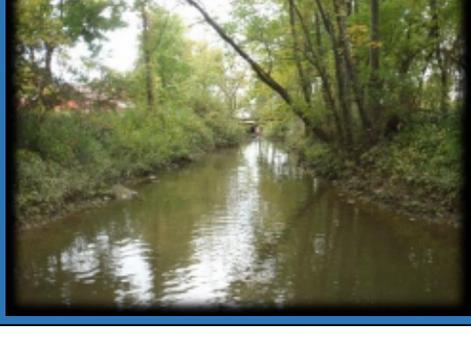


Willow Creek Restoration Potential Study

May 2015



Lorain County
General Health District



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Executive Summary

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Under contract with the Lorain County General Health District, EnviroScience, Inc. completed an analysis of the restoration potential within the Willow Creek subwatershed of the Black River for the Black River Area of Concern Advisory Committee (Black River AOC). The funding for this project was provided by the Black River AOC for the purpose of improving water quality in the Willow Creek watershed. Willow Creek is a tributary to the East Branch of the Black River located mainly within Eaton Township in Lorain County. It is important to acknowledge that, although the majority of the Willow Creek watershed is located in Eaton Township, key stakeholders and representatives from other watershed communities and agencies were active participants in the project's proposal review process and the selection of the contractor, EnviroScience, Inc.

The Willow Creek watershed drains an area of just over 23 square miles and also includes portions of the City of North Ridgeville, Columbia Township, and Grafton Township in Lorain County, and Olmsted Township in Cuyahoga County. A 2012 survey conducted by the Ohio EPA found that the creek is polluted and is not meeting state water quality standards. In addition, county and local officials have noted water quality and flooding problems in the watershed, caused mainly by excessive storm water runoff and erosion as well as poorly treated sewage entering the creek. The project team identified locations within the Willow Creek watershed that may be eligible for future grant funding to conduct stream, wetland, or floodplain restoration. The project team also developed restoration plans for three locations within the watershed as well as budgets for conducting the work.

The project was conducted in four stages: identification of areas with high potential for stream or wetland restoration or preservation using GIS analysis, public involvement, site evaluation and restoration concept development, and restoration plan preparation. During each step of the project, EnviroScience coordinated with the Black River AOC, local officials, and concerned citizens to guide our progress.

The first phase of the project used GIS-based modeling and the review of local data to identify problem areas potentially most in need of restoration. The second phase of the project was the public involvement phase, which included meetings with the technical advisory committee as well as a public shareholder meeting to receive input from local landowners and community officials to identify potential sites for more in-depth study. Once this information was processed and landowner permission was obtained, EnviroScience biologists and restoration experts visited 16 sites to collect the detailed information needed to develop the restoration plans. Of the 16 sites visited, three were chosen for the development of detailed restoration or preservation plans suitable for inclusion in grant applications. This final report includes all of the data collected for use of all stakeholders and watershed communities. A meeting was held with the Black River AOC Advisory Committee on May 4, 2015 to present the findings of the study and the final conceptual restoration plans. A public meeting was held later on the same day to present the information to the public.

Section 1
Introduction

INTRODUCTION

Purpose of the Project

This project was funded by the Black River Area of Concern Advisory Committee through the Lorain County General Health District with the purpose of improving water quality in the Willow Creek watershed of the Black River watershed. The project team, which is comprised of the Lorain County General Health District, the Black River AOC, Eaton Township, and EnviroScience, identified locations within the Willow Creek watershed that may be eligible for future funding to conduct wetland, stream, or floodplain restoration. The project team developed specific restoration and habitat enhancement plans for three areas as well as a budget for conducting the work.

AREA OF FOCUS

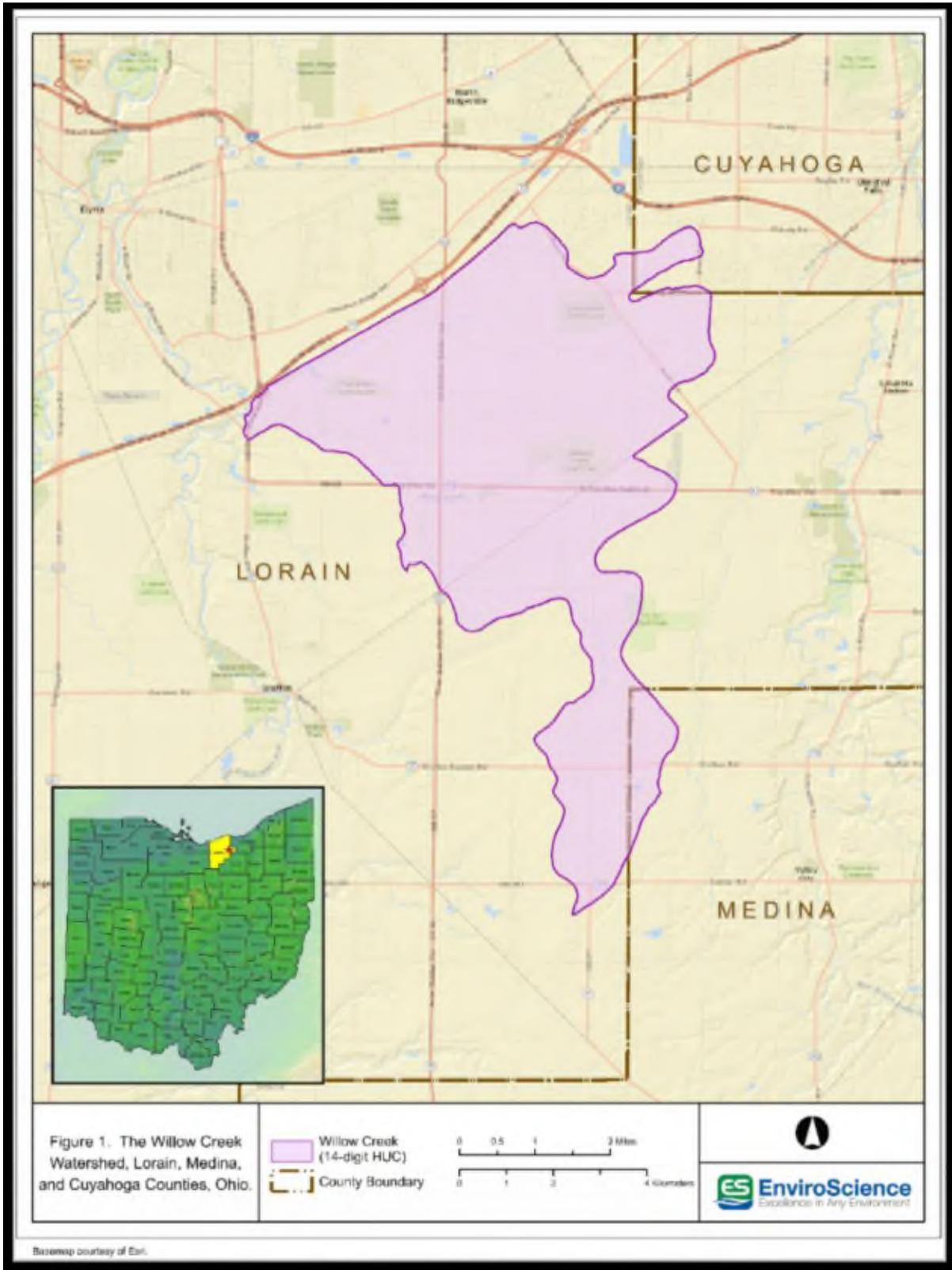
The focus of the study is the Willow Creek watershed. Willow Creek is a tributary to the East Branch of the Black River located mainly within Eaton Township in Lorain County (Figure 1). The Willow Creek watershed drains an area of just over 23 square miles and also includes portions of the City of North Ridgeville, Columbia Township, and Grafton Township in Lorain County, and Olmsted Township in Cuyahoga County.

The Willow Creek watershed is characterized by low topographic relief (Figure 2) with poorly drained soils that are often hydric in nature within lower lying areas between the beach ridges. Hydric soils are poorly and very poorly drained soils that formed in low-lying or restricted drainage areas by standing water and/or saturated soils. They tend to be associated with wetlands, but are generally more extensive and can be found in habitat outside of wetland areas. As a result, these soils present severe limitations for on-site home sewage treatment and are a cause of localized flooding. Many hydric soils are seasonally inundated in the early spring and have saturated soils for only a portion of the growing season. This is sufficient for the soils to develop hydric characteristics, such as anaerobic conditions in the upper parts, and support hydrophytic vegetation.

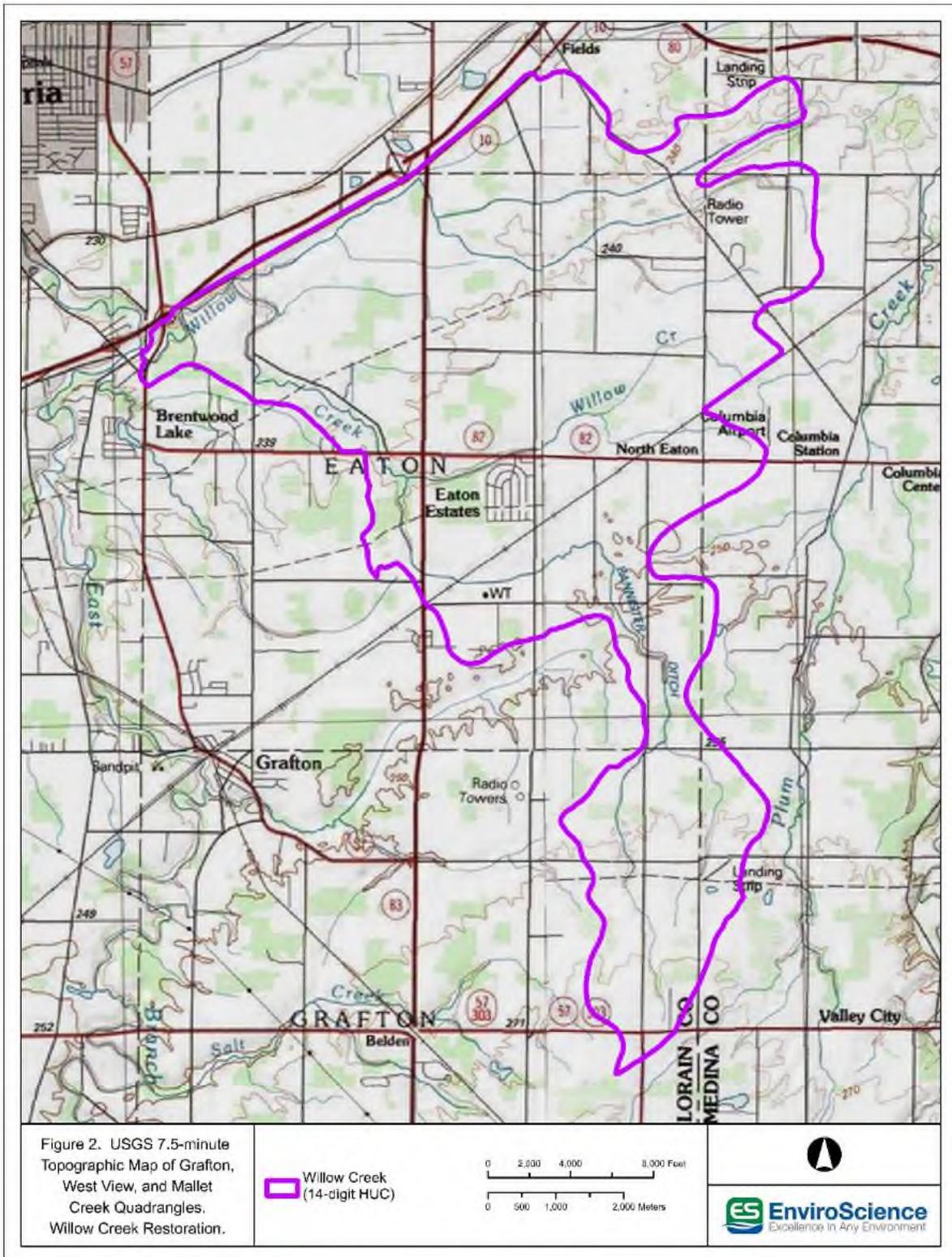
IMPAIRMENT ISSUES WITHIN THE WILLOW CREEK WATERSHED

Ohio EPA completed habitat evaluations and biological sampling at two sites on the mainstem of Willow Creek in 2012. These evaluations showed that Willow Creek is in non-attainment of its Warm Water Habitat (WWH) use designation. It was determined that throughout the Willow Creek watershed, habitat alternation from channelization and riparian removal has created a mode of continual degradation. In addition, flooding problems in the area are caused mainly by excessive storm water runoff and erosion.

INTRODUCTION



INTRODUCTION



Basemap courtesy of National Geographic Society (2013).

INTRODUCTION

The existing water quality and habitat impairments in the Willow Creek watershed indicate ongoing legacy impacts and a poor functional state over a majority of the watershed. This situation will not improve without significant efforts to restore critical water resources.

Low-gradient streams are often heavily modified, especially in agricultural areas. The goal of these modifications is often to transport a higher volume of water offsite as a result of the modifications. These channel modifications, such as ditching and channel straightening, result in streams with insufficient energy to move silt and clay substrates. The entrenchment of streams through these activities also isolates the stream from the adjacent floodplain by increasing the vertical separation between stream bed and floodplain. This reduces flood storage, causes stormwater to be transported downstream at increased rates, and increases flood volumes downstream. Over time, the accumulation of sediment within the channel alters flows and causes streambank instability that can result in further sediment deposition within the stream. These sediment deposits bury larger stream substrate materials, such as rocks and boulders, which are important habitat for aquatic life in the stream. The resulting degradation of habitat features impact fish and macroinvertebrate populations and cause a reduction in species diversity.

PROJECT GOALS

One of the goals of this project was to evaluate various streams and associated natural areas within the Willow Creek watershed and to provide information on wetland and stream restoration opportunities that may be eligible for future funding. If implemented, the restoration projects will improve water quality and reduce flooding in the basin.

