ILLINOIS RIVER BASIN RESTORATION

WAUBONSIE CREEK RESTORATION

KANE AND KENDALL COUNTIES, ILLINOIS

FEASIBILITY REPORT WITH INTEGRATED ENVIRONMENTAL ASSESSMENT

PUBLIC REVIEW DRAFT

US Army Corps of Engineers ®
Rock Island District

MAY 2004

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Executive Summary

The Waubonsie Creek watershed is an approximately 30-square-mile watershed in northeastern Illinois. Waubonsie Creek is 10.8 miles long and flows into the Fox River in the Village of Oswego, Illinois. The watershed drains portions of Kane, Kendall, DuPage, and Will Counties.

Agriculture and urban development in the watershed have impacted upland and riparian wetlands, altered flow regimes, and encroached upon the riparian corridor. Dams in the lower part of the creek block connectivity with the Fox River and prevent Fox River fish from utilizing spawning habitat available in the creek. The dams also prevent re-colonization of fish and mussels following extreme flow events.

Ecosystem restoration of Waubonsie Creek is proposed under the authority provided by Illinois River Basin Restoration, Section 519 of the Water Resources Development Act of 2000. Illinois River Basin Restoration authorizes implementation of critical restoration projects that produce independent, immediate and substantial restoration, preservation, and protection benefits. The proposed restoration is consistent with basin restoration goals of increasing connectivity of aquatic habitat, restoring floodplain habitat, and maintaining viable populations of native species.

The primary goals identified were restoration of aquatic habitat and restoration of riparian habitat. The objectives included: (1) providing fish passage at the lower dams to restore stream connectivity, (2) increasing in-stream habitat, and (3) restoring or creating riparian wetlands. Potential restoration features included dam removal, installing fish passage structures, meandering channelized stream sections, installing riffles, creating off-channel refuge, installing streambank structures, and creating floodplain wetlands.

Restoration alternatives were proposed for four main areas: (1) the lower dams—Lower and Upper Stonegate Dams, Lower and Upper Pfund Dams and the Fox Bend Golf Course Dam, (2) the Oswegoland Greenway, (3) the Parkview Estates Reservoir, and (4) the Fox Valley Greenway.

The cost and habitat benefits were estimated for each restoration alternative. Habitat benefits of the various features were estimated using Habitat Evaluation Procedures. Cost estimates included construction, contingency, construction management, engineering during construction, and real estate costs. Cost effectiveness and incremental cost analyses were performed to identify cost-effective plans and reveal changes in costs for increasing levels of environmental outputs.

The Recommended Plan consists of the following features:

1. Notch and extend the Lower Stonegate Dam, improve Stonegate Riffles, remove Upper Stonegate Dam, and install bankline protection;
2. Remove Lower Pfund Dam debris and ramp the Upper Pfund Dam;
3. Ramp Fox Bend Golf Course Dam;
4. Install two (2) riffles, install one (1) grade control structure, construct three (3) oxbow wetlands, establish diverse wetland and grassland vegetation in the Oswegoland Greenway;

5. Construct one (1) wetland and establish diverse wetland and grassland vegetation in the Parkview Estates Reservoir; and
6. Install one (1) riffle in the Fox Valley Greenway.

The recommended plan would restore access between the Fox River and 7 miles of tributary habitat on Waubonsie Creek; create 6 acres of refuge habitat for fish during high flows, increase in-stream habitat by constructing 3 small riffles and 3 large riffles (rock ramps); create 5.4 acres of shallow water wetland; and establish diverse native vegetation on 25 acres of floodplain.

The total first cost for the recommended ecosystem restoration plan is $2,806,600. The IDNR (Illinois Department of Natural Resources) is the non-Federal sponsor and is responsible for 35% of the costs of the ecosystem restoration plan. The IDNR is also responsible for operation, maintenance, repair, replacement and rehabilitation of project features, which is estimated at an annual average cost of $5,800.

The District Engineer has reviewed the project outputs and determined that the implementation of the recommended plan is justified and in the Federal interest. The total Federal cost is estimated at $1,824,300. The total non-Federal cost is estimated at $982,300.

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Section 1

Project Background

1.1 INTRODUCTION

1.1.1 Purpose and Format of Report

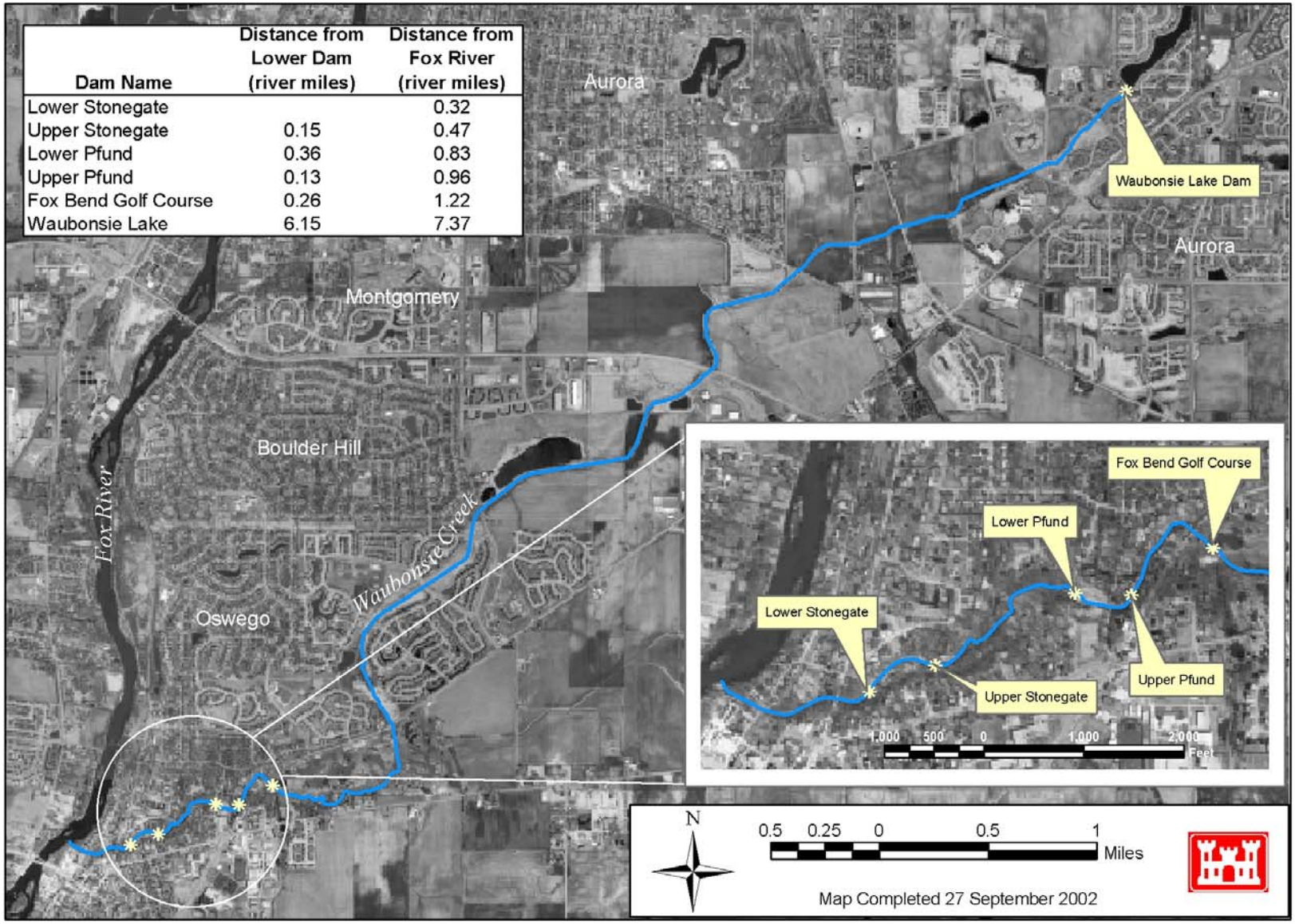
This report presents a detailed proposal for the restoration of Waubonsie Creek. It provides planning, engineering, and limited construction details of the recommended restoration plan. This report is a decision document—approval of the report will allow the project to proceed to implementation. The report will have sufficient engineering and construction details of the recommended plan to allow final design and construction to proceed following report approval. The report meets the requirements of the NEPA (National Environmental Policy Act) and related environmental laws and regulations.

The report is organized to follow a general problem-solving format. Existing conditions and anticipated future conditions are reviewed. Project goals and objectives are identified. Restoration alternatives are formulated to address the goals and objectives. Costs and benefits of the restoration alternatives are identified and the alternative plans are compared on this basis. A single restoration plan is recommended for implementation. A detailed analysis of the recommended plan is presented. The detailed analysis includes design and construction considerations; operation, maintenance, and rehabilitation considerations; a detailed cost estimate; a plan for monitoring the performance of the restoration; real estate requirements; environmental effects; and a detailed schedule for implementation.

1.1.2 Summary of Habitat Problems and Opportunities

The Waubonsie Creek watershed is a 29.6-square-mile watershed in northeastern Illinois. Waubonsie Creek is 10.8 miles long. It originates in the southwest corner of DuPage County and flows southwest to its confluence with the Fox River in the Village of Oswego, Illinois. The watershed drains portions of Kane, Kendall, DuPage, and Will Counties. Plate 1 provides vicinity and general location maps for Waubonsie Creek.

Waubonsie Creek has been channelized and wetlands have been drained to maximize row crop production and is now experiencing urbanization. Five dams are located near the confluence with the Fox River (see Figure 1-1). While two of the dams recently failed, the remaining three dams prevent fish from utilizing spawning habitat available in the steep downstream portions of the creek and prevent re-colonization of fish and mussels from the Fox River after extreme flow events. A sixth dam, the Waubonsie Lake Dam, is located in the upper reaches of Waubonsie Creek. Drainage, channelization, and now urbanization have reduced in-stream habitat diversity as well as the riparian wetland habitat.



Dam Name	Distance from Lower Dam (river miles)	Distance from Fox River (river miles)
Lower Stonegate		0.32
Upper Stonegate	0.15	0.47
Lower Pfund	0.36	0.83
Upper Pfund	0.13	0.96
Fox Bend Golf Course	0.26	1.22
Waubonsie Lake	6.15	7.37

Figure 1-1. Dams on Waubonsie Creek near confluence with Fox River.

The opportunity exists to restore stream connectivity by modifying or removing the dams. Three of the five dams are in public ownership. As agricultural lands are converted to residential development, developers are transferring ownership of portions of the riparian corridor to the Oswegoland Park District (Oswegoland Greenway) and Fox Valley Park District (Fox Valley Greenway). The Village of Montgomery owns a detention facility, the Parkview Estates Detention Area, adjacent to Waubonsie Creek. These public areas offer an opportunity to restore some riparian wetlands, increase in-stream diversity, and restore stream connectivity. The project area includes the five dams and publicly held riparian areas along Waubonsie Creek. Plate 2 shows the location of the dams and publicly owned lands along Waubonsie Creek. The scope of the study includes restoration of Waubonsie Creek and riparian wetlands along Waubonsie Creek.

1.1.3 Project Authorization

The site-specific evaluation was initiated as a component of the Illinois River Ecosystem Restoration Study, which is a General Investigation study authorized by Section 216 of the Flood Control Act of 1970. The evaluation was completed under authority provided by the Illinois River Basin Restoration, Section 519 of the Water Resources Development Act of 2000. The Illinois River Basin Restoration authorizes implementation of critical restoration projects that produce independent, immediate and substantial restoration, preservation, and protection benefits. The authority states:

Critical Restoration Projects

If the Secretary, in cooperation with appropriate Federal agencies and the State of Illinois, determines that a restoration project for the Illinois River Basin will produce independent, immediate and substantial restoration, preservation, and protection benefits, the Secretary shall proceed expeditiously with the implementation of the project.

1.2 GENERAL PROJECT PROCESSING

1.2.1 Eligibility Criteria

The authorizing legislation (Section 519 of the Water Resources Development Act of 2000, paragraph (c)(1)), identified the following minimum eligibility criteria for the critical restoration projects: "If … a restoration project for the Illinois River Basin will produce independent, immediate and substantial restoration, preservation and protection benefits, the Secretary shall proceed expeditiously with the implementation of the project." Consistency with these criteria will be reviewed in Section 2.6 of this report.

Project eligibility was judged based on whether the restoration project addresses the ecosystem restoration goals identified in the Initial Assessment for the Illinois River Basin Restoration. The ecosystem restoration goals are as follows:

- Reduce sediment delivery from upland areas and tributaries to the Illinois River,
- Selectively remove sediment, reduce sediment deposition, and improve sediment characteristics in backwaters and side channels,
- Restore floodplain habitat and function,
- Increase connectivity of aquatic and terrestrial habitats,
- Naturalize hydrologic regimes in tributaries and the mainstem Illinois River,

- Restore natural disturbance regimes,
- Protect high quality and restore degraded native ecosystems and habitats,
- Maintain viable populations of native species, and
- Improve water quality.

The proposed Waubonsie Creek restoration project is consistent with the ecosystem restoration goals of increasing connectivity of aquatic habitats, restoring degraded habitats, restoring floodplain habitat, and maintaining viable populations of native species.

1.2.2 Selection Process

In the fall of 2000, the IDNR (Illinois Department of Natural Resources) prioritized Illinois River Basin watersheds. The process identified high quality watersheds that are threatened with degradation, where there is high potential for restoration, and where there is public ownership or willing landowners. The following six watersheds/areas were selected for the initial site-specific projects: Blackberry Creek, Waubonsie Creek, Iroquois River, Kankakee River near Aroma Park, Pekin Lake, and McKee Creek.

The study team reviewed available literature, met with local agencies and partnerships, and visited the areas to further define problems and opportunities and initiate feasibility level evaluations for restoration activities in the watershed that met the ecosystem restoration goals described above.

Eligibility requirements and the project selection process will be further developed as part of the Illinois River Ecosystem Study, and Illinois River Basin Restoration and will be described in the Illinois River Basin Restoration and Illinois River Ecosystem Restoration Feasibility Report and Comprehensive Plan.

1.3 ASSESSMENT OF EXISTING RESOURCES

1.3.1 Related Studies, Reports, and Projects

Applicable studies, reports, and projects are listed below.

- Waubonsie Creek Watershed Plan and Technical Appendix, 1999, Waubonsie Creek Resource Planning Committee and Waubonsie Creek Technical Advisory Committee.[1] The watershed plan is the result of a locally led planning process guided by the NRCS (Natural Resources Conservation Service). The watershed plan describes the resources and history of the watershed. The plan identifies flooding, the environment, and funding as the important resource concerns in the watershed. The plan describes each resource concern and provides recommendations. The Technical Appendix has detailed information about the watershed resource inventory.
- Waubonsie Creek Biological Survey, 1997, S. Pescitelli and B. Rung. The survey was conducted in 1997 to assess the fish, macroinvertebrates, and habitat in Waubonsie Creek.

[1] Waubonsie Creek Planning Committee. 1999. Waubonsie Creek Watershed Plan (Volume I) and Technical Appendix (Volume II).

- Strategic Planning Study of Waubansee Creek from Montgomery to Oswego, Kane and Kendall Counties, Illinois, 1975, State of Illinois Department of Transportation, Division of Water Resources. The study investigated the feasibility of constructing a detention reservoir and channel improvements along the creek near Montgomery, Illinois. The document appears to be the basis for design of the existing Parkview Estates detention reservoir.

- Lower Stonegate Dam Modification. A project was conducted in 1999 to modify the lowermost dam on Waubonsie Creek to allow fish passage. This dam failed during a 1996 flood event. The dam was partially removed and boulder riffles were installed. The constructed riffles have slopes that were steeper than is optimal for fish passage. This project was funded by the NRCS Emergency Watershed Protection Program and Illinois Department of Natural Resources Conservation 2000 Program.

- Fox River Fish Passage Feasibility Study. This study assessed the effects of dams on fish and macroinvertebrate populations, physical habitat and water quality in the Fox River between Chain of Lakes and Dayton, Illinois. The study identified opportunities for dam removal or modification to enhance fisheries and improve river-based recreational activities and outlined options for such actions. The study was conducted by Victor J. Santucci, Jr. (Max McGraw Wildlife Foundation) and Stephen R. Gephard (Connecticut Department of Environmental Protection) with funding from the Illinois Department of Natural Resources C2000 Program, U.S. Environmental Protection Agency, and the Max McGraw Wildlife Foundation and was sponsored by the Fox River Ecosystem Partnership and the IDNR.[2]

1.3.2 Resource History

Waubonsie Creek, located in the western suburbs of Chicago, Illinois, has undergone several changes in the past century to form what is today a stressed and degraded stream ecosystem. Historically, the stream's headwaters flowed out of Naperville Township of DuPage County. Waubonsie Creek was once a free flowing creek that meandered its way southwest toward the Fox River, through a large marshy area called Waubansia Swamp.[3] It has become a straightened and confined system impacted by small dams and intense urban development.

Prior to 1996, the lower reach of Waubonsie Creek was confined by five small, but operational, dams—Lower Stonegate Dam, Upper Stonegate Dam, Lower Pfund Dam, Upper Pfund Dam and the Fox Bend Golf Course Dam (plate 3). The dams on Waubonsie Creek were constructed for a variety of purposes[4]. The Upper and Lower Stonegate Dams were constructed in the 1920's by a private landowner as landscaping for an estate. The Stonegate riffles were constructed in 1999 following the failure of the Lower Stonegate Dam. The Oswegoland Park District currently owns both Stonegate dams as well as the Golf Course Dam. The Golf Course Dam is believed to have been constructed in the 1950's, at the earliest, and is associated with the Fox Bend Golf Course.

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[2] Santucci, V.J. Jr. and S. R. Gephard. 2003. Fox River Fish Passage Feasibility Study. Max McGraw Wildlife Foundation, Dundee, IL. 352 pp.
[3] Waubonsie Creek Planning Committee. 1999. Waubonsie Creek Watershed Plan (Volume I) and Technical Appendix (Volume II).
[4] Rickers, C. S. and C. Stratton. 2003. Phase I Archaeological, Architectural and Geomorphological Survey for Historic Properties within the Waubonsie Creek Site Specific Projects, Illinois River Ecosystem Restoration Program, Kendall and Kane Counties, Illinois. Illinois State Museum.

The Lower Pfund Dam was constructed circa 1901 for ice harvesting. It is owned by a private corporation. The Upper Pfund Dam was constructed by a private individual in the middle-to-late 20th century to create a pond for recreation/aesthetic purposes. A private individual currently owns the Upper Pfund Dam. A sixth dam, the Waubonsie Lake Dam, is located at the upper reaches of Waubonsie Creek. It is owned by the Fox Valley Park District and was constructed in the mid 1970s.

During the summer of 1996, the Chicago area experienced a series of rain events. The storm brought with it a very serious and damaging flood, which damaged and led to the failure of two Waubonsie Creek dams. The Lower Stonegate and the Lower Pfund Dams were both severely damaged and subsequently failed. As a result, the Oswego Park District, with the help of the IDNR, notched (or partially removed) the lower Stonegate Dam and built riffle structures. Habitat connectivity had been gained from the Fox River up Waubonsie Creek to the Upper Stonegate Dam. Resource managers realized that the removal or modification of the Upper Stonegate Dam would gain fish passage to the Upper Pfund Dam (an additional 0.5 mile of stream habitat). As the project became more involved and more agencies expressed interest, the plan was expanded to evaluate restoration of habitat and connectivity, throughout the entire lower Waubonsie Creek.

1.3.3 Land Use and Management

The Waubonsie Creek drainage basin is typical of a watershed under residential and commercial development and has a mix of urban and rural features. Land cover data from 1996 indicates that roughly half of the watershed is agriculture row crop (49.1%) and only 20% of the area is urban. However, the area is urbanizing rapidly. The upper portion of the watershed has residential, commercial, and light industrial developments and the middle portion is a mix of residential, commercial, and agricultural. The lower portion was primarily cropland, but is now experiencing residential development adjacent to the creek upstream from Oswego and commercial and light industrial development along Illinois Route 34. Park districts in the area have been actively acquiring land adjacent to the stream in an attempt to conserve the riparian habitat of Waubonsie Creek.

1.3.4 Stream Characteristics

Waubonsie Creek can be divided in three stream reaches based on stream slope, substrate, and other characteristics.[5] Figure 1-2 shows the elevation profile of Waubonsie Creek. The lower reach (Stream Mile [SM] 0-2.0) near the confluence with the Fox River is steeper. It has developed pools and riffles and has gravel-cobble substrates with some boulders. The middle reach (SM 2.1-6.5) is very flat with muck and silt substrates and few riffles. The upper reach (SM 6.6-7.1) has more gradient than the middle reach and has two on-stream detention lakes—Waubonsie Lake and Spring Lake.

[5] Waubonsie Creek Planning Committee. 1999. Waubonsie Creek Watershed Plan (Volume I) and Technical Appendix (Volume II).

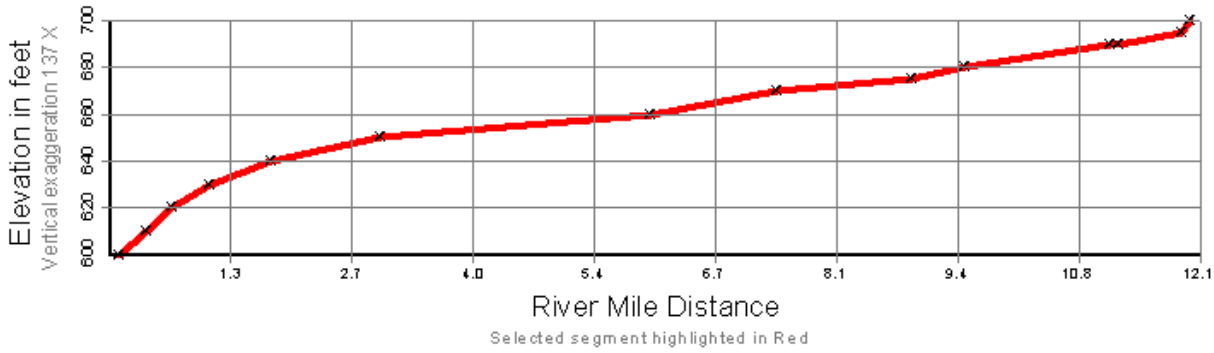

Figure 1-2. Elevation profile of Waubonsie Creek average % slope: 0.159.

1.3.5 Aquatic Resources

Waubonsie Creek provides aquatic habitat that cannot be found in larger rivers, and yet is sometimes very intricately connected to larger rivers through the complex life cycles of aquatic organisms. For example, many species of fish and other aquatic inhabitants utilize smaller creeks as a source of breeding or spawning habitats. These small tributaries are sought after for their unique substrate composition, as well as their temperatures and depths, which are optimal for many species' reproductive requirements. Many fish species migrate out of the Fox River and into tributaries, like Waubonsie Creek, during spring spawning events. After spawning, many of these species slowly migrate back down the stream and return to the Fox River, while others remain in the stream as summer inhabitants. As winter approaches, many more species return to the Fox River to search out overwintering habitats with warmer temperatures and greater depths.

