

US Army Corps of Engineers®

CHICAGO DISTRICT

LEADERS IN CUSTOMER CARE

RAVINE 10 ECOSYSTEM RESTORATION SECTION 506 GREAT LAKES FISHERY AND ECOSYSTEM RESTORATION (GLFER)

Civil Engineering Appendix A

Feasibility Submittal

August 22, 2019

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1.0 Site selection and project development

The National Ecosystem Restoration (NER) Plan selected that maximizes ecosystem restoration benefits compared to costs is Alternative 8. The NER plan would first perform minor grading, sheet pile and debris removal to prepare the new stream channel and banks for riffle and step pool placement. No piping or water diversion structures would be used to divert higher flows. The riffles and step pool are designed to specifically handle the larger urban derived flood pulses. Once the stream channel is in place, opportunistic trees and invasive species would be removed by the USACE, all areas will be planted with native species, and establishment activities would commence.

The purpose of this section is to 1) describe the design criteria, engineering methods, procedures, and assumptions that were used for layout and perform preliminary design analysis of the recommended plan; 2) present the methods used and calculations developed for earthwork quantities, 3) present the requirements for the real estate needed; 4) present criteria and requirements for utility interferences; and 5) discuss the engineering design analysis requirements for the next phase of the project.

2.0 Study Location

Historically, the Highland Park moraine was dominated by several naturally occurring communities including wetlands, forests, savannas and prairies. By the late 1800s, much of these communities, particularly prairies, savannas and wetlands, were converted to agricultural, urban or industrial use. Subsequently, there was a significant loss of biodiversity and adverse physical effects such as an increase in flooding events and a decrease in water quality. Furthermore, the remnant parcels of natural community types are under pressure from continued human activities. Human induced disturbances to the remaining natural areas include fire suppression, altered hydrology and hydraulics, increase colonization of invasive species and fragmentation. Specific problems that need to be addressed are detailed in Section 2.6.

Dune & Bluff – Recreation and residential development has had a major influence on the physical structure of coastal habitat and the processes that created and sustained these habitats. This has allowed invasive nonnative species to colonize these altered areas that no longer provide suitable life requisites for native species. Lacustrine process of littoral drift and wave/current patterns have been altered from their natural state through shoreline development; the construction of harbors, break walls, jetties, piers, etc. Coastal habitat can no longer rely on the natural replenishment and movement of sand down the coast since these structure now intercept a great deal of the material. Sand flats are located far enough from the shore as to not be effected by this; however, near shore, beach, dune and bluffs are dramatically affected by these altered conditions. It is apparent that littoral drift sands accumulate where humans have built structures and erode away from natural areas where there are no effective structures.

Ravine – The colonization and subsequent development of the land surrounding the north shore ravines has greatly accelerated the pace of the natural forces which first created them. The primary force responsible for the ravines' continued degradation is the increased volume of water flowing into and through them. The proliferation of impervious surfaces and turf grass within the subwatersheds has greatly increased the flow of rainwater runoff. The result is an increase in the quantity and velocity of water flowing through the ravine, which increases the rate of erosion. This condition combined with foreign debris within the channel bottom from previous failed stabilization structures has ultimately caused the ravine stream and bank habitats to become severely degraded to a point where the ravine currently does not provide fish with any habitat and minimal habitat for riparian macroinvertebrates and migratory birds.

2.1 Staging and Storage

There will be one staging and storage area proposed for the project. Staging Area will be located in the middle of the construction area, just off the Sheridan Rd (at Moraine Park). The staging area is open area with a few trees. The staging areas will be secured with perimeter fences and gates. The proposed staging and storage areas will be restored upon construction completion.

2.2 Access Roads\Haul Routes

2.2.1 Land Access

The project areas can be accessed from the major and local roads. Entry points to the sites are shown on the drawings and are connected to existing pathway. The existing pathways will be used as haul routes where necessary within the project areas. The existing pathways or multi-use trails are heavily used by pedestrians and bikers. It is recommended that the trails/pathways are closed to the public during heavy construction period, which has to be coordinated with the City. Construction damages to the paths will be repaired or replaced upon construction completion.

2.2.2 Ravine Access

Ravine access is needed for to complete majority of the construction. Clearing some of the trees to be able to access the site might be necessary. The ravine is not very steep, to cross the water, temporary gravel might be put on the bottom to provide crossings. Clearing and grubbing maybe necessary for access.