A second goal of this project was to develop conceptual plans for specific restoration and enhancement projects for various stream segments within the Willow Creek watershed as well as a budget for conducting the work.

PROJECT APPROACH

This project was conducted in various phases to identify potential sites for restoration and enhancement projects, with the ultimate goal of locating three to five sites for final consideration and planning. The different phases that were incorporated into the project are:

- Kickoff meeting with stakeholders
- GIS Data Collection/Modeling
- Site Selection Meeting
- Initial Public Meeting
- Landowner Coordination
- In-Field Site Evaluation
- Restoration Site Selection Meeting
- In-Field Restoration Site Evaluation
- Conceptual Plan Preparation
- Draft Report Development
- Draft Report Meeting
- Final Report Development

Section 2
Project Implementation

PROJECT IMPLEMENTATION

GIS DATA COLLECTION/ MODELING, LITERATURE REVIEW AND PRELIMINARY SITE IDENTIFICATION.

The first step of the project was to use available existing GIS resources to identify areas within the Willow Creek watershed with high potential for restoration. Sources utilized included the 2012 Eaton Township Comprehensive Land Use Plan, Ohio EPA data, U.S. Geological Survey (USGS) topographic maps, National Wetlands Inventory (NWI) maps, County Soil Survey, Flood Insurance Rate Maps (FIRM), and the Ohio Department of Natural Resources' (ODNR) Biodiversity database. Data from the literature review were then placed into a weighted GIS model to identify sites for further evaluation for restoration opportunities. The model used was modified from a similar effort that was developed for the Maumee River Basin. The weighting allows the different attributes to be given different values based on their restoration importance and distance from Willow Creek. The model weighed the previously mentioned attributes along with any cultural resources, parcel size, slope, existing canopy cover, land uses, presence of impervious cover, historic contamination issues, and distance from Willow Creek or its tributaries. Metrics used for generating these relative restoration and preservation models for this project are summarized in Table 1.

Table 1. GIS Weighting Models for the Willow Creek Restoration Screening for Wetlands (Large Habitat) and Streams (Riparian)

	Large Habitat Model		Riparian Model	
	Maumee	Willow Creek	Maumee	Willow Creek
Impervious Cover	20%	25%	---	---
Land Cover	20%	25%	13%	14%
Management	17%	Note a	4%	Note a
Parcel Size	15%	20%	4%	4%
Floodplain	6%	8%	22%	24%
River/Ditch	6%	8%	35%	36%
Rare Species	6%	Note b	---	---
Woodlots	10%	14%	9%	9%
Canopy	---	---	9%	9%
Soils	---	---	4%	4%
Total	100%	100%	100%	100%

Note a. No managed conservation lands reported for the watershed by Lorain Metroparks or WRLC.

Note b. Data regarding rare and endangered species not yet received from ODNR Natural Heritage Database.

PROJECT IMPLEMENTATION

As a result of this model approach, the Willow Creek watershed was assigned restoration potential for habitat and riparian restoration opportunities. Figures 3 and 4 identify the results of the weighted model.

For the Large Habitat Restoration Potential Model, the areas identified as dark-purple represent those areas with greatest potential for restoration based on the attributes identified above. For Riparian Restoration Potential, the areas identified in dark-blue represent those areas of the watershed that have the greatest potential for restoring riparian areas along streams.

SITE SELECTION MEETING

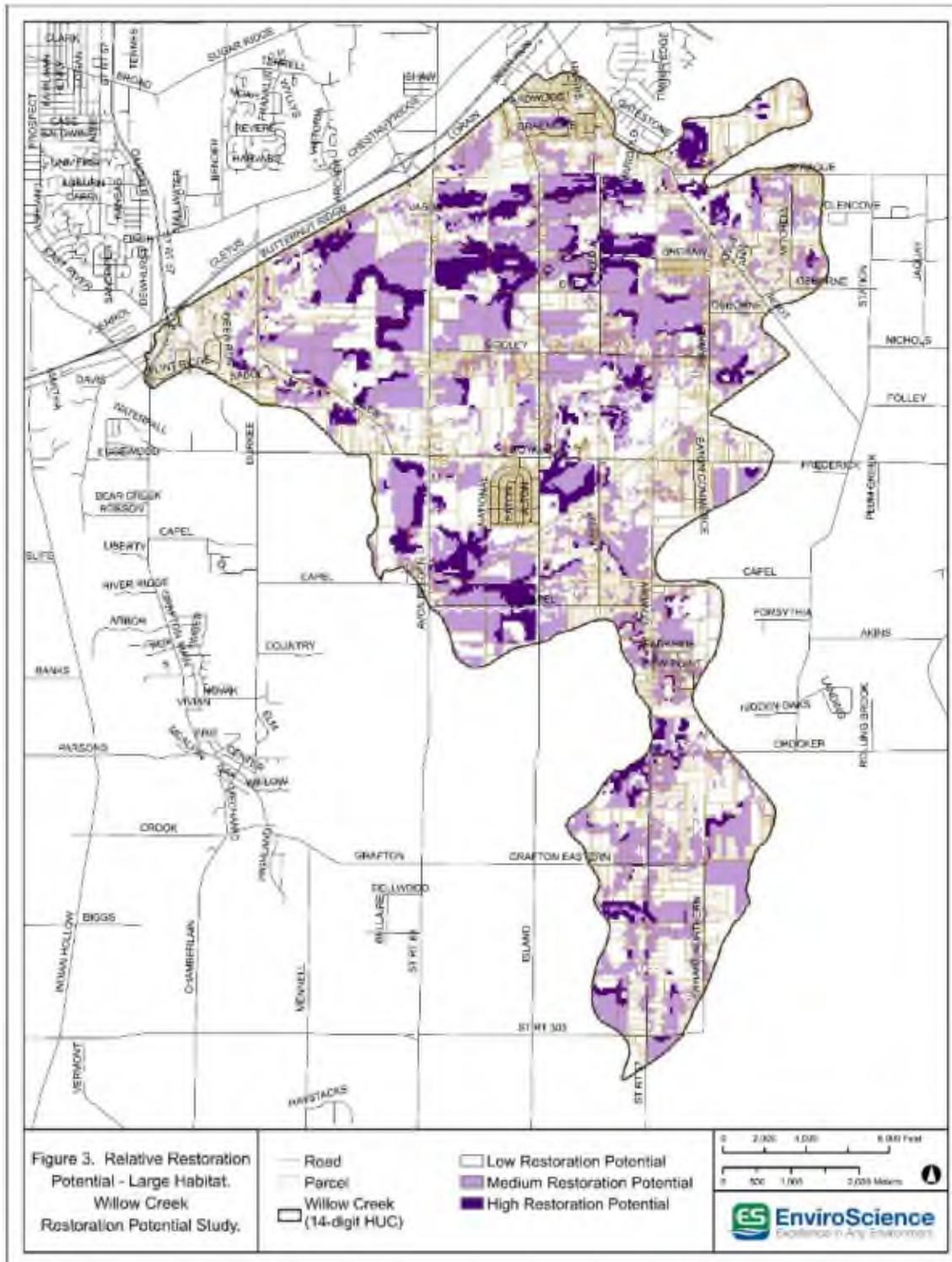
The results of the potential site selection and any additional findings made during the modeling process were presented to the Black River AOC Advisory Committee and stakeholders during a meeting on June 9, 2014. The meeting was to select sites for further investigation with respect to their restoration potential. This meeting provided a forum for discussion of each site's positive and negative attributes, including ecological potential and possible landowner coordination issues. The EnviroScience GIS model was reviewed and potential sites for investigation were discussed. The sign in sheet from the meeting is provided in Appendix A.

INITIAL PUBLIC MEETING AND LANDOWNER COORDINATION

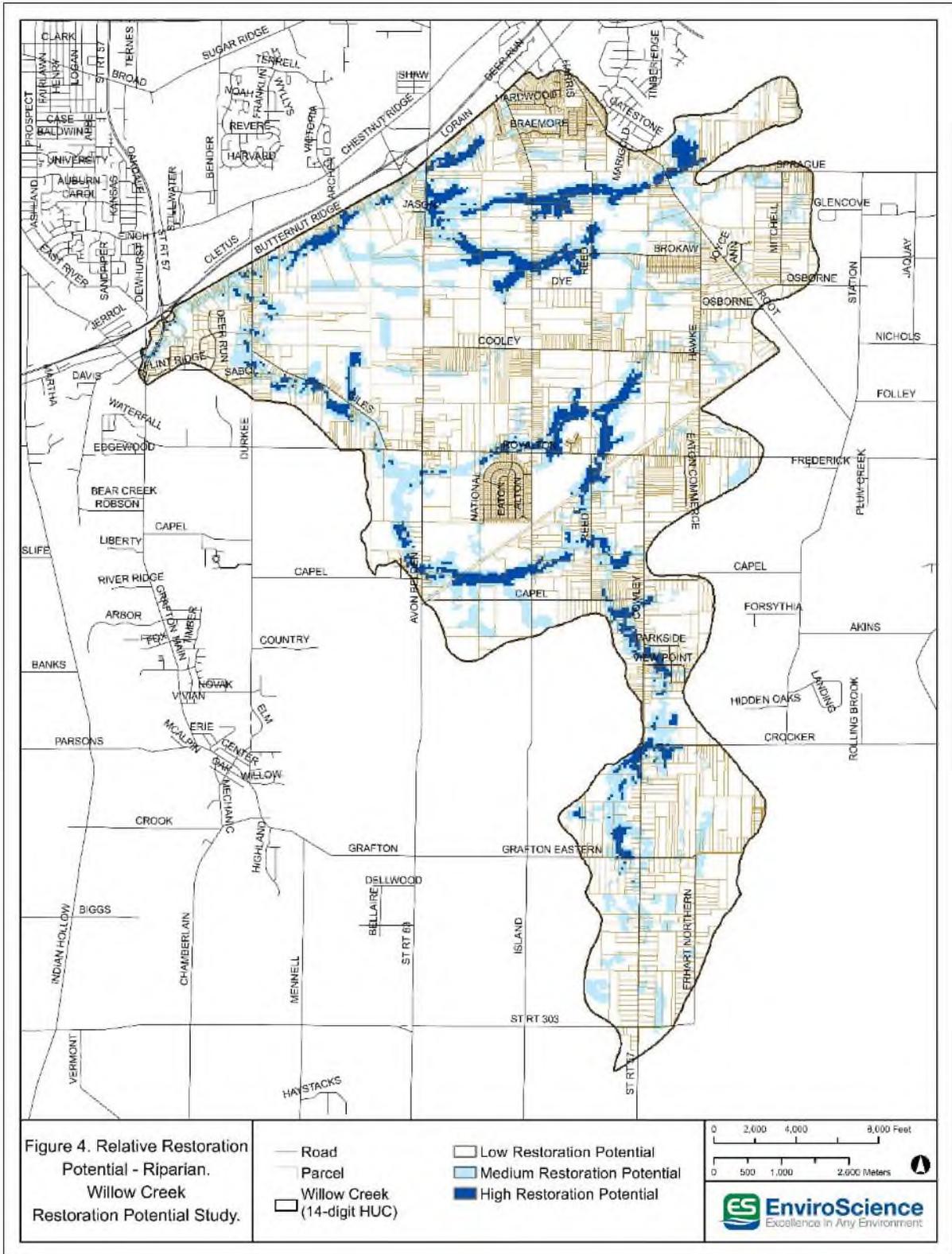
Following the site selection meeting, an initial meeting was held on June 18, 2014 to present information to the public and landowners interested in participating in the project. The meeting was held to allow for efficient collection of information about landowner interest, and to provide the public the opportunity to provide input on the selected sites. This enables the public to take a sense of ownership of the process, which can lead to greater participation. The sign in sheet from the meeting is provided in Appendix A.

Additional landowners were contacted to solicit interest in participation. The Black River AOC Advisory Committee and various stakeholders helped in the process to establish contact with the landowners. Written permission was received from the landowner in the form of a signed card or email prior to performing work on their property. Based on screening of the GIS model data, the outcome of the public meeting, and a mailing used to contact additional property owners, seventy-five (75) properties were identified as candidate sites.

PROJECT IMPLEMENTATION



PROJECT IMPLEMENTATION



FIELD EVALUATION OF PRELIMINARY SITES

A secondary screening of the seventy-five land parcels was conducted for restoration and enhancement activities. Based on this desktop review, twenty (20) sites were selected for additional field studies.

On eight separate days during the period covering August 28 through October 29, 2014, field evaluations of the twenty sites were conducted to determine the best opportunities for restoration or enhancement activities. The criteria used to evaluate the twenty sites were:

- stream habitat evaluations using the QHEI and/or HHEI,
- stream morphology cross section measurements,
- Bank Erosion Hazard Index (BEHI) assessment,
- riparian/vegetative assessment
- identification of the presence of wetlands possible wetlands,
- impairment recognition
- restoration feasibility and potential
- land owner comments/concerns
- positive and negative characteristics for each site.

