Draft

WEST BRANCH DUPAGE RIVER WATERSHED PLAN

for

DuPage County Division of Stormwater Management
DUPAGE COUNTY
ILLINOIS

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List of Abbreviations and Acronyms

BOD	Biochemical Oxygen Demand
CBBEWL	Christopher B. Burke Engineering West, Ltd.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
County	DuPage County
CWS	Community Water Supply
DCCSFPO	DuPage County Countywide Stormwater and Flood Plain Ordinance
DFIRM	Digital Flood Insurance Rate Map
DO	Dissolved Oxygen
EPA	(United States) Environmental Protection Agency
FAC	Factors applied for Calibration of FEQ Model
FEQ	Full Equations (Model)
FEQUTL	FEQ Utility Program
Forest Preserve	Forest Preserve District of DuPage County
FPDDC	Forest Preserve District of DuPage County
GIS	Geographic Information System
HSPF	Hydrologic Simulation Program - Fortran
IEPA	Illinois Environmental Protection Agency
INAI	Illinois Natural Areas Inventory
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
REF	Rare Earths Facility
RFM	Regulatory Flood Map
SESC	Soil Erosion and Sediment Control
STP	West Chicago Sewage Treatment Plant
TMDL	Total Maximum Daily Load
TSF	Time Series File
USACE	United States Army Corps of Engineers
USRC	Urban Stream Research Center
USGS	United States Geological Survey
WDM	Watershed Data Management
WHPA	Wellhead Protection Area

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EXECUTIVE SUMMARY

E-1.0 Introduction

This Watershed Plan for the West Branch DuPage River (West Branch) was prepared for the DuPage County Stormwater Management Department at the direction of the DuPage County Stormwater Management Planning Committee by Christopher B. Burke Engineering West, Ltd. (CBBEWL). The Watershed Plan has been completed in accordance with the criteria and standards established by the Committee in the DuPage County Stormwater Management Plan that was adopted September 1989 and the DuPage County Stormwater and Flood Plain Ordinance which was adopted October 1991 (Revised March 2005).

The Stormwater Management Plan, Countywide Stormwater and Flood Plain Ordinance, and the Watershed Plans all contribute to addressing existing and future issues along the County's waterways. The Stormwater Management Plan established the goals, objectives, and policies for developing a successful program. The Countywide Ordinance established the regulatory mechanism to address flood plain management, stormwater drainage and detention, wetland impacts, soil erosion and sediment control, and riparian and stream protection resulting from development activities. The Watershed Plans serve to identify existing problems or deficiencies in the watershed and then assesses and propose remediation of these problems.

The West Branch watershed has incurred the most recent widespread development as compared to other County watersheds. Current stormwater management and environmental resources protection regulations at the local, state, and federal levels have helped mitigate the potentially adverse effects of development. The Forest Preserve District of DuPage County, the watershed communities, and the DuPage County Board deserve acknowledgement for the protection of these water resources.

Although the West Branch watershed has benefited from these protection measures, flooding, degraded water quality, and natural area restoration remain as issues that need to be addressed. A unique opportunity being provided by a CERCLA cleanup in the heart of the watershed will allow the County and its partner agencies to significantly improve the water resources of the West Branch watershed.

The focus of this plan is to provide an outline of various engineering/environmental projects within the West Branch watershed. These projects are intended to improve water quality, expand natural areas, introduce and/or restore wildlife habitat, and provide an educational setting as it relates to the enhancement of the West Branch DuPage River watershed.

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Aside from previously approved watershed plans and flood control projects along the mainstem and tributaries, which are referenced and/or attached as Appendix A, this current plan is not intended to address any other overbank flooding issues or concerns along the mainstem and tributaries of the West Branch. Flooding concerns and potential projects along the mainstem and tributaries can be addressed as warranted with addendums to this plan.

E-2.0 Watershed Description

The West Branch DuPage River is part of the Des Plaines River Watershed (Watershed 07120004). Overall, the West Branch watershed encompasses approximately 127 square miles at the confluence with the East Branch DuPage River, which then flows into the Des Plaines River.

The West Branch DuPage River Watershed covers much of the western portion of DuPage County. The watershed boundary extends from Cook County in the north to the confluence with the East Branch DuPage River in Will County to the south and includes 17 tributaries. Smaller creeks and drainages are included within each of the 17 tributaries designated by the County as shown in Figure 2-1. Portions of the cities/villages of Schaumburg, Bartlett, Hanover Park, Carol Stream, Wheaton, West Chicago, Warrenville, and Naperville drain to the West Branch within DuPage County. The watershed is primarily composed of residential, commercial, and open space land uses and is nearly fully developed.

The main channel of the West Branch DuPage River has a total length of 32.0 miles and an average slope of approximately 0.06%. Major tributaries to the West Branch include Tributaries #1 through #8, Klein Creek, Winfield Creek, Springbrook No. 1, Kress Creek, Ferry Creek, Cress Creek, Steeple Run, Winding Creek, and 87th Street (see Figure 2-1). The largest tributary to the West Branch is Kress Creek in the middle reach of the main stem with a watershed area of approximately 18.4 square miles.

Along the main stem of the West Branch, there are several dams and flood detention facilities. There are three in-stream dams along the West Branch including the Warrenville Dam upstream of Warrenville Road, the McDowell Grove Dam at the McDowell Grove Forest Preserve, and Fawell Dam upstream of Ogden Avenue.

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E-3.0 Identified Watershed Problems

Issues identified for the purposes of developing and implementing the West Branch DuPage River Watershed Plan include flood plain management, wetland protection, riparian zone protection and enhancement, stream restoration and bank stabilization, groundwater recharge, and water quality concerns within the watershed.

Historic flooding problems include overbank flooding of the main stem and its tributaries. Specifically, in the flood of 1996, downtown businesses in the City of Naperville incurred a significant amount of damage. Overall, however, Forest Preserve District ownership of a large amount of property along the West Branch has minimized development in flood plains and has helped reduce the amount of damages resulting from overbank flooding that have occurred in more developed watersheds in the County.

The riparian zones of the West Branch of the DuPage River provide the following functions:

- Groundwater release to the base flow of the West Branch and its tributaries
- Riverine shading for stream habitat enhancement
- Aquatic habitat for aquatic and terrestrial organisms
- Groundwater recharge in specific regions of the main stem
- Vegetation buffers to pollutant loading from anthropogenic sources
- Active recreation for canoeing, kayaking, fishing, and hiking
- Passive recreation for birding.

Riparian zones have two distinct ownership conditions, public and private sectors. The vast majority of land on the main stem and certain tributaries is under the ownership of public open space agencies responsible for the preservation and conservation of natural resources. The second category of ownership is mainly small, individual residential properties. Typically, the two ownership categories identified above result in conflicting land management objectives. Open space agencies strive to improve the riparian buffer conditions and manage the riparian zones as wildlife habitat. Although some individual landowners provide appropriate riparian buffers, many use the properties as private open space with generally well-kept, manicured landscapes, including large areas of turf grass.

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Commonly turf grass on private lands extends to the waters edge, creating an erosion problem along the stream banks.

In addition to bank erosion, the functionality of riparian zones is also reduced by disconnectivity caused by dams. Dams along the West Branch DuPage River inhibit the safe passage of fish, canoes, and kayaks, thus preventing the river of meeting its goal to be a fishable and navigable stream. The dams also disrupt the sediment balance within the riparian system.

Wetlands within the West Branch watershed vary in function and quality. The primary deficiency of wetlands of lower quality is a lack of diversity. In many instances, reed canary grass (*Phalaris arundinace*a) and giant reed (*Phragmites communis*) has invaded and dominated native plants. Wetlands that once provided natural filtration of stormwater runoff or diverse habitat can be restored with proper management. Except in the case of wetland restoration, the projects contained within this watershed plan are designed to avoid and minimize impacts to existing wetlands. Any wetlands adversely impacted by projects in this watershed plan will be mitigated at the appropriate ratio as determined by DuPage County Ordinances.

Water quality concerns within the West Branch include turbidity, dissolved oxygen, chloride and temperature. Turbidity is elevated due largely to fine particulates entering the river from erosion of stream banks and stormwater runoff from upland areas. Dissolved oxygen (DO) is required by fauna in the river. It is often depleted as a result of increased biochemical oxygen demand (BOD) – a measure of oxygen used by microorganisms in the oxidation of organic matter – caused by high levels of organic compounds needing decomposition. This is compounded by a low population of aquatic plants. Riffles and aquatic plants generally restore DO levels, but the existing geomorphology of the West Branch does not include many riffles. Finally, water temperatures are often warmer than those in a typical stream of this order and location due to the large portion of base flow contributed by sewage treatment plants along the river and warmer runoff from impervious surfaces.

Recently, Three Rivers Environmental Assessments, LLC conducted limited biologic sampling in an area of the West Branch DuPage River generally bounded by Gary's Mill Road to the north and Mack Road to the south in 2005. The assessment included sampling for small mammals, reptiles, amphibians, fishes, aquatic macroinvertebrates, benthic organic matter, and crayfishes. Although the climatic conditions during this sampling period were not considered representative of a normal year because of drought, the preliminary results of the assessment appear to be consistent with similar evaluations performed in the past. Briefly, this assessment identified five different species of small mammals, three snake species, four frog species, approximately twelve fish species, and one species of crayfish. Based on the preliminary results of the sampling, it appears

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that West Branch DuPage River is not very speciose and the fish species that do inhabit this stream are known to be very tolerant and frequently occur in areas where water quality is poor. It appears these water quality issues are likely larger scale watershed issues. Preliminarily, these trends are evident in the other taxa surveyed in the bioassessment as well (i.e. mussels, crayfish, and macroinvertebrates).

E4.0 Identified Watershed Opportunities

The bed and banks of the West Branch DuPage River from the West Chicago Sewage Treatment Plant (STP) to McDowell Grove Dam in Unincorporated DuPage County comprise an Environmental Protection Agency (EPA) Superfund site subject to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Kerr-McGee is responsible for the cleanup of radioactive thorium residuals in portions of Kress Creek, the West Branch, and their associated flood plains. Kerr-McGee remediation activities include the excavation and processing of approximately 125,300 cubic yards of soil and sediment, 77,200 of which will be hauled away for disposal (according to a May 2004 release by the EPA). Subsequent restoration will be preformed by Kerr-McGee within the construction limits.

The National Oceanic and Atmospheric Administration (NOAA) responsibility is the protection and restoration of coastal resources throughout the nation. Within the Great Lakes region, grant monies are available for the protection and enhancement of lakes, rivers, and streams. In order to enhance the restoration activities of Kerr-McGee, NOAA has awarded a grant to DuPage County. NOAA grant-funded activities are to begin during and/or following the CERCLA cleanup.

The overall goals of the NOAA projects identified within the CERCLA site reach include the following:

- Improve fish spawning, mollusk, and macroinvertebrate habitat along a 4-mile stream reach,
- Increase dissolved oxygen in the 4-mile reach by creating riffle/pool sequences,
- Provide the public improved recreational canoe/boating access on the river by removing man-made obstructions and improving access to the stream corridor for fishing, hiking, birding, and other passive activities, and
- Enhance the water quality in the 4-mile reach to meet the County's goal of a fishable/swimable stream.

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Additionally, alternatives for ecological improvement of the West Branch DuPage River were evaluated based on the following criteria, constraints, and assumptions:

- Conformance to the Countywide Stormwater Management Plan,
- Conformance to the Countywide Stormwater and Flood Plain Ordinance,
- Water quality enhancement as a result of individual projects,
- Environmental impacts associated with the proposed project,
- Public input,
- Level of flood protection provided, and
- Capital cost.

Furthermore, the Forest Preserve District of DuPage County (FPDDC) has its own guidelines and restoration priorities for property in its control. The District has mapped the plant communities and assessed natural quality of various areas of its property with the intent of maintaining and restoring each as necessary. A four-tiered classification system of Forest Preserve property also exists. This land use policy designates areas according to restoration and protection priority based on criteria such as species quantity, quality, and diversity. Projects in this watershed plan on FPDDC property are designed with FPDDC priorities in mind.

Unique opportunities exist in the West Branch due to the extensive restoration that is being completed separately as part of the Kerr-McGee cleanup and the funding available through the NOAA Grant. The proposed activities described below are those projects to be developed and administered through the NOAA Grant. The general location of each of these projects is shown on Figure 7-1.

Stormwater Quality Wetlands: The corridor between IL Route 59 and the West Branch from Gary's Mill Road to Edgewood Walk is Blackwell Forest Preserve owned by the Forest Preserve District of DuPage County (FPDDC). The goal of this project is to improve the water quality of this reach of the West Branch. Proposed enhancement of existing wetlands can improve the quality of stormwater runoff from the road by naturally trapping and fixing particulates, oils and greases, and de-icing salts. The opportunity also exists for the creation of wetlands in existing hydric soils by restoring the hydrology in this corridor through the removal of subsurface drainage structures or other obstacles to groundwater migration. Removal of invasive species within the degraded wetland and adjacent fen community, and the restoration of a diverse native plant community, will markedly improve wildlife habitat and wetland functions. Furthermore, dissipation of energy at the discharge will decrease the amount of sediment that enters the West Branch. Figure 7-2 is a conceptual depiction of the

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stormwater quality wetlands. A pictorial description outlining the concept is provided in Appendix B.