Waubonsie Creek provides these unique spawning and foraging habitats. Various locations throughout the creek contain the appropriate substrates, depths, flows, and stream vegetation, which have been shown to produce high quality fish spawning and foraging habitat. However, the inability of fish to penetrate and move upstream of such obstructions as the remaining small dams located in the lower reach of the stream has kept many of these areas from being utilized by local fish species.

Fisheries surveys conducted by the IDNR in May 1997 collected 22 species of fish using a backpack, 12-volt, direct current (DC), electrofishing system. Fish surveys were also conducted in 2001. An IBI (Index of Biological Integrity) was calculated for each fish sampling station (Table 1-1) [Note IBI calculation protocol was modified between 1997 and 2001]. Figure 1-3 shows a plan of Waubonsie Creek delineated with mile markers. These data show a higher diversity of fish species downstream of the dams and a lower diversity upstream of the dams. The 1997 data resulted in a downstream IBI score of 42 and upstream IBI scores of 26 and 28. The 2001 data resulted in a downstream IBI score of 54 and upstream IBI scores ranging from 32 to 46. The difference in IBI scores is partly attributed to the dams' restricting upstream movement of fish. The difference in IBI scores could also be attributed to other environmental factors. However, dams create an unnatural situation in stream ecosystems and are believed to be the main constraint on the Waubonsie Creek fishery. With dam removal or other connective schemes, Waubonsie Creek would have a more natural community of aquatic inhabitants, which would potentially remedy other life requisite needs of resident fish.

The QHEI (Qualitative Habitat Evaluation Index) was used to estimate habitat quality for Waubonsie Creek. The QHEI provides a measure of habitat quality corresponding to the physical features that affect fish and invertebrate communities. The QHEI scale of 0-100 was used as the habitat quality measurement in the stream habitat evaluation. A high score indicates a higher quality of habitat. Table 1-1 shows the QHEI scores for various sites in the creek.

Table 1-1. Waubonsie Creek indices of species diversity and stream habitat quality.

Site ID	Stream Mile[1]	1997 Index of Biological Integrity (IBI)[2]	2001 Index of Biological Integrity (IBI)[3]	Qualitative Habitat Evaluation Index (QHEI)[4]
Site 1	0.1	42	54	78
Site 2	0.4		46	53
Site 3	0.9		44	71
Site 4	2.3	26	44	58
Site 5	3.3			37
Site 6	4.6		40	34
Site 7	5.6		--	27
Site 8	6.7		32	55
Site 9	7.2	28		56

[1] See Figure 1-3
[2] Illinois Department of Natural Resources 1997 data (Waubonsie Creek Watershed Plan Vol II, 1999)
[3] Illinois Department of Natural Resources 2001 data (Bob Rung, personal communication)
[4] QHEI numbers were rounded

The IDNR also conducted benthic invertebrate surveys. Benthic invertebrates are an indicator of water quality. Certain species require good water quality, while other species are tolerant of poor water quality. These data indicate that water quality in the creek is sufficient to support fish populations.

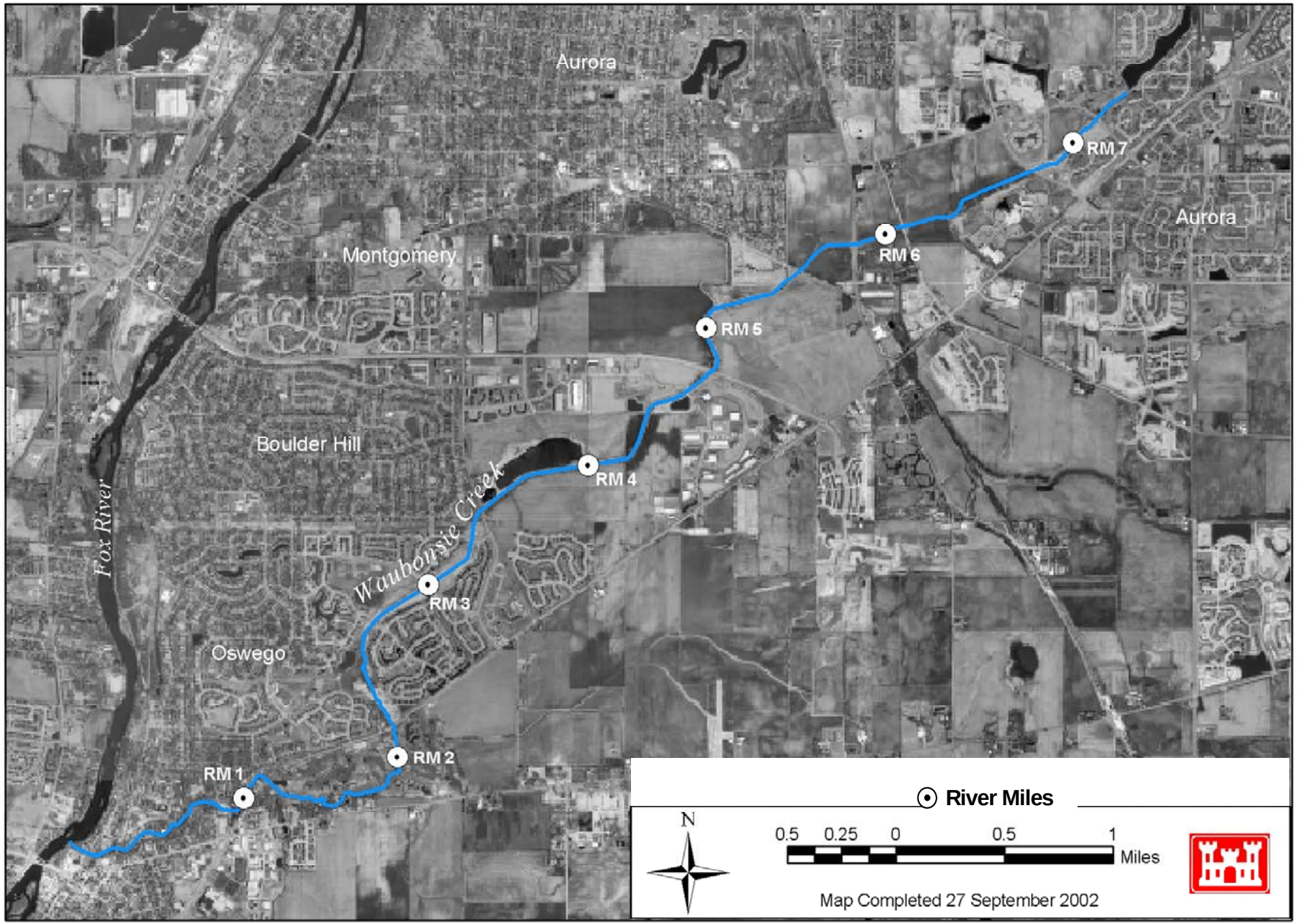

Figure 1-3. Waubonsie Creek stream miles.

1.3.6 Terrestrial and Wetland Resources

Terrestrial and wetland resources in the Waubonsie Creek watershed are limited. The riparian corridor is rapidly being converted into non-natural uses. This results in a loss of habitat that is vital for much of the terrestrial life in the Waubonsie Creek watershed.

The riparian corridor along Waubonsie Creek varies greatly. From its confluence with the Fox River, upstream approximately 1 stream mile, there is a 50- to 200-foot-wide buffer of forest cover. For the next mile, the stream passes through a golf course and is bordered by turf grass with some areas of native vegetation. For the next 0.5 mile, the stream corridor is forested. Between SM 2.5 and 3.5, the stream passes through a residential development with a 100- to 300-foot buffer that is dominated by reed canarygrass, which provides limited habitat value. Few trees are found within this segment. A subdivision is currently being developed adjacent to the stream between SM 3.5 and 4. A former quarry is adjacent to the right descending bank through segment. The left descending bank is likely to be similar to the downstream segment with a buffer dominated by reed canarygrass. For the next 2 miles, the stream passes through agricultural fields with a 5- to 10-foot buffer with a single row of trees in some areas and reed canarygrass in other areas. There is a fallow field along the right descending bank between SM 5.0 and 5.5. Between SM 6 and 7, the riparian corridor has a buffer approximately 100 to 200 feet wide consisting of trees and shrubs.

1.3.7 Fish and Wildlife Resources

Fish species composition in Waubonsie Creek is representative of other streams of equal size. The fishery composition is an interesting mix of darter species, minnows, chubs, catfish, carp, shad, and shiners. Game species include black crappie, channel catfish, largemouth bass, smallmouth bass, and bluegill.

In addition to fisheries, other wildlife use the area along Waubonsie Creek and its riparian corridor. Raccoons, opossums, egrets, muskrats, and other wildlife currently utilize these areas for hunting, nesting, foraging, and inhabitation.

1.3.8 Endangered Species

The following is a list of federally endangered (E) or threatened (T) species potentially found in Kane, DuPage, Kendall, and Will Counties.

Status	Common Name	Scientific Name
E	Hines' Emerald Dragonfly	*Somatochlora hineana*
T	Bald Eagle-Wintering	*Haliaeetus leucocephalus*
E	Prairie Bush Clover	*Lespedeza leptostachya*

Female Hines' emerald dragonflies lay eggs in suitable aquatic habitat, which consists of cool, shallow, slow-moving waters (usually only several centimeters deep) fed by calcerous groundwater seepage. It is the professional opinion of Rock Island District and IDNR biologists that the Hines' Emerald Dragonfly does not inhabit Waubonsie Creek as it is not fed by calcerous groundwater seepage. The District feels that it is unlikely that bald eagles would utilize any habitat along Waubonsie Creek due to its highly developed urban location and the increased human contact that would be found along Waubonsie Creek. Prairie Bush Clover is historically more of an upland species. It is not likely found in the riparian areas and wetlands along Waubonsie Creek. The project is unlikely to affect any areas inhabited by the Prairie Bush Clover. The USFWS (US Fish

and Wildlife Service), in a letter dated November 19, 2002 (Appendix A) concurs that none of the restoration sites on Waubonsie Creek contain suitable habitat for any of the above listed species.

Along with these federally listed species, other State endangered or threatened species that may potentially be found in the areas include Eastern Prairie Fringed Orchid (*Platanthera leucophaea*), Lakeside Daisy (*Hymenopsis herbacea*), Leafy Prairie Clover (*Dalea foliosa*), Black-Crowned Night Heron (*Nycticorax nycticorax*), Common Moorhen (*Gallinula chloropus*), Great Egret (*Casmerodius albus*), Least Bittern (*Ixobrychus exilis*), Loggerhead Shrike (*Lanius ludovicianus*), Pied-Billed Grebe (*Podilymbus podiceps*), Slippershell Mussel (*Alasmudonta viridis*), Spike (*Elliptio dilatata*), and Yellow-Headed Blackbird (*Xanthocephalus xanthocephalus*).

1.3.9 Water Quality

Water quality within the mainstem of Waubonsie Creek is relatively good. This assessment was made based on a macroinvertebrate survey conducted by the IDNR which surveyed three sites on Waubonsie Creek. The survey followed the IEPA (Illinois Environmental Protection Agency) protocol, which has been calibrated to estimate water quality within warmwater stream ecosystems using the macroinvertebrates present. Table 1-2 summarizes water quality at each of the survey sites. The benthic invertebrate surveys indicated a relatively "good" water quality at sites WC-2 and WC-3. The most upstream site, WC-1, showed a slightly lower water quality. Water quality is not thought to be limiting habitat suitability.

Table 1-2. Waubonsie Creek water quality based on invertebrate survey.

Site ID	Stream Mile	Macroinvertebrate Biotic Index (MBI)	Water Quality Rating
WC-1	7.0	6.42	Fair
WC-2	2.5	5.86	Good
WC-3	0.5	4.52	Good
Water Quality Rating, MBI relationship - Good ≤ 6.0; Fair 6.1 – 7.5; Poor 7.6 – 8.9; Very Poor ≥ 9.0			

1.3.10 Historical and Cultural

An archival search for historic properties was conducted using the Corps' Illinois Geographic Information Systems site file database. This search revealed a high density of architectural and buried (archeological) historic properties surrounding the project area, although no previously recorded or reported historic properties are located within the project area of potential effect. The high density of historic properties in the vicinity may be associated with the long-term human occupation of this area near the confluence of Waubonsie Creek and Fox River and location of the Village of Oswego. The Fox River and the Village of Oswego are significant highly urbanized, hydrological, topographical, and geomorphological regions unique to the Illinois River Valley.

The Waubonsie Creek Restoration project was coordinated by letter with the IHPA (Illinois Historic Preservation Agency), Springfield, Illinois, and 12 other consulting parties by letter dated March 19, 2002 (Appendix A). This letter proposed a Phase I Intensive Archeological Survey in the areas of potential effect, excluding areas previously surveyed or disturbed by construction. Allowing for tribal and other consulting parties review and comment on the project and proposal contributes to fulfilling the District's obligations as set forth in the NHPA (National Historic

Preservation Act, PL 89-665), as amended; the NEPA of 1969 (PL 91-190); EO (Executive Order) 11593 for the "Protection and Enhancement of the Cultural Environment" (Federal Register, May 13, 1971); the Archaeological and Historical Preservation Act of 1974 (PL 93-291); the ACHP (Advisory Council on Historic Preservation) "Regulations for the Protection of Historic and Cultural Properties" (36 CFR, Part 800); and the applicable National Park Service and Corps of Engineers regulations.

In response to the Rock Island District's letter dated March 19, 2002, correspondence dated March 28, 2002, was received from the Citizen Potawatomi Nation (Appendix A) requesting site locational data and a copy of the proposed Phase I Archeological report. The IHPA returned the District's letter stamped "concur," dated March 25, 2002, and signed by the Illinois SHPO (State Historic Preservation Officer)(Appendix A). The District will conduct a Phase I Intensive Archeological Survey to search for significant historic properties, in full consultation with the State of Illinois and consulting parties. Final reports will be provided for the permanent files of the SHPO, IHPA, Springfield, Illinois, and appropriate consulting parties. Any request for site or reports containing site locations will require the comment of the IHPA.

1.3.11 HTRW Assessment

Based on the findings of the Phase I-A and I-B Environmental Site Assessment, the Waubonsie Creek Section 519 Project may proceed without limitations or special construction techniques, which are associated with HTRW (hazardous, toxic, and radioactive waste) contamination. The HTRW Documentation Report by Missman, Stanley & Associates, P.C. is on file at the Rock Island District office.

1.4 FUTURE CONDITIONS WITHOUT PROJECT

The Waubonsie Creek watershed and the riparian corridor along Waubonsie Creek will experience continued development. Areas adjacent to the riparian corridor will be fully developed into residential, commercial, or light industrial developments. The Illinois Route 34 corridor within the watershed will be fully developed into commercial and light industrial businesses. As development occurs, additional portions of the riparian corridor between Oswego and Montgomery may be set aside as green space or stormwater detention. If stormwater detention measures are not fully implemented along with development, short duration high flows on Waubonsie Creek will continue to increase. Reduced baseflows are likely to occur.

Fish populations in Waubonsie Creek will continue to be limited by lack of refuge habitat and slow re-colonization due to lack of connectivity with the Fox River. During high flows, fish and other aquatic species cannot find refuge from flows and are washed downstream into the Fox River. Re-colonization by fish moving from the Fox River into Waubonsie Creek is blocked or slowed by the dams.

The dams will continue to prevent fish from using suitable spawning, rearing, and overwintering habitat in Waubonsie Creek. Some of the fish from the Fox River will be able move past the Lower Stonegate Dam and the Stonegate riffles during moderate flows; however, passage may be blocked during lower flow conditions. In most flow conditions, fish will not be able to move upstream of the Upper Stonegate Dam and therefore will not have access to suitable habitat upstream of this dam. While it does not block fish passage, the debris from the Lower Pfund Dam could shift and cause local bank scour. The Upper Pfund Dam is unstable and may fail in future high flow events. If failure occurs, the private landowners could choose to rebuild the dam. The

Fox Bend Golf Course Dam will remain in place to provide irrigation water for the golf course. Systematic modification or removal of all the Waubonsie Creek dams is not anticipated to occur with funding from other authorities or agencies.

Portions of the riparian corridor that have been or will be set aside for green space will provide habitat of limited value. Areas will likely have little plant diversity and be dominated by a monoculture of reed canarygrass. The areas will continue to support urban wildlife such as opossum and raccoons, but will not provide suitable habitat for a diverse bird population.

Section 2

Project Formulation

2.1 GOALS AND OBJECTIVES

2.1.1 Habitat Problems and Opportunities

Land use changes have reduced stream length and in-stream diversity. Agricultural and urban development have impacted upland and riparian wetlands, altered flow regimes, and encroached upon the riparian corridor. The dams have prevented Fox River fish from utilizing spawning habitat available in the steeper downstream reaches. The dams also prevent re-colonization of fish and mussels from the Fox River after extreme flow events.

There is the opportunity to restore stream connectivity by modifying or removing the dams. Three of the five dams are in public ownership. As agricultural lands are converted to residential development, developers are transferring ownership of portions of the riparian corridor to the Oswegoland Park District and Fox Valley Park District. The Village of Montgomery owns a detention facility adjacent to Waubonsie Creek. These public areas offer an opportunity to restore some riparian wetlands and increase in-stream diversity (see Figure 2-1).

2.1.2 Resource Significance

Waubonsie Creek and the tributary habitat it provides to the Fox River has institutional, public, and technical significance.

2.1.2.1 Institutional Significance

American Rivers, the Fox River Ecosystem Partnership, and the Waubonsie Creek Watershed Planning Committee are institutions that recognize the impacts that dams have on fish and macroinvertebrates. The latter two institutions also recognize the importance of Fox River tributaries such as Waubonsie Creek to fish populations in the Fox River. In the *Integrated Management Plan for the Fox River in Illinois*,[6] the Fox River Ecosystem Partnership recommends assessment of feasibility and development of a plan for removal or modification of all dams on the Fox River and its tributaries for safety and environmental reasons. The Waubonsie Creek Resource Planning Committee recognized the connectivity problems caused by the Waubonsie Creek dams. The Waubonsie Creek Watershed Plan recommended removal or modification of dams to facilitate fish passage, construction of wetlands, and creation of fish refuge. American Rivers, a national river conservation organization, recognizes how dams negatively affect rivers and advocates dam removal or modification, as appropriate. Part of American River's "River's Unplugged" campaign focuses on small dams such as those on Waubonsie Creek.

[6] Fox River Ecosystem Partnership. 1999. Integrated Management Plan for the Fox River in Illinois. 38 pp.

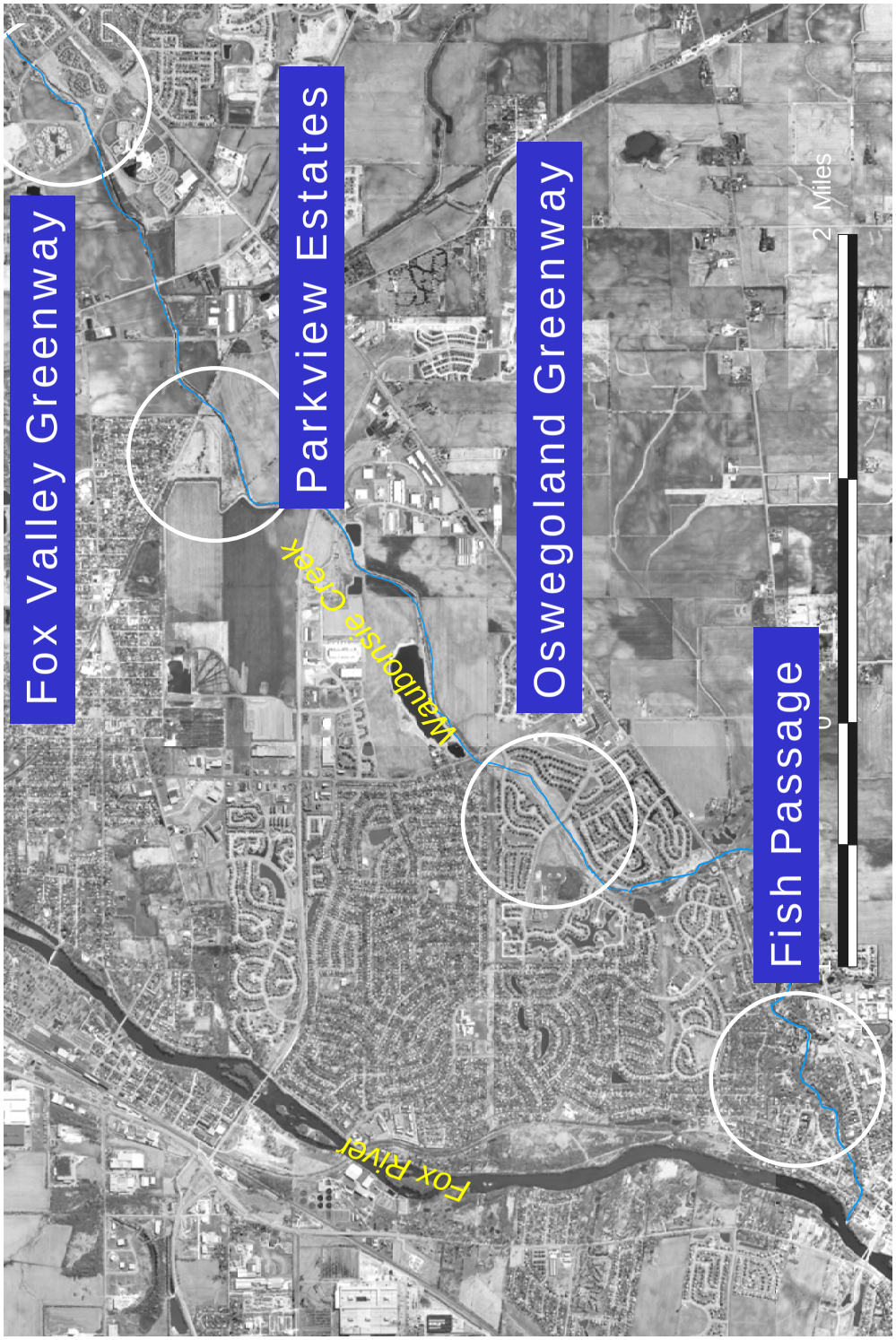

Figure 2-1. Waubonsie Creek public areas.

2.1.2.2 Public Significance

The local public has recognized the significance of Waubonsie Creek and its habitat by forming and participating in the Waubonsie Creek Planning Committee, by developing the Waubonsie Creek Watershed Plan, and by attending the public open houses for this feasibility study. The Fox River Ecosystem Partnership demonstrates regional recognition of the significance of the environmental resources of the Fox River and its tributaries such as Waubonsie Creek. As stated previously, both the Fox River Ecosystem Partnership and the Waubonsie Creek Planning Committee recognize the importance of connectivity between the Fox River and tributary habitat.

2.1.2.3 Technical Significance

Fisheries biologists have long recognized the importance of migrations to the life cycle of fish species such as salmon and the American eel. Fisheries biologists now also recognize the importance of migrations to the life cycle of freshwater riverine fish.[7] [8] Riverine fishes move between feeding, staging/resting, thermal refuge, spawning, and nursery areas, and these critical areas are often found in different parts of a river system from small tributaries to the main channel of a larger river. Fish migrate to these different habitats seasonally and at different stages in their life cycle. Fish populations may be severely impacted if dams restrict these natural movement patterns. Open migratory pathways are important in providing access to the diversity of habitats needed by various life stages of aquatic species.