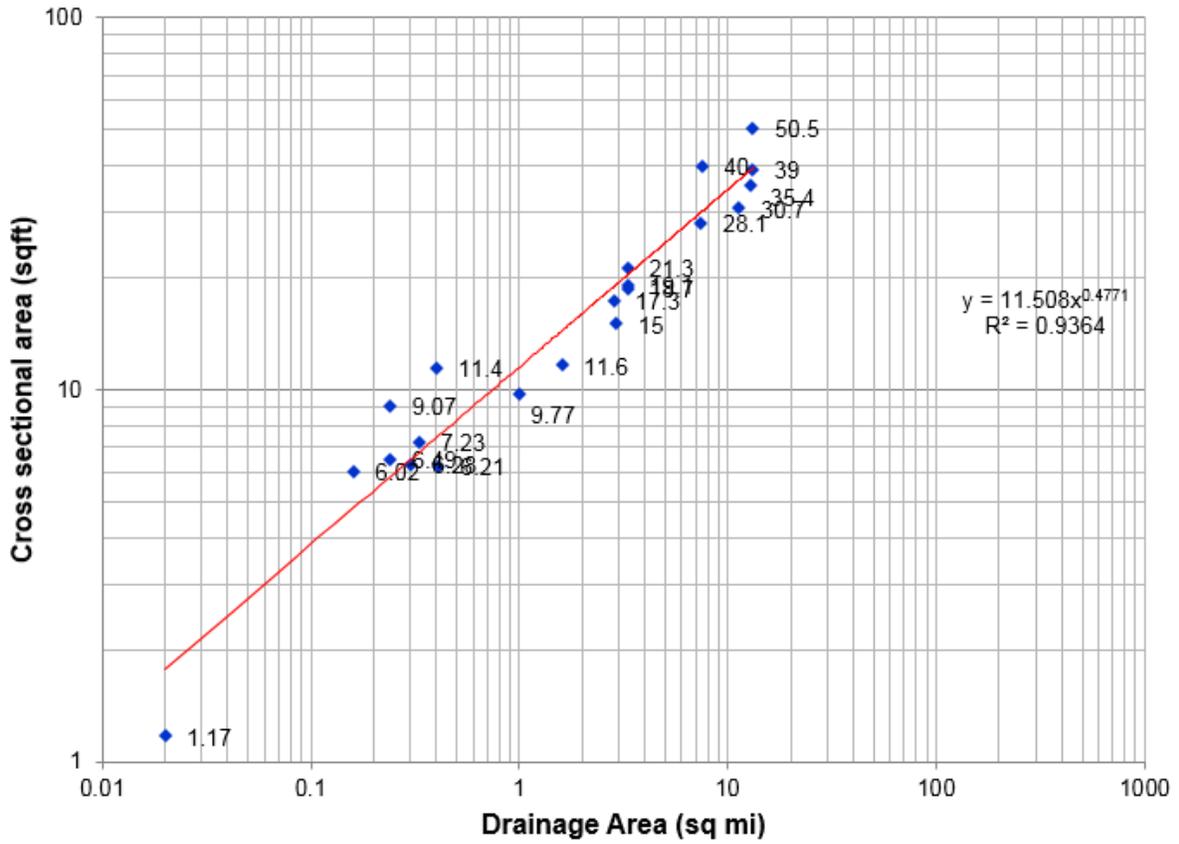
An important component of this evaluation was possible floodplain expansion and wetland construction, and the effect of those actions to alleviate some of the problems that the watershed has been experiencing. The collection of stream cross-sections enabled generation of a specific regional curve from our site assessment data.

A regional curve is a calculated mathematical relationship between a watershed's area and stream hydraulic characteristic such as bankfull width, mean depth, and cross-sectional area. These formulas are often used to calculate the proper dimensions for a stream channel for a watershed of given size. Properly sized stream channels are important for stability in the system, as an improperly sized stream channel can lead to excessive erosion of the stream banks or increased sedimentation problems within the channel. Properly sized stream channels and floodplains are in balance, and transport water and sediment without significant erosion or depositional problems. This in turn improves in-stream habitat and water quality. As more data are collected within the watershed, the regional curve equation can be refined to be improve its accuracy and better predict the proper dimensions. The regional curve that was developed for the Willow Creek watershed in this project is shown in Figure 5.

From the field survey, eighteen (18) of the twenty sites were selected for further consideration. The eighteen sites selected for further evaluation are listed in Table 1.

PROJECT IMPLEMENTATION

Figure 5. Specific Regional Curve for the Willow Creek Watershed, 2015



PROJECT IMPLEMENTATION

Table 2. Eighteen Sites Selected for Additional Evaluation. All lengths expressed are in linear feet. Afp denotes adjusted floodprone acreage along the stream channel as a measurement of floodplain connectivity.

Location	Characteristic	Summary Condition	Existing Condition	Proposed Condition
Dawley Ditch @ CME Property Upper Latitude: 41.3253; Longitude: -82.02499	Watershed Area (mi ²)	1.00		
	Valley Length	602		
	Channel Length		637	700
	Net Increase (l.f.)	83		
	Afp (acres)		0.17	0.57
	% Target		10.4%	34.3%
	Net Increase (acres)	0.40		
Storage Delta (ac ft)	0.70			
Dawley Ditch @ CME Property Lower Latitude: 41.32232; Longitude: -82.03343	Watershed Area (mi ²)	1.50		
	Valley Length	2,620		
	Channel Length			3,130
	Net Increase (l.f.)	3,130		
	Afp (acres)			2.47
	% Target			34.3%
	Net Increase (acres)	2.47		
Storage Delta (ac ft)	3.04			
Dawley Ditch near Mouth XS1 Latitude: 41.32041; Longitude: -82.03375	Watershed Area (mi ²)	1.60		
	Valley Length	173		
	Channel Length		180	190
	Net Increase (l.f.)	10		
	Afp (acres)		0.07	0.16
	% Target		19.4%	45.1%
	Net Increase (acres)	0.09		
Storage Delta (ac ft)	0.17			
Willow Creek DWS Dawley Latitude: 41.32016; Longitude: -82.03435	Watershed Area (mi ²)	12.90		
	Valley Length	783		
	Channel Length		1,035	
	Net Increase (l.f.)	0		
	Afp (acres)		0.53	0.94
	% Target		16.2%	29.0%
	Net Increase (acres)	0.42		
Storage Delta (ac ft)	0.78			
Willow Creek UPS Dawley	Watershed Area (mi ²)	11.30		
	Valley Length	425		
	Channel Length		456	456
	Net Increase (l.f.)	0		
	Afp (acres)		0.25	0.47
	% Target			26.4%
	Net Increase (acres)	0.22		
Storage Delta (ac ft)	0.43			
Fortune Ditch UPS XS1 Latitude: 41.34577; Longitude: -82.033142	Watershed Area (mi ²)	7.43		
	Valley Length	1,049		
	Channel Length		1,063	1,123
	Net Increase (l.f.)	60		
	Afp (acres)		0.60	1.74
	% Target		22.6%	65.5%
	Net Increase (acres)	1.14		
Storage Delta (ac ft)	1.56			

PROJECT IMPLEMENTATION

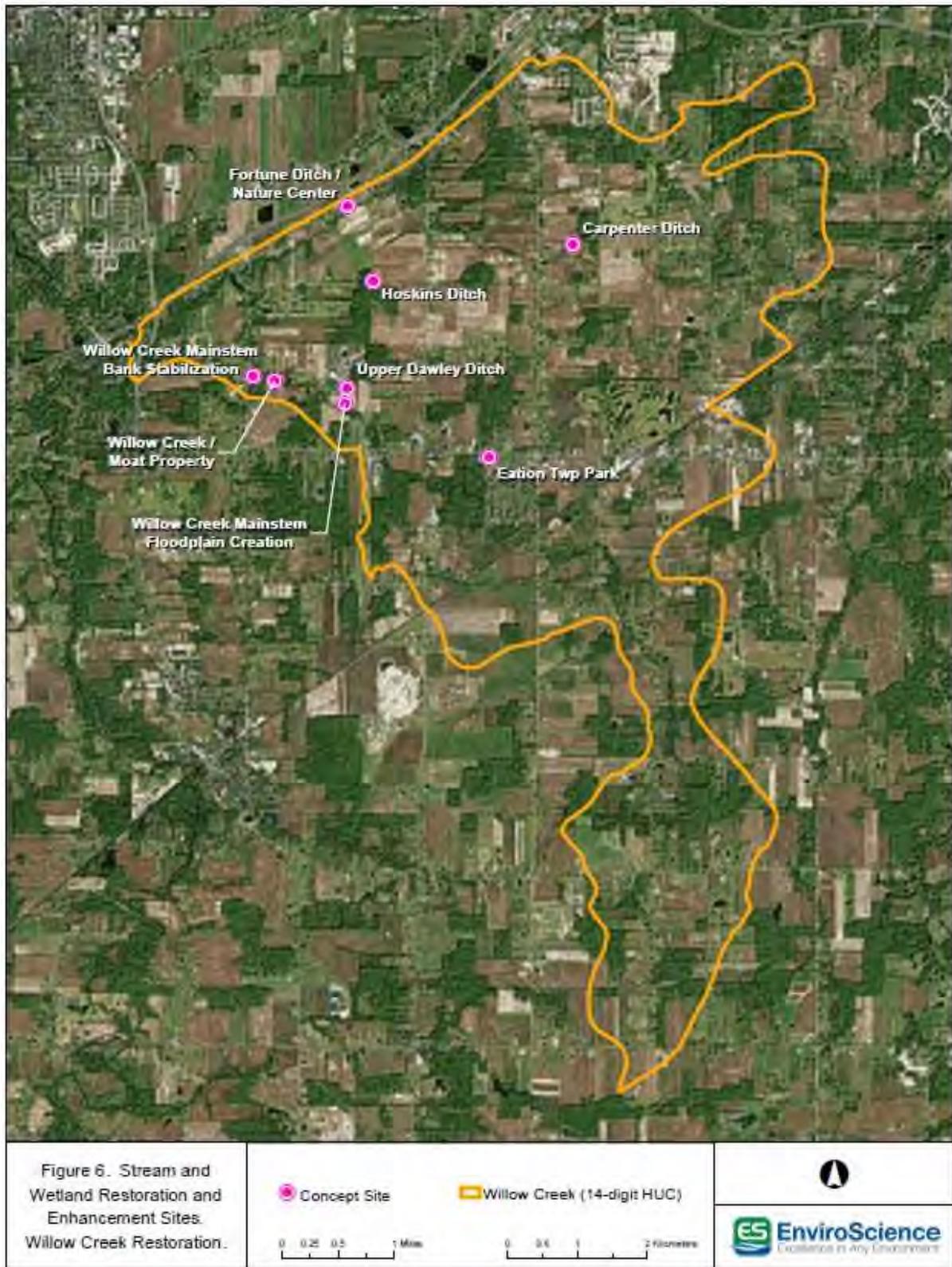
Location	Characteristic	Summary Condition	Existing Condition	Proposed Condition
Fortune Ditch DWS XS3 Latitude:41.34476; Longitude: 82.034773	Watershed Area (mi ²)	7.50		
	Valley Length	556		
	Channel Length		655	655
	Net Increase (l.f.)	0		
	Afp (acres)		0.77	0.99
	% Target		26.5%	34.0%
	Net Increase (acres)	0.22		
	Storage Delta (ac ft)	0.58		
North Fortune Trib. XS9	Valley Length	1,909		
	Channel Length		1,910	2,400
	Net Increase (l.f.)	490		
	Afp (acres)		0.39	3.52
	% Target		9.8%	87.9%
	Net Increase (acres)	3.12		
	Storage Delta (ac ft)	0.94		
North Fortune Trib. XS7 Latitude: 41.3400; Longitude: 82.0326	Watershed Area (mi ²)	0.41		
	Valley Length	695		
	Channel Length		727	870
	Net Increase (l.f.)	143		
	Afp (acres)		0.14	1.27
	% Target		9.8%	87.4%
	Net Increase (acres)	1.13		
Hoskins Ditch XS6	Watershed Area (mi ²)	0.35		
	Valley Length	773		
	Channel Length		773	900
	Net Increase (l.f.)	127		
	Afp (acres)		1.93	2.48
	% Target		127.8%	164.3%
	Net Increase (acres)	0.55		
Hoskins Ditch XS5	Watershed Area (mi ²)	0.35		
	Valley Length	809		809
	Channel Length		820	900
	Net Increase (l.f.)	80		
	Afp (acres)		0.17	2.01
	% Target		10.8%	131.5%
Hoskins Ditch XS3 Latitude: 41.33608; Longitude: -82.02884	Watershed Area (mi ²)	0.39		
	Valley Length	940		
	Channel Length		949	1,035
	Net Increase (l.f.)	86		
	Afp (acres)		2.03	2.35
	% Target		63.1%	73.1%
	Net Increase (acres)	0.32		
Trib. to Hoskins Ditch	Storage Delta (ac ft)	1.04		
	Watershed Area (mi ²)	0.07		
	Valley Length	1,013		
	Channel Length		1,071	1,090
	Net Increase (l.f.)	19		
	Afp (acres)		0.22	0.49
	% Target		10.0%	22.5%
	Net Increase (acres)	0.27		
	Storage Delta (ac ft)	0.36		

PROJECT IMPLEMENTATION

Location	Characteristic	Summary Condition	Existing Condition	Proposed Condition
Carpenter Ditch Trib. Latitude: 41.34065; Longitude: -81.99467	Watershed Area (mi ²)	0.24		
	Valley Length	556		
	Channel Length		574	630
	Net Increase (l.f.)	56		
	Afp (acres)		0.17	2.10
	% Target		14.9%	180.3%
Carpenter Ditch UPS XS2	Watershed Area (mi ²)	2.60		
	Valley Length	700		
	Channel Length		705	800
	Net Increase (l.f.)	95		
	Afp (acres)		0.30	1.06
	% Target		10.8%	37.7%
Carpenter Ditch DWS XS1 Latitude: 41.3387; Longitude: -82.00001	Watershed Area (mi ²)	2.94		
	Valley Length	779		
	Channel Length		780	820
	Net Increase (l.f.)	40		
	Afp (acres)		0.48	0.89
	% Target		16.8%	31.1%
	Net Increase (acres)	0.41		
Storage Delta (ac ft)	0.36			
Willow Creek at Moat Property Latitude: 41.3233; Longitude: -82.04581	Watershed Area (mi ²)	13.10		
	Valley Length	560		
	Channel Length		660	660
	Net Increase (l.f.)	0		
	Afp (acres)		0.47	0.80
	% Target		17.5%	30.1%
	Net Increase (acres)	0.33		
Storage Delta (ac ft)	0.42			
Willow Creek Twp. Park Typical	Watershed Area (mi ²)	13.10		
	Valley Length	817		
	Channel Length		850	950
	Net Increase (l.f.)	100		
	Afp (acres)		0.40	1.09
	% Target		12.1%	32.6%
	Net Increase (acres)	0.68		
Storage Delta (ac ft)	0.94			

After the completion of all the site evaluations, the data was summarized and the sites ranked based upon the identified site impairments and their potential for restoration. Eight (8) preliminary restoration, enhancement, and preservation scenarios were developed as a result of this effort. The project site locations are shown on Figure 6. The eight scenarios are identified and described in Tables 3 through 10, and Figures 7 through 14. The tables and figures represent preliminary restoration concepts for the eight selected sites.