Deep Over-wintering Pool: The goal of this project is to provide over-wintering habitat for certain native species of fish as an element of a created marsh and wetland in order to diversify and improve fish spawning and macroinvertebrate habitat along the West Branch. This type of deep aquatic habitat is rare along the West Branch. The pool, shown on Figure 7-3, would enhance aquatic diversity within the reach by providing a pool habitat ranging from 10 to 15 feet in depth for smallmouth bass, largemouth bass, rock bass, bluegill, sunfish, and channel catfish. It will also provide a littoral zone (wetland shelf) to create deep emergent habitat and structure as a fish nursery for species such as, golden shiners, fathead minnows, mosquitofish, central mudminnows, blackstripe topminnows, pumpkinseeds, and green sunfish. Additional shallow (0" to 6") wetland is proposed to be graded within the perimeter hydric soils, creating microhabitats and seasonally inundated flats, affording a full complement of aquatic and semi-aquatic transition to the surrounding landscape.

The proposed deep pool will receive groundwater seepage and surface runoff. A proposed surface connection, restoring the historical drainage pattern from McKee Marsh, will connect the present deep pool basin to the historical McKee Marsh basin, representing an increase in total drainage basin area supporting the planned deep over-wintering pool. The McKee Marsh water elevation is currently controlled by a man-made outfall structure and drainage channel to the river located at its southwest corner of the marsh area. A portion of the flow from the marsh will be redirected to the deep pool but will remain hydraulically disconnected by a step in the proposed connection, preventing the migration of fish from the deep pool to the marsh. Existing habitat interspersion will be enhanced by expanding wetland and marshland acreage and increasing the number of habitats across a larger landscape within the West Branch river valley.

In addition to providing fish habitat, the pool and wetland complex will offer opportunities for educational programs. Students can learn about the transition of flora in a wetland zone or the variety of fish habitats necessary to sustain a healthy population.

Vernal Pools: The goal of the vernal pool project is to provide unique and specific habitat for amphibians, reptiles, and macroinvertebrates that is currently missing from the project reach. One of the habitat components that was identified as lacking in the West Branch watershed is vernal pools (sometimes referred to as ephemeral pools). Vernal pools are extremely important for the successful reproduction of several native species of amphibians and reptiles. The pools are planned near marsh areas and in wooded environments to increase the diversity of habitat function. The proposed pools will hold water during seasons of amphibian reproduction and dry up in the mid to late summer. The 18-inch deep pools

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provide approximately 0.3 acres of habitat for amphibians and macroinvertebrates, including frogs and salamanders. Existing brush and canopy cover around the proposed pools will remain or be replaced to provide shading, cover from predation by birds, and additional habitat. Figure 7-4 shows the location of the proposed vernal pools. Pictorial representations are shown in Appendix B.

Side Channel: A significant amount of the baseflow in the West Branch is discharge from municipal sewage treatment plants. The goal of this project is to provide a reach of potentially higher quality water to promote and sustain fish species that require water quality better than that currently found in the West Branch. The valley width is sufficient in this reach to reestablish appropriate geomorphic patterns in the channel system more conducive to habitat diversity.

It is anticipated that the primary source of water in the new channel will be at equilibrium with the river, but will be filtered through existing levee substrates. Additional groundwater seepage from the surrounding west upland will contribute higher quality water causing flow in the side channel to be higher than that in the main channel, whose physical and chemical characteristics are dominated by the sewage treatment plant discharges. The side channel is designed for creating unique aquatic habitat with exceptional high water quality beyond what the river offers. Side channel and tributary habitats are seen in the literature as being most important to sustaining conservative communities of marcoinvertebrates, non-game fish, and mussels.

The proposed channel will be excavated to a depth necessary to expose a subsurface natural aggregate bottom. Such excavation will provide for subsurface hydraulic connectivity to the river, as well as optimizing substrate habitat conditions in the pools for fish and mussel species. Grade controls will be constructed as riffles between these pools to maintain sufficient water elevation during drought periods. The proposed side channel includes an alternating pool-riffle sequence to provide habitat variation different from the river that will be targeted for the reintroduction of non-game fish and mussels. These riffles will increase dissolved oxygen within the reach as well. In addition to variation in the channel bottom, proposed in-stream boulder clusters, plunge pools, root wads, and aquatic plantings will provide shade, cover, and habitat for the target species. Naturalized rock outcroppings will support additional shade habitats and bank armament. The channel will be positioned to avoid pockets of erodable organic soils that are present within the valley.

The pools and side slope excavation to the channel will remove colluvial and alluvial material overlying the sawmill soils that will be stripped and spread on the east levee separating the channel and river. The levee will be planted with a goal of producing a plant community dominated by Bur Oak. Graded side slopes from the west toe will slope perpendicular and down to the channel and will be

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shaped into relatively shallow rivulet seeps, shallow depressional terraces, and hummock and hollow micro-habitats and planted/seeded to restore the remnant fens and calcareous seep communities adjacent to the channel. Adjacent upland areas of the fen and calcareous seep restoration zones will be cleared of invasive woody species to decrease evapotranspiration and encourage hydration subsurface flow through the slopes to the fen and seep communities. Cleared areas will be planted with native species of trees and shrubs to maintain a buffer from the adjacent highway. Figure 7-5 is a conceptual design of the side channel. A pictorial representation of the side channel concept is provided in Appendix B.

Warrenville Grove Partial Dam Removal and Restoration: The effects of dams on river corridors have been documented in several studies and in Northeastern Illinois most notably by the Illinois Department of Natural Resources-Fisheries. Among the detrimental effects are the blockage of sediments and nutrients from flow downstream and the migration of aquatic species upstream. As the pool forms upstream of a dam, it becomes filled with accumulated sediments, water depths decrease inhibiting temperature stratification, and increased water temperatures contribute to the depletion of dissolved oxygen. Dams which no longer serve their original purposes have increasingly been identified for removal or modification, where appropriate, to revive the natural river corridor functions.

The overall goal of this project is to increase connectivity of the riparian zone/system, which will improve aquatic diversity, reduce dissolved oxygen depletion, and enhance recreational opportunities. A partial dam removal to satisfy the overall goals of the West Branch watershed restoration is proposed. The remaining abutments will be developed for public access to provide for scenic, historic views of the dam, if a safe and permittable design for such access can be identified.

Sediment movement has proven to be a significant issue for permitting of dam removals/modifications in Northeastern Illinois. This project will benefit from the removal of virtually all sediments in the pool upstream of the dam which is being done separately under the supervision of the USEA. Removal of the sediment affords a unique opportunity for this project to consider modification of the dam without the problem of sediment discharge from deposits accumulated historically behind the dam.

The design considerations for modification of the dam include hydraulic analysis of alternative removal scenarios and limited sediment transport modeling. Further, characterization of the hydrologic regime upstream of the modified dam will be required so that appropriate restoration and management measures can be identified. It is expected that one of the benefits of the partial removal will be that effective in-stream flood storage will be obtained, although only for smaller flood events, and hydraulic/hydrologic modeling will help quantify this effect.

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Conceptual investigations indicate that "notching" the dam may meet project objectives such as providing fish passage, improving natural transport of sediment, reducing dissolved oxygen depletion, and improving the navigability of the West Branch. This approach leaves the majority of the structure intact, which helps maintain the historic context and character of the dam. The notch is envisioned to be kept as small as possible to maintain the low flow stream cross-section, promote fish passage, and allow for passage by canoe/kayak. Appropriate design approaches to minimize instability on the tributaries, including grade control potentially utilizing pool/riffle complexes, will be a part of the design. It is anticipated that some fill will be placed immediately downstream of the dam at the notch to provide better connectivity at low flow conditions for both fish passage and the movement of canoes/kayaks. This may take the form of a rock ramp or other fill configuration serving the stated purposes.

The main change in the landscape associated with the modification will be the reduction in open pool areas behind the dam, due to the lowering of the normal water surface elevation. It is expected that the land that emerges will be restored as wetlands, which will in part compensate for the impacts to wetlands for the totality of the projects. With the lowering of the normal water surface elevation, there is the potential to impact existing adjacent wetlands due to the change in hydrology. The expected benefits in terms of water quality improvement, habitat and aquatic community enhancements, and created wetland will far outweigh -a loss of adjacent existing wetlands. Figure 7-6 shows a concept for the restoration of the Warrenville Grove Preserve after modification of the dam, while a pictorial summary of the concept and its benefits is provided in Appendix B.

Urban Stream Research Center: The goal of the Urban Stream Research Center (USRC) is to enhance biological diversity within the West Branch. The proposed USRC is a species recovery hatchery and mussel production facility that can also offer educational opportunities. Species recovery activities are to focus on native non-game fish and mussels that are uncommon, extirpated, threatened, or endangered species in the West Branch. A goal is to provide valuable propagation techniques to production facilities that can then mass produce these smaller fish and mussels. Ultimately, research knowledge of fish and mussels species targeted for re-introduction will focus on driving the in-situ microhabitat conditions necessary to sustain populations and facilitate reproductive success.

The proposed center would be owned and maintained by the Forest Preserve. Daily operations will be the responsibility of the Forest Preserve District staff or potentially a research organization selected by the FPDDC. As shown on Figure 7-7, the proposed facility is located within walking distance of Warrenville Grove Dam and the FPDDC's Regional Trail. The USRC concept and its possible components are also shown in Appendix B.

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Riverarium and Educational Kiosks: The goal of the Riverarium and Educational Kiosks is to provide educational opportunities focused on the river system and mussel beds for reintroduction of mussels from the USRC. In order for the public to gain greater knowledge and insight into the function of the river, a "riverarium" is proposed. The riverarium will provide a cross-sectional view of the river created by removing a section of one side of the millrace at the dam and replacing it with a viewing window. A ramp will loop from the existing parking lot down to the viewing area, located two to three feet below the existing bottom of the millrace. Figure 7-8 illustrates the Riverarium and includes a photograph from a similar facility at the Kentucky Department of Fish and Wildlife Salato Wildlife Education Center in Frankfort, Kentucky. The concept is also represented pictorially in Appendix B.

The deep on-line pool upstream of the dam will provide for settlement of particulates prior to this viewing area for increased visibility. Screens will also be provided in the millrace prior to the window to prevent the passage of large debris. The remainder of the millrace will be configured as a series of shallow holding tanks for acclimation of mussels produced at the proposed USRC.

In addition to the nearby USRC and Riverarium, the proposed notch in the dam will be complimented by nearby educational kiosks explaining the history of the dam, the removal process, and seasonal habitat functions of the river and local forest preserve.

Channel Stabilization: The goal of the project is to increase habitat health and diversity of the channel by restoring the natural vegetation and substrate in areas that are untouched by Kerr-McGee. Deposition banks and point bars along the river are typically found with contamination and will be excavated and restored by Kerr-McGee. This project proposes restoration of non-contaminated areas positioned on a depositional plain or bar consistent with Kerr-McGee restoration. Such consistency greatly enhances management efficiencies and the likelihood of achieving performance specifications. Due to irregular distances of breadth and length of these units along the stream bank, restoration needs will exceed the proposed footprint of the Kerr-McGee restoration. Additionally, channel stabilization will be provided in areas exposed as a result of the planned Warrenville Grove Dam removal, as well as those tributary inlets to the mainstem. This project seeks to conduct additional mechanical clearing work of invasive woody species, disposal of biomass by burning, and follow up cut stump herbicide applications. In addition, vegetative reconstruction through selectively herbiciding of invasive species, seeding, plug planting, and structural replacement of desired woody species will follow to achieve diverse composition for improved wildlife habitat and improved community health.

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E5.0 Additional Watershed Opportunities

To date, as part of this watershed plan, several additional projects have been identified to meet the overall watershed goals as outlined in the County's Stormwater Management Plan. The opportunities summarized below are not currently funded but could be by alternate means in the future. These include:

- Fen, Seep, and Wetland Restoration along the West Branch,
- Creek Restoration/reconstruction along the West Branch Main Stem,
- River Flood Plain and Terrace Community Restoration along the West Branch,
- McDowell Grove Dam, Stream Channel, and Stream Pool Re-Configuration, Fawell Dam Retrofit for Effective Fish Passage, and
- Creek Restoration/reconstruction along Ferry Creek

A more detailed description and estimated cost of these additional projects are presented in Sections 8.0 and 10.2 of the Watershed Plan, respectively.

E6.0 Recommended Plan and Estimate of Cost

The locations of the proposed improvements to the West Branch Watershed are shown on Figure 7-1. Currently, funding is available through a NOAA Grant for the following tasks:

- <u>Stormwater Quality Wetlands</u>
  Description: Selective clearing and planting to improve filtration capabilities of wetlands between Route 59 and the West Branch south of Gary's Mill Road.
  Estimated Project Costs: $120,000

- <u>Deep Over-wintering Pool</u>
  Description: Excavation of 3.6 acre pool 10 to 15 feet deep for a variety of habitat enhancement structures.
  Estimated Project Costs: $2,300,000

- <u>Side Channel</u>
  Description: Creation of pool-riffle meandering channel between Kress Creek and the West Branch between Gary's Mill Road and the confluence.
  Estimated Project Costs: $550,000

- <u>Vernal Pools</u>

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Description: Excavation of 0.25 acres to create two 1.5 foot deep pools for amphibian reproduction and refuge.
Estimated Project Costs: $50,000

- Urban Stream Research Center
  Description: Construction of an 8,000 square foot facility for the development of non-game fish and species for reintroduction into the West Branch watershed.
  Estimated Project Costs: $2,900,000

- Warrenville Grove Partial Dam Removal and Restoration
  Description: Multi-stage notching of the Warrenville Grove Dam and concurrent lowering of the millrace to reconnect the river for fish and canoe passage.
  Estimated Project Costs: $850,000

- Riverarium and Educational Kiosks
  Description: Replacement of a section of the existing millrace with a viewing window to allow the public to examine the stream in cross section. Educational kiosks will explain the river system and history of the Warrenville Grove Dam.
  Estimated Project Costs: $1,400,000

- West Branch Channel Stabilization
  Description: Assess and restore banks by clearing/planting along banks, channel reconfiguration, and reintroduction of aquatic vegetation.
  Estimated Project Costs: $1,170,000

- Kress Creek Channel Stabilization
  Description: Assess and restore banks by clearing/planting along banks, channel reconfiguration, and reintroduction of aquatic vegetation.
  Estimated Project Costs: $130,000

The recommended plan is to complete design and implementation of these projects subject to the constraints of the Grant. Projects that are not funded by the NOAA Grant will be completed as funding becomes available through the DuPage County Forest Preserve budget or additional grant opportunities.