Fisheries biologists, stream restoration specialists, and engineers nationwide are developing and implementing plans to modify or remove dams to restore stream connectivity for fish and other aquatic organisms. Projects to remove or construct fishways at several of the Fox River mainstem dams are being evaluated. The IDNR, U.S. Environmental Protection Agency, and Max McGraw Wildlife Foundation funded a study to evaluate effects of Fox River dams on fish and macroinvertebrates and to identify opportunities and options for removing or modifying the Fox River dams. Fishways have been constructed at a number of dams on Midwestern streams, including the Red River of the North. In the Midwest, the Corps is currently in the reconnaissance or feasibility phase of studies to construct fishways or remove dams at dam sites on the Des Moines River (Iowa), the Sugar River (Wisconsin), the Rock River (Illinois), the Des Plaines River (Illinois), tributaries of the Fox River, and the Red River of the North.

2.1.3 Land Use Management Goals

The IDNR's goals are to restore stream connectivity, increase in-stream habitat diversity, and restore riparian wetland habitat. To the extent possible, the IDNR would like to focus restoration efforts on lands already in public ownership. The IDNR does not currently own or have real estate interest in any lands within the Waubonsie Creek watershed. The Oswegoland Park District, Fox Valley Park District, and Village of Montgomery are three public entities that own land within the watershed.

The Oswegoland Park District owns and manages a number of sites along Waubonsie Creek. A small parkway is located at the site of the Upper and Lower Stonegate Dams. The site has a small parking area, a trail along the right descending bank (north side) of the creek, and park benches.

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[7] Jungwirth, M. and S. Schmutz and S. Weiss (eds.), 1998. Fish migration and fish bypasses. Fishing News Books, Blackwell Science, Inc., Malden, MA. 438 p.

[8] Bednarek, A. T. 2001. Undamming rivers: a review of the ecological impacts of dam removal. Environmental Management Volume 27(6):803-814.

This site provides low-density recreational opportunities such as walking and fishing. The park district desires to maintain the impounded area for aesthetic purposes. The Oswegoland Park District has an easement at the Lower Pfund Dam and is in the process of purchasing the land adjacent to the easement area. This site will provide low-density recreational opportunities with minimal facilities such as park benches. The Oswegoland Park District owns and maintains a riparian corridor in a subdivision of the Village of Oswego. This site provides low-density recreational opportunities. The Waubonsie Trail bike trail runs along the northwestern edge of the riparian corridor and connects to the Fox River Trail. The management goals for the Oswegoland Park District are to acquire and manage natural areas and open space with minimal costs for operation and maintenance. The natural areas should be aesthetically pleasing and should not encourage mosquito breeding.

A private corporation owns the Lower Pfund Dam and adjacent lands. As stated above, they have granted a perpetual easement to the Oswegoland Park District for the construction, operation, maintenance, repair and replacement of a public use area that may include sidewalks and paths.

The Village of Montgomery owns and manages the stormwater detention facility for the Parkview Estates subdivision. The Gilman Nature Trail, a Fox Valley Park District managed bike trail, runs along an abandoned railroad embankment on the north edge of the detention facility. The management goals for this site are to continue to provide stormwater detention functions, provide low-density recreation opportunities, and maintain native vegetation. They would like to discourage mosquito breeding in the detention facility. The Village of Montgomery wants to minimize costs for operating and maintaining this area.

The Fox Valley Park District owns and manages a riparian corridor along the left descending bank (southeast side) of Waubonsie Creek, immediately downstream of Waubonsie Lake, another park district managed area. A bike trail runs along the corridor. Management goals for this site are to maintain the bike trail and to maintain a vegetated riparian corridor along the creek.

The Fox Valley Park District and the Oswegoland Park District jointly operate the Fox Bend Golf Course. The management goals of this site are to maintain the golf course. This involves continued use of the impoundment structure as an irrigation pond. Golf course personnel have indicated that the stoplogs are placed only during times of very low flow, typically in the late summer months, in order to ensure adequate water for irrigation.

A private individual owns the Upper Pfund Dam. The landowner's goals for the area are to maintain a pooled area for geese and to keep the area private. The landowner would like to minimize the funds spent maintaining the dam and keeping it clear of debris.

2.1.4 Constraints

The following constraints were considered in plan formulation.

- *Impacts to Flood Heights.* Restoration features should not detrimentally increase flood heights so as to adversely affect private property or infrastructure.
- *Infrastructure.* Restoration features shall not impact the function of infrastructure such as bridges, drainage outlets, detention facilities, sewer lines, etc.
- *Operation and Maintenance.* Restoration features shall be designed to have minimal operation and maintenance requirements.

- *Real Estate*. Restoration features shall be constructed on public lands or lands where there are willing landowners.
- *Aesthetics*. Due to the urban nature of the project area, restoration features shall not have a significant negative impact on aesthetics.
- *Stream Stability*. Restoration features shall be designed to maintain stream stability and shall not negatively impact the stability of upstream or downstream reaches.
- *HTRW*. Project features should be designed to avoid disturbance of HTRW to minimize and prevent Federal liability under the CERCLA (Comprehensive Environmental Response, Compensation and Liability Act), to reduce any threats to project workers, and to avoid costly delays associated with environmental abatement activities.

2.1.5 Project Goals, Objectives, and Potential Features

The goals, objectives, and potential enhancement features are identified in Table 2-1.

Table 2-1. Project goals, objectives, and potential features.

Goal	Objective	Potential Features
Restore aquatic habitat	Provide fish passage, restore connectivity	Dam removal
		Fish passage structures
Restore riparian habitat	Increase in-stream habitat	Meander channelized stream sections
		Install riffles
	Restore/create riparian wetlands	Create off-channel refuge
		Install streambank structures
		Create floodplain wetlands

The primary goals identified were: (1) restoration of aquatic habitat and (2) restoration of riparian habitat. The objectives included: (1) providing fish passage at the dams to restore stream connectivity, (2) increasing in-stream habitat, and (3) restoring or creating riparian wetlands.

The potential project features listed in Table 2-1 are described below. Table 2-2 shows the relationship between project objectives and project features.

- <u>Dam removal</u> would allow fish from the Fox River to access spawning habitat in the steep, rocky portions of the stream, would allow recolonization of Waubonsie Creek by fish and other macroinvertebrates following extreme flow events, and would eliminate the artificially pooled habitat that accumulates sediment behind the dams.

- Fish passage structures also would allow access to spawning habitat and recolonization of Waubonsie Creek following extreme flow events that flush fish and mussels downstream. The structures would provide a more gradual slope over the dams and provide areas with lower velocities behind large rocks where fish can rest. Fish passage structures consisting of rock ramps downstream of the dams would also provide additional spawning habitat.
- Meander channelized stream sections would restore in-stream diversity with meander bends and channel crossovers, increase stream length, and decrease stream slope.
- Riffles would introduce stream diversity to channelized sections by creating self-scouring deep pools behind the riffles and oxygenating water as it breaks over the rock riffles. Diverse aquatic insects would utilize the rocky substrate of the riffles.
- Create off-channel refuge would provide refuge from flows during flood events so fish would not be flushed downstream to the Fox River. These areas would also provide wetland habitat for birds, small mammals, small fishes, and invertebrates.
- Install streambank structures would increase in-stream diversity by providing cover habitat for fish.
- Create floodplain wetlands would provide habitat for birds, small mammals, and invertebrates. Wetland creation could increase the diversity of wetland plants in floodplain areas that are dominated by monocultures of invasive species such as reed canarygrass. Wetlands also have the ability to remove nutrients from the water and thus improve water quality.

Table 2-2. Relationship between project objectives and potential features.

Potential Features	Project Objectives		
	Fish Passage/ Connectivity	**Increase In-Stream Habitat**	**Restore Riparian Wetlands**
Dam removal	X	X	
Fish passage structures	X	X	
Meander channelized stream sections		X	
Install riffles		X	
Off-channel refuge		X	X
Streambank structures		X	
Floodplain wetlands		X	X

2.2 FORMULATION OF ALTERNATIVES

Most of the task of locating potential projects within the watershed was accomplished by the Waubonsie Creek Resource Planning Committee and the Waubonsie Creek Technical Advisory Committee. These two groups produced the Waubonsie Creek Watershed Management Plan, which identified nine potential project areas within the watershed. This list of potential projects effectively served as a starting point for identifying opportunities for this study.

This list was screened against the goals of the authorizing program, namely increasing connectivity with the Fox River and restoring floodplain habitat. Potential projects that were not compatible with the program goals were eliminated from consideration. The remaining potential projects were evaluated as the opportunities for this study. These areas include existing stream obstruction (dam) sites (Stonegate Dams, Pfund Dams and Fox Bend Golf Course Dam), Oswegoland Park District Greenway, Parkview Estates Reservoir, and the Fox Valley Park District Greenway.

Restoration measures were formulated for each restoration site. Restoration criteria were developed. Feasible restoration measures and increments of restoration were identified for each restoration site. Restoration measures were combined to develop restoration alternatives.

2.2.1 Initial Formulation of Restoration Measures

The restoration areas are described in detail below. An initial screening of restoration measures that could be implemented at each of the restoration areas is also included.

The dam area sites, located within the Village of Oswego, Illinois, begin just upstream of the Illinois Route 25 Bridge and end a little under a mile upstream of the bridge. There are five dams throughout this reach, and for alternative development the area was divided into three reaches—Stonegate, Pfund, and Golf Course.

The Stonegate area is located just upstream of the Route 25 Bridge (see Figure 2-2). In this reach, the stream is contained in a relatively steep, narrow valley. There is residential development on the bluffs on both sides of the creek. A small park incorporating a walking trail and benches is along the right descending bank. The Lower Stonegate Dam is located about 400 feet upstream of the Route 25 Bridge, and the Upper Stonegate Dam is located about 800 feet upstream of the Lower Dam. The stream runs on limestone bedrock below the Lower Stonegate Dam. The Lower Stonegate Dam is composed of a reinforced concrete spillway. During an extreme event in 1996, the upper portion of the dam broke off due to the high flow, causing the dam to fail.

The Oswegoland Park District completed a restoration project of the Lower Stonegate Dam in 1999 that involved cutting the failed spillway to a consistent elevation, cutting a notch in the spillway, and placing a rock ramp on the downstream dam face. The remaining spillway is approximately 5 feet above the bedrock streambed. The rock ramp has a slope of 7.5 H:1V. There was also dredging of the dam pool area and the construction of two rock riffle structures between the Lower and Upper Dams. Lunker structures and riprap were installed along the right bank between the two rock riffle structures.

The goal of the 1999 project was to allow upstream fish passage at the Lower Stonegate Dam and provide fish habitat within the Stonegate area. Although the project has been successful in passing some fish, it is believed that a more gradual slope on the downstream face of the rock ramp and riffle structures would allow passage of more individuals and species. The area behind the left bank between the dams was impounded prior to the dam failure in 1996. The area is now mostly above stream elevation during typical flows, but is rather marshy due to its proximity to the stream and flows from natural springs along the bluff. The left bank just downstream of the Upper Dam is actively eroding. The Upper Stonegate Dam is also a reinforced concrete spillway, approximately 3 feet above the streambed. It is believed that this structure is currently prohibiting upstream fish passage.

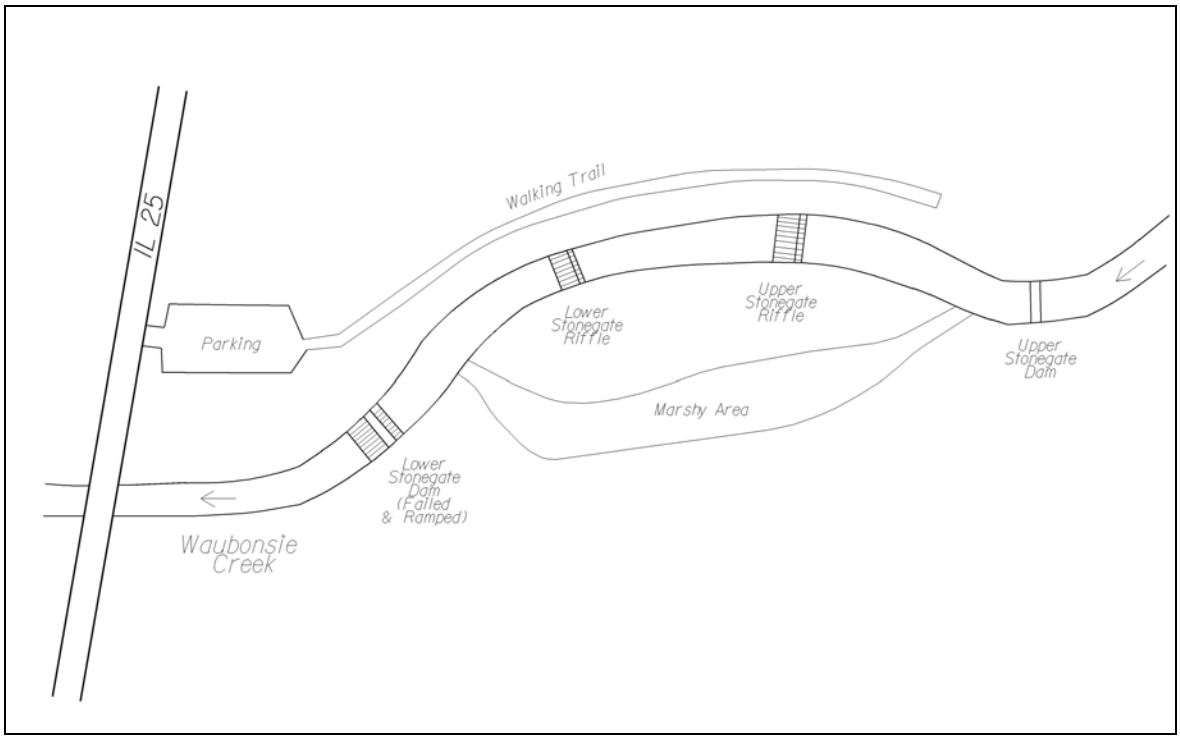

Figure 2-2. Stonegate area.

Several features could improve fish passage at the Lower Stonegate Dam. The V-notch in the existing dam has filled with rock, essentially raising the spillway. The rock ramp on the downstream face of the dam could be raised to the top of the spillway to enhance fish passage. Alternately, the existing notch could be enlarged, and the rock ramp enhanced to a more gradual slope. An additional riffle structure could be installed downstream of the dam in conjunction with either of these alternatives. The riffle structure would back water up on the toe of the rock ramp and would break up the total drop into two smaller steps. The two riffle structures between the two dams could be given more gradual downstream slopes by placing additional rock, or they could be rebuilt completely. Since the impoundment from the upper riffle backs onto the upper dam, it is believed that the upper dam could be removed without significantly affecting the aesthetics of the area. Alternately, placement of a rock ramp on the Upper Stonegate Dam also would be effective. The left bank between the upper dam and riffle could be lined with riprap to prevent further erosion and to keep the creek in its existing channel. Streambank fish habitat structures also could be considered.

The Pfund Area is where Pfund Court crosses the creek north of the intersection of US Highway 34 and Illinois Route 71 (see Figure 2-3). The creek has a steep left bank with some bedrock outcroppings in the upstream section. The right bank is broad and slopes gradually to higher ground. Development in the area is residential, with some commercial developments high off the left bank. The Lower Pfund Dam site is located approximately 350 feet downstream of the Pfund Court Bridge. This reinforced concrete dam failed entirely during the extreme event in 1996. Large debris from the former dam is still located within the creek downstream of the dam site. This debris has caused splitting and redirecting of the flow, but does not currently appear to be inhibiting the passage of fish. This dam is owned by a private corporation. The creek runs on

exposed limestone bedrock between the Lower and Upper Pfund dams, although there is some minor deposition on the bedrock just downstream of the Upper dam.

The Upper Pfund Dam, located about 250 feet upstream of the Pfund Court Bridge, is a 3-foot-high reinforced concrete and masonry dam with a central portion composed of timber stoplogs. While this structure is still a functioning dam, it is in poor repair and water no longer flows through the central portion. The installation of stoplogs too high and the collection of fallen trees and other debris have caused water to flow randomly over the dam. This dam is in private ownership, belonging to the individual who owns the land on both sides of the creek in this area. It is believed that this structure is currently prohibiting upstream fish passage.

The debris from the failed Lower Pfund Dam could be removed from the channel to reduce flow diversion. Several features could be considered to facilitate fish passage at the Upper Pfund Dam. The existing dam structure is in poor repair, but it still functions. The owner of the dam desires the impoundment to remain after the project, so simple removal is not an alternative. One alternative would be to remove the dam and replace it with a new riffle structure that would allow fish passage and retain the water impoundment. Another option would be to construct a rock ramp on the downstream face of the dam and remove the existing stoplogs. This would allow fish passage and also stabilize the dam. Similar to the Lower Stonegate Dam, an additional downstream riffle could be considered with either alternative.

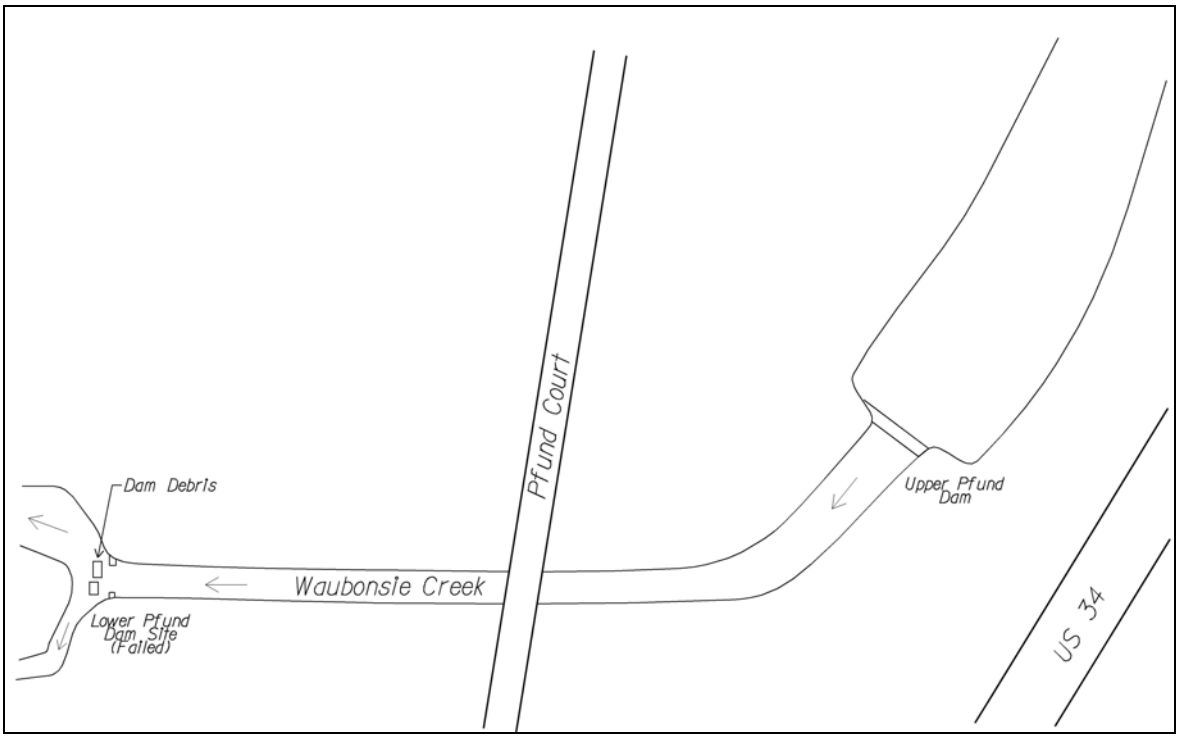

Figure 2-3. Pfund area.

The Golf Course Area is located just upstream from the Pfund Area, where US Highway 34 crosses the creek (US 34 crosses the creek again northeast of this area). The Golf Course Dam is located alongside a small pond about 250 feet upstream of the US 34 Bridge, within the Fox Bend Golf Course (see Figure 2-4). This 3-foot-high structure is composed of reinforced concrete and has the potential to be raised through the use of timber stoplogs. Golf Course personnel install stoplogs to raise the dam about 1 additional foot during dry periods in late summer to maintain the adjacent pond for irrigation purposes. The streambed is exposed bedrock downstream of the dam, and some erosion has occurred along the banks. It is believed that this structure is currently prohibiting upstream fish passage.

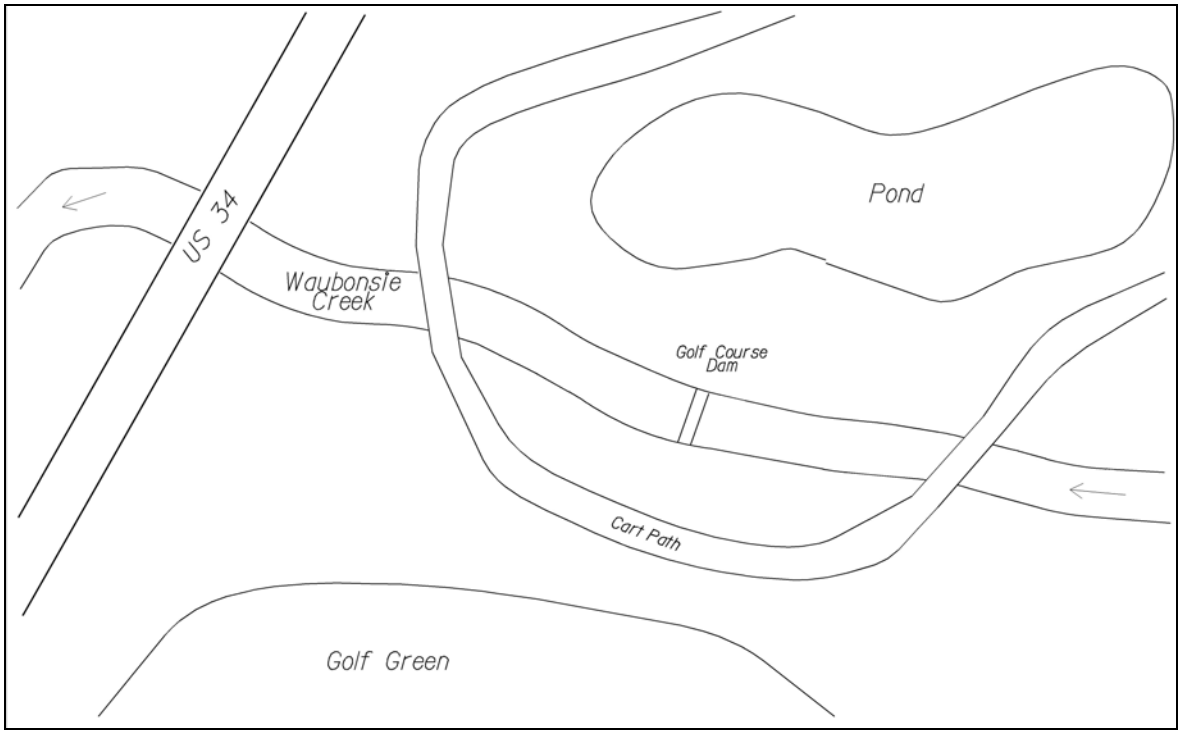

Figure 2-4. Golf Course Dam.