PROJECT IMPLEMENTATION



PROJECT IMPLEMENTATION

Table 3. Fortune Ditch Restoration

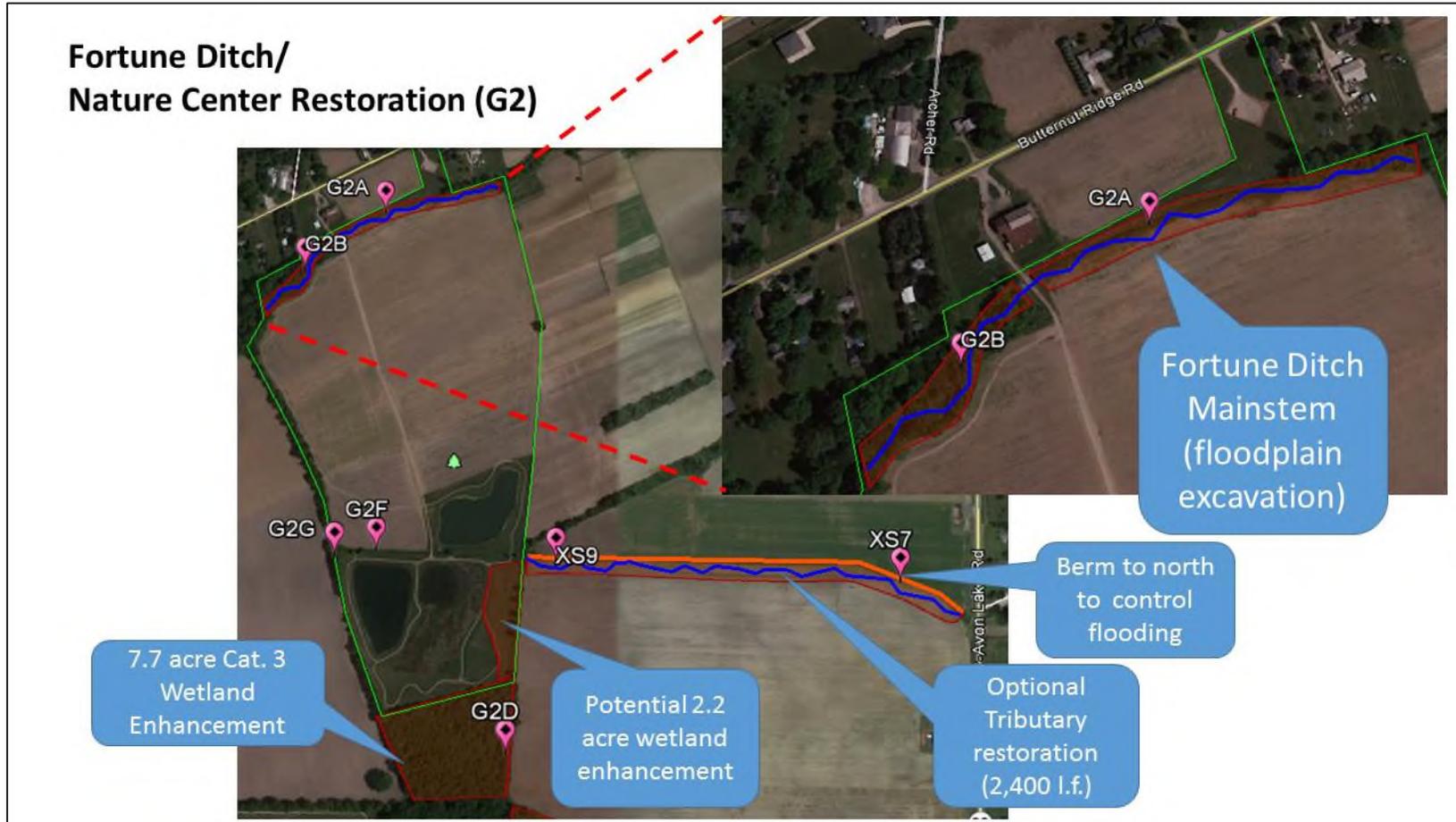
Project Rank	Property Owner	Location	Evaluation Sites
1 (75 pts)	Eaton Township	Eaton Twp Nature Center, Butternut Ridge Rd.	G2A, G2B (optional G2F)
Approach	Benefits	Project Summary	Options
<ul style="list-style-type: none"> • Floodplain creation (excavation) • Habitat (wetland and stream) enhancement • Riparian planting 	<ul style="list-style-type: none"> • Improved flood storage • Improved habitat for aquatic life • Nutrient reduction • Pathogen reduction • Reduced suspended sediments 	<ul style="list-style-type: none"> • Restoration of approximately 1,700 - 1,900 l.f. of stream via floodplain creation and channel rehabilitation. • Extension of the stream channel by approximately 100 - 200 l.f.¹ • Floodplain created via excavation • Improve habitat quality from a rating of Fair to Good • Re-establishment of a wooded riparian corridor • Expansion of functional floodplain area by 2.5 – 3.0 acres • Additional flood storage capacity of approximately 2.1 – 2.2 acre ft.² • Enhancement of 7.7 acres of Category 3 wetland • Enhancement of 2.2 acres of Category 2 wetland. 	<ul style="list-style-type: none"> • Restoration of 2,400 l.f. of tributary ditch located on the northern boundary of the Ross Picket properties. • Net extension of the stream channel by approximately 500 l.f. • Creation of approximately 4.25 acres of functional floodplain • Additional flood storage capacity of approximately 1.1 acre ft. • Minimal habitat benefit of this option (limited by stream size and isolation of the stream reach from the rest of the watershed) • This option by itself ranks #7 (60 pts) • Removal of this option from the project does not change the ranking of the Fortune Ditch mainstem restoration project

¹ Linear Feet

² One acre foot = a foot of water covering a 1 acre area or 325,851.4 gallons

PROJECT IMPLEMENTATION

Figure 7. Proposed Fortune Ditch Nature Center Restoration



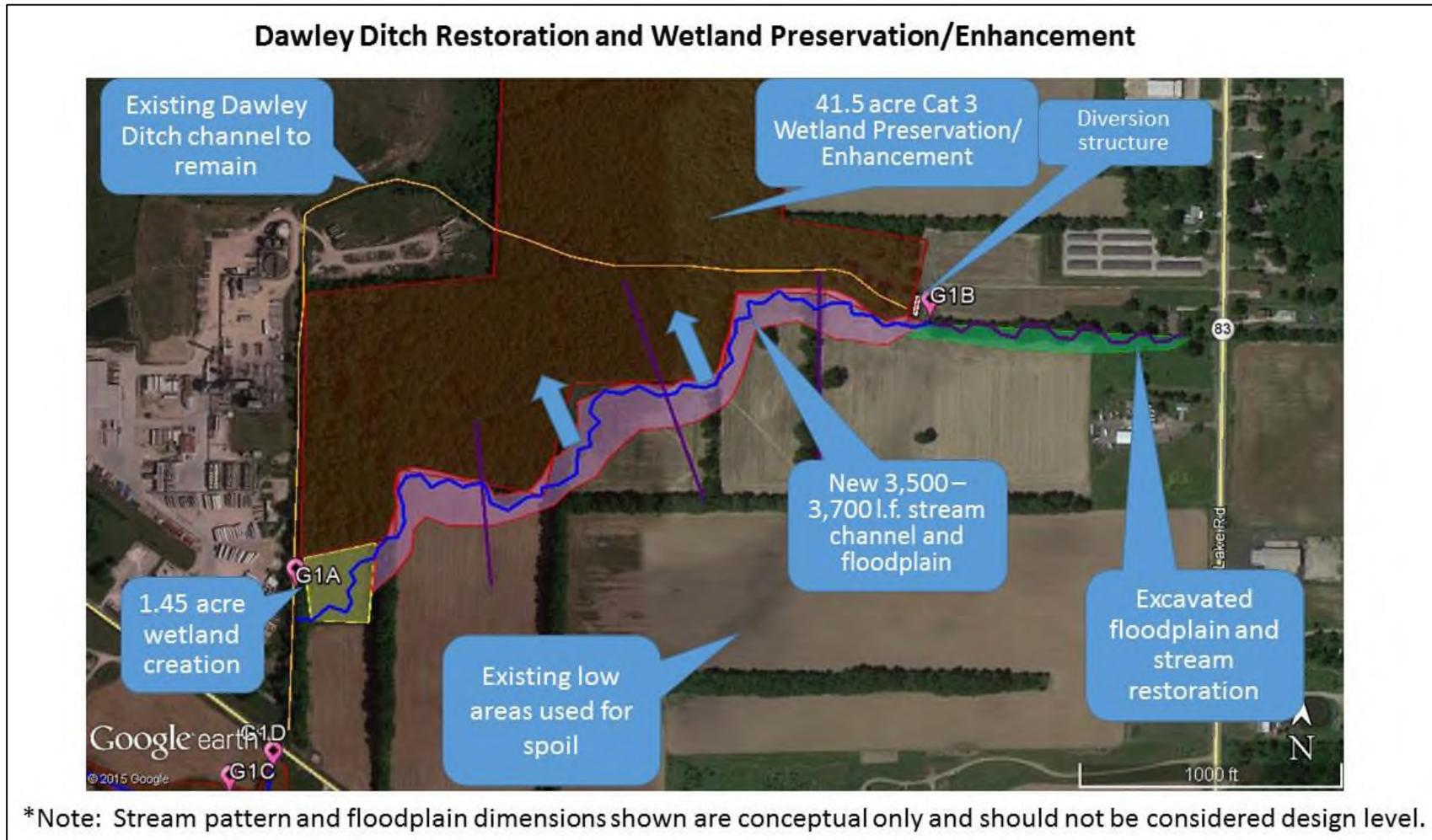
PROJECT IMPLEMENTATION

Table 4. Upper Dawley Ditch Restoration and Wetland Enhancement

Project Rank	Property Owner	Location	Evaluation Sites
2 (71.25 pts)	CME and Split Rail Properties (Ross)	North of Giles Rd., West of S.R. 83	G1A, G1B
Approach	Benefits	Project Summary	Options
<ul style="list-style-type: none"> • Stream channel creation (diversion and channel construction) • Floodplain creation (excavation) • Wetland hydrology enhancement • Wetland preservation • Habitat enhancement (stream and wetland) • Riparian planting 	<ul style="list-style-type: none"> • Creation of new flood storage areas • Improved habitat for aquatic life • Improved drainage pattern to forested wetland • Nutrient reduction • Pathogen reduction • Reduced suspended sediments 	<ul style="list-style-type: none"> • Preservation of approximately 41.5 acres of Category 3 (forested) wetland • Creation of approximately 3,300 l.f. of stream channel via diversion of existing ditch and floodplain creation • Restoration of approximately 600 l.f. of the upstream reach of Dawley Ditch by floodplain excavation and stream channel restoration • Improvement of stream habitat performance from Poor to Fair/Good • Enhancement of wetland ecosystem through the creation of vernal pools • Improve wetland hydrology through the re-routed stream design • Establishment of a wooded riparian corridor along new and restored stream • Expansion of functional floodplain area by 4+ acres • Additional flood storage capacity of approximately 3.0 acre ft. • Existing ditch downstream of the diversion left unchanged • Spoil used to raise grade in other flood risk areas of property 	<ul style="list-style-type: none"> • Plans can be modified to accommodate future development plans with minimal disturbance to usable acreage and roadway needs • Options may be explored with respect to the outlet of the created stream channel to minimize requirements for excavation along the lower reach.