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1.0 INTRODUCTION AND BACKGROUND

1.1 Introduction

This Watershed Plan for the West Branch DuPage River (West Branch) was prepared for the DuPage County Stormwater Management Department at the direction of the DuPage County Stormwater Management Planning Committee by Christopher B. Burke Engineering West, Ltd. (CBBEWL). The Watershed Plan has been completed in accordance with the criteria and standards established by the Committee in the DuPage County Stormwater Management Plan that was adopted September 1989 and the DuPage County Stormwater and Flood Plain Ordinance which was adopted October 1991 (Revised March 2005). The West Branch DuPage River Watershed Plan characterizes existing watershed concerns and proposes creative and restorative solutions. It is the goal of this watershed plan to integrate flood control programs with aquatic restoration to provide a comprehensive plan for the management and protection of the water resources in the West Branch watershed.

1.2 Jurisdictional Responsibilities and Regulatory Authorities

The DuPage County Stormwater Management Division has maintained a comprehensive approach to stormwater and flood plain management. The Stormwater Management Plan, Countywide Stormwater and Flood Plain Ordinance, and Watershed Plans adopted by the County Board all contribute to addressing existing and future issues along the County's waterways. The Stormwater Management Plan established the goals, objectives, and policies for developing a successful program. The Countywide Ordinance established the regulatory mechanism to address flood plain management, stormwater drainage and detention, wetland impacts, soil erosion and sediment control, and riparian and stream protection resulting from development activities. The Watershed Plans for the tributaries as well as the mainstems, serve to identify existing problems and assess remediation of these problems as well as develop updated flood plain maps.

The DuPage County Stormwater Management Plan (September 1989) was developed by the County's Stormwater Management Planning Committee to address extensive flooding, protect environmental resources, protect and improve water quality, and provide standards for flood plain and stormwater management within the County. The Plan was developed in response to the State of Illinois legislation in Public Act 85-905 passed in 1987, which authorized specific northeastern Illinois counties to develop Stormwater Management Programs with the authority to regulate and fund stormwater management projects on a Countywide basis.

The DuPage County Stormwater Management Plan:

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- Consolidates the stormwater management framework throughout DuPage County into a united countywide structure,

- Provides for countywide coordination for the management of stormwater runoff in both natural and manmade drainageways and storage areas, and

- Sets minimum countywide standards for flood plain and stormwater management.

Six objectives were developed, as part of the Stormwater Management Plan, that define the direction of DuPage County stormwater management. The six primary objectives include:

1. Reduce existing potential for stormwater damage to public health, safety, life, and property,
2. Protect and enhance the quality, quantity, and availability of surface and groundwater resources,
3. Preserve and enhance existing aquatic and riparian environments and encourage restoration of degraded areas,
4. Control sediment and erosion in and from drainageways, developments, and construction sites,
5. Control future increases in stormwater damage within DuPage County and in areas of adjacent counties affected by DuPage County drainage, and
6. Promote equitable, acceptable, and legal stormwater management measures.

It is these objectives that provide the basis for each watershed plan that is developed as part of the County's Stormwater Management Program.

The DuPage County Countywide Stormwater and Flood Plain Ordinance (DCCSFPO) addresses aspects of stormwater and flood plain management within the County. It provides requirements that address stormwater runoff and detention, sediment and erosion control, flood plain impacts, riparian and wetland impacts, and water quality impacts. The Ordinance also sets administrative requirements regarding permitting procedures, performance security, enforcement and penalties, appeals, and variance procedures.

The County's overall Stormwater Management Program is under the direction of the Stormwater Management Planning Committee and the DuPage County Board. The directives of the Committee are executed by the staff of the Stormwater Management Division. In addition to regulation by DuPage County and the Stormwater Management Program, the following agencies also have

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primary regulatory authority over projects in the West Branch DuPage River watershed:

- United States Army Corps of Engineers (USACE),
- Illinois Environmental Protection Agency (IEPA), and
- Illinois Department of Natural Resources-Office of Water Resources (OWR)

1.3 Purpose of Watershed Plan

The primary objectives of the West Branch DuPage River Watershed Plan are consistent with those outlined in the County's Stormwater Management Plan as described in Section 1.2.

The West Branch watershed has incurred the most recent widespread development as compared to other County watersheds. Current stormwater management and environmental resources protection regulations at the local, state, and federal levels have helped mitigate the potentially adverse effects of development. The Forest Preserve District of DuPage County, the watershed communities, and the DuPage County Board deserve acknowledgement for the protection of these water resources.

Although the West Branch watershed has benefited from these protection measures, flooding, degraded water quality, and natural area restoration remain as issues that need to be addressed. A unique opportunity being provided by a CERCLA cleanup in the heart of the watershed will allow the County and its partner agencies to significantly improve the water resources of the West Branch watershed.

The focus of this plan is to provide an outline of various engineering/environmental projects within the West Branch watershed. These projects are intended to improve water quality, expand natural areas, introduce and/or restore wildlife habitat, and provide an educational setting as it relates to the enhancement of the West Branch DuPage River watershed.

Aside from previously approved watershed plans and flood control projects along the mainstem and tributaries, which are referenced and/or attached as Appendix A, this current plan is not intended to address any other overbank flooding issues or concerns along the mainstem and tributaries of the West Branch. Flooding concerns and potential projects along the mainstem and tributaries can be addressed as warranted with addendums to this plan.

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2.0 WATERSHED CHARACTERISTICS

2.1 Watershed Description

The West Branch DuPage River is part of the Des Plaines River Watershed (Watershed 07120004). Overall, the West Branch watershed encompasses approximately 127 square miles at the confluence with the East Branch DuPage River, which then flows into the Des Plaines River.

The West Branch DuPage River Watershed covers much of the western portion of DuPage County. The watershed boundary extends from Cook County in the north to the confluence with the East Branch DuPage River in Will County to the south and includes 17 tributaries. Smaller creeks and drainages are included within each of the 17 tributaries designated by the County as shown in Figure 2-1. Portions of the cities/villages of Schaumburg, Bartlett, Hanover Park, Carol Stream, Wheaton, West Chicago, Warrenville, and Naperville drain to the West Branch within DuPage County. The watershed is primarily composed of residential, commercial, and open space land uses and is nearly fully developed, as shown in Figure 2-2.

The main channel of the West Branch DuPage River has a total length of 32.0 miles and an average slope of approximately 0.06%. Major tributaries to the West Branch include Tributaries #1 through #8, Klein Creek, Winfield Creek, Springbrook No. 1, Kress Creek, Ferry Creek, Cress Creek, Steeple Run, Winding Creek, and 87th Street (see Figure 2-1). The largest tributary to the West Branch is Kress Creek in the middle reach of the main stem with a watershed area of approximately 18.4 square miles. Table 2-1 summarizes the drainage area of the tributaries to the West Branch.

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Table 2-1
Tributary Drainage Areas for West Branch Within DuPage County

Tributary	Area	
	(acres)	(sq.mi.)
Main Stem	27,040	42.25
Tributary 1	1,725	2.70
Tributary 2	3,005	4.70
Tributary 3	1,080	1.69
Tributary 4	1,890	2.95
Tributary 5	1,070	1.67
Klein Creek	8,094	12.65
Kress Creek	12,116	18.93
Winfield Creek	5,420	8.47
Spring Brook 1	4,920	7.69
Ferry Creek	7,924	12.38
Cress Creek	2,695	4.21
Steeple Run	1,754	2.74
Tributary 6	770	1.20
Tributary 7	375	0.59
Winding Creek	732	1.14
South of Foxcroft	586	0.92
South of 87th	494	0.77
TOTAL	**81,690**	**127.65**

Along the main stem of the West Branch, there are three dams and several flood detention facilities. Major bridge/culvert crossings include: Elgin-O'Hare Expressway, Lake Street, Arlington Road, Jefferson Street., St. Charles Road, North Avenue, Chicago and Northwestern Railroad, Geneva Road, High Lake Road, Beecher Street, Roosevelt Road, Gary's Mill Road, Mack Road, Williams Street, Butterfield Road, Warrenville Road, East-West Tollway, Diehl Road, Ogden Avenue, Burlington Northern Railroad, Jefferson Avenue, Main Street, Washington Street, Gartner Road, Hobson Road, Bailey Road, and Washington Street South.

There are three in-stream dams along the West Branch, including the Warrenville Dam upstream of Warrenville Road, the McDowell Grove Dam at the McDowell Grove Forest Preserve, and Fawell Dam upstream of Ogden Avenue.

2.2 Geology and Soils

The West Branch DuPage River watershed lies at the morainal boundary between the Valparaiso Morainic System and the Marseilles Morainic System, (formerly known as the Bloomington Morainal System). The West Chicago

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Moraine formed in the Wadsworth silty clay loam glacial diamicton and lies to the immediate east of the West Branch main stem.

Tributaries on the east side of the river begin on the top of the West Chicago Moraine and traverse the outwash plain in which the river lies. The river valley is formed in the stratified sands and gravels of the Henry formation. These materials range widely in size from medium sands to small boulders.

The presence of a large outwash plain at the base of the West Chicago Moraine creates conditions that favor rapid groundwater movement from the edge of the moraine through the outwash. As a result, sections of the West Branch receive a significant portion of their base flow from local groundwater discharge (a gaining reach), while other sections are "losing reaches" of stream releasing base flow to groundwater. The main stem of the West Branch has a number of former large gravel pits along its length. These include pits at West Branch Forest Preserve, Blackwell Forest Preserve, Cantera in the City of Warrenville, and the much larger gravel pit and quarry operations at Barbers Corners in southern DuPage County. The watershed has historically been a large source of aggregate for development in DuPage County. All pits have ceased production, with the exception of Barbers Corners. The river channel bottom is typically armored by the outwash.

The soils in the West Branch DuPage River Watershed can be characterized by three general groups: (1) glacial till soils in uplands and upland drainage ways, (2) outwash soils in uplands, and (3) alluvial soils over outwash in drainage ways and stream corridors. Isolated pockets of organic soils containing remnant fen communities also occur at the base of drainageways along the main stem West Branch.

The glacial till soils are characterized as having a thin silty mantle over the top of silty clay loam glacial till. These soils have high clay content and typically produce higher run off rates than other soils in the watershed. They are typically characterized as Hydrologic Group B or C. They include Markham (530C), Varna (223) and Ashkum (232) map units.

Outwash soils typically have a silty mantle over a coarse textured sand and gravel subsoil. These soils occur adjacent to the main stem, including areas that intersect where tributaries enter the main stem. These soils typically have higher infiltration rates and lower runoff rates than the glacial till soils. They are typically characterized as hydrologic Soil Group B.

The stream corridors and flood plain soils are typically characterized as alluvial soils belonging to the Sawmill soil map unit. The occasional occurrence of an organic soil is either Lena muck or Muskego muck. These are shallow organic soils over sand and gravel at the base of slopes immediately adjacent to drainage

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courses. They include the Fox (327), Warsaw (290), and Casco (323) map units. Alluvial soils are characterized by the Sawmill (107) map unit.

2.3 Land Use and Land Cover

The West Branch watershed is predominantly residential with some light industry, commercial, transportation corridors, and open space. Of the 127 square miles in the watershed, approximately 24.6 square miles are impervious area. The watershed is prone to flooding due to its very flat slope and the large amount of development that has occurred in the watershed over the years. Figure 2-2 shows the land use in the watershed. Table 2-2 summarizes the land cover for the entire West Branch watershed, including tributaries. Table 2-3 summarizes the land cover for the main stem watershed only.

Table 2-2
Land Cover for West Branch DuPage River Watershed
(Including Tributaries)

Land Cover Category	Square Miles in Watershed	Percent of Watershed
Impervious Cover	24.56	18.3%
Grass, Flat Slope	29.63	22.4%
Grass, Moderate Slope	26.73	19.4%
Grass, Steep Slope	10.22	13.2%
Forest	12.90	12.2%
Agricultural Land	22.34	14.5%
TOTAL[1]	126.38	100%

1) Total drainage area taken at Naperville USGS Gauge

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Table 2-3
Land Cover for West Branch DuPage River Watershed
(Main Stem Only)

Land Cover Category	Square Miles in Watershed	Percent of Watershed
Impervious Cover	7.57	17.9%
Grass, Flat Slope	10.18	24.0%
Grass, Moderate Slope	10.06	23.8%
Grass, Steep Slope	4.07	9.6%
Forest	4.77	11.3%
Agricultural Land	5.67	13.4%
TOTAL[1]	42.32	100%

1) Total drainage area taken at Naperville USGS Gauge

2.4 Groundwater Resources

The Illinois Groundwater Protection Act was adopted in part to protect groundwater recharge areas that feed public water supplies from an unnecessary amount of potential contamination. The Illinois Wellhead Protection Plan establishes a 1,000-foot wellhead protection area (WHPA) for all public water supply wells. The Illinois Groundwater Protection Act establishes regulatory management zones within the WHPA's. According to the Act, no new or potential primary or secondary source or potential route of contamination can be located within the minimum setback zone of any potable water supply well.