3.0 Real Estate Requirements

The local sponsor for the project is the City of Highland Park. The project area is not owned by the local sponsor because the ravine is part of home owners' rear yards. The project objectives

and measures are not inclusive of rear yard uses and are bounded by the City's "Steep Slope Ordinance" which prevents impractical uses of the ravine slopes. This project seeks to utilize a standard estate, channel improvement easement in the ravine; fee in the sponsor owned area and a temporary work area easement. Full details of the real estate requirements will be available in the real estate report.

Temporary easements, which are also called work limits, consist of property that is needed during the construction phase. The amount of property required for the work limits will include the dune restoration area along the coastline, ravine restoration area, as well as identified staging and storage areas. See Civil Drawing G-03 showing the work limits and easements. It should be noted that the work limit points and parcel/easements shown are subject to change upon completion of a field survey.

4.0 Utilities

Based on the site visit, some of the piping exposed was identified to direct storm water runoff to ravine. Structure protected by the gabion baskets was identified as a sewer collection system. No other utilities were noted. Based on previous similar project in vicinity, the piping used for storm water runoff, is connected to houses in near vicinity. The pipe are not to the city code. The contractor instead of protecting them during construction, will probably remove them and replace with storm water piping only to work limits boundaries. The village code requires for the pipe to be replaced all the way to the house, but waiver was issued last time allowing the contractor to replace the pipe only to worklimit boundary. Placement of the riprap around the discharge end of the pipe should be included in the cost estimate.

5.0 Surveying and Mapping

The horizontal coordinates used for this project referenced the Illinois State Plane Coordinate System, East Zone (Zone Number 1201), North American Datum of 1983 (NAD83) U.S. feet. The elevations used is referenced to the North American Vertical Datum of 1988 (NAVD88) U.S. feet. The elevation data used is from a GIS Lidar data from a 2015 data. This data set was created by Cook County to serve as part of a standard database for virtually all geospatial applications in Cook County, and is intended to support general location, planning, and cartography projects, as well as general inventory and asset management, Census analysis and mapping, and geocoding by address. This data set is adequate for this feasibility study and actual survey of the site will be performed for the design phase.

6.0 Recommended Plan Project Features

6.1 Debris Removal

Based on the site visit, broken concrete, loose riprap, clay pipes were located on site. Majority of that material can be picked up by hand. Assume hauling all material off the site, 10CY per 200 ft, so total about 30 CY of material.

6.2 J-Hook and Riffle Placement

Step stones and riffles will be placed after tree clearing and minor grading. The J-Hook will be constructed with about 10 2ft dia boulders at the crest. Assuming the channel is about 15 ft wide, the length of the structure will be about 25 feet, just one stone deep. No bedding stone, no excavation into the banks or key-ins. The existing stone in the ravine is being replenished. Based on the volume computation with 20% contingency, each structure will be constructed using 11 Tons of stone. The contingency was based on Ravine 8 (similar project in SOW) which was constructed. Based on lesson learned, the riffle total volume was increased about 15-20% during construction to build to specs due to compaction of the bottom channel material after the riffles were placed.

6.3 Tree and Shrub Removal

Selective tree removal will be completed at the upland areas within the project limits. No grubbing is necessary.

6.4 Bank Grading and Stabilization

Most of the banks along the channel won't be graded, the existing cross section will stay the same. Some work will be required after the sheet pile and retaining wall is removed.

6.5 Toe Stone Protection

Toe stone protection will be placed at a few areas along the ravine banks by the bridge and along the ravine close the lake side.

6.6 Path Trail

The path trail was added to the design after the site visit was conducted with local sponsor, heavy erosion was observed due to storm water runoffs. Without detailed survey and investigations the following assumptions were made: Sheet pile wall does not have any gaps underneath that would be allowing material migration and loss behind the wall; relocate the path to more stable/stiffer clay and reuse the stone to build the trail, build 3 ft tall retaining wall; excavate behind it to install drainage system with weep holes every 10 feet to release the pressure; back fill it with granular CA-6 fill; reused the material from excavating to flatten slopes 2 to 1; backfill behind the sheet pile wall with CA-7 material.

7.0 Maintenance and Traffic

Maintenance of traffic during construction is required. Recommend using a street sweeper during heavy construction.