PROJECT IMPLEMENTATION

Figure 8. Dawley Ditch Restoration and Wetland Preservation/Enhancement



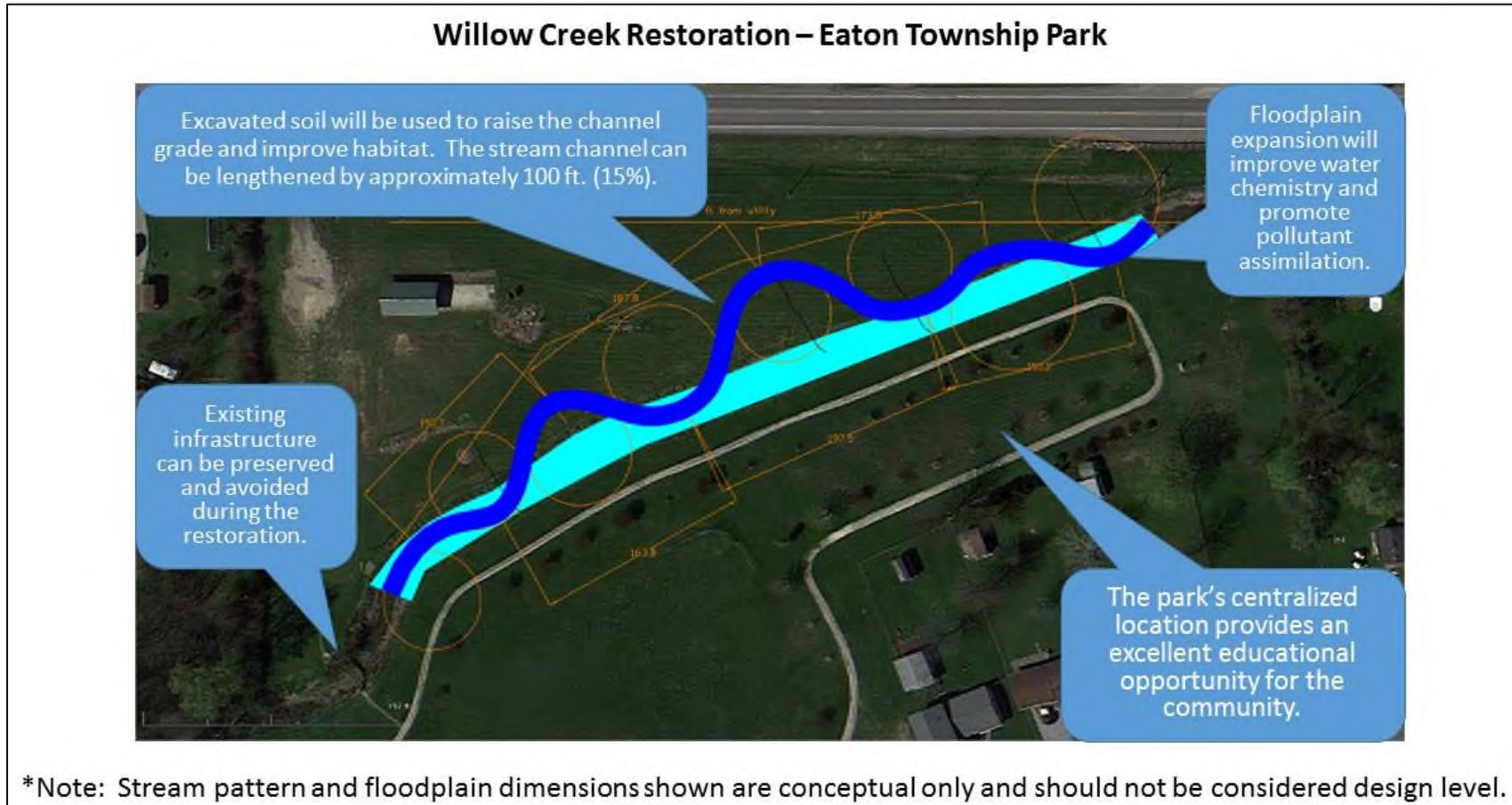
PROJECT IMPLEMENTATION

Table 5. Eaton Township Park Willow Creek Stream Restoration

Project Rank	Property Owner	Location	Evaluation Sites
3 (69.2 pts)	Eaton Township	S.R. 82 East of S.R. 83 (Eaton Estates)	G9A
Approach	Benefits	Project Summary	Options
<ul style="list-style-type: none"> • Stream channel restoration (raise grade hybrid approach) • Floodplain creation (excavation) • Stream habitat enhancement • Riparian Planting 	<ul style="list-style-type: none"> • Improved flood storage • Improved habitat For aquatic life • Nutrient reduction • Pathogen reduction • Reduced suspended Sediments • Control of bank erosion • Enhanced aesthetics for the park 	<ul style="list-style-type: none"> • Restoration of approximately 900 -1,100 l.f. of Warmwater Habitat stream channel via a combination of raising the grade of the stream and floodplain excavation • Establishment of a natural riparian corridor along the restored stream through plantings • Expansion of functional floodplain area by 0.65 – 0.70 acres • Additional flood storage capacity of approximately 0.9 - 1.0 acre ft. 	No additional options evaluated

PROJECT IMPLEMENTATION

Figure 9. Willow Creek Restoration - Eaton Township Park

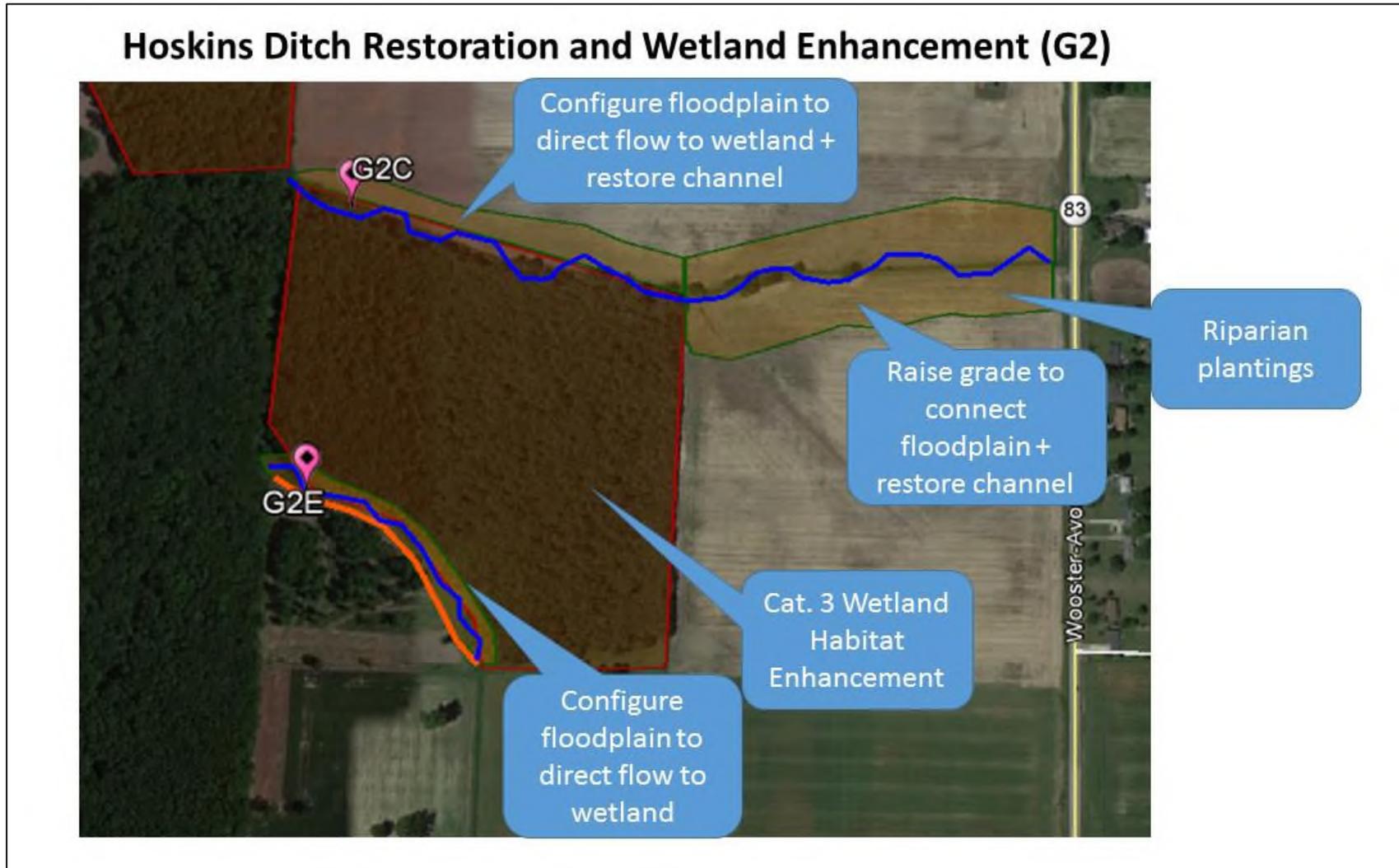


PROJECT IMPLEMENTATION

Table 6. Hoskins Ditch Restoration and Wetland Enhancement

Project Rank	Property Owner	Location	Evaluation Sites
4 (68.75 pts)	Picket and CME Properties (Ross)	West of S.R. 83, Mid-way Between SR 82 and Butternut Ridge Rd	G2C, G2E
Approach	Benefits	Project Summary	Options
<ul style="list-style-type: none"> • Stream channel restoration (raise grade hybrid approach) • Floodplain creation (excavation) • Stream Habitat Enhancement • Riparian planting • Wetland hydrology enhancement • Wetland preservation • Habitat enhancement (stream and wetland) • Riparian planting 	<ul style="list-style-type: none"> • Creation of new flood storage areas • Improved habitat for aquatic life • Improved drainage pattern to forested wetland • Nutrient reduction • Pathogen reduction • Reduced suspended sediments 	<ul style="list-style-type: none"> • Preservation of approximately 34.7 acres of Category 3 (forested) wetland • Restoration of approximately 3,800 – 3,900 l.f. of Hoskins Ditch through a raised grade - floodplain excavation hybrid approach • Stream restoration to improve stream habitat performance from Very Poor to Fair • Improve wetland hydrology through the stream channel design to re-route high flows into the forested area • Enhancement of wetland ecosystem through the creation of vernal pools • Establishment of a wooded riparian corridor along new and restored stream in areas susceptible to flooding (area will evolve into forested wetland) • Expansion of functional floodplain area by approximately 2.5 acres • Additional flood storage capacity of over 1.5 acre ft. • Spoil can be used to raise grade in other flood risk areas of property 	No additional options evaluated

Figure 10. Proposed Hoskins Ditch Restoration and Wetland Enhancement



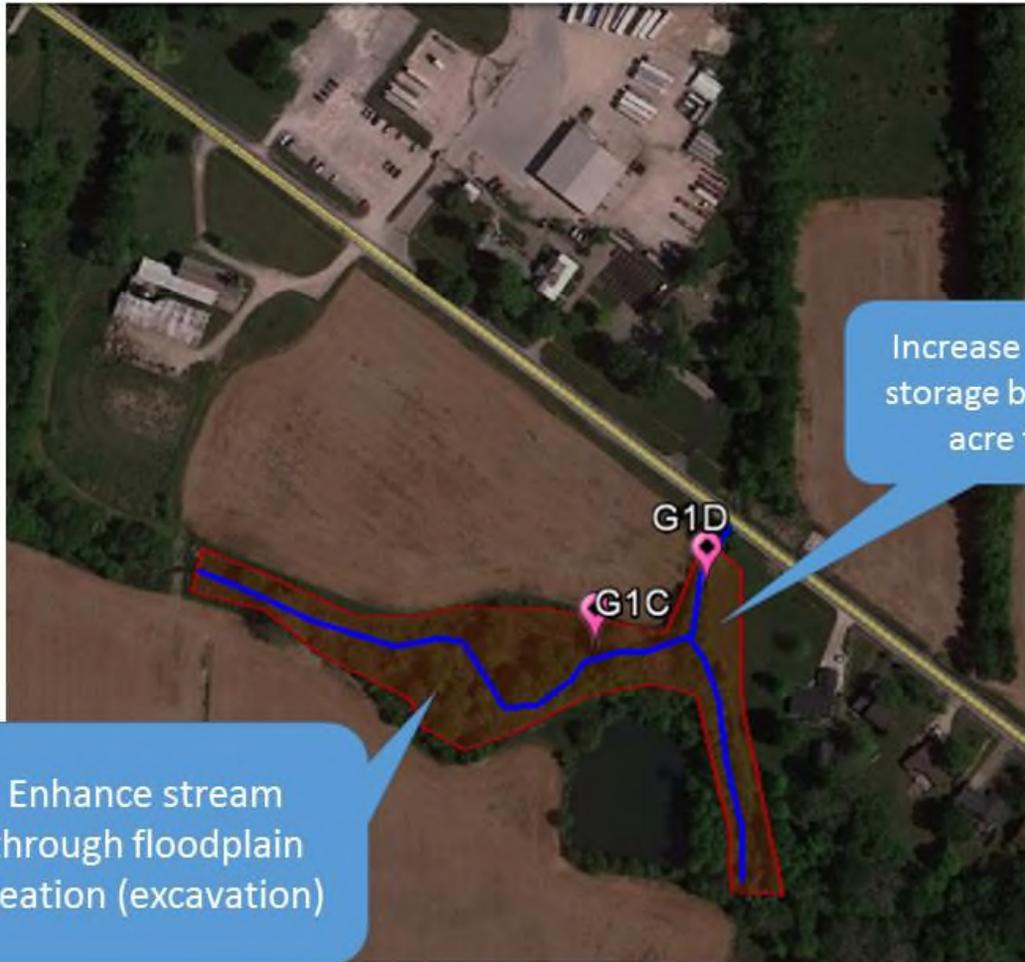
PROJECT IMPLEMENTATION

Table 7. Willow Creek/Lower Dawley Ditch Stream Restoration

Project Rank	Property Owner	Location	Evaluation Sites
5 (64.2 pts)	Moat Properties (Ross), Gladys	South of Giles Rd	G1C, G1D
Approach	Benefits	Project Summary	Options
<ul style="list-style-type: none"> • Floodplain creation (excavation) • Habitat enhancement • Riparian planting 	<ul style="list-style-type: none"> • Improved flood storage • Improved habitat for aquatic life • Nutrient reduction • Pathogen reduction • Reduced suspended sediments 	<ul style="list-style-type: none"> • Restoration of approximately 1,491 l.f. of Willow Creek mainstem and 190 l.f. at the mouth of Dawley Ditch via floodplain creation and channel rehabilitation. • Floodplain created via excavation • Improve habitat quality from a rating of Good to Good/Excellent • Re-establishment of a wooded riparian corridor • Expansion of functional floodplain area by 0.73 acres • Additional flood storage capacity of approximately 1.38 acre ft. 	No additional options evaluated

Figure 11 Willow Creek/Lower Dawley Ditch Stream Restoration

Willow Creek Mainstem Floodplain Creation (G1)