A total of 96 Community Water Supply (CWS) systems exist in the watershed. Sixty of these systems are active, 9 are inactive, and 27 are abandoned, according to Illinois Environmental Protection Agency (IEPA) records. Currently, there have been no regulated recharge areas established pursuant to Section 17.3 of the Illinois Environmental Protection Act. Furthermore, there have been no Class III Groundwaters designated pursuant to 35 Illinois Administrative Code 620. According to the Illinois Department of Public Health, a total of 74 semi-private and non-community public water supply wells are also found in the West Branch watershed. Projects considered as part of this watershed plan will remain outside of the 1,000-foot radius of influence of the community water supply systems.

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2.5 Existing Wetlands and Riparian Zones

The DCCSFPO defines wetlands as areas "inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (Sec. 15-17). The DCCSFPO sets forth the requirements for wetland delineation (Sec. 15-134), for development in wetlands (Sec. 15-135), and information to be included in a wetland submittal (Sec. 15-151). All wetland areas are subject to permit requirements. The absence or presence of jurisdictional wetlands can be definitively determined only by an on-site investigation conducted in accordance with current federal and DuPage County wetlands determination methodology. The wetlands identified make up approximately 9% of the land in the watershed or about 7,300 acres.

A riparian zone, as defined in the DCCSFPO, is "land bordering a waterway or wetland that provides habitat or amenities dependent on the proximity to water." Riparian zones are identified as the limits defined by the 100-year flood plain.

The riparian zones of the West Branch of the DuPage River provide the following functions:

- Groundwater release to the base flow of the West Branch and its tributaries
- Riverine shading for stream habitat enhancement
- Aquatic habitat for aquatic and terrestrial organisms
- Groundwater recharge in specific regions of the main stem
- Vegetation buffers to pollutant loading from anthropogenic sources
- Active recreation for canoeing, kayaking, fishing, and hiking
- Passive recreation for birding.

Riparian zones have two distinct ownership conditions, public and private sectors. The vast majority of land on the main stem and certain tributaries is under the ownership of public open space agencies responsible for the preservation and conservation of natural resources. This includes the Forest Preserve District of DuPage County, the Bartlett Park District, the West Chicago Park District, the Warrenville Park District, the Wheaton Park District, the Winfield Park District, the Hanover Park District, the Carol Stream Park

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District, and the Naperville Park District. The second category of ownership is mainly small, individual residential properties.

2.6 Existing Water Quality

The West Branch has been part of an assessment program under Section 303(d) of the Clean Water Act since 1992. Municipal point sources, land development (construction), channelization, and flow regulation/modification have been identified as potential sources of impairment, contributing stressors such as chloride, zinc, nitrogen, sediment, total dissolved solids, and fecal coliform bacteria (IEPA 2002). The current Total Maximum Daily Load (TMDL) study on the West Branch primarily addresses chloride. A TMDL workgroup, the DuPage River/Salt Creek Work Group, is being formed as a tax exempt organization. With state funding, the group is implementing an ongoing monitoring program to document the dissolved oxygen levels in the West Branch and East Branch of the DuPage River and Salt Creek on a bimonthly basis.

In addition, the Conservation Foundation, in their study entitled, "Assessment of the Impacts of Dams on the DuPage River" prepared in October 2003 indicated that the DuPage River is highly enriched with nutrients throughout the system. They also concluded that dissolved oxygen (DO) levels in the river fall below the minimum 5 mg/L standard (IEPA) at the Warrenville Dam Pool to as low as 3.98 mg/L. Furthermore the study indicated that along with the low DO levels, another indicator of stress to the system are the diurnal fluctuations of DO. Diurnal fluctuations occur naturally in water bodies due to photosynthesis during the day and plant respiration at night. However, large variability between the daily high and low DO values is a potential indicator of nutrient enrichment.

Also, when compared to recommended guidelines for Nitrogen Zone 2 and Phosphorus Zone 4 for Midwestern Streams (Robertson et al. 2001), recorded values were highly elevated along the entire system. Total nitrogen values were for the most part between the 75th percentile (6.80mg/L) and the 90th percentile (9.35 mg/L) with a high of 10.24 mg/L at the Warrenville Dam Pool, well above the expected level of 1.24 mg/L for a minimally impacted site within the zone. Total phosphorus levels were all above the 90^{th} (0.54 mg/L) percentile with a high of 1.64 mg/L at Warrenville Dam Pool, well elevated above the expected value of 0.11 mg/L. High nutrient levels can be attributed to the fact that a significant portion of the flow comes from wastewater treatment plants (WWTP) in the watershed as well as the mostly urbanized land cover in the upper portions of the watershed. These WWTP do not have permit limits for nutrients and are not required to provide nutrient removal. Lastly, Chlorophyll-a was sampled as an indicator of algal growth and nutrient enrichment in the water column. All samples were well below the recommended value of 7.3 mg/L based on the 25^{th} percentile of all seasons data from aggregate ecoregion

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VI streams (USEPA 2000). Chlorophyll-a may be depressed due to the lack of a "seed source" for phytoplankton, the velocity of the flow, as well as the large beds of macrophytes and peryphyton throughout most of the system that uptake some of the nutrients.

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3.0 HYDROLOGIC AND HYDRAULIC ANALYSES

3.1 Hydrologic Analysis

A continuous hydrologic model "Hydrologic Simulation Program, FORTRAN (HSPF)" - was used to simulate the hydrologic characteristics of the watershed. DuPage County has worked with the Northeastern Illinois Planning Commission (NIPC) the Conservation Design Forum (CDF) to perform the regional hydrologic analysis for various watersheds since early 1980. HSPF uses a Watershed Data Management (WDM) file for storing input and output data. The current WDM file contains detailed precipitation data, other meteorological data, recorded streamflow data, and simulated runoff and streamflow throughout DuPage County. Data is available back to 1948. The precipitation, meteorological, and recorded streamflow data, along with land cover data, are used to develop and calibrate the HSPF model to produce the simulated runoff for six land cover types. The land cover areas for each of the six land cover types are generated by the County's Geographic Information Systems (GIS) for each watershed. The six land cover types are impervious; flat, medium, and steep grass; forestland; and agricultural/cropland. The procedures used for hydrologic analysis are discussed in *Application Guide for Hydrologic Modeling in DuPage County using Hydrologic Simulation Program – Fortran (HSPF)* (Price, 1996). HSPF simulates continuous hourly runoff from continuous precipitation and meteorological data. Both surface and subsurface runoff are simulated. Thus, both stormflow and baseflow are simulated.

The simulated runoff generated by HSPF is routed through the stream network using a separate hydraulic model called FEQ or Full Equations (Franz and Melching, 1996). In DuPage County, FEQ is generally used to simulate discrete events rather than a continuous record. TSFs (Time Series File) are used to transfer runoff from the HSPF model to the FEQ model. The TSF contains runoff for each of the six land cover types and for each precipitation gage used to generate the runoff. A number of TSFs are created. Most are used in hydraulic calibration and are created for specific portions of the County or for specific watersheds. Two TSFs (TSFLNG01.MAP and TSFBIG) were created for Countywide use in flood plain studies and alternative analysis. These TSFs are applied only after the models have been calibrated. TSFLNG01.MAP is based on precipitation data from the O'Hare and Wheaton long-term gages and contains 115 storm events from water years 1949 through 1993. The results from TSFLNG01.MAP are used to evaluate the effectiveness of flood control alternatives. TSFBIG contains runoff based on very large precipitation events that have occurred in the Midwest. Results from both TSFLNG01.MAP and TSFBIG will be used to perform flood frequency analyses for future flood plain

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mapping. These events can also be used to assess the performance of the stream system and its hydraulic features under very extreme conditions.

3.2 Hydrologic Calibration

HSPF was regionally calibrated to five streamflow gages in the three primary watersheds in DuPage County (Salt Creek, East Branch DuPage River, and West Branch DuPage River) and then verified using a separate period of record and additional streamflow gages (ten total gages). The model was later applied in a smaller watershed at the edge of the County (Sawmill Creek) and outside the three primary watersheds. The calibration and verification are described in *Hydraulic Evaluation of HSPF Model for West Branch DuPage River Watershed* (Price 2002) and additional references in Section 10.0 by T.H. Price. During the regional calibration and verification, it was found that a single set of HSPF model parameters (for each of the six land cover types) was applicable throughout each of the watersheds.

During the calibration of the regional HSPF models, only unrouted runoff volumes were compared to annual, monthly, and event streamflow volumes determined from streamflow gage data. The model was not calibrated in terms of matching peak flows or timing of runoff within events. That portion of the hydrologic calibration occurs during the hydraulic modeling of specific watersheds and is termed "hydraulic evaluation". After hydraulic routing of the runoff through a specific stream network system, a final adjustment of HSPF model parameters can occur to produce appropriate timing of runoff within events.

3.3 Hydraulic Analysis

The unsteady state flood routing model FEQ and its utility program FEQUTL were used to analyze the stream systems of the West Branch DuPage River. The effects of flood plain encroachment, on-line and off-line storage, diversions, channel improvements, bridges, culverts, dams, pumps, gates, weirs, and other drainage system features can be easily represented by these programs.

The surveying for the Lower and Upper main stem of the West Branch DuPage River was performed by Thomson Surveying, Ltd. (Thomson, 1993). Envirodyne Engineering, Inc. (EEI, 1991) performed the surveying for the Middle main stem from Warrenville Road to North Avenue. Supplemental cross sections and structures on the main stem were later surveyed by Woodward-Clyde Consultants (now URS Corporation). In addition, the County's 2-foot digital topographic mapping was used to extend the surveyed cross sections when it was needed. The topographic maps were also used to add more cross sections to the model where no survey data was available.

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Since the start of constructing the West Branch watershed hydrologic and hydraulic model, subsequent field reconnaissance was conducted to verify the previous survey data. The subsequent survey identified several datum errors in the original survey (at Naperville gauging station and Warrenville gauging station). As a result, the original cross sectional survey results were corrected using the corrected datum and used in the FEQ model.

High water marks for the August 1987 storm were used for model calibration purposes. For the July 1996 storm event, high water marks along the lower reach of West Branch were estimated from information gathered by CTE Engineers (1996), DuPage County, and Christopher B. Burke Engineering, Ltd. The information includes photos and field hand measurements of relative water levels at several bridge locations in the lower reach of West Branch. Since no survey was conducted to actually determine those high water marks, they marks remain estimates only.

Manning's friction coefficients for the cross sections along the main stem were initially estimated from the field survey and were modified during the model calibration.

The West Branch DuPage River FEQ hydraulic model consists of 118 hydraulically connected branches for the main stem, 98 free nodes, 59 hydraulic structures, 20 linear reservoirs, 5 sections of braided channel, and 3 in-stream dams. A model schematic is included in Figures 3-1a and 3-1b.

Eight tributaries to the West Branch were simulated with separate FEQ models that provided outflow hydrograph files as input into the main stem model. These tributaries were Tributary No. 1, Tributary No. 4, Klein Creek, Winfield Creek, Springbrook No. 1, Kress Creek, Ferry Creek, and Steeple Run Tributary. Tributary No. 1 and Steeple Run tributary models were developed and added to the main stem model since 2002, while the other tributary models were available at an earlier stage of the main stem model development.

Tributary No. 2, Tributary No. 3, Tributary No. 5, Cress Creek, Tributary No. 6, Tributary No. 7, Winding Creek, Foxcroft, and 87th Street tributaries were not modeled in detail but were modeled as linear reservoirs to the main stem.

3.4 Hydraulic Calibration

The current FEQ model for West Branch was rigorously calibrated by comparing the simulated peak discharges, peak stages, hydrographs, and rating curves to the observed conditions using extensive measured flow data that cover a period of more than 10 years with more than 35 storm events. Three simulations were conducted for the main stem during model calibration:

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- 1987 calibration event with factors (FAC) applied to the NOAA network rain gage assignments (TSFNOAA.DR2 with FAC).
- 1985 to 1996 storm events for model verification (TSFNOAA.DR2 with FAC = 1.0) with NOAA rain gage network.
- July 1996 with the local rain gage network with FAC.

Model calibration targets included the following:

- High water marks estimated from the August 1987 storm event.
- High water marks estimated from the July 1996 storm event.
- Recorded peak discharges and stages for the storm events considered from 1985 to 1996.
- Observed flow and stage hydrographs at three USGS gaging stations along the main stem.
- Flow volumes as compared to the HSPF modeling results.
- Flow discharge – elevation rating curves at all three gaging stations.

Model calibration of the August 1987 event produced an average prediction error of 0.24 foot for the peak flood elevations along the main stem. The July 1996 event calibration also produced reasonably good results in terms of peak stage prediction, with an average prediction error of 0.32 foot. For the TSFNOAA.DR2 storm event without FACs, the current model produced a reasonable match between the simulated and recorded peak discharges and stages at all three USGS gages. The simulated hydrographs also matched well with the recorded hydrographs.

3.5 Hydraulic Evaluation

The process of routing the HSPF simulated runoff with the FEQ model for the purpose of evaluating the "within storm" hydrologic representation has been termed "hydraulic evaluation." The report *"Hydraulic Evaluation of HSPF Model for West Branch DuPage River Watershed"* describes the calibration of the HSPF model for the West Branch watershed (Price et. al. 2003).