Fish passage could be obtained at this location by constructing a rock ramp on the downstream face of the dam. The ramp would extend up to the top of the concrete portion of the spillway and may not be effective if the stoplogs are in place. The rock ramp would need to be constructed of fieldstone boulders rather than riprap to meet the aesthetic requirements of the golf course. Figures 2-5 and 2-6 show the existing dam and a photo altered to show what a riffle structure might look like.

Figure 2-5. Fox Bend Golf Course Dam existing condition.

Figure 2-6. Fox Bend Golf Course Dam, modification of photo to illustrate what a rock ramp might look like.

The Oswegoland (Park District) Greenway is located about 1.5 stream miles upstream of the dam sites (see Figure 2-7). This reach, approximately three-fourths of a mile long, is located within the Victoria Meadows subdivision in the Village of Oswego, Illinois. Three city streets cross the creek in this reach: (going upstream) Pearces Ford Road, Old Post Road, and Barnaby Drive. All three bridges are believed to have similar construction, which is precast concrete arch spans on spread footings. The creek is contained within a steep, straightened, narrow ditch and surrounded by residential development. There is a buffer area of approximately 22 acres, averaging about 200 feet wide between the creek and the residential development. Several stormwater detention basins are beyond the buffer zone in several locations, and there is a school and associated grounds between Pearces Ford Road and Old Post Road to the west. A recreation trail skirts the greenway in this area as well. Large portions of the greenway are covered with a monoculture of reed canarygrass, and there are very few trees or other in-stream cover along the creek. Although some minor bank erosion is apparent, the stream appears to be relatively stable. An area downstream is actively eroding and is being repaired through a grant from the State of Illinois.

Figure 2-7. Oswegoland Greenway.

A grade control structure could be considered downstream of the Pearces Ford Road Bridge to arrest any headcuts propagating upstream. Re-meandering the stream through this channelized section could be considered. There are three areas along the creek between Pearces Ford Road and Barnaby Drive where lateral wetlands could be constructed. These areas are in wider portions of the buffer strip and do not contain stormwater detention basin outfalls. Lateral wetlands could be excavated and have a low-water connection to the creek. These wetlands would provide not only a more productive area for wetland species, but would also provide areas of low flow for fish refuge

during large rain events. Riffle structures could be considered in this area to provide aquatic habitat diversity and to control low-water elevations in the lateral wetlands. Streambank structures could be considered to provide in-stream cover. The Oswegoland Park District has also requested that regrading the banks to a gentler slope be considered. The lateral wetlands could be planted with native wetland vegetation, and the surrounding areas planted in prairie species to prevent domination by reed canarygrass.

The Parkview Estates Reservoir is a dry detention facility serving the Parkview Estates subdivision in the Village of Montgomery, Illinois (see Figure 2-8). This facility, approximately 19 acres in size, was constructed in the late 1970's. It is bounded by the Gilman Nature Trail (an abandoned railroad embankment) on the north, and by a levee on the remaining sides. A shallow collection ditch runs along the north edge of the reservoir to a pumping station at the east edge of the facility. Water can be discharged into a ditch outside the levee that runs about 300 feet south to the creek. The floor of the facility is generally level, with some lower areas in the central and eastern portions. The groundwater table is believed to be seasonally very high, at or near the ground surface. With the exception of the lower areas in the eastern and central portions, vegetative cover is exclusively reed canarygrass. The Parkview Estates subdivision has experienced flooding from Waubonsie Creek on several occasions, and many of the homeowners along the north edge of the reservoir have been bought out and the houses removed. The reservoir's proximity to the Gilman Nature Trail makes it highly visible.

Figure 2-8. Parkview Estates.

Shallow wetland areas could be considered in the northern and southern portions of the facility. Since there is no connection with the creek, excavating to groundwater would be necessary. The excavated wetlands and the surrounding area could be planted in appropriate vegetation.

The Fox Valley (Park District) Greenway is located in the City of Aurora, Illinois, between Waterford Drive and Montgomery Road, just downstream of the Waubonsie Lake control structure (see Figure 2-9). Waubonsie Lake is an on-channel stormwater detention basin along Waubonsie Creek. The dam is a fixed weir. There is a recreational trail that follows the creek above the left bank. The creek downstream of the lake has been channelized and generally lacks the depth of water necessary to provide good aquatic habitat.

Riffle structures could be considered in this area to provide increased water depth and flow diversity for improved aquatic habitat. Streambank structures could be considered to provide in-stream cover. Modification of the Waubonsie Lake Dam was not considered, as habitat upstream of the dam is limited and the stormwater detention function needed to be maintained.

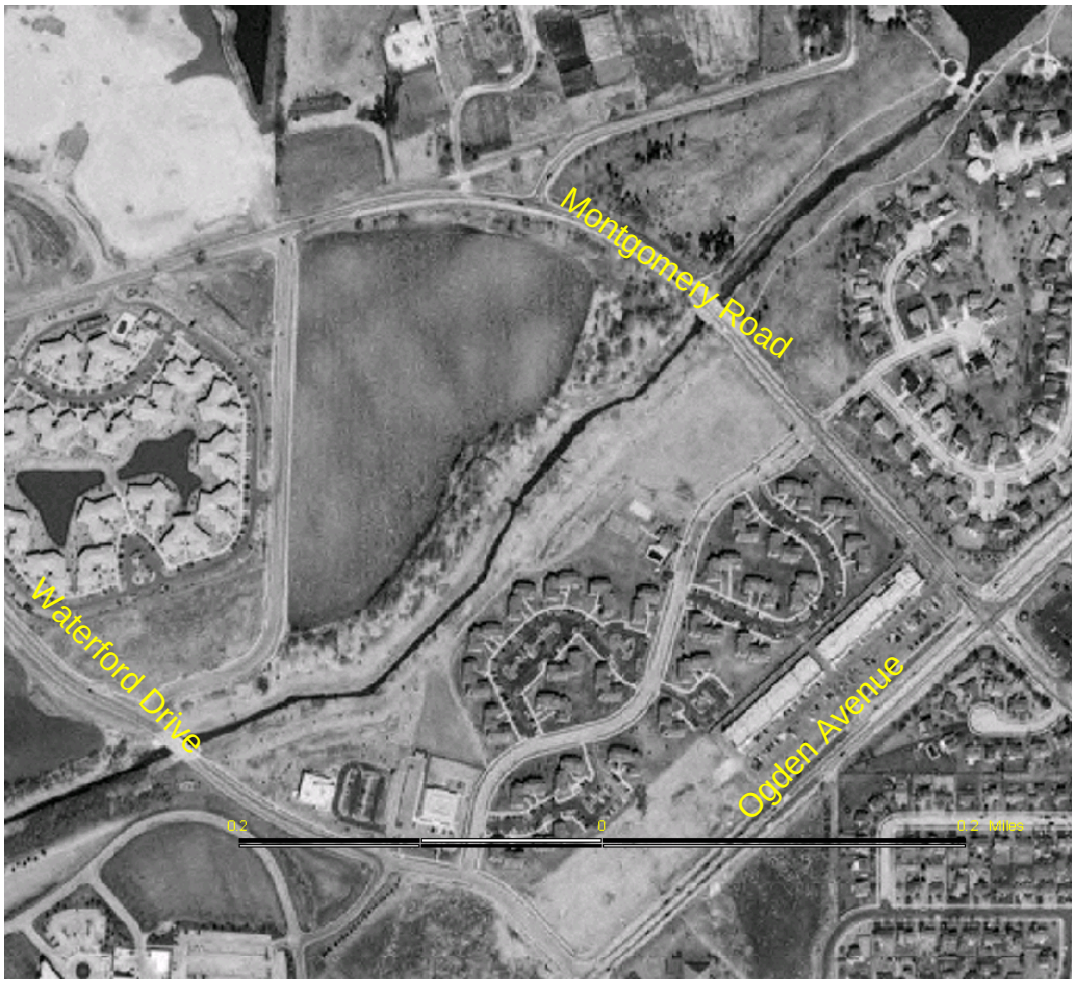

Figure 2-9. Fox Valley Greenway.

2.2.2 Criteria for Formulation of Alternatives

The following criteria were considered when formulating restoration alternatives.

Dam Removal

- Dam removal shall not cause stream instability or negatively impact infrastructure.

Fish Passage Structures

- Fish passage structures shall have a 20 horizontal:1 vertical slope on the downstream side and a 4 horizontal:1 vertical slope on the upstream side. These slopes have been found to provide flow conditions suitable for fish passage.
- Fish passage structures shall have large boulders or riprap on the downstream slopes to create areas of low-flow velocity where fish can seek refuge from flows while moving up the slope.
- Fish passage structures at the Lower Stonegate Dam should maintain an impoundment for aesthetic purposes.
- Fish passage structures at the Upper Pfund Dam should maintain an impoundment for use by resident geese as required by the dam owners. Minor lowering of the impoundment (less than 1 foot) is considered acceptable by the dam owners.
- Fish passage structures at the Fox Valley Golf Course Dam should maintain the impoundment, which provides irrigation water for the golf course. The structure should also consider operation of the stoplog structures.
- Installation of riffle structures should include an establishment period to allow minor modifications of the structure following the first few high flow events. Initial minor modifications may be required to ensure the success of the fish passage structure.

Meander Channelized Stream Sections

- Meander pattern shall be carefully designed to mimic that found in natural streams with similar hydrologic and geomorphic conditions.
- The altered channel alignment should not adversely impact adjacent landowners or infrastructure.

Install Riffles

- Riffles shall have a 20 horizontal:1 vertical slope on the downstream side and a 4 horizontal:1 vertical slope on the upstream side. These slopes have been found to provide flow conditions suitable for fish passage.

Create Off-Channel Refuge

- Off-channel refuge shall have a low-water connection to the stream to avoid trapping fish.

- Off-channel refuge shall not encourage mosquito breeding. This can be accomplished through maintaining low-water connection with the creek to allow access by small fish that consume the mosquito larvae.
- Off-channel refuge shall be closed at the top to provide areas of lower velocity for fish refuge and to reduce sedimentation rates.
- Off-channel refuge shall be sloped to drain with lower stream levels.

Install Streambank Habitat Structures

- Streambank structures shall be constructed at an elevation such that they are submerged and functioning during normal low-water levels.

Create Floodplain Wetlands

- Wetlands shall not encourage mosquito breeding. This can be accomplished by maintaining a low-water connection with the creek to allow access by small fish or by continued treatment with chemical growth regulator.
- Wetlands plantings shall incorporate tall vegetation, which discourages use by geese.
- Wetland establishment shall include plowing topsoil, planting native vegetation, and intensive maintenance for the first few years. This will reduce the competitive advantage of reed canarygrass and allow a diversity of wetland vegetation to become established.

2.2.3 Feasible Project Features and Increments

Project features were grouped together to form measures. Measures that did not meet project objectives or were infeasible were eliminated from further study. Only measures that are feasible and meet project goals were presented in the report.

2.2.3.1 Stonegate Restoration (S)

The measures designated by the letter "S" represent increments of restoration at the Upper Stonegate and Lower Stonegate Dam sites. These measures are described below. Fish passage at the Stonegate Dams provides fish access to an additional 0.64 mile of stream habitat upstream to the Upper Pfund Dam. Removal of the Lower Stonegate Dam was not considered because sponsors and landowners did not support this alternative. Ramping of the Upper Stonegate Dam was not considered because cost would be comparable with notching and local sponsors indicated notching was preferable. Construction of a riffle downstream of the Lower Stonegate Dam was evaluated to break the rise into two steps and provide a resting pool upstream of the downstream riffle. Total reconstruction of the existing riffle structures was not considered because the existing structures appear to be stable. Streambank habitat structures were not considered at any site because IDNR fisheries biologists did not indicate the need for such structures.

Stonegate Features

Lower Stonegate

Ramp Dam – This feature involves additional rock placement on the downstream face of the dam. The slope of this rock ramp would be more gradual (20H:1V) than the existing ramp to allow upstream passage of more individuals and species. This would further stabilize the dam.

Notch Dam – This feature involves widening the existing V-notch cut in the dam spillway. The downstream rock ramp also would be augmented and modified to the preferred slope (20H:1V) for fish passage.

Install Riffle – This feature involves constructing a rock riffle structure downstream of the dam. The downstream slope would be 20H:1V and the upstream slope would be 4H:1V. This would "back up" water onto the toe of the dam rock ramp and break the head drop from the dam into two steps.

Middle Stonegate

Improve Riffles – This feature involves additional rock placement on the two existing (Upper and Lower) riffle structures. The downstream slope of the riffles would be more gradual (20H:1V) to allow upstream passage of more individuals and species.

Bank Protection – This feature involves placing rock protection along the left descending bank between the Upper Stonegate Dam and the upper riffle structure. This reach is on the outside of a bend in the stream and is actively eroding. This feature would prevent flanking of the Upper Stonegate Dam and Upper Stonegate Riffle.

Upper Stonegate

Notch Dam – This feature involves removing a majority of the exposed dam crest. Rock protection would also be placed upstream and downstream to minimize erosion resulting from eddy currents from the remaining dam abutments.

Stonegate Measures

Table 2-3 shows a series of measures, which are feature combinations, for the Stonegate area. With the exception of the No Action option, each measure is congruent with the planning objectives and constraints by providing fish passage at each of the four structures and maintaining a stable stream reach.

Table 2-3. Stonegate measures.

Measure	Feature					
	Lower Stonegate			Stonegate Riffles		Upper Stonegate
	Extend Dam Ramp	Notch Dam and Extend Ramp	Install Riffle	Improve Riffles	Bank Protection	Notch Dam
S0						
S1	X			X	X	X
S2		X		X	X	X
S3	X		X	X	X	X
S4		X	X	X	X	X

No Action (S0). This measure would result in no additional management efforts beyond the existing practices. The Lower Stonegate Dam has been modified since its failure, but the slope of the downstream face is 7.5H:1V, which is steeper than is optimal for fish passage. The two constructed riffles (upper and lower riffle) located between the Upper and Lower Stonegate Dams are also steeper than is optimal for fish passage. The Upper Stonegate Dam is in place and prevents upstream movement of fish in most flow conditions.

2.2.3.2 Pfund Restoration (F)

The measures designated by the letter "F" represent increments of restoration at the Upper Pfund and Lower Pfund Dam sites. These measures are described below. Fish passage at the Pfund Dams provides fish access to an additional 0.26 mile of stream habitat upstream to the Fox Bend Golf Course Dam. Permanent removal of the Upper Pfund Dam was not considered because the private landowner desires to keep the impoundment. Construction of a riffle downstream of the Upper Pfund Dam was evaluated to break the rise into two steps and provide a resting pool.

Pfund Features

Lower Pfund

Remove Debris – This feature involves the removal of the in-stream remains of the failed Lower Pfund Dam. Large pieces of the failed concrete dam are just downstream of the original location.

Upper Pfund

Ramp Dam – This feature involves rock placement on the downstream face of the dam. The slope of this rock ramp would be that to best allow upstream fish passage of fish species (20H:1V). The rock ramp would stabilize the dam.

Replace Dam – This feature involves construction of a new riffle structure immediately downstream of the existing dam, with 20H:1V slopes on the downstream face and 4H:1V on the upstream face. The dam structure would subsequently be removed.

Install Riffle – This feature involves construction of a rock riffle structure downstream of the dam. The structure would have 20H:1V slopes on the downstream face and 4H:1V slopes on the upstream face. This would "back up" water onto the toe of the rock ramp and break the head drop from the dam/riffle into two steps.

Pfund Measures

The following table shows a series of measures, which are feature combinations, for the Pfund area. With the exception of the No Action option, each measure is congruent with the planning objectives and constraints by providing fish passage at each of the two structures, maintaining a pool at the Upper Pfund site, and maintaining a stable stream reach.

Table 2-4. Pfund measures.

Measure	Feature			
	Lower Pfund	Upper Pfund		
	Remove Debris	Ramp Dam	Replace Dam	Install Riffle
F0				
F1	X		X	
F2	X	X		
F3	X		X	X
F4	X	X		X

No Action (F0). This measure would result in no additional management efforts beyond the existing practices. The Lower Pfund Dam failed in 1996, but the remains of the concrete structure still lie in the channel. This structure currently does not block movement; however, in future high flow events, the structure could shift in the channel and cause bank erosion or block fish movement. The Upper Pfund Dam is in place and prevents upstream movement of fish in most flow conditions.

2.2.3.3 Fox Bend Golf Course Restoration (G)

The measure designated by the letter "G" represents an increment of restoration at the Fox Bend Golf Course Dam. This measure is described below. Fish passage at the Fox Bend Golf Course Dam provides fish access to an additional 6.15 miles of stream habitat upstream to the dam at Waubonsie Lake. Removal of the dam was not considered as water in the impoundment is utilized for irrigation of the golf course.

Golf Course Features

Ramp Dam – This feature involves placement of rock on the downstream face of the dam in order to allow upstream fish passage. The slope of the ramp would be 20H:1V. The rock used would be rounded field stone to meet aesthetic requirements.

Golf Course Measure

The following table shows the feature for the Golf Course area. The with-project measure is congruent with the planning objectives and constraints by providing fish passage at the structure, meeting aesthetic requirements, and maintaining a stable stream reach.

Table 2-5. Golf Course measures.

Measure	Feature
	Ramp Dam
G0	
G1	X

No Action (G0). This measure would result in no additional management efforts beyond the existing practices. The Fox Bend Golf Course Dam would remain in place and prevent upstream movement of fish in most flow conditions.

2.2.3.4 Oswegoland Greenway (O)

The measures designated by the letter "O" represent increments of restoration at the Oswegoland Park District Greenway. The measures are described below. Meander of the stream was not considered because of the risk of affecting the three bridges in this stretch, which are founded on shallow footings.

Oswegoland Greenway Features

Wetland Area 1 – This feature involves the excavation of an oxbow channel wetland on the west side of the stream between Pearces Ford Road and Old Post Road. This wetland would be vegetated with native plant species and have a low-water connection to the stream.

Wetland Area 2 – This feature involves the excavation of an oxbow channel wetland on the east side of the stream between Old Post Road and Barnaby Drive. This wetland would be vegetated with native plant species and have a low-water connection to the stream.

Wetland Area 3 – This feature involves the excavation of an oxbow channel wetland on the west side of the stream between Old Post Road and Barnaby Drive. This wetland would be vegetated with native plant species and have a low-water connection to the stream.

Bank Grading – This feature would involve cutting a 10-foot-wide horizontal bench about 3.5 feet above the thalweg on both sides of the creek and providing a 3H:1V slope from the bench to the upland. This would increase riparian area adjacent to the creek and would be performed between the three bridges.

Upstream Riffle – This feature involves construction of a rock riffle between Old Post Road and Barnaby Drive. The structure would have a downstream slope of 20H:1V and an upstream slope of 4H:1V. This riffle structure would provide deeper water for fish habitat and maintain a minimum low-water elevation in Wetland Area 3.

Downstream Riffle – This feature involves construction of a rock riffle between Pearces Ford Road and Old Post Road. The structure would have a downstream slope of 20H:1V and an upstream slope of 4H:1V. This riffle structure would provide deeper water for fish habitat and maintain a minimum low-water elevation in Wetland Areas 1 & 2.

Grade Control – This feature involves construction of a rock grade control structure downstream of the Pearces Ford Road Bridge. This would arrest any grade instability propagating upstream from the park area downstream.

Vegetation Establishment – This feature involves establishing native vegetation in the areas surrounding the wetlands within the greenway between Pearces Ford Road and Barnaby Drive.

Oswegoland Greenway Measures

The following table shows a series of measures, which are feature combinations, for the Oswegoland Greenway area. With the exception of the No Action option, each measure is congruent with the planning objectives and constraints by providing fish refuge, creating and enhancing wetland and aquatic habitat, and maintaining a stable stream reach.

Table 2-6. Oswegoland Greenway measures.

Measure	Feature							
	Wetland Area 1	Wetland Area 2	Wetland Area 3	Bank Grading	U/S Riffle	D/S Riffle	Grade Control	Establish Vegetation
O0								
O1	X			X		X	X	X
O2	X	X		X		X	X	X
O3	X	X	X	X	X	X	X	X
O4	X	X	X	X	X	X	X	

No Action (O0). This measure would result in no additional management efforts beyond the existing practices. No off-channel refuges existing in this reach of Waubonsie Creek. The riparian corridor has low diversity of vegetation and little wetland habitat. The stream channel has been straightened and has little to no in-stream diversity.

2.2.3.5 Parkview Estates (P)

The measures designated by the letter "P" represent increments of restoration at the Parkview Estates Detention Area. The measures are described below. Restoring connection with the creek was not considered because the project could not detrimentally affect the reservoir operation.

Parkview Estates Features

2.1-Acre Wetland – This feature involves the excavation of a shallow wetland within the northern portion of the existing dry reservoir. Native wetland plant species would be established within the wetland. This wetland would not have a connection to the stream for use as aquatic habitat.

3.2-Acre Wetland – This feature involves the excavation of a shallow wetland within the southern portion of the existing dry reservoir. Native wetland plant species would be established within the wetland. This wetland would not have a connection to the stream for use as aquatic habitat.

Vegetation – This feature involves establishment of native plant species within the dry reservoir around the proposed excavated wetland area(s).

Parkview Estates Measures

The following table shows a series of measures, which are feature combinations, for the Parkview Estates area. With the exception of the No Action option, each measure is congruent with the planning objectives and constraints by providing and enhancing wetland habitat.

Table 2-7. Parkview Estates measures.

Measure	Feature		
	2.1-Acre Wetland	3.2-Acre Wetland	Vegetation
P0			
P1	X		X
P2		X	X
P3	X	X	X

No Action (P0). This measure would result in no additional management efforts beyond the existing practices. The Parkview Estates Detention Facility has low diversity of wetland vegetation and much of the area is in reed canarygrass.

2.2.3.6 Fox Valley Greenway (V)

The measure designated by the letter "V" represents an increment of restoration at the Fox Valley Greenway that is managed by the Fox Valley Park District. The measure is described below.

Fox Valley Greenway Feature

Riffle Structure – This feature involves construction of a rock riffle structure downstream of the Montgomery Road Bridge. The structure would have a downstream slope of 20H:1V and an upstream slope of 4H:1V. The riffle would provide flow and substrate diversity and the pool behind the riffle would provide depth diversity.

Fox Valley Greenway Measures

The following table shows the feature for the Fox Valley Greenway area. The with-project measure is congruent with the planning objectives and constraints by providing and enhancing aquatic habitat.

Table 2-8. Fox Valley Greenway measures.

Measure	Feature
	Riffle Structure
V0	
V1	X

No Action (V0). This measure would result in no additional management efforts beyond the existing practices. The stream channel has been straightened and has little to no in-stream diversity.

2.3 COST AND HABITAT VALUE EVALUATIONS

The costs and habitat benefits were estimated for each of the restoration measures described above.

Habitat benefits were estimated using Habitat Evaluation Procedures developed by the USFWS to document habitat quantity and quality. The analysis used four methodologies to quantify project benefits. The QHEI developed by the Ohio EPA was used to model habitat quality of the stream reaches for use in evaluating habitat benefits of the fish passage alternatives at the Stonegate Dams (S), Pfund Dams (F) and Fox Bend Golf Course (G). The QHEI was also used to model in-stream benefits for the Fox Valley Greenway alternatives (V), but was applied differently. Published models for the marsh wren, Eastern meadowlark, and muskrat were utilized to model habitat benefits of the Oswegoland Greenway alternatives (O) and the Parkview Estates alternatives (P). A model was developed by Rock Island District fisheries biologists and hydraulic engineers to quantify the fish refuge benefits of the oxbow wetland at the Oswegoland Greenway.

