Horner Park Section 206
Aquatic Ecosystem Restoration

Detailed Project Report and Environmental Assessment

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EXECUTIVE SUMMARY

Section 206 of the Water Resources Development Act (WRDA) 1996 (P.L. 104-303), as amended, gives the US Army Corps of Engineers (USACE) authority to carry out aquatic ecosystem restoration and protection projects so long as the project improves environmental quality, is in the public interest, and is cost effective. This Section 206 Aquatic Ecosystem Restoration study evaluates the feasibility of restoring a portion of the North Branch Chicago River at Horner Park to a more natural state. The site totals about 14 acres encompassing approximately 2,600 feet of riverbank. Chicago Park District (CPD), the non-Federal sponsor, currently owns the park land and is willing and able to obtain the stream bank from the Metropolitan Water Reclamation District of Greater Chicago (MWRD) through a Channel Improvement Easement.

The Chicago River is one of the most altered river systems in the Midwest; the system has experienced stream channel relocation, channelization, removal of riparian plant communities, total reversal of basin flow, reduction in ground water inflow, erratic inflows of effluent from storm sewers and stream side industry and other degradation. In the past 20 years, water quality has improved enough to support a low diversity of native fishes and aquatic macro-invertebrates. This highly urbanized stream system will remain low in aquatic diversity unless habitat is restored. Technological improvements will upgrade the water quality of this system, but habitat restoration is necessary to sustain an acceptable level of diversity and abundance of aquatic organisms that forages along the river corridor.

Horner Park is an ideal section to restore aquatic ecosystem habitat because of the open space provided by the Chicago Park District. The objectives of this project are: 1) restoring stream morphology and hydraulics, 2) restoring a native riparian oak savanna ecosystem habitat, and 3) removing and preventing the recurrence of invasive species. The project aims to increase the species richness and abundance of native plant, aquatic, and riparian communities at Horner Park. Restoration measures considered to increase channel complexity, flow diversity, and species richness are wetland creation through a foreshore dike or cut bank wetland, bank contouring, riffle-pool creation, removal of invasive species, native plant community reestablishment, and vernal pool wetlands. Riffles and J-Hook Vanes were removed from consideration due to design and navigation restrictions.

The mean Coefficient of Conservatism (C) and Fish Species Richness assessment methodologies are used to capture changes in function, structure and health of the ecosystems, by measure, within the Horner Park Restoration Site. The environmental benefits and conceptual planning level parametric cost estimates are combined via the IWR-Planning Suite software to find the most cost-effective and feasible measures to reduce ecological degradation.

Selecting the National Ecosystem Restoration (NER) Plan requires careful consideration of the planning objectives and constraints, and the plan must reasonably maximize environmental benefits while passing tests of cost-effectiveness and incremental cost analyses, significance of outputs, acceptability, completeness, efficiency, and effectiveness.

Plan A-8, generating a total of 48.22 net Average Annual Habitat Units (AAHUs), is identified as the desired project scale and is recommended as the NER, or "Best Buy," plan. The plan includes re-grading 2,600 feet of river bank, restoring approximately ten acres of Oak Savannah habitat and creating four sixty-by-fifty foot vernal pool wetlands for a total of 0.25 wetland acres. In addition to the NER Plan, the Chicago Park District would also like to add small recreational features, such as dirt paths for control of foot traffic to water access, fencing to ensure that the restored area is not greatly disturbed by pedestrian traffic, and a series of educational signs. These recreation features would not raise the federal cost by more than 10% and would be cost-shared 50:50.

An Environmental Assessment (EA) has been prepared to evaluate the existing conditions and potential impacts of the proposed alternatives. The EA did not reveal significant impacts resulting from the proposed alternatives. The draft report and unsigned Finding of No Significant Impact (FONSI) were made available for a 30 day public review on September 5, 2012. Reponses to the review are included in Appendix A along with a copy of the Corps Notice of Availability.

The Preliminary Restoration Plan for Horner Park was approved in 2003, thus the project is considered "grandfathered" and follows the former Continuing Authorities Program (CAP) guidance in which no Feasibility Cost Sharing Agreement (FCSA) is required. The Planning and Design study funds are initially provided by the Federal government. The non-Federal share of Feasibility costs are included in the total project costs and are recouped after a Project Partnership Agreement (PPA) is signed.

The estimated total project first cost is $6,364,922. The cost-shared Feasibility phase is estimated to cost $294,050. Design and Implementation is projected to cost a total of $5,480,486 for ecosystem restoration features and $590,386 for recreational features. Lands, Easements, Rights-of-Way, Relocations, and Disposal Areas (LERRDs) are estimated at $94,500. Cost-sharing requirements for project implementation are 65% Federal and 35% non-Federal for ecosystem restoration features and 50%-50% for recreational features. The estimated non-Federal share of the total project first cost is $2,316,281. An estimate of $94,500 would be covered by the LERRDs value, $200,000 of work in kind and $2,021,781 of cash would cover the remaining share. In addition to the total first cost, the operation and maintenance (O&M) costs of the project are estimated to total $1,050 annually, in 2013 dollars. The $200,000 of in-kind credit would be for work done in the design and implementation phase and would be negotiated in the PPA.

Chicago District and Chicago Park District have completed two similar restoration efforts upstream of Horner Park along the North Branch Chicago River. The restoration of Horner Park would continue the restoration effort to increase the natural ecosystem habitat along the North Branch Chicago River. The Horner Park project offers a great opportunity for restoring the riparian corridor to a functional and more diverse state through re-grading the stream bank to a more stable slope, planting native riparian species, restoring oak savanna habitat, and constructing small pockets of vernal pool wetlands. Chicago District recommends that this project proceed into the design and implementation phase.

CONTENTS

* denotes pertinent to Environmental Assessment

LIST OF ACRONYMS

AAHUs	Average Annual Habitat Units
ASA(CW)	Assistance Secretary of the Army (Civil Works)
ATR	Agency Technical Review
C	Coefficient of Conservatism
CAP	Continuing Authorities Program
CE/ICA	Cost Effective/Incremental Cost Analysis
CFR	Code of Federal Regulations
CPD	Chicago Park District
D&I	Design and Implementation Phase
EA	Environmental Assessment
EC	Engineering Circular
EDC	Engineering During Construction
ER	Engineer Regulation
FCSA	Feasibility Cost Sharing Agreement
FONSI	Finding of No Significant Impact
FQA	Floristic Quality Assessment
FWCA	Fish & Wildlife Coordination Act
FWOP	Future without Project Condition
HSI	Habitat Suitability Index
HTRW	Hazardous, Toxic, and Radioactive Waste
HUs	Habitat Units
I&M	Illinois and Michigan
IEPA	Illinois Environmental Protection Agency
IVE	Informal Value Estimate
IWR	Institute for Water Resources
IWR-PLAN	Institute for Water Resources – Planning Suite Software
LERRDs	Lands, Easements, Rights-of-Way, Relocations, and Disposal Areas
LIDAR	Light Detection and Ranging
LPP	Locally Preferred Plan
LUST	Leaking Underground Storage Tank
MOU	Memorandum of Understanding
MWRD	Metropolitan Water Reclamation District of Greater Chicago
NED	National Economic Development
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration
NFS	Non-Federal Sponsor
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resource Conservation Service
O&M	Operation and Maintenance
OMRR&R	Operations, Maintenance, Repair, Replacement, and Rehabilitation
P&G	Principals and Guidelines
P.L.	Public Law
PPA	Project Partnership Agreement
PRP	Preliminary Restoration Plan

SHPO	State Historic Preservation Officer
TACO	Tiered Approach to Corrective Action Objectives
URRI	Urban Rivers Restoration Initiative
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USF&WS	U.S. Fish and Wildlife Service
WRDA	Water Resources Development Act

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CHAPTER 1 – INTRODUCTION

1.1 Study Authority

Section 206, Water Resources Development Act (WRDA) 1996 (P.L. 104-303), as amended, is the project authority. The US Army Corps of Engineers (USACE) may carry out aquatic ecosystem restoration and protection projects if the project will improve environmental quality, is in the public interest, and is cost effective. The Federal share of the costs for any one project may not exceed $5,000,000. There is an annual appropriation limit of $25,000,000 nationwide. Section 4 of the Flood Control Act of 1944, Public Law 78-534, as amended (16 U.S.C. 460d) and the Federal Water Project Recreation Act of 1965, Public Law 89-72, as amended (16 U.S.C. 4601-12 et seq.) provide authority to include recreation as a project purpose in conjunction with aquatic ecosystem restoration provided that the total costs of recreation do not increase the Federal share of the project by more than 10%. All recreation costs are cost shared 50%/50%.

The Preliminary Restoration Plan for Horner Park was approved in 2003, thus the project is considered "grandfathered" and follows the old Continuing Authorities Program (CAP) guidance in which there is no Feasibility Cost Sharing Agreement (FCSA). The Planning and Design study funds are initially funded by the Federal government. The non-Federal share of Planning and Design costs are included in the total project costs and are recouped after a Project Partnership Agreement (PPA) is signed. The non-Federal sponsor (Chicago Park District) is responsible for paying 35% of the total aquatic ecosystem restoration costs, 50% of the total recreation costs, and providing all lands, easements, rights-of-way, relocations, and disposal areas (LERRDs). The value of the LERRDs is credited toward the sponsor's share of the total project cost. If the LERRDs are less than the sponsor's cost share, the local sponsor may provide work-in-kind performed subsequent to execution of the PPA. Credit for the total LERRDs and work-in-kind cannot exceed the local sponsor's share. Once the project is completed, the local sponsor is required to pay 100% of the annual operation, maintenance, repair, rehabilitation, and replacement (OMRR&R) for the project. The sponsor is aware of its requirements and has requested the project study move forward.

1.2 Study Background and Sponsorship*

The Chicago River consists of three northern branches and one southern branch that total about 74 river miles and drain 280 square miles. Prior to modern intervention, the three northern branches were a wetland complex of sloughs, oxbows, bottomlands, ponds, and marshes. The system was a group of narrow elongated depressions within the late Wisconsinan Age Glacial drift (Pepoon 1927) that once lazily meandered over the Chicago Lake Plain unimpeded until around 1848. By occupying the lowlands of the Lake Border Moraines, the wetlands sluggishly drained an area of about 102 square miles east into Lake Michigan. All of these landscape features were densely populated with native plant species that included sedges (*Carex spp.*), arrowheads (*Sagittaria spp.*), rushes (*Juncus spp.*), pondweeds (*Potamogeton spp.*), oaks (*Quercus spp.*) and hundreds of prairie species. These features and associated plant species no longer exist in the project area. Figure 1 depicts what the Chicago River North Branch looked like before development.

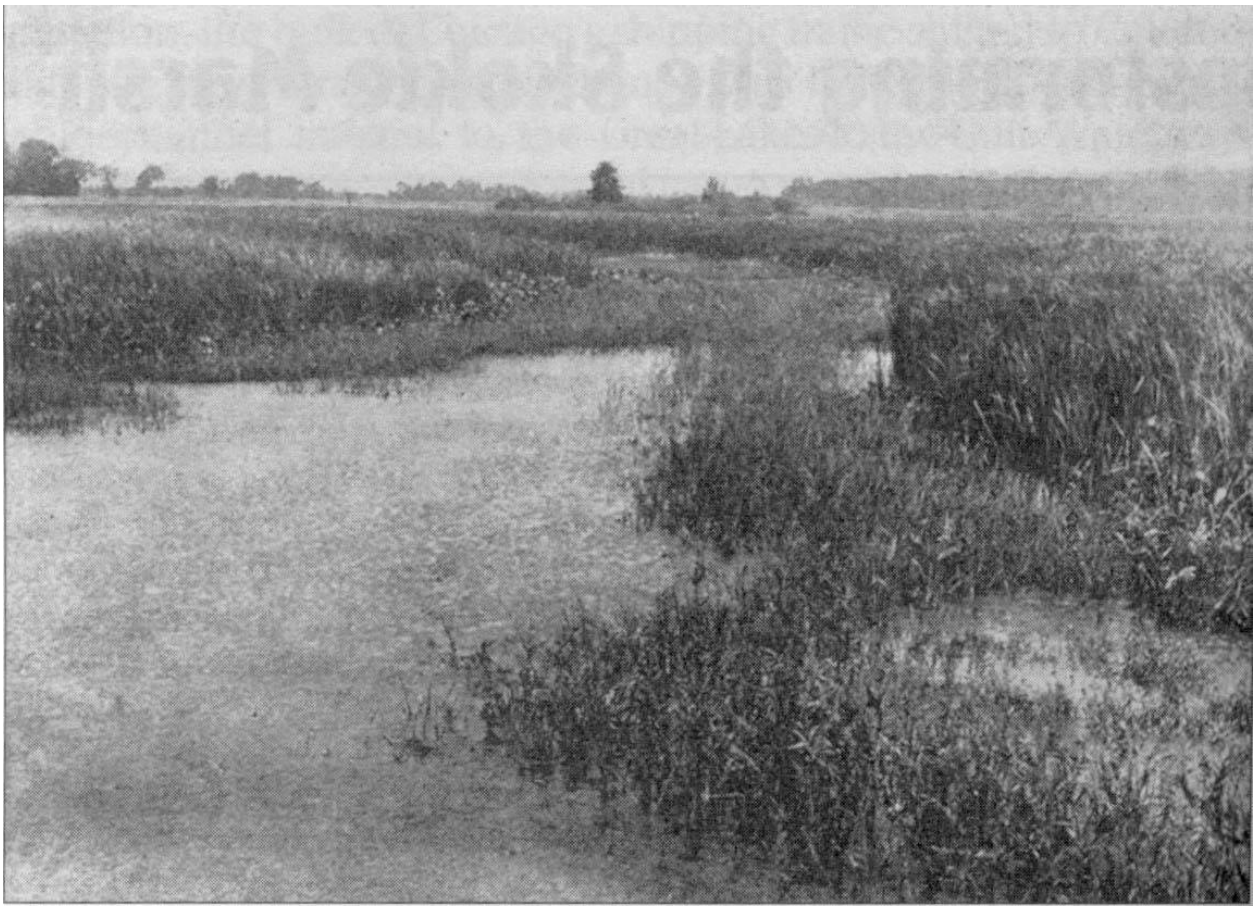

Figure 1: Depicting the North Branch Chicago River through the Skokie Marsh (Hill 2000).
Photo: Earl E. Sherrff "Vegetation of the Skokie Marsh" 1913.

Although only a few miles to the west of the Chicago River, the Des Plaines River naturally flowed west into the Mississippi River drainage basin. Figure 2 shows the proximity of the Des Plaines River system to the project site. There were periods of high flow when the Des Plaines River changed its course and flowed into the Chicago River. This critical hydraulic divide was known as Mud Lake. Sporadically, during spring floods, Mud Lake would overflow into the West Fork of the South Branch of the Chicago River near Kedzie Avenue. This flow reversal provided a temporary connection between the respective drainage basins. Completion of the Illinois and Michigan (I&M) Canal in 1848 reversed the flow of the Chicago River thereby seizing this natural occurrence. The dimensions of the original I&M Canal were 60 feet wide at the surface, 36 feet wide at the base, and 6 feet deep. The I&M canal gave way to a much larger Sanitary and Ship Canal started in 1892 that connected Lake Michigan with the Illinois Waterway. The permanent connection between the Lake Michigan and Mississippi drainage basins was finalized in 1900 by the completion of the Sanitary and Ship Canal (Hill 2000). Today this riverine system is primarily fragmented by five run of the river dams. Free flowing sections occur above and below these dams, but do not offer sufficient habitat or water quality for aquatic organisms.

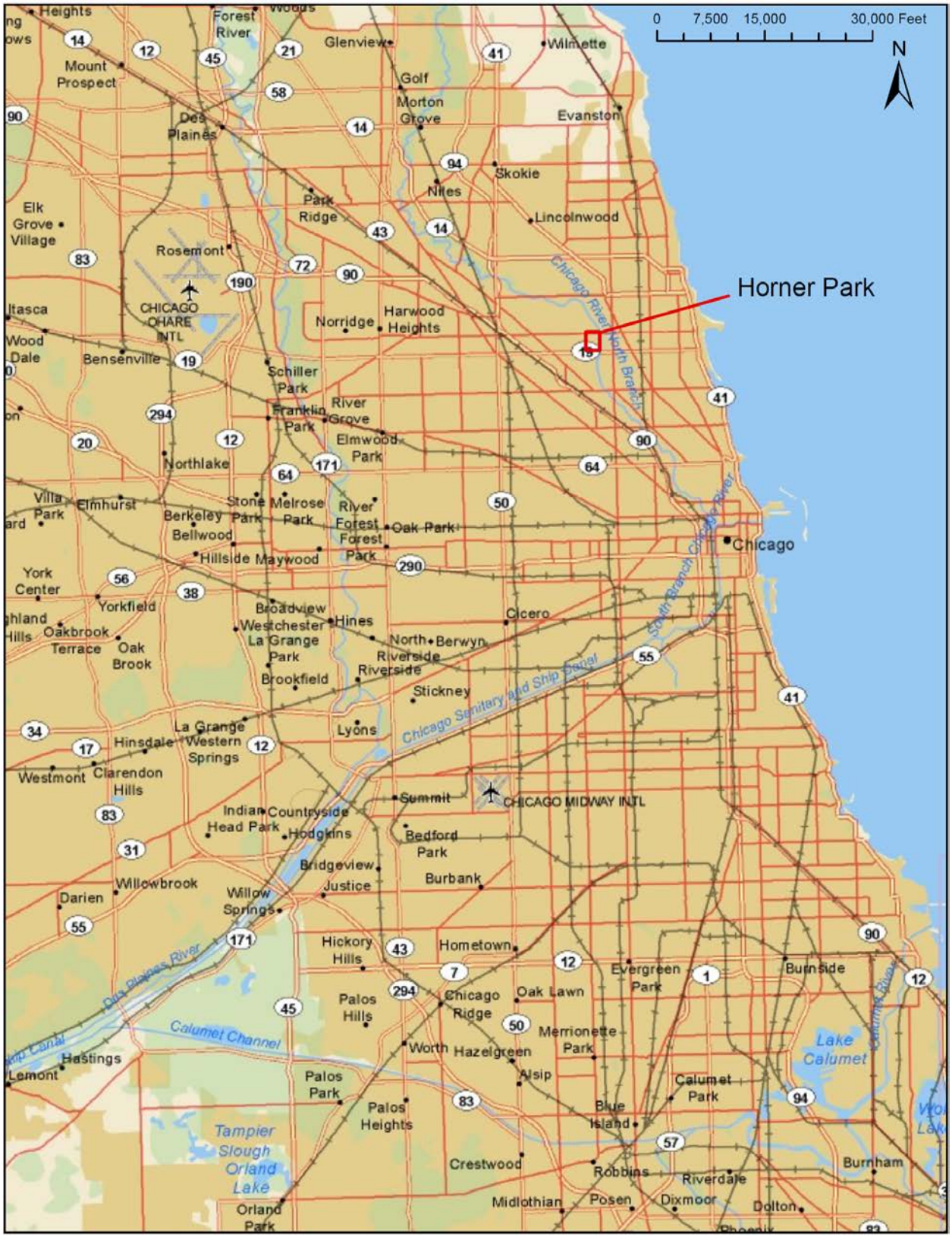

Figure 2: Proximity of the Des Plaines River and the Sanitary and Ship Canal to Horner Park

This Section 206 Aquatic Ecosystem Restoration study evaluates the feasibility of restoring a portion of the Chicago River North Branch to a more natural state. The scope of this study addresses the issues of altered river morphology and hydraulics, riparian habitat, species richness, and encourages public recreation. This Detailed Project Report and Integrated Environmental Assessment assesses and identifies problems and opportunities associated with the ecological degradation at Horner Park and identifies and evaluates measures to address the ecological problems caused by years of human disturbance. It also recommends the most cost-effective and feasible measures to reduce ecological degradation.