3.6 Working Hydraulic Model

The working hydraulic model was used for project design and analysis for the Fawell Dam Modifications Project constructed in 2000. It also has been used to analyze the impacts of proposed future development in the watershed, especially culvert/bridge modifications, on-line detention, and other projects impacting the floodway. A copy of the current West Branch DuPage River FEQ model is

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available upon request from the DuPage County Stormwater Management Division. The FEQ hydraulic model will be used to evaluate impacts of each of the projects presented in this watershed plan as part of final design.

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4.0 ECONOMIC ANALYSIS

Currently, the West Branch main stem includes one project, the Fawell Dam Modifications Project, that focused primarily on flood control. This project involved the rehabilitation of an existing structure and was paid for through funding from the Illinois Department of Natural Resources – Office of Water Resources. Economic analysis of the Fawell Dam project and other flood control projects within the tributaries are included in the specific plans/reports for the tributaries/projects. Executive summaries from each of the existing sub-watershed plans are included in Appendix A of this document. No additional economic analysis has been performed as part of this plan, with respect to these projects.

As noted previously, a unique opportunity is being provided by a CERCLA cleanup in the heart of the West Branch watershed. As a result of this cleanup activity, DuPage County obtained a $10 million grant for "Habitat Restoration" within the West Branch River Valley through the National Oceanic and Atmospheric Administration (NOAA Grant NA16FZ1559). Receipt of the grant required a summary of the projects to be considered in the watershed, as well as a conceptual level estimate of costs. The typical economic analyses performed during the watershed planning process focuses mainly on structural and damages to structure contents due to overbank flooding of the creek. Since the proposed projects described herein are located mainly within DuPage County Forest Preserve areas, it is not anticipated that flooding impacts to structures on or off Forest Preserve property will occur. As such, for the purposes of this plan, only conceptual cost estimates have been prepared for these projects, as described in Section 9.0. These costs serve as a guide for the NOAA grant funding allocation. The projects identified herein as NOAA grant projects, will be funded in accordance with the requirements set forth in this NOAA grant.

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5.0 EXISTING SUB WATERSHED PLANS

Currently, the West Branch main stem includes one project focused primarily on flood control. Flood control projects within the tributaries are included in their own specific sub-watershed plans/reports. The Executive Summaries from the following tributaries are provided in Appendix A.

- Tributary No. 1: Prepared by V3 Consultants, August 2002
- Klein Creek: Prepared by STS Consultants, Ltd., August 1994
- Tributary No. 4: Prepared by Christopher B Burke Engineering, February 1993
- Kress Creek, Prepared by Christopher B Burke Engineering, January 2005
- Winfield Creek, Prepared by Christopher B Burke Engineering, April 1994
- Ferry Creek, Prepared by URS Greiner Woodward-Clyde, February 1999
- Steeple Run, Prepared by CEMCON, Ltd., September 1997

Complete detailed reports for each tributary can be reviewed at the DuPage County offices.

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6.0 IDENTIFICATION OF SIGNIFICANT WATERSHED PROBLEMS

Issues identified for the purposes of developing and implementing the West Branch DuPage River Watershed Plan include flood plain management, wetland protection, riparian zone protection and enhancement, stream restoration and bank stabilization, groundwater recharge, and water quality concerns within the watershed. In addition, other potentially sensitive areas within the watershed are identified and discussed.

6.1 Historic Flooding

Historic flooding problems include overbank flooding of the main stem and its tributaries. Specifically, in the flood of 1996, downtown businesses in the City of Naperville incurred a significant amount of damage. Overall, however, Forest Preserve District ownership of a large amount of property along the West Branch has minimized development in flood plains and has helped reduce the amount of damages resulting from overbank flooding that have occurred in more developed watersheds in the County.

6.2 Flood Plains

Flood plains and floodways in DuPage County are protected by federal law, state law, the DuPage Countywide Stormwater and Flood Plain Ordinance (DCCSFPO), and local zoning. Figure 6-1 shows the flood plains within the West Branch watershed.

6.3 Lack of Biodiversity Within Riparian Zones

A riparian zone, as defined in the DCCSFPO, is "land bordering a waterway or wetland that provides habitat or amenities dependent on the proximity to water." Riparian zones are identified as the limits defined by the 100-year flood plain.

The riparian zones of the West Branch of the DuPage River provide the following functions:

- Groundwater release to the base flow of the West Branch and its tributaries
- Riverine shading for stream habitat enhancement
- Aquatic habitat for aquatic and terrestrial organisms
- Groundwater recharge in specific regions of the main stem
- Vegetation buffers to pollutant loading from anthropogenic sources
- Active recreation for canoeing, kayaking, fishing, and hiking
- Passive recreation for birding.

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Riparian zones have two distinct ownership conditions, public and private sectors. The vast majority of land on the main stem and certain tributaries is under the ownership of public open space agencies responsible for the preservation and conservation of natural resources. This includes the Forest Preserve District of DuPage County, the Bartlett Park District, the West Chicago Park District, the Warrenville Park District, the Wheaton Park District, the Winfield Park District, the Hanover Park District, the Carol Stream Park District, and the Naperville Park District.

The second category of ownership is largely small, individual residential properties. Typically, the two ownership categories identified above result in conflicting land management objectives. Open space agencies strive to improve the riparian buffer conditions and manage the riparian zones as wildlife habitat. Although some individual landowners provide appropriate riparian buffers, many use their properties as private open space with generally well-kept, manicured landscapes, including large areas of turf grass. Commonly, turf grass on private lands extends to the water's edge, creating an erosion problem along the stream banks.

In addition to bank erosion, the functionality of riparian zones is also reduced by disconnectivity caused by dams. Dams along the West Branch DuPage River inhibit the safe passage of fish, canoes, and kayaks, thus preventing the river of meeting the goal to be a fishable and navigable stream. The dams also disrupt the sediment balance within the riparian system.

6.4 Wetlands and Aquatic Habitat

The DCCSFPO defines wetlands as areas "inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (Sec. 15-17). The DCCSFPO sets forth the requirements for wetland delineation (Sec. 15-134), for development in wetlands (Sec. 15-135), and information to be included in a wetland submittal (Sec. 15-151).

Figure 6-2 shows known wetlands in the watershed but is not an exhaustive listing. All areas shown as wetland are subject to permit requirements. The absence or presence of jurisdictional wetlands can be definitively determined only by an on-site investigation conducted in accordance with current federal and DuPage County wetlands determination methodology. The wetlands identified make up approximately nine percent of the land in the watershed or about 7300 acres.

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Wetlands within the West Branch watershed vary in function and quality. The primary deficiency of wetlands of lower quality is a lack of diversity. In many instances, reed canary grass (*Phalaris arundinace*a) and giant reed (*Phragmites communis*) have invaded and dominated native plants. Wetlands that once provided natural filtration of stormwater runoff or diverse habitat can be restored with proper management. Except in the case of wetland restoration, the projects contained within this watershed plan are designed to avoid and minimize impacts to existing wetlands. Existing wetlands adversely impacted by the projects proposed in this watershed plan will be mitigated at the appropriate ratio as determined by DuPage County Ordinances.

6.5 Water Quality

Water quality concerns within the West Branch include turbidity, dissolved oxygen, chloride, and temperature. Turbidity is elevated due largely to fine particulates entering the river from erosion of stream banks and stormwater runoff from upland areas. Dissolved Oxygen (DO) is required by fauna in the river. It is often depleted as a result of increased biochemical oxygen demand (BOD) – a measure of oxygen used by microorganisms in the oxidation of organic matter – caused by high levels of organic compounds needing decomposition. This is compounded by a low population of aquatic plants. Riffles and aquatic plants generally restore DO levels, but the existing geomorphology of the West Branch does not include many riffles. Expression of riffles, and therefore DO levels are further impacted by the upstream impoundments of dams on the mainstem. Finally, water temperatures are often warmer than those in a typical stream of this order and location due to the large portion of base flow contributed by sewage treatment plants along the river and warmer runoff from impervious surfaces.

Programs are currently in place to help alleviate the stress of pollutant sources on the watershed. DuPage County's Stormwater and Flood Plain Ordinance addresses the need for best management practices, such as silt fences during the construction and the protection of sensitive wetland areas. Also, DuPage County is subject to the United States Environmental Protection Agency's (EPA) National Pollutant Discharge Elimination System (NPDES) Phase II program. This program regulates discharges from construction sites, industrial facilities, and other non-point pollution sources.

Another water quality regulatory program initiated by the USEPA is the Total Maximum Daily Load (TMDL) program, which exists under Section 303(d) of the Clean Water Act. This program effectively targets pollution control and restoration activities in a watershed by requiring states to identify waters that still do not meet state water quality standards and develop TMDLs for them. TMDLs determine how much pollutant load a lake or stream can receive without violating established water quality standards. TMDLs help shift the

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focus of water quality standards from technology-based controls to water quality-based controls.

The West Branch has been part of the Section 303(d) assessment program since 1992. Municipal point sources, land development (construction), channelization, and flow regulation/modification have been identified as potential sources of impairment, contributing stressors such as chloride, zinc, nitrogen, sediment, total dissolved solids, and fecal coliform bacteria (IEPA 2002). The current TMDL study on the West Branch primarily addresses chloride. Additionally, a TMDL workgroup, the DuPage River/Salt Creek Work Group, is being formed as a tax exempt organization. With state funding, the group is implementing an ongoing monitoring program to document the dissolved oxygen levels in the West Branch and East Branch DuPage Rivers and Salt Creek on a bimonthly basis.

Site specific solutions, such as additional buffer zones along the river corridor and selective planting of wetland species to naturally manage runoff before it enters the river, can be implemented to further improve existing conditions.

6.6 Streambank Erosion Control, Real Estate Protection, and Long-term Maintenance

In order for streambank erosion control, real estate protection, and long-term maintenance to be performed effectively, an assessment of the West Branch must be performed to identify areas of need. Such an assessment should be performed following excavation and remediation of portions of the bed and banks of the West Branch and Kress Creek. Refer to Section 7.0 for an explanation of Kerr-McGee CERCLA activities.

6.7 Biological Diversity of the Watershed

In the mid-1970s, the Illinois Natural Areas Inventory (INAI) developed a classification system, rating scheme, and inventory of 1,089 sites throughout the state. As of August 2000, there were 1,193 sites on the Inventory, encompassing approximately 350,000 acres of natural area (Robertson 2001). Data from each of the sites is available from the Illinois Department of Natural Resources as part of the Illinois Natural Heritage Database.

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The FPDDC has also compiled an extensive data base with respect to the biological diversity of the West Branch DuPage River Valley. For instance, FPDDC records since 1990 indicate the following wildlife occurrences in the riparian corridor between Gary's Mill and Mack Roads.

Amphibians		2
Birds		
	Residents	45
	Migrants	2
Fish		12
Mammals		11
Invertebrates		12

Furthermore, since 1990 the FPDDC records indicate the following wildlife occurrences in the Blackwell Forest Preserve.

Amphibians		7
Birds		
	Residents	117
	Migrants	93
	Overwintering	1
	Accidental	3
Fish		17
Mammals		17
Reptiles		7
Invertebrates		23

Additional biological data relative to the West Branch watershed is available upon request from the FPDDC.

In addition to the historical surveys of the West Branch, Three Rivers Environmental Assessments, LLC conducted limited biologic sampling in an area of the West Branch DuPage River generally bounded by Gary's Mill Road to the north and Mack Road to the south, in Spring/Summer 2005. The assessment included sampling for small mammals, reptiles, amphibians, fishes, aquatic macroinvertebrates, benthic organic matter, and crayfishes. Although the climatic conditions during this sampling period were not considered representative of a normal year because of drought, the preliminary results of the assessment appear to be consistent with similar evaluations performed in the past. Briefly, this assessment identified five different species of small mammals, three snake species, four frog species, approximately twelve fish species, and one species of crayfish. Based on the preliminary results of the sampling, it appears that West Branch DuPage River is not very speciose and the fish species that do inhabit this stream are known to be very tolerant and frequently occur in areas where water quality is poor. It appears these water

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quality issues are likely larger scale watershed issues. Preliminarily, these trends are evident in the other taxa surveyed in the bioassessment as well (i.e., mussels, crayfish, and macroinvertebrates).

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7.0 IDENTIFICATION OF OPPORTUNITIES WITHIN THE CERCLA SITE

Originally owned by Lindsay Light and Chemical Co. and later purchased by Kerr-McGee in 1967, the West Chicago Rare Earths Facility (REF) operated between 1931 and 1973. The extraction of thorium and other elements from ores resulted in the distribution of low level radioactive thorium residuals in portions of Kress Creek, the West Branch DuPage River, and their associated flood plains. During this period, the West Chicago Sewage Treatment Plant (STP) received debris and waste from the REF, contributing to the spread of contamination.

The bed and banks of the West Branch DuPage River from the West Chicago Sewage Treatment Plant (STP) to McDowell Grove Dam in Unincorporated DuPage County comprise an Environmental Protection Agency (EPA) Superfund site subject to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Kerr-McGee is responsible for the cleanup of radioactive thorium residuals in portions of Kress Creek, the West Branch, and their associated flood plains. Kerr-McGee remediation activities include the excavation and processing of approximately 125,300 cubic yards of soil and sediment, 77,200 of which will be hauled away for disposal (according to a May 2004 release by the EPA). Subsequent restoration within the construction limits will be preformed by Kerr-McGee.

The National Oceanic and Atmospheric Administration's (NOAA) responsibility is the protection and restoration of coastal resources throughout the nation. Within the Great Lakes region, grant monies are available for the protection and enhancement of lakes, rivers, and streams. In order to enhance the restoration activities of Kerr-McGee, NOAA has awarded a grant to DuPage County. NOAA grant-funded activities are to begin before, during and/or following the CERCLA cleanup.