The estimated costs and habitat benefits are shown in Tables 2-9 through 2-11. The costs estimates were prepared to a February 2003 price level. Construction costs include construction, 25% contingency, construction management, and engineering during construction. Land costs are based on a preliminary gross appraisal and include both land costs and incidental acquisition expenses. Total project costs include construction and lands costs. Total project costs were annualized based on the Fiscal Year 2003 discount rate of 5.875 % and a 50-year project life. The annualized total project costs and annual operation and maintenance costs were summed to get a total annual cost.

Table 2-9. Fish passage alternatives - cost and environmental output.

Alternative	Construction Cost	Land Cost	Total Project Cost	O&M Cost	Annualized Cost	Aquatic Benefits[1]
STONEGATE DAMS						
S0 – no action	$0					
S1 – extend ramp	$138,000	$188,000	$326,000	$1,700	$22,000	41
S2 – notch dam and extend ramp	$100,000	$188,000	$288,000	$1,600	$19,600	41
S3 – extend ramp, add lower riffle	$186,000	$188,000	$374,000	$2,200	$25,500	41
S4 – notch dam, extend ramp, add lower riffle	$149,000	$188,000	$337,000	$2,100	$23,100	41
PFUND DAMS						
F0 – no action	$0					
F1 – remove dam and replace with riffle	$111,000	$66,000	$177,000	$600	$11,600	17
F2 – construct ramp on downstream dam face	$74,000	$66,000	$140,000	$600	$9,300	17
F3 – remove dam, replace with riffle, add lower riffle	$139,000	$66,000	$205,000	$1,000	$13,800	17
F4 – construct ramp on downstream face and add lower riffle	$103,000	$66,000	$169,000	$1,000	$11,500	17
G0 – no action	$0					
G1 – ramp downstream face of dam	$39,000	$62,000	$101,000	$400	$6,700	213

[1] Benefits are in net Average Annual Habitat Units (AAHUs)

Table 2-10. Fish refuge and wetland alternatives - cost and environmental output.

Alternative	Construction Cost	Land Cost	Total Project Cost	O&M Cost	Annualized Cost	Fish Refuge Benefits[1]	Wetland/ Grassland Benefits[1]
OSWEGOLAND GREENWAY							
O0 – no action	$0						
O1 – construct 1 lateral wetland (2.7 acre), d/s riffle	$551,000	$436,000	$987,000	$1,300	$62,800	23	11
O2 – construct 2 lateral wetlands (2.7 & 2.4 acre), d/s riffle	$698,000	$436,000	$1,134,000	$1,600	$72,300	38	12
O3 – construct 3 lateral wetlands (2.7, 2.4, 1.0 acre), 2 riffles	$833,000	$436,000	$1,269,000	$2,300	$81,400	61	12
O4 – construct 3 lateral wetlands (2.7, 2.4, 1.0 acre), 2 riffles, no grassland plantings	$635,000	$436,000	$1,071,000	$1,600	$68,400	61	5
PARKVIEW ESTATES							
P0 – no action (3.5-acre existing wetland)	$0						
P1 – construct 2.1-acre wetland (3.5-acre restored wetland)	$501,000	$277,000	$778,000	$400	$48,900	-	12
P2 – construct 3.2-acre wetland (3.5-acre restored wetland)	$657,000	$277,000	$934,000	$400	$58,600	-	13
P3 – construct 2.1- and 3.2-acre wetlands (3.5-acre restored wetland)	$997,000	$277,000	$1,274,000	$400	$79,800	-	14

[1] Benefits are in net Average Annual Habitat Units (AAHUs)

Table 2-11. Aquatic restoration alternatives - cost and environmental output.

Alternative	Construction Cost	Land Cost	Total Project Cost	O&M Cost	Annualized Cost	Aquatic Benefits[1]
FOX VALLEY GREENWAY						
V0 – no action	$0					
V1 – construct downstream riffle	$20,000	$71,000	$91,000	$300	$6,000	11

[1] Benefits are in net Average Annual Habitat Units (AAHUs)

2.4 FORMULATION OF ALTERNATIVE PLANS

Alternative plans were formulated by combining the above restoration measures. Fish passage measures (Stonegate, Pfund, and Fox Bend Golf Course) were combined to formulate alternative plans for fish passage. Wetland creation measures (Oswegoland Greenway and Parkview Estates) were combined to formulate alternative plans for wetland creation as the measures produced similar wetland benefits and the wetland benefits were measured using the same habitat quality models. The Oswegoland Greenway also provides fish refuge benefits. Restoration measures at the Fox Valley Greenway were not combined with other measures to formulate plans, as the benefits were not comparable to the other measures. Comparison across all groupings was not made as the habitat benefits units were not comparable. Different models were used for the benefit evaluation, and the benefit outputs have different relative magnitudes. Within group evaluations were made as appropriate. Below are details on the combinability of the fish passage measures.

The fish passage alternatives (S, F, G) were evaluated using one model and were compared as a group. The O and P alternatives used similar models and were compared as a group. While the V alternative used the same model as the fish passage alternatives, the application was different and therefore not comparable.

Fish passage measures were combinable and were compared as a group. The benefit of providing fish passage at a given dam site was dependent upon having fish passage at the downstream dams. The first set of alternative plans considered only “with-project” alternatives at the Stonegate Dams, which are the lowermost dams. This set of alternatives provides fish access to 0.96 stream mile (Table 2-12). The next set of alternative plans considered “with-project” alternatives at both the Stonegate Dams and the Pfund Dams and provides fish access to 1.22 stream miles. The final set of alternative plans considered “with-project” alternatives at the all the dams—the Stonegate Dams, Pfund Dams, and the Fox Bend Golf Course Dam—and provides fish access to a total of 7.37 stream miles. In other words, Measure G (Fox Bend Golf Course Dam) was dependent upon Measure F (Pfund Dams) and Measure S (Stonegate Dams). Measure F (Pfund Dams) was dependent upon Measure S (Stonegate Dams).

Table 2-12. Miles of accessible stream habitat.

Alternative Plans	Measure	Total Miles	Net Gain in Miles	Incremental Gain in Miles
No action		0.32		0
Stonegate	S	0.96	0.64	0.64
Stonegate and Pfund	S,F	1.22	0.90	0.26
Stonegate, Pfund, and Fox Bend Golf Course	S,F,B	7.37	7.05	6.15

2.5 COMPARISON OF ALTERNATIVE PLANS AND SELECTION OF RECOMMENDED PLAN

For planning ecosystem restoration projects, traditional benefit-cost analysis is not possible because cost and benefits are expressed in different units. However, cost-effectiveness and incremental cost analyses can provide decision makers with relative benefit-cost relationships of the various restoration solutions. While these analyses are not intended to lead to a single best solution, they do improve the quality of decision making by ensuring that a rational, supportable, focused, and traceable approach is used for considering and selecting alternative methods to produce ecosystem outputs.

2.5.1 Methods

Corps of Engineers guidance requires incremental cost analyses for recommended ecosystem restoration plans. Two analytical processes are conducted to meet these requirements. First, a cost-effectiveness analysis is conducted to ensure that the least cost solution is identified for each possible level of ecosystem output. Cost effectiveness means that no plan can provide the same benefits for less cost or more benefits for the same cost. Then, incremental cost analysis of the least cost solutions is conducted to reveal changes in costs for increasing levels of environmental outputs. Plans that provide the greatest increase in benefits for the least increase in costs are identified as “best buy” plans. In the absence of a common measurement unit for comparing the non-monetary benefits with the monetary costs of ecosystem restoration plans, cost effectiveness and incremental analysis are valuable tools to assist in decision making.

2.5.2 Results

Results of the cost-effectiveness and incremental cost analyses are presented below.

Figure 2-10 shows all alternative plans for fish passage. Three of these alternative plans were cost effective (Table 2-13). Table 2-14 and Figure 2-11 show that one restoration plan, S2F2G1, was identified as a “best buy” plan. Alternative Plan S2F2G1 was identified as the recommended plan for fish passage. The plan is cost effective and provides the greatest increase in benefits for the least increase in costs. It provides approximately 271 habitat units at an incremental cost of $131 per habitat unit. The total first cost of the plan is $529,000.

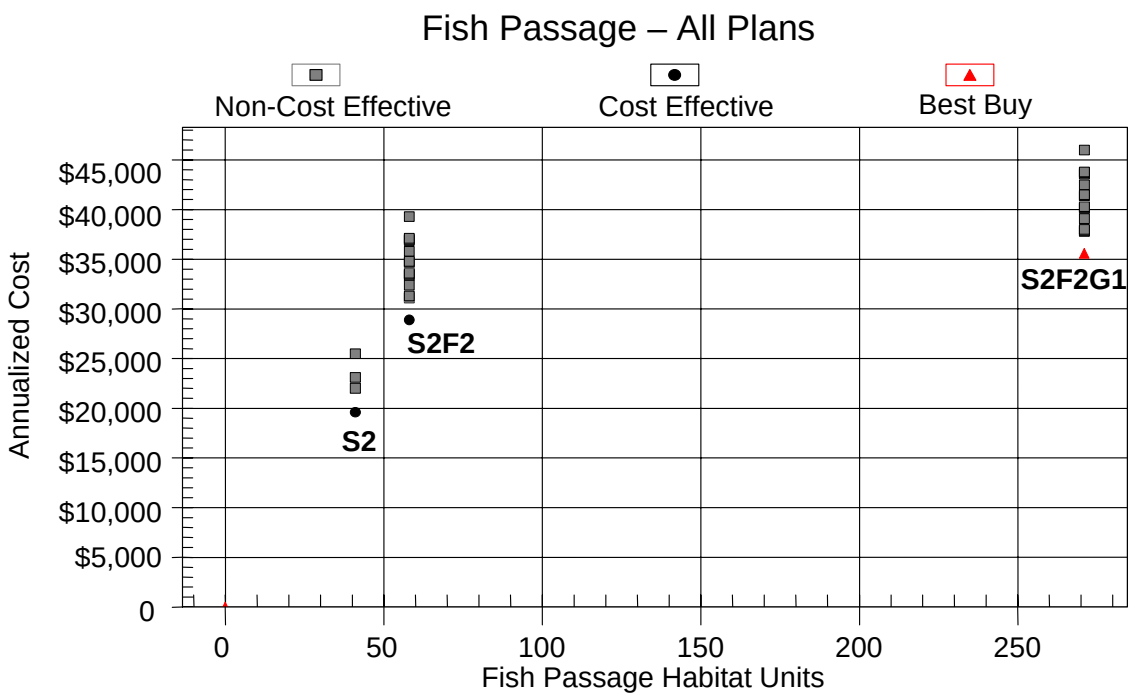

Figure 2-10. Fish passage alternative plans. (Plan names are shown only for cost-effective and best buy plans.)

Table 2-13. Fish passage cost-effective plans.

Plan	Total First Cost	Annualized Cost [1]	Fish Passage Habitat Units	Average Cost/ Habitat Unit
No Action			0	
S2	$288,000	$19,600	41	$478
S2F2	$428,000	$28,900	58	$498
S2F2G1	$529,000	$35,600	271	$131

[1] Includes O&M costs.

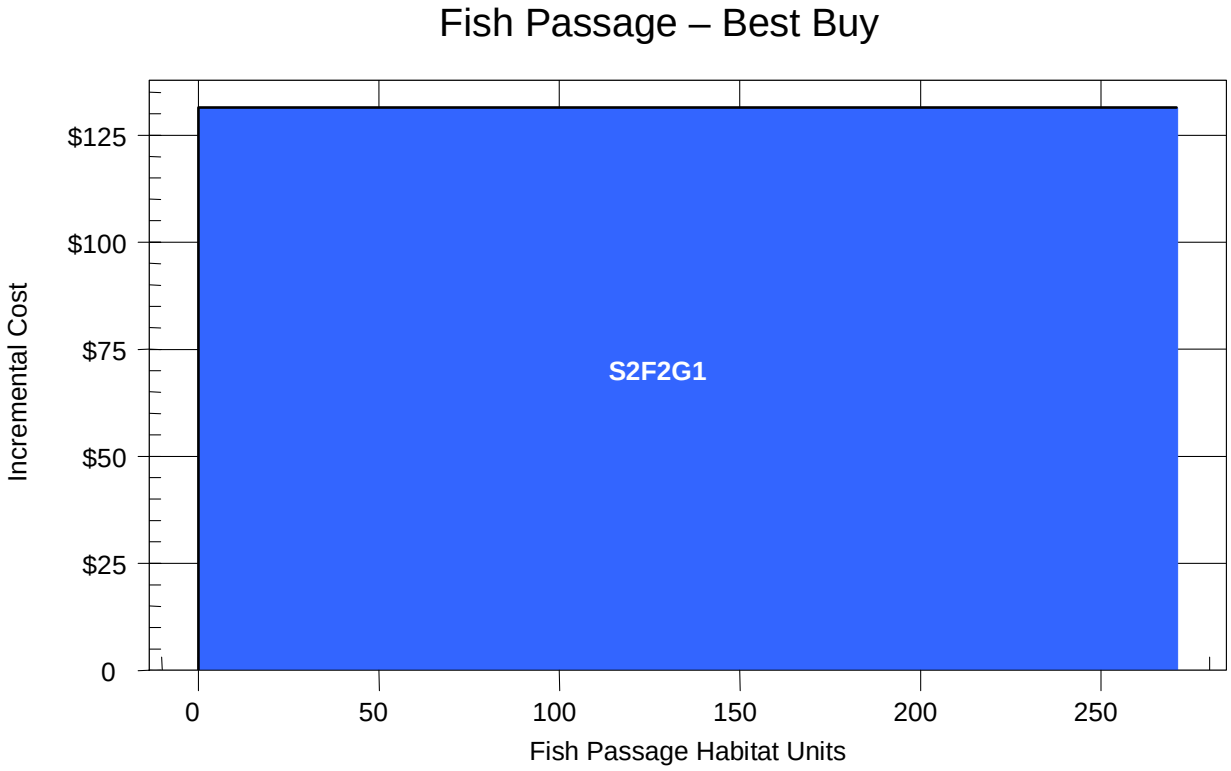

Figure 2-11. Fish passage best buy plans.

Table 2-14. Fish passage incremental cost of best buy plans.

Plan	Total First Cost	Annualized Cost [1]	Incremental Cost	Fish Passage Habitat Units	Incremental Habitat Units	Incremental Cost Per Habitat Unit
S2F2G1	$529,000	$35,600	$35,600	271	271	$131

[1] Includes O&M costs.

Figure 2-12 shows all alternative plans that provide wetland/grassland restoration and fish refuge benefits. Ten of these alternative plans were cost-effective (Table 2-15). Table 2-16 and Figure 2-13 show that five restoration plans—O4, O3, O3P1, O3P2, and O3P3—were identified as a "best buy" plans. Alternative Plan O3P1 was identified as the Recommended Plan for wetland restoration. It provides a total of 85 combined wetland/grassland and fish refuge habitat units with an incremental cost of $4,075 per habitat unit. The total first cost of the plan is $2,047,000.

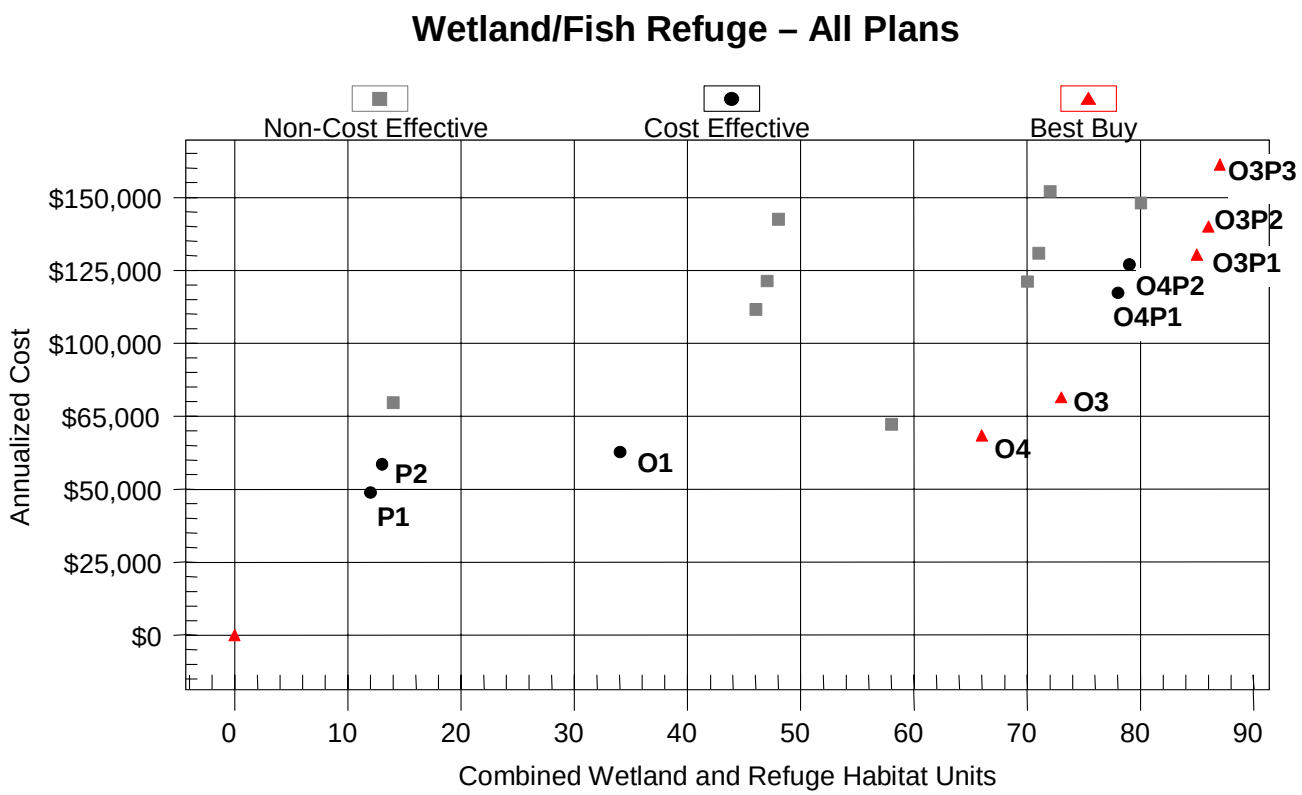

Figure 2-12. Wetland and fish refuge restoration alternatives. (Plan names are shown only for cost-effective and best buy plans.)

Table 2-15. Wetland and fish refuge restoration cost-effective plans.

Plan	Total First Cost	Annualized Cost [1]	Fish Refuge Habitat Unit	Wetland/ Grassland Habitat Unit	Combined Habitat Units	Average Cost/ Habitat Unit
P1	$ 778,000	$ 48,900	0	12	12	$4,075
P2	$ 934,000	$ 58,600	0	13	13	$4,508
O1	$ 987,000	$ 62,800	23	11	34	$1,847
O4	$1,071,000	$ 68,400	61	5	66	$1,036
O3	$1,269,000	$ 81,400	61	12	73	$1,115
O4P1	$1,849,000	$117,300	61	17	78	$1,504
O4P2	$2,005,000	$127,000	61	18	79	$1,608
O3P1	$2,047,000	$130,300	61	24	85	$1,533
O3P2	$2,203,000	$140,000	61	25	86	$1,628
O3P3	$2,543,000	$161,200	61	26	87	$1,853

[1] Includes O&M costs.

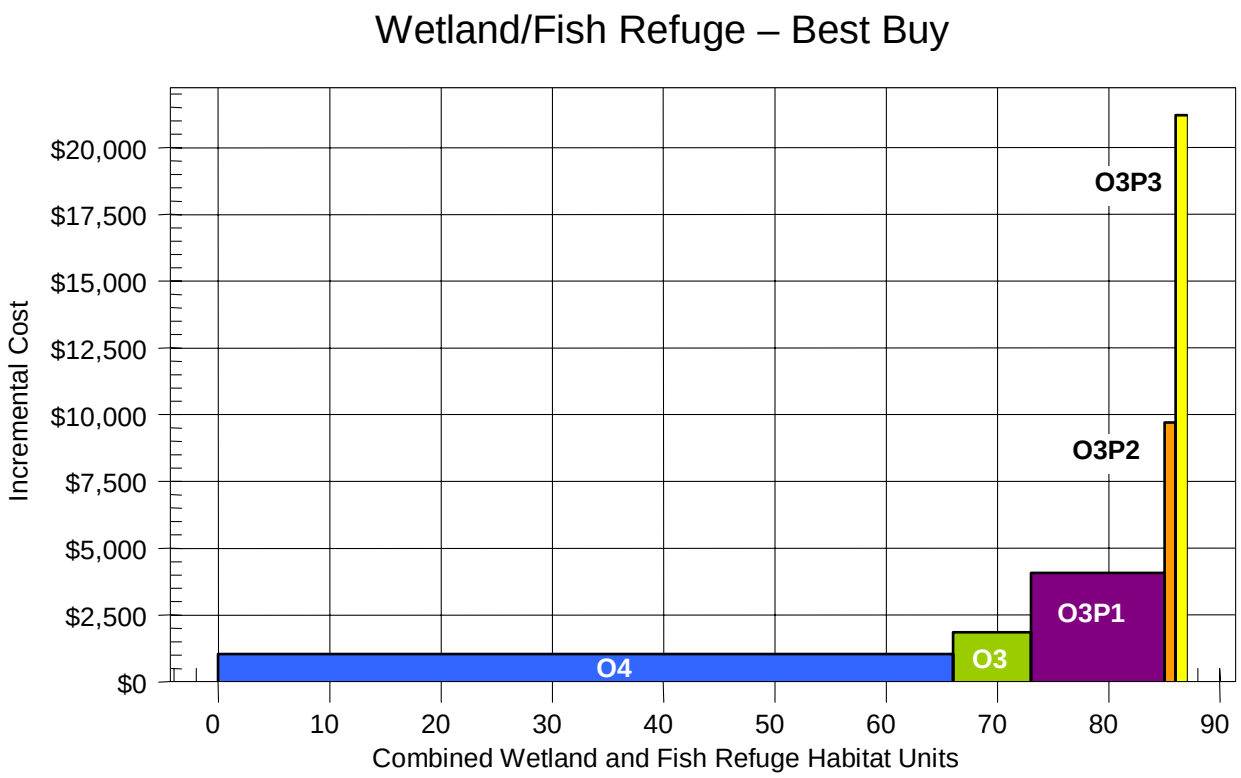

Figure 2-13. Wetland and fish refuge restoration best buy plans.

Table 2-16. Wetland restoration incremental cost of best buy plans.

Plan	Total First Cost	Annualized Cost [1]	Incremental Cost	Combined Habitat Units	Incremental Habitat Units	Incremental Cost/Habitat Unit
No Action						
O4	$1,071,000	$ 68,400	$68,400	66	66	$ 1,036
O3	$1,269,000	$ 81,400	$13,000	73	7	$ 1,857
O3P1	$2,047,000	$130,300	$48,900	85	12	$ 4,075
O3P2	$2,203,000	$140,000	$ 9,700	86	1	$ 9,700
O3P3	$2,543,000	$161,200	$21,200	87	1	$21,200

[1] Includes O&M costs.