The Chicago River is one of the most altered river systems in the Midwest. The system has experienced stream channel relocation, channelization, removal of riparian plant communities, total reversal of basin flow, reduction in ground water inflow, erratic inflows of effluent from storm sewers and stream side industry and other degradation. In the past 20 years, water quality has improved enough to support a low diversity of native fishes and aquatic macro-invertebrates. This highly urbanized stream system will remain low in aquatic diversity unless habitat is restored. Technological improvements planned, and in some cases already implemented, will upgrade the water quality of this system, but habitat restoration is necessary to sustain an acceptable level of diversity and abundance of aquatic organisms that forages along the river corridor. Horner Park is an ideal section to restore aquatic ecosystem habitat because of the open space provided by the Chicago Park District.

The non-Federal sponsor is the Chicago Park District (CPD). Stakeholders include the City of Chicago, the U.S. Fish and Wildlife Service, the Illinois Department of Natural Resources, and the Metropolitan Water Reclamation District of Greater Chicago (MWRD).

1.3 General Study Area*

Horner Park lies along the North Branch of the Chicago River in the City of Chicago, IL. The restoration area is bounded by Montrose Avenue to the north and Irving Park Road to the south (Figure 3). The slope of the bank varies from being almost vertical in many areas, to more gently sloping in the southern part of the site (average 3:1, Vertical: Horizontal). The project site encompasses approximately 2,600 feet of riverbank and at some points extends inland about 300 feet. The site totals about 14 acres. Figure 4 depicts the Horner Park Preliminary Restoration Plan (PRP) approved in 2003. CPD currently owns the park land and is willing and able to obtain the right stream bank from MWRD through a Channel Improvement Easement. The opposite bank is owned by MWRD but abuts private development and falls outside of the study area. Metropolitan Water Reclamation District of Greater Chicago is aware and supportive of this restoration project.

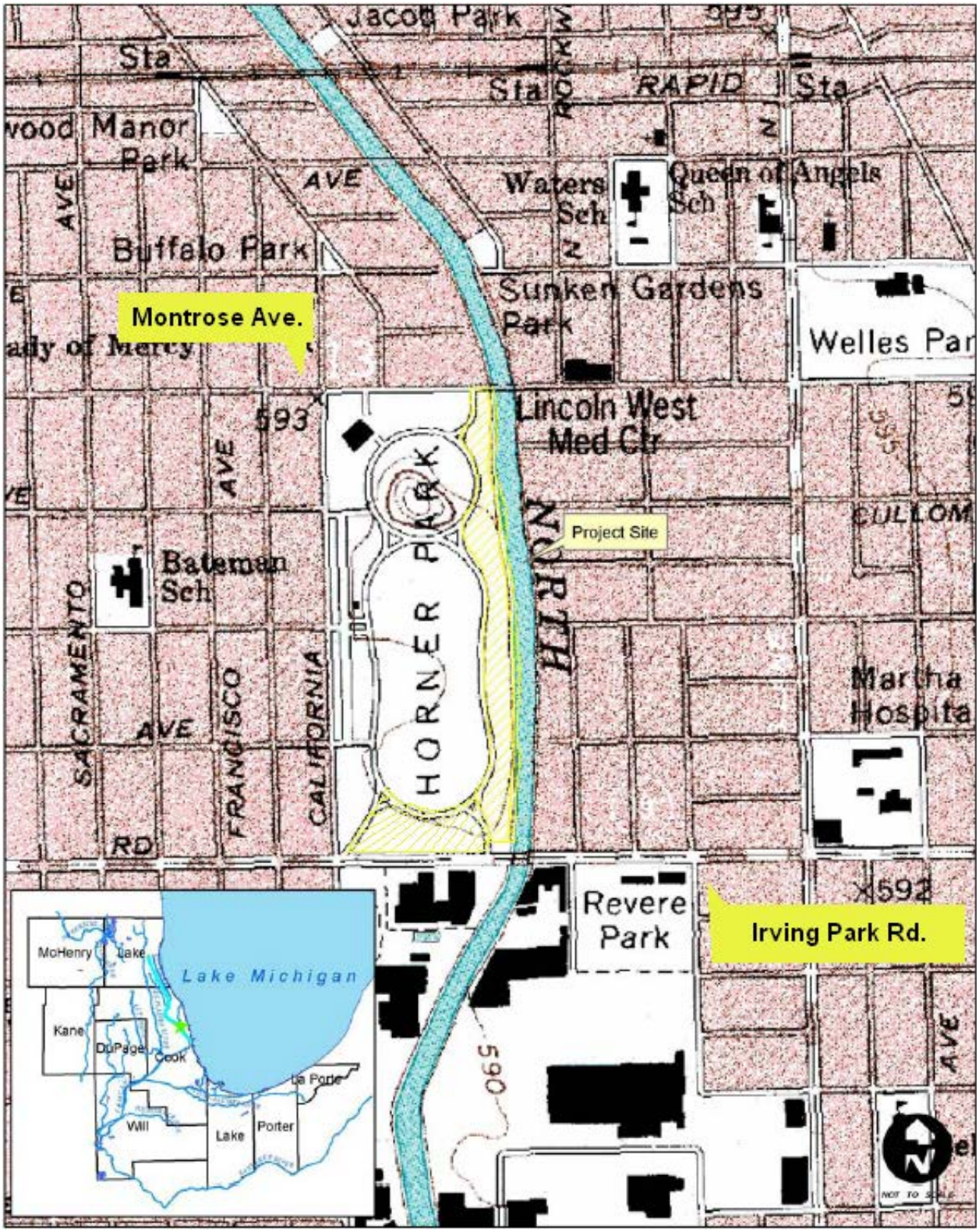

Figure 3: Location of Horner Park (North Branch Chicago River)

Figure 4: Aerial and preliminary restoration overlay of Horner Park from the PRP (North Branch Chicago River)

1.4 Related Studies, Reports, and Projects

Chicago District and Chicago Park District have completed two similar restoration efforts upstream of Horner Park along the North Branch Chicago River. The restoration of Horner Park would continue the effort to increase ecosystem habitat along the North Branch Chicago River.

Gompers Park – Early in the 1990's, the City of Chicago's Department of the Environment and the U.S. Fish and Wildlife Service (USF&WS) implemented wetland restoration sites in the Chicago metropolitan area. One of these sites was Gompers Park along the North Branch Chicago River, which is owned by the Chicago Park District. The National Resource Conservation Service (NRCS) recommended removing unnatural fill down to the natural soils series and re-grading the area to restore a wetland plant community. The Chicago Park District removed unnatural fill and re-graded the site so the area would hold an appropriate amount of water and expose wet soils needed to sustain planted native wetland and prairie vegetation. The combination of a water control structure and the improved ability of the area to hold moisture help to reduce impacts from downstream flooding. The wetland plants naturally filter pollutants and sediments in storm water runoff to improve water quality. The wetland now provides habitat for a variety of birds, turtles, and fish, and frogs. The completed project is considered successful. (U.S. Army Corps of Engineers, Chicago District).

Eugene Field Park – As part of a continued effort between the Chicago Park District, USACE, and NRCS, the Eugene Field Park, located in Chicago, IL, is an 8-acre parcel along the Chicago River North Branch that currently serves as a city park. The site suffers from impairments typically associated with a heavily urbanized watershed - complete obliteration of natural fluvialgeomorphic and hydrologic processes. Ensuing problems include loss of channel morphology and instream complexity, loss of riparian corridor and habitat fragmentation, loss of native species diversity, and extremely degraded water quality. The Corps has completed a feasibility study and detailed design of a restoration plan under the Section 206 Authority (Aquatic Ecosystem Restoration). The recommended plan begins by removing structures and facilities such as fencing, light poles, and asphalt pathways from the project footprint. The site is then cleared of non-native brush and trees, with certain native tree species being salvaged such as oak and willow. Next, 20,000 cubic yards of fill material will be removed to expose the natural soils beneath and provide the proper hydrology for wetland reestablishment. Final grading of the site will establish naturally sloping contours along the river banks and wetland depression. Two riffles will be placed in the Chicago River to increase instream complexity, flow velocity diversity, sediment transport and to reduce bank erosion. Seeding of wetland, mesic prairie and oak savanna plant communities will commence after the earthwork is complete. The next two or three years after construction will involve supplementing the site with native plugs to further increase plant species richness and ecological surveys to monitor success. Construction started in spring 2011 and is scheduled for completion in fall 2013. Construction will be followed by a two year monitoring period.

1.5 Planning Process and Report Layout

Plan formulation is an iterative process in which a number of alternative plans are developed to reduce or eliminate the identified problems. USACE planning process follows the six-step process defined in the Principals & Guidelines (P&G). This process is a structured approach to problem solving which provides a rational framework for sound decision-making.

Step 1 – Identifying problems and opportunities relevant to the project scope
Step 2 – Inventorying and forecasting conditions relevant to the project scope
Step 3 – Formulating alternative plans
Step 4 – Evaluating alternative plans
Step 5 – Comparing alternative plans
Step 6 – Selecting a plan

Alternative plans may be different from one another in function or in scale. Once a number of alternative plans are developed, the costs and benefits (both monetary and qualitative environmental) of each plan are developed and compared to each other. In this way, the most cost-effective plans (the ones with the greatest net benefits per unit cost) can be identified. In the early iterations, the benefits and costs may be developed at a relatively low level of detail to screen out the most obviously non-feasible plans. If plans appear to have relatively similar outputs per unit cost, the plans should be retained for further evaluation. The likelihood of plan implementation may also be considered at early levels of iteration.

For this study, the plan formulation process is carried out on a management measure basis. Initially, an array of possible measures is developed to meet one or more of the planning objectives for the proposed site. A measure or combinations of measures form reasonable alternatives that address the objectives without violating the constraints. Each alternative will be numbered in some fashion, and the costs and benefits of each will be developed to a somewhat greater level of detail, sufficient to be relatively certain that computed differences between benefits and costs are accurate. The final screening iteration will then be done to eliminate the least cost-effective alternatives. The Institute for Water Resources (IWR) of the USACE has developed a computer program, the IWR-Planning Suite, which identifies the most cost-effective alternatives (Robinson et al 1995).

CHAPTER 2 – INVENTORY AND FORECASTING

2.1 Current Conditions

2.1.1 Physical and Biological Resources (Affected Environment)*

Climate

The climate in northeastern Illinois is classified as humid continental, characterized by warm summers, cold winters, and daily, monthly, and yearly fluctuations in temperature and precipitation. Average annual rainfall is usually between 30 to 40 inches per year, with greater proportions falling between April and August. Seasonal snowfall averages about 28 inches annually. Early spring floods occur when snow accumulations extend into a period of increasing temperature that results in melting. If soils are already saturated, and given the amount of impervious surfaces within the basin, runoff increases dramatically.

Topography

The Chicago area lies within a lake plain, surrounded by moraines paralleling former shorelines because of glacial scouring and alluvial deposition. Nearly all of the natural topography of the project area was changed through urban development.

Geology & Soils
The Wisconsinan glaciations and the resulting Glacial Lake Chicago shaped Horner Park and the surrounding areas. Silurian bedrock in the study area is overlain by as much as 100 feet of till and lacustrine sediments of the Wadsworth Formation. The Wadsworth Formation encircles the southern margin and underlies the approximate southern third of Lake Michigan. In the study area, this material typically consists of calcareous gray silts and clays with very few coarse fragments or sand. The soils that formed at Horner Park developed in silty and clayey lakebed sediments. They have a silt loam or silty clay loam surface layer that is dark-colored and relatively high in organic matter. The subsoil and substratum are silty clay loam and silty clay. The soils are similar to the Del Rey, Martinton, and Milford soil series. The natural soils are severely disturbed as the site has been filled with clayey material during the conversion of the site from its former usage as brick making pits and a former dump site into the current park setting. Additional information on soil quality can be found on page 12, Hazardous, Toxic, and Radiological Waste Investigation. Complete testing results can be found in Appendix E.

Within the Chicago region, shallow aquifers in the till are hydraulically connected with the shallow dolomite aquifer of the underlying Silurian System. Recharge of the aquifer seems to occur from local precipitation, but given the slow permeability of the overlying soils, some horizontal movement may be occurring.

Hydrology & Hydraulics
The Chicago River system begins in Lake County, IL, where its headwaters arise near Lake Bluff. This river was essentially a sluggish prairie slough complex that flowed relatively unaltered into Lake Michigan until 1833. It would intermittently make a confluence with Lake Michigan depending on precipitation, sand deposition and dunal processes at the mouth. Completion of the Sanitary & Ship Canal in 1900 reversed the flow of the Chicago River to the Illinois River basin. The Chicago River consists of three northern branches and one southern branch, which total about 74 river miles. The system drains a total area of 280 square miles, or about 2% of the Chicago Region. The majority of the Chicago River's flow consists of wastewater discharge and no longer flows through its original stream channels. There are five low head dams, one lock and dam, and numerous culvert impediments within the Chicago River drainage. Major tributaries of the Chicago River are the North Branch Chicago River, West Fork North Branch Chicago River, Middle Fork North Branch Chicago River, Skokie River, the North Shore Channel, South Fork South Branch Chicago River, and the South Branch Chicago River. Dry weather flow in the North Branch Chicago River at Horner Park is slow and comprised of almost ninety-percent treated effluent from the MWRD's treatment plants. Controlled both upstream and downstream by dams, the river holds a fairly constant pool elevation of 577.5 NAVD 88.

Air Quality
The air quality for the study area is reported in the 2009 Illinois Annual Air Quality Report. Cook County, Illinois is considered part of the Chicago Metropolitan Area. The Illinois Environmental Protection Agency maintains air monitors as part of the National Ambient Air Monitoring Program. In the year 2009, the air quality in northwest Cook County was predominantly good (58.4%), with some days of moderate air quality events (40.3%). 1.4% of the time the air quality was unhealthy for sensitive groups so active children and adults, and

people with respiratory disease, such as asthma, were cautioned to limit prolonged outdoor activity. There were no days of unhealthy air quality.

Water Quality

In general, the water quality in the Chicago River is poor. This section of the North Branch through Horner Park is classified as a secondary contact and indigenous aquatic life water body. The North Branch has been listed as an impaired stream in the Illinois Environmental Protection Agency (IEPA) 303(d) report since 1992 due to inability to achieve and reach the applicable general use water quality standards. It has been assessed based on site-specific data collected as part of selected monitoring programs, physical and chemical Ambient Water Quality Monitoring Network, and Intensive Basin Survey data. According to IEPA, the Horner Park segment of the North Branch Chicago River does not support primary contact recreation due to elevated levels of fecal coliform; aquatic life because of aldrin, chloride, DDT, Hexachlorobenzene, total suspended solids, and phosphorus; fish consumption because of polychlorinated biphenyls and mercury; and indigenous aquatic life for iron, phosphorus, oil, and grease. The potential sources of impairment are municipal and combined sewer overflows, hydrologic/habitat modification (channelization and stream bank modification and destabilization), highway maintenance and runoff, and contaminated sediments (IEPA 2002a, IEPA 2002b, IEPA 2010).

Sediment Quality

In general, the sediment quality in the Chicago River and its tributaries is poor. A variety of sediment studies were performed within the Chicago River between 1990 and 2000. These sediment studies indicate that contaminants of concern include: polycyclic aromatic hydrocarbons, oil & grease, pesticides, PCBs, and heavy metals, including: lead, arsenic, cadmium, chromium, nickel, and zinc. Based on the results of the May 16, 2011 sediment analysis, the sediment does not indicate the potential for hazardous waste as defined under 40 CFR Part 261 Subpart C. Some samples exceeded TACO limits for arsenic and lead. Complete testing results can be found in Appendix E.

Native Plant Communities

The present plant communities are quite degraded and dominated by invasive and non-native species. Current exotic species found on the site include Norway maple (*Acer platanoides*), common privet (*Ligustrum vulgare*), amur honeysuckle (*Lonicera maackii*), etc. A complete inventory of the site's plant species is listed in Table 1.

Table 1: Current Plant Community of the Horner Park Site
Scientific names in capital letters indicate Exotic Species

SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME	COMMON NAME
Acer negundo	BOX ELDER	*MELILOTUS ALBA*	WHITE SWEET CLOVER
ACER PLATANOIDES	NORWAY MAPLE	*PLANTAGO LANCEOLATA*	ENGLISH PLANTAIN
Acer saccharinum	SILVER MAPLE	*PLANTAGO MAJOR*	COMMON PLANTAIN
Acer saccharum	SUGAR MAPLE	*POA COMPRESSA*	CANADA BLUE GRASS
ARCTIUM MINUS	COMMON BURDOCK	*POA PRATENSIS*	KENTUCKY BLUE GRASS
ARTEMISIA VULGARIS	MUGWORT	*Populus deltoides*	EASTERN COTTONWOOD
Celtis occidentalis	HACKBERRY	*Quercus alba*	WHITE OAK
CIRSIUM ARVENSE	FIELD THISTLE	*Quercus macrocarpa*	BUR OAK
Cornus racemosa	GRAY DOGWOOD	*Quercus rubra*	RED OAK
Cornus stolonifera	RED-OSIER DOGWOOD	*Quercus velutina*	BLACK OAK

CRATAEGUS PHAENOPYRUM	WASHINGTON HAWTHORN	*RHAMNUS CATHARTICA*	COMMON BUCKTHORN
DIGITARIA SANGUINALIS	HAIRY CRAB GRASS	*Rubus occidentalis*	BLACK RASPBERRY
FESTUCA ELATIOR	TALL FESCUE	*Rudbeckia laciniata*	WILD GOLDEN GLOW
Fraxinus pennsylvanica subintegerrima	GREEN ASH	*Solidago altissima*	TALL GOLDENROD
Gleditsia triacanthos	HONEY LOCUST	*Solidago gigantea*	LATE GOLDENROD
Impatiens capensis	ORANGE JEWELWEED	*SYRINGA VULGARIS*	LILAC
LEPIDIUM CAMPESTRE	FIELD CRESS	*TARAXACUM OFFICINALE*	COMMON DANDELION
LIGUSTRUM VULGARE	COMMON PRIVET	*Tilia americana*	AMERICAN LINDEN
LONICERA MAACKII	AMUR HONEYSUCKLE	*Ulmus americana*	AMERICAN ELM
LONICERA TATARICA	TARTARIAN HONEYSUCKLE	*Vitis riparia*	RIVERBANK GRAPE
MALUS SIEBOLDII	JAPANESE CRAB		

Wildlife and Habitat

Upland habitat consists of non-native trees and mowed turf grasses. Various site visits by USACE biologists indicate that the wildlife is typical of urban settings. The trees and mowed turf grasses provide minimal habitat for tolerant bird species such as American crows (*Corvus brachyrhinchos*), European starlings (*Strunus vulgaris*), and other animals such as gray squirrels (*Sciurus caroliniensis*), and beaver (*Castor Canadensis*). It is assumed that the riparian zone provides cover for small mammal species such as native mice and voles.