7.1 Design Criteria

The overall goals of the NOAA projects identified within the CERCLA site reach include the following:

- Improve fish spawning, mollusk, and macroinvertebrate habitat along a 4-mile stream reach,
- Increase dissolved oxygen in the 4-mile reach by creating riffle/pool sequences,
- Provide the public improved recreational canoe/boating access on the river by removing man-made obstructions and improving access to the

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stream corridor for fishing, hiking, birding, and other passive activities, and

- Enhance the water quality in the 4-mile reach to meet the County's goal of a fishable/swimable stream.

Additionally, alternatives for ecological improvement of the West Branch DuPage River were evaluated based on the following criteria, constraints, and assumptions:

- Conformance to the Countywide Stormwater Management Plan,
- Conformance to the Countywide Stormwater and Flood Plain Ordinance,
- Water quality enhancement as a result of individual projects,
- Environmental impacts associated with the proposed project,
- Public input,
- Level of flood protection provided, and
- Capital cost.

Furthermore, the Forest Preserve District of DuPage County (FPDDC) has its own guidelines and restoration priorities for property in its control. The District has mapped the plant communities and assessed natural quality of various areas of its property with the intent of maintaining and restoring each as necessary. A four-tiered classification system of Forest Preserve property also exists. This land use policy designates areas according to restoration and protection priority based on criteria such as species quantity, quality, and diversity. Projects in this watershed plan on FPDDC property are designed with FPDDC priorities in mind.

7.2 Permitting Requirements

The projects will follow the standard permitting process within the County where consistent with the objectives of this plan, including Stormwater Management and Wetland permitting. Permitting requirements outside of the DuPage County Stormwater Permit process will be followed where applicable and may include the following:

USACE Section 404 Permit

A USACE permit may be required for wetland impacts to Corps jurisdictional waters and wetlands. The existing DuPage County General Permit requires that projects undertaken by the County be permitted by the USACE using either the regional permit program or the individual permit program. The USACE permit program generally

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requires that applicants demonstrate that any project has 1) Avoided wetlands and Waters of the U.S. to the maximum extent possible, 2) Minimized fill of wetland and Waters of the U.S., and 3) Provided compensatory mitigation for impacts that cannot be avoided.

As part of the USACE permit process, the Kane-DuPage Soil and Water Conservation District reviews the erosion and sediment control plans for completeness and adequacy of Soil Erosion and Sediment Control (SESC) protection for the aquatic resources. This is in addition to the Illinois EPA 401 Water Quality Certification.

IEPA Clean Water Act Section 401 Certification (Water Quality)

Illinois Environmental Protection Agency provides water quality certification pursuant to Section 401 of the Clean Water Act. This certification is mandatory for all projects requiring a Section 404 Permit. In addition to determining that the proposed work will not violate the applicable water quality standards, the IEPA also makes a determination of additional permit requirements pursuant to the Illinois Pollution Control Board rules and regulations.

Illinois Department of Natural Resources Floodway Construction Permit

DuPage County has been delegated the Floodway Construction program by IDNR-OWR. Several projects require work in the floodway and may not meet the appropriate use criteria. During permitting of environmental projects, coordination with IDNR-OWR will be necessary for the Side Channel and Dam Removal projects.

Threatened and Endangered Species Consultation

Consultation with the United States Fish and Wildlife Service is necessary to comply with Section 7 of the Endangered Species Act. Consultation is routine and will be carried out on a project by project basis. Recommendations of the Service will be incorporated into project final designs in the event that federally threatened or endangered species are identified within any of the project areas.

Threatened and endangered species consultation with the Illinois Department of Natural Resources (IDNR) will be completed on a project basis. IDNR recommendations will be incorporated into project final designs in the event that state threatened or endangered species are identified within any of the project areas.

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City of Warrenville Building Permits

All projects will obtain the necessary local permits prior to construction.

7.3 West Branch

Unique opportunities exist in the West Branch due to the extensive restoration that is being completed separately as part of the Kerr-McGee cleanup and the funding available through the NOAA Grant. The proposed activities described below are those projects to be developed and administered through the NOAA Grant. Each of these projects will be designed in accordance with the overall goals described in Section 7.1. The general location of each of these projects is shown on Figure 7-1.

7.3.1 Stormwater Quality Wetlands

The corridor between IL Route 59 and the West Branch from Gary's Mill Road to Edgewood Walk is Blackwell Forest Preserve owned by the Forest Preserve District of DuPage County (FPDDC). The goal of this project is to improve the water quality of this reach of the West Branch. Proposed enhancement of existing wetlands can improve the quality of stormwater runoff from the road by naturally trapping and fixing particulates, oils and greases, and de-icing salts. The opportunity also exists for the creation of wetlands in existing hydric soils by restoring the hydrology in this corridor through the removal of subsurface drainage structures or other obstacles to groundwater migration. Removal of invasive species within the degraded wetland and adjacent fen community, and the restoration of a diverse native plant community, will markedly improve wildlife habitat and wetland functions. Furthermore, dissipation of energy at the discharge will decrease the amount of sediment that enters the West Branch. Figure 7-2 is a conceptual depiction of the stormwater quality wetlands. A pictorial description outlining the concept is provided in Appendix B.

7.3.2 Deep Over-wintering Pool

The goal of this project is to provide over-wintering habitat for certain native species of fish as an element of a created marsh and wetland in order to diversify and improve fish spawning and macroinvertebrate habitat along the West Branch. This type of deep aquatic habitat is rare along the West Branch. The pool, shown on Figure 7-3, would enhance aquatic diversity within the reach by providing a pool habitat ranging from 10 to 15 feet in depth for smallmouth bass, largemouth bass, rock bass, bluegill, sunfish, and channel catfish. It will also provide a littoral zone (wetland shelf) to create deep emergent habitat and structure as a fish nursery for species such as, golden shiners, fathead minnows, mosquitofish, central mudminnows, blackstripe

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topminnows, pumpkinseeds, and green sunfish. Additional shallow (0" to 6") wetland is proposed to be graded within the perimeter hydric soils, creating microhabitats and seasonally inundated flats, affording a full complement of aquatic and semi-aquatic transition to the surrounding landscape.

Hydric soils and aquatic plants comprise the substrate of the proposed littoral zone. The bottom of the deep pool is strewn with boulder piles offering shelter and/or spawning type habitat. Additional habitat variation will be found in limestone slabs and overhangs along portions of the side slopes. The proposed pool will be connected to the river by a pool-riffle sequenced channel 10 to 30 feet wide, using natural rock and vegetation for stabilization. The pool will feature areas with built-in habitat structures designed to maximize sheltering and spawning opportunities for fishes. Downed snags are planned in the littoral zone to provide further protection from birds and terrestrial predators. Trees will be planted in appropriate locations around the pool to provide shading and shrubs planted along the northwest edge of the pool will reduce siltation by trapping sediment. Amphibians and reptiles will benefit from the littoral and transitional wetland zone which provide food and shelter for all stages of the life cycle.

The proposed deep pool will receive groundwater seepage and surface runoff. A proposed surface connection, restoring the historical drainage pattern from McKee Marsh, will connect the present deep pool basin to the historical McKee Marsh basin, representing an increase in total drainage basin area supporting the planned deep over-wintering pool. The McKee Marsh water elevation is currently controlled by a man-made outfall structure and drainage channel to the river located at its southwest corner of the marsh area. A portion of the flow from the marsh will be redirected to the deep pool but will remain hydraulically disconnected by a step in the proposed connection, preventing the migration of fish from the deep pool to the marsh. Existing habitat interspersion will be enhanced by expanding wetland and marshland acreage and increasing the number of habitats across a larger landscape within the West Branch river valley.

In addition to providing fish habitat, the pool and wetland complex will offer opportunities for educational programs. Students can learn about the transition of flora in a wetland zone or the variety of fish habitats necessary to sustain a healthy population.

The river reach from Gary's Mill Road to the Warrenville Grove Dam has been selected for siting of the deep pool. The location of the deep pool is shown on Figures 7-1 and 7-3. Other potential locations for the deep pool were considered and subsequently eliminated, based on failure to satisfy the design considerations summarized below:

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- A location within the flood plain that provides sufficient area for pool construction (since much of the reach is restricted by steeply sloped over bank.),

- Avoidance and minimization of wetland impacts,

- A location such that surface and groundwater sources are available for fish diversity and sustainability, and

- A location such that the pool could be located outside of the floodway.

A pictorial representation of the deep over-wintering pool concept is provided in Appendix B.

7.3.3 Vernal Pools

The goal of the vernal pool project is to provide unique and specific habitat for amphibians, reptiles, and macroinvertebrates that is currently missing from the project reach. One of the habitat components that was identified as lacking in the West Branch watershed is vernal pools (sometimes referred to as ephemeral pools). Vernal pools are extremely important for the successful reproduction of several native species of amphibians and reptiles. The pools are planned near marsh areas and in wooded environments to increase the diversity of habitat function. The proposed pools will hold water during seasons of amphibian reproduction and dry up in the mid to late summer. The 18-inch deep pools provide approximately 0.3 acres of habitat for amphibians and macroinvertebrates, including frogs and salamanders. Existing brush and canopy cover around the proposed pools will remain or be replaced to provide shading, cover from predation by birds, and additional habitat. Figure 7-4 shows the location of the proposed vernal pools. Pictorial representations are shown in Appendix B.

7.3.4 Side Channel

The West Branch main stem, with approximately 100 cfs baseflow, falls approximately four feet in elevation over this roughly 7,000 foot reach of CERCLA cleanup activities. A significant amount of the baseflow is discharge from municipal sewage treatment plants. The goal of this project is to provide a reach of potentially higher quality water to promote and sustain fish species that require water quality better than that currently found in the West Branch. The valley width is sufficient in this reach to reestablish appropriate geomorphic patterns in the channel system more conducive to habitat diversity.

The reach of the West Branch between Gary's Mill Road and Mack Road also represents the most extensive reach of bank remediation excavation and

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restoration required of Kerr-McGee. In addition, upstream in Kress Creek (7,510 feet) there is significant thorium contamination that must be excavated from the banks. The disturbance from the cleanup affords the impetus to review the site for opportunities to enhance habitat diversity and water quality in concert with the cleanup. Therefore, the creation of a secondary stream channel is proposed.

It is anticipated that the primary source of water in the new channel will be at equilibrium with the river, but will be filtered through existing levee substrates. Additional groundwater seepage from the surrounding west upland will contribute higher quality water causing flow in the side channel to be higher than that in the main channel, whose physical and chemical characteristics are dominated by the sewage treatment plant discharges. The side channel is designed for creating unique aquatic habitat with exceptional high water quality beyond what the river offers. Side channel and tributary habitats are seen in the literature as being most important to sustaining conservative communities of marcoinvertebrates, non-game fish, and mussels.

The proposed channel will be excavated to a depth necessary to expose a subsurface natural aggregate bottom. Such excavation will provide for subsurface hydraulic connectivity to the river, as well as optimizing substrate habitat conditions in the pools for fish and mussel species. Grade controls will be constructed as riffles between these pools to maintain sufficient water elevation during drought periods. The proposed side channel includes an alternating pool-riffle sequence to provide habitat variation different from the river that will be targeted for the reintroduction of non-game fish and mussels. These riffles will increase dissolved oxygen within the reach as well. In addition to variation in the channel bottom, proposed in-stream boulder clusters, plunge pools, root wads, and aquatic plantings will provide shade, cover, and habitat for the target species. Naturalized rock outcroppings will support additional shade habitats and bank armament. The channel will be positioned to avoid pockets of erodable organic soils that are present within the valley.

The pools and side slope excavation to the channel will remove colluvial and alluvial material overlying the sawmill soils that will be stripped and spread on the east levee separating the channel and river. The levee will be planted with a goal of producing a plant community dominated by Bur Oak. Graded side slopes from the west toe will slope perpendicular and down to the channel and will be shaped into relatively shallow rivulet seeps, shallow depressional terraces, and hummock and hollow micro-habitats and planted/seeded to restore the remnant fens and calcareous seep communities adjacent to the channel. Adjacent upland areas of the fen and calcareous seep restoration zones will be cleared of invasive woody species to decrease evapotranspiration and encourage hydration subsurface flow through the slopes to the fen and seep communities. Cleared areas will be planted with native species of trees and shrubs to maintain

a buffer from the adjacent highway. Figure 7-5 is a conceptual design of the side channel. A pictorial representation of the side channel concept is provided in Appendix B.

7.3.5 Warrenville Grove Partial Dam Removal and Restoration

The overall goal of this project is to increase connectivity of the riparian zone/system, which will improve aquatic diversity, reduce dissolved oxygen depletion, and enhance recreational opportunities. A partial dam removal is proposed and the remaining abutments will be developed for public access to provide for scenic, historic views of the dam, if a safe and permittable design for such access can be identified.

The effects of dams on river corridors have been documented in several studies and in Northeastern Illinois most notably by the Illinois Department of Natural Resources-Fisheries. Among the detrimental effects are the blockage of sediments and nutrients from flow downstream and the migration of aquatic species upstream. As the pool forms upstream of a dam, it becomes filled with accumulated sediments, water depths decrease inhibiting temperature stratification, and increased water temperatures contribute to the depletion of dissolved oxygen. Dams which no longer serve their original purposes have increasingly been identified for removal or modification, where appropriate, to revive the natural river corridor functions.