Figure 2-14 shows the alternative plan for in-stream restoration at the Fox Valley Greenway. Figure 2-15 and Table 2-17 show that Alternative V1 was the only alternative evaluated. No other suitable riffle locations were identified in this reach. Alternative V1 was identified as the recommended plan for in-stream restoration. It provides approximately 11 habitat units of in-stream benefit at an average cost and incremental cost of $545 per habitat unit. The total first cost of the plan is $91,000.

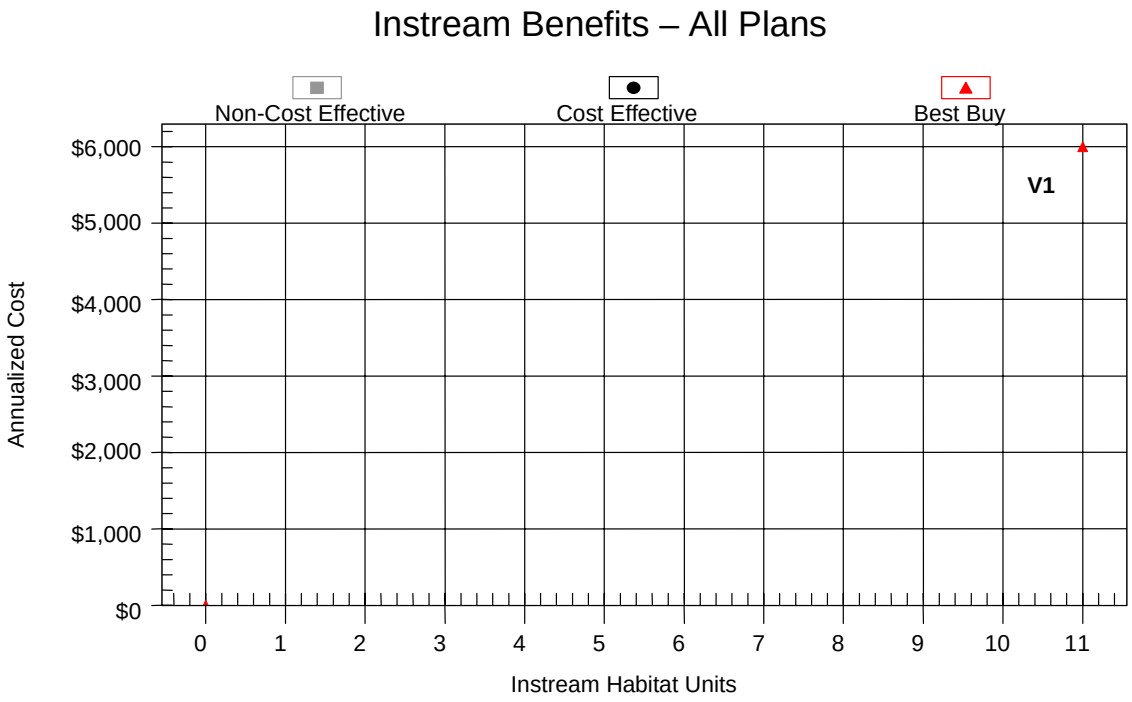

Figure 2-14. In-stream restoration alternatives.

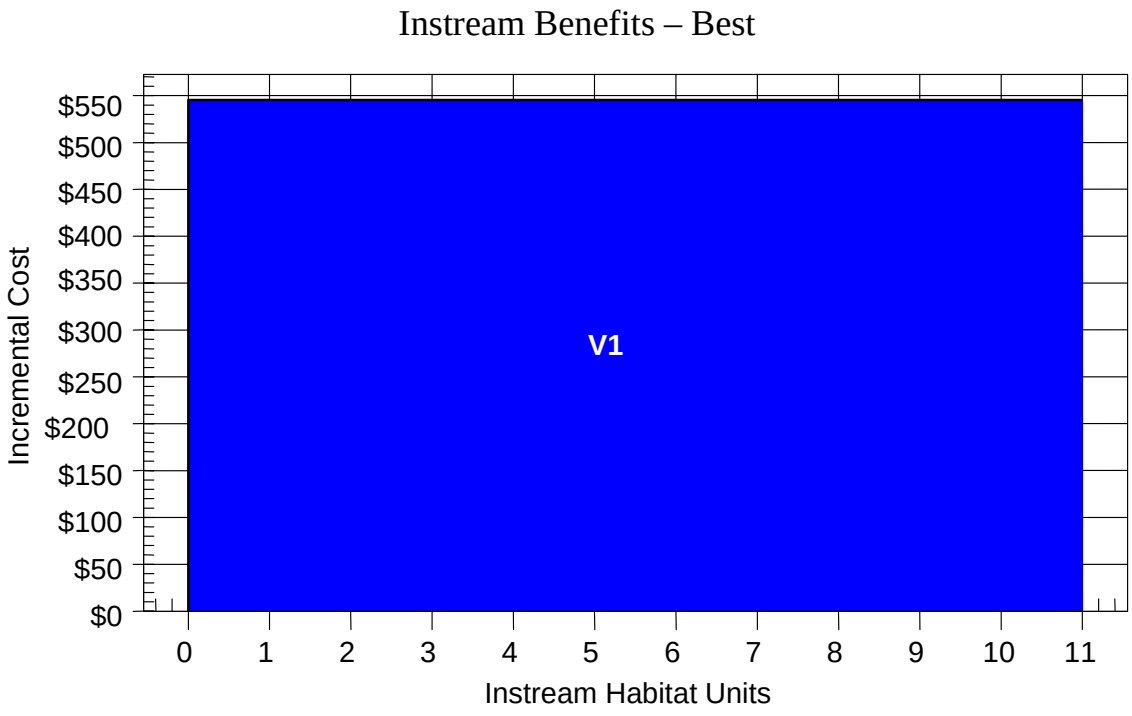

Figure 2-15. In-stream restoration best buy plans.

Table 2-17. In-stream restoration incremental cost of best buy plan.

Plan	Total First Cost	Annualized Cost [1]	Incremental Cost	In-Stream Habitat Units	Incremental Habitat Units	Incremental Cost/Habitat Unit
V0			0		0	0
V1	$91,000	$6,000	$6,000	11	11	$545

[1] Includes O&M costs.

2.6 RECOMMENDED PLAN

The combined recommended plan is comprised of measures S2 F2 G1 O3 P1 V1. The recommended plan would restore access between the Fox River and 7 miles of tributary habitat on Waubonsie Creek; create 6 acres of refuge habitat for fish during high flows; increase in-stream habitat by constructing 3 small riffles and 3 large riffles (rock ramps); create 5.4 acres of shallow water wetland; and establish diverse native vegetation on 25 acres of floodplain. The plan provides 271 fish passage habitat units, 29 wetland/grassland habitat units, 61 fish refuge habitat units, and 11 in-stream habitat units. The total first cost is $2,667,000 (February 2003 price levels) with an annualized cost (including operation and maintenance costs) of $171,900.

The four evaluation criteria of the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*[9] are acceptability, completeness, effectiveness, and efficiency; the recommended plan meets these criteria. The recommended plan is acceptable: the plan is feasible from technical, environmental, economical, financial, political, legal, institutional, and social perspectives. The plan is fully supported by the IDNR, the Oswegoland Park District, the Fox Valley Park District, the Village of Montgomery, the USFWS, and the Natural Resources Conservation Service. Members of the public who attended the July 2002 open houses were also supportive of the project. The recommended plan is complete: realization of the plan benefits does not depend on implementation of actions outside of the plan. The plan is effective: it addresses all the project objectives by restoring connectivity to the maximum amount of stream miles, increasing in-stream habitat and creating/restoring riparian wetlands. Rock ramp fishways are effective at providing upstream and downstream passage for a wide range of fish species at various life stages. The plan is efficient: alternatives with similar project outputs were grouped and cost-effectiveness and incremental cost analysis were conducted on each grouping. The recommended plan is composed of “best buy” plans from each grouping.

The authorizing language (Section 519, Water Resources Development Act of 2000) requires that Illinois River Basin Restoration critical restoration projects produce immediate, independent, and substantial restoration, preservation, and protection benefits; the recommended plan meets these criteria. Restoration benefits would be immediate, as habitats would be connected and accessible once the existing structures are modified. The project would be independent, requiring no other non-project feature to meet performance objectives. The benefits would be substantial as fish and aquatic organisms have access to important tributary habitat.

[9] U.S. Water Resources Council, 1983. Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. U.S. Government Printing Office, Washington DC.

Section 3

Project Assessment

3.1 RECOMMENDED PLAN

This section describes in detail the plan recommended in the previous section. Plates 4 through 9 show locations of the project features, while plates 10 through 20 show more specific details.

3.1.1 Stonegate Area

The Lower Stonegate Dam would be modified by widening the existing notch in the spillway. This V-notch was performed as part of the 1999 project, but has subsequently filled in with boulders and cobbles such that it is no longer effective. In addition to widening the notch, additional rock would be placed on the downstream face of the dam, creating a more gradual slope from the notch to the streambed. Plate 10 details the proposed work. This combination of lowering the spillway and improving the rock ramp is expected to greatly enhance upstream passage of fish species during critical spawning periods.

The two existing riffle structures between the Upper and Lower Stonegate Dams would be modified by flattening their downstream slopes. This would be accomplished by placing additional rock material. Plates 11 and 12 show this modification. The flattening of these slopes is expected to enhance upstream passage of more individuals and species of fish during critical spawning periods. The left bank of the stream between the Upper Stonegate Dam and upper riffle would be lined with riprap to prevent flanking of the Upper Stonegate Dam and Upper Stonegate Riffle. Plate 20 shows the proposed placement detail.

The Upper Stonegate Dam would be severely notched such that the majority of the exposed spillway would be removed. Since the notch elevation would be lower than the crest of the existing upper riffle, the notched spillway should not be apparent even at low-water elevations. The bank would be protected with riprap upstream and downstream of the dam. This modification is detailed on plate 13. This effective removal of the dam spillway is expected to facilitate fish passage.

3.1.2 Pfund Area

The Lower Pfund Dam site would be cleared of the large residual debris. This debris is creating a flow diversion and would be placed off site. Although it is not believed to currently be inhibiting fish passage, the removal of this debris would eliminate potential future shifting of this material and creation of an obstruction.

The Upper Pfund Dam would be modified by constructing a rock ramp on the downstream face of the structure. Rock fill would be placed in the center section of the dam and the stoplogs would be removed. This center section would be lower than the rest of the dam, which would allow the flow to concentrate in this area. Plate 14 shows the proposed modification. The proposed rock ramp is expected to facilitate upstream passage of fish.

3.1.3 Golf Course Area

The Golf Course Dam would be modified by constructing a rock ramp on the downstream face of the structure. This ramp would be as high as the concrete spillway, thereby assuming the absence of stoplogs during the high spring flows. The ramp placement is shown on plate 15. The rock used to construct this ramp would be rounded fieldstone boulders in order to match the aesthetic character of the area.

3.1.4 Oswegoland Greenway Area

There would be three in-stream structures in this reach of the project. The first of these would be a grade control structure downstream of the Pearces Ford Road Bridge, detailed on plate 16. This grade control structure would be constructed of rock keyed into the streambed and banks. This structure would not project into the stream and would serve only to arrest a potential head cut propagating from the unstable area just downstream. The other two would be riffle structures as shown on plates 17 and 18. These structures also would be constructed of rock keyed into the streambed and bank, but they would project into the stream approximately 18 inches to create a permanent pool and provide a consistent low-water elevation in the proposed wetlands. The downstream riffle structure would be located upstream of the Pearces Ford Road Bridge, and the upstream riffle would be located upstream of the Old Post Road Bridge.

There would be three oxbow channel wetlands along the stream in this reach of the project. Each wetland channel would have the same streambed elevation as the adjacent channel. Each wetland would have a low-water connection to the stream at the downstream end, angled downstream. This would prevent flow through or into the wetland, but would allow water to “back up” into the wetland. The wetland channels would have a 10-foot bottom width with 2H:1V slopes up to a horizontal bench 3.5 feet above the channel bottom on both sides. The horizontal bench would be 6 feet wide on each side and slope up to meet the existing ground at a 4H:1V slope. These lateral wetlands are expected to not only provide a more diverse wetland habitat, but also would provide low-velocity refuge areas for fish during high flow events. There is a proposed wetland (Area 1) west of the stream upstream from Pearces Ford Road, a wetland (Area 2) east of the stream upstream of Old Post Road, and a wetland (Area 3) west of the stream downstream of Barnaby Drive. A typical template showing the oxbow channels is included on plate 20. The low-water elevation for Wetland Areas 1 and 2 would be controlled by the downstream riffle, and for Wetland Area 3 by the upper riffle.

The wetland areas would be planted with native wetland vegetation, with emergent species in inundated areas and mesic prairie species in higher areas. Additionally, the entire surrounding greenway area between Pearces Ford Road and Barnaby Drive would be replanted with mesic prairie species.

3.1.5 Parkview Estates Area

There would be one off-channel wetland in this area within the existing dry reservoir. A 2.1-acre wetland is proposed in the northern portion. This wetland would be constructed so that at least 12 inches of water would be present over a majority of the wetland area. The wetland area would be planted with native wetland vegetation, with emergent species in inundated areas and mesic prairie species in the higher surrounding areas. Existing areas of more diverse plant communities would be preserved to the extent possible. Plate 20 shows a typical section of the wetland excavation. This area is expected to provide enhanced wetland habitat.

3.1.6 Fox Valley Greenway Area

One riffle structure would be installed downstream of the Montgomery Road Bridge. This structure, shown on plate 19, would be constructed of rock keyed into the streambed and bank, and would project into the stream approximately 12 inches to create a permanent pool. This structure is expected to improve aquatic habitat by providing an area of increased water depth.

3.1.7 HTRW Assessment

3.1.7.1 Introduction

A Phase I ESA (Environmental Site Assessment) was performed in general conformance with ASTM Practices E 1527-00 and E 1528-00, ER 1165-2-132, and Illinois Statute 415 ILCS 5/22.2(j)(6)(E)(v) for the following Waubonsie Creek Section 519 Project Plan study areas, located near the cities of Oswego, Montgomery and Aurora, in Kane and Kendall Counties, Illinois. The plan study areas (sites) generally consisted of dam or riffle structures in Waubonsie Creek or a wetland creation adjacent to the creek as follows:

- Dam sites located within the banks of Waubonsie Creek including the Stonegate area, Pfund area, and Golf Course area (site 1).

- Oswegoland Greenway includes three wetland locations adjacent to the banks of Waubonsie Creek (site 2).

- Parkview Estate Reservoir includes one wetland location adjacent to Waubonsie Creek (site 3).

- Fox Valley Greenway includes one location within the banks of Waubonsie Creek (site 4).

The Phase I ESA, dated October 9, 2002, is on file for review at the Rock Island District headquarters. Any exceptions to, or deletions from, this practice are described in Section 2 of the report. A detailed summary of the Phase I ESA findings is included in Appendix D.

3.1.7.2 Phase I ESA Conclusions

The Phase I ESA revealed no evidence of hazardous substances, HTRW, or other regulated contaminants in connection with the target properties.

3.1.7.3 Phase IIA ESA Conclusions

Since the Phase I ESA revealed no potential existence of hazardous substances, HTRW, or other regulated contaminants within the project study areas, no Phase IIA ESA occurred to determine the presence or absence of contaminants on the aforementioned project study areas.

3.1.7.4 Recommendations

The HTRW due diligence process did not reveal any evidence of significant concentrations of hazardous substances, HTRW, or other regulated contaminants in connection with the Waubonsie Creek Section 519 River Basin Restoration Project Study areas. Therefore, the Waubonsie Creek Section 519 River Basin Restoration Project may proceed without implementing any limitations or special construction techniques commonly associated with HTRW contamination.

3.1.7.5 Disclaimer

No ESA can wholly eliminate uncertainty regarding the existence for recognized environmental conditions concerning a property. The HTRW due diligence process intends to reduce, but not eliminate, uncertainty regarding the existence of recognized environmental conditions in connection with a property with reasonable limits of time and cost. Continuing the HTRW due diligence process beyond the Phase IIA ESA may not necessarily reduce uncertainty nor reveal unidentified environmental liabilities. If any previously unaddressed recognized environmental condition should arise, this HTRW due diligence process will be revisited and amended.

3.2 DESIGN CONSIDERATIONS

General design considerations for all projects features involve meeting project goals while not adversely impacting the 100-year flood profile. In addition, the constructed works should be low maintenance and aesthetically compatible with the surroundings. Constructed works should not cause detriment to personal or public property. Table 3-1 summarizes quantities of the key features that constitute the project.

In-stream structures, including riffles and ramps on dams, would be sloped downstream at an angle of 20H:1V (5%). This slope is believed to be traversable upstream by the warmwater fish. The rock ramps would be constructed of crushed limestone riprap, sized appropriately by hydraulic analysis. The crestline of the rock riffles would be composed of cut limestone blocks, keyed approximately 3 feet into the streambed. The crestline would also be keyed into the bank approximately 10 feet on each side. The use of bedding stone beneath the placed rock is not anticipated to be necessary. When first constructed, the rock structures may experience a higher level of through-flow than is desired. Over time, this would decrease as bedload and small debris become drawn into the rock.

Hydrologic analysis of the watershed and hydraulic analysis of the proposed project features and existing conditions were performed. The design of in-stream structures was performed in accordance with floodplain regulations of the State of Illinois. A full discussion of these issues is available in Appendix F.

Table 3-1. Design feature summary.

Area/Feature	Item	Quantity	Unit
Lower Stonegate Dam	Sawcut Notch	15	LF
	Riprap	83	Ton
Middle Stonegate			
• Riffles	Riprap	34	Ton
• Left Bank	Riprap	258	Ton
Upper Stonegate Dam	Sawcut Notch	16	LF
	Riprap	150	Ton
Lower Pfund Dam Site	Remove Dam Debris	8	CY
Upper Pfund Dam	Crest Stones	16	Ton
	Riprap	484	Ton
Golf Course Dam	Fieldstone	64	Ton
Oswegoland Greenway			
• Wetland 1	Length	600	LF
	Excavation	5000	CY
• Wetland 2	Length	600	LF
	Excavation	4800	CY
• Wetland 3	Length	400	LF
	Excavation	2800	CY
• Bank Shaping	Length	2800	LF
	Excavation	5600	CY
• In-Stream Structures	Crest Stones	150	Ton
	Riprap	126	Ton
• Vegetation Establishment	Total Area	24	Acre
Parkview Estates			
• 2.1-Acre Wetland	Depth	3	FT
	Excavation	9000	CY
• Vegetation Establishment	Total Area	19	Acre
Fox Valley Greenway			
• Riffle	Crest Stones	28	Ton
	Riprap	30	Ton

3.2.1 Stonegate Area

A project was executed in 1999 in the Stonegate area involving modification (notching and ramping) of the Lower Stonegate Dam and the installation of two riffle structures between the dams. Much of the proposed work is a modification of this existing project. The modification of the Lower Riffle Structure would require a slight lowering of the crest elevation to avoid detrimentally impacting flood elevations. The crest elevation would be lowered by approximately 0.7 foot.

3.2.2 Pfund Area

As noted earlier in this report, the Upper Pfund Dam is in private ownership. The owner desires to retain the pool created by the dam for a small flock of resident domestic geese. Therefore, removal of the dam was not an option, and any modification would need to maintain a pool for this purpose.

Lowering of the pool by a small increment (approximately 0.5 foot) is considered acceptable and would likely be necessary to return the central portion of the dam spillway to the control section.

3.2.3 Golf Course Area

The Golf Course Dam is a low-head structure that can be raised through the use of stoplogs. Golf course personnel have indicated that stoplogs are placed to a maximum of 1 foot above the concrete spillway during dry periods (late summer) to maintain the adjacent pond elevation for irrigation purposes. The design of the required rock ramp would consider only the distance from the streambed to the concrete spillway. It would be assumed that stoplogs would not be in place during the critical spring spawning period. It would be prudent, however, to specify periods during which stoplogs cannot be installed in the Operation and Maintenance Manual. Additionally, the existing dam abutments incorporate rounded fieldstone boulders as do the banks in the vicinity of the dam. Golf course personnel have requested that the proposed rock ramp be constructed of fieldstone rather than a crushed limestone material.

3.2.4 Oswegoland Greenway Area

The low-water elevations in the proposed off-channel wetlands would be controlled by the proposed riffle structures. The connections from the wetlands to the channel would be angled downstream to discourage high velocity flow and sediment from entering the wetlands. Wetland side slopes would be no steeper than 4H:1V on the channel side to minimize erosion and potential channel rerouting through the wetland when the stream elevation exceeds bankfull. Since the wetland would be connected to the channel, the differential head between the channel and the wetland water level at overtopping should be minimal. Some excavated material from the wetland creation and the bank grading would be placed on site by widening the areas of the existing bridge approach embankments. These areas are often termed “hydraulic shadows,” as they are areas of ineffective flow that have minimal impact on flood elevations. Excavation in excess of that allowed in the hydraulic shadows would be placed off site.

3.2.5 Parkview Estates Area

Consistent water elevations within the excavated wetlands would depend on site ground water elevation. Initial information indicates that the seasonal low groundwater elevation is about 2 feet below the ground surface. Therefore, a nominal excavation depth of 3 feet is anticipated to provide adequate water depth at all times. Excavated material would be hauled to the off-site placement area so as not to reduce the storage capacity of the reservoir.

3.2.6 Fox Valley Greenway Area

The proposed riffle structure in this area would be placed to effect an increase in water depth. Like the other proposed riffle structures, it would be constructed of rock and keyed into the streambed and banks.

3.2.7 Vegetation Establishment

Vegetation establishment would be required in the Oswegoland Greenway and Parkview Estates areas. An intensive 5-year regimen is proposed to be included as an auxiliary contract, and then the areas would be turned over to the sponsors. Tables 3-2 and 3-3 show proposed vegetation establishment procedures for the subject areas. These tables assume planting in the fall and would need to be adjusted accordingly if planting occurs during the spring.

Table 3-2. Establishment procedure for mesic prairie (5 year).

YEAR 1	
Plow under existing rootmat	Mid-Late Fall
Apply desired species seed	Late Fall
YEAR 2	
Apply herbicide (100% of area)	Early Spring
Mow to about 8 inches	Early June
Mow to about 8 inches	Early October
YEAR 3	
Spot-treat with herbicide (50% of area)	Early Spring
Mow to about 8 inches	Early June
Mow to about 8 inches	Early October
Re-apply desired species seed (50% seeding density)	Late Fall
YEAR 4	
Spot-treat with herbicide (25% of area)	Early Spring
Spot-treat with herbicide (10% of area)	Early Summer
Spot-treat with herbicide (10% of area)	Early Fall
YEAR 5	
Spot-treat with herbicide (10% of area)	Early Spring
YEAR 6-50 (O&M)	
Spot-treat with herbicide (5% of area)	Early Spring or Summer

Notes:

- The early spring herbicide applications are intended to affect the reed canarygrass before the desired species have emerged.
- The mowing and herbicide applications in early summer and fall are intended to affect surviving reed canarygrass before seeds ripen.
- Herbicide should be Rodeo, applied at a rate of 2 quarts/acre.
- Plowing at Parkview Estates may be problematic due to high water table.