Aquatics

The aquatic system at Horner Park has been severely impacted through development. The Chicago River North Branch system has been drained and forced into an unnatural channel. This channel primarily consists of fine silts and soils. Flows are flashy and stream lacks structure such as riffle-pool sequences or submergent vegetation. Floodplain features are absent due to surrounding development and flood events that are mostly confined within the channel. The riparian zone consists of non-native brush. The study reach is much lower in habitat and biological diversity than a reference site approximately 1 mile upstream. Species diversity and abundance of fishes are low, while species tolerance levels to habitat degradation are high. See Table 2 for a list of the fish species found in the project stream reach.

Table 2: Fish Species found in the North Branch Chicago River Adjacent to Horner Park
* Species data were collected with a boat shocking unit following Illinois DNR protocols or by a Corps biologist using a backpack shocking unit.

SCIENTIFIC NAME	COMMON NAME
Ameiurus melas	Black Bullhead
Lepomis cyanellus	Green Sunfish
Lepomis humilis	Orangespotted Sunfish
Lepomis macrochirus	Bluegill
Micropterus salmoides	Largemouth Bass
Pomoxis nigromaculatus	Black Crappie

Amphibian Populations

According to The Illinois Gap Analysis Project (IL-GAP), approximately 11 species of amphibians could occur at the Horner Park Site. They are the following: Blue-spotted Salamander (*Ambystoma laterale*), tiger salamander (*Ambystoma tigrinum*), Eastern Newt

(*Notophthalmus viridescens*), American toad (*Bufo americanus*), Fowler's toad (*Bufo fowleri*), Cope's gray treefrog (*Hyla chrysoscelis*), gray treefrog (*Hyla versicolor*), Western chorus frog (*Pseudacris triseriata*), Spring peeper (*Pseudacris crucifer*), bullfrog (*Rana catesbeiana*), and green frog (*Rana clamitans*).

Threatened and Endangered Species
Coordination with the Illinois Department of Natural Resources and the US Fish and Wildlife Service did not indicate the presence of listed species or their critical habitats. The proposed project area does not provide critical habitat for Federal or state listed species nor are Federal or state listed species present at the site.

Hazardous, Toxic, and Radiological Waste Investigation
No HTRW investigation can wholly eliminate uncertainty regarding the potential for HTRW associated with a project area. Performance of the HTRW investigation is intended to reduce, not eliminate, uncertainty regarding the potential for HTRW in connection with a project area. A Phase I HTRW investigation was carried out by the Corps, Chicago District (LRC) and included a data base review, review of existing information, and a site visit. The findings of that report state the following:

> Review of a database search provided by Environmental Data Resources (EDR) identified a Leaking Underground Storage Tank (LUST) near the project site. The Chicago Park District is currently working with the IEPA. However, it is unlikely the LUST would interfere with the ecosystem restoration since most of the proposed construction activities are located along the river.
>
> Existing information on this project revealed the site has previously been used by a brick manufacturing company and as a small landfill. Prior sampling south of the proposed project site suggests that sediment along the Chicago River has been impacted by the previous usage of the land adjacent to the riverbank.
>
> Other than some small amounts of debris along the riverbank, a site visit revealed no additional environmental concerns at the project site.
>
> A preliminary sampling analysis was conducted and concluded the soil and sediment is not suitable for off-site reuse and excess material should be transported to a landfill facility. Additional sampling is recommended to determine the geotechnical make-up of the material or to comply with any Federal or State regulations prior to construction.

The on-site LUST identified at the Horner Park site is owned by the Chicago Park District. CPD was contacted and verified the LUST is an old heating tank located under the field house. CPD has been working with the Illinois Environmental Protection Agency and no corrective action is being required. The LUST is located on the far west side of the parcel approximately 0.15 miles away from the proposed project site on the east bank along the Chicago River. Due to the nature and location of the identified LUST, it is not anticipated to interfere with proposed construction activities.

As a recommendation from the Phase I HTRW investigation, sediment, soil, and water sampling was conducted on 16 May 2011 by the U.S. Army Corps of Engineers (USACE), Chicago District, personnel. FutureNet Group was contracted to complete sample analysis which they contracted out to Test America Laboratories. The complete sampling analysis report, as well as

scopes of work for laboratory analysis and sampling activities, is included in the HTRW Appendix E. The sampling analysis report is summarized below:

> The purpose of the soil, sediment, and water analysis is to determine the composition of the proposed project area. Based on the results of the analysis, the soil does not indicate the potential for hazardous waste as defined under 40 CFR Part 261 Subpart C. It is recommended for disposal at a landfill facility due to parameters outside of the regulatory limits for clean soils.
>
> Based on the results of the sediment analysis, the sediment does not indicate the potential for hazardous waste as defined under 40 CFR Part 261 Subpart C. It is recommended for disposal at a landfill facility due to parameters outside of the regulatory limits for clean material. Any water removed with the sediment should not be allowed to return to the river untreated.
>
> Access to the river may require a Clean Water Act (401) permit. The water results should not have a negative impact on acquiring the 401 permit but the local agency, the Illinois Environmental Protection Agency (IEPA), may also require additional sampling or water monitoring if they perceive construction activities are going to impact the water quality.
>
> Project information for this report is based on preliminary design objectives. Analyzed soil and sediment samples are grab samples. If the project would include work deeper than 4', core samples should be taken to determine the quality of the deeper sediment.

Social Setting

Chicago is in northeastern Illinois near the southwestern tip of Lake Michigan. It straddles the St. Lawrence divide between the Great Lakes and Mississippi River watersheds. Chicago is the third most populous city in the United States with an ethnically and racially diverse population of approximately 2.8 million people. Median household income for the City of Chicago is $43,650.00 (2006), and the median home cost is $238,567.00 (2010). Surrounding communities include Evanston, Oak Park, Cicero, and Evergreen Park.

Recreation

Horner Park is a central recreational park on the northwest side of Chicago. It features basketball, tennis, baseball and softball leagues during the spring, summer and fall. It also has open green space and walking trails.

2.1.2 Cultural and Archaeological Resources*

The National Register of Historic Places has 321 listings located within the City of Chicago. These include 270 structures and 51 historic districts. The closest property currently listed on the National Register of Historic Places to the project area is the Curt Tech & Company building (listed in 1990), located approximately 1/5 mile to the east.

Horner Park is named after former Governor Henry Horner. The northwest corner of the park features a memorial to the governor carved by the sculptor John David Brcin. This memorial is an Illinois State Historical Site.

Chicago maintains its own list of City Landmarks totaling approximately 270 individual structures and 53 historic districts. City Landmarks closest to the Horner Park project area are the Race House, Schurz High School, the Whistle Stop Inn and the Villa Historical District, all

located approximately one mile to the west. No City Landmarks are present in the general project area.

Horner Park was created through heavy landscape modification that included grading and filling. The site was originally a brickyard. The site has been altered many times leaving no intact archaeological deposits present in the project location.

Land Use History
The project area is within the Irving Park neighborhood of Chicago. This area was first settled as a farm in 1843. The area remained farmland until the 1860s when suburban development was encouraged by the spreading railroad network. The Chicago and Northwestern Railroad built a station for the newly developed community of Irvington in 1869. The name was later changed to Irving Park. In 1889 the area was annexed to the City of Chicago. The largely residential community has gone through periods of decline and renewal. Currently the Irving Park neighborhood is a stable middle-class family-oriented community.

Horner Park
Horner Park was established by the Chicago Park District in the spring of 1946. It is bordered by the North Branch of the Chicago River on the east. The 55 acre site was used as a brick factory in the 1920s. Once the factories were shut down the site served as an unregulated dump prior to being turned into a park. During the conversion to a park facility all remaining brick kilns and industrial structures were demolished and the site was filled and graded. By the early 1950s, the park had a large tobogganing hill, tennis courts, a playground, and a comfort station. A large, open meadow bordered with trees stretched across the southern section of the park. A field house was added in 1956. Handball courts were added in the 1970s. Most recently, the park district installed a new soft surface playground with separate areas for tots, young children, and older children.

2.2 Problems and Opportunities

The current soils have been compacted and altered to such an extent that they do not allow infiltration and are responsible for increased direct runoff into the North Branch Chicago River. The stream banks are subject to erosion because of slope steepness, excessive runoff, and lack of sufficient or proper ground cover. The ground cover itself has deteriorated due to a lack of adequate light and the invasion of non-native species such as common privet, and honeysuckle species. In turn the siltation and runoff has degraded the nearby aquatic habitat. There is very little submergent or emergent vegetation within the river itself due to the lack of proper growing substrata. There are, however, a number of native oak trees present on the upland site that would be preserved. In addition, one exotic species, Washington hawthorn, would be maintained due to its large size and non-invasive nature.

Stream habitat has become severely degraded through a combination of channelization, siltation, bank erosion, and human modifications. Stream channelization has effectively removed in-stream habitat and river morphology from the project reach. Natural soils and substrates have been silted in or scoured away due to the increased imperviousness of the watershed and removal of a natural hydraulic floodplain. Bank erosion has also been accelerated by the presence of large, weedy tree species that have shaded the banks to a point where deep-rooted grass, rush,

and sedge plants cannot survive. The absence of these plants allows the soils to be eroded away by river current and sheet flow of fallen rain.

Emergent wetland communities and habitat have been eliminated from the site. Development of local neighborhoods, mining for clay, and refuse dumping required the infilling and drainage of riparian wetlands. This was most likely accomplished through ditching the North Branch Chicago River, dumping borrow from off site locations, and grading. The majority of the indigenous Oak Savanna habitat has been wiped clean. Mowed turf grass is maintained for open space within the park. Due to the large amount of fill placed on site it is probable that the natural soils of the site have been completely lost and the current fill is severely compacted. A natural seed bank is also unlikely due to the extreme amounts of infilling and earth moving.

When evaluating the entire suite of species that utilize the riparian corridor within Horner Park, it becomes clear that many amphibian, reptile and bird species not only need a functional riparian zone, but also a functional adjacent community type, which would be more commonly referred to as a buffer zone. A restored oak savanna would result in increased carbon inputs into the stream system by way of dead plant material (e.g., leaves, bark, limbs) during rain events, enabling and sustaining a dynamic aquatic process (Allan 2004).

2.3 Project Goals, Objectives, and Constraints

Goals

The goal of this project is to restore the natural features of the North Branch Chicago River at Horner Park and its riparian zone within the constraints of the current system utilizing the most beneficial and cost effective restoration strategies.

Objectives

The objectives of this project include: 1) restoring stream morphology and hydraulics, 2) restoring a native riparian oak savanna ecosystem habitat, and 3) remove and prevent recurrence of invasive species. The project would aim to increase the species richness and abundance of native plant, aquatic, and riparian communities. A list of potential measures for further consideration and possible inclusion in the recommended project that increases channel complexity, flow diversity, and species richness is shown below.

- Restoration of stream morphology and hydraulics
    - Wetland creation
    - Riffle(J-hooks) installation/ pool creation
    - Bank contouring
- Riparian zone restoration
    - Restoration of hydrology
    - Native plant community reestablishment
- Prevention and/or removal of invasive species
    - Herbicide
    - Clearing

Section 206 projects must achieve the national objective for aquatic ecosystem restoration in response to legislation and administrative policy. This objective is to contribute to the nation's ecosystems, or National Ecosystem Restoration (NER), by restoring degraded ecosystem

structure, function, and dynamic processes to a less degraded, more natural condition. Contributions to NER are increases in ecosystem value and productivity and are measured in non-monetary units such as acres or linear feet of habitat, average annual habitat units, or increased species number or diversity. The Chicago Park District is looking to restore the ecological function of Horner Park to regain historic populations of diverse and valuable flora and fauna through a more natural riparian and aquatic environment.

Constraints
While designing a cost effective aquatic ecosystem restoration plan at Horner Park there are several site-specific constraints that must be considered. Complete site history, including the extent of the dump area and materials that were placed in the clay pits, remains relatively unknown. Therefore, to remain conservative, it must be assumed that all disposal materials would be taken to an IEPA regulated landfill and would not be suitable for reuse. Disposal is quite costly and this assumption likely significantly increases project costs. However, to ensure that there are not unexpected costs during implementation, this is the only way to proceed. There is also a storm sewer outfall on the project site and an access shaft to underground tunnels. Restoration design features would be designed to not impact these utilities. Small pleasure crafts and trash barges with drafts from one to three feet recreate along the North Branch Chicago River near Horner Park. According to the Chicago District USACE, the North Branch is not regulated for navigation. However, for safety reasons and in order to not impede boat traffic at least half of the channel shall remain undisturbed for navigation purposes.

2.4 Future Without-Project Condition (No Action)*

If no action is taken at the Horner Park site, it would continue on as city parkland. If the project is implemented, Horner Park could act as a demonstration project to encourage similar projects along the North Branch Chicago River and riparian corridor.

Within the project area, the river would continue to erode the existing unstable banks, contributing to the sedimentation of the minimal in-stream habitat. The present invasive and weedy tree species would continue to form poor habitat along the stream bank and not allow for native grass/sedge/rush species to grow. The invasive species present would also continue to act as a seed source that will continue to affect habitat throughout the North Branch drainage. The mowed turf grass would continue on as the ground cover not providing substantial habitat for various species.

Water quality within the North Branch is expected to improve due to improvements in water treatment plants and the Tunnel and Reservoir Plan projects, which will reduce sewage discharge to the Chicago River by diverting storm water and sewage into temporary holding reservoirs, and the many other small non-Corps restorations along the Chicago River. Expected increases in water quality in the next 50 years would have minor positive influence on the site since native plant communities and habitat would not be present, and this lack of habitat will then become the main limiting resource of the site. Expected dam removals along the North Branch may not have the expected benefits since up-stream habitat is absent due to the lack of restoration.

2.5 Habitat Assessment Methodology

Many methods and models are available to measure ecosystem function and structure and to predict future conditions based on differing scenarios. Habitat models developed for individual species may have limitations when used to assess ecosystem problems and restoration objectives. They do not consider communities of organisms and typically consider habitat in isolation from its ecosystem context. The assessment methodology chosen for this study is community based and meets the needs of the study goals, objectives, and level of detail. The assessment methodologies, mean Coefficient of Conservatism (C) and Fish Species Richness, focus on specific habitat parameters designed to capture changes in function, structure and health of the ecosystems within the Horner Park Restoration Site. These methodologies were developed and are used by state and regional agencies, and have been deemed acceptable by the USACE in the past for habitat unit output analyses.

Coefficient of Conservatism

The C value of a plant species can be used to evaluate the quality of native habitat in the project area (Swink & Wilhelm 1994) on a scale of 0 - 10. The C value is the basic tool of the Floristic Quality Assessment (FQA) method. The number reflects the fidelity of the species to specific habitat integrity and conversely, its lack of tolerance to unnatural disturbance factors. A C value of 0 is assigned to species that are highly tolerant to disturbance and are considered general in their habitat distribution. A C value of 1 indicates a very weedy species and a 10 indicates a very conservative one. The mean C is the average for a site and reflects the amount of degradation or improvement as it changes. Around 90% of the plants in a region have a C value of 4 or higher and occupy a wide array of specialized hydro-geomorphic features. The other 10 percent are found in many plant communities. Generally, if a site has a mean C of 3.5 or higher, it has at least marginal ecological quality. Numbers under 3.5 reflect areas with a lesser degree of ecosystem function. Areas with a mean C of 6 and above are only found in remnant natural areas. The quality of the existing Horner Park site was rated as low quality with the mean C value between (Swink & Wilhelm 1994) 1.5 to 1.7.

Fish Species Richness

Species Richness is defined as the number of different species located within a given area. By examining the existing fish species richness of the section of North Branch Chicago River located adjacent to the project site and the fish species richness of a reference section of the North Branch Chicago River, the ability of the aquatic habitat to meet species requirements can be assessed.

This study uses a reference site located approximately 1 mile upstream (Figure 5) from Horner Park which, according to survey data, has approximately 15 native species that occur (Table 3). This site was chosen for its higher diversity of habitat structure and water flow conditions (contains a riffle).

Table 3: Fish species located in the North Branch Chicago River approximately 1 mile upstream of the project site.
* Species data were collected with a boat shocking unit following Illinois DNR protocols or by a Corps biologist using a backpack shocking unit.

Fish Species	Scientific Name
black bullhead	*Ameiurus melas*
yellow bullhead	*Ameiurus natalis*
white sucker	*Catostomus commersonii*
spotfin shiner	*Cyprinella spiloptera*
gizzard shad	*Dorosoma cepedianum*
blackstripe topminnow	*Fundulus notatus*
green sunfish	*Lepomis cyanellus*
pumpkinseed	*Lepomis gibbosus*
orangespotted sunfish	*Lepomis humilis*
bluegill	*Lepomis macrochirus*
largemouth bass	*Micropterus salmoides*
golden shiner	*Notemigonus crysoleucas*
bluntnose minnow	*Pimephales notatus*
black crappie	*Pomoxis nigromaculatus*
longnose dace	*Rhinichthys cataractae*

Using the 15 species of the reference site, the number of species at the project site for both the with and without project was divided by 15 to get a habitat quality score. The score was normalized by multiplying by 10.

Benefit Calculation (Habitat Units, HUs)
Environmental benefits (HUs) were calculated for the without project condition and each measure type by first using the FQA score and multiplying by the area (acres). Then, additional HUs were calculated using the fish species richness scores and multiplying by stream surface area (acres). Finally both the FQA and fish species richness (HUs) were added together for each study measure and the without project condition. Appendix B includes the benefit calculation of the with and without project conditions.

Figure 5: Map of the Fish Data Reference Site

CHAPTER 3 – PLAN FORMULATION AND EVALUATION

The formulation, evaluation, and comparison of alternative plans comprise the third, fourth, and fifth steps of the Corps' planning process. These steps are often referred to collectively as plan formulation. Plan formulation is a highly iterative process that involves cycling through the formulation, evaluation, and comparison steps many times to develop a reasonable range of alternative plans and then narrow those plans down to a final array of feasible plans from which a single plan can be identified for implementation.