The Warrenville Grove Dam was constructed on the site of a pre-existing private dam in the mid 1930's as part of the efforts of the Civilian Conservation Corps. It is a significant scenic and historic feature of both the Forest Preserve District of DuPage County who owns it and the City of Warrenville that surrounds the preserve. However, the dam has no documented flood control or water power functions. Any plan to modify the dam will consider all beneficial aspects and create opportunities to acknowledge and preserve that context.

Sediment movement has proven to be a significant issue for the permitting of dam removals/modifications in Northeastern Illinois. This project will benefit from the removal of virtually all sediments in the pool upstream of the dam which is being done separately under the supervision of the USEPA. These sediments include radioactive thorium waste material deposited in the stream through a storm sewer outfall from a now closed processing facility that operated between 1932 and 1973. The clean-up work is expected to be completed by the end of 2008. Removal of the sediment affords a unique opportunity for this project to consider modification of the dam without the problem of sediment discharge from deposits accumulated behind the dam.

The existing millrace, in-place since the original dam construction in the 1930's, was modified in order to promote fish passage in the mid-1990's. The original

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construction introduced a water surface drop at the entrance, which the Forest Preserve District "softened" by adding a series of weir gates in the millrace to make the change in water surface elevation occur in more gradual steps. Fish sampling conducted since the modification indicates that this has resulted in only partial success in reconnecting fish species to the upstream reaches. The location and structure of the millrace does afford, however, an opportunity to view the flow of water in cross-section, which is discussed in Section 7.3.7 as the "Riverarium" project with educational and interpretive value.

The design considerations for modification of the dam include hydraulic analysis of alternative partial removal scenarios and limited sediment transport modeling. Further, characterization of the hydrologic regime upstream of the modified dam will be required so that appropriate restoration and management measures can be identified. It is expected that one of the benefits of the partial removal will be that effective in-stream flood storage will be obtained, although only for smaller flood events, and hydraulic/hydrologic modeling will help quantify this effect.

Conceptual investigations indicate that "notching" the dam may meet project objectives such as providing fish passage, improving natural transport of sediment, reducing dissolved oxygen depletion, and improving the navigability of the West Branch. This approach leaves the majority of the structure intact, which helps maintain the historic context and character of the dam. The notch is envisioned to be kept as small as possible to maintain the low flow stream cross-section, promote fish passage, and allow for passage by canoe/kayak. The bottom elevation of the partial removal has to be planned to maintain flow in the millrace as well, and should limit upstream velocity increases at important roadway structures so that they will not be unduly affected by scour. Limiting the depth of the notch will also reduce but not eliminate the potential for head cutting of the tributaries tying in within the zone of influence of the dam. Measures to control the potential head cut areas will be implemented as part of the dam removal project. The return of free flow conditions at the confluence is expected to improve aquatic habitat and botanic diversity. Appropriate design approaches to minimize instability on the tributaries, including grade control potentially utilizing pool/riffle complexes, will be a part of the design. It is anticipated that some fill will be placed immediately downstream of the dam at the notch to provide better connectivity at low flow conditions for both fish passage and the movement of canoes/kayaks. This may take the form of a rock ramp or other fill configuration serving the stated purposes.

The main change in the landscape associated with the modification will be the reduction in open pool areas behind the dam, due to the lowering of the normal water surface elevation. It is expected that the land that emerges will be restored as wetlands, which will in part compensate for the impacts to wetlands for the totality of the projects. With the lowering of the normal water surface

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elevation, there is the potential to impact existing adjacent wetlands due to the change in hydrology. The expected benefits in terms of water quality improvement, habitat and aquatic community enhancements, and created wetland will far outweigh -a loss of adjacent existing wetlands. Figure 7-6 shows a concept for the restoration of the Warrenville Grove Preserve after modification of the dam, while a pictorial summary of the concept and its benefits is provided in Appendix B. This plan indicates that the existing pool behind the dam is 10.7 acres, with the opportunity to create approximately 5.3 acres of wetlands as mitigation for this and other projects in this plan.

The open pool will not be completely lost behind the modified dam. A deeper pool will be created by a combination of the sediment removal, which is part of the cleanup of thorium waste products by the Kerr-McGee Corporation and active excavation contemplated with this project. It is expected that further appropriate fish habitat restoration opportunities will be included in the restoration plan. Overall the dam modification will provide the public easier access to recreational activities along the river by removing or mitigating manmade obstructions and improving access. The net effect of this project is to compliment the other watershed plan projects in enhancing the overall aquatic community and improving water quality with a secondary benefit of increasing fishing opportunities.

7.3.6 Urban Stream Research Center

The goal of the Urban Stream Research Center (USRC) is to enhance biological diversity within the West Branch. The proposed USRC is a species recovery hatchery and mussel production facility that can also offer educational opportunities. Species recovery activities are to focus on native non-game fish and mussels that are uncommon, extirpated, threatened, or endangered species in the West Branch. A goal is to provide valuable propagation techniques to production facilities that can then mass produce these smaller fish and mussels. Ultimately, research knowledge of fish and mussels species targeted for re-introduction will focus on driving the in-situ microhabitat conditions necessary to sustain populations and facilitate reproductive success.

The proposed center would be owned and maintained by the Forest Preserve. Daily operations will be the responsibility of the Forest Preserve District staff or potentially a research organization selected by the FPDDC. Outside the building, a modular stream (e.g. above-ground moveable aquaria used to simulate natural conditions) will be used for research and public viewing. The proposed modular stream will be supported by an educational kiosk explaining the current research at the facility. As shown on Figure 7-7, the proposed facility is located within walking distance of Warrenville Grove Dam and the FPDDC's Regional Trail. The USRC concept and its possible components are also shown in Appendix B.

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7.3.7 Riverarium and Educational Kiosks

The goal of the Riverarium and Educational Kiosks is to provide educational opportunities focused on the river system and mussel beds for reintroduction of mussels from the USRC. In order for the public to gain greater knowledge and insight into the function of the river, a "riverarium" is proposed. The riverarium will provide a cross-sectional view of the river created by removing a section of one side of the millrace at the dam and replacing it with a viewing window. A ramp will loop from the existing parking lot down to the viewing area, located two to three feet below the existing bottom of the millrace. Figure 7-8 illustrates the Riverarium and includes a photograph from a similar facility at the Kentucky Department of Fish and Wildlife Salato Wildlife Education Center in Frankfort, Kentucky. The concept is also represented pictorially in Appendix B.

The deep on-line pool upstream of the dam will provide for settlement of particulates prior to this viewing area for increased visibility. Screens will also be provided in the millrace prior to the window to prevent the passage of large debris. The remainder of the millrace will be configured as a series of shallow holding tanks for acclimation of mussels produced at the proposed USRC.

In addition to the nearby USRC and Riverarium, the proposed notch in the dam will be complimented by nearby educational kiosks explaining the history of the dam, the removal process, and seasonal habitat functions of the river and local forest preserve.

7.3.8 Channel Stabilization

The goal of the project is to increase habitat health and diversity of the channel by restoring the natural vegetation and substrate in areas that are untouched by Kerr-McGee. Deposition banks and point bars along the river are typically found with contamination and will be excavated and restored by Kerr-McGee. This project proposes restoration of non-contaminated areas positioned on a depositional plain or bar consistent with Kerr-McGee restoration. Such consistency greatly enhances management efficiencies and the likelihood of achieving performance specifications. Due to irregular distances of breadth and length of these units along the stream bank, restoration needs will exceed the proposed footprint of the Kerr-McGee restoration. Additionally, channel stabilization will be provided in areas exposed as a result of the planned Warrenville Grove Dam removal, as well as those tributary inlets to the mainstem. This project seeks to conduct additional mechanical clearing work of invasive woody species, disposal of biomass by burning, and follow up cut stump herbicide applications. In addition, vegetative reconstruction through selectively herbiciding of invasive species, seeding, plug planting, and structural

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replacement of desired woody species will follow to achieve diverse composition for improved wildlife habitat and improved community health.

7.4 Kress Creek

7.4.1 Channel Stabilization

The goal of the project is to increase habitat health and diversity of the channel by restoring the natural vegetation and substrate in areas that are untouched by Kerr-McGee. Re-construction of the West Branch (Section 7.3.3, Side Channel) would likely alter the hydraulics and hydrology of a portion of Kress Creek. The West Chicago Park District owns much of the Kress Creek area impacted by the remediation work. This project includes restoration of non-contaminated areas positioned on a depositional plain or bar consistent with Kerr-McGee restoration. Such consistency will greatly enhance management efficiencies and the likelihood of achieving performance specifications. Due to irregular distances of breadth and length of these units along the stream bank, restoration needs will exceed the proposed footprint of the Kerr-McGee restoration. This proposed project seeks to conduct additional mechanical clearing work of invasive woody species, disposal of biomass by burn pile, and follow up cut stump herbicide applications. In addition, vegetation reconstruction through herbiciding invasive species, seeding, plug planting, and structural replacement of desired woody species will follow to achieve diverse composition for improved wildlife habitat and improved community health.

7.5 Summary of Environmental Improvement Projects

Consistent with the DuPage County Stormwater Management Plan, each of the projects described above were developed recognizing the integrated nature of the watershed system and the need to consider stormwater management planning on a watershed basis incorporating other watershed issues. Table 7-1 below summarizes the Stormwater Management Plan goals as they relate to each of the planned projects.

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Table 7-1
Summary of Environmental Improvement Projects

Watershed Goals	Planned Environmental Improvements						
	Storm-water Quality Wetlands	Deep Over-wintering Pool	Side Channel	Vernal Pools	Urban Stream Research Center	Partial Dam Removal	Riverarium and Educational Kiosks
Protect/Enhance Surface/ Groundwater Resources	X	X	X	X	X	X	X
Preserve/Enhance Existing Wetlands/Riparian Environments	X	X	X	X		X	
Restrict Future Development in Flood plains and Subsequent Flood Damage	na	na	na	na	na	na	na
Prohibit Development in the Floodway	na	na	na	na	na	na	na
Preserve Wetlands to Maintain Natural Flood/Environmental Benefits	X	X	X	X		X	
Incorporate Water Quality/Habitat Protection in all Stormwater Management Activities	X	X	X	X	X	X	X

As presented in Table 7-1, it is apparent that each individual project alone does not meet every goal as outlined in the County's Stormwater Management Plan. It is also apparent that individually these projects could result in some minimal impacts to the existing environment in the quest to achieve the overall objective of improving and sustaining the West Branch DuPage River watershed. However, a unique opportunity has presented itself to the County with the receipt of the NOAA Grant. Given this funding mechanism, the County can't afford not to complete these projects because when considered as a whole, this package of projects not only meets the County's objectives, but even exceeds some of the basic stormwater management criteria set in the County's Ordinance. As an example, Table 7-2 below summarizes the estimated wetland impacts versus mitigation for the planned projects.

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Table 7-2
Project Summary of Wetland Impact vs. Mitigation

Project	Existing Resource Area (Acres)	Existing Resource Type		Impacts (Acres)			Enhancement (Acres)		Creation (Acres)	
		Wetland	Open Water	Buffer	Temp.	Perm.	Wetland	Open Water	Wetland	Open Water
SW Quality Wetlands										
A) West of 59	3.25	X					3.25		9.50	
B) East of 59	0.85	X			0.12		0.85			
Deep Pool	6.75	X		0.65		2.95			0.65	3.80
Vernal Pools				0.47			0.29		1.75	
Side Channel										
A)Channel	2.40	X			2.40	0.50				
B)Outfall Area	0.22	X				0.13	1.32		0.16	
Dam	10.7		X					5.45	5.25	
TOTALS					2.52	3.58	5.71		17.31	
Impact					6.10					
Credit							1.43	5.45	17.31	3.80
Wetland Mitigation Ratio							**3.07**			
Open Water Mitigation Ratio							**0.86**			

Evidenced by the resulting wetland mitigation ratio shown above, this package of projects exceeds the County's wetland mitigation requirement of 1.5 to 1. This is just one example indicating that these projects as a whole can satisfy the intent of the County's overall Stormwater Management Plan and regulatory requirements.

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8.0 IDENTIFICATION OF ADDITIONAL OPPORTUNITIES WITHIN THE WATERSHED

To date, as part of this watershed plan, several additional projects have been identified to meet the overall watershed goals as outlined in the County's Stormwater Management Plan. The opportunities summarized below are not currently funded but could be by alternate means in the future.

8.1 West Branch

8.1.1 Fen, Seeps, and Wetland Restoration

The various fen, seeps, and wetlands hydraulically connected to the West Branch DuPage River should be enhanced and restored by extending structural, compositional, and functional restoration initiatives over these wetlands. The upland basin driving the hydrology of surface and sub-surface water chemistries to these fens, seeps, and wetlands should also be restored to function.

These types of communities contain unique plant assemblages and critical rivulet aquatic systems that provide significant habitats for certain invertebrates, amphibians, small fisheries such as darters and minnows, and a host of nesting and migratory waterfowl. This proposed project includes conducting mechanical clearing of invasive woody species, disposal of biomass by controlled burn pile, and follow up cut stump herbicide applications. These activities will increase the diversity of ground flora and the function of subsurface water movement and chemistry. Following clearing, vegetation reconstruction through; selective herbiciding of invasive species, seeding, plug planting, and structural replacement of desired woody species will restore a diverse plant composition for improved wildlife habitat and improved community health.