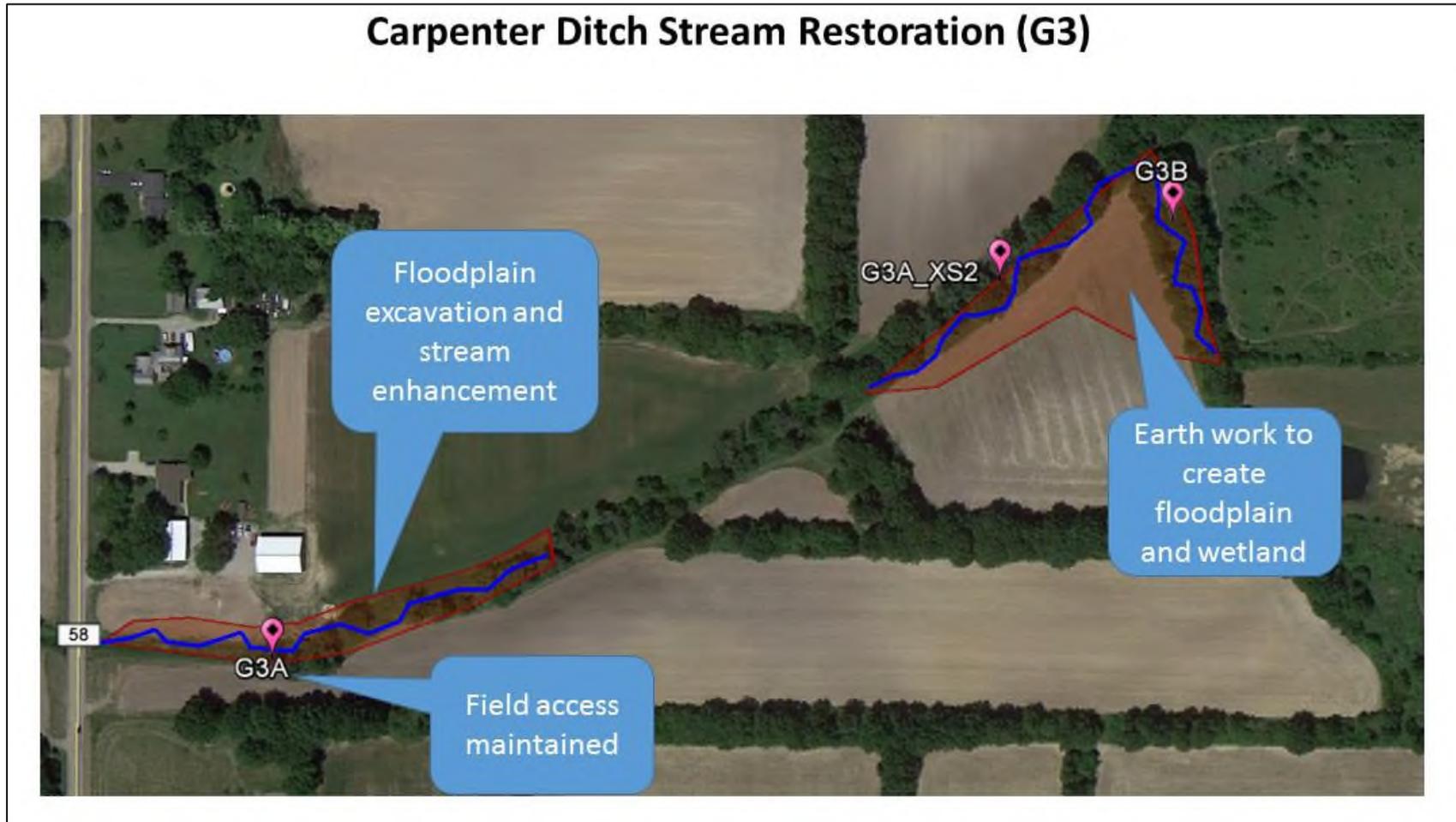


PROJECT IMPLEMENTATION

Table 8. Carpenter Ditch Restoration

Project Rank	Property Owner	Location	Evaluation Sites
6 (63.8 pts)	Houston Family	Between Island Rd and Reed Rd	G3A, G3B
Approach	Benefits	Project Summary	Options
<ul style="list-style-type: none"> • Floodplain creation (excavation) • Habitat enhancement • Wetland creation • Riparian planting 	<ul style="list-style-type: none"> • Improved flood storage • Improved habitat for aquatic life • Nutrient reduction • Pathogen reduction • Reduced suspended sediments 	<ul style="list-style-type: none"> • Restoration of approximately 1,620 l.f. of stream via floodplain creation and channel rehabilitation. • Extension of the stream channel by approximately 135 l.f. • Floodplain created via excavation • Control of flood elevations and excavation would create 2+ acres of wetland in low areas susceptible to flooding • Improve stream habitat quality from a rating of Very Poor to Fair/Good • Re-establishment of a wooded riparian corridor • Expansion of functional floodplain area by 0.73 acres • Additional flood storage capacity of approximately 1.38 acre ft. 	<ul style="list-style-type: none"> • Upper portion of project could be eliminated • Changes project ranking to #8 (57.5 pts) • Reduces project to 820 l.f., net increase floodplain acreage and flood storage reduced to 0.41 acres, and 0.36 acre ft., respectively.

Figure 12. Carpenter Ditch Stream Restoration



PROJECT IMPLEMENTATION

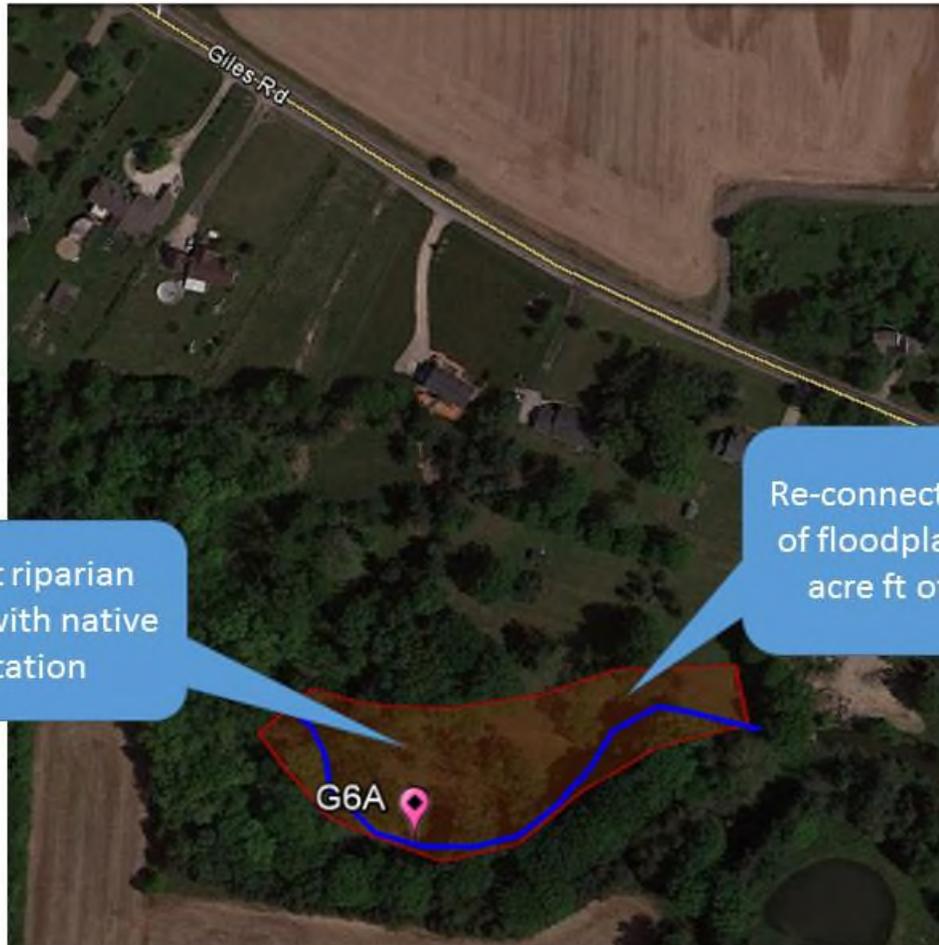
Table 9. Willow Creek Mainstem Floodplain Enhancement

Project Rank	Property Owner	Location	Evaluation Sites
9 (55.8 pts)	Moat Properties (Ross)	South of Giles Rd	G6A
Approach	Benefits	Project Summary	Options
<ul style="list-style-type: none"> • Floodplain creation (excavation) • Habitat enhancement • Riparian planting 	<ul style="list-style-type: none"> • Improved flood storage • Improved habitat for aquatic life • Nutrient reduction • Pathogen reduction • Reduced suspended sediments 	<ul style="list-style-type: none"> • Restoration of approximately 660 l.f. of the mainstem of Willow Creek via re-connection to floodplain and riparian planting. • Floodplain re-connected via excavation • Improve stream habitat quality from a rating of Good to Excellent • Re-establishment of a wooded riparian corridor • Expansion of functional floodplain area by 0.33 acres • Additional flood storage capacity of approximately 0.42 acre ft. 	No additional options evaluated

PROJECT IMPLEMENTATION

Figure 13. Willow Creek Mainstem Bank Stabilization

Willow Creek Floodplain Enhancement (Moat Properties G6)



Re-plant riparian corridor with native vegetation

Re-connect 0.33 acres of floodplain for 0.42 acre ft of storage

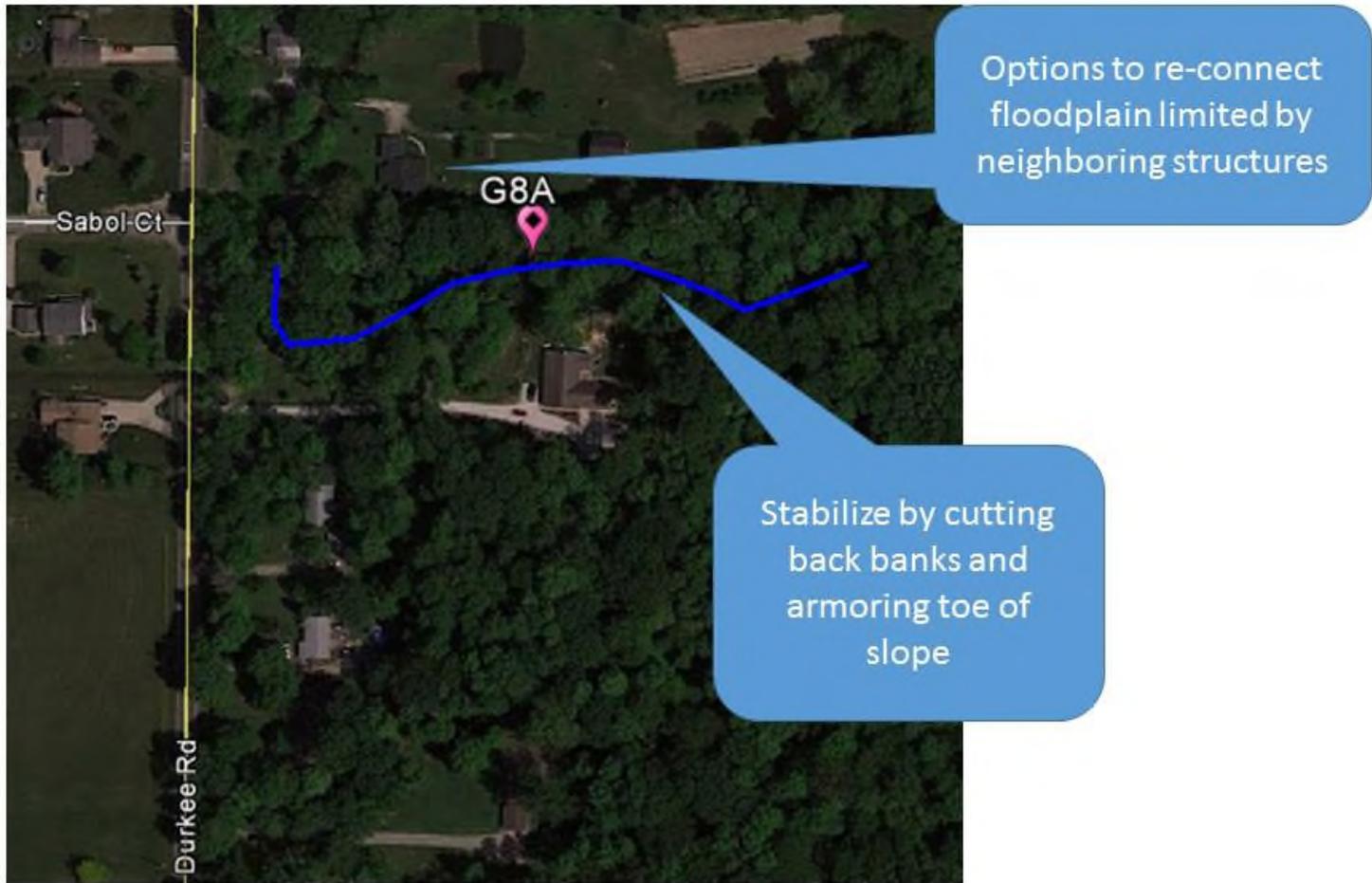
PROJECT IMPLEMENTATION

Table 10. Willow Creek Mainstem Bank Stabilization

Project Rank	Property Owner	Location	Evaluation Sites
10 (35.4 pts)	Galvin	South of Giles Rd	G6A
Approach	Benefits	Project Summary	Options
<ul style="list-style-type: none"> • Stabilization of eroding banks • Habitat enhancement • Riparian planting 	<ul style="list-style-type: none"> • Decreased erosion and tree loss • Decreased loads of suspended sediments 	<ul style="list-style-type: none"> • Stabilization of approximately 1,000 l.f. of stream bank along the mainstem of Willow Creek via slope stabilization and bank armoring • Minimal floodplain re-connected (limited by surrounding land use) • Minimal improvement in habitat quality or flood storage 	No additional options evaluated

Figure 14. Willow Creek Mainstem Bank Stabilization

Willow Creek Mainstem Bank Stabilization (G8)



FINAL RESTORATION SITE SELECTION

Following selection of the eight scenarios, a meeting was held on February 13, 2015 with the Black River AOC Advisory Committee and stakeholders to select 3 to 5 restoration sites for additional in-field evaluation. This process identified the appropriate approach for restoration at the sites and also included an evaluation of site-specific concerns and challenges including constructability, site access, and fundability. The eight scenarios were evaluated using twelve (12) different metrics selected to identify sites that will produce the most cost-effective projects.