Plan formulation for ecosystem restoration (ER) presents a challenge because alternative plans have non-monetary benefits. To facilitate the plan formulation process, the methodology outlined in the Corps' Engineering Circular 1105-2-404, "Planning Civil Work Projects under the Environmental Operating Principles," 1 May 2003 was used.

3.1 Measure Identification and Screening

J-Hook Vanes/Riffles
A J-Hook Vane is an upstream directed, gently sloping structure composed of natural materials including boulders, logs, and rootwads. The vane portion of the structure occupies 1/3 of the bankfull width of the channel, while the "hook" occupies the center 1/3. J-hooks would create riffle habitat and increase stream diversity to provide fish habitat. However, the North Branch Chicago River is too narrow and deep to meet the mandatory design requirements so this measure was eliminated from further consideration (Rosgen). Other types of riffle structures would impede navigation and were not be considered for this reach.

Foreshore Dike (M-2)
Shown in Figure 6, this measure would use glacial cobble to construct a linear dike parallel to the bank, with the crest approximately 22 feet from the bank, for the full 2600 linear feet of Horner Park. The dike would be backfilled with 10 inches of clean topsoil to elevation 577.5 NAVD 88 (approximately where the water surface is most of the time, ordinary high water). It is important to stay near ordinary high water so that soils will be saturated with water. This measure would create a riverine wetland of approximately 1.3 acres in size. Moderate aquatic habitat would be created from the boulder dike placement. The boulders would add structure, and feeding, resting, and spawning habitat for various aquatic invertebrates and fish species listed in Table 3.

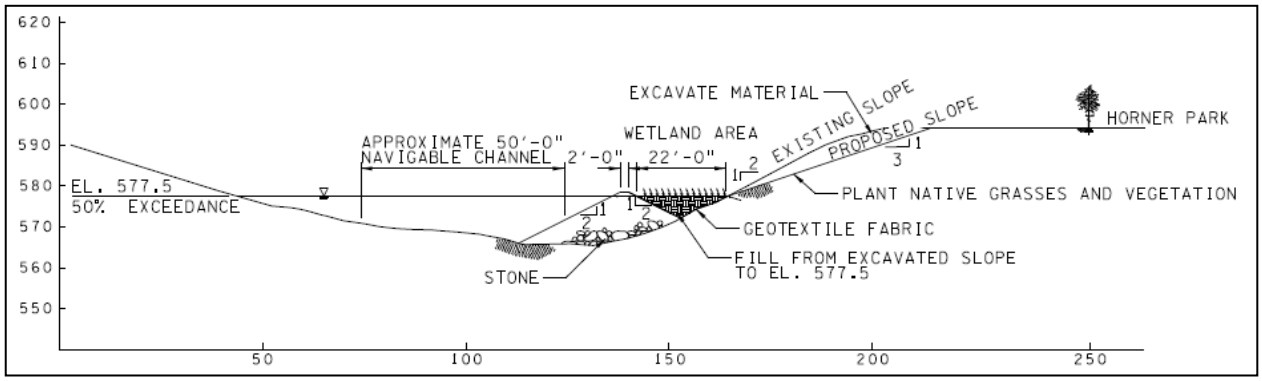

Figure 6: Foreshore Dike Measure

Cut Bank Wetland (M-3)

Shown in Figure 7, this measure would excavate the bank to create an approximately 20 foot-wide shelf adjacent to Horner Park for approximately 2,600 linear feet. This shelf would also be placed at approximate elevation 577.5 NAVD 88 (approximate high water). Glacial cobble would be used to armor the bank to protect against erosion. The stream bank would be sloped to a 3:1 slope above the armor. This measure would provide similar habitat as M-2, described above.

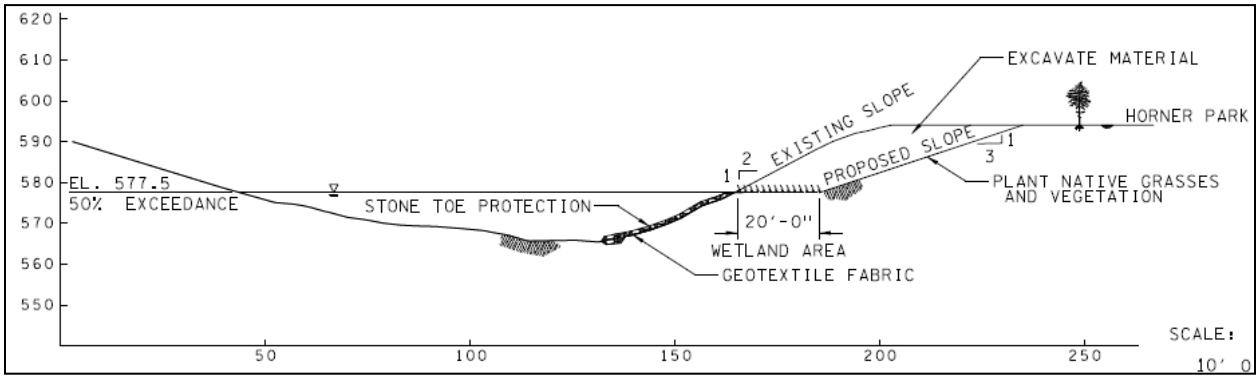

Figure 7: Cut Bank Wetland Measure

Re-grade Bank (M-4)

Shown in Figure 8, this measure would be to re-grade the bank above normal pool from its present approximate 2:1 slope to a more gradual 3:1 for approximately 2,600 linear feet. The current riparian vegetation made up of primarily invasive exotic species would be replaced with a native mix of trees, grasses, and forbs to restore the park to a more natural state. Due to soil composition all cut material would be taken to an IEPA regulated landfill.

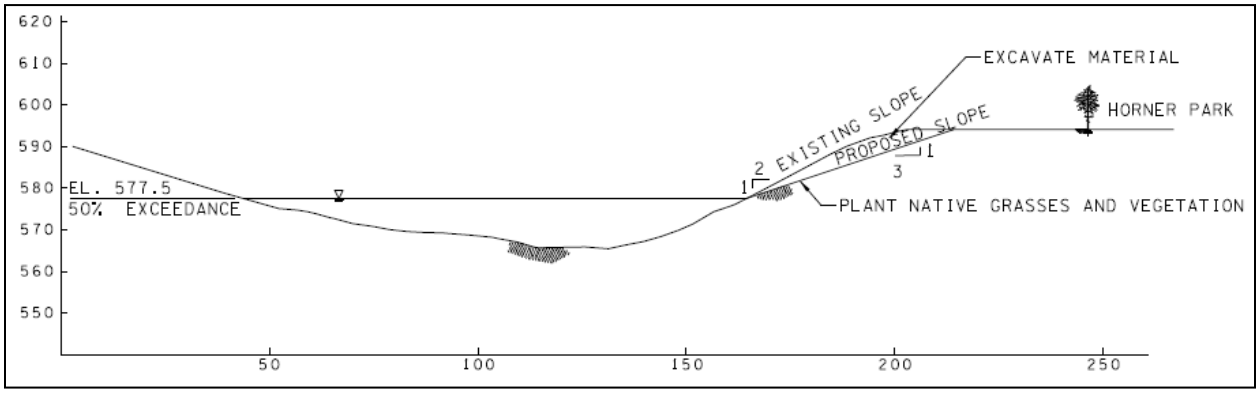

Figure 8: Re-grade Bank Measure

Vernal Pool Wetlands (M-5)

Vernal Pools are small depressional wetlands that are ephemeral (temporary) in nature. Figure 9 shows an example of a constructed vernal pool. Fish cannot survive in vernal ponds because of their dry cycle, however, a wide diversity and abundance of amphibian, insect and crustacean species thrive in these fishless environments. As vernal ponds dry, exposed mudflats provide important feeding areas to migrating shorebirds; sites surrounded by oak trees can receive considerable wood duck use (Biebighauser). Under this measure 4 vernal pools, approximately 60 by 50 feet in size, would be created in the upland area of the riparian zone to add habitat

diversity as well as an educational component. These 4 wetlands would total approximately a quarter of an acre and would be placed in existing topographic depressions. According to the "Guide to Creating Vernal Ponds," by Tom Biebighauser, natural vernal pools average 60 ft in diameter.

Figure 9: Vernal Pond Wetland Approximately 1 Year from Construction. Russell County, KY.

Oak Savanna Habitat (M-6, M-7)

This measure seeks to restore oak savanna habitat to complete the restoration of Horner Park's riparian zone. Riparian zones hold a complex array of different microhabitats suitable for a diverse set of aquatic species. Many species utilizing the riparian corridor within Horner Park, such as amphibian, reptile, and bird species, not only need a functional riparian zone, but also a functional adjacent community type, which would be more commonly referred to as a buffer zone. The oak savanna habitat would also provide increased carbon inputs into the stream system by way of dead plant material (e.g., leaves, bark, limbs) during rain events, enabling and sustaining aquatic processes. Under this measure, all invasive and non-native vegetation would be eradicated physically or through the use of herbicide. Approximately 10.0 acres (size depends on which measure it is combined with, see Table 5, there are less acres available when cutting the stream bank) of grass species, along with secondary growth of woody species (opportunistic trees and shrubs), would need to be removed to set the stage for oak savanna restoration. Any mature oaks or other mature savanna tree species would be preserved. After all invasive herbaceous species and secondary woody growth are removed; a wet savanna native plant seed mix would be sown. Various savanna trees and shrubs would also be planted in a sparse fashion to achieve appropriate savanna canopy cover and structure. A specific plant list may be viewed in Appendix B.

Measure Summary

- M-1 – Future Without Project (No Action)
- M-2 – Foreshore Dike
- M-3 – Cut Bank Wetland
- M-4 – Re-grade Bank
- M-5 – Vernal Pools
- M-6 – Oak Savanna Habitat combined with M-2 or M-4 (Oak Savanna F)
- M-7 – Oak Savanna Habitat combined with M-3 (Oak Savanna C)

3.2 Technique Descriptions

This section provides additional detail for techniques that would be used to construct and/or maintain measures that were discussed in general terms above.

Selective Tree, Shrub & Understory Clearing

Woodland, oak savanna and shrubland communities could be partially restored through the physical removal of invasive trees and shrubs that would otherwise shade out the understory. This can be accomplished through the use of a brush hog to remove shrubs and small trees and a chain saw for large trees. Large trees should be cut flush to the ground with roots left. The removal of these species would also aid in raising the water table and providing more groundwater discharge during the summer months through reducing the rate of evapotranspiration of the plant community. Removal of invasive species and restoring the structure of the savanna or shrubland would attract nesting birds and Neotropical migrants. Habitat for a variety of reptile, amphibian, butterfly and other species would improve as well.

Herbicide Application for Woody Species

Wherever tree/shrub removal is required, woody stem re-sprouts and saplings should be treated with herbicide to impede woody regeneration. Burning alone is not an efficient method to remove the small brush that invades grasslands in a timely manner. Burn treatments may take 10-20 years to see results depending on many unpredictable variables. Thus woody species re-sprouts in areas that are to be managed as grassland should be treated with herbicide until mortality. Woody stem removal is imperative for hydrologic and riparian restoration. The most efficient way to remove invasive and aggressive woody shrubs and small trees, whether in grassland or wooded settings, is to cut stems and treat with herbicide, followed by prescribed burning and foliar spray of re-sprouts and saplings. Herbicide treatment of re-sprouts would be required throughout the establishment and Operation and Maintenance (O&M) of the project life. IL EPA has mandated that, as of October 2011, all applications of pesticides (including weed and algae pesticides) near or over waters of the U.S. are permitted under the general NPDES permitting process. Label instructions must be enforced and actions must be reported to the ILEPA. The general permit would be obtained prior to any construction.

Herbicide Application for Turf

The turf grasses in the project area should be killed using an herbicide treatment at the beginning of the growing season and again at the end of the growing season to kill any re-growth.

Native Species plantings

Native Trees should be planted in the fall if possible. If there is time before the winter season, a temporary cover crop and the native seeding (excluding tree species) should be planted. If there is no time before the winter season, a cover crop should be planted and the native planting should wait until spring of next growing season.

Controlled Burns

Any monocultures of Eurasian grasses could be broken down by prescribed burns. Areas of dense fescue would be sufficiently weakened to allow for the establishment of a high proportion of native seed. Burning into the oak savannas would help control re-sprouts and assist in plant reproduction. Wetland areas generally should also be included in the burns wherever possible to

encourage the germination of the native seed bank. Temporary firebreaks would need to be mowed in September or October to delineate these areas. To avoid impacts to grassland birds, prescribed fires should be implemented in fall/winter months and early spring prior to 15 April. All burning should be in accordance with state and local laws.

Native Plantings
In conjunction with the local sponsor, a seed list of desirable plants, including many conservative species, has been developed for the site. Most species specified may be purchased from a nursery that grows them annually. This allows the planting of a highly diverse seed mix that is closely tailored to the site, even when seed collected from the site is not available. When the nursery is not able to supply all of the requested seed, they may make suggestions for substitutes that need to be carefully evaluated. It is prudent to order native seed in November so the nursery is prepared for the order a year ahead of time.

The use of locally collected seed is recommended in ecosystem restorations because they are likely to be the best adapted for the specific conditions of any given site. A problem is that many native plant species are not in production at nurseries. Because adequate seed for large restorations is typically not available nearby, land managers either may acquire local seed grown by contractors (which can be expensive) or may acquire some portion of their seed from indigenous populations within 100 to 150-miles with the hope that the more locally gathered seed would supply any missing genetics.

The introduction of certain plant species that do not grow well from seed requires the use of plant plugs or saplings. These usually have a greater survival rate and bring a site to maturity more quickly, which is a distinct advantage on sites where a threat is posed by highly invasive plant species. Species requiring this method of planting should be designated in the planting plans.

3.3 Measure Costs and Assumptions

Conceptual, planning level parametric cost estimates were prepared for measures/features that were identified by the study team and are included in Appendix C. The measures were used to provide an economic basis for the development and analysis of project alternatives via the IWR-Planning Suite software. Average annual construction first costs and average annual OM&R costs are calculated via cost stream analysis for each measure, assuming a 50-year project period of evaluation and an FY 2013 project discount rate of 3.75 percent. The value of real estate for each measure was developed using an Informal Value Estimate (IVE). The IVE consisted of two types of acreage: fee ($5000/acre) and channel improvement easement (50% value of $5000/acre). The acreages used to develop habitat units were also used to calculate real estate costs by measure and can be found in Appendix C. In order to account for small deviations in acreage and other required lay down areas a twenty percent contingency on the real estate value was added. Each alternative includes only the lands necessary to implement the project and reasonably assure benefits sufficient to justify the project. Construction first costs, real estate costs, OMRR&R, as well as all average annual costs are presented in Table 4.

Table 4: Horner Park, Construction First Costs and Average Annual Costs, By Measure.

Measure	Construction First Costs	Real Estate Costs	Total Project Costs	Average Annual Construction First Costs	Average Annual OM&R Costs	Average Annual Costs
M-1	$0	$0	$0	$ -	$ -	$ -
M-2	$6,689,049	$3,930	$6,692,979	$ 298,334	$ -	$ 298,334
M-3	$7,033,230	$3,570	$7,036,800	$ 313,660	$ -	$ 313,660
M-4	$2,539,265	$9,390	$2,548,655	$ 113,604	$ 500	$ 114,104
M-5	$127,238	$1,680	$128,918	$ 5,746	$ 50	$ 5,796
M-6	$421,976	$59,040	$481,016	$ 21,441	$ 500	$ 21,941
M-7	$367,085	$51,540	$418,625	$ 18,660	$ 500	$ 19,160

3.4 Measure Habitat Benefits

Environmental outputs are the desired or anticipated measurable products or results of restoration measures and plans. The term "outputs" is often used interchangeably with "benefits" or "habitat units (HUs)." Ecosystem restoration proposals may possess multiple output categories, as well as other effects that may need to be considered, but the evaluation must at least address cost and an output category that has been determined to represent reasonable ecosystem restoration benefits. A comparison of the future without-project and future with-project HUs was performed in order to determine if a measure, or group of measures, would actually have beneficial effects to the Horner Park ecosystem. The measures for this study were evaluated with the methodology described in Section 2.5. The evaluation of habitat benefits, a comparison of the with-project and without-project conditions for each measure, is shown below in Table 5. See Appendix B for the benefit calculation.

Table 5: Average Annual Habitat Units by Measure

	Acres	Future Without-Project (FWOP) Habitat Units (HU)	FWOP Fish HU	Total FWOP HU	Future With-Project (FWP) HU	FWP Fish HU	Total FWP HU	Net HU	Average Annual HU
M-2	1.31	0	14.4	14.4	7.39	23.83	31.23	16.83	**15.96**
M-3	1.19	0	14.4	14.4	6.72	31.20	37.92	23.52	**22.30**
M-4	3.13	4.27	14.4	18.67	13.60	19.20	32.80	14.14	**13.10**
M-5	0.28	0	14.4	14.4	1.43	14.40	15.83	1.43	**1.38**
M-6	8.59	15.75	14.4	30.15	44.29	14.40	58.69	28.54	**27.52**
M-7	9.84	15.75	14.4	30.15	50.74	14.40	65.14	34.99	**33.74**

3.5 Alternative Plan Descriptions

Seven measures, including No Action, were input in the IWR-Planning Suite as shown in Table 4. In order to maintain bank stabilization during invasive species removal and/or construction of the foreshore dike or bench cut wetland, the bank would need to be contoured to a 3:1 slope. As such, all alternatives include re-grading the bank (M-4). Measures 2 and 3, the foreshore dike

and cut bank wetlands, are independent from each other. There are two separate oak savanna measures (M-6 and M-7) that are independent of each other. M-6 would be used for all alternatives except when combined with M-3, cut bank wetland. M-7 would only be used when combined with M-3. All other measures are combinable. The IWR-Planning software generated 14 alternative combinations (Table 6).

Table 6: Alternatives generated by IWR Planning Suite

	Alternatives
M-1	No Action
M-4	Re-grade Bank
M-5	Vernal Pools
A-1	Foreshore Dike, Re-grade Bank
A-2	Cut Bank, Re-grade Bank
A-3	Re-grade Bank, Vernal Pools
A-4	Foreshore Dike, Re-grade Bank, Vernal Pools
A-5	Cut Bank, Re-grade Bank, Vernal Pools
A-6	Re-grade Bank, Oak Savanna F
A-7	Foreshore Dike, Re-grade Bank, Oak Savanna F
A-8	Re-grade Bank, Vernal Pools, Oak Savanna F
A-9	Foreshore Dike, Re-grade Bank, Vernal Pools, Oak Savanna F
A-10	Cut Bank, Re-grade Bank, Oak Savanna C
A-11	Cut Bank, Re-grade Bank, Vernal Pools, Oak Savanna C

3.6 Cost Effectiveness and Incremental Cost Analysis

Cost effectiveness and incremental cost analysis (CE/ICA) are two distinct analyses that must be conducted to evaluate the effects of alternative plans. First, it must be shown through cost effectiveness analysis that a restoration plan's output cannot be produced more inexpensively by another alternative. *Cost effective* means that, for a given level of non-monetary output, no other plan costs less and no other plan yields more output at a lower cost.