8.0 Quantity Calculations

Quantity takeoffs were computed and by using Microstation. Refer to Ravine 10 Civil Quantities_30%.docx. Microstation Inroads was used to create digital terrain models, or surfaces, from existing topography and proposed contours/elevations that compared existing

and proposed surfaces to calculate earthwork cut/fill quantities. This is done by projecting prisms from one surface to the other and computing the volume of each prism for a total volume. The net earthwork cut/fill is used as basis for the earthwork lump sum bid item.

9.0 Attachments

9.1 Bid Schedule

Title: Bid Schedule - Section 00010
Project Name: Moraine Park Ravine 10
Phase: Feasibility
Date: 8/22/2019
Lead Engineer: Witold Kluza
Estimator:

ITEM	DESCRIPTION	Quantity	U/M	Unit Price	Amount
00 01	MOBILIZATION/DEMOBILIZATION	1	JOB		
00 02	TEMPORARY CONSTRUCTION FACILITIES	1	JOB		
00 03	MAINTENANCE OF TRAFFIC	1	JOB		
00 04	<u>SMC STREAM MORPHOLOGY AND CONNECTIVITY</u>				
00 04 A A	DEBRIS REMOVAL WITHIN CHANNEL	30	CY		
00 04 A B	RIFFLE / J-HOOK INSTALLATION	31	EA		
00 04 A C	ADAPTIVE MANAGEMENT PLAN	1	JOB		
00 05	REPAIR EXISTING LIMESTONE PATH/WALKWAY	1	JOB		
00 06	<u>RB: RAVINE AND BLUFF PLANT COMMUNITY</u>				
00 06 A A	REMOVE INVASIVE TREES AND SELECTIVELY REMOVE OPPORTUNISTIC NATIVE TREES >6" DBH - NO GRUBBING	8	AC		
00 06 A B	REMOVE ALL INVASIVE AND EXOTIC SHRUBS AND TREES <6" DBH - NO GRUBBING	12	AC		
00 06 A C	COVER BANK WITH BIODEGRADABLE EROSION BLANKET	1	AC		
00 06 A D	SELECTIVELY SEED AREAS WITH NATIVE SEED MIX	14	AC		
00 06 A E	PLANT NATIVE PLUGS (COMMERCIAL)	120,000	EA		
00 06 A F	PLANT CONTRACT GROWN NATIVE PLUGS FROM GOVERNMENT PROVIDED SEED	20,000	EA		
00 06 A G	PLANT NATIVE TREES (5 GAL)	50	EA		
00 06 A H	PLANT NATIVE SHRUBS (5 GAL)	500	EA		
00 06 A J	SPOT HERBECIDE INVASIVE SPECIES 5 YEARS FROM APRIL - OCTOBER	14	AC		
00 06 A K	PERFORM PRESCRIBED BURNS (4 BURNS) 6 ACRES EACH YEAR	24	AC		
00 07	PERFORMANCE AND PAYMENT BOND	1	COST		

Total Estimate

9.2 Quantity Takeoff



**US Army Corps
of Engineers**
Chicago District

PROJECT TITLE:
Moraine Park Ravine 10

COMPUTATION TITLE:
Quantities TakeOffs

COMPUTED BY:
Witold Kluza

CHECKED BY:
JG

DATE:
8/22/2019

DATE:
8/22/2019

I. Mob and Demob

Contractor will be a local, within 30 miles from the site.

II. Temporary Construction Facilities

Staging area will be located in the middle of the construction area, just off the sheridan rd (at Moraine Park). It appears area is owned by the city, the grass area will be replaced after the construction is over. There is enough space for the storage/staging.

III. Traffic Control and Maintenance

Contractor will place temporary signs during construction around staging area. Flagman will be necessary. Also, street sweeper might be used during heavy construction only.