- 1) The potential length and/or area of the restoration site,
- 2) Riparian/streambank conditions,
- 3) Channel modifications,
- 4) Estimated readiness to proceed,
- 5) Restoration approach,
- 6) Flood storage benefit,
- 7) Flow regime,
- 8) Cause of condition,
- 9) Potential for increase in habitat quality,
- 10) Construction feasibility,
- 11) Post project floodplain connectivity,
- 12) Potential risk of hazards to human habitation, roads, property, and valuable natural resources.

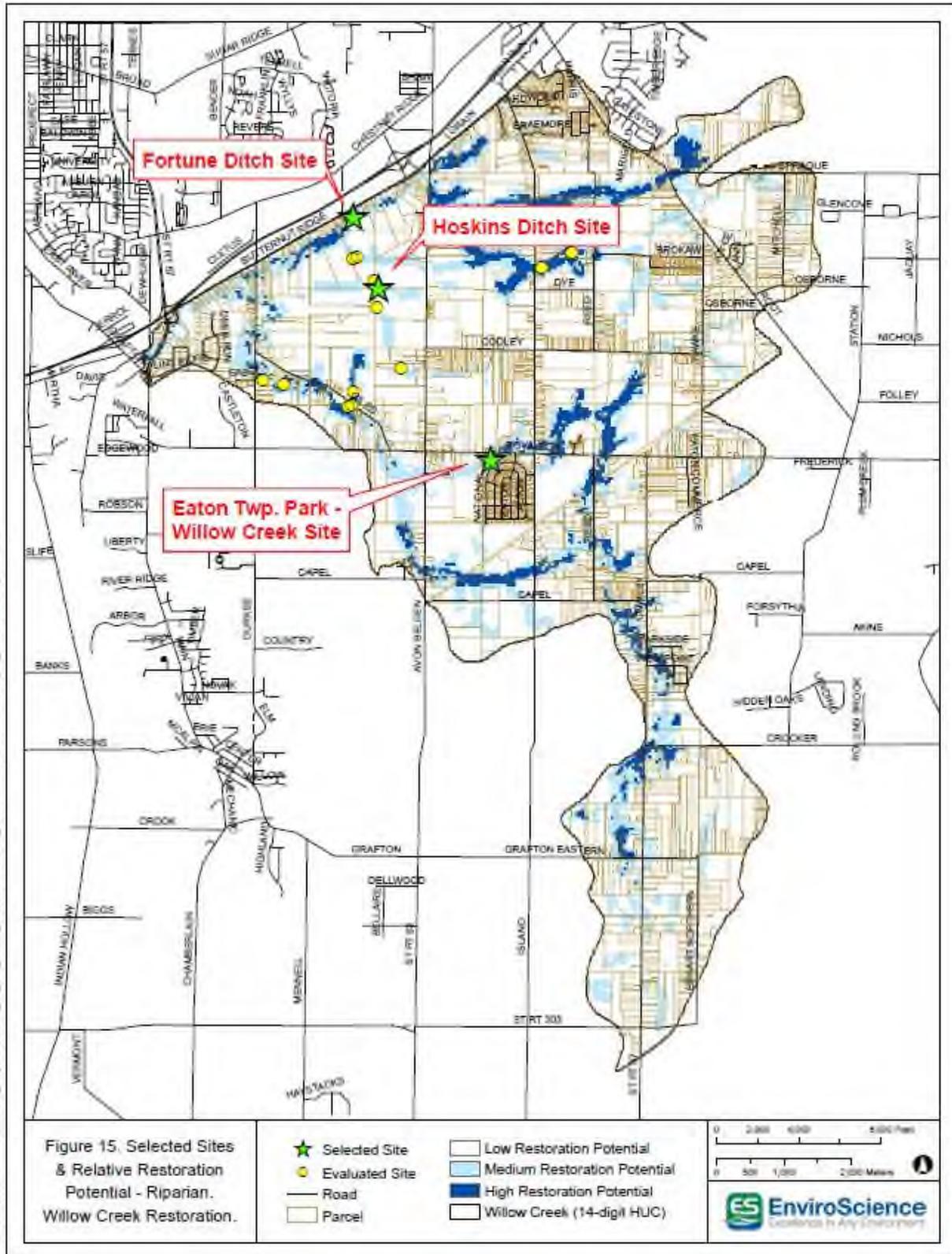
Initial screening identified four sites for possible restoration; however one site along Dawley Ditch was subsequently dropped from project because of coordination issues.

The outcome of the stakeholders meeting clarified three (3) sites for restoration and enhancement projects, and identified the direction for the conceptual plans. The three sites that were selected are shown on Figures 14 and 13 below.

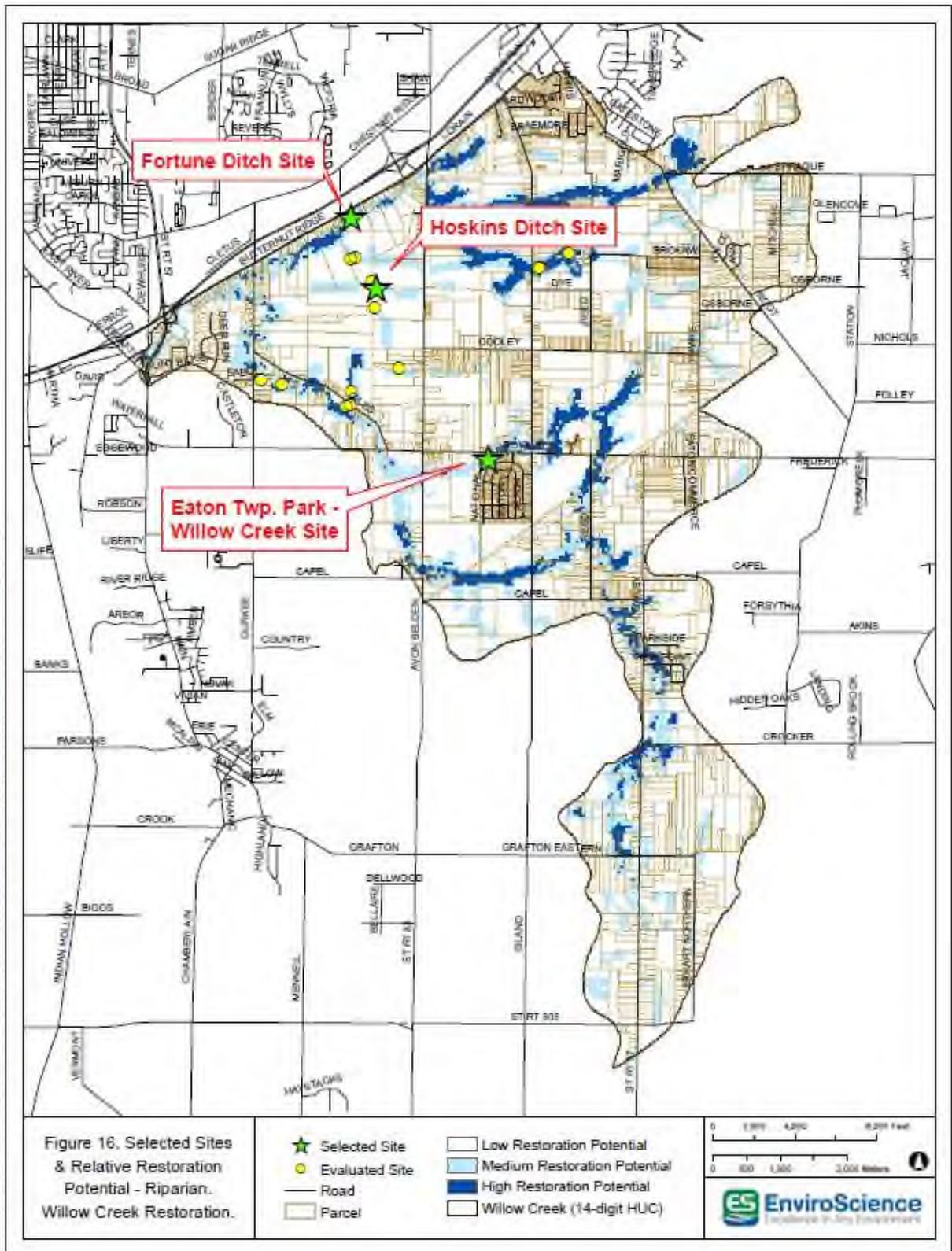
IN-FIELD SITE EVALUATION OF RESTORATION SITES

A second visit to the three final sites was completed by the restoration team to collect more precise data. This data was used to develop initial conceptual plans for each of the selected sites and to determine construction feasibility at the sites. A preliminary restoration plan was created prior to the second field visit based on the site data and observations during the original field evaluation.

Following the site visits, the conceptual plans for the selected sites were refined and finalized. The plans take into account the natural features of the sites and blend them with the best possibilities for maximizing the benefits to the watershed. Section 3 of this report discusses the final restoration and enhancement concepts for the selected sites.



PROJECT IMPLEMENTATION



Section 3

*Final Restoration and
Enhancement Concepts*

FINAL SITE SELECTION

The three sites selected for final conceptual restoration plans are listed below.

1. Willow Creek at Eaton Township Park
2. Fortune Ditch at the Margaret Peak Nature Preserve
3. Hoskins Ditch

All three were selected for easy access to the sites and the area available for conducting construction activities. In addition, all three sites have the necessary area to expand the floodplain for increased flood storage.

The Willow Creek and Fortune Ditch sites were selected because of their location within township park areas. These locations will provide public access to the projects both during and after construction, and will permit citizens to see firsthand how these types of restoration projects are constructed and progress over time. The sites will also provide educational opportunities for habitat and stream function enhancements.

During the AOC advisory Committee meeting and the subsequent meeting with the public on May 4, 2015, draft cost estimates were provided. Subsequent analysis has resulted in slightly higher cost estimates as reflected in the following sections

WILLOW CREEK RESTORATION AT EATON TOWNSHIP PARK

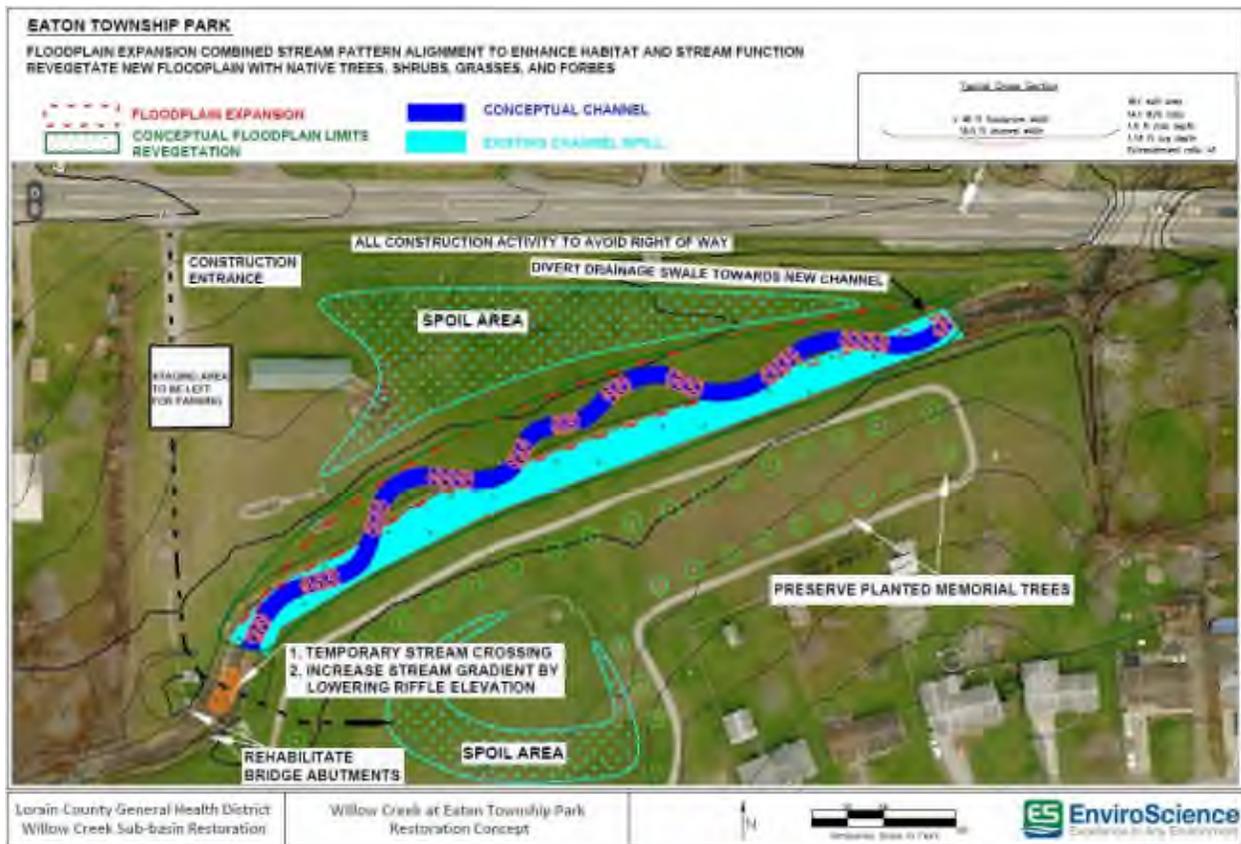
This conceptual restoration plan includes stream and floodplain restoration of Willow Creek at the Eaton Township Park, located south of Royalton Road (SR 82) between Wooster Avon Lake Road (SR 83) and Island Road (SR 58). The center of the project is located at approximately 41.313456° N, 82.008750° W. At this location, the existing channel of Willow Creek has been channelized and is detached from its floodplain. The riparian corridor is open, with no tree cover. The goal of the restoration is to improve the habitat within this reach of Willow Creek by adding a more natural pattern to the stream, increase habitat diversity by adding riffles and pools, and excavating a floodplain to allow for storage of flood flows. Native plants will be installed in floodplain and wetland areas.