The subset of cost effective plans are examined sequentially (by increasing scale and increment of output using incremental cost analysis) to ascertain which plans are most efficient in the production of environmental benefits. Those most efficient plans are called "best buys." As a group of measures, they provide the greatest increase in output for the least increases in cost. They have the lowest incremental costs per unit of output. In most analyses, there will be a series of best buy plans, in which the relationship between the quantity of outputs and the unit cost is evident. As the scale of best buy plans increases (in terms of output produced), average costs per unit of output and incremental costs per unit of output will increase as well. Usually, the incremental analysis by itself will not point to the selection of any single plan. The results of the incremental analysis must be synthesized with other decision-making criteria (i.e., significance of outputs, acceptability, completeness, effectiveness, risk and uncertainty, reasonableness of costs) to help the study team select and recommend a particular plan.

The ICA for Horner Park is performed in accordance with IWR-Plan, with reference to the Principles and Guidelines of Institute of Water Resources (IWR) Report #95-R-1, Evaluation of Environmental Investments Procedures Manual, Interim: Cost Effectiveness and Incremental Cost Analyses (May 1995). Through incremental cost analysis in IWR-Planning Suite, several progressive steps identify the most cost-effective measures/alternatives to be considered in environmental restoration planning. These steps are described and computed below. Output, measured as Habitat Unit's (HU's), is computed in Section 3.4 of the report. Net HU's (calculated by subtracting the without project Habitat Unit's from the with project Habitat Unit's) are a measure of the average "annualized" net functional habitat improvement generated under each measure (AAHU's).

Cost Effectiveness

Non-cost effective measures/alternatives are identified as either *inefficient in production* or i*neffective in production*. To be *inefficient in production* the output of a measure/alternative can be generated at a lesser cost by another measure/alternative. When two or more measures/alternatives provide the same output level, aside from any other considerations (i.e., uncertainty about the reliability of cost or output estimates), and the more costly measures/alternative is eliminated. *Ineffective in production* measures/alternatives are then identified. Any measure/alternative that can generate a greater output level at a lesser or equal cost renders the higher costing or lower generating measure/alternative *ineffective in production*. With the measures/alternatives still sorted by output level (AAHUs), a pair-wise comparison of output level and average annual cost is made for all remaining measures/alternatives that 'passed' the *inefficient in production* screening in the previous step. The measures/alternatives are evaluated and any measure/alternative generating less output at an equal or greater cost is eliminated. These steps identify the least-cost measure/alternative for every level of output under consideration. Nine cost effective plans were identified including the No Action Plan and are shown below in Table 7 and Figure 10.

Table 7: Cost Effective Total AAHU's and Average Annual Costs by Measure/Alternative, Sorted by Output

Measure/Alt.	AAHU's	Average Annual Costs
M-1	0	$ -
M-5	1.38	$ 5,796
M-4	13.10	$ 114,104
A-3	14.48	$ 119,901
A-6	46.84	$ 136,045
A-8	48.22	$ 141,767
A-7	62.80	$ 434,380
A-9	64.18	$ 440,101
A-11	64.30	$ 452,646

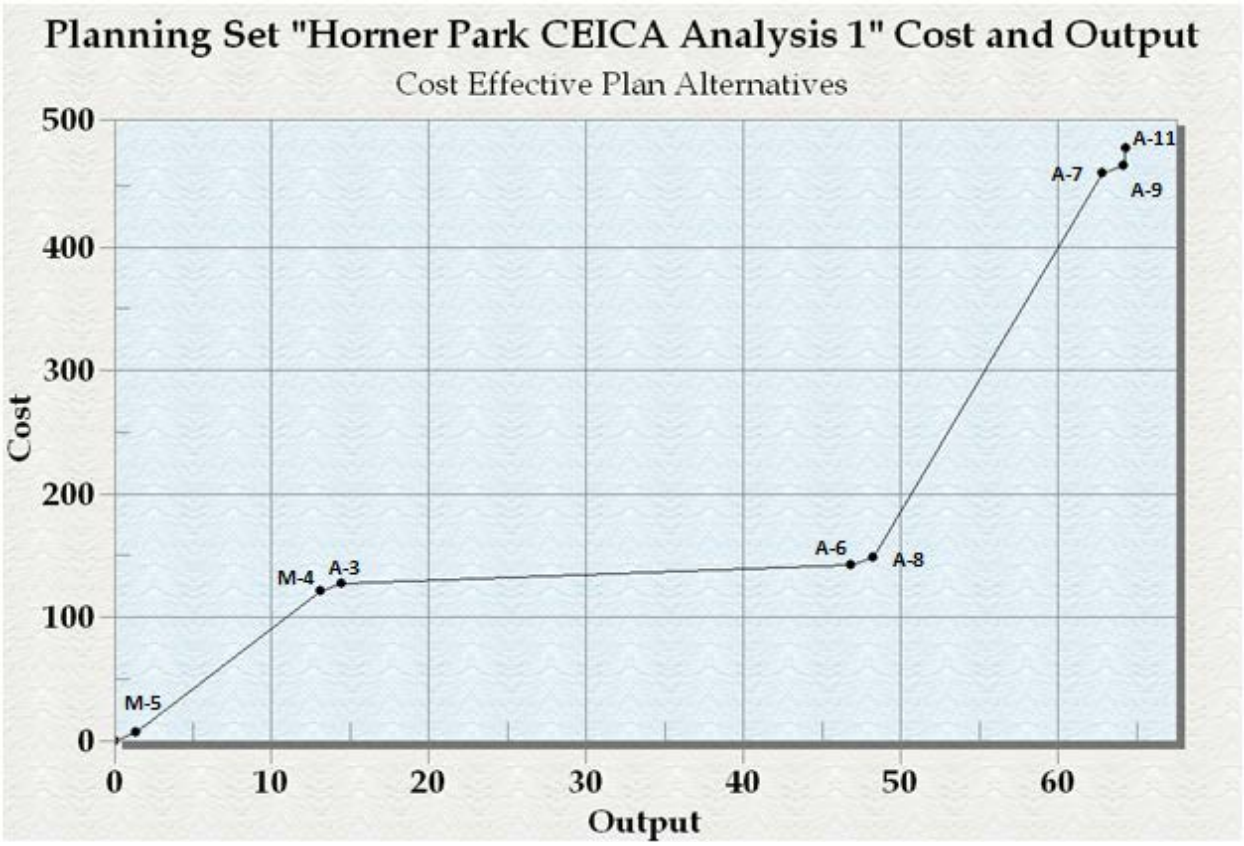

Figure 10: Cost Effective Plan Alternatives

Incremental Cost Analysis

An incremental cost analysis was performed on those plans deemed cost-effective. The objectives of the incremental cost analysis are to provide information to assist in determining whether the additional output provided by each successive cost-effective measure/alternative is worth the additional cost that must be incurred for implementation; that is, to assist in determining the scale of the recommended plan. This incremental cost analysis has identified five alternative plans that would be considered as best buys, including the no action plan, for study implementation. All other cost effective plans were not determined to be best buys. These are presented in Table 8 and Figure 11.

Table 8: Average Annual and Incremental Values of "Best Buy" Plans

Measure /Alt.	Total Project Cost	Output (Net AAHU's)	Average Annual Costs	Incremental Output (Net AAHU's)	Average Annual Incremental Costs	Average Annual Incremental Cost Per Unit
M-1	$ -	0	$ -	0	$ -	$ -
A-6	$ 3,029,672	46.84	$136,045	46.84	$ 136,045	$ 2,904
A-8	$ 3,156,910	48.22	$ 141,767	1.38	$ 5,722	$ 4,146
A-9	$ 9,849,889	64.18	$ 440,101	15.96	$ 298,334	$ 18,693
A-11	$ 10,131,318	64.30	$ 452,646	0.12	$ 12,545	$ 104,542

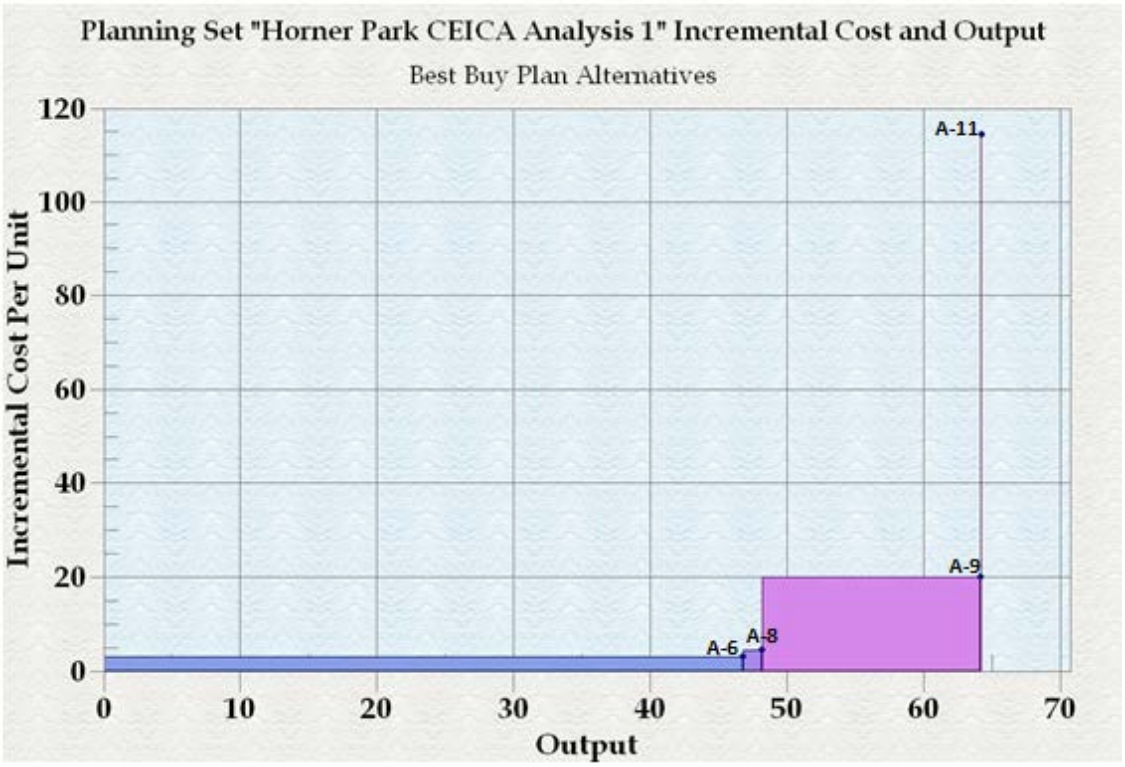

Figure 11: Best Buy Plan Alternatives

3.7 Selection of NER Ecosystem Restoration Plan

When selecting a single alternative plan for recommendation from those that have been considered, the criteria used to select the NER plan include all the evaluation criteria discussed above. Selecting the NER plan requires careful consideration of the plan that meets planning objectives and constraints and reasonably maximizes environmental benefits while passing tests of cost-effectiveness and incremental cost analyses, significance of outputs, acceptability, completeness, efficiency, and effectiveness. Additional factors to consider include the following items.

The Best Buy Plans presented in Table 8 provide the information necessary to make well-informed decisions regarding desired project scale. Progressing through the increasing levels of output for the Plans in Table 7 helps determine whether the habitat value of the additional Net AAHUs in the next level of output is worth the additional cost.

As long as decision makers consider a level of output to be “worth it”, subsequent levels of output are considered. When a level of output is determined to be “not worth it”, then subsequent levels of output will also likely be “not worth it”, and the final decision regarding desired project scale for environmental restoration planning will have been reached.

If it is determined Plan A-6, generating 46.56 AAHU’s at an incremental cost of $2,904 per unit, is “worth it”; i.e., preferred to M-1(No Action Plan), then one would proceed to the next level of output to determine if it is worth its additional cost. Proceeding to the next level of output reveals Plan A-8 generates an increase in habitat units of 1.38 over Plan A-6, at an incremental cost of $4,146 per unit. As each successive “Best Buy” Plan is considered, the last three

columns of Table 8 display the increase in Incremental Cost, the accompanying increase in Incremental Output (Net AAHUs), and the increase in Incremental Cost per Unit (of Output or Net AAHUs), computed as Incremental Cost divided by Incremental Output.

Typically in the evaluation of Best Buy Plans, 'break points' are defined as significant increases or 'jumps' in Incremental Cost per Output, such that subsequent levels of output may/may not be considered "worth it" regarding increasing the desired project scale. Identification of such breakpoints can be subjective.

Looking at the last two Best Buy Plans (A-9 and A-11), Plan A-9 generates 15.96 additional net AAHU's over Plan A-8. However, those additional 15.96 net AAHUs come at an incremental cost of $18,693 per unit. Finally, Plan A-11, identified as both the last breakpoint and the last "Best Buy" Plan, generates only 0.12 additional Net AAHUs over Plan A-9, yet those additional 0.12 Net AAHUs come at a considerably higher incremental cost of $104,542 per unit. Observing Graph 2 also reveals the considerable increase in Incremental Cost per Unit (of Output) for the last Best Buy Plan.

Therefore, Plan A-8 generating a total of 48.22 net AAHUs is identified as desired project scale, and is recommended as the NER "Best Buy" plan. The plan includes re-grading 2,600 feet of river bank, restoring approximately ten acres of Oak Savannah habitat and creating four sixty-by-fifty foot vernal pool wetlands for a total of 0.25 wetland acres.

The NER plan is also the locally preferred plan. In addition to the NER, the Chicago Park District would also like to add small recreational features, such as dirt paths for control of foot traffic to water access, fencing to ensure that the restored area is not greatly disturbed by pedestrian traffic, and a series of educational signs. These recreation features would not raise the federal cost by more than 10% and would be cost-shared 50:50. Once Plan A-8 was identified as the recommended alternative plan, additional design information was developed for the recommended plan and a more detailed MII cost estimate was performed. This analysis brought the design and implementation first cost for Plan A-8 to $5,480,486 for ecosystem restoration features and $590,386 for recreation features. Real estate requirements and laydown areas were also refined. Plan A-8 requires 12.46 acres of fee simple land and 2.02 acres of channel improvement easement. Including contingency this brings LERRDs to about $94,500. A detailed cost estimate can be found in Appendix C.

3.8 Significance of Ecosystem Outputs

Because of the challenge of dealing with non-monetized benefits, the concept of output significance plays an important role in ecosystem restoration evaluation. Along with information from cost effectiveness and incremental cost analyses, information on the significance of ecosystem outputs will help determine whether the proposed environmental investment is worth its cost and whether a particular alternative should be recommended. Statements of significance provide qualitative information to help decision makers evaluate whether the value of the resources of any given restoration alternative are worth the costs incurred to produce them. The significance of the Horner Park restoration outputs are herein recognized in terms of institutional, public, and/or technical importance.

The proposed project is locally significant for its ecological value to the City of Chicago and the Chicago Park District. Horner Park also provides significant opportunities for environmental awareness and education as ancillary benefits. The proposed project activities would have a combined effect of improving the ecological value of this area, as well as generally improving the Chicago River's water quality and meeting stakeholder's objectives.

By reconnecting sustainable habitat along the Chicago River, this project supports urban river restoration and is regionally significant. The U.S. Environmental Protection Agency (USEPA) and USACE formalized their commitment to a collaborative approach to restore urban rivers by signing the Memorandum of Understanding (MOU) for the Urban Rivers Restoration Initiative (URRI), dated July 2, 2002, included in Appendix F. The purpose of the URRI is to facilitate collaborative efforts between the government agencies, States, and stakeholders to improve water quality and habitat of degraded urban rivers. The Chicago Area Rivers for URRI was nominated for national pilot status on September 26, 2002. The North Branch of the Chicago River, where Horner Park is located, and the Chicago River Corridor Development plan are included in the plan for the Chicago Area Rivers Restoration Initiative. The proposed project at Horner Park would increase aquatic habitat quality, enrich wildlife migration corridors, and create opportunities for improved regional wildlife habitat. Restoration of wetlands and aquatic habitat is a high priority mission for the Corps of Engineers. The proposed project would create vernal pool wetlands and native plant communities, which are currently extirpated from the project area.

Institutional Recognition

Fish and Wildlife Conservation Act of 1980 – All Federal departments and agencies to the extent practicable and consistent with the agencies authorities should conserve and promote conservation of non-game fish and wildlife, and their habitats. This project would restore critical habitat for invertebrates, reptiles, amphibians, birds and mammals.

National Environmental Policy Act of 1969 – National policy includes promoting efforts, which will prevent or eliminate damage to the environment. This project will comply with NEPA since it would restore native habitat, improve the quality of human life, and would have positive impacts to the local economy.

EO 11514: Protection and Enhancement of Environmental Quality – Federal policy is to protect and enhance the quality of the Nation's environment. This project would protect and restore the quality of the Nation's environment through naturalizing an area that is currently of no value to local flora and fauna.

MOU for the Urban Rivers Restoration Initiative, dated July 2, 2002 - The purpose of the URRI is to facilitate collaborative efforts between the government agencies, States and stakeholders to improve water quality and habitat of degraded urban rivers at the regional level. The proposed project would increase aquatic habitat quality, enrich wildlife migration corridors, and create opportunities for improved regional wildlife habitat.

Public Recognition
Organizations - Groups such as the Friends of the Chicago River are striving towards protection of remnant ecosystems from destruction, degradation and invasive non-native species, while promoting efforts to restore sections of the Chicago River System.

Technical Recognition
Representation – The restoration of stream and native plant communities would restore this section of the Chicago River to be more representative of what was present 200 years ago.

Connectivity – Restoring portions of the North Branch Chicago River would further the process of reconnecting the entire Chicago River back together in terms of sustainable habitat.

Limiting Habitat – The North Branch Chicago River lacks riparian habitat. This project would restore wetlands and native plant communities, which are currently extirpated from the project area.

Biodiversity – This restoration would increase the biodiversity of macroinvertebrates, amphibians, reptiles, mammals, and birds within the project area. Floral diversity would increase as well through native plantings.

Potential Higher Costs Associated with Urban Ecosystem Restoration
In general, as urbanization intensifies, so does the destruction of natural areas. Wildlife habitats are degraded, native species extirpated, and valuable ecosystem lost. Urban landscape becomes devoid of open space and can be plagued with air and water pollution.

Currently, most areas along the Chicago River are below their ecological potential. As human-induced stress hinders ecosystem form and function, diversity and abundance of species are greatly reduced. Additional disturbances, such as physical stream impact, drought, or concentrated storm water runoff, may have a greater negative effect than would normally occur in a more stable ecosystem.