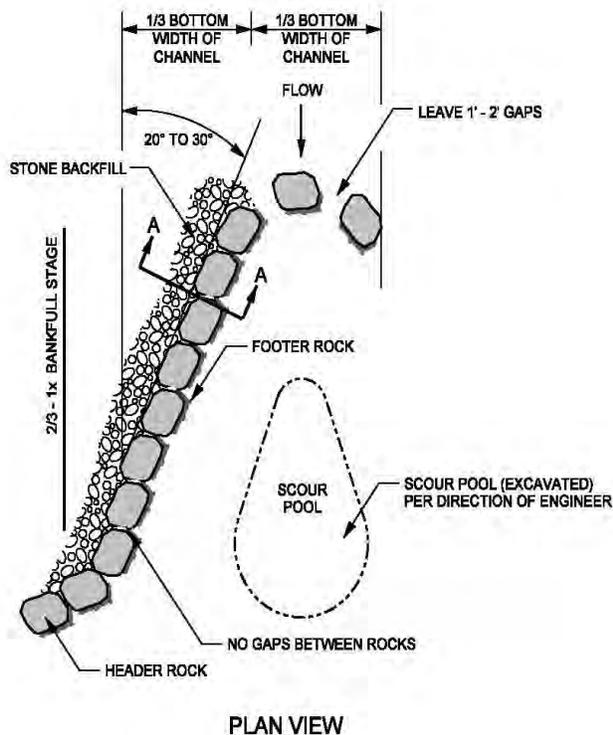
IV. SMC Stream

Debris Removal within channel - based on the site visit photos, broken concrete, loose riprap, clay pipes were located. Majority can be picked up by hand. Material needs to be hauled off site. Assume 10CY per 200ft, total length = 600ft
Gabion Baskets still intact should be left in place. Broken baskets should be just clipped with wire to grade, 250 lf of this condition

Riffle J-hook Installation - assume 10 1-2 ft Dia Boulders at the crest. The channel width is about 15 ft. Assume 2 ft band of soft ball size cobble on both sides of the riffle crest, just one stone layer deep. Assume larger crest boulders, basketball size one, would be bedded down halfway into the existing substrate. There won't be excavation into the banks or key ins. No bedding stone needed. The existing substrates that are being replenished in this ravine is high in gravels and large grain sands.

Stones at Each Riffle			
Thickness of crest =	2.0	FT	
Length of Riffle =	25.0	FT	
Depth of Stone =	2.0	FT	
Volume =	100.0	FT ³	
Smaller Stone 6" Thickness =	0.5	FT	
Width on both sides riffle =	4.0	FT	
Volume =	50.0	FT ³	
Total Stone Volume =	150.0	FT ³	
ASSUME 1.6 TON/CY	8.9	TONS	
EXTRA 20%	11	TONS	EA

Assume 31 Riffle/J-Hooks





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8/22/2019

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IV. SMC Stream Con't

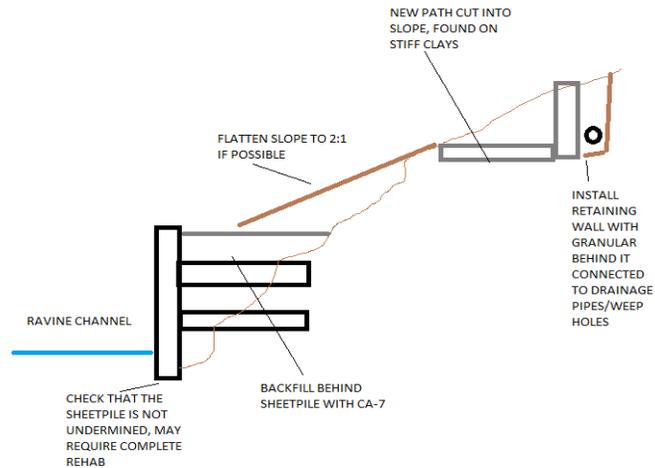
Adaptive Management Plan - assume 20 stones and cobble (10 cu yds).

V. PATH TRAIL

The path trail was added to the design after last site visit, when it was noted that masonry/stone pathway was damaged due to erosion caused by storm runoffs. Without detailed survey and investigation the following assumptions were made:

1. Sheet Pile wall does not have any gaps underneath that would be allowing the material loss behind the wall.
2. Backfill with granular fill to slow the erosion, any larger voids will be filled with fines CA-7.
3. Pathway should be relocated to stiff clay
4. Build Retaining Wall and Install drainage layer behind the retaining wall and weep holes every 10 ft to release the pressure.