The addition of sinuosity to the stream will increase the stream length by 100-200 feet in this reach. Improvements to the instream habitat should raise the habitat quality from very poor to good. The construction of floodplains will increase flood storage capacity by 0.9-1.0 ac-ft. In addition, the approximately 0.7 acres of floodplain wetlands will improve sediment retention and nutrient processing, helping to improve water quality within Willow Creek. In addition to the ecological improvements, the township's existing park will be improved, and important elements will be preserved. The parking area for the picnic shelter will be used as a construction staging area, and will be left as an improved parking area for future township use. Spoil areas will be low (<2 ft) to not obstruct views, and will be placed in upland lawn areas within the park. One option for a spoil area is to be placed around the ball field to improve spectators' views of the field. The bridge abutments near the temporary stream crossing will be rehabilitated. The existing trail and memorial trees will be preserved.

FINAL RESTORATION AND ENHANCEMENT CONCEPTS

Because of its location and high visibility from the road and the park, this restoration project provides a significant opportunity for public education. Motorists will see the project from SR 82, and park visitors will have a chance to see the project and view educational signs about the benefits of ecological restoration. As such, it is hoped that this project will serve as a demonstration project that will lead to greater local support for future restoration projects within the Willow Creek watershed.

Figure 17. Willow Creek Restoration Concept - Eaton Township Park



FINAL RESTORATION AND ENHANCEMENT CONCEPTS

COST ESTIMATE FOR WILLOW CREEK – EATON TWP. PARK

Following are cost estimates for the Willow Creek - Eaton Park restoration concept. Table 11 presented the minimum and maximum estimated cost for the project.

Table 11. Estimated Costs for the Willow Creek - Eaton Township Restoration Concept

	Cost Range	
	Min	Max
Final Design	\$13,500	\$15,000
Environmental Permitting	\$5,000	\$6,000
Construction + oversight	\$260,000	\$265,000
Planting and Seeding	\$20,000	\$22,500
Monitoring	\$22,500	\$25,000
TOTAL	\$321,000	\$333,500

FORTUNE DITCH RESTORATION AT THE MARGARET PEAK NATURE PRESERVE

This conceptual restoration plan includes stream and floodplain restoration of Fortune Ditch within the 98-acre Margaret Peak Nature Preserve, owned by Eaton Township. The site is located south of Butternut Ridge Road between Wooster Avon Lake Road (SR 83) and Archer Road. The center of the project is located at approximately 41.345816° N, 82.033067°. At this location, the existing channel of Fortune Ditch has been channelized and is detached from its floodplain. The riparian corridor is open, with no tree cover. The goal of the restoration is to improve the habitat within this reach of Fortune Ditch by adding a more natural pattern to the stream, increase habitat diversity by adding riffles and pools, and excavating a floodplain to allow for storage of flood flows. Native plants will be installed in floodplain and wetland areas.

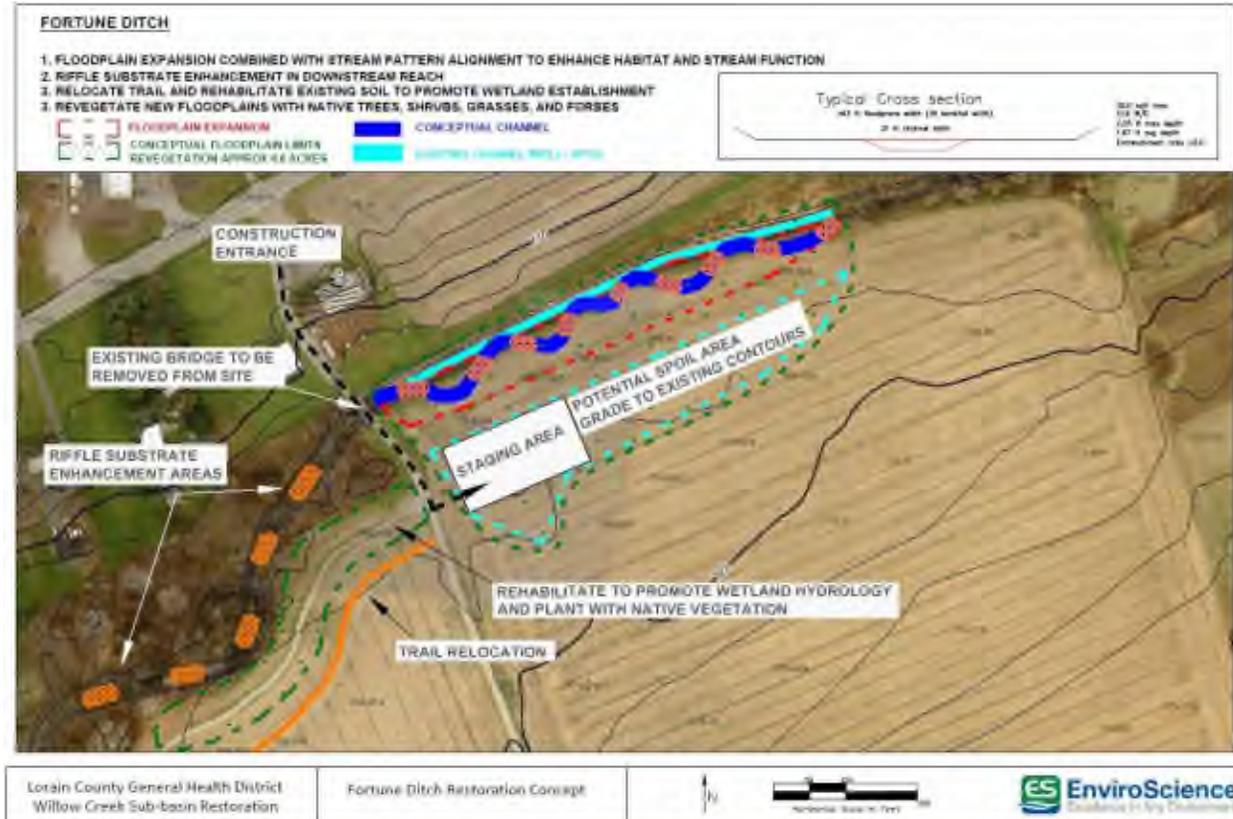
The addition of sinuosity to the stream will increase the stream length by approximately 100-200 feet in this reach. The construction of approximately 4.5-5 acres of floodplain wetlands will increase flood storage capacity by 2.1-2.2 ac-ft. In addition, the wetlands will improve sediment retention and nutrient processing, helping to improve water quality within Fortune Ditch. Soil from the floodplain excavation will be placed to the south of the floodplain, tying into an existing beach ridge. An existing unused bridge near the active culvert crossing will be removed.

FINAL RESTORATION AND ENHANCEMENT CONCEPTS

This restoration project integrates well with the vision of Ms. Margaret L. Peak, who donated the land to the township. According to the Township website (<http://www.eatontownship.org/recreation.html>). “It is Mrs. Peak's wish to establish and maintain a nature preserve on this farm land for the residents of the Township to enjoy and get away from the hectic pace of everyday life. Mrs. Peak desires to preserve in Lorain County for future generations an area devoted to its natural setting.”

Because of its location and high visibility from Butternut Ridge Road, this restoration project provides a significant opportunity for public education. Motorists will see the project from the road, and park visitors will have a chance to see the project and view educational signs about the benefits of ecological restoration. This will also add another point of interest near the beginning of the walking trail. As such, it is hoped that this project will serve as a demonstration project that will lead to greater local support for future restoration projects within the Willow Creek watershed.

Figure 18. Fortune Ditch Restoration Concept



FINAL RESTORATION AND ENHANCEMENT CONCEPTS

COST ESTIMATE FOR FORTUNE RUN RESTORATION AT THE MARGARET PEAK NATURE PRESERVE

Following are cost estimates for the Fortune Run – Margaret Peak Nature Preserve restoration concept. Table 12 presented the minimum and maximum estimated cost for the project.

Table 12. Estimated Costs for the Fortune Run Restoration Concept

	Cost Range	
	Min	Max
Final Design	\$15,000	\$17,000
Environmental Permitting	\$7,500	\$8,500
Construction + oversight	\$332,000	\$335,000
Planting and Seeding	\$40,000	\$42,000
Monitoring	\$22,500	\$24,500
TOTAL	\$417,000	\$427,000

HOSKINS DITCH RESTORATION

This conceptual restoration plan includes stream and floodplain restoration of Hoskins Ditch on private property owned by Ross Environmental Services, Inc. The site is located west of Wooster Avon Lake Road (SR 83) and north of Cooley Road (CR 141). The center of the project is located at approximately 41.335266° N, 82.024772° W. At this location, the existing channel of Fortune Ditch has been channelized. To the east, the riparian corridor is open, with no tree cover. The western side of the parcel contains Category 3 (high quality) forested wetlands. The goal of the restoration is to improve the habitat within this reach of Hoskins Ditch by adding a more natural pattern to the stream, increase habitat diversity by adding riffles and pools, and excavating a floodplain to allow for storage of flood flows. Flood connections will be reestablished between Hoskins Ditch and the forested wetlands, to increase the flow of water into the wetlands and increase their functionality. Native plants will be installed in floodplain and wetland areas.

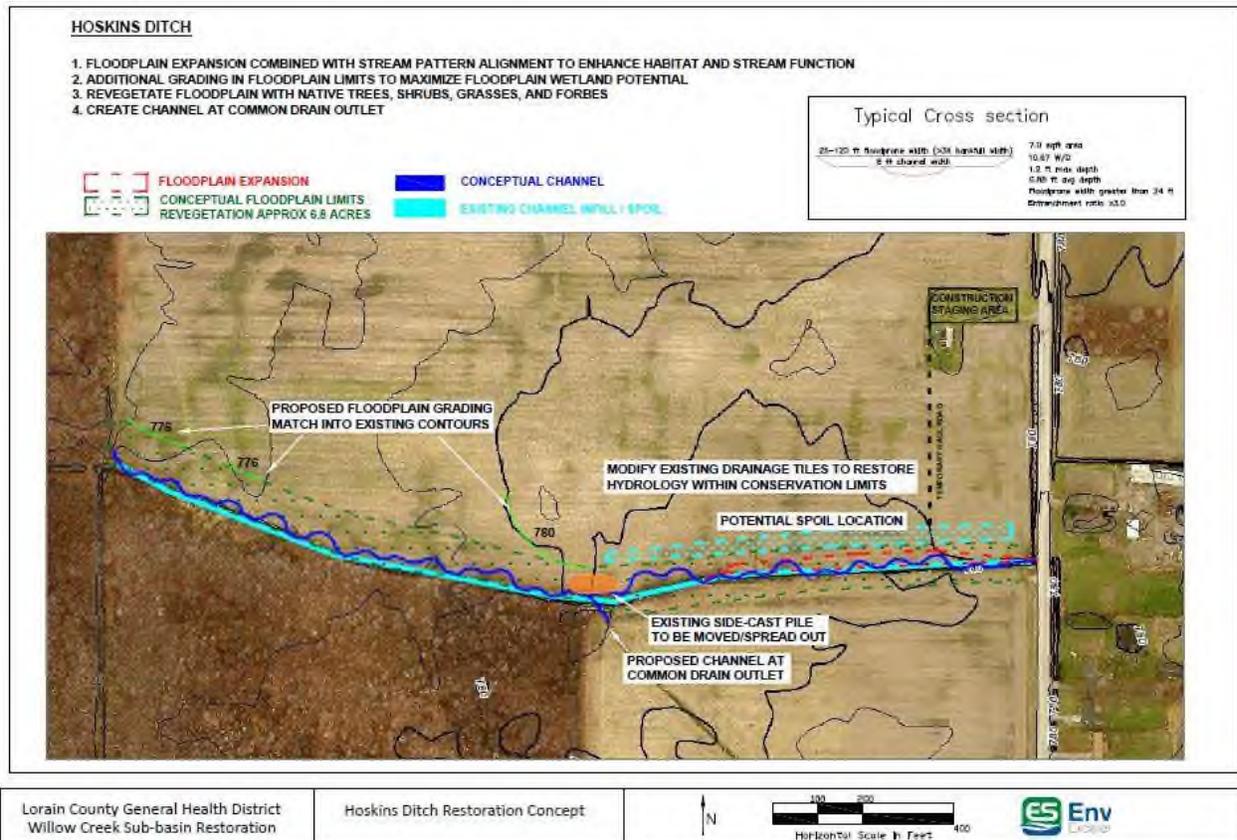
The addition of sinuosity to the stream will increase the stream length by approximately 300-400 feet in this reach. The construction of approximately 2.0-2.5 acres of floodplain wetlands will increase flood storage capacity by 1.5-2.0 ac-ft. In addition, the wetlands will improve sediment retention and nutrient processing, helping to improve water quality within Hoskins Ditch. Soil

FINAL RESTORATION AND ENHANCEMENT CONCEPTS

from the floodplain excavation will be placed to the north of the floodplain to provide additional protection for the adjacent agricultural areas.

Because of its location, this restoration provides limited opportunities for public education. If walking trails from the nearby Margaret Peak Nature Preserve were extended, public education opportunities would be increased.

Figure 19, Hoskins Ditch Restoration Concept



FINAL RESTORATION AND ENHANCEMENT CONCEPTS

COST ESTIMATE FOR HOSKINS DITCH RESTORATION

Following are cost estimates for the Hoskins Ditch restoration concept. Table 13 presented the minimum and maximum estimated cost for the project.

Table 13. Estimated Costs for the Hoskins Ditch Restoration Concept

	Cost Range	
	Min	Max
Final Design	\$15,000	\$18,000
Environmental Permitting	\$8,000	\$10,000
Construction + oversight	\$475,000	\$490,000
Planting and Seeding	\$30,000	\$35,000
Monitoring	\$23,000	\$25,000
TOTAL	\$551,000	\$578,000