As discussed previously, benefits associated with wetland restoration activities include improvement of the vegetative diversity, restoration of habitat suitable for wetland dependent wildlife (including birds, amphibians, and small mammals), and incidental increased attenuation and treatment of elevated flows. Aquatic habitat quality for fish and macroinvertebrates would be improved through the area due to bank stabilization, reduced erosion and sedimentation, and less fluctuation in dissolved oxygen levels.

Higher costs may be associated with ecosystem restoration in urban areas due to space constraints, high cost of real estate, and costs associated with excavation and disposal activities required to grade riverbanks. In addition restoration may not achieve the same level of quality in other areas with fewer constraints. Nonetheless, these natural areas are valuable ecological resources; in high public demand in urban areas for access, education, passive recreation to observe wildlife; and regionally significant for reconnecting green space and migratory corridors.

3.9 Acceptability, Completeness, Effectiveness, and Efficiency

Acceptability, completeness, effectiveness, and efficiency are the four evaluation criteria USACE uses in evaluating alternative plans. Alternatives considered in any planning study, not just ecosystem restoration studies, should meet minimum subjective standards of these criteria to quality for further consideration and comparison with other plans.

Acceptability

Acceptability is the workability and viability of the alternative with respect to acceptance by Federal and non-Federal entities and the public and compatibility with existing laws, regulations, and public policies. Two primary dimensions to acceptability are implementability and satisfaction. Implementability means that the alternative is feasible from technical, environmental, economic, financial, political, legal, institutional, and social perspectives. If it is not feasible due to any of these factors, then it cannot be implemented, and therefore is not acceptable. An infeasible alternative should not be carried forward for further consideration. However, just because an alternative is not the preferred alternative of a non-Federal sponsor does not make it infeasible or unacceptable. The second dimension to acceptability is the satisfaction that a particular alternative brings to government entities and the public. Obviously, the extent to which an alternative is welcome or satisfactory is a qualitative judgment. Nevertheless, discussions as to the degree of support (or lack thereof) enjoyed by particular alternatives from a community, state, or other national or regional organizations are additional pieces of information that can help planners evaluate whether to carry forward or screen out alternatives.

Completeness

Completeness is the extent to which an alternative provides and accounts for all necessary investments or other actions needed to ensure the realization of the planned restoration outputs. This may require relating the plan to other types of public or private plans if these plans are crucial to the outcome of the restoration objective. To establish the completeness of an alternative, it is helpful to list those factors beyond planning team control which are required to make the alternative's effects (benefits) a reality. Real estate, operations and maintenance, monitoring, and sponsorship factors must be considered. Where there is uncertainty concerning the functioning of certain restoration features an adaptive management plan should be proposed and must be accounted for in the implementation plan.

Effectiveness

Effectiveness is the extent an alternative alleviates the specified problems and achieves the specified opportunities. An effective alternative is responsive to the identified needs and makes a significant contribution to the solution of some problems or to the realization of some opportunity. It also contributes to the attainment of planning objectives. The most effective alternatives make significant contributions to all the planning objectives (altered steam morphology and hydraulics and a lack of a native riparian zone and Oak Savanna habitat). Alternatives that make little or no contribution to the planning objectives can be rejected because they are relatively ineffective. Another factor that can impact the effectiveness of an alternative is whether there is a substantial risk and uncertainty associated with the alternative. If the function or success of an alternative is uncertain, or less certain than another alternative, its effectiveness may be compromised and should be discussed.

Efficiency
Efficiency is the extent to which an alternative is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the National's environment. It must be determined that the plan's restoration outputs cannot be produced more cost effectively by another agency or institution. Through the CE/ICA analyses, Measures 1, 4 and 5 and Alternatives 3, 6, 7, 8, 9, and 11 were identified as cost-effective. All inefficient options were removed from consideration and only the "best buy" plans having the least incremental increase in cost per unit of habitat output were retained for further consideration and the identification of the NER Plan. As identified through incremental cost analyses, Alternative Plans 6, 8, 9, 11 and the No Action Plan were determined to be the most efficient plans in terms of costs and benefits that meet project objectives.

To allow for easier comparison, a matrix was prepared to rank each best buy alternative according to how well the alternatives met the four evaluation criteria while considering the project objectives (Table 9). The following is a discussion of the factors considered when ranking the alternatives in Table 9.

Table 9: Best Buy Alternatives Evaluated on the Four Planning and Guidance Evaluation Criteria

Best Buy Alternatives	Measure/ Alternative	P&G Evaluation Criteria			
		Acceptability	**Completeness**	**Effectiveness**	**Efficiency**
	M-1	Low	High	Low	Low
	A-6	Medium	High	Medium	High
	A-8	**High**	**High**	**Medium**	**High**
	A-9	Medium	High	High	Low
	A-11	Medium	High	High	Low

All of the best buy alternatives rank as having high completeness because each alternative accounts for all necessary investments and is able to stand alone relying on no factors beyond the planning team's control.

Measure 1 (No Action): Aquatic Ecosystem Restoration at Horner Park is not only implementable but is supported by both Federal and non-Federal agencies. Therefore, taking no action would be classified as low acceptability. The No Action plan does not address any of the specified problems and opportunities making it both ineffective and inefficient.

Alternative 6 (Re-grade Bank, Oak Savanna F): Re-grading the bank and reestablishing Oak Savanna habitat is implementable and supported by Federal and non-Federal agencies. Without direct aquatic benefits alternative six is less acceptable than the other three best buy action alternatives. Within the project constraints, alternative six is somewhat effective at addressing the problems and opportunities but lacks in-stream features that would make it highly effective. Alternative six is highly efficient with 46.56 average annual habitat units each at $136,045.

Alternative 8 (Re-grade Bank, Vernal Pools, Oak Savanna F): Alternative eight is implementable and supported by Federal and non-Federal agencies having direct aquatic ecosystem benefits from the vernal pools. Within the project constraints, alternative eight is somewhat effective at addressing the problems and opportunities but lacks in-stream features that

would make it highly effective. Alternative eight is highly efficient with 48.22 average annual habitat units each at $141,767. This alternative is shown in Table 9 in green as it is the best method of restoration according to the criteria identified in ER 1105-2-100.

Alternative 9 (Foreshore Dike, Re-grade Bank, Vernal Pools, Oak Savanna F): Alternative nine is highly supported by Federal and non-Federal agencies having direct aquatic ecosystem benefits from both the foreshore dike and vernal pools. However, construction of the foreshore dike is not easily implementable giving alternative nine a medium acceptability ranking. Within the project constraints, alternative nine is highly effective at addressing the specified problems and opportunities but is very costly making it not efficient.

Alternative 11 (Cut Bank, Re-grade Bank, Vernal Pools, Oak Savanna C): Alternative eleven is highly supported by Federal and non-Federal agencies having direct aquatic ecosystem benefits from both the cut bank wetland and vernal pools. However, construction of the wetland is not easily implementable giving alternative eleven a medium acceptability ranking. Within the project constraints, alternative eleven is highly effective at addressing the specified problems and opportunities but is very costly making it not efficient.

3.10 Risk and Uncertainty

When the costs and outputs of alternative restoration plans are uncertain and/or there are substantive risks that outcomes will not be achieved, which may often be the case, the selection of a recommended plan becomes more complex. It is essential to document the assumptions made and uncertainties encountered during the course of planning analyses. When identifying the NER plan the associated risk and uncertainty of achieving the proposed level of outputs must be considered. For example, if two plans have similar outputs but one plan costs slightly more, according to cost effectiveness guidelines, the more expensive plan would be dropped from further consideration. However, it might be possible that, due to uncertainties beyond the control or knowledge of the planning team, the slightly more expensive plan would actually produce greater ecological output than originally estimated, in effect qualifying it as a cost-effective plan. But without taking into account the uncertainty inherent in the estimate of outputs, that plan would have been excluded from further consideration.

While estimating habitat output and associated costs for each restoration measure, risk and uncertainty were considered. Habitat output was determined by first estimating the effects of the measure and then projecting species richness that could be sustained by those conditions. The same model was used to analyze all restoration measures; therefore the relative uncertainty between measures was reduced.

In an effort to keep feasibility phase costs low, certain assumptions about the site were made. A typical river section was taken from the HEC-RAS model to determine disposal and fill quantities since a detailed survey was not available for the park. A twenty-five percent contingency was added to the quantities in order to account for this uncertainty in quantities. To account for the soil and sediment composition, it was assumed that all disposal material would be taken directly into an IEPA-regulated dump and not re-used in any way. This assumption may make the preliminary cost estimates in the Feasibility Phase higher than what may actually occur in Design and Implementation, but it is a conservative approach and reduces uncertainty in the

cost estimate. Implementation costs were estimated using feasibility-level designs and associated quantities. To account for uncertainties in actual quantities and unit costs, contingencies were utilized. The level of contingency assigned to various features was based upon uncertainties in the design and the likelihood of cost variations. Operation and Maintenance would be the responsibility of the sponsor, Chicago Park District. If CPD does not adequately maintain the vegetation and non-native species are allowed to reestablish within the project area some of the environmental benefits would be lost. However, CPD has experience maintaining similar sites and the likelihood that the prescribed O&M is not fulfilled is low.

CHAPTER 4 – ENVIRONMENTAL ASSESSMENT*

4.1 Need and Purpose of Proposed Action

The Chicago River is one of the most altered river systems in the Midwest. The system has experienced stream channel relocation, channelization, removal of riparian plant communities, total reversal of basin flow, reduction in ground water inflow, erratic inflows of effluent from storm sewers and side stream industry and other sources of degradation. This highly urbanized stream system would remain low in aquatic diversity unless habitat that was once present, but now gone, is restored. As technology improves ways of upgrading water quality of this system, habitat restoration is necessary to sustain an acceptable level of diversity and abundance of aquatic organisms that forage along the river corridor. Horner Park is an ideal section to restore aquatic ecosystem habitat because of the open space provided by the Chicago Park District.

4.2 Alternatives Considered

As described in Section 3.1 above, seven measures were considered in this study. Those measures were input into the IWR Planning Suite and 14 alternative combinations were generated (see Table 6). Only 9 of those alternatives were considered cost effective (Table 7) and only 5 of the cost-effective plans were considered “best buys” including No Action. Of the 5 best buys, only 3, including No Action, don’t exceed the statutory limits of the Section 206 project authority. Therefore, only two action alternatives are considered feasible from an economic perspective; A6, Re-grade the Bank and restore Oak Savanna Habitat and A8, Re-grade the Bank, restore Oak Savanna Habitat, and construct vernal pool wetlands. Under both action alternatives disposal would go to an IEPA regulated landfill. Any required fill would be from a commercial vendor and not from a previously undisturbed site. These two action alternatives along with the No Action alternative are further evaluated in the following paragraphs for environmental effects.

4.3 The Affected Environment

See Section 2.1.1.

4.4 Direct and Indirect Effects of Alternatives

The No Action alternative and both action alternatives would have no significant adverse impact on public facilities or services, regional growth, employment or business, tax revenues, property values, community growth or cohesion, air quality, water quality, natural resources, or aesthetic values. Individuals or farms would not be displaced.

Either action alternative would have beneficial effects on community growth, tax revenues, property values, and public facilities, by creating an enhanced recreational and educational resource that is easily accessible. Though the park already receives a certain amount of visitation either action alternative would enhance the appeal of the site to a greater number of individuals. Therefore, the surrounding area of the project, with many small businesses and restaurants, could benefit economically from people observing nature at the restored natural area.

Air Quality
The action alternatives would have short-term impacts on air quality in areas directly adjacent to the project site due to particulates and exhaust from construction machinery and controlled burns of invasive species. All activities would have minor short-term impacts and would be in compliance with local, state, and federal laws. There is no expected significant adverse impact on air quality from the action alternatives or no action.

Water Quality
The action alternatives would have a short-term impact on the water quality in the project area. No significant adverse impacts to water quality would be expected. Short-term turbidity impacts may result from re-grading the stream bank. Stream bank stabilization measures would prevent future water quality degradation by preventing future bank incision. Also, there could be small insignificant quantities of herbicide reaching the stream during invasive eradication. To reduce soil erosion, sedimentation, and other potential minor impacts, storm water management best management practices (BMPs) would be used and monitored at the project site in accordance with the Illinois Urban Manual during construction. The no action alternative would continue to impact water quality by allowing sedimentation from occasional bank erosion.

Native Plant Communities
The action alternatives would have temporary negative impacts to the quality of the present plant communities at the restoration site. Long-term, this project would restore native wetland species and oak savanna, all of which have been eliminated from the site from previous urban development and alteration. The average mean C from the Floristic Quality Index would be raised from the current score of approximately 1.5 to 5, greatly improving site quality with species diversity. The no action alternative would continue to maintain the low quality habitat and would allow the site to act as a seed generator for invasive exotic plant species to disperse to adjacent lands.

Wildlife
The action alternatives would have no adverse impacts to the diversity or abundance of the present wildlife communities at the restoration site, or to adjacent natural areas. Tolerant animals that are present would relocate during the restoration phase. Songbirds would benefit from the restoration through increasing plant diversity and providing a richer food source. Terrestrial invertebrates and small mammals would benefit from these same increases in food value. As the diversity of small animals increase, so will the predators that depend on them for food, such as snakes, birds of prey, and larger mammals. No action will continue the site as a park land with low plant diversity and high numbers of non-native species.

Aquatics
The action alternatives would have no adverse impacts to the diversity or abundance of the existing aquatic communities at the restoration site, or to upstream or downstream reaches. The alternatives would provide better filtration of sediments entering the stream and stop erosion of the stream banks, helping to prevent siltation of existing habitat. No action would allow a continuing of stream bank erosion and minimal filtration of run-off from the site.

Threatened and Endangered Species
No Federal or state listed species or their critical habitats occur at the site. Therefore no adverse impacts would be caused by the alternatives, including no action.

Hazardous, Toxic, and Radioactive Waste Investigation
Based on the results of the sampling analysis, the soil and sediment does not indicate the potential for hazardous waste as defined under 40 CFR Part 261 Subpart C. It is recommended for disposal at a landfill facility due to parameters outside of the regulatory limits for clean material. Soil borings would be taken along the river to determine what materials the contractor would be excavating as the bank is contoured. Due consideration will be given, as per the soil analysis results, to ensure that disturbing the ground layers while re-grading the bank does not introduce potential contaminants into the river. The LUST is located approximately 0.15 miles away from the proposed project site, and due to the nature and location of the identified LUST, it is not anticipated to impact proposed construction activities.

Cultural and Archaeological Resources
The alternatives would not affect any archeological or historic properties; the Illinois State Historic Preservation Officer (SHPO) has concurred with this finding by letter dated November 9, 2010.

Social Effects
Residential homes and businesses would experience increased noise, dust, and traffic congestion during construction if either action alternative were carried out. These impacts would be localized and short term. The no action alternative would have minor or no impacts to social resources.

Recreation
The action alternatives would cause short term impacts to recreation in the form of exclusion from parts of Horner Park, increased noise, dust, etc. from construction. After construction the action alternatives would increase both recreational and educational opportunities at the park. The no action alternative would have no impacts to the current recreational activities at the park.

4.5 Cumulative Effects

Consideration of cumulative effects requires a broader perspective than examining just the direct and indirect effects of a proposed action. It requires that reasonably foreseeable future impacts be assessed in the context of past and present effects to important resource. Often it requires consideration of a larger geographic area than just the immediate “project” area. One of the most important aspects of cumulative effects assessment is that it requires consideration of how actions by others (including those actions completely unrelated to the proposed action) have and

will affect the same resources. In assessing cumulative effects, the key determinant of importance or significance is whether the incremental effect of the proposed action will alter the sustainability of resources when added to other present and reasonably foreseeable future actions.

Cumulative environmental effects for the proposed ecosystem restoration project were assessed in accordance with guidance provided by the President's Council on Environmental Quality (USEPA, EPA 315-R-99-002, May 1999). This guidance provides an eleven-step process for identifying and evaluating cumulative effects in NEPA analyses.

The overall cumulative impact of the Horner Park ecosystem restoration project is considered to be beneficial environmentally, socially and economically. The most significant cumulative effect is the habitat improvement of parkland that contributes acreage of green space and habitat within the City of Chicago.

Scoping
The spatial boundary for the cumulative effects assessment has been broadened to consider effects beyond the footprint of Horner Park. The spatial boundary being considered is normally in the general area of the proposed project; however, this area may be expanded on a case-by-case basis if some particular resource condition necessitates broadening the boundary.

The temporal boundaries considered are:

Past – pre 1750, because this is the approximate time that the landscape was in its natural state, a large sluggishly flowing wetland complex
Present – 2012, when the project decision is being made
Future – 2061, the year used for determining project life end, although the ecological restoration should last until a geologic event disturbs the area.

Projecting the reasonably foreseeable future actions is difficult at best. Clearly, the proposed action (ecological restoration) is reasonably foreseeable; however, the actions by others that may affect the same resources are not as clear. Projections of those actions must rely on judgment as to what are reasonable based on existing trends and where available, projections from qualified sources. Reasonably foreseeable does not include unfounded or speculative projections. In this case, reasonably foreseeable future actions include:

- Sowing of native plants to return plant communities across the landscape
- Stable growth in both population and water consumption of this Chicago neighborhood
- Continued increase in tourism/recreation in the open spaces of Chicago
- Continued urban land use
- Continued application of environmental requirements such as those under the Clean Water Act
- Implementation of various programs and projects to deal with runoff and waste water pollution and to restore degraded environments, including the Corps' restoration project, Eugene Field Park, currently being constructed upstream of Horner Park.

Cumulative Effects on Resources

Geology & Soils

The topography and soils of this area have been majorly disturbed by past actions of filling and tilling. Cumulative effects of past agricultural practices, landfills, and infrastructure may have damaged the properties of the soil types and have severely altered topographical relief from its natural state. Changing the site back to a natural landscape should replace the altered topsoil layer over the years to come. Sculpting the site and planting native vegetation, to achieve a more natural topography representative of the area, is the goal of the proposed project. Future actions such as infrastructure upgrade may have damaging effects. Cumulative impacts of the proposed and combined future actions to topography and soils should be minimally beneficial.

Hydrology

The natural water systems of the area have long disappeared since humans have altered the landscapes at the beginning of the 1700s to create more land suitable for agriculture and development. Surface and groundwater flow is no longer dominated by sluggish prairie sloughs, but by sewer and stormwater systems. The hydrology of the area has been stressed due to agricultural practices and heavy urbanization. Relatively small modifications, such as this project, would have positive benefits to water resources, ecosystems and the human community. Proposed future actions such as runoff improvement programs and projects would improve the hydrology to have significant benefits to the human environment, water resources (quality and quantity) and ecosystem sustainability.