Length of Trail	600	ft
Fill Area Behind Ret. Wall	24	ft ²
Slope Grading 2:1	40	ft ²
Fill Behind Sheet Pile Wall	60	ft ²



Volume Granular fill CA-6	14400.0	FT ³
Behind Retaining Wall	533.3	CY
w/ 20% (compact + voids)	640	CY

Volume for Slope Grading	24000	FT ³
	888.89	CY
w/ 20% (compact + voids)	1067	CY

Reuse material from behind retaining wall = 1067 - 640 = 430 CY

Volume for Fill Behind SPW	36000	FT ³
CA-7	1333.33	CY
w/ 20% (compact + voids)	1600	CY



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CHECKED BY:

JG

DATE:

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VI. RB Ravine and Bluff Plant Community

Assume no major slope grading.

Remove Invasive trees - assume 110 per acre. Average DBH 12"

Remove all invasive and Exotic Shrubs and Trees - Provided by PL

Cover Bank with Biodegradable erosion blanket - area provided by PL

Selectively seed areas with Native Seed Mix - assume 120 oz/acre on wooded ravine and bluff slopes.

Plant Native Plugs (commercial) - number of plugs provided by PL

Plant Contract Grown Native Plugs from Government Provided Seeds - provided by PL

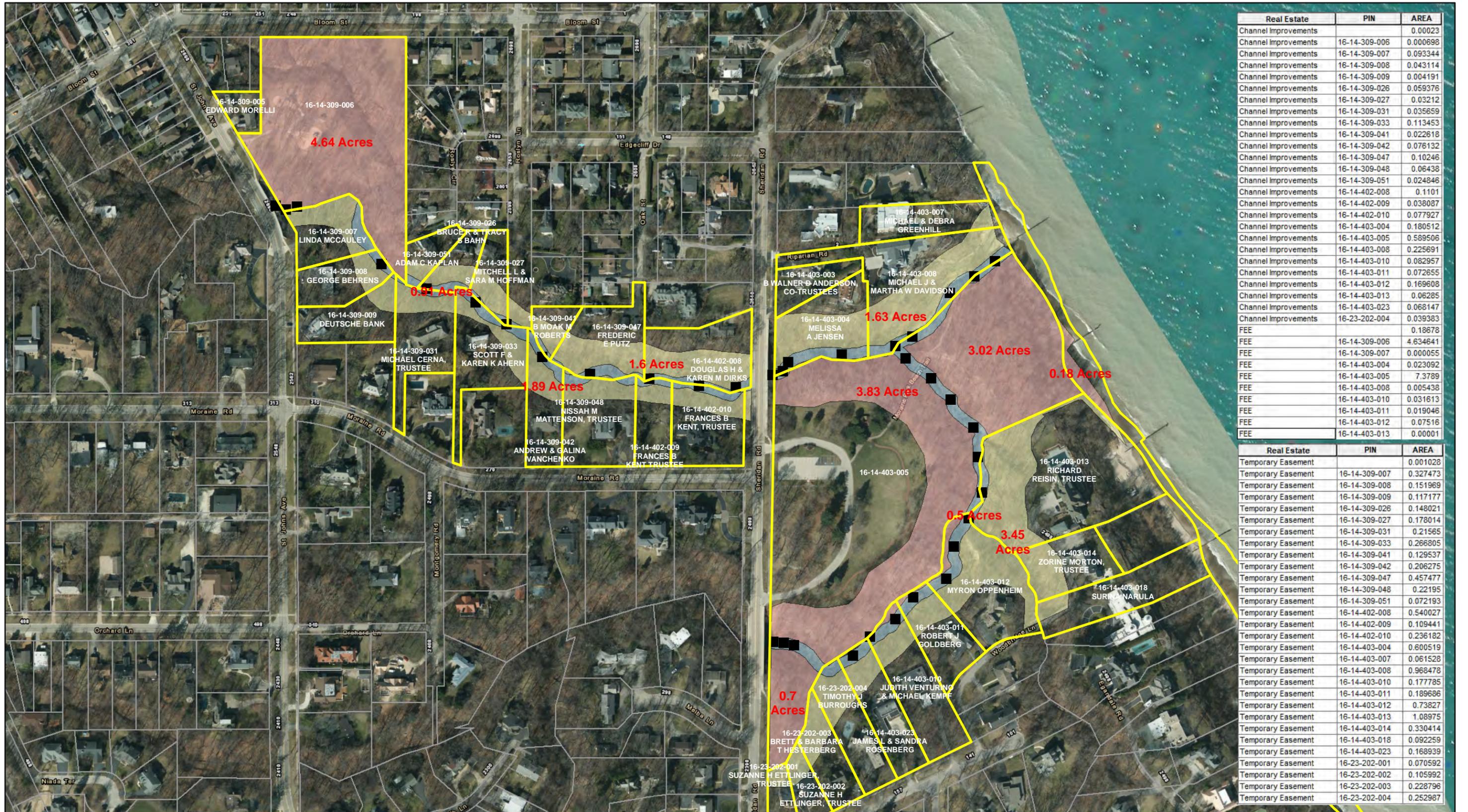
Plant Native Trees (5 Gal) - provided by PL