Table 3-3. Establishment procedure for wetland (5 year).

YEAR 1	
Plant emergent rootstock	Early Fall or Spring
YEAR 2	
Assess survival and re-plant (25%)	Early Fall or Spring
YEAR 3	
Assess survival and re-plant (15%)	Early Fall or Spring
YEAR 4	
Assess survival and re-plant (10%)	Early Fall or Spring
YEAR 5	
Assess survival and re-plant (5%)	Early Fall or Spring
YEAR 6-50 (O&M)	
Spot-herbicide fringe to control reed canarygrass	Early Spring or Summer

Notes:

Reed canarygrass control on the perimeter of the submerged wetlands will be conducted as part of the establishment and control procedure for the mesic prairie.

3.2.8 Off-Site Placement

The wetland excavation sites at Oswegoland Greenway and Parkview Estates would produce excess material that would need to be placed off site. The contractor would be responsible for locating a commercial dumping site. The material also could be put to beneficial use in other local construction projects. The material must be placed in a manner that complies with federal, state, and local laws. For the cost estimate, it was assumed that material would be hauled to and dumped at Fox Ridge Sand and Gravel, 6110 State Route 71, Oswego, IL. This is a readily available commercial site that will take fill material for a fee and is located about 6 miles from the Oswegoland Greenway site and about 9 miles from the Parkview Estates site.

3.3 CONSTRUCTION CONSIDERATIONS

The proposed construction generally can be separated into two types of work: in-stream and off-stream. The in-stream work includes modification and construction of dams, riffles, ramps, revetment, and grade control structures. The off-stream work includes wetland excavation and vegetation establishment.

In-stream construction would most easily be performed during low-flow periods, typically expected during late summer or winter. It is assumed that rock placement and adjustment can be done in-stream without dewatering or diversion. Two locations require concrete sawing on existing spillways (Upper and Lower Stonegate Dams). It is believed that this work can be accomplished in the dry by use of minor sandbag cofferdams and pumping.

An informal search and relocation of freshwater mussels shall be completed prior to initiation of in-stream construction including dam modifications, riffle modifications, and riffle construction. Relocations shall be completed in early to mid-summer during normal flows to minimize stress on relocated individuals. Relocations shall be conducted by Corps of Engineers or IDNR staffs.

Off-stream construction also would be better suited to drier periods, presumably during summer and fall. Wetland excavation should be coordinated with subsequent vegetation establishment so that large bare areas are not exposed to weathering and erosive processes for extended periods. Wetland excavations are expected to encounter groundwater, and the contractor will need to be prepared to deal with this. Appendix E includes soil boring information from the proposed wetland sites, along with a discussion of subsurface conditions.

3.3.1 Stonegate Area

Staging and access would be from the right bank. Most of the work should be performed from within the stream or the right bank, with the exception of the bank protection along the left bank.

3.3.2 Pfund Area

Removal of the Lower Pfund Dam debris shall be accomplished, if possible, with equipment on the right bank, not in the stream. Streambed irregularities caused by debris removal shall not be shaped as these areas provide in-stream habitat. The streambank shall be shaped following debris removal.

Staging and access would be from the right bank, just downstream of the Pfund Court bridge over Waubonsie Creek. Equipment would access the Upper Pfund Dam by traveling beneath the bridge and upstream a short distance within the stream to the dam.

3.3.3 Golf Course Area

This area is very sensitive to any damage or disturbance, as it lies within the Fox Bend Golf Course. The most likely staging area would be the maintenance shed northeast of the dam. Equipment to transport rock to the dam and effect placement should be relatively light to minimize turf disturbance.

3.3.4 Oswegoland Greenway Area

As this area is adjacent to three city streets, access would be relatively straightforward. The areas of wetland excavation would be stripped to a depth of about 6-12 inches, with the stripped material stockpiled on site. Additional organic soil would be hauled to the Parkview Estates site for topsoil dressing. Most of the excavated soil would be placed along the existing bridge approaches. The balance of the excavation would be placed off site. The stockpiled topsoil would be used to bring the wetland area to final grade and provide a fertile medium for the establishment of plant species in any disturbed areas.

3.3.5 Parkview Estates Area

Access to this area is off a city street, crossing the Gilman Nature Trail. The material produced by wetland excavation would be placed off site. Stockpiled topsoil from the Oswegoland Greenway excavations would be used to bring the wetland area to final grade and provide a fertile medium for the establishment of plant species.

3.3.6 Fox Valley Greenway Area

Staging and access would be off the left bank, near Montgomery Road.

3.4 STORM WATER POLLUTION/EROSION CONTROL

The areas disturbed by riffle and ramp construction are relatively small and should not present major erosion problems. There is potential for storm water pollution during wetland construction and bank regrading at the Oswegoland Greenway site. The contractor would need to coordinate construction activities and employ erosion control measures to minimize sediment release into the channel.

3.5 PERMITS

A Section 404(b)(1) Evaluation is included as Appendix B of this document. A Section 401 water quality certificate from the State of Illinois will be included in the final submission of this report. An IDNR-OWR permit for modifications to existing dams also will be required.

3.6 OPERATION AND MAINTENANCE CONSIDERATIONS

The only operated works associated with this project are the Golf Course Dam and Parkview Estates Reservoir. The Golf Course Dam is raised by stoplogs by golf course personnel during times of low flow, for purposes not associated with this project. Since fish passage would not be desired or possible during periods of low flow, this practice should not interfere with project operation. The proposed wetlands within Parkview Estates Reservoir would not affect the operation of the facility.

Maintenance considerations involve replacement of rock material, removal of debris, removal of sediment, and vegetation maintenance.

Riffle structures, rock ramps, and bankline revetment are composed of large rock particles. Over time, some rock loss is expected due to high flow events and, in urban areas, vandalism. Frequency of this required maintenance is estimated at about every 5 years, depending on actual

conditions. In-stream structures would also catch fallen trees and other debris and would need to be periodically cleared, probably once or twice a year.

The areas susceptible to sedimentation would be the wetlands in the Parkview Estates and Oswegoland Greenway areas. Since Parkview Estates is effectively disconnected from the channel, only storm water discharge from the subdivision enters the reservoir. The only time sediment from the stream could enter the reservoir is when the perimeter berm is overtopped. While this has happened before, it is a relatively rare event. This report assumes that sedimentation of the wetland excavations in Parkview Estates is negligible. The Oswegoland Greenway wetlands are expected to experience some sedimentation since they are connected to the creek. Coarser sediment may be deposited within the connecting channels between the wetlands and the creek and would require periodic removal. Frequency of this removal is estimated to be every 3-5 years, but would depend on actual conditions. The wetlands themselves would only be expected to collect finer sediments. Over the 50-year life of the project, no more than 1 foot of sediment, and likely much less, would be expected. Periodic removal of sediment from the wetland areas is not anticipated.

Vegetation maintenance would be required in the Oswegoland Greenway and Parkview Estates areas after the initial 5-year establishment. Table 3-5 in section 3.7.2 outlines O&M requirements for the areas.

3.7 COST ESTIMATES AND PROJECT FUNDING

3.7.1 First Costs

A detailed estimate was developed for the selected alternative plan using the Micro Computer Aided Cost Estimating System (MCACES). This detailed estimate was prepared using preliminary project plans, information gathered from site visits, and discussions with design team members and the local sponsor, and review of similar construction projects.

The Current Working Estimate (CWE) design and construction costs were revised to reflect March 2004 price levels. Plans and Specifications are scheduled for August-November 2004. The Fully Funded Estimate (FFE) design costs are based on the midpoint of October 2004, resulting in inflation of 2%. Construction is scheduled for December 2005-September 2007. The Fully Funded Estimate (FFE) construction costs are based on the midpoint of November 2006, resulting in inflation of 6% for construction and 8% for construction management and engineering during construction per EM 1110-2-1304, dated September 30, 2003.

The project design and construction costs are presented in Table 3-4, for a summary of estimated costs by site see Appendix G. Operation, Maintenance and Rehabilitation estimated costs are presented in Table 3-5. A more detailed description of cost estimating procedures can be found in Appendix G.

Table 3-4. Waubonsie cost summary (recommended plan).

ACCOUNT	FEATURE	CURRENT WORKING ESTIMATE (CWE)	FULLY FUNDED ESTIMATE (FFE)
1	LANDS AND DAMAGES	$959,000	$959,000
6	FISH AND WILDLIFE FACILITIES[1]	$1,377,000	$1,459,600
30	PLANNING, ENGINEERING AND DESIGN[2]	$137,700	$140,500
	PROJECT COOPERATION AGREEMENT	$9,600	$9,600
31	CONSTRUCTION MANAGEMENT[3]	$123,900	$133,800
61	ENGINEERING DURING CONSTRUCTION[4]	$96,400	$104,100
	PROJECT COSTS SUBJECT TO COST SHARING	$2,703,600	$2,806,600
	NON-FEDERAL COSTS[5]	$946,300	$982,300
	ESTIMATED NON-FEDERAL LANDS AND DAMAGES[6]	($878,000)	($878,000)
	REQUIRE NON-FEDERAL CASH OR WORK-IN-KIND	$68,300	$104,300
	FEDERAL COST[5]	$1,757,300	$1,824,300

Notes:

[1] Includes 25% contingency

[2] Estimated at 10% of construction cost.

[3] Estimated at 9% of construction cost

[4] Estimated at 7% of construction cost

[5] All project features are subject to 65% Federal and 35% non-Federal cost share.

[6] Non-Federal Lands and Damages include land payments for the required real estate expenses and incidental real estate expenses including mapping, title evidence appraisals, negotiating, closings, etc.

3.7.2 Annual O&M Costs

Table 3-5. Annual Operation, Maintenance and Rehabilitation cost summary.

Area	Operation [1]	Annual Maintenance	Rehabilitation[2]
Stonegate		$1,700	
Pfund		$600	
Golf Course		$400	
Oswegoland Greenway*		$2,300	
Parkview Estates*		$400	
Fox Valley Greenway		$300	
Total		$5,800	

* Herbicide applications for Oswegoland Greenway and Parkview Estates for Years 1-5 are included with Construction Costs. For Years 1-5, Maintenance is $1,557 at Oswegoland and $0 at Parkview.

[1] The proposed projects are self-operating and would require only periodic inspection and maintenance.

[2] Rehabilitation is reconstructive work that significantly exceeds the annual operation and maintenance requirements. This is typically the result of major storm or flood events. Therefore, rehabilitation cannot be accurately estimated.

3.7.3 Post-Construction Monitoring Costs

Table 3-6 outlines post-construction monitoring costs. The IDNR is responsible for all post-construction monitoring. The IDNR may develop sub-agreements with other agencies to conduct some of the post-construction monitoring as indicated in Table 3-6.

Table 3-6. Project monitoring costs.

Monitoring Item	Frequency	Estimated Cost per Occurrence	Agency
Electrofishing	Every 5 years	$4,600	IDNR
Fish Seining	Twice (Year 1)	$3,000	IDNR
Benthic Surveys	Once (Year 10)	$2,000	IDNR
Vegetation Transect	Once (Year 10)	$ 560	IDNR
Visual Vegetation Monitoring	Every year	$ 400	IDNR/Oswego Park District/Village of Montgomery
Ramp Slope	Every 5 years	$ 800	IDNR/Park Districts
Wetland Water Level	Three (Year 1)	$ 200	IDNR

3.8 POST-CONSTRUCTION PROJECT PERFORMANCE ASSESSMENT

The Project Performance Assessment will allow measurement of differences from baseline conditions for key physical and biological factors. This should allow a quantitative determination of improvement and assessment of whether features are functioning as intended.

3.8.1 Monitoring and Performance Evaluation Matrix

Table 3-7 shows general performance evaluation purposes and responsible agencies for all stages of the project.

3.8.2 Data Collection Summary

Table 3-8 shows specific data collection requirements for all stages of the project.

TABLE 3-7. Data collection and performance evaluation matrix.

Project Phase	Type of Activity	Purpose	Responsible Agency	Implementing Agency	Funding Source
Feasibility	Resource Monitoring	Establish baselines for problem identification and performance evaluation.	Corps/Sponsor	Corps/Sponsor	Corps/ Sponsor
	Problem Analysis	Identify system-wide problems based on data and observations.	Sponsor	Sponsor	Sponsor
		Identify site-specific problems consistent with project goals and objectives.	Corps/Sponsor	Corps/Sponsor	Corps/ Sponsor
	Project Feature Data Collection	Establish need of proposed project features consistent with goals and objectives.	Corps	Corps	Corps/ Sponsor
Design	Data Collection for Design	Include quantification of project objectives, design of project, and development of performance evaluation plan.	Corps	Corps	Corps
Construction	Construction Monitoring	Assess construction impacts; assure permit conditions are met.	Corps	Corps	Corps
Post-Construction	Performance Evaluation Monitoring	Determine success of project as related to goals and objectives.	Sponsor	Sponsor as part of O&M	Sponsor

TABLE 3-8. Resource monitoring and data collection summary.

Type Measurement	Engineering Data			Natural Resource Data			Sampling Agency	Remarks
	Pre-Project Phase	Design Phase	Post-Const. Phase	Pre-Project Phase	Design Phase	Post-Const. Phase		
POINT MEASUREMENTS								
Boring Stations Geotechnical Borings		1					Corps	See Appendix E for boring logs and locations.
Fish Stations Electrofishing[1]				5Y		1; 5Y	IDNR	IDNR sampling sites should be sampled the first spring following modification of dams for fish passage. Sampling should be continue at IDNR sampling sites every 5 years according to IDNR protocol. A sampling site between the Upper Stonegate Dam and the Lower Pfund Dam should be added. Sampling should be conducted during 2 time periods: (1) spring spawning period (Mar-Apr) to monitor use by spawning fish, and (2) summer to monitor fish and invertebrate diversity. Sampling conducted in 1997, 2001.
Fish Seining						1	IDNR	Wetland refuges in Oswegoland Greenway should be sampled during or following a high flow event to determine if fish are using the refuge areas.
Benthic Surveys				5Y		1	IDNR	Sampling should be conducted at IDNR sampling sites. A sampling site in the riffle portion of Oswegoland Greenway should be added.
QHEI					1		Corps, IDNR	Qualitative Habitat Evaluation Index was conducted in fall 2001 by Corps and IDNR staff at IDNR electrofishing sites.
TRANSECT MEASUREMENTS								
Vegetation Transects				1		2[2]	Corps/IDNR	Parkview Estates and Oswegoland Greenway, at Year 5 (during construction, Corps) and Year 10 (post-construction, IDNR).

TABLE 3-8. Resource monitoring and data collection summary (continued)

Type Measurement	Engineering Data			Natural Resource Data			Sampling Agency	Remarks
	Pre-Project Phase	Design Phase	Post-Const. Phase	Pre-Project Phase	Design Phase	Post-Const. Phase		
AREA MEASUREMENTS								
Visual Estimate						1Y	Oswegoland Park District and Village of Montgomery	Visual estimates of Reed Canarygrass invasion at Oswegoland Greenway and Parkview Estates.
LAND SURVEY								
Topographic		1					Corps, NRCS	NRCS at Fox Valley Greenway; Corps at remaining sites
Slope			5Y				IDNR/ Oswegoland Park District	Survey slope of rock ramp at all dams modified for fish passage and riffles installed to ensure maintenance of 20H:1V slope on ramps.
HYDRAULIC AND HYDROLOGIC MEASUREMENTS								
Flow Measurement [3]	C						IDNR OWR	IDNR Office of Water Resources stream gage located on Highway 34 Bridge behind Oswego Police Dept (3525 Highway 34, Oswego), gage active from March 1998 to September 2001.
Flow and Depth			4[2]				Corps	Flow and depth at all dam sites should be measured 2 years during spawning period (Mar-Apr); 2 years during low flow (Jul-Aug).
Water Level			3				IDNR	Measure depth of water in the wetlands in the Oswegoland Greenway.

LEGEND
C = Continuous
Y = Yearly
NY = n-Year interval
1,2,3 --- = number of times data is collected within designated project phase

Notes:
[1] 1997 Sampling data included in Technical Appendix Volume II, of Waubonsie Creek Watershed Plan, 1999
[2] Monitoring by the Corps through Year 5 is considered during construction due to contracts for vegetation establishment.

3.8.3 Post-Construction Evaluation

The Post-Construction Evaluation, or Monitoring Plan, is outlined in Table 3-8 and on plates 21-24. The specific monitoring requirements are briefly outlined below.

Electrofishing – IDNR sampling sites should be sampled the first spring following modification of dams for fish passage. Subsequent sampling should occur every 5 years thereafter. Each sampling includes two time periods: spring spawning event and summer. Electrofishing stations are shown on plate 21.

Fish Seining – Nets should be used at the openings to the lateral wetlands in the Oswegoland Greenway Area, as shown on plate 23, following high water events to determine if fish are using the lateral wetlands for low-velocity refuge as intended. This should be performed at least once at each wetland.

Benthic Surveys – A benthic survey to assess any changes in water quality should be performed at approximately Year 10.

Vegetation Transects – An investigation of the vegetation encountered along predetermined transects, shown on plates 23 and 24, should be made pre-project and again at Years 5 and 10. Year 5 corresponds to the end of the intensive vegetation establishment program outlined earlier.

Vegetation Visual Estimates – A rough visual survey should be made each year to determine portions of the Oswegoland Greenway and Parkview Estates Areas that are comprised of reed canarygrass. This should help guide annual vegetation maintenance to control the invasive plant.

Flow Depth – Depth of flow over riffles and ramped dam structures, indicated on plates 21-23, should be measured during the first 2 years during the high spring flows and during the late summer low flows. This will help assess the flow regime considering the results of the electrofishing sampling.

Slope – Riffles and rock ramps should be surveyed every 5 years to ensure maintenance of the proper slope for passage. This information will be useful for periodic rock replenishment.

Wetland Water Levels – Water depth soundings will be taken along the vegetation transect lines to assess sedimentation within the wetlands. This should be performed at the same time as the vegetation transects, at Years 5 and 10.

3.9 REAL ESTATE CONSIDERATIONS

The Real Estate Plan for the project provides a detailed analysis of the real estate requirements (see Appendix H). Justification for Easement estates in lieu of Fee is included in the Real Estate Plan. In general, a Channel Improvement Easement would be acquired over 52.8 acres, a Road Easement would be acquired over 1.16 acres, and a Temporary Work Area Easement would be acquired over 6.34 acres. The project lands are expected to affect 14 landowners.

The Sponsor, the IDNR, does not own any of the lands required for the project. There are no Federal projects or federally owned lands within any of the project boundaries. Navigational Servitude does not apply. It is not anticipated that the project will cause induced flooding.

A model PCA (Project Cooperation Agreement) is not available for this project. A PCA has been drafted and will require review and approval by Corps of Engineers Headquarters. This agreement will be executed after project approval and funding availability.

3.10 ENVIRONMENTAL EFFECTS

3.10.1 Environmental Impacts of the No Action Plan

With the selection of the no action plan, Waubonsie Creek would continue in its present state. Section 1.4 describes future without-project conditions in more detail.

- Off-channel wetlands would remain absent from the majority of the watershed and Oswegoland Greenway fish would continue to be negatively affected by the increased flows.
- Parkview Estates would continue to be dominated by reed canarygrass.
- Dam locations would remain barriers to aquatic migration into Waubonsie Creek until their failure or removal/modification by other agency.
- Habitat-enhancing riffles would not be built into the Fox Valley Greenway.

3.10.2 Environmental Impacts of the Recommended Plan

3.10.2.1 Natural Resources

Natural resources of the Waubonsie Creek watershed would be positively affected by this project. Fish passage at dam sites would allow fish and other aquatic organisms to migrate into Waubonsie Creek and utilize habitats. Creation of wetland areas within the Oswego Greenway would allow for wetland-dependant species to utilize the area for spawning, rearing, and foraging life requirements. Parkview Estates area has the potential to be a more naturally functioning wetland and would serve as a niche for waterfowl, mammals, and amphibians that depend on such habitat. Fox Valley riffle construction may increase fish habitat by creating invertebrate habitat and by creating slightly deeper waters for fish to congregate in during high stress periods in the creek. Minor and temporary effects to Waubonsie Creek would be seen during the construction of the proposed project.

3.10.2.2 Summary of Negative Effects

Increased turbidity, destruction of habitat, and other disturbances would be seen immediately following construction. However, these negative effects would be short lived and relatively small in comparison to the positive benefits that Waubonsie Creek would see post construction. Waubonsie Creek would have increased habitat diversity, higher quality in-stream habitat, high quality off-channel wetlands to be used as foraging and spawning habitat, better water quality, and most importantly, a much improved aquatic system with the elimination of fish passage barriers.

3.10.2.3 Endangered Species Act of 1973, as amended

The proposed action has been coordinated with the USFWS and the IDNR. To avoid impacts to the state listed slippershell mussel and spike, the Corps and IDNR staffs would conduct an informal search and relocation of mussels as requested in the January 31, 2002, letter from the IDNR. Individuals collected from the in-stream construction areas would be recorded and moved to sites with similar substrate and flow outside of the areas of disturbance. No impacts are anticipated. Coordination letters can be found in Appendix A.

3.10.2.4 Water Quality

Water quality of Waubonsie Creek would be relatively unchanged. Constructed wetlands, riffle placement, and fish passage structures may all play a role in increasing the overall water quality of Waubonsie Creek. However, the excess runoff and non-point source pollution of an urbanized area, such as this, are unlikely to decrease in the future.

3.10.2.5 Air Quality

Very limited air pollution effects would be produced from machinery exhaust during construction of the project.

3.10.2.6 Historic Properties

The Phase I survey of the areas of potential effect was documented in the final ASSR (Archaeological Short Survey Report) entitled, *Phase I Archaeological, Architectural, and Geomorphological Survey for Historic Properties within the Waubonsie Creek Site Specific Projects, Illinois River Ecosystem Restoration Program, Kendall and Kane Counties, Illinois*, dated October 2003 (Archaeological Survey Report No. 2003-1586-7). The Illinois State Museum Society, Springfield, Illinois, prepared the report under Rock Island District Indefinite Deliveries Contract No. DACW25-98-D-0017, Delivery Order No. 0026. In the ASSR, five historic properties were reported and determine to be water-retaining dams or dam remains from the early to late-20th century, constructed to for ice harvesting and/or potential recreational and landscaping purposes. The reported sites are 11KE479 (Fox Bend Dam), 11KE480 (Upper Pfund Dam), 11KE481 (Lower Pfund Dam), 11KE482 (Upper Stonegate Dam), and 11KE483 (Lower Stonegate Dam). All of these dams have been determined to not be of historic significance, except for the 11KE481 (ASSR Attachment B). Although a portion of the Lower Pfund Dam was partially destroyed by a flood in 1996, the intact portion of the dam does provide information concerning the technology of ice harvesting during the early 20th century (ASSR Attachment B, page 8). Therefore, the intact portions of the Lower Pfund Dam may potentially be eligible for listing to the NRHP (National Register of Historic Places) under criteria considerations C and D of 36 CFR Part 60.

The District supports the findings and recommendation of the ASSR that one potential NRHP site was discovered within the Waubonsie Creek project area of potential effect, identified as 11KE483 (Lower Pfund Dam). The project site-specific restoration proposed within the reach of the Lower Pfund Dam consists of removal of dam debris within the Waubonsie Creek channel that originated from the severe damage induced by the 1996 flood. This debris was reported, described, and determined in the ASSR to be no longer architecturally or archeologically contributing to the Lower Pfund Dam site. No proposed

Waubonsie Creek site-specific measures would affect the potentially NRHP eligible intact portions of the Lower Pfund Dam.