Water Quality

The water quality of this area is generally poor and was much better before humans began to use the land for cultivating crops and building urban infrastructure. Water clarity is moderate to poor. The Chicago River North Branch only supports a limited aquatic resource. The restoration of riparian plant communities would aid in the improvement of water quality in the Chicago area by removing nutrients and other pollutants from runoff and acting as detention and supplementing flow during dry periods. Other present and future actions such as the Eugene Field Park project and subsequent pollution and runoff improvement projects would combine to be beneficial to water quality.

Aquatic Resources

The project area lies entirely within the bounds of the Chicago Lake Plain. Wet prairies and marshes with sporadic wet oak savannas primarily dominated this flat system before adverse human impacts. The plant communities were just about completely eradicated for agriculture and urban space. These systems originally supported an enormous diversity of aquatic plants and animals. Cumulative impacts of the past have decimated critical habitat for thousands of species and reduced them to isolated patches scattered throughout the lake plain. The Chicago River North Branch has been surveyed over the past 30-years for species composition, and only a small fraction of the native species that once occurred have been identified as extant today. The aquatic systems of the area are currently stressed due to continued use as urban lands. The proposed project proposes to restore riparian plant communities, in which these unique organisms are dependent upon. Proposed future actions would improve the aquatic resources.

Terrestrial Resources
The upland portions of the project were destroyed in the 1700s when humans began to strip the land and alter hydrology for agricultural purposes. Natural communities have been destroyed at the project site and its surrounding watershed. Uplands and wetlands are now homes and buildings. The remaining patches of terrestrial natural resource of the area are currently stressed due to urbanization and invasive species that dominate these sites. Relatively small modifications, such as this project, would have benefits to wetlands and upland communities, which include plants and animals.

Aesthetic Values
Past actions have completely removed the naturalness of The Horner Park area. The ecosystem restoration project would naturalize a small portion of the riparian corridor of the Chicago River North Branch. This would include reestablishing native plant communities in an area that is currently overrun with weeds and littered with unnatural and non-functioning structures. Making the river more accessible to the public and reestablishing native vegetation (includes wildflowers) would only increase the aesthetic value of the project site. Additional future actions may restore additional areas along the North Branch; however increases in population and development may negatively offset restoration attempts.

Cumulative Effects Summary
Along with direct and indirect effects, cumulative effects of the proposed restoration were assessed following the guidance provided by the President's Council on Environmental Quality Table 9. There have been numerous negative effects to resources from past and present actions, and reasonably foreseeable future actions can also be expected to produce both beneficial and adverse affects. In this context, the increments of effects from the proposed ecological restoration are relatively minor. Assessment of cumulative effects did reveal that long-term sustainability of any of the resources would be beneficially affected. Based on the expectation of continued sustainability of all resources, cumulative effects are not considered significant.

4.6 Coordination and Compliance
A scoping letter was introduced to all known interested parties on October 28, 2010. Five responses were received and are included in Appendix A along with a copy of the scoping letter and a mailing list. No significant concerns were noted from any of the responses.
The draft report and unsigned Finding of No Significant Impact (FONSI) were made available for a 30 day public review on September 5, 2012. Reponses to the review are included in Appendix A along with a copy of the Corps Notice of Availability. The following table shows the preferred alternative's compliance with various laws and policy.

Table 10: The preferred alternative's compliance with Various laws and policy
*****(Items identified as being in "Full Compliance" assumes their compliance status upon completion of the NEPA process)

Public Laws		
Title of Public Law	**US Code**	**Compliance Status**
American Indian Religious Freedom Act	42 USC 1996	N/A
Agriculture and Food Act (Famland Protection Act) of 1981	7 USC 4201 et seq.	N/A
American Folklife Preservation Act of 1976, as amended	20 USC 2101	N/A
Anadromous Fish Conservation Act of 1965, As Amended	16 USC 757 a et seq.	N/A

Antiquities Act of 1906, As Amended	16 USC 431	Full Compliance
Archeological Resources Protection Act of 1979, As Amended	16 USC 469	Full Compliance
Bald Eagle Act of 1972	16 USC 470	N/A
Clean Air Act of 1972, As Amended	42 USC 7401 et seq.	Full Compliance
Clean Water Act of 1971, As Amended	33 USC 1251 et seq.	Full Compliance
Comprehensive Environmental Responses, Compensation and Liability Act of 1980	42 USC 9601	N/A
Conservation of Forest Lands Act of 1960	16 USC580 mn	N/A
Endangered Species Act of 1973	16 USC 1531	Full Compliance
Farmland Protection Policy Act	7 USC 4201 et seq.	N/A
Federal Environmental Pesticide Act of 1972	7 USC 136 et seq.	Full Compliance
Federal Water Project Recreation Act of 1965, As Amended	16 USC 4601	Full Compliance
Fish and Wildlife Coordination Act of 1958, As Amended	16 USC 661	Full Compliance
Flood Control Act of 1944, As Amended, Section 4	16 USC 460b	Full Compliance
Flood Security Act of 1985 (Swampbuster)	16 USC 3811 et seq.	N/A
Historic and Archeological Data Preservation	16 USC 469	Full Compliance
Historic Sites Act of 1935	16 USC 461	Full Compliance
Land and Water Conservation Fund Act of 1965	46 USC 4601	N/A
Migratory Bird Conservation Act of 1928, As Amended	16 USC 715	Full Compliance
Migratory Bird Treaty Act of 1918, As Amended	16 USC 703	Full Compliance
National Environmental Policy Act of 1969, As Amended	42 USC 4321 et seq.	Full Compliance
National Historic Preservation Act of 1966, As Amended	16 USC 470	Full Compliance
National Historic Preservation Act Amendments of 1980	16 USC 469a	Full Compliance
Native American Religious Freedom Act of 1978	42 USC 1996	N/A
Native American Graves Protection and Repatriation Act	25 USC 3001	Full Compliance
National Trails System Act	16 USC 1241	N/A
Noise Control Act of 1972, As Amended	42 USC 4901 et seq.	Full Compliance
Resource Conservation and Recovery Act of 1976	42 USC 6901-6987	N/A
River and Harbor Act of 1888, Sect 11	33 USC 608	N/A
River and Harbor Act of 1889, Sections 9, 10, 13	33 USC 401-413	Full Compliance
River and Harbor and Flood Control Act of 1962, Section 207	16 USC 460	N/A
River and Harbor and Flood Control Act of 1970, Sections 122, 209, and 216	33 USC 426 et seq.	Full Compliance
Safe Drinking Water Act of 1974, As Amended	42 USC 300f	Full Compliance
Toxic Substances Control Act of 1976	15 USC 2601	N/A
Utilization of Small Business	15 USC 631, 644	Full Compliance
Executive Orders		
Title of Executive Order	**Exec. Order Number**	**Compliance Status**
Protection and Enhancement of Environmental Quality	11514/11991	Full Compliance
Protection and Enhancement of the Cultural Environment	11593	Full Compliance
Floodplain Management	11988	Full Compliance
Protection of Wetlands	11990	Full Compliance
Federal Compliance with Pollution Control Standards	12088	Full Compliance
Procurement Requirements and Policies for Federal Agencies for Ozone-Depleting Substances	12843	Full Compliance
Federal Compliance with Right-To-Know Laws and Pollution Prevention	12856	Full Compliance
Federal Actions to Address Environmental Justice and Minority and Low-Income Populations	12898	Full Compliance
Energy Efficiency and Water Conservation at Federal Facilities	12902	Full Compliance
Federal Acquisition and Community Right-To-Know	12969	Full Compliance
Protection of Children from Environmental Health Risks and Safety Risks	13045	Full Compliance

Greening the Government Through Waste Prevention, Recycling and Federal Acquisition	13101	Full Compliance
Invasive Species	13112	Full Compliance
Greening the Government Through Leadership in Environmental Management	13148	Full Compliance
Consultation and Coordination with Indian Tribal Governments	13175	Full Compliance
Responsibilities of Federal Agencies to Protect Migratory Birds	13186	Full Compliance
Executive Order Facilitation of Cooperative Conservation	13352	Full Compliance

CHAPTER 5 – DESCRIPTION OF RECOMMENDED PLAN*

5.1 NER Plan Components

Re-grade Bank

The river bank above normal pool, approximately 2,600 linear feet, would be re-graded from its present approximate 2:1 slope to a more gradual 3:1 as shown in Figure 12. The current riparian vegetation made up of primarily invasive exotic species would be replaced with a native mix of trees, grasses, and forbs. All disposal material would be taken directly to an IEPA regulated landfill and not re-used in any way in accordance with the HTRW soil sampling summary recommendation.

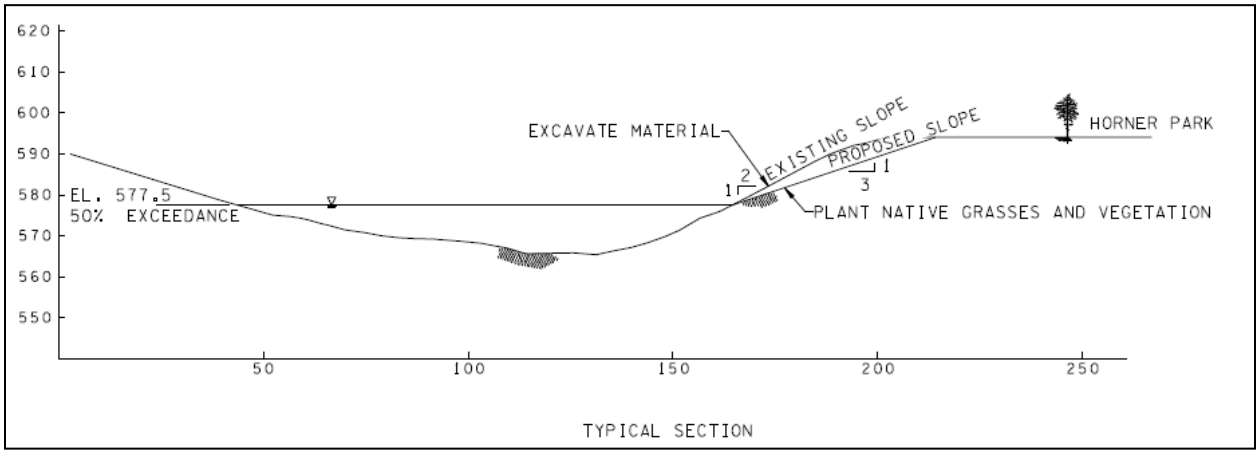

Figure 12: Typical Section of Stream Bank Re-graded

Vernal Ponds

Four vernal pools, approximately 60 by 50 feet in size, would be created in the upland area of the riparian zone. These 4 wetlands would total approximately 0.25 acres. See Figures 13 and 14 below for designs and Figure 15 for approximate locations of the four pools. Preliminary locations were selected based on existing topographic depressions on the project site.

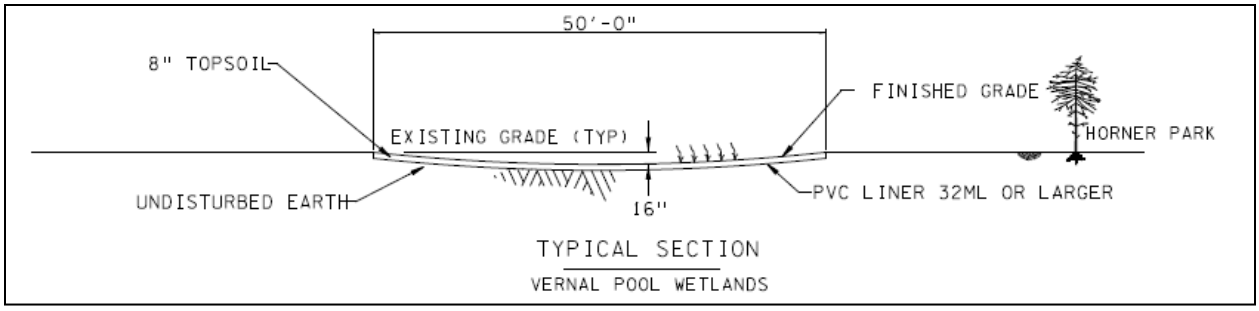

Figure 13: Typical Section of Vernal Pool Wetlands from NER Plan

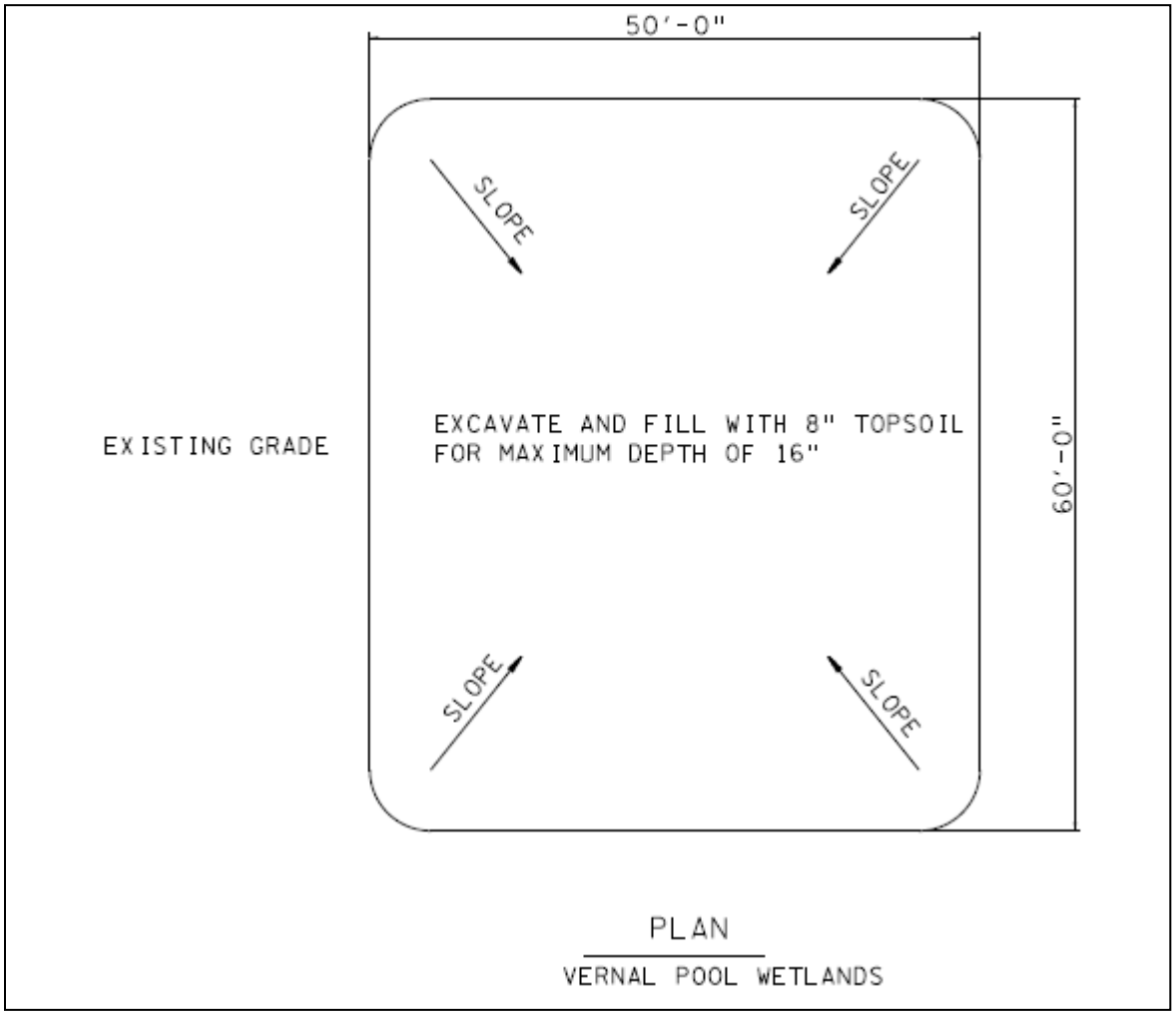

Figure 14: Typical Plan View of Vernal Pool Wetlands from NER Plan

Oak Savanna Habitat

Approximately 10 acres of oak savanna would be restored by eradicating the existing invasive vegetation and turf and planting natives. See Figure 15 for a map of the proposed habitat restoration. A complete list of the native plantings is included in Appendix B.

Figure 15: Plan View of NER Plan

5.2 Design and Implementation Considerations

If this project enters into Design and Implementation (D&I) Phase more detailed analyses would be required. This section explains key assumptions that were made during feasibility and associated additional studies needed during design to refine plans and reduce cost contingencies.

River Bank and Project Site Survey – A detailed river bank survey was not available for use during the feasibility study. The HEC-RAS model had three detailed stream cross sections in the vicinity of Horner Park: one just upstream of the project site near Montrose Avenue, one downstream of the project site near Irving Park Road, and one at approximately the center of the project site. The three cross sections were very similar and therefore the study team assumed that the entire site had a typical river section equal to that of the middle cross section. As part of the feasibility study, the typical river section taken from the HEC-RAS model was used to develop quantities of soil disposal for each alternative. The river section was merged in AutoCAD with City of Chicago Light Detection and Ranging (LIDAR) data to develop a site layout. As part of the D&I phase a detailed bank and site survey would need to be conducted to gain a more accurate understanding of the project site.

Soil Borings – During development of the feasibility study soil borings were not attained due to cost restraints. HTRW sampling therefore consisted of soil, sediment, and water grab sampling. In this site's history, Horner Park used to house brick making facilities with clay pits near the North Branch of the Chicago River and the site was then turned into an unregulated dump before being converted into a park in the 1950s. During the conversion, the site was filled with silty-clay material. The ultimate soil strength, quality, soil composition, and amount of debris from the dump still onsite are unknown. The HTRW Sampling Report summary recommends that if project work is deeper than four feet, core samples should be taken to determine the quality of the deeper soil. Excavation work re-grading the bank would be deeper than four feet in some areas. Therefore, soil borings should be taken along the river to determine what materials the contractor would be excavating as the bank is contoured. Due consideration should be given, as per the soil analysis results, to ensure that disturbing the ground layers while re-grading the bank does not introduce potential contaminants into the river. To comply with state permitting requirements, a silt fence or other best management practice should be employed. Chicago Park District also noted that the site approximately 300 feet south of Montrose Avenue sank during construction. There is an underground aquifer that discharges rust-colored water. The discharge has been tested for iron and other metals and has come back clean. This area should be given special consideration to determine its stability and contents.

Outfall and Access Shaft – Horner Park has a sewer outfall on the southern end of the site and has an access shaft that leads to an underground tunnel approximately 200 feet below the river. The contractor would need to work around these existing features, owned by the Water Reclamation District, to avoid any potential impacts. MWRD would need access to the features several times a year so no obstacles shall be placed to disallow this access. A specific site plan would be created in the D&I phase to ensure that these features are not disturbed.