Plant Native Shrubs (5 Gal) - Provided by PL

Spot Herbicide Invasive Species 5 year - provided by PL

Perform Prescribed Burns (4 burns) 6 acres per year.

9.3 Project Drawings



Real Estate	PIN	AREA
Channel Improvements		0.00023
Channel Improvements	16-14-309-006	0.000698
Channel Improvements	16-14-309-007	0.093344
Channel Improvements	16-14-309-008	0.043114
Channel Improvements	16-14-309-009	0.004191
Channel Improvements	16-14-309-026	0.059376
Channel Improvements	16-14-309-027	0.03212
Channel Improvements	16-14-309-031	0.035659
Channel Improvements	16-14-309-033	0.113453
Channel Improvements	16-14-309-041	0.022618
Channel Improvements	16-14-309-042	0.076132
Channel Improvements	16-14-309-047	0.10246
Channel Improvements	16-14-309-048	0.06438
Channel Improvements	16-14-309-051	0.024846
Channel Improvements	16-14-402-008	0.1101
Channel Improvements	16-14-402-009	0.038087
Channel Improvements	16-14-402-010	0.077927
Channel Improvements	16-14-403-004	0.180512
Channel Improvements	16-14-403-005	0.589506
Channel Improvements	16-14-403-008	0.225691
Channel Improvements	16-14-403-010	0.082957
Channel Improvements	16-14-403-011	0.072655
Channel Improvements	16-14-403-012	0.169608
Channel Improvements	16-14-403-013	0.06285
Channel Improvements	16-14-403-023	0.068147
Channel Improvements	16-23-202-004	0.039383
FEE		0.18678
FEE	16-14-309-006	4.634641
FEE	16-14-309-007	0.000055
FEE	16-14-403-004	0.023092
FEE	16-14-403-005	7.3789
FEE	16-14-403-008	0.005438
FEE	16-14-403-010	0.031613
FEE	16-14-403-011	0.019046
FEE	16-14-403-012	0.07516
FEE	16-14-403-013	0.00001

Real Estate	PIN	AREA
Temporary Easement		0.001028
Temporary Easement	16-14-309-007	0.327473
Temporary Easement	16-14-309-008	0.151969
Temporary Easement	16-14-309-009	0.117177
Temporary Easement	16-14-309-026	0.148021
Temporary Easement	16-14-309-027	0.178014
Temporary Easement	16-14-309-031	0.21565
Temporary Easement	16-14-309-033	0.266805
Temporary Easement	16-14-309-041	0.129537
Temporary Easement	16-14-309-042	0.206275
Temporary Easement	16-14-309-047	0.457477
Temporary Easement	16-14-309-048	0.22195
Temporary Easement	16-14-309-051	0.072193
Temporary Easement	16-14-402-008	0.540027
Temporary Easement	16-14-402-009	0.109441
Temporary Easement	16-14-402-010	0.236182
Temporary Easement	16-14-403-004	0.600519
Temporary Easement	16-14-403-007	0.061528
Temporary Easement	16-14-403-008	0.968478
Temporary Easement	16-14-403-010	0.177785
Temporary Easement	16-14-403-011	0.189686
Temporary Easement	16-14-403-012	0.73827
Temporary Easement	16-14-403-013	1.08975
Temporary Easement	16-14-403-014	0.330414
Temporary Easement	16-14-403-018	0.092259
Temporary Easement	16-14-403-023	0.168939
Temporary Easement	16-23-202-001	0.070592
Temporary Easement	16-23-202-002	0.105992
Temporary Easement	16-23-202-003	0.228796
Temporary Easement	16-23-202-004	0.252987



1 inch = 250 feet

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