The District requested concurrence from the IHPA with the findings and recommendation of the ASSR by letter dated August 5, 2003 (Appendix A) with the determination of *No Historic Properties Affected*, as defined in 36 CFR Part 800.3(a)(1) for all reaches of the Waubonsie Creek, except that reach which encompasses the Lower Pfund Dam. The District documented that the proposed project within the reach which encompasses the Lower Pfund Dam does not meet the adverse effect criteria of CFR Part 800.5(a)(1), being consistent with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (36 CFR Part 68) and applicable guidelines. The District's determination of *No Adverse Effect* for 11KE483 is based upon complete avoidance of those intact architectural remains of Lower Pfund Dam by confining the restoration to the main channel, which adheres to 36 CFR Part 800.4(d). The IHPA was provided with an opportunity to comment on the draft ASSR and the District's determination and findings. No comment or response was received from the IHPA within the 30-day review period. The IHPA was provided with two copies of the final ASSR reports by District letter dated October 27, 2003 (Appendix A). Final copies of the report are retained in the District's permanent files as evidence of compliance with the NHPA and its implementing regulations.

The Waubonsie Creek Restoration is in compliance with the NHPA of 1966, amended through 2000 (PL 89-665; 16 U.S.C. 470 et seq.). The NHPA and its implementing regulations 36 CFR Part 800: "Protection of Historic Properties," establishes the primary policy, authority for preservation activities, and compliance procedures. The NHPA ensures early consideration of historic properties preservation in Federal undertakings and the integration of these values into each agency's mission. The Act declares Federal policy to protect historic sites and values in cooperation with other nations, states, and local governments. The head of any Federal agency having direct or indirect jurisdiction over a proposed Federal or federally assisted undertaking shall, prior to the approval of the expenditure of any Federal funds on the undertaking, take into account the effect of the undertaking of any district, site building, structure, or object that is included in or eligible for inclusion in the NRHP. The head of any such Federal agency shall afford the ACHP a reasonable opportunity to comment with regard to such undertaking.

Pursuant to Section 800.3 of the ACHP's regulations and, in part, to meet the responsibilities under the NEPA of 1969, the District and the IDNR developed a preliminary Consulting Parties List. Those on the preliminary Consulting Parties List, comprised of 325 parties, including 47 federally recognized Tribes, were provided an opportunity to comment on a draft PA. Although the IRER (Illinois River Ecosystem Restoration) program primarily lies within the State of Illinois, consulting parties from elsewhere in the United States are given equal and due consideration. Since the District remains unaware of any lands held in Federal trust or of any Federal trust responsibilities for Native American Indians within the Illinois River watershed, the District requested any information concerning Federal trust responsibilities.

Those on the list were asked to submit a request to be placed on the final Consulting Parties List. Those on the final Consulting Parties List will be provided with study newsletters, public meeting announcements, special releases, and notifications of the availability of report(s), including all draft agreement documentation, as stipulated by 36 CFR Part 800.14(b)(ii) of the NHPA. Consulting parties may request correspondence on future topics relevant to compliance concerning the IRER and to provide comments.

Comments on the IRER program or projects received by the District and the IDNR will be taken into account when finalizing plans for the IRER, as promulgated by the NHPA.

The Chicago, Rock Island, and St. Louis Districts of the U.S. Army Corps of Engineers, the IDNR, the Illinois SHPO, and the ACHP executed the final *Programmatic Agreement Among the Chicago, Rock Island, and St. Louis Districts of the U.S. Army Corps of Engineers, the State of Illinois Department of Natural Resources, the Illinois State Historic Preservation Officer, and the Advisory Council on Historic Preservation, Regarding Implementation of the Illinois River Ecosystem Restoration* (Appendix A). The execution of this PA by the signatories forms a partnership for the purposes of implementing the IRER program, authorized by Section 216 of the 1970 Flood Control Act and Section 519 (Illinois River Basin Restoration) of Water Resources Development Act of 2000.

The Corps and the IDNR executed the PA, promulgated under 36 CFR Part 800.14(b)(ii) of the NHPA to afford protection to known and unknown historic properties accorded by the NHPA. The Corps proposes use and implementation of the PA for any inadvertent discoveries for any inadvertent or related discoveries of historic properties during construction of the Waubonsie Creek Restoration. As regulated by 36 CFR Part 800.8(c)(1), the executed PA will be used within reports promulgated under NEPA. It is the opinion of the Corps and the IDNR that the PA is appropriate for the Waubonsie Creek Restoration compliance promulgated under the NHPA for the protection of any unreported or recorded historic properties.

Although the PA assures that the Corps will comply with the NHPA and executed PA, if any construction activities and ancillary actions result in the discovery or potentially affect significant historic properties, the Corps will discontinue the undertaking and resume coordination with the IHPA, Tribes, agencies, and other consulting parties to identify the significance of the historic property and determine potential effects. All consulting parties must be aware that the specific locations of historic and archaeological properties are subject to protection through nondisclosure under Section 304 of the NHPA. All maps subject to public review/access shall not contain any information on archeological sites. This information is not to be released in order to protect the resources at the sites.

The District is concerned about impacts to those traditional cultural properties and sacred sites recognized by Native Americans, Tribes, ethnic and religious organizations, communities, and other groups as potentially affected by the IRER. Presently, the District is unaware of any traditional cultural properties or sacred sites within the Illinois River watershed. Those on the preliminary Consulting Parties List were asked to provide any concerns about traditional cultural properties or potential effects known or identified and were asked to notify the District. To facilitate tribal coordination, the District asked those on the preliminary Consulting Parties List to refer to the National Park Service, NRHP Bulletin 38, *Guidelines for Evaluating and Documenting Traditional Cultural Properties* and provided with a Traditional Cultural Property and Sacred Site Form developed by the Corps for the IRER. Traditional Cultural Property location and ancillary information may not be disclosed to the public pursuant to Section 304 of the NHPA, consulting parties are not to disclose locations, and the District and the IDNR will secure this information from the general public.

If human remains, funerary objects, sacred objects, or objects of cultural patrimony are encountered or collected, the District will comply with all provisions outlined in the appropriate state acts, statutes, guidance, provisions, etc., and any decisions regarding the

treatment of human remains will be made recognizing the rights of lineal descendants, Tribes, and other Native American Indians and under consultation with the SHPO/THPO(s) and the other consulting parties, designated Tribal Coordinator, and/or other appropriate legal authority for future and expedient disposition or curation. When finds of human remains, funerary objects, sacred objects, or objects of cultural patrimony are encountered or collected from Federal lands or federally recognized tribal lands, the District will coordinate with the appropriate federally recognized Native American Tribes, pursuant to the Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. § 3001 *et seq*.) and its implementing regulations (43 CFR Part 10).

3.10.2.7 Cumulative Effects

Though easily seen through a general perspective, trying to quantify the benefits of aquatic passage at dam locations is very difficult. The obvious benefit of making this habitat accessible to aquatic organisms is only a small portion of the benefits. A vast array of organisms would benefit. The impacts these organisms have on a particular ecosystem through processes such as trophic regeneration, water filtration, and energy production, among others, is essential to creating and maintaining high quality aquatic habitats. This assessment is overly simplistic and may only capture a very minute increment of the benefits incurred by aquatic passage along Waubonsie Creek.

Returning free-flowing streams to their natural state, or close to their natural state, is a growing interest within the Midwest. Where barrier removal is not an option, organizations are implementing similar features as proposed within the document. Of the 15 dams on the Fox River between Dayton, Illinois, and the Chain of Lakes, all have been recommended for fish passage by either dam removal or fish passage structures (Santucci and Gephard 2002).

Waubonsie Creek, though not as large as the Fox River, plays a role in establishing the biological community of the Fox River. Restoring connectivity at the barriers on Waubonsie Creek is a small piece to the larger picture of free-flowing waters and habitat connectivity of the Fox River.

3.10.2.8 Relationship of the Proposed Project to Land Use Plans

The proposed project offers an opportunity for the restoration and enhancement of wetland habitat within the riparian corridor of Waubonsie Creek. Current land use of the areas would not be affected. The project offers an opportunity for the protection and preservation of these areas against future urban sprawl into the natural riparian corridor of Waubonsie Creek.

3.10.2.9 Compliance with Environmental Quality Statutes

Tabular summation of compliance can be found in Table 3-9.

Table 3-9. Effects of the preferred action on natural and cultural resources.

Types of Resources	Authorities	Measurement of Effects
Air quality	Clean Air Act, as amended (42 U.S.C. 165h-7, et seq.)	No significant effect
Areas of particular concern within the coastal zone	Coastal Zone Management Act of 1972, as amended	Not present in project area
Endangered and threatened species critical habitat	Endangered Species Act of 1973, as amended (16 U.S.C. 1531, et seq.)	No significant impacts anticipated
Fish and wildlife	Fish and Wildlife Coordination Act (16 U.S.C. 661, et seq.)	No significant effect
Floodplains	Executive Order 11988, Flood Plain Management	No significant effect
Historic and cultural properties	National Historic Preservation Act of 1966, as amended (16 U.S.C. 470, et seq.)	Determined through implementation of Programmatic Agreement
Prime and unique farmland	CEQ Memorandum of August 1, 1980; Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing the National Environmental Policy Act	Not present in project area
Water quality	Clean Water Act of 1977, as amended (33 U.S.C. 1251, et seq.)	No significant effect
Wetlands	Executive Order 11990, Protection of Wetlands, 24 May 1977	No significant effect
Wild and scenic rivers	Wild and Scenic Rivers Act, as amended (16 U.S.C. 1271, et seq.)	No significant effect

3.10.2.10 Economic and Social Effects

Community and Regional Growth. No impacts to the growth of the community or region would be realized as a result of the proposed restoration project.

Community Cohesion. As yet, no public opposition to the enhancement measures has been expressed. To meet the criteria for the formulation of restoration alternatives, all project features would be constructed on public lands or lands where there are willing landowners. Property owners throughout the proposed project area would need to be notified prior to the start of construction to ensure they are fully aware of the potential for temporary changes in traffic, noise, and air quality that could occur.

Two open houses were conducted to allow the public to view the proposed projects and to provide feedback. Overall, the majority of comments provided were very complimentary toward the proposal, indicating public support and anticipation of project completion. No responses expressed any disagreement with the proposed plan.

The IDNR, as project sponsor, has actively worked to gather public and financial support for this project.

Displacement of People. No residential displacements would be caused by the proposed restoration project.

Property Values and Tax Revenues. Most of the land along Waubonsie Creek is in public ownership by the local park districts; therefore, no change in property values or tax revenues would occur. The Upper Pfund Dam and Lower Pfund Dam are privately owned.

Public Facilities and Services. The project involves restoration at six different sites along Waubonsie Creek. Much of the land adjacent to the creek provides low-density recreational opportunities such as walking, biking, and fishing. Restoration of fish passage and habitat in the project areas would not adversely impact these activities. Several features are proposed to help the public enjoy and understand the benefits of the restoration project.

Construction at the Fox Bend Golf Course would take place during the winter months and would not interfere with public use of this facility. Damage to the golf course would be minimized by performing construction activities during the winter months when the ground is frozen and by using smaller construction equipment.

The Gilman Nature Trail would sustain some damage from trucks driving over the trail to haul excavated material from this project site and would have to be repaired following project completion.

Access to public roads throughout the project area would be maintained to avoid disruptions to traffic flow and to minimize inconvenience for residents and emergency vehicles.

Life, Health, and Safety. During the construction phase, disruption of traffic would occur in the project areas. Hauling of excavated material from the Oswegoland Greenway to the suggested placement site on Illinois Route 71 would increase truck traffic in the adjacent residential area by approximately five vehicles per day. Increased traffic would cause the most concern in the early morning when staff and students are traveling to school and residents are driving to work, and again in the early evening when area residents are returning home from work. The trucks would travel approximately 6 miles along existing major traffic arteries to haul material to the placement site. The five extra vehicles per day would easily be absorbed into the volume of traffic already present on these heavily-used routes and should not cause significant traffic issues or safety concerns.

For the Parkview Estates site, hauling of excavated material to the suggested Illinois Route 71 site for placement would increase truck traffic in the adjacent residential areas by approximately 19 vehicles per day. The trucks would have to travel approximately 9 miles along existing major traffic arteries to the material placement site and would create a negligible increase in the volume of traffic already present on these heavily-used routes.

Trucks from the Parkview site also have to cross the Gilman Nature Trail which is open year-round for recreational use; however, potential impacts for recreationists on this portion of the trail would not be as great since this location is near the end of the trail and is not as heavily used.

Flagmen will be provided during construction to direct traffic and minimize safety concerns, as needed.

Construction at the Fox Valley Greenway is relatively minor and involves building one riffle structure. The project would require approximately 2 days to complete and would not notably impact traffic in this area.

As a health issue, the residents of the area have expressed concern that this project would increase mosquito populations. The project would discourage mosquito reproduction by establishing a healthy wetland that would serve as fertile breeding ground for many of the mosquito's natural predators. By maintaining a healthy wetland buffer and diverse plant community in a wetland, mosquito populations would be reduced naturally. Also, the design of the elongated 2-acre wetland scrape would have a fetch long enough to produce ample turbulence on surface water, and discourage breeding of mosquitoes in the area. Currently, the Parkview Estates area is being treated twice annually with a growth inhibitor for mosquito control. This practice would continue after project implementation.

An HTRW compliance assessment was conducted. No obvious indications of potential contamination sources or any risk of HTRW contamination within the project area were identified.

Business and Industrial Growth. No long-term impacts to business or industrial activity would result from the proposed project.

Employment and Labor Force. Project construction would slightly increase short-term employment opportunities in the project area.

Farm Displacement. No farms or farmsteads would be displaced. No prime and unique farmland would be impacted.

Noise Levels. Heavy machinery would generate an increase in noise levels during project construction and temporarily disturb residents and recreationists in the area.

No particular problems should occur in the Stonegate Dams area. This work site is more isolated and all residential structures are located on a bluff approximately 35 feet above the construction area.

The Oswegoland Greenway is located in the midst of a residential neighborhood and site access would be via three residential streets. Construction would occur along the creek directly behind several homes. Also, the Old Post Elementary School is located approximately two blocks from the proposed project site. The potential exists for significant noise disturbance throughout this area during the estimated 2-month construction period.

Construction at the Fox Bend Golf Course project site would occur during the winter months when the course is not in use.

Work in the Parkview Estates area would likely occur during periods of low precipitation, which would be late summer. The Gilman Nature Trail is still in full use at that time. The potential exists for significant noise disturbance throughout this area during the estimated two-month construction period.

Once the project is completed, noise levels would return to existing conditions and no significant long-term noise impacts are anticipated.

Aesthetics. The project area is highly urbanized. Restoration features would be planned and constructed with minimal negative impacts to the aesthetics of the area. The enhancement of natural areas and open space should be aesthetically pleasing and enhance the overall viewscape for residents and visitors.

Federal Water Project Recreation Act. Recreational opportunities for bike paths and educational signs were identified, but were not included as part of the project. In addition to the educational and bike path opportunities, Waubonsie Creek may experience an increase in fish diversity, which will increase recreational fishing opportunities.

National Environmental Policy Act of 1969, as amended. The compilation of the Feasibility Report with Integrated Environmental Assessment and Finding of No Significant Impact fulfills NEPA compliance.

Section 4

Project Implementation

4.1 SCHEDULE FOR DESIGN AND CONSTRUCTION

Distribution of Feasibility Report for public and agency review	June 2004
Submission of final and public reviewed Feasibility Report to Mississippi Valley Division	August 2004
Feasibility Report approval by MVD and HQUSACE	October 2004
Initiate plans and specifications	October 2004
Complete plans and specifications	January 2005
PCA execution	January 2005
Sponsor acquisition of lands and easements	November 2005
Advertise contract	December 2005
Award contract	February 2006
Complete construction	September 2007
Complete vegetation establishment	September 2011

4.2 IMPLEMENTATION RESPONSIBILITIES AND VIEWS

Table 4-1 provides the financial data.

Table 4-1. Financial data.

Fully Funded Estimated Project Costs			
	Totals	**Federal**	**Non-Federal**
Ecosystem Restoration	$2,806,600	$1,824,300	$982,300

4.2.1 U.S. Army Corps of Engineers

The Federal Government would provide 65% of the first costs of implementing the recommended ecosystem restoration plan including PED (Pre-construction Engineering and Design), construction, and construction management, which is estimated to total $1,824,300. In addition to its financial responsibility, the Federal Government would design and prepare plans and specifications for the construction of the Recommended Plan; and administer and manage contracts for construction and supervision of the project after authorization, funding, and execution of a PCA with the IDNR.

4.2.2 Illinois Department of Natural Resources

The IDNR would be responsible for providing 35% of the first cost of implementing the recommended ecosystem restoration plan. Table 4-2 outlines the IDNR requirements. The 35% share of project cost includes the IDNR's responsibility for providing all LERRD (lands, easements, rights-of-way, relocations and disposal areas). The estimated costs are $104,300 in cash with $878,000 in LERRD credit.

The IDNR would also be responsible for operations, maintenance, repairs, replacements and rehabilitation (OMRR&R) of project features. The IDNR may develop sub-agreements with local agencies such as the Oswegoland Park District, Village of Montgomery, and Fox Valley Park District to accomplish the operation and maintenance of some project features. The operations and maintenance costs are anticipated to be minimal over the project life at an annual average cost of $5,800.

Table 4-2. Non-Federal requirements.

Non-Federal Requirements	Ecosystem Restoration
Project Cost	$982,300
LERRD	$878,000
Cash	$104,300
Work-in-kind	$ 0
Annual OMRR&R	$ 5,800

4.3 COORDINATION, PUBLIC VIEWS, AND COMMENTS

4.3.1 Coordination Meetings

Starting in the spring of 2001, meetings with the interagency team were held monthly to facilitate project formulation. Meetings were attended by the following agencies: IDNR, Oswegoland Park District, Fox Valley Park District, Village of Montgomery and their representatives, USDA Natural Resources Conservation Service, and U.S. Army Corps of Engineers, Rock Island District. The U.S. Army Corps of Engineers, Chicago District attended some of the meetings. Agency representatives reported project status to their respective boards and to the Fox River Ecosystem Partnership, an organization promoting the health of the Fox River watershed.

Public open houses were held on July 1, 2002, in the Village of Montgomery and July 9, 2002, in the Village of Oswego to present the preliminary recommended restoration plan. The open houses

were attended by 41 individuals. Attendees were generally supportive of the project. A few attendees expressed concerns that the Parkview Estate wetlands would increase adult mosquito populations.

The project supports the Integrated Management Plan for the Fox River Watershed in Illinois, which was developed by Fox River Ecosystem Partnership and has been endorsed by over 37 communities, agencies, and organizations in the Fox River watershed. The project addresses the following three recommendations of the Integrated Management Plan: (1) protect and restore in-stream habitat, (2) improve riparian areas, and (3) assess feasibility and develop plan for removal or modification of dams on the main stem of the Fox River and its tributaries.

4.3.2 Coordination Correspondence

A coordination letter was sent to local, state, and federal agencies on December 21, 2001, describing the proposed project and potential project features and asking for comments on potential environmental issues. The District received correspondence from the following agencies during the development of the project: IDNR, Oswegoland Park District, IHPA, Citizen Potawatomi Nation, and the USFWS. All formal correspondence is found in Appendix A.

Section 5

Project Summary

5.1 SUMMARY OF PROJECT ACCOMPLISHMENTS

The Recommended Plan for restoration of Waubonsie Creek would restore connectivity between Waubonsie Creek and the Fox River by restoring fish passage at four dams and two artificial riffles. It would provide fish on Waubonsie Creek and the Fox River unrestricted access to habitats that are seasonally important such as overwintering habitat, and to habitats that are important at different life stages such as spawning and nursery habitat. The recommended plan would provide three lateral connected wetlands in the Oswegoland Greenway where fish could seek refuge from high flows. The plan would restore in-stream diversity by constructing three riffle structures—two in the Oswegoland Greenway and one in the Fox Valley Greenway. The Oswegoland Greenway wetlands and a constructed wetland in the Parkview Estates area also would provide diverse wetland and grassland habitat for a variety of birds, mammals, and amphibians.

5.2 RECOMMENDATIONS

I have weighed the outputs to be obtained from the full implementation of this ecosystem restoration project against its estimated cost and have considered the various alternatives proposed, impacts identified, and overall scope. In my judgment, this project, as proposed, justifies expenditure of Federal funds. I recommend that the Secretary of the Army for Civil Works approve the proposed project to include modification of four dams and two riffles, construction of three lateral connected wetlands, construction of three riffle structures, and construction of one wetland along Waubonsie Creek.

The current estimated first cost of the recommended plan is $2,806,600. This total includes construction of the project features, planning engineering and design; construction management, and real estate. Implementation would be cost shared 65% by the Federal Government and 35% by the IDNR, the non-Federal sponsor. The Federal contribution is estimated at $1,824,300. It is the IDNR's responsibility to provide the real estate and conduct operation and maintenance. The operation and maintenance of these features is estimated to cost $5,800 annually.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of the national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before final approval for implementation.

5.3 FINDING OF NO SIGNIFICANT IMPACT

Illinois River Ecosystem Restoration
Waubonsie Creek Restoration
Kane and Kendall Counties, Illinois

In accordance with the National Environmental Policy Act, the Rock Island District, U.S. Army Corps of Engineers, has assessed the environmental impacts of the above project. The intent of this project is to provide aquatic connectivity and wetland restoration to the Waubonsie Creek ecosystem. Waubonsie Creek is located in the western suburbs of Chicago, Illinois, and flows through Kane, Kendall, Will, and DuPage Counties. The stream has a drainage area of 30 square miles, which is predominantly composed of agriculture, but is experiencing heavy urbanization.

The recommended plan would restore fish passage at four dams and two artificial riffles; provide three lateral connected wetlands in the Oswegoland Greenway where fish could seek refuge from high flows; restore in-stream diversity by constructing three riffle structures; and construct a riparian wetland.

This finding of no significant impact is based on the following factors:

a. The project would have remarkable positive benefits to fish and wildlife resources and on water quality by creating off-channel wetland areas. These areas would act both as aquatic refuge during high flows and may increase water quality due to the increased plant diversity along Waubonsie Creek.

b. The proposed project would provide aquatic passage at four dam locations and two riffles locations that would otherwise continue to present an impassible barrier to seasonal migration of fish and other aquatic organisms.

c. No significant social, economic, environmental, or cultural impacts are anticipated as a result of the proposed action.

d. The Chicago, Rock Island, and St. Louis Districts of the U.S. Army Corps of Engineers; the IDNR; the Illinois SHPO; and the ACHP executed the Programmatic Agreement (Appendix A). The Programmatic Agreement is appropriate to address potential concerns to any undiscovered, undocumented, or incidental significant historic properties.

The environmental review process indicates that the proposed action does not constitute a major Federal action significantly affecting the environment. Therefore, preparation of an EIS (Environmental Impact Statement) is not required. This determination may be reevaluated if warranted by later developments.

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Date

Duane P. Gapinski
Colonel, U.S. Army
District Engineer