5.3 Real Estate Requirements

The Real Estate Plan is included as Appendix I. The estimated value of the lands, easements, rights of way, relocations, and disposal area (LERRDs) required for the project were determined

by a gross appraisal as part of the Real Estate Plan to be $81,000. Additional estimated administrative costs were estimated at $7,500 bring total non-federal real estate costs to $88,500 (2013 price levels). The LERRDs project first cost is $94,500. A detailed record of all property in the project area is contained in the Real Estate Plan. The Non-Federal Sponsor, Chicago Park District, will be responsible for providing 100 percent of the LERRDs. The value of LERRDs shall be included in project costs as part of the non-Federal cost share. The Chicago Park District will be responsible for acquiring the following estates:

Channel Improvement Easement: 2.02 acres – A perpetual and assignable right and easement to construct, operate and maintain channel improvement works on, over and across the land for the purpose as authorized by the Act of Congress, including the right to clear, cut, fill, remove and dispose of any and all timber, trees, underbrush, buildings, improvements, and/or other obstructions there from; to excavate, dredge, cut away, and remove any and all of said land and to place thereon dredge or spoil material; and for such other purposes as may be required in connection with said work of improvement; reserving, however, to the owners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easements herby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads, and pipelines. The Metropolitan Water Reclamation District of Greater Chicago currently owns from the centerline of North Branch Chicago River to the top of bank.

A construction access easement/permit would need to be purchased from the City of Chicago for access from Irving Park Road directly onto the southern boundary of the site. If the City does not grant this access, construction equipment would enter through Chicago Parks land. The rest of the project site is owned by the Chicago Park District and does not need to be acquired. Due to the high land values in urban areas, if the LERRDs value exceeds 25 percent of the total project costs, the non-Federal sponsor is prepared to provide a letter of intent to voluntarily waive reimbursement for the value of LERRD that exceeds the non-Federal sponsor's percentage share of total project costs.

5.4 Operation and Maintenance

The non-federal sponsor is responsible for the long-term operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) of this project once completed. Total construction is expected to take two to three months for physical work to be completed (grading, contouring and initial seeding) one growing season to establish the appropriate vegetative cover, and three years for bolstering plantings and vegetative cover. The primary restoration goal is to return the aquatic ecosystem of the North Branch Chicago River within Horner Park to a more natural state. The amount of O&M, therefore, should be minimal after the project is turned over to the local sponsor. A detailed O&M Plan would be prepared near the end of the construction phase. This plan would include the following annual maintenance requirements:

- General grooming of the fence, including trash pickup
- Plant replacement of major areas where vegetation has failed because of disease, insects, uncontrolled wildfires, illegal dumping, or other such problems
- All plantings must be monitored to ensure proper species selection and growth and to prevent the establishment of non-native and invasive species. Any invasive species

observed at these sites should be physically removed or treated with the appropriate herbicide
- In areas of public access, at a minimum twice a year, the stream bank should be maintained by the removal of foreign debris and garbage

5.5 Division of Responsibilities

Federal Responsibilities

The estimated Federal cost share of the first project cost is about $4,048,641 and the Federal government would be responsible for the following:

- Contract for construction
- Overall supervision during construction
- A portion of monitoring after construction
- Prepare an Operation and Maintenance Manual

The Federal Government, following approval of the DPR and receipt of federal funds, would finance the share indicated in Table 13. The non-Federal cost sharing portion of the DPR would initially be funded by the federal government and to be repaid after the Project Partnership Agreement (PPA) is signed and prior to construction. The USACE would supervise and administer the construction contracts in accordance with the PPA and available funding.

Non-Federal Responsibilities

Prior to initiation of construction the Federal Government and the CPD, the non-Federal sponsor, would execute a PPA. The model PPA for Section 206 projects with recreation would be used. The lands, easements, rights-of-way, relocations, and O&M of the project would be the responsibility of the non-Federal sponsor for the proposed project. The estimated non-Federal share of the total first cost of the project is about $2,316,281. An estimate of $94,500 would be covered by the LERRDs value and work in kind of $200,000 and cash of $2,021,781 would cover the remaining share. In addition to the total first cost, the O&M costs of the project are estimated to total an annual cost of $1,050 in 2013 dollars. The $200,000 of in-kind credit would be for work done in the design and implementation phase and would be negotiated in the PPA. This work is preliminarily expected to include procurement and installation of signs/fencing.

A PPA would be required from the nonfederal sponsor, under which the sponsor would agree to:

1. Provide 35 percent of the separable project costs allocated to environmental restoration and 50 percent of the separable recreation costs as further specified below
    - Provide the non-Federal share of all complete planning and design work upon execution of the PPA
    - Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or ensure the performance of all relocations determined by the government to be necessary for the construction and O&M of the project
    - Provide or pay to the government the cost of providing all retaining dikes, waste-weirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, and O&M of the project

- Provide, during construction, any additional costs as necessary to make its total contribution equal to 35 percent of the separable project costs allocated to environmental restoration and 50 percent of the separable project costs allocated to recreation

2. Contribute all project costs in excess of the Federal Statutory limitation of $5,000,000
3. For so long as the project remains authorized, operate, maintain, repair, replace, and rehabilitate the completed project or the functional portion of the project at no cost to the government in accordance with applicable federal and state laws and any specific directions prescribed by the government
4. Give the government a right to enter, at reasonable times and in a reasonable manner, upon land that the local sponsor owns or controls for access to the project for the purpose of inspection and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project
5. Assume responsibility for OMRR&R of the project or completed functional portions of the project without cost to the government in a manner compatible with the project's authorized purpose and in accordance with applicable federal and state laws and specific directions prescribed by the government in the OMRR&R manual and any subsequent amendments thereto
6. Comply with Section 221 of Public Law (P.L.) 91-611, Flood Control Act of 1970, as amended, and Section 103 of the WRDA of 1986, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resource project or separable element thereof until the nonfederal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element
7. Hold and save the United States free from damages due to construction of or subsequent maintenance of the project except those damages due to the fault or negligence of the United States or its contractors
8. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as would properly reflect total project costs
9. Perform or cause to be performed such investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 *U.S. Code* 9601 through 9675, that may exist in, on, or under lands, easements, or rights-of-way necessary for the construction, and O&M of the project, except that the nonfederal sponsor shall not perform investigations of lands, easements, or rights-of-way that the government determines to be subject to navigation servitude without prior written direction by the government
10. Assume complete financial responsibility for all necessary cleanup and response costs for CERCLA-regulated material located in, on, or under lands, easements, or rights-of-way that the government determines necessary for the construction and O&M of the project
11. To the maximum extent practicable, conduct OMRR&R of the project in a manner that would not cause liability to arise under CERCLA
12. Prevent future encroachment or modifications that might interfere with proper functioning of the project
13. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, P.L. 91-646, as amended in Title IV of the

Surface Transportation and Uniform Relocation Assistance Act of 1987, P.L. 100-17, and the uniform regulation contained in Part 24 of Title 49, *Code of Federal Regulations* (CFR), in acquiring lands, easements, and rights-of-way for construction and subsequent O&M of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said acts

14. Comply with all applicable federal and state laws and regulations, including Section 601 of Title VI of the Civil Rights Act of 1964, P.L. 88-352, and Department of Defense Directive 5500.11 issued pursuant thereto and published in 32 CFR, Part 300, as well as Army Regulation 600-7 entitled "Non-Discrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"
15. If necessary, provide 35 percent of that portion of the total cultural resource preservation, mitigation, and data recovery costs attributable to environmental restoration that are in excess of 1 percent of the total amount authorized to be appropriated for environmental restoration
16. Do not use federal funds to meet the nonfederal sponsor's share of total project costs unless the federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute

CHAPTER 6 – PLAN IMPLEMENTATION

6.1 Project Authorization

Section 206, Water Resources Development Act (WRDA) 1996 (P.L. 104-303), as amended, authorizes the US Army Corps of Engineers to participate in planning, engineering and design, and construction of projects to restore degraded aquatic ecosystem structure, function, and dynamic processes to a less degraded, more natural condition if the project will improve environmental quality, is in the public interest, and is cost effective. Projects require partnering with a non-Federal sponsor who may be a public agency, state or local government, or a large national non-profit environmental organization. The Federal share of the costs for any one project may not exceed $5,000,000. There is an annual appropriation limit of $25,000,000 nationwide. Section 4 of the Flood Control Act of 1944, Public Law 78-534, as amended (16 U.S.C. 460d) and the Federal Water Project Recreation Act of 1965, Public Law 89-72, as amended (16 U.S.C. 4601-12 et seq.) provide authority to include recreation as a project purpose in conjunction with aquatic ecosystem restoration provided that the total costs of recreation do not increase the Federal share of the project by more than 10%. All recreation costs are cost shared 50%/50%.

The Horner Park project offers a great opportunity for restoring the riparian corridor to a functional and more diverse state through re-grading the stream bank to a more stable slope, planting native riparian species, restoring oak savanna habitat, and constructing small pockets of vernal pool wetlands.

6.2 Implementation Sequencing

Initial construction plans indicate that invasive species would be removed from the riparian zone and the banks contoured first. Major construction equipment would be removed and then the entire park would be planted. The construction contract would be a three year construction project with the bulk of the work occurring in year one.

Year1: Grading (banks, vernal pools), tree removal (cut flush with ground, leave roots), herbaceous plant removal (herbicide any remaining invasive species and turf (turf is to be killed in place)), cover crop (if time before winter) and native seeding (if time, if not then seed in spring of next year), install native trees (in fall if time), erosion control blankets. These activities would occur as appropriate in all community types.

Year 2: Install live plant plugs (early spring), native seed installation (if not installed in the previous fall), spot herbicide and/or hand pulling/mechanical removal of invasive plant species through growing season

Year 3: Continue to control for invasive plant species and close out contract at end of growing season if all performance criteria have been met.

6.3 Monitoring and Adaptive Management

The goal of the Horner Park Restoration Project is to restore stream habitat, restore a native riparian oak savanna ecosystem habitat, and to remove and prevent recurrence of invasive species. This would be done by grading the bank to a stable slope, eradicating invasive plant species, and planting native vegetation.

Monitoring would be necessary to determine the effectiveness of this project. Data would be used to provide feedback for future stream restoration projects. The goal is to identify whether immediate adaptive management may be required and to provide the information necessary to improve the effectiveness of similar projects. The results would be shared with other agencies and posted on the Corps District's website.

Five years of monitoring is typically required as part of the permit conditions in stream restoration projects in several states. The Corps would adhere to that requirement for this project. Monitoring is an especially critical component of stream restoration projects, given the dynamic nature of the riparian environment and the inherent uncertainty of changes in conditions.

The Corps would either perform the work or oversee an awarded service contract to qualified contractors. Annual narrative reports documenting the results would be required. A cumulative report would be written at year 5.

If annual narrative reports indicated a need for an emergency fix, funds needed for adaptive management would be requested. These would be cost-shared and added to the total project cost. If the reports show that none of the goals have been met and there is little to no success after 5 years, the Corps and the sponsor would determine whether it is possible to cost-share additional work.

A description of the monitoring components is below:
1. Walk the stream and take notes/photos of the project area. Write annual narrative reports documenting project walk-through detailing any significant changes from the as-built conditions. This would determine if the goals of restoring bank stability and habitat improvement were met.

- Years 1-5
- Determine how the project is holding together and what type of repairs, if any, are needed and document the following in annual narrative reports:
  1. Spots of erosion/deposition
  2. Success of vegetation goal (80% coverage of disturbed areas)

2. Survey reference cross sections. This would determine if the goal of restoring bank stability was achieved.
- Years 1-5
- Upstream and downstream

3. Fish population assessment using electroshocking. This would determine if the goal of habitat improvement has been met.
- Year 0 (preconstruction) and year 5

Table 11: Monitoring Cost Estimate

Activity	Year	Corps Labor or A/E cost	Total
A. Walk the stream and take notes & photo documentation B. Annual narrative report	1	20 hours x $150/hr= $3000	$3000
	2	20 hours x $150/hr= $3000	$3000
	3	20 hours x $150/hr= $3000	$3000
	4	20 hours x $150/hr= $3000	$3000
	5	20 hours x $150/hr= $3000	$3000
Total			***$15,000***
Fish population assessment using electroshocking & annual narrative report	0	20 hours x $150/hr= $3000	$3,000
	5	20 hours x $150/hr= $3000	$3,000
Total			***$6,000***
Project Management, Cumulative Report	1-5, 5	20 hours x $150/hr= $3000	$3000
			$3000
Grand Total			**$24,000**

6.4 Mitigation Requirements

Since this is an ecosystem restoration project, environmental benefits would exceed detriments, therefore mitigation is not anticipated for this project.

6.5 Permit Requirements

Known required permits include a National Pollutant Discharge Elimination System (NPDES). A Stormwater general permit for construction would be required for any project disturbing more than one acre of land.

Clean Water Act – The preferred alternative meets the Corps, Chicago District's Section 404 regional permit #5, Wetland and Stream Restoration and Enhancement. The regional permit was certified by the Illinois Environmental Protection Agency (IEPA) by letter dated 31 January 2007. The regional permit and IEPA Water Quality Certification is included in Appendix J.

6.6 Public/Agency Views and Comments

The study team coordinated with several state and federal agencies throughout the development of the feasibility study. The draft report and unsigned FONSI were made available for a 30 day public review on September 5, 2012. Reponses to the review are included in Appendix A along with a copy of the Corps Notice of Availability. No objections were received.

6.7 Project Schedule

The project schedule is dependent on the availability of federal funds. An estimated schedule for project implementation is shown below in Table 12.

Table 12: Project Implementation Schedule

Schedule Item	Completion Date
Feasibility Report Approved	March 2013
Project Partnership Agreement (PPA) Signed	October 2013
Design Activities	February 2014
Real Estate Acquisitions Complete	March 2014
Contract Award	April 2014
Implementation Complete	September 2017

6.8 Total Project Costs

Total project costs include costs for study, design, implementation, contingencies, construction management, engineering during construction (EDC) and project management. Costs for design and management are based on a percentage of estimated implementation costs and contingencies. These costs would be revised prior to the execution of a Project Partnership Agreement (PPA). The base total project cost is $6,259,716 (2013 price levels). The total project first cost is $6,364,922 (budget year FY 14 price levels) and is divided in Table 13 below. The fully funded total project cost is $6,485,989. For detailed cost estimates see Appendix C. Actual costs for these activities would be used to remedy final cost sharing responsibilities during project closeout.

Table 13: Total Project First Cost

Feasibility Study	$ 294,050
Design & Implementation* Ecosystem	$ 5,480,486
Design & Implementation* Recreation	$ 590,386
LERRDs	$ 94,500
Total	**$ 6,364,922**
AAOMMR&R	$ 1,050

* The cost of the feasibility study is initially federally financed. The Federal government would recapture the non-federal share of these costs after signing the PPA. Feasibility study cost does not include initial federally funded $100K. Design & Implementation costs include the design, procurement, construction contract, engineering design during construction, contract administration (S&A), coordination, and project close out activities.

6.9 Cost Apportionment

As established in PL99-662, as amended, project costs are shared with the local sponsor in accordance with project outputs. Project elements providing aquatic ecosystem restoration benefits are cost shared on the cost sharing provisions in Section 206 of the 1996 WRDA. Section 206 required non-Federal interests to pay 35 percent of the cost of the project assigned to

aquatic ecosystem restoration during construction and to provide all land, easements, rights-of-way, relocations, and disposal areas (LERRDs). Non-Federal interests are required to pay 50 percent of the costs of the project assigned to recreation.

The Chicago Park District has agreed to serve as the local cost-sharing sponsor for the Horner Park aquatic ecosystem restoration project. The cost sharing requirements and provisions would be formalized with the signing of the Project Partnership Agreement between the local sponsor and the USACE prior to the initiation of contract award services. The $200,000 of in-kind credit would be for work done in the design and implementation phase and would be negotiated in the PPA. An integral determination report does not need to be prepared since all in-kind contributions would be covered by the PPA.

Table 14: Cost Apportionment of NER Plan Project First Cost

Purpose	Non-Fed Cash	Non-Fed Work in Kind	Non-Fed LERRD	Total Non-Fed Share	Federal Share	Total Project Costs
Feasibility	$102,918	$0	$0	$102,918	$191,133	$294,050
Ecosystem Restoration D&I	$1,733,670	$90,000	$94,500	$1,918,170	$3,562,316	$5,480,486
Recreation D&I	$185,193	$110,000	$0	$295,193	$295,193	$590,386
Total	$2,021,781	$200,000	$94,500	$2,316,281	$4,048,641	$6,364,922

6.10 Financial Capability of Non-Federal Sponsor

The Chicago Park District provided a letter of intent date October 4, 2010 in which it stated it is prepared to sign a Project Partnership Agreement and met its obligations. An updated letter of intent from Chicago Park District was received on May 10, 2012. The letter clearly indicates that the Park District understands the local requirements.

The Chicago Park District's financial capability is clear. It is a very large institution with extensive management, planning, construction, and operational experience and capabilities. It has a very large revenue base and high bond ratings as reported by recognized credit rating services. Its financial condition is strong, with significantly large net assets and high-unused bonding capacity. It has demonstrated its management and financial capabilities as a non-Federal sponsor on a high profile, large storm damage reduction project. The non-Federal commitment for the Horner Park ecosystem restoration project, at $2,221,781 of in-kind services and cash, is very small in comparison to the sponsor's financial and non-financial capabilities.

The Chicago Park District, as the non-Federal sponsor, has indicated its ability and willingness to participate in the finalization, engineering, and design of the selected restoration plan as well as in the construction of the project. Having considered several indicators of both financial and non-financial capability, and having considered the sponsor's prior performance as a local partner, the Chicago Park District is a credible and capable partner for the Horner Park Ecosystem Restoration project.

CHAPTER 7 – RECOMMENDATION

After considering the significant engineering, economic, environmental, and social aspects relative to the construction of the proposed aquatic ecosystem restoration project at Horner Park, I recommend that the selected plan be authorized and constructed as a Federal project with such modifications as may be advisable, in the discretion of the Chief of Engineers, under the authority of Section 206 of the 1996 Water Resource Development Act (P. L. 104-303), as amended.

The estimated total first cost of the recommended plan is $6,364,922 comprised of $5,480,486 for ecosystem restoration, cost shared 65/35, and $590,386 for recreation, cost shared 50/50. Federal first costs are estimated at $4,048,641. The non-Federal share is estimated to be $2,316,281, which is comprised of $94,500 credits for lands, easements, rights-of-ways, and relocations; $200,000 of work in kind contributions to be negotiated in the PPA, and $2,021,781 cash. Accordingly, I recommend that the project be funded and constructed subject to cost-sharing and financing arrangements acceptable to the Chief of Engineers and the Secretary of the Army.

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the national civil works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before implementation funding. However, the non-Federal sponsor, the States, interested Federal agencies, and other parties would be advised of any modifications and would be afforded an opportunity to comment further.

Frederic A. Drummond Jr.
Colonel, U.S. Army
District Commander

CHAPTER 8 – BIBLIOGRAPHY/REFERENCES

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