions;
- Develop real estate costs and identify needed properties; and
- Develop an implementation plan that includes Corps projects, local efforts, and future management options.