8.1.2 Main Stem Creek Restoration/Reconstruction

McKee Marsh Creek, Bremme Woods Creek, and Springbrook Creek convey significant drainage into the West Branch through Forest Preserve property. Each of these creek drainages should be evaluated for reconstruction and restoration with goals to improve water quality, physical and biological structure and composition, and functional health. The proposed assessment of present creek geomorphology and hydrology will result in alternatives for reconstruction and restoration with measurable objectives defined to achieve goals. Restoration alternatives to each creek system may include:

- Cutting, herbiciding, and burning the invasive brush and tree species to increase the abundance and diversity of ground flora species along creek reaches;

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- Following clearing, vegetation reconstruction through selective herbiciding of invasive species, seeding, plug planting, and structural replacement of desired woody species to restore a diverse plant composition for improved wildlife habitat and improved community health.

- Increasing the abundance and diversity of creek side plants to decrease bank erosion;

- Restoring or re-configuring creek channel sections to produce and sustain appropriate sediment substrates and streamflow velocities to increase the diversity of spawning habitat for non-sport fisheries;

- Re-introducing aquatic vegetation to increase the diversity of spawning habitat for non-sport fish.

8.1.3 River Flood Plain and Terrace Community Restoration

Flood plain and terrace plant communities along the West DuPage River could be improved with adaptive restoration initiatives. The project also seeks to complete adaptive management by selective herbiciding of invasive species, seeding, plug planting, and structural replacement of desired woody species. These combined tasks will establish a diverse composition for improved wildlife habitat and improved community health.

8.1.4 McDowell Grove Dam, Stream Channel, and Stream Pool Re-Configuration

The project seeks to implement a partial removal of McDowell Dam, reconstructing the remaining stream channel upstream and downstream of the dam, and stabilization and restoration of the resulting upstream exposed flood plain once influenced by the original pool created by the dam.

As proposed, an amount of clean sediment in front of the dam will be removed and re-distributed in the Forest Preserve as fill. The partial removal of the McDowell Grove Dam would leave a portion of both bank structures intact for preservation of historical features, as well as the water snake hibernacula known to be present beneath the limestone outcrops. Sediment that becomes stabilized behind the remaining dam bank structures will remain and be re-vegetated. A centralized channel notch will be cut in phases through the face of the dam. The notch will significantly reduce the steep elevation of the streamflow through the dam, as well as the channel and pool elevation upstream of the dam.

Reconstruction of the new stream channel will be consistent with upstream and downstream geomorphology in equilibrium with the new flow regime. Bank

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stabilization and colonization by vegetation is an expected priority followed by similar vegetative reconstruction of the flood plain. The stream channel, immediately upstream and downstream of the dam, will be reconstructed to establish a new transition bed and resultant slope through this area. The plunge pool below the dam will be filled with appropriate aggregate substrates.

The newly exposed flood plain will be allowed to stabilize and re-vegetate. Once the flood plain achieves equilibrium in relation to the new channel, a restoration effort of appropriate native species will be seeded and plugged to create aquatic, emergent, marshland, and wetland floral communities. Wetlands, previously hydraulically connected to the past pool of influence, will be reconstructed and/or restored.

8.1.5 Fawell Dam Retrofit for Effective Fish Passage

Once partial dam removals are completed at Warrenville Grove and McDowell Grove, a retrofit design for the Fawell Dam discharge apron is proposed in order to facilitate effective fisheries passage and subsequent restoration of fish migration patterns upstream. One of the three discharge chutes is to be retrofitted.

8.2 Kress Creek

To date, as part of this watershed plan, no additional projects have been identified along Kress Creek.

8.3 Ferry Creek

8.3.1 Creek Restoration/Reconstruction

Ferry Creek conveys significant drainage into the West Branch through McDowell Forest Preserve. Its drainages should be evaluated for reconstruction and restoration with goals to improve water quality, physical and biological structure and composition, and functional health. The proposed assessment of the present creek geomorphology and hydrology will result in recommendations of alternatives for reconstruction and restoration with measurable objectives defined to achieve goals. Restoration to the creek system may include the following adaptive management strategies:

- Cutting, selective herbiciding, and burning the invasive brush and tree species to increase the abundance and diversity of ground flora species along creek reaches;

- Following clearing, vegetation reconstruction through selective herbiciding of invasive species, seeding, plug planting, and structural

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replacement of desired woody species to restore a diverse plant composition for improved wildlife habitat and improved community health.

- Increasing the abundance and diversity of creek side plants to decrease bank erosion;

- Restoration or re-configuration of creek channel sections to produce and sustain appropriate sediment substrates and streamflow velocities to increase the diversity of spawning habitat for non-sport fisheries; and

- Re-introduction of aquatic vegetation to increase the diversity of spawning habitat for non-sport fish.

8.4 Summary

These additional projects contribute to meeting the overall restoration goals for the West Branch DuPage River. Any excess funding from the NOAA Grant will be used to initiate as many of these projects as possible. For all projects, long-term success will require close involvement of governmental, public, and environmental groups and the educational community.

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9.0 FLOOD CONTROL ALTERNATIVES DEVELOPMENT AND EVALUATION

9.1 Flood Control Design Criteria

Alternatives for site improvement of the West Branch DuPage River are evaluated based on the following criteria, constraints, and assumptions:

- Conformance to the Countywide Stormwater Management Plan
- Conformance to the Countywide Stormwater and Flood Plain Ordinance
- Level of flood protection provided
- Capital cost
- Environmental impacts associated with proposed projects (wetlands to be mitigated) riparian impacts, temp reduction in biodiversity.
- Water quality enhancement opportunities
- Public input and comment

9.2 Flood Control Permitting Requirements

All projects will follow the standard permitting process within the County, including Stormwater Management and Wetland permitting. Furthermore, each project will adhere to the State and Federal regulations as appropriate (IDNR-OWR, USACE, and IEPA).

9.3 Flood Control Alternatives Development

To date, the number of flood control alternatives planned and/or completed along the West Branch DuPage River is limited. Executive summaries from the existing sub-watershed plans within the West Branch are provided in Appendix A. These documents summarize the flood control alternatives considered. Details of the work within each sub-watershed can be found in the complete sub-watershed plans available at the County.

9.4 Flood Control Alternatives Evaluation

See complete sub-watershed plans for details regarding the evaluation of flood control alternatives proposed in the West Branch DuPage River.

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9.5 Economic Analysis of Flood Control Alternatives

See complete sub-watershed plans for details regarding the economic analyses of flood control alternatives proposed in the West Branch DuPage River.

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10.0 RECOMMENDED WATERSHED CAPITAL IMPROVEMENT PLAN

10.1 Recommended Plan with Cost Estimate

The locations of the proposed improvements to the West Branch Watershed are shown on Figure 7-1. Currently, funding is available through a NOAA Grant for the following tasks:

- Stormwater Quality Wetlands
  Description: Selective clearing and planting to improve filtration capabilities of wetlands between Route 59 and the West Branch south of Gary's Mill Road.
  Estimated Project Costs: $120,000

- Deep Over-wintering Pool
  Description: Excavation of 3.6 acre pool 10 to 15 feet deep for a variety of habitat enhancement structures.
  Estimated Project Costs: $2,300,000

- Side Channel
  Description: Creation of pool-riffle meandering channel between Kress Creek and the West Branch between Gary's Mill Road and the confluence.
  Estimated Project Costs: $550,000

- Vernal Pools
  Description: Excavation of 0.25 acres to create two 1.5 foot deep pools for amphibian reproduction and refuge.
  Estimated Project Costs: $50,000

- Urban Stream Research Center
  Description: Construction of an 8,000 square foot facility for the development of non-game fish and species for reintroduction into the West Branch watershed.
  Estimated Project Costs: $2,900,000

- Warrenville Grove Partial Dam Removal and Restoration
  Description: Multi-stage notching of the Warrenville Grove Dam and concurrent lowering of the millrace to reconnect the river for fish and canoe passage.
  Estimated Project Costs: $850,000

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- Riverarium and Educational Kiosks
  Description: Replacement of a section of the existing millrace with a viewing window to allow the public to examine the stream in cross section. Educational kiosks will explain the river system and history of the Warrenville Grove Dam.
  Estimated Project Costs: $1,400,000

- West Branch Channel Stabilization
  Description: Assess and restore banks by clearing/planting along banks, channel reconfiguration, and reintroduction of aquatic vegetation.
  Estimated Project Costs: $1,170,000

- Kress Creek Channel Stabilization
  Description: Assess and restore banks by clearing/planting along banks, channel reconfiguration, and reintroduction of aquatic vegetation.
  Estimated Project Costs: $130,000

The recommended plan is to complete design and implementation of these projects subject to the constraints of the Grant. Projects that are not funded by the NOAA Grant will be completed as funding becomes available through the DuPage County Forest Preserve budget or additional grant opportunities.

10.2 Actions for Other Watershed Issues

The following projects are included in this watershed plan in order to provide for a comprehensive restoration of the West Branch DuPage River, primarily within the property boundary of the DuPage County Forest Preserve District.

- McKee Marsh Perimeter Vegetative Restoration
  Description: Herbicide and seed over two years.
  Estimated Project Costs: $250,000

- McDowell Grove Dam
  Description: Hydraulic modeling, design alternative analysis, engineering, and permitting for partial dam removal and stream channel restoration
  Estimated Project Costs: $350,000

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- McDowell Grove Dam
  Description: Sediment removal and modification upstream of dam to construct pilot channel morphology to be coordinated with Kerr McGee remediation excavation.
  Estimated Project Costs: $300,000

- McDowell Grove Dam
  Description: Partial dam removal and stream channel restoration.
  Estimated Project Costs: $1,150,000

- Fawell Dam Retrofit for Effective Fish Passage
  Description: Retrofit one of three discharge chutes with riffle run channel/pools for effective fish passage.
  Estimated Project Costs: $450,000

- West Branch Bank Stabilization
  Description: Stabilization of 5,250 lineal feet, inclusive of woody invasive clearing, regarding, seeding, and planting.
  Estimated Project Costs: $1,312,500

- Creek Restoration Projects

730ft of McKee Marsh Creek:	$182,500
2662ft of Harding Creek:	$665,500
8002ft of Springbrook Creek:	$2,000,500
Dam mod./permit/Const.:	$175,500
1730ft Bremme Creek:	$432,500
542ft Little Bremme Creek:	$135,500
3547ft Ferry Creek:	$886,750

- West Branch Channel Habitat Improvements
  Description: 5000 lineal feet of structural improvements.
  Estimated Project Costs: $1,500,000

10.3 Implementation of Recommended Plan

The following steps should be completed in order to implement the recommended plan:

- The public review process must be successfully completed, and the Watershed Plan must be adopted by the County Board,
- Final design of the proposed projects should be performed, and

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- Projects should be implemented as soon as possible following Kerr-McGee's completion of remediation activities, in order to minimize the duration of disturbance of the river corridor. Without specific agreements with Kerr-McGee and the EPA, contaminant removal and restoration must be completed before these projects can begin. The cleanup process began in spring 2005 and has an estimated duration of four years. Certain projects can be completed during the time Kerr-McGee is completing its maintenance and monitoring obligations, whereas projects directly affecting Kerr-McGee projects will require specific agreements to proceed or will begin following signoff by Kerr-McGee and the EPA.

10.4 Funding and Maintenance

The DuPage River Restoration Grant from the National Oceanic and Atmospheric Administration (NOAA Grant NA16FZ1559) funds those projects in this watershed plan described in Section 7.0. Projects on Forest Preserve Property, upon acceptance, will be operated and maintained by the Forest Preserve District of DuPage County. Projects outside of Forest Preserve property will be operated and maintained by DuPage County or its designee.

Additional projects described in Section 8.0 of this watershed plan are considered amenities to the watershed and may be completed by outside entities or the County, if funds become available. However, taken as a whole, these projects represent an optimal plan for the successful restoration of natural resources and reduction of flood damages for the West Branch DuPage River.

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11.0 FLOOD PLAIN MAPPING

The Federal Emergency Management Agency (FEMA) developed flood insurance maps in the late '70s and early '80s that show the 100-year flood plain boundary for DuPage County. With the rapid urbanization that has occurred in DuPage County, these maps are outdated and inaccurate. Accurate maps are needed as a source of information for property owners, regulators, and developers to reduce and prevent future flood damages. The Stormwater Management Division has been developing the new flood plain maps based on their watershed plan models, rather than using traditional techniques. The Stormwater Management Division is using the HSPF model to determine the hydrology, the FEQ model to perform the hydraulics and determine flood elevations, and a statistical computer program called PVSTATS (based on a peak-to-volume approach) to determine the 100-year flood elevations. This methodology has been approved by FEMA and the IDNR-OWR.

All flood plain maps will be produced and maintained in an Arc/Info GIS system currently used by the County. Floodway encroachments are determined using the SCS floodway model. The encroachments are placed back in the FEQ model to insure that maximum depth and velocity increase requirements are not exceeded. FEMA has agreed to this method of determining the floodway limits in DuPage County.

The County completed the conversion of the existing FEMA Flood Insurance Rate Maps (FIRM) to Digital Flood Insurance Rate Maps (DFIRM) for the entire County in 2003. The Regulatory Flood Map (RFM) became official on July 1, 2004 for regulatory purposes. It became official for insurance purposes on December 31, 2004. This process includes transferring all current regulatory flood elevation information to a new base map and re-delineating the flood plain boundaries, incorporates all Letters of Map Revisions (LOMR), as well as correcting all known errors and omissions to the maps, utilizing the County's 2-foot topographic mapping. Over time, new flood plain information based on the watershed plan models will replace outdated flood plain information. New mapping will be based on the HSPF/FEQ/PVSTATS procedure and will reflect current watershed and land use conditions. New mapping will be updated on a basin wide approach rather than the traditional community based approach and will be completed by 2008.

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APPENDIX A

Existing Sub-Watershed Plan Executive Summaries

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APPENDIX B

Project Presentations and Pictorial Summaries