Engineering Feasibility and Design Study

Oliver, Olin, and Martin Lakes Watershed
Clearspring and Johnson Townships
LaGrange County, Indiana

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Executive Summary

This Oliver, Olin, and Martin Lakes Watershed *Engineering Feasibility and Design Study* was arranged to investigate the feasibility of implementing projects that will reduce sediment, nutrients, and other pollutants from reaching Oliver, Olin, and Martin Lakes. This study was funded by an Indiana Department of Natural Resources (IDNR) Lake and River Enhancement Program (LARE) grant with a match provided by the Oliver and Martin Lakes Conservation and Improvement Association (OMLCIA). OMLCIA retained Davey Resource Group, a division of The Davey Tree Expert Company, to conduct the study. Engineering services were provided by Gensic Engineering.

The Oliver, Olin, and Martin Lakes Watershed consists of approximately 7,240 acres (2,942 hectares). It is located in Clearspring and Johnson Townships in south central LaGrange County, Indiana. The watershed is bisected by State Route (SR) 9.

Projects incorporated into this study include four projects previously identified in the *Oliver, Olin, and Martin Lakes Diagnostic Study* completed by JFNew in October 2009, a fifth project recommended by the IDNR LARE Program for inclusion prior to grant funding, and a sixth project identified during a public outreach event associated with this study. The types of projects evaluated include streambank erosion control and bank stabilization, wetland hydrology enhancement, and site-specific agricultural field erosion. Factors taken into consideration for determining the feasibility of each project include land availability and permit requirements, as well as the benefits and costs associated with each project.

Introduction

OMLCIA is comprised of landowners who own property contiguous to Oliver and Martin Lakes. OMLCIA strives to manage the quality of its lakes by minimizing the amount of sediment and nutrients from watershed sources that reach the lakes.

Photograph 1 (12-2-11). A small stream's confluence into Oliver Lake. Lake water quality is influenced by watershed characteristics.

OMLCIA pursued and was awarded funding from the IDNR LARE Program to conduct an Engineering Feasibility and Design Study. Davey Resource Group was retained by OMLCIA to conduct the study. The purpose of the study was to investigate the feasibility of implementing six projects; the first five were previously identified in the Oliver, Olin, and Martin Lakes Watershed and a sixth project was added as a result of issues raised during public meetings. The study designed plans for two specific projects (Projects 3 and 5). The proposed projects are as follows:

- *Project 1*: Erosion control along a ditch adjacent to County Road (CR) 550.
- *Project 2*: Erosion control on a ditch bank southwest of the intersection of SR 9 and CR 600.
- *Project 3*: Streambank erosion control on a stream located at the Olin Lake Nature Preserve owned by IDNR.
- *Project 4*: Erosion control on a ditch located south of CR 450 and north of Oliver Lake (Photograph 1).
- *Project 5*: Hydrological enhancement to a degraded wetland on property owned by The Nature Conservancy east of Martin Lake.
- *Project 6*: A sixth project to minimize sediment reaching the lake from an agricultural field north of Oliver Lake.

Many of the projects investigated during the course of this study were originally identified during the Oliver, Olin, and Martin Lakes Diagnostic Study (JFNew 2009). Modifications were made to some projects, adding to their feasibility. New projects were also investigated during the course of the Engineering Feasibility and Design Study. Below is a summary of each project's relations to the original diagnostic study.

Table 1. Project Location Relationships Between Current Engineering Feasibility & Design Study and the Lake Diagnostic Study (JFNew 2009)

Engineering Feasibility & Design Project Number	Oliver, Olin, and Martin Lakes Diagnostic Study Recommended Site Numbers
Project 1	Sites 3, 4, and 5
Project 2	Site 6
Project 3	Sites 11 and 12
Project 4	New project not previously identified
Project 5	Sites 7 and 8 and other new areas
Project 6	Near to Site 17; Davey Resource Group recommends OMLCIA work with LaGrange County SWCD and the NRCS to incorporate Site 17 from the diagnostic study into this project

Project Location

The Oliver, Olin, and Martin Lakes Watershed consists of approximately 7,240 acres (2,942 hectares) within Clearspring and Johnson Townships in south central LaGrange County, Indiana (U.S. Geological Survey 2011). The watershed is bisected by SR 9.

The location of Projects 1–6 are depicted on an aerial photograph on the Overview Map in Appendix A.

Historical Studies and Other Background Information

Oliver, Olin, and Martin Lakes Diagnostic Study was completed by JFNew in October 2009. The study determined that water quality in the lakes is good and has remained stable over the past 30 years. However, a proactive approach to watershed management was recommended to maintain the good water quality. Projects 1–4 were recommended as part of the diagnostic study.

Project 5 was recommended by the IDNR LARE Program prior to grant funding. Project 6 was identified during a public outreach event associated with this study and deemed significant enough to be incorporated into this study.

Most of the watershed is in agricultural, row-crop production (64%); however, significant percentages of hay/pastures (16%), natural area (7%), and development (4%) are also present. The remaining 9% of the watershed consists of open water including the lakes (JFNew 2009). Water flows from Martin Lake to Olin Lake to Oliver Lake and discharges from the southwest corner of Oliver Lake.

Phosphorus was identified as the limiting nutrient in the lakes in the *Oliver, Olin, and Martin Lakes Diagnostic Study* (JFNew 2009), and the reductions in Table 2 were recommended to achieve mean phosphorus concentrations of 0.03 milligram per liter (mg/L) in the lakes.

Table 2. Recommended Annual Phosphorus Reduction Per Lake (JFNew 2009)

Lake	Phosphorus Reduction Needed (kilograms/year)
Martin	729
Olin	1,450
Oliver	2,604

Public Outreach

Three public outreach meetings were conducted to inform watershed residents about the purpose and progress of the study. Meeting dates, attendees, and topics of discussion from each meeting are included in Appendix B. An educational public information brochure was produced for this project and distributed at the June 16, 2012 public meeting. A copy of the brochure is included in Appendix C.

An area of concern not previously identified was brought to the attention of Davey Resource Group and OMLCIA during the first and second public meeting. The concern regarded sediment reaching the Oliver Lake from an agricultural field located north of the lake. The site was investigated by OMLCIA and Davey Resource Group and incorporated into this study as Project 6.

Feasibility Assessment Methods

Environmental Assessments

A variety of environmental factors such as the presence or absence of wetlands, the quality of existing vegetation, macroinvertebrate community qualities, and water quality measurements influence feasibility and can provide data for evaluating the long-term effectiveness of implemented practices. Methodology for specific environmental assessment methods conducted in the field follows.

Wetlands

Wetlands are areas where soils are saturated at or near the surface at a frequency and duration long enough to support a dominance of wetlands plant and the development of hydric soils (Environmental Laboratory 1987; US Army Corps of Engineers 2010). National Wetlands Inventory (NWI) maps are a good starting point to determine if wetlands are present on a project site.

However, these maps were derived from aerial photointerpretation, and wetland boundaries as reflected on NWI maps may not reflect actual site conditions. Small wetlands may also be present that are not included on NWI maps. Consequently, when earth disturbing activities are proposed, a wetland site inspection is warranted. Approximate wetland boundaries were mapped by a trained wetlands delineator using a GeoXH™ Trimble® GeoExplorer® 6000 series Dual-frequency Global Navigation Satellite System or GNSS (GPS, GLONASS, SBAS [WAAS]) receiver and antenna with Everest™ multipath rejection technology and Floodlight technology with 220 channels running professional TerraSync™ software capable of decimeter (10–75 centimeters) accuracy after differential correction. Approximate wetland boundaries were mapped based on the presence of wetland vegetation. Subsurface soil profile inspections and a detailed assessment of hydrology indicators were not performed as required to precisely delineate a wetland boundary. Approximate wetland boundaries are shown on plan sheets where applicable.

Macroinvertebrates

Davey Resource Group Biologists Alicia Douglass and Jacob Bannister sampled benthic macroinvertebrates on July 26, 2012, directly downstream of Project 2 on Regulated Drain 45 and north of CR 600 South. Benthic macroinvertebrates were sampled on July 27, 2012, at Project 5 in the Olin-Raber Wetlands stream. All other project sites were dry at the time of macroinvertebrate sampling due to drought conditions. The Olin-Raber Wetlands stream appeared to be primarily groundwater fed. Macroinvertebrates were collected in riffles and leaf packs where riffles were not present using a kick net in accordance with the Rapid Bioassessment Protocol single-habitat approach (Barbour et al. 1999). A 100-organism subsample was taken in accordance with Indiana Department of Environmental Management's (IDEM) subsampling protocol and the IDNR LARE Protocol for Macroinvertebrate Sample Collections and Index Calculation (IDNR 2011a; Todd Davis, personal communication, December 10, 2008). All specimens in the sub-sample were identified to the family level. Identifications are based on Merritt and Cummins (1996) and Voshell (2002). A complete list of the families identified and the number of individuals at each site is included in Appendix D.

Macroinvertebrate Index of Biotic Integrity (mIBI)

IDEM has developed scoring criteria for a family level mIBI based on a single habitat (KICK) sampling technique. IDEM's mIBI for KICK samples was used to evaluate the macroinvertebrate community. Using mIBI, a score is determined for each site in 10 different metrics (Todd Davis, personal communication, October 13, 2008). The average of all 10 metric scores is the mIBI score for a site. The 10 mIBI metrics include the family-level Hilsenhoff biotic index (HBI) score; the number of taxa collected at the family level; the number of individual macroinvertebrates collected; the percent of the dominant macroinvertebrate family collected; the number of families from the orders Ephemeroptera, Plecoptera, and Trichoptera (EPT Index); the total number of EPT individuals (EPT Count); the number of individuals from the EPT orders to the total number of individuals; the number of individuals from the EPT orders to the total number of chironomids; the total number of chironomids; and the total number of individuals to the number of squares sorted when subsampling.

Ranges for each metric are assigned a score of 0, 2, 4, 6, and 8. Scores from each metric are averaged to obtain an overall mIBI score for each sampling site. A mIBI score between 0 and 2 indicates that the site is severely impaired. A score between 2 and 4 indicates moderate impairment. Scores between 4 and 6 and scores between 6 and 8 suggest that sites are slightly impaired and non-impaired, respectively.

IDEM designates sites sampled using the KICK method and receiving a score less than 2.2 as impaired for aquatic life (IDEM 2010c; Todd Davis, personal communication, December 5, 2008). Table 3 depicts mIBI scoring criteria using the KICK method.

Table 3. Scoring Criteria for the Family Level mIBI Riffle KICK Samples[1]

	Classification Score				
	0	2	4	6	8
Family Level Hilsenhoff Biotic Index (HBI)	≥5.63	5.06-5.62	4.55-5.05	4.09-4.54	<4.08
Number of Taxa	<7	8-10	11-14	15-17	>18
Number of Individuals	<79	80-129	130-212	213-349	>350
Percent Dominant Taxon	>61.6	43.9-61.5	31.2-43.8	22.2-31.1	<22.1
EPT Index	<2	3	4-5	6-7	>8
EPT Count	<19	20-42	43-91	92-194	>195
EPT Count to Total Number of Individuals	<0.13	0.14-0.29	0.30-0.46	0.47-0.68	>0.69
EPT Count to Chironomid Count	<0.88	0.89-2.55	2.56-5.70	5.71-11.65	>11.66
Chironomid Count	>147	55-146	20-54	7-19	<6
Total Number of Individuals to Number of Squares Sorted	<29	30-71	72-171	172-409	>410

[1] Calibrated from transformed data distribution of the 1990–1995 100-organism subsamples.

HBI is a family level macroinvertebrate biotic index developed to evaluate organic and nutrient stream pollution. Macroinvertebrate families are assigned a number from 0 to 10 based on tolerance to organic pollution. A 0 is assigned to families most intolerant to organic pollution and a 10 to families most tolerant to organic pollution (Hilsenhoff 1988). In accordance with IDEM and IDNR standard practices, in this study Hilsenhoff tolerance values were supplemented with values from Bode (1988). Families not assigned a tolerance value by either Hilsenhoff or Bode were excluded from the HBI. HBI scores are determined by multiplying the total number of individuals for each family by the family tolerance values. The sum of all products for a site is divided by the total number of individuals to determine the HBI score.

The EPT Index is a measure of taxa richness within the orders Ephemeroptera, Plecoptera, and Trichoptera. These orders typically contain families less tolerant of pollution (Mandaville 2002). Chironomids are organisms belonging to the taxonomic family Chironomidae.

Rapid Bioassessment Protocol RBPII

RBPII is one of several Rapid Bioassessment Techniques. RBPII involves identification of macroinvertebrates to the family level in a 100-organism subsample (US Environmental Protection Agency [USEPA] 1990).

Standard LARE RBPII metrics include an analysis of the number of taxa, the EPT Index, the percent of the dominant taxon, the ratio of EPT individuals to Chironomidae individuals, the HBI, the ratio of scraper to filtering collector feeders, the ratio of shredder to non-shredder feeders, and the Community Loss Index. A numeric score of 6, 3, or 0 is assigned to each metric with 6 indicating non-impaired and 0 indicating severe impairment. The numeric scores for all metrics at each site are then totaled and divided into the score for a reference site. Each site is then assigned a biological condition category based on its percent comparison to the reference site score (IDNR 2011a). Tables 4 and 5 include scoring classifications for RBPII (USEPA 1989).

Table 4. RBPII Metric Scoring Criteria

RBPII Metric	Metric Scoring Criteria		
	6	3	0
Number of Taxa[1]	>80%	40-80%	<40%
Family Level HBI[2]	>85%	50-85%	<50%
Ratio of Scrapers to Filtering Collectors[1]	>50%	25-50%	<25%
Ratio of EPT to Chironomidae[1]	>75%	25-75%	<25%
Percent Dominant Taxon	<30%	30-50%	>50%
EPT Index[1]	>90%	70-90%	<70%
Community Loss Index	<0.5%	0.5-4.0%	>4%
Ratio of Shredders to Nonshredders[1]	>50%	25-50%	<25%

[1] Score is the percentage of the ratio of study site to reference site.

[2] Score is the percentage of the ratio of the reference site to study site.

Table 5. RBPII Biological Condition Categories

Percent of Study Site Score Compared to a Reference Score	Biological Condition Category	Attributes
>79	Non-impaired	Comparable to the best situation to be expected within an ecoregion. Balanced trophic structure. Optimum community structure (composition and dominance) for stream size and habitat quality.
29-72[1]	Moderately impaired	Fewer species due to loss of most intolerant forms. Reduction in EPT Index.
<21[1]	Severely impaired	Few species present. If high densities of organisms, then dominated by one or two taxa. Only tolerant organisms present.

[1] Percentage values between 22–28 and 73–78 require best professional judgment for placement in the most appropriate category and may take into consideration habitat and other water quality data.

Stream Habitat

The Qualitative Habitat Evaluation Index (QHEI) is a six-metric index used to evaluate the physical habitat of a waterway. QHEI takes into account stream substrate, in-stream cover, channel morphology, riparian zone and bank erosion, Pool/Glide and Riffle/Run quality, and the waterway gradient within a specified stream reach. The maximum QHEI score is 100. IDEM has determined that a total QHEI score less than 51 indicates a poor quality habitat. QHEI scores are evaluated to determine if a poor quality habitat is a contributing stressor on aquatic biotic communities (IDEM 2012). Table 6 lists QHEI general score ranges and habitat quality ratings assigned by Ohio Environmental Protection Agency (Ohio EPA 2006). QHEI data were collected in the same location and at the same time that macroinvertebrate communities were sampled.

Table 6. QHEI Score Ranges Assigned by Ohio EPA

Habitat Rating	QHEI Score Range	
	Headwaters (watershed ≤20 square miles)	Larger Streams (watershed >20 square miles)
Excellent	≥70	≥75
Good	55–69	60–74
Fair	43–54	45–59
Poor	30–42	30–44
Very Poor	<30	<30

QHEI may sometimes underscore primary headwater streams, which are considered to be streams having an upstream watershed of less than 1.0 square mile. The Headwater Habitat Evaluation Index (HHEI) is often used to evaluate these smaller streams (Ohio EPA 2012). Headwater habitat evaluations are not categorized on a firm score range. Headwater habitat scores may be compared to one another and often incorporate biological community group characteristics—such as salamanders. The HHEI also provides different primary headwater habitat stream classes that one may use to compare streams to one another.

Stream habitat analyses were conducted by Alicia Douglass at each site at the same time that macroinvertebrate communities were sampled. Davey Resource Group collected both QHEI and HHEI data for primary headwater habitat streams.

Physical and Chemical Water Quality Data

Basic physical and chemical water quality data were collected at the same time as macroinvertebrate sampling. Data collected included temperature, pH, specific conductivity, and dissolved oxygen. These parameters, in addition to habitat and other water chemistry parameters, can influence macroinvertebrate communities.

Water temperature affects the maximum amount of dissolved oxygen that water can hold. Dissolved oxygen is a necessary component for most aquatic life. Many aquatic organisms also require specific temperature ranges for proper metabolic function (IDNR 2008). Indiana water quality standards specify that streams shall not exceed a certain temperature depending upon the month of sampling. Water temperature measurements were conducted in the field using the temperature function on a YSI® EcoSense pH100 instrument.

Many aquatic organisms are sensitive to pH (IDNR 2008). Indiana water quality standards for aquatic life specify that no pH values shall be below 6.0 or above 9.0 per Indiana Administrative Code (327 IAC 2-1-6). A YSI® EcoSense pH100 instrument was used to collect pH readings in the field.

Specific conductivity measurements increase with ion concentration. Thus, specific conductivity is an indirect measure of dissolved solids including, but not limited to, chloride, nitrate, sulfate, phosphate, sodium, magnesium, calcium, and iron. Specific conductivity shall not exceed 1,200 microsiemens (µS) per centimeter at 25°C (327 IAC 2-1-6). Specific conductivity was measured in the field using a YSI® EcoSense EC300 instrument that compensated measurements to 25°C.

Most aquatic organisms require dissolved oxygen gas in the water for survival. Indiana water quality standards for aquatic life state that dissolved oxygen shall not be less than 4.0 mg/L at any time and shall average at least 5.0 mg/L per calendar day (327 IAC 2-1-6). The Indiana average dissolved oxygen concentration is 9.8 mg/L (IDNR 2008).

Modeling

The Spreadsheet Tool for Estimating Pollutant Load (STEPL) modeling program from the US EPA was used to model the potential effects that may result from actions undertaken in the proposed projects. Region 5 Load Estimate Spreadsheet Model (Region 5) was also used to calculate site-specific best management practices (BMPs) within the watershed. Region 5 is also available from the US EPA.

Permit Requirements

Multiple federal, state, and local agencies regulate activities that have the potential to influence water quality, alter flow regimes, or modify existing hydrology levels. The agencies that regulate a particular project and the specific permit required is based on a variety of site-specific data, which include but is not limited to the size of the disturbance, the distance to a public freshwater lake, the disturbance elevation, and the size of the upstream watershed. A brief summary of applicable regulatory agencies and common permits they issue is following. Certain site-specific parameters for a project may result in a deviation from common scenarios as outlined in the summary. Regulatory agencies should be consulted on a project-by-project basis to prevent unintentional violations. Davey Resource Group has coordinated with regulators at these agencies as appropriate to determine the necessary permits for a proposed project.

US Army Corps of Engineers

USACE regulates placement of fill in navigable waters and "waters of the US" that drain to navigable waters including rivers, streams, lakes, and non-isolated wetlands under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. Jurisdiction of "waters of the US" is determined by USACE and USEPA.

USACE commonly issues three types of permits in Indiana including Nationwide Permits, Individual Permits, and Regional General Permits. Nationwide Permits authorize activities that USACE has determined to be "similar in nature, cause only minimal cumulative adverse environmental effects when performed separately, and cause only minimal cumulative adverse effects on the aquatic environment" when certain conditions are met. IDEM has granted approval for many but not all USACE Nationwide Permits.

A USACE Individual Permit is required when a project will impact equal to or greater than 1 acre of wetland or stream. A USACE Regional General Permit allows for impacts that are less than 1 acre, but are not authorized by a Nationwide Permit.

Impacts to greater than 0.10 acre of aquatic resources typically require compensatory mitigation including maintenance and monitoring for a period of several years following mitigation implementation.

Indiana Department of Environmental Management

Under Section 401 of the Clean Water Act, IDEM regulates placement of fill and potentially other secondary water quality impacts for all aquatic features regulated by USACE under Section 404. IDEM also regulates isolated wetlands under the State Isolated Wetland Law (IC 13-18-22). These waters are collectively referred to as "waters of the State".

A Regional General Permit notification form and additional standard data requested by IDEM may be submitted to IDEM for impacts to "waters of the US" equal to or less than 0.10 acre or 300 linear feet providing that certain conditions are met. A Regional General Permit is considered authorized if the applicant is not contacted within 30 days of IDEM's date of receipt.

If a project does not meet the terms and conditions required for a Regional General Permit from IDEM, then an Individual Section 401 Water Quality Certification or Isolated Wetlands Permit from IDEM will be necessary. Compensatory mitigation is typically required for projects requiring Section 401 Water Quality Certification, and the permit application process may take several months.

Indiana Department of Natural Resources

IDNR Division of Water administers the Lakes Preservation Act (IC 14-26-2), the Lowering of Ten Acres Lakes Act (IC 14-26-5), and the Flood Control Act (IC 14-28-1). A Lakes Preservation Act is required when any work is being conducted within 10 feet of the shoreline as established by the legal lake level on a public freshwater lake. A permit often referred to as a Ditch Reconstruction permit is required under the Lowering of Ten Acres Lakes Act when work is conducted within 0.5 mile of a public freshwater lake and below the legal lake level. A Flood Control Act permit is needed for any work conducted in the floodway of a stream with an upstream drainage area of 1 square mile or greater.

An IDNR permit application may require extensive data collection and a lengthy review time depending on specific project site conditions and the presence of existing data. The approval process may be streamlined for work on regulated county drains for which the county surveyor or drainage board is the applicant under Senate Enrolled Act 368.

Oliver and Olin Lakes are both public freshwater lakes with a legal lake level of 899.45 feet above mean sea level established by IDNR. Martin Lake is also a public freshwater lake; however, it does not have a court established legal lake level. Whenever a lake does not have a court established legal lake level the permit applicant is responsible for finding the average natural water surface level. This process is completed by conducting a simple survey of the lake shoreline and documenting the average water surface elevation.

LaGrange County Soil and Water Conservation District

LaGrange County Soil and Water Conservation District (SWCD), in conjunction with IDEM, administers 327 IAC 15-5, commonly referred to as Rule 5. A Stormwater Pollution Prevention Plan (SWPPP) must be submitted to the SWCD for approval when a project will disturb equal to or greater than one acre of land. Following approval of the SWPPP by the SWCD, a Notice of Intent must also be submitted to IDEM.

Project site owners are required to submit a Notice of Termination to IDEM at the completion of the land disturbing project. All construction must be complete, the entire site stabilized with no bare soil, and all temporary best management practices removed to be considered a terminated project.

LaGrange County Drainage Board

Indiana Drainage Code establishes the right of a Drainage Board for each county. Drainage Boards consist of 3 to 5 members of which one must be a county commissioner. The county surveyor also serves on the board as a technical advisor and non-voting member. A tax is typically assessed to lands that drain to regulated drains to financially support maintenance activities. Maintenance activities can include dredging, tile repair, and removal of any obstructions.

The LaGrange County Drainage Board has jurisdiction over established Regulated Drains that may be either open or tiled drainageways in LaGrange County. Maintenance of Regulated Drains is the responsibility of the County Surveyor.

It is recommended that any project proposed on a Regulated Drain involve coordination with the county surveyor and the project should be presented to the Drainage Board for approval. Since it is the duty of the Drainage Board to facilitate efficient drainage in the county, projects that involve increased detention times may not always be authorized. Regulated drains have an easement for maintenance 75 feet outward from the top of each bank.

Engineering Feasibility Study Results

Project 1: Erosion Control along a Ditch Adjacent to CR 550 (Regulated Drain 49B)

Streambank erosion is occurring on a segment of Regulated Drain 49B which runs adjacent to the south side of CR 550 South and east of SR 9 (Photograph 2). Maintenance on Regulated Drain 49B has historically involved substantial channelization, or straightening, of the stream in order to drain water more quickly from the landscape. In the channelization process, 90 degree bends were created in the stream channel. The force of water crashing into these hard bends during storm events resulted in excessive erosion.

Photograph 2 (02-02-12). Water emerging from a culvert beneath CR 550 South is eroding the ditch bank.

Installing an elbow onto the end of the culvert outlet has been proposed in the location of the upstream-most 90 degree bend. The purpose of the elbow is to allow water flowing from the culvert to make the 90 degree turn within the pipe, thereby eliminating the erosive force from impacting the streambank. The project is further illustrated on the map sheet for Project 1 within the conceptual drawings in Appendix A. Placement of riprap is proposed at the second 90 degree bend approximately 150 yards downstream to alleviate streambank erosion in that location.

Easements and Land Availability

Regulated Drain 49B is under the authority of the LaGrange County Drainage Board. The Drainage Board has an easement of 75 feet outward from the top of bank to conduct maintenance activities.

Environmental Impact Assessment

Wetlands and Existing Vegetation

There are no wetlands adjacent to Regulated Drain 49B in the vicinity of the project area. The ditch was dry in summer 2012; consequently, collection of macroinvertebrates was not feasible. Ditch substrates primarily consist of silt.

Vegetation along the edge of Regulated Drain 49B within the proposed project site consists of common native and non-native species having low floristic quality. Table 7 lists dominant species identified in the proposed project area.

Table 7. Dominant Vegetation Species Identified On Site for Project 1

Species Name	Common Name	Wetland Indicator Status	Coefficient of Conservatism[1]
Acer negundo	ash-leaf maple	FAC	1
Arctium minus	lesser burdock	FACU	*
Bromus inermis	smooth brome	FACU	*
Parthenocissus quinquefolia	Virginia creeper	FACU	2
Phalaris arundinacea	reed canary grass	FACW	*
Rubus occidentalis	black raspberry	UPL	1
Sambucus nigra	black elder	FACW	2
Solidago altissima	tall goldenrod	FACU	0
Symphyotrichum lanceolatum	white panicle aster	FAC	3

[1] Non-native species do not have a coefficient of conservatism and are noted with an asterisk.

Macroinvertebrates, Stream Habitat, and Water Quality Data

The stream was dry at the time of benthic macroinvertebrate and water quality data sampling making these analyses infeasible. Stream habitat is negligible. The project site is the upstream-most daylighted portion of Regulated Drain 49B. Thus, colonization of the site by a diverse and healthy macroinvertebrate population is highly unlikely.

Permit Requirements

USACE/IDEM

Regulated Drain 49B is a jurisdictional stream under Section 404. To complete the proposed project within Regulated Drain 49B, it will be necessary to apply for a USACE Regional General Permit as well as an IDEM Individual Water Quality Certification. The project will not qualify for a USACE Nationwide Permit #3 for the maintenance of the drain due to the recommended placement of stone at the downstream-most 90 degree bend adjacent to CR 550 South that is not directly associated with the installation of the culvert extension.

A Section 401 Water Quality Certification from IDEM is necessary for the project because the reinforced concrete pipe proposed to encapsulate the 90 degree bend is different from the type of culvert that is currently present on site and because work is proposed at two separate locations within the drain.

Application for both permits can be made by filling out an IDEM Section 401 Water Quality Certification and submitting this document to both IDEM and USACE because the project impact is less than 0.1 acre of "waters of the US" and will have a minimal impact on the aquatic environment.

IDNR

The project site has a total drainage area of 0.321 square mile (0.831 square kilometer), and it is not within 0.5 mile of a public freshwater lake. Consequently, no permits are needed from IDNR to conduct work as proposed on Regulated Drain 49B.

Local

Regulated Drain 49B is under the maintenance authority of the LaGrange County Drainage Board. The Drainage Board maintains an easement of 75 feet from the top of edge of the bank on each side of the regulated drain. No work should be conducted within this easement without approval of the Drainage Board.

Unusual Physical or Social Costs

Physical or social costs of the proposed project will be negligible. Land outside of the ditch channel will not be modified and the project will not influence drainage capacity of the ditch.

Functionality of Proposed Project

Modeling was performed using the USEPA's Spreadsheet Tool for Estimating Pollutant Load (STEPL) program (Tetra Tech 2006). The purpose of STEPL is to easily allow users to model the effects of enacting several different kinds of BMPs including streambank erosion control, agricultural filter-strip control, and reduced tillage systems.

The current project environment allows for an estimated 35 feet of severe streambank erosion to occur each year. Based on the model, the proposed project is anticipated to reduce eroding sediment from 3.94 tons per year to 0.20 ton per year—a sediment reduction of 3.74 tons per year.

Cost Approximations and Timeline

It will cost an estimated $9,200 to complete the proposed project for Regulated Drain 49B. This estimate includes purchasing and installing a 24-inch reinforced concrete pipe elbow, flared end and fittings, approximately 15 cubic yards of glacial stone, and costs associated with permitting and project management (Table 8).

Permit acquisition for this project can be expected to take approximately three months. Work on Regulated Drain 49B can begin any time after sufficient funding has been identified. On-site project completion time is estimated to take one day. Work is recommended to occur during late summer when the channel will likely be dry.

Table 8. Summary of Project Costs for Regulated Drain 49B

Implementation Activity	Estimated Cost
Stone (15 cubic yards)	$1,200
Equipment (skid loader and small excavator and stone installation labor)	$2,000
Pipe materials and installation	$3,500
Permit acquisition and project management	$2,500
Total Estimated Cost	$9,200

Institutional Resources and Potential Funding

The current LaGrange County Surveyor, Rex Pranger, has expressed willingness to oversee this project and to be listed as the permit applicant. At this time there is not a ditch assessment on Regulated Drain 49B, consequently there are no maintenance funds available from the Drainage Board or the LaGrange County Surveyor's Office to conduct the project. Due to the small nature of this project, the most efficient funding sources include the IDNR LARE Program along with a match from OMLCIA or a private donor.

Justification of Site Selection

In the 2009 *Oliver, Olin, and Martin Lakes Diagnostic Study* (JFNew), it was noted that the ditch inlet to Martin Lake, which is fed in part by Regulated Drain 49B, has by far the highest average sediment depth of all inlets in the Oliver, Olin, and Martin Lakes chain indicating high sediment inputs from upstream sources. The identified project on Regulated Drain 49B has the potential to reduce sediment loads by approximately 3.74 tons per year for a very minimal cost.

Feasibility Summary

Funding and cost are the primary obstacles for the project to overcome. The relatively small cost associated with the project would be best addressed through the IDNR LARE program with a cost-share match provided by OMLCIA or a private donor. The project is simple, yet provides a very significant and measurable benefit to the whole watershed. The feasibility for completion is high.

Project 2: Erosion Control on Ditch Bank Southwest of the Intersection of SR 9 and CR 600 (Regulated Drain 45)

A large pile of spoils was placed directly west of a bend in Regulated Drain 45 on the south side of CR 600 South the last time that the maintenance occurred on the drain. Periods of high flow have resulted in erosion of the spoils pile to a height of greater than six feet above the typical water elevation (Photograph 3).

Removal of the spoils pile consisting of an estimated 50 cubic yards of soil to create a floodplain bench, armoring the streambank toe through the bend in the channel with stone, and stabilizing the streambank with native plantings is proposed to alleviate streambank erosion in this location (Appendix A, Project 2).

Photograph 3 (8-26-12). Excessive streambank erosion is widespread with large amounts of bare soil.

Easements and Land Availability

Regulated Drain 45 is under the authority of the LaGrange County Drainage Board. The Drainage Board has an easement of 75 feet outward from the top of the bank to conduct maintenance activities. Rex Pranger, the LaGrange County Surveyor, has expressed willingness to coordinate with the landowner and be the permit holder for drain maintenance activities to occur within this easement.

Wetlands and Existing Vegetation

Wetlands are present adjacent to both sides of Regulated Drain 45 in the vicinity of the project area. Special care should be taken to ensure that these wetlands are not impacted during construction activities. The wetlands locations are depicted on the conceptual design map for Project 2 in Appendix A.

Construction activities will ultimately improve the riparian habitat of the stream through the removal of the spoils pile and the low-quality and invasive species currently growing on it such as *Lonicera* spp. (bush honeysuckle), *Arctium minus* (lesser burdock), *Acer negundo* (ash-leaf maple), and *Vinca minor* (common periwinkle). The spoils pile will be exchanged for a floodplain bench that will be planted with native species.

Macroinvertebrates, Stream Habitat, and Water Quality Data

Table 9 depicts macroinvertebrate data taken from the stream reach. The score is above 2.2—IDEM's critical cut-off value for aquatic life impairment in streams. Scores ranging from 0–2 were recorded in half the metrics. A family level HBI score of 4.11 suggests possibility of slight organic input. Chironomid counts, which are typically high in polluted waters compared with other taxa, were low in the sample reach. A final mIBI score of 3.40 suggests moderate impairment for the stream in regards to the macroinvertebrate community.

Table 9. mIBI Score for Restricted Drain 45

Metric	Data	Score
Family Level HBI	4.11	6
Number of Taxa	6	0
Number of Individuals	118	2
Percent Dominant Taxon	64.4	0
EPT Index	2	0
EPT Count	80	4
EPT Count to Total Number of Individuals	0.68	6
EPT Count to Chironomid Count	13.33	8
Chironomid Count	6	8
Number of Individuals to Number of Squares Sorted	9.8	0
Site mIBI Score		3.40

Regulated Drain 45 was used as a reference stream for analyzing the RBPII macroinvertebrate data in the watershed. Regulated Drain 45 was chosen as a reference site based on habitat quality and macroinvertebrate data compared to the other sites investigated in the watershed and nearby. Regulated Drain 45 is a typical stream segment in this area.

The Rapid Bioassessment Protocol was developed as a way to quickly compare stream macroinvertebrate communities to one another. Table 10 contains RBPII data for this site. An RBPII impairment category cannot be assigned to the data for this stream since it was also used as the reference site.

Table 10. RBPII Reference Site Scores at Restricted Drain 45

Metric	Reference Site		
	Data	RBPII[1]	Score
Number of Taxa	2	100	6
Family level HBI	4.1	100	6
Ratio of scrapers to filtering collectors	0.013	100	6
Ratio of EPT to Chironomidae	13	100	6
Percent dominant taxon	64	100	0
EPT Index	2	100	6
Community loss index	0	0	6
Ratio of shredders to non-shredders	0.017	100	6
Total score			42
Percent of reference site			100
Impairment category			n/a

[1] RBPII data as a percent of the reference site.

The stream reach sampled had a QHEI score of 59 (non-impaired). A data sheet is included in Appendix E. The current habitat quality in the project area is classified as good. The stream recorded the best habitat quality of all project sites evaluated in the watershed. The lowest metric scores were recorded in the Pool/Glide and Riffle/Run Quality sections. The low mIBI score may be attributed to a lack of prime habitat quality. Moderate levels of siltation and embeddedness were recorded at the site. These two parameters can have a large effect on macroinvertebrate populations.

Water quality data obtained on site revealed a water temperature of 19.7°C, a pH of 7.7, specific conductivity (compensated for temperature) of 625 µS, and a dissolved oxygen concentration of 6.6. All parameters fall within standard ranges per IDEM requirements.

Permit Requirements

USACE/IDEM

A permit for the project as proposed will be required from USACE under Section 404 and IDEM under Section 401. This project will qualify for USACE Regional General Permit No. 1 because it will affect less than 0.10 acre, or 300 linear feet, of "waters of the US" and will have minimal effect on the aquatic environment. An Individual Water Quality Certification will be required from IDEM because the proposed project will permanently alter the cross-sectional area under the bank full elevation.

IDNR

The project site is not within 0.5 mile of a public freshwater lake. Consequently, neither a Lakes Preservation Act nor a Ditch Reconstruction permit is needed for this project.

The downstream-most portion of the project site has a total drainage area of 3.068 square miles (7.946 square kilometers). A Flood Control Act permit is necessary unless the work is conducted by the LaGrange County Surveyor's Office, in which case the project would be exempt from this permit requirement.

Local

Regulated Drain 45 is under the maintenance authority of the LaGrange County Drainage Board. The Drainage Board maintains an easement of 75 feet from the top of edge of the bank on each side of the regulated drain. No work should be conducted within this easement without approval of the drainage board. In addition, work should be overseen by the drainage board, so that a Flood Control Act permit from IDNR is unnecessary. The LaGrange County Surveyor is aware of erosion concerns at the site and has expressed willingness to assist with coordination of the project.

Unusual Physical or Social Costs

There are no unusual physical or social costs associated with this project. Work is proposed in an area currently dominated by scrubby, undesirable vegetation. The area is not in agricultural production. Re-grading of minimal spoils in the agricultural field within the drainage easement, if necessary, will have a negligible impact on the landowner/farmer.

Functionality of Proposed Project

Streambank erosion on site is extensive and ongoing. STEPL modeling suggests streambank stabilization may result in a decrease in sediment load from 2.15 tons per year to 0.11 ton per year—a decrease of over 2.04 tons per year.

Cost Approximations and Timeline

As proposed, the project on Regulated Drain 45 is estimated to cost approximately $12,000. This estimate includes grading of approximately 420 cubic yards of soil within the drainage easement, vegetation materials and installation, placement of approximately 5 cubic yards of glacial stone within the stream channel, obtaining USACE and IDEM permits for the project, and general project management. A breakdown of costs associated with the project is included in Table 11.

Table 11. Summary of Project Costs for Regulated Drain 45

Implementation Activity	Estimated Cost
Earthwork, equipment (excavator, skid steer, dump truck), soil removal (420 cubic yards), and regrading	$4,800
Stone (5 cubic yards), equipment (skid steer and small excavator), and installation labor	$2,500
Vegetation material (2- to 3-gallon pin oak trees [*Quercus palustris*], 33 silky dogwood [*Cornus amonum*] live stakes, seed) and installation labor	$1,700
Permit acquisition and project management	$3,000
Total Estimated Cost	$12,000

Work on Regulated Drain 45 can start after funding and appropriate permits have been secured. Davey Resource Group recommends starting the permitting process approximately four months prior to the anticipated construction date. Implementation is recommended to occur from September through October for maximizing success rates of planted woody vegetation.

Institutional Resources and Potential Funding

No local drainage improvement funds are available for this project. The IDNR LARE Program is the most likely funding source for this project due to its small nature. The IDNR LARE Program provides up to 80% of the cost of a project. The project sponsor is expected to contribute a 10% cash match and an additional 10% of the value of the project as in-kind services.

While not the most probable funding sources, the Five Star Restoration Program through the USEPA and the Sustain Our Great Lakes Program through the National Fish and Wildlife Foundation are other possibilities. The Five Star Restoration Program looks to collaborate between communities and possible stakeholders to restore streams and wetlands. The Sustain Our Great Lakes Program brings together several federal agencies for public-private collaboration to restore and enhance habitat by improving quality and connectivity of tributaries, wetlands, and coastal habitats. This program is specific to the Great Lakes basin.

Justification of Site Selection

The 2009 *Oliver, Olin, and Martin Lakes Diagnostic Study* (JFNew) recommends the stabilization of eroded streambanks throughout the watershed—this location specifically was identified as a potential project location. Extensive streambank erosion in this area is very apparent. Erosion will continue in this area if steps are not taken to correct it. Stabilizing the streambank in this location will help improve water quality in streams and lakes downstream of the proposed project location.

Feasibility Summary

The project as proposed is highly feasible. Other than determining and securing funding sources, there are no other identified factors hampering the feasibility of implementing the proposed. The County Surveyor is willing to coordinate with the land owner to work within the easement.

Project 3: Olin Lake Nature Preserve Streambank Erosion Control

IDNR Division of Nature Preserves owns and manages the 269-acre (109-hectare) Olin Lake Nature Preserve that surrounds Olin Lake and is adjacent to the southern tip of Oliver Lake and the west side of Martin Lake (IDNR 2011b). Multiple unnamed, intermittent streams flow north through the nature preserve to Olin Lake. Streambank erosion resulting from headcutting and associated channel incision is occurring on one of the streams (Photograph 4).

Streambank erosion is a natural process, but it can be accelerated by man-induced changes in a watershed.

Photograph 4 (12-2-11). Severe streambank erosion is occurring on an unnamed tributary to Olin Lake in the Olin Lake Nature Preserve.

Alteration of natural stream conditions and changing land use patterns can lead to channel instability and land loss among other effects that contribute to above-average sediment levels and accompanying nutrients in waterways.

The eroding intermittent stream channel is fed by multiple ephemeral streams originating on the southern edge of the nature preserve. The ephemeral streams are fed from surface flow from a cultivated cropland.

One tile was also observed draining to the intermittent stream from the direction of the cultivated field. The total watershed of the intermittent stream is approximately 30.7 acres (12.4 hectares), or 0.048 square mile (0.124 square kilometer) of which approximately 1.5 acres (0.6 hectare) is forested wetlands near the edge of Olin Lake (US Geological Survey [USGS] 2011).

Soils in the upper part of the watershed including the cultivated field are mostly composed of Conover loam as well as some Wawasee fine sandy loam (Soil Survey Staff 2011). An analysis of aerial photographs indicates that irrigation equipment has been present in the field since at least September 2003.

Davey Resource Group completed preliminary conceptual plans for coordination with IDNR Division of Nature Preserves, IDEM, and USACE. These plans are included in Appendix A, Project 3. Davey Resource Group worked with Gensic Engineering to produce engineered plans for the site once the project was determined feasible. The engineered plans are included in Appendix F. A full size copy of engineered plans was provided to and discussed with IDNR Division of Nature Preserves staff Rich Dunbar, the northeast regional ecologist, and John Bacone, the division director.

Easements and Land Availability

The land is owned by IDNR Division of Nature Preserves. The organization desires to stabilize the streambank, and land availability is not an obstacle to implement the project.

Environmental Impact Assessment

Wetlands and Existing Vegetation

The eroding stream drains through lakeshore wetlands prior to entering Olin Lake; however, there are no wetlands present in the work zone location where bank stabilization measures are proposed. A small amount of riparian area will be affected adjacent to the stream. The riparian area is currently made up of mature forest. It may be necessary to remove some small saplings in order to transport and place rock within the channel using small equipment. Conduct as much work as is feasible by hand to minimize sapling loss. While quality native species were observed adjacent to the stream channel, no species of special concern were noted.

Macroinvertebrates, Stream Habitat, and Water Quality Data

The stream was dry at the time of benthic macroinvertebrate and water quality data sampling making these analyses infeasible.

Habitat analysis included the use of QHEI and HHEI methods (Appendix E). The QHEI method yielded a score of 54 (non-impaired). The stream contains a drainage area of approximately 0.06 square mile. The primary method for evaluating streams of this size is HHEI. The HHEI method yielded a score of 34. A stream with this score and characteristics is classified as Class II PHWH (Ohio EPA 2012).

Permit Requirements

USACE/IDEM

Permit pre-coordination was conducted with USACE, IDEM, and IDNR Division of Water for the stream restoration based on the conceptual design (Appendix A, Project 3). It was determined that this project would qualify for a USACE Nationwide Permit 27 for Aquatic Habitat Restoration, Establishment, and Enhancement Activities.

It will be necessary to submit an Application for Authorization to Discharge Dredged or Fill Material to Isolated Wetlands and/or Waters of the State to IDEM. IDEM Project Manager Heather Parsons did not express any concerns with permitting for the project based on the conceptual design.

IDNR

As the project has been designed, no work is proposed within 10 feet of the shoreline of Olin Lake. Work is proposed within 0.5 mile of Olin Lake. Olin Lake is a public freshwater lake with a legal lake level of 899.45 feet (274.15 meters) above mean sea level (IDNR 2009a). No work is proposed below the legal lake level of 903.5 feet. The project site upstream drainage area is 0.048 square mile (0.124 square kilometer). Consequently, no permits are required from IDNR to conduct this project.

Local

This stream is not a LaGrange County regulated drain; consequently, no local permits or approvals are necessary to implement bank stabilization measures in this stream.

Unusual Physical or Social Costs

It will be necessary to remove some saplings within the nature preserve near the stream to facilitate the use of small equipment needed for implementing restoration measures. A brief discussion of this possibility was conducted with IDNR Division of Nature Preserves, and objections were not expressed. There are no other known unusual or physical or social costs.

Functionality of Proposed Project

STEPL was used to model the potential benefits for streambank stabilization in the Olin Lake Nature Preserve. Approximately 10.03 tons of sediment is estimated to erode from the streambank each year. Streambank stabilization is estimated to decrease sediment erosion by 9.53 tons per year.

Cost Approximations and Timeline

Work on the stream can start after funding and appropriate permits have been secured. Davey Resource Group recommends starting the permitting process approximately four months prior to the anticipated construction date. Implementation can be phased over a period of years, beginning downstream and working upstream, to spread out the cost of implementation. Installation of stone is recommended to occur during late summer when the stream is most likely to be dry. The total estimated cost of the project, including material and labor, is listed in Table 12.

Table 12. Summary of Project Costs for Olin Lake Nature Preserve Streambank Erosion Control

Implementation Activity	Quantity	Unit Price	Estimated Cost
Native Glacial Stone (6–12″)[1]	150 tons	$35	$5,250
Native Hardwood Lumber			
16′–2″ x 12″	20 boards	$25	$500
8′–6″ x 6″	8 posts	$20	$160
Equipment Rental Costs			
Loader			$1,600
Excavator			$1,600
Hauler			$2,000
Labor[2]			
Operator (1)	120 hours	$60	$7,200
Laborers (2)	240 hours	$50	$12,000
Staging Area Lease	1 lump sum	$2,000	$2,000
Access Road Lease	1 lump sum	$2,000	$2,000
Construction Engineering[3]	32 hours	$125	$4,000
Total Estimated Cost[4]			$38,310

[1] Stone is potentially available at the county pit for the cost of hauling. Contact Rex Pranger: 260-499-6307.
[2] IDNR Division of Natural Preserves could do some work in-house to reduce external labor costs.
[3] Field staking oversight and construction activities.
[4] Work can be completed in stages over a period of several years.

Institutional Resources and Potential Funding

The IDNR Division of Nature Preserves intends to allocate funds for implementation of the design plan by an approved contractor as funding is available. This project may be implemented in its entirety as designed or in segments over a period of multiple years. OMLCIA could apply for grants on behalf of the DNR Division of Nature Preserves. The USEPA Five Star Restoration Program is a potential grant funding source that focuses on stream and wetland restoration projects.

Justification of Site Selection

The site was identified during the 2009 *Oliver, Olin, and Martin Lakes Diagnostic Study* (JFNew) due to the extensive amount of streambank erosion. The project will combat sediment and nutrient load contribution to the lake. The site is found within a nature preservation owned by IDNR, which increases the feasibility of the proposed project. Stabilizing the streambank will help increase water quality in streams and lakes downstream of the project site.

Feasibility Summary

Stabilization of the eroding stream channel within the Olin Lake Nature Preserve is highly feasible. The ability of IDNR Division of Nature Preserves to allocate internal funding or bring in outside funding is the only potential obstacle for implementing this project.

Project 4: Erosion Control on Ditch Located South of CR 450 and North of Oliver Lake

Minor erosion is occurring along a very small ditch between homes 1380 E and 1360 E along 450 South between the road and the lake (Photograph 5). The area is currently dominated by turfgrass with shallow root systems failing to firmly hold soils in place.

Photograph 5 (12-2-11). Minor erosion along a stream on the north side of Oliver Lake can be addressed with native vegetation plantings.

The erosion can be easily addressed by planting native shrubs along the stream edge to anchor soils. Planting native shrubs will also improve the overall environmental integrity of the stream corridor. No permits would be required for native vegetation planting.

Davey Resource Group recommends planting a total of 60 *Symphoricarpos orbiculatus* (coralberry, Indian currant) bare-root shrubs approximately every 3 feet along the stream edge. Coralberry is a fast, but low-growing (2- to 5-feet-tall), ornamental native shrub that tolerates both sun and shade. It is also attractive to birds and pollinators. *Rhus aromatica* (fragrant sumac) and *Schizachyrium scoparium* (little bluestem) may also be placed along the streambank as a substitute.

Bare-root shrubs should be planted in early spring prior to budbreak. Bare-root shrubs are available for shipping from Cold Stream Farm in Michigan. The planting project is highly feasible and could be accomplished by volunteers in a couple of hours. Costs are estimated at less than $100. The project could be funded by either the landowner or lake association.

Project 5: Olin-Raber Wetlands Hydrological Enhancement

The Olin-Raber Wetlands (Appendix A, Project 5) are located east of Martin Lake on a 32.33-acre nature preserve. The property is in the process of being transferred to ACRES Land Trust (ACRES) from The Nature Conservancy. This property contains a large wetland area dominated by *Phalaris arundinacea* (reed canary grass). The wetland contains some remnant fen vegetation but overall is highly degraded.

Photograph 6 (2-2-12). The ditch dug through the nature preserve is deeply entrenched.

A ditch was originally dug through the wetland without permits. The ditch conveys water east to west, in nearly a straight line across the nature preserve. It originates at a tile outlet near the eastern edge of the property and flows to Regulated Drain 45 just before it drains to Martin Lake. The stream is deeply entrenched for most of the distance it travels across the site and is disconnected from the adjacent wetlands.

Sheet piling covered with small earthen berms is proposed to be inserted into the ditch channel to incapacitate the ditch and reconnect the flow of water with the adjacent wetland. Water is proposed to be diverted from the channel into shallowly excavated wetland cells and then allowed to sheet flow further across the wetland surface. Slowing the flow of water will allow sediment and nutrients to settle out as well as allow for bacteria to die off prior to reaching Martin Lake.

Engineered drawings for the project are in Appendix G.

Easements and Land Availability

The Olin-Raber Tract was formerly acquired from Levi and Irene Raber by The Nature Conservancy in 1993. Ownership of the land is being transferred to ACRES. A 10-foot-wide walking easement, used to gain access to the nature preserve, exists along the northern edge of the property owned by Wilber Miller at 5400 South State Road 9, Wolcottville, Indiana 46795. The walking easement does not provide sufficient passage for equipment to enter the project site. A map depicting the easement location is in Appendix H. Davey Resource Group has obtained permission from Mr. Miller to transport heavy equipment to the nature preserve through the Miller property. A letter addressed to Mr. Miller proposing the allowance has been signed can be found in Appendix I. Further coordination and scheduling with Mr. Miller prior to initiation of work should take place by the earthwork contractor.

Due to the extent of wetland area on the nature preserve, excavated soils will need to be removed from the property and deposited in an upland location. Nearby landowners who have expressed interest in taking excavated soils are listed in Appendix J.

An ACRES representative has met on site with Davey Resource Group, regulators, and IDNR LARE Program staff to discuss the project. However, implementation of the project has not been formally approved by ACRES. ACRES can formally address implementation of the project in spring 2014 after the land transfer from The Nature Conservancy is complete.

Environmental Impact Assessment

Wetlands and Existing Vegetation

NWI maps show that nearly the entire nature preserve is palustrine emergent, seasonally flooded to well-drained (PEMCD) wetland. Formal wetland delineation was not conducted on site due to obvious indicators of wetland hydrology, hydric soils, and hydrophytic vegetation across the entire proposed project area and concurrence by wetland regulators during a field meeting that the entire project area is wetland. The vast majority of the wetland is a monoculture of reed canary grass, an invasive species, with scattered *Salix interior* (sandbar willow) and box elder. One large area of relatively diverse remnant fen vegetation dominated by *Carex stricta* (upright sedge) exists on the nature preserve north of the proposed project location (Appendix A, Project 5). Species observed in this location are listed in Table 13. A small monoculture of upright sedge exists west of the proposed project location.

Table 13. Vegetation Species Identified in the Fen

Species Name	Common Name	Wetland Indicator Status	Coefficient of Conservatism[1]
Alliaria petiolata	garlic mustard	FACU	*
Apocynum cannabinum	Indianhemp	FAC	2
Calamagrostis canadensis	bluejoint	OBL	5
Carex stricta	upright sedge	OBL	5
Cornus spp.	dogwoods		
Dasiphora fruticosa	shrubby cinquefoil	FACW	9
Impatiens capensis	jewelweed	FACW	2
Iris virginica	Virginia iris	OBL	5
Onoclea sensibillis	sensitive fern	FACW	4
Rosa palustris	swamp rose	OBL	5
Solidago gigantea	giant goldenrod	FACW	4
Solidago patula	roundleaf goldenrod	OBL	8
Symplocarpus foetidus	skunk cabbage	OBL	8
Toxicodendron vernix	poison sumac	OBL	10
Typha sp.	Cat-tail		

[1] Non-native species do not have a coefficient of conservatism and are noted with an asterisk.

The remnant fen vegetation community to the north is located at a higher elevation than the proposed project work area. The fen is groundwater-fed and the proposed project should not influence the existing hydrology in the fen location. Extreme care should be taken during implementation of the project to ensure that the remnant fen community is not disturbed.

Macroinvertebrate, Stream Habitat, and Water Quality Data

Water was observed flowing through the ditch traversing the nature preserve during a time of drought suggesting substantial groundwater input to the channel. Macroinvertebrates were sampled, and the mIBI score for the project site was identical to the reference site at Regulated Drain 45; however, slight variations in the scoring metrics were present (Table 14). The score is above 2.2—IDEM's critical cut-off value for aquatic life impairment in streams. A final score of 3.40 is considered moderately impaired by this scoring system. Scores ranging from 0–2 were found in four metrics suggesting impairment.

These metrics include number of taxa, percent dominant taxon, EPT Index, and number of individuals to number of squares sorted. Low scores in these sections suggest a low density of macroinvertebrates at the project location. It also suggests that low populations of desirable macroinvertebrate species are found at the site.

Table 14. mIBI Score for Olin-Raber Wetlands

Metric	Data	Score
Family Level HBI	4.19	6
Number of Taxa	8	0
Number of Individuals	145	4
Percent Dominant Taxon	53.8	2
EPT Index	2	0
EPT Count	44	4
EPT Count to Total Number of Individuals	0.30	4
EPT Count to Chironomid Count	8.80	6
Chironomid Count	5	8
Number of Individuals to Number of Squares Sorted	13.2	0
Site mIBI Score		3.40

RBPII scores for the same stream segment and the Regulated Drain 45 reference site are found in Table 15. A large difference in the number of scrapper macroinvertebrates was found between the reference site and Olin-Raber Wetlands. This difference accounts for the difference in score between the sites. Olin-Raber Wetlands scored approximately 86% of the reference site score.

Table 15. RBPII Raw Data and Score for Olin-Raber Wetlands

Metric	Reference	Olin-Raber Wetlands		
	Data	Data	RBPII	Score
Number of taxa	6	8	100%	6
EPT Index	2	2	100%	6
Percent dominant taxa	64	54	84%	0
Ratio of EPT to Chironomidae	13.0	8.8	68%	6
Modified HBI	4.1	4.2	100%	6
Ratio of scrapers to filtering collectors	0.013	0.350	100%	0
Ratio of shredders to non-shredders	0.017	0.028	100%	6
Community loss index	0	0.125	100%	6
Total score	42		36	
Percent of reference	100%		86%	

The stream reach sampled had a QHEI score of 33 (poor). A data sheet is included in Appendix E. The current habitat quality in the project area is classified as poor. The stream contains a drainage area of approximately 0.11 square mile. The primary method for evaluating streams of this size is HHEI.

The HHEI method yielded a score of 39. A stream with this score and characteristics is characterized as Modified Class II PHWH (Ohio EPA 2012). The lowest scores were recorded in the Pool/Glide and Riffle/Run Quality sections. The low mIBI score is attributed to a lack of prime habitat quality. Moderate levels of siltation and embeddedness were recorded at the site. These two parameters can have a large effect on macroinvertebrate populations.

Basic water quality data at the time of sampling included temperature, dissolved oxygen, pH, and specific conductivity (13.80°C, 6.70 mg/L, 7.19, and 598 µS, respectively). These metrics fall within acceptable parameters set forth by IDEM and are not expected to have influenced macroinvertebrate data.

Permit Requirements

USACE/IDEM

This ditch and adjacent wetland are jurisdictional under Section 404. It will be necessary to apply for a USACE Regional General Permit for discharge of fill below the ordinary high watermark of the ditch and within the wetland boundary. Proposed impacts from fill are below the threshold requiring mitigation by USACE.

The ditch and wetland are also "waters of the state". A Section 401 Water Quality Certification from IDEM will be necessary to discharge fill below the OHWM of the stream and within the wetland boundary. Both fill and excavation are counted toward wetland impact totals by IDEM. However, IDEM indicated that as long as the proposed pools are planted with quality wetland vegetation the net impact will be reduced and formal mitigation will not be required (Heather Parsons, personal communication, April 5, 2013).

IDNR

Earthwork is proposed within 0.25 mile of Martin Lake. Martin Lake is a public freshwater lake; however, it does not have a court established legal lake level. The permit applicant will be responsible for assessing the average normal lake level by means of a simple survey. Work is not proposed below an elevation of 902 feet. If the average normal lake level is below this elevation, then neither a Lakes Preservation Act nor a Ditch Reconstruction permit is required from IDNR.

As the project is designed there is no work proposed within 0.5 mile of Olin Lake, which is also a public freshwater lake. All work is proposed above the 899.45 feet (274.15 meters) legal lake level of Olin Lake. Consequently, neither a Lakes Preservation Act nor a Ditch Reconstruction permit is required from IDNR for Olin Lake.

The project site has an upstream drainage area of 0.109 square mile (0.282 square kilometer). A Flood Control Act permit is not needed from IDNR.

Local

The ditch through the wetland is not a LaGrange County regulated drain; consequently, no approval for the project is needed from the LaGrange County Drainage Board.

Less than 1.0 acre of land is anticipated to be directly excavated as part of the proposed project. However, the entire project construction limits exceeds 1.0 acre; thus, a SWPPP should be submitted to the LaGrange County SWCD.

Unusual Physical or Social Costs

Implementation of the wetland hydrological plan will be costly as depicted in the Cost Approximations and Timeline section. In addition, a small social cost will be incurred by the Wilber Miller family, an Amish family who has agreed to allow heavy equipment to pass through land to access the site. Caution should be exercised not to disturb livestock on the Miller property and to repair any damage to the land that may result from heavy equipment passage.

Functionality of Proposed Project

A base flow water sample was collected from the tile out-letting to the ditch on September 26, 2012. The sample was analyzed for ammonia nitrogen, *Escherichia coli* concentrations, and total phosphorus.

Ammonia nitrogen concentrations were below the 0.0500 milligram per liter (mg/L) laboratory reporting detection limit. *E. coli* concentrations were reported at 90.6 most probable numbers per 100 milliliters. Indiana water quality standards limit *E. coli* to 235 colony forming units per 100 milliliters for full body contact recreation. Total phosphorus was 0.026 mg/L.

Extrapolated *E.coli* loads coming from the tile under base flow conditions are estimated at approximately 54 billion bacteria per year, and total phosphorus loads are estimated at 3,410 pounds (1,550 kilograms) per year.

The National Pollutant Removal Performance Database version 3 September 2007 from the Center for Watershed Protection summarizes the results of 37 studies examining removal efficiency of total phosphorus. The median total phosphorus removal efficiency was 48%. Using the median total phosphorus reduction rate for wetlands, an estimated 1,640 pounds (740 kilograms) of total phosphorus per year will be prevented from reaching Martin Lake by implementing this project.

Only three studies in the National Pollutant Removal Performance Database looked at bacteria removal efficiencies. The median bacterial removal efficiency was 78%. Using the median *E. coli* load reduction rate for wetlands, an estimated 42 billion bacteria per year will be prevented from reaching Martin Lake by this project.

STEPL modeling suggests the proposed project may reduce total nitrogen reaching Martin Lake by 46 pounds per year, total phosphorus by 9 pounds per year, and sediment by 35,712 pounds per year.

Implementation of the proposed project could result in substantial reduction of pollutants reaching the Oliver Lake chain.

Cost Approximations and Timeline

Additional coordination regarding implementation of this project between OMLCIA, IDNR LARE Program staff, and ACRES regarding pursuit of funding should occur after acquisition of the property by ACRES has been finalized in spring 2014. Permit acquisition should begin a minimum of four months prior to the start of construction. It is recommended that construction occur during winter when soils are frozen or during late summer when the wetland is driest to minimize unintentional disturbance to soils. The wetland shall be planted according to the timeline specified in the planting plan included as part of the final engineered drawings (Appendix G). Table 16 depicts the cost estimates for each specific task within the construction project.

Table 16. Cost Estimate for Olin-Raber Wetlands Hydrological Enhancement

Description	Quantity	Unit Price	Extension
Earthwork mobilization	1	$3,000	$3,000
Earthwork for Habitat Pool H-1N	780 cubic yards (yd^3)	$10	$7,800
Planting for Habitat Pool H-1N			$1,000
Earthwork for Habitat Pool H-1S	1,630 yd^3	$10	$16,300
Planting for Habitat Pool H-1S			$1,500
Earthwork for Habitat Pool H-2N	810 yd^3	$10	$8,100
Planting for Habitat Pool H-2N			$1,000
Earthwork for Habitat Pool H-2S	350 yd^3	$10	$3,500
Planting for Habitat Pool H-2S			$1,075
Earthwork for Habitat Pool H-3N	780 yd^3	$10	$7,800
Planting for Habitat Pool H-3N			$1,250
Earthwork for Habitat Pool H-3S	1,050 yd^3	$10	$10,500
Planting for Habitat Pool H-3S			$1,275
Polyvinyl chloride (PVC) sheet piling for all berms	3	$2,880	$8,640
Planting Berm 1			$4,775
Planting Berm 2			$4,800
Planting Berm 3			$4,800
Construction engineering	1	$5,000	$5,000
Permit acquisition (USACE, IDEM)	1	$2,000	$2,000
Contingency	1	$8,000	$8,000
Total			$102,115

Institutional Resources and Potential Funding

Possible federal funding sources for the proposed project include the Five Star Restoration Program, the Sustain Our Great Lakes Programs, the North American Wetland Conservation Grants Program, and the IDNR LARE Program. The Five Star Restoration Program through the USEPA strives to bring together communities and possible stakeholders to restore streams and wetlands. The Sustain Our Great Lakes Programs administered by the National Fish and Wildlife Foundation brings together several federal agencies for public-private collaboration to restore and enhance habitat by improving quality and connectivity of tributaries, wetlands, and coastal habitats. The North American Wetland Conservation Grants Program provides funds through the US Fish and Wildlife Service to projects which further the goals set forth by the North American Wetlands Conservation Act. Projects must involve long-term protection, restoration, and/or enhancement of wetlands for the benefit of migratory birds.

The IDNR LARE Program, a state funding source, can provide cash matches for federally funded grants.

Justification of Site Selection

The site was recommended to OMLCIA for inclusion in this study by IDNR LARE Program staff based on suspected high pollutant loads discharging from the tile into the channelized ditch and its close proximity to Martin Lake. Enhancing wetland hydrology near the lake allows for the most pollution removal possible prior to water entering the lake. The fact that the project site is owned by a conservation organization and currently is of low environmental integrity also increases the feasibility of implementing a project in this location.

Feasibility Summary

Implementation of the proposed project has the potential to result in significant pollutant reduction reaching the Oliver Lake chain. The proposed project is costly; however, there are multiple potential funding sources that may aid in implementation. While final approval for implementation of the project by ACRES is pending, the organization has expressed verbal support for allowing this project to occur after transfer of the land to the organization has been completed. Once acquisition of the property by ACRES is finalized, Davey Resource Group recommends that OMLCIA begin coordinating with IDNR LARE Program staff and ACRES to pursue funding.

Project 6: Erosion Control on an Agricultural Field Located North of CR 450 South and East of CR 100 East

Sheet erosion is occurring on an agricultural field located north of CR 450 South and east of CR 100 East. Water drains through a low-lying area in the field to a dilapidated drop box structure on the south edge of the field and through a wooded, sediment-laden gully to an old sediment trap approximately 60 yards north of CR 450 South. Water entering the sediment trap flows directly into a 6-inch tile, which drains to a catch basin directly north and adjacent to CR 450 South. Water flows directly south approximately 50 yards from the catch basin through a tile to Oliver Lake. Davey Resource Group visited the site with representatives from OMLCIA, Natural Resources Conservation Service (NRCS), and the LaGrange County SWCD. At the time of the field meeting, NRCS personnel recommended installing a grass waterway in the field and replacing the drop box structure and associated incoming tiles along the field edge.

Photograph 7 (6-20-12). Agricultural drainage and associated pollutants drain to Oliver Lake from an adjacent field.

Easements and Land Availability

David Sears, the landowner, has expressed interest in making improvements to the field drainage system that will minimize pollutants reaching the lake. NRCS was contacted regarding enrolling the property in the Conservation Reserve Program (CRP). The temporary lack of an active federal Farm Bill limited CRP funds and stalled work on the project.

As of the date of this report, implementation of the project was reported to be on hold pending agreement between the landowner and NRCS (Kevin Shide, personal communication, January 10, 2014).

Environmental Impact Assessment

Wetlands are not found within the agricultural field or adjacent to the small ditch between the field and Oliver Lake. Vegetation around the drop box structure proposed for replacement is limited to weedy species. Negative impacts to the environment will be negligible.

Permit Requirements

No permits are necessary to install the grass waterway and replace the drop box structure in the agricultural field. No permits would be necessary to excavate sediment from the old sediment trap providing the sediment is excavated in a one-step method and deposited in an upland location.

Unusual Physical or Social Costs

CRP establishes a cost-sharing relationship between the landowner and NRCS to implement BMPs. A cost share for the project's installation will be incurred by the land owner for the installation. The landowner has expressed willingness to participate with NRCS for CRP enrollment for this project (Kevin Shide, personal communication, January 10, 2014).

Photograph 8 (9-28-12). Placing a grass waterway in this location will aid sediment and nutrient extraction from water prior to leaving the site.

Functionality of Proposed Project

A grass waterway will allow sheet water flow to pass through the agricultural field at a slower rate. The slower rate and physical presence of vegetation allows sediment and nutrients to be removed from the water prior to it leaving the area. Installation of a new drop box structure will allow water to descend a steep grade at the field edge without resulting in erosion.

The effects of installing a grass waterway were modeled using Region 5 because the project is a site-specific BMP with an extremely small watershed. By applying the grass waterway to this location, the following non-point source pollution reduction rates may be achieved: 48.2 pounds/year for nitrogen, 24.1 pounds/year for phosphorus, and 28.4 tons/year of sediment.

Cost Approximations and Timeline

Engineered plans and a cost estimate for the grass waterway and drop box outlet structure were developed during winter 2012-2013 by NRCS. Installation of the project is weather dependent. Seeding of the grass waterway will be necessary between March 15 and May 30 or August 1 and September 30 per requirements of CRP. The project is dependent upon funding. Engineered design drawings were completed by NRCS after the expiration of the Farm Bill on September 30, 2012.

Because cost-share funding has not been available, implementation of the project has been on hold (Kevin Shide, personal communication, January 10, 2014).

Once an active Farm Bill is in place and the project is formally enrolled for implementation, a payment will be made to the landowner for subsequent years thereafter based on soil rental rates calculated by NRCS. The duration of the contract will be discussed between NRCS and the landowner.

Institutional Resources and Potential Funding

NRCS has survey data and developed—free of charge—engineering drawings for the grass waterway and replacement drop box outlet to which the grass waterway will drain. The landowner can apply for a cost share to construct the BMP through CRP. Cost-share funding is a component of the Farm Bill. An active federal Farm Bill will be required before NRCS funding will be available through CRP. OMLCIA could also assist the landowner with implementation costs.

Justification of Site Selection

Water flowing into the lake from a tile draining the agricultural field has been observed to contain, at times, an excessive amount of sediment. Inquiry of BMPs to reduce sediment inputs from this tile were pursued as a result of concerns raised by lake association members at public meetings.

Feasibility Summary

The landowner and agricultural producer currently farming the field have expressed support for installation of the grass waterway and associated drop box outlet and have been working with the LaGrange County SWCD and NRCS regarding the project. The project is currently on hold pending reaching an agreement between the landowner and NRCS and pending securing federal cost-share funding.

Findings and Recommendations

Engineering Feasibility Study Summary

Many different forms of data were collected over the course of the Engineering Feasibility & Design Study. Data collection involved macroinvertebrate communities, habitat evaluations, water quality, and modeling of potential pollutant reductions resulting from project implementation. The table below summarizes data collected.

Table 17. Data Collection Summary

Project	Data Collection Types			
	Macroinvertebrate	Habitat Evaluations (QHEI and HHEI)	Water Quality	Pollutant Modeling Anticipated Reductions
1	n/a	n/a	n/a	Sediment: 3.74 tons/yr
2	mIBI: Moderate Impairment RBPII: Reference Site	QHEI: Suitable for Aquatic Life	Met water quality standards[1]	Sediment: 2.04 tons/yr
3	n/a	QHEI: Suitable for Aquatic Life HHEI: Class II PHWH	n/a	Sediment: 9.53 tons/yr
4	n/a	n/a	n/a	n/a
5	mIBI: Moderate Impairment RPBII: Non-Impaired compared to Reference[2]	QHEI: Impaired for Aquatic Life HHEI: Modified Class II PHWH	Met water quality standards[1]	Nitrogen: 46 lbs./yr Phosphorus: 9 lbs./yr Sediment: 17.9 tons/yr
6	n/a	n/a	n/a	Nitrogen: 48.2 lbs./yr Phosphorus: 24.1 lbs./yr Sediment: 28.4 tons/yr

[1]Parameters measured include temperature, pH, dissolved oxygen, and conductivity.
[2]Project site and reference contain similar macroinvertebrate moderate impairment.

Table 18 provides a summary of obstacles to feasibility for each project evaluated as a part of this study. The primary obstacle for most projects involves cost and funding.

Table 18. Summary of Obstacles to Feasibility for Each Project.

Project	Description	Primary Obstacles to Project Feasibility			
		Land Availability	Permit Requirements	Cost	Environmental Constraints
1	Regulated Drain 49B			x	
2	Regulated Drain 45			x	
3	Olin Lake Nature Preserve			x	
4	Erosion control on ditch located south of CR 450 and north of Oliver Lake				
5	Olin-Raber Wetlands hydrological enhancement			x	
6	Erosion control on an agricultural field located north of CR 450 South and east of CR 100 East			x	

A summary of feasibility conclusions is included in Table 19. Each project listed is technically feasible as planned during the study. The primary obstacle for each project is cost and funding.

Table 19. Feasibility Conclusions Summary

Project	Description	Feasible with Financial Resources	Not Feasible at this Time	Not Technically Feasible
1	Regulated Drain 49B	x		
2	Regulated Drain 45	x		
3	Olin Lake Nature Preserve	x		
4	Erosion control on ditch located south of CR 450 and north of Oliver Lake	x		
5	Olin-Raber Wetlands hydrological enhancement	x		
6	Erosion control on an agricultural field located north of CR 450 South and east of CR 100 East	x		

Future Recommendations Prioritization

Davey Resource Group recommends that OMLCIA take the following steps moving forward. Projects are listed in order of general priority, but prioritization should be adjusted as necessary based on available resources at any given time. Many of the projects can be addressed simultaneously; however, some projects may be more easily addressed sooner than others due to cost and general project size.

- Seek funding for implementing erosion control methods recommended on Regulated Drain 49B and Regulated Drain 45. Coordinate with the LaGrange County Drainage Board regarding these projects (Projects 1 and 2). These projects are relatively affordable and funding can be easily sought by OMLCIA through the LARE Program.
- Coordinate with the landowner and install native plantings along the ditch located south of CR 450 and north of Oliver Lake (Project 4). This project is inexpensive and can be accomplished by lake association volunteers in less than one day.
- OMLCIA should remain in contact with David Sears and the SWCD regarding the status of implementing BMPs in the agricultural field he owns north of Oliver Lake (Project 6). Davey Resource Group estimates this project to be the most effective project for non-point source pollution removal from the watershed. However, timing of the project is ultimately dependent on the timing of availability of funding through NRCS.
- OMLCIA should make contact with IDNR Division of Nature Preserves Director John Bacone emphasizing the importance of implementing the streambank stabilization project designed for the Olin Lake Nature Preserve (Project 3). OMLCIA should also inquire if there is any support they could provide regarding grant funding application for this project if the DNR does not have internal funding available.
- OMLCIA and IDNR LARE Program staff should make contact with ACRES to obtain ACRES' official approval for implementing the designed wetland hydrological enhancement plan once the organization has finalized acquisition of the property (Project 5). A plan to obtain funding for implementing the project should be developed and pursued in conduction with ACRES. It is recommended that ACRES be the grant applicant for this project. OMLCIA may provide support including grant application writing and contribution of in-kind services and cash matches. Forward movement for this project is dependent upon ACRES obtaining the land which is an ongoing process.

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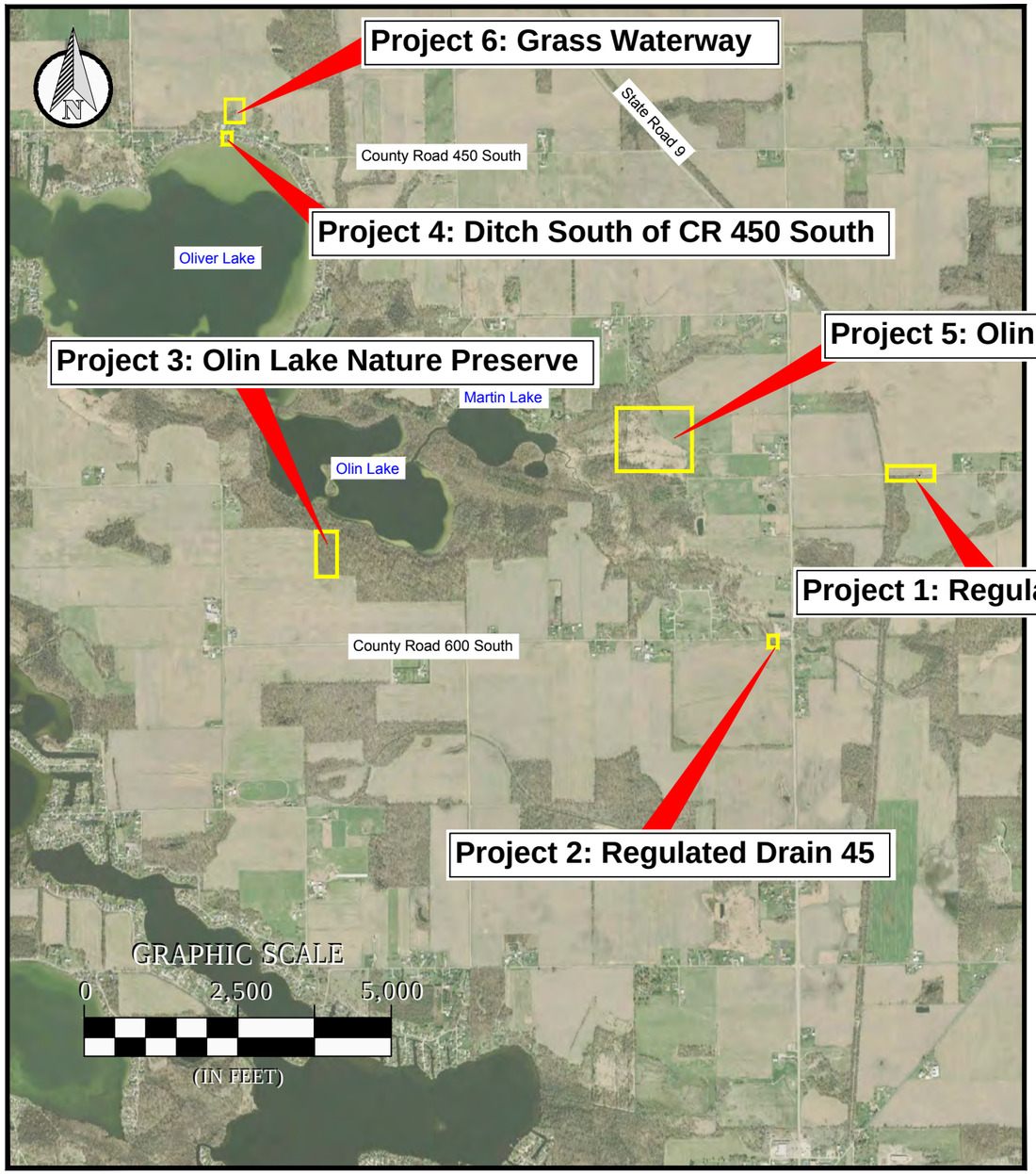
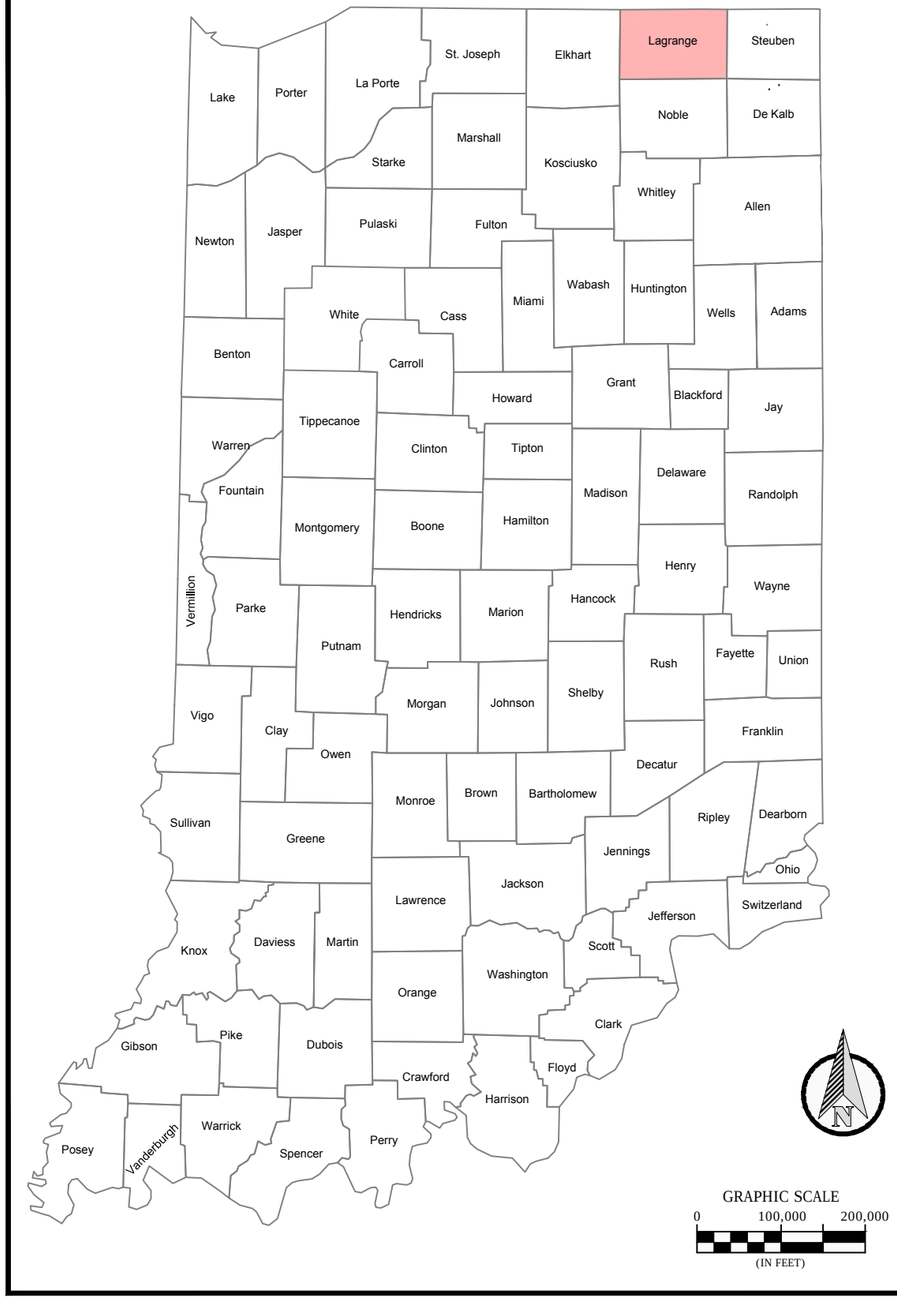
Appendix A
Conceptual Plan Sheets

Oliver & Martin Lakes Conservation and Improvement Association, Inc

Project Sites on 2012 Aerial



LaGrange County, Indiana



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Prepared for
Oliver & Martin Lakes Conservation and Improvement Association, Inc

LARE Engineering Feasibility Study and Design
for Oliver, Olin, and Martin Lakes
LaGrange County, Indiana

Data used to produce this map were collected on December 2, 2011, and February 2, and March 28, 2012

Overview Map

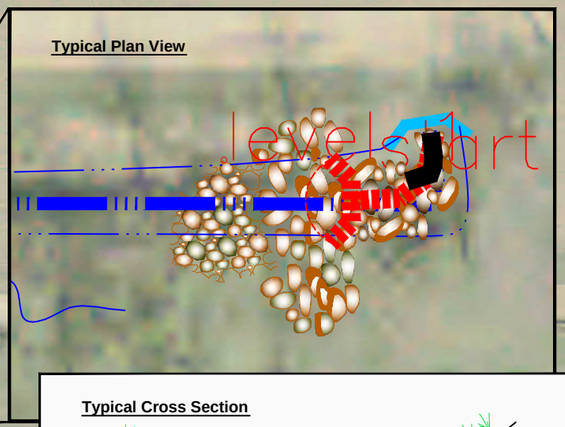
Project 1:
Regulated Drain 49B

existing culverts

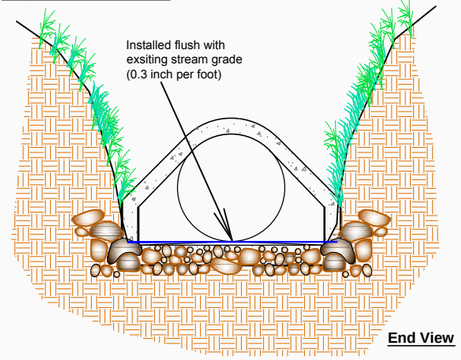
4-foot x 4-foot box inlet

Proposed 24-inch Reinforced Concrete Pipe (RCP) elbow and circular RCP flared end section to redirect the existing southerly water flow to a westerly flow to parallel the road and align with existing ditch channel. The redirection of flow with a flared end and rip-rap will buffer erosive forces of the water in this area.

Typical Plan View



Typical Cross Section



End View

Map Legend

= Proposed 24-inch diameter elbow and outlet

= Proposed restored stream and direction of flow

Rock Grade Control and Habitat Structures

= Culvert outfall rock riffle diffuser

= Rock toe bank protection and in-stream stone habitat

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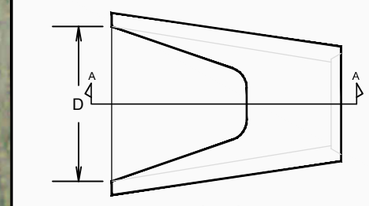
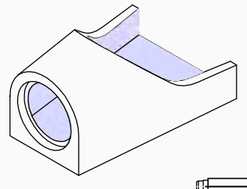
PIPE

CIRCULAR RCP FLARED END SECTION

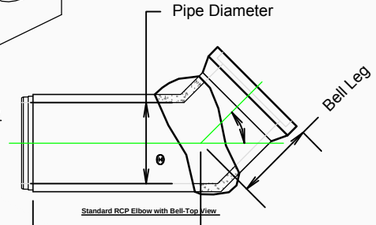
Model: **RCP FLARED END**

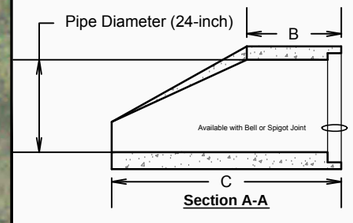


Plan View

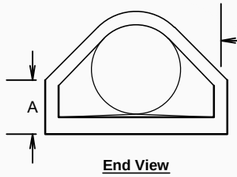


Isometric View
(For Reference Only)





Section A-A



End View

GRAPHIC SCALE

0 100 200

(IN FEET)

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LARE Engineering Feasibility Study and Design
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LaGrange County, Indiana

Data used to produce this map were collected on December 2, 2011, and February 2, and March 28, 2012

Project 1

Project 2:
Regulated Drain 45

Map Legend

= Field tiles

= Proposed restored stream and direction of flow

Rock Grade Control and Habitat Structures

= Field tile outfall rock riffle diffuser

= Rock toe protection and in-stream stone habitat (~ 65 linear feet)

Tree/shrub riparian planting

= *Quercus palustris* (pin oak)

= *Cornus amomum* (silky dogwood) live-stakes installed 2 feet on-center

NOTE: Actual species, numbers, and locations will be dependent on availability and post-construction site conditions, including hydrology and projected light levels.

= Wetlands delineated

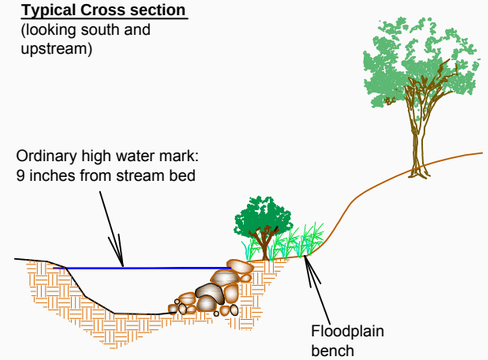
Remove spoil in this area and create a floodplain bench and add outfall protection for existing field tiles.

The entire restored floodplain bench and any disturbed areas will be seeded with a stabilization seed mix and mulched with a oat or wheat straw mulch.

existing culvert

County Road 600 South

Typical Cross section
(looking south and upstream)



N

GRAPHIC SCALE
0 25 50
(IN FEET)

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LARE Engineering Feasibility Study and Design
for Oliver, Olin, and Martin Lakes
LaGrange County, Indiana

Data used to produce this map were collected on December 2, 2011, and February 2, and March 28, 2012

Project 2

Project 3:
Olin Lake Nature Preserve

TOPOGRAPHIC SURVEY

Part of the Lands of The State of Indiana
Department of Natural Resources
Olin Lake - Wolcottville, IN
PART OF SECTION 20, T. 36 N., R. 10 E.,
LAGRANGE COUNTY, INDIANA

PROJECT BENCHMARK

DNR TBM LLK 140, 1976
In Lagrange County, Oliver Lake Quadrangle, in the NW ¼ of Sec. 18, T. 36 N., R. 10 E., 2nd PM, about 4.35 miles northwest of Wolcottville; at the 450 South Road 12-foot steel pipe culvert over Dove Creek; set in the top of the south end of the culvert, 200 feet east from T-road south (50 East Road), 24 feet south from the center line of the road, 4 feet below the roadway; the center of two filed notches.

Elevation: 904.504 feet NGVD 1929

Source: *http://www.in.gov/dnr/water/files/bm_lagrange.pdf*

OHWM
EL=926.41

OHWM
EL=916.51

Ex. foot
wooden
bridge

OHWM
EL=913.21

Map Legend

- Riparian area, spot seeded with native basin mix
- Proposed restored stream and direction of flow (~857 linear feet)

Rock Grade Control and Habitat Structures

- Newbury riffle grade control structure
- Rock riffle and plunge pool habitat
- Bendway and/or partial weirs
- Rock riffle and in-stream stone habitat

NTS

811
Know what's **below.**
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GRAPHIC SCALE
0 50 100
(IN FEET)

N

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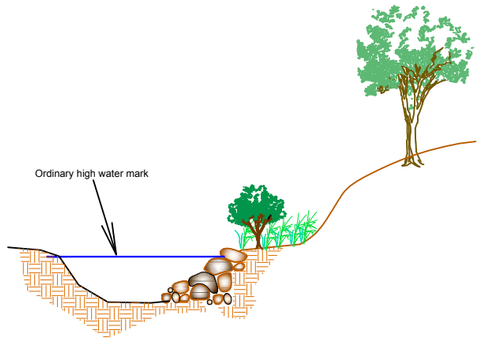
for Oliver, Olin, and Martin Lakes
LaGrange County, Indiana

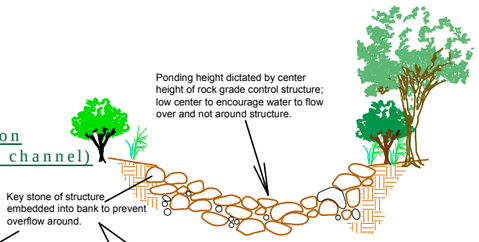
Data used to produce this map were collected on December 2, 2011, and February 2, and March 28, 2012

Project
3

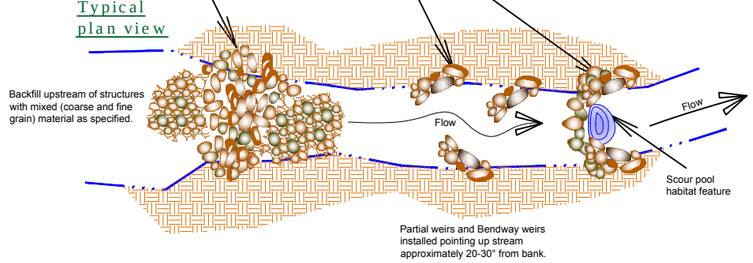


Typical Rock Grade Control Structure and Riffle Features

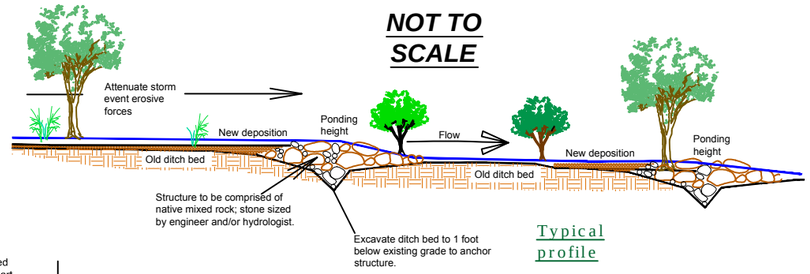
Typical cross-section (looking up channel)



Typical plan view

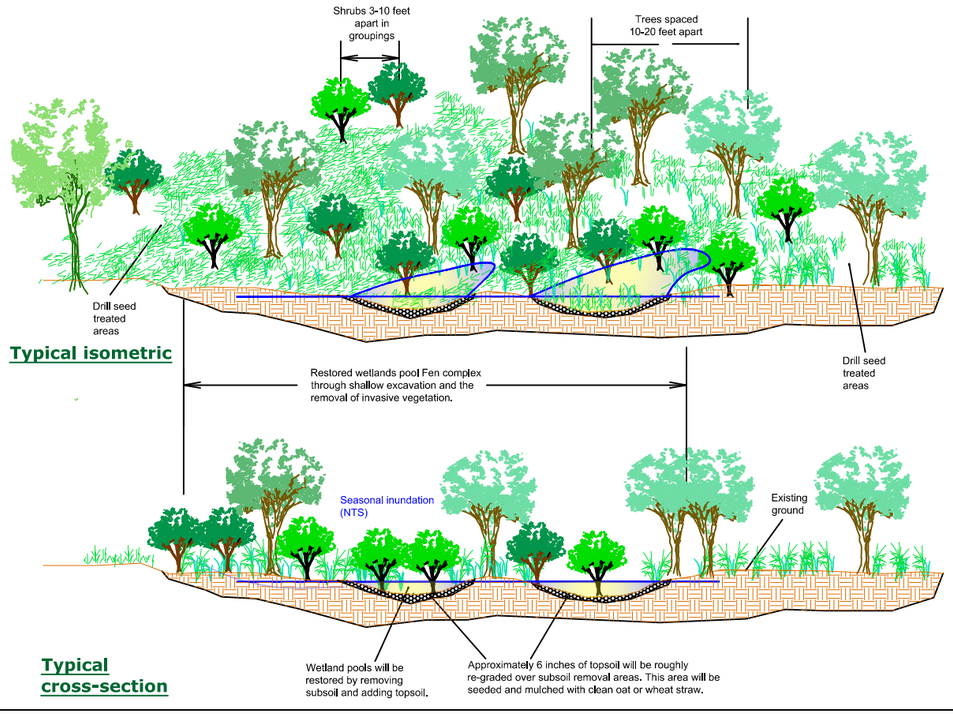


NOT TO SCALE



Typical profile

Typical pool restoration

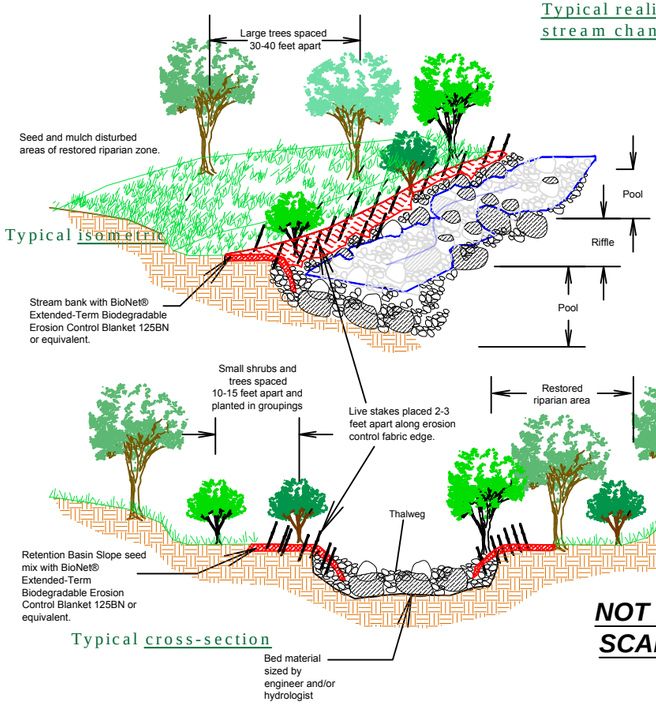


Typical isometric

Typical cross-section

NOT TO SCALE

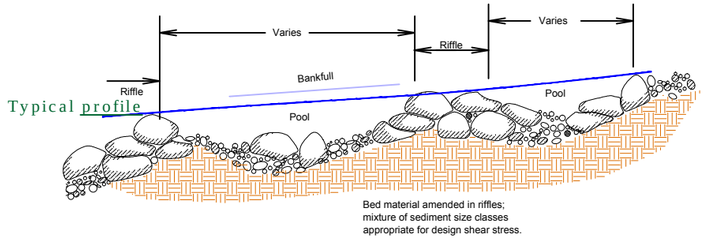
Typical realigned stream channel



Typical isometric

Typical cross-section

NOT TO SCALE



Typical profile

Prepared by
DAVEY RESOURCE GROUP
A Division of The Davey Tree Expert Company

Prepared for
Oliver & Martin Lakes Conservation and Improvement Association, Inc

LARE Engineering Feasibility Study and Design
for Oliver, Olin, and Martin Lakes
LaGrange County, Indiana

Data used to produce this map were collected on December 2, 2011, and February 2, and March 28, 2012

Typicals
Sheet

Project 5:
Olin-Raber Wetlands

TOPOGRAPHIC SURVEY

Part of the Lands of The State of Indiana
Department of Natural Resources
Nature Conservancy - Martin Lake - Wolcottville, IN
PART OF SECTION 21, T. 36 N., R. 10 E.,
LAGRANGE COUNTY, INDIANA

PROJECT BENCHMARK

DNR TBM LLK 140, 1976
In Lagrange County, Oliver Lake Quadrangle, in the NW ¼ of Sec. 18, T. 36 N., R. 10 E., 2nd PM, about 4.35 miles northwest of Wolcottville; at the 450 South Road 12-foot steel pipe culvert over Dove Creek; set in the top of the south end of the culvert, 200 feet east from T-road south (50 East Road), 24.0 feet south from the center line of the road, 4.0 feet below the roadway; the center of two filed notches.

Elevation: 904.504 feet NGVD 1929

Source: *http://www.in.gov/dnr/water/files/bm_lagrange.pdf*

Map Legend

= Remnant fen vegetation

PEMCD = National Wetlands Inventory Polygons (1992) as defined by the U.S. Fish and Wildlife Service and compiled from the National Wetland Inventory (NWI)*.

= Existing ditch to be plugged and diverted to restore wetlands hydrology and improve storm water retention.

= Earthen berms/ditch plugs (1,370 square feet each)

= Proposed shallow pool habitat with 15:1 side slopes. Size and shape to be field adjusted.

= Rock plunge pool protection and armament (approximately 10 feet by 10 feet or 100 square feet)

EL=905.38 = Surveyed spot elevations in feet

811 Know what's **below.** **Call** before you dig.

* http://maps.indiana.edu/layerGallery.html?category=Wetlands

EL=907.24
EL=905.84
EL=904.72
EL=906.80
EL=904.95
EL=906.71
EL=905.38
EL=907.26
EL=909.69
OHWM EL=905.24
OHWM EL=907.66
PEMCD
proposed pool (0.22 acre)
proposed pool (0.15 acre)
proposed pool (0.21 acre)
proposed top of berm 905.5
proposed top of berm 907.5
proposed top of berm 910
Ex. wood dam water control structure
TOP 15" CMP ELEV=913.08
15" CMP INV=911.83

GRAPHIC SCALE
0 100 200
(IN FEET)

Prepared by DAVEY RESOURCE GROUP
A Division of The Davey Tree Expert Company

Prepared for Oliver & Martin Lakes Conservation and Improvement Association, Inc

LARE Engineering Feasibility Study and Design
for Oliver, Olin, and Martin Lakes
LaGrange County, Indiana

Data used to produce this map were collected on December 2, 2011, and February 2, and March 28, 2012

Project 5

Appendix B
Public Meeting Notes

Oliver, Olin, & Martin Lakes Watershed Engineering Feasibility Study

Oliver & Martin Lakes Conservation & Improvement Association, Inc.

Public Meeting Notes

Thursday, May 3, 2012, 7:00 PM
Grossman's Tap Room, LaGrange, Indiana

Attendees List

Steve Moran, Donna Moran, Steve Seifert, Rae Ann Seifert, Mark O'Shaunessy, Meredith Cameron, Larry Phillips, Joyce Phillips, Robert Holbrook, Vince Heiny, Joe Greenley, Fred Leiter, Betty Leiter, Pat Hart, Pat Wiltshire, LaDona Wiltshire, Jeff Freiburger, Alesia Feiertag, John Feiertag, Stan Delauter, Wanda Delauter, Felix Lipsky, John Stork, Buck Toenges, Alicia Douglass

Discussion Summary

- Alicia Douglass of Davey Resource Group (Davey) made a presentation to meeting attendees. Ms. Douglass started with an overview discussion of the LARE grant awarded to Oliver & Martin Lakes Conservation & Improvement Association, Inc. (OMLCIA) and an overview of Davey Resource Group.
- It was explained that the purpose of the Engineering Feasibility Study was to assess the feasibility of implementing practices previously identified in the watershed through a diagnostic study completed in 2009. The feasibility assessment includes landowner willingness to implement a BMP and the ability to obtain all of the federal, state, and local permits and approvals necessary for implementing the BMPs and the technical specifications for implementing each practice.
- An overview of each potential project in the watershed being assessed for feasibility was discussed including the practices proposed for each project in order to reduce erosion in channels and reduce pollutants reaching the lakes.
- An overview of potential permits required for each project was discussed.

Questions/Concerns Summary

- What is the timeline for ACRES taking possession of the Olin-Raber Wetland property currently owned by The Nature Conservancy?
    - ACRES has officially agreed to take possession of the parcel. The Nature Conservancy is in the process of completing the vetting paperwork, and it is expected that the transfer will occur before the end of the calendar year (Douglass).
- What types of equipment will be necessary to complete the projects?
    - It should be feasible for small skid steer of mini excavator to enter the Olin Lake Nature Preserve Property from the agricultural field to the south. It will be necessary to remove a few saplings in order to get the equipment in and adjacent to the stream. It is expected that work at the Olin-Raber wetlands could be completed with a backhoe and perhaps a small bulldozer (Douglass).
- Is ACRES on board with the practice proposed by the LARE grant?
    - It was explained that Shane Perfect with ACRES had stated that ACRES was willing to hold the property due to its potential water quality benefit to the lakes. Mr. Perfect and representatives from The Nature Conservancy have both visited the site with Davey and the DNR (Douglass).
- Will there be cost estimates for the different practices at the meeting in June?
    - Rough cost estimates will be provided as part of the study, and they may be available in June (Douglass).
- Why were the two sediment trap basins north of Oliver Lake excluded from the study?

- It was explained that Davey and the DNR were only aware of one sediment trap basin, and that it was visited appeared to still be functioning at this point in time (Douglass). It was the only basin identified in the diagnostic study (D. Moran). A lake resident pointed out that there is a second basin west of the one that had been visited. The resident expressed concern that this basin is failing and that a sediment plume is visible coming from it to the lake after storm events. Concern was also expressed that the sediment appears to be negatively influencing the mussel population in that location. Ms. Douglass requested photographs of the area and the location of the basin pinpointed on a map. She mentioned that she would include the information provided by the residents as a concern in the report, and that it may be possible for her to GPS the perimeter of the basin.

Oliver, Olin, & Martin Lakes Watershed Engineering Feasibility Study

Oliver & Martin Lakes Conservation & Improvement Association, Inc.

Public Meeting Notes

Saturday, June 16, 2012, 9:00 AM
Limberlost Camp Dining Hall, Oliver Lake, Indiana

Attendees List

Michael Altendorf, Jeanne Andersen, Hugh Baldus, Mary Baldus, Lynn Bowmen, Glenn Brinker, Victor Brown, Beverly Brown, Richard Burton, Meredith Cameron, Robert Clark, Don Crum, Monica Crum, Pat Davis, Wanda Delauter, Tom Dunbar, Terry Dunbar, Brad, Ellis, Joseph Feiertag, Jim Feller, Jeff Freiburger, Ron Gerber, Jane Gerber, Al Germanson, Louis Gillespie, Mark Goodhew, James Greenlee, Joseph Greenlee, Jerry Grosenbacher, Pat Grosenbacher, Larry Gump, Patricia Grump, Patricia Hart, David Heiny, Paul Heiny, Vince Heiny, Jill Heller, Larry Hoffman, Roger Inskeep, Barb Inskeep, Wallace Kehr, Margaret Krouse, Paul Lauver, Marily Lauver, Lloyd Leeka, Fred Leiter, Betty Leiter, Felix Lipsky, Mary Little, Rita Masanz, Jim McFadden, Pat McFadden, Gail Moore, Donna Moran, Craig Nelson, Dorothy Nisley, Laura O'Shaughnessy, Marcia Perdriau, Lynne Peterman, Mark Peterman, Larry Phillips, Joyce Phillips, Mike Renno, Don Retterbush, Joe Retterbush, James Robbins, Steve Salisbury, Stacey Salisbury, Steve Seifert, Rae Ann Seifert, Joe Stock, Mary Jane Storck, John Storck, Buck Toenges, Fred Tonges, Jack Vanek, Bobbie Vanek, Paul Wilson, LaDonna Wiltshire, Nancy Winling, Keith Wright, Alicia Douglass

Meeting Summary

- A presentation was made by Alicia Douglass of Davey Resource Group (Davey) as part of the annual meeting of the Oliver and Martin lakes Conservation & Improvement Association, Inc. There were over 80 people in attendance at this meeting.
- Ms. Douglass explained that the purpose of the Engineering Feasibility Study was to assess the feasibility of implementing practices previously identified in the watershed through a diagnostic study completed in 2009. The feasibility assessment includes landowner willingness to implement a BMP and the ability to obtain all of the federal, state, and local permits and approvals necessary for implementing the BMPs, and technical specifications for implementing each practice.
- An overview of each potential project in the watershed being assessed for feasibility was discussed including the practices proposed for each project in order to reduce erosion in channels and reduce pollutants reaching the lakes. Each project site was identified on a map and photographs of each site were provided.
- An overview of potential permits required for each project was discussed as well as potential funding sources.

Questions/Concerns Summary

- A concern was raised that a sediment trap north of Oliver Lake be inspected due to the presence of sediment laden water entering the lake from a tile draining the sediment trap.
    - It was stated that the sediment trap was not included as part of the feasibility study, but that Davey would take a look at when conducting other fieldwork in July (Douglass).
- It was asked, "What percent of the overall problem in the lakes would the proposed projects take care of?"
    - It was explained that we do not know the overall pollutant load entering the lake, so that is difficult to quantify. However, estimates for the percent of pollutants each practice will reduce in its specific location will be included in the Engineering Feasibility Study report (Douglass).

- A question was raised regarding where soil would come from to create the berms through the ditch on the Olin-Raeber property.
    - It was explained that sediment would come from on-site including original sidecast of material dug from the channel and that additional soil would be excavated from the pools (Douglass).

Oliver, Olin, & Martin Lakes Watershed Engineering Feasibility Study

Oliver & Martin Lakes Conservation & Improvement Association, Inc.

Public Meeting Notes

Saturday, June 15, 2013, 9:00 AM
Limberlost Camp Dining Hall, Oliver Lake, Indiana

Attendees List

Myron Newar, Cindy Newar, Dave Sears, Marti Sears, Bob Beerbower, Neva Beerbower, Elaine Flynn, Pat Wiltshire, Jerry Chapman, Suzy Chapman, Dave Williams, Carol Williams, Donley Bell, Tom Malle, Bill Berkey, Michele Berkey, Roger Fruchte, Jeff Wible, Rob Bollinger, Lynn Bowmen, Victor Brown, Meredith Cameron, Bob Clark, Monica Crum, Tom Dunbar, Terry Dunbar, Jeff Freiburger, Ron Gerber, Jane Gerber, Al Germanson, Larry Gump, Patricia Gumpfly, Patricia Hart, Jill Heller, Dave Heller, Marsha Heller, Dan Heller, Larry Hoffman, Wallace Kehr, Margaret Krouse, Fred Leiter, Felix Lipsky, Rita Masanz, Gail Moore, Fred Moore, Donna Moran, Marcia Perdriau, Lynne Peterman, Myrita Peterman, Mark Peterman, Joyce Phillips, Don Retterbush, Rae Ann Seifert, Joe Stock, John Storck, Paul Wilson, Keith Wright, Alicia Douglass

Meeting Summary

- A presentation was made by Alicia Douglass of Davey Resource Group (Davey) as part of the annual meeting of the Oliver and Martin lakes Conservation & Improvement Association, Inc. Approximately 60 people attended the meeting.
- Ms. Douglass provided a brief overview explained that the purpose of the Engineering Feasibility Study was to assess the feasibility of implementing practices previously identified in the watershed through a diagnostic study completed in 2009. The feasibility assessment includes landowner willingness to implement a BMP and the ability to obtain all of the federal, state, and local permits and approvals necessary for implementing the BMPs, and technical specifications for implementing each practice.
- An overview of each potential project in the watershed was provided. Each project feasibility assessment was discussed including the practices proposed for each project in order to reduce erosion in channels and reduce pollutants reaching the lakes. Each project site was identified on a map and photographs of each site were provided.
- Addition of the Sears Property to the feasibility study was addressed. The landowners were in attendance. The NRCS is now in charge of the project going forward.
- A brief overview of potential permits required for each project was discussed as well as potential funding sources.

Appendix C
Oliver Lake Brochure

Lake And River Enhancement (LARE) Engineering Feasibility & Design Study

Oliver and Martin Lakes Conservation Improvement Association, Inc. (Association) is dedicated to improving Oliver, Olin, and Martin Lakes for our enjoyment today as well as protecting and preserving our lakes for future generations.

The Association was awarded a LARE grant in August, 2011 to conduct a study on the feasibility of previously identified projects in the lakes' watershed that will reduce the amount of pollutants that reach the lakes from upstream sources.

Conceptual design drawings will be produced and coordination for state and federal permits needed to implement the feasible projects is included as part of this study.

The next step will be for the Association to work with identified partners and secure funding to implement the streambank stabilization and wetlands restoration projects.

OLIVER AND MARTIN LAKES CONSERVATION IMPROVEMENT ASSOCIATION, INC.

Visit us on the web at:
http://olivermartinlakes.mylaketown.com/home

Or e-mail us for more information at:
info.olivermartinlakes@mylaketown.com

The *Oliver, Olin, and Marin Lakes Watershed Engineering Feasibility and Design Study* and this brochure was made possible by funding from the Indiana Department of Natural Resources Lake and River Enhancement Program and the Oliver and Martin Lakes Conservation Improvement Association, Inc.
Davey Resource Group managed the study.

DNR

DAVEY RESOURCE GROUP
A Division of The Davey Tree Expert Company

Doing our part to protect our lakes!

OLIVER AND MARTIN LAKES CONSERVATION IMPROVEMENT ASSOCIATION, INC.

YOU CAN MAKE A DIFFERENCE FOR CLEAN WATER!

Residential properties can be a significant source of water pollution. By following a few simple steps, you can personally keep the water in our lakes cleaner and reduce aquatic weeds!

Just 1 pound of phosphorus can support 500 pounds of algae!

1.) Use phosphorus free fertilizer.

Look for lawn fertilizer bags marked with a "0" as the center number. For example, a bag marked "22-0-15" indicates that it contains that it does not contain phosphorus.

In addition, do not use a larger quantity of fertilizer or pesticide or your lawn than is recommended by the manufacturer. Better yet, learn to care for your lawn naturally!

2.) Plant a natural shoreline and/or rain garden.

Natural shorelines provide many desirable benefits. They provide a buffer that can help filter pollutants from rain water running across lawns, they help stabilize shorelines, they provide habitat for desirable wildlife, and they are less attractive to Canada geese. Waste from Canada geese can produce the same negative effects in water as pet waste described below.

Rain gardens are designed to infiltrate rain water that would otherwise run across lawns and impervious surfaces such as driveways and asphalt roofs and carry pollutants to a stream or lake.

3.) Pick up after your pets and do not feed the geese.

The average dog can excrete 7,820,000,000 fecal coliform bacteria per day and each goose can excrete 2-3 pounds of waste daily! These bacteria and other biological agents in pet and waterfowl waste can be harmful to human health, and they are frequently found in our streams and lakes. Pet and waterfowl waste also contains nutrients such as nitrogen and phosphorus that support growth of algae and aquatic weeds.

4.) Responsibly maintain boats and automobiles.

Did you know that where you wash your car matters? Washing your car at home could result in dirt, soaps, salts, and heavy metals entering the lake. Wash your car at a commercial car wash or in a gravel or grassy area where runoff will not reach a stream or lake.

Conduct regular maintenance on your automobiles and on your boats while out of the water to prevent leaks and spills of oils, antifreeze, fuels, and other harmful substances. Properly dispose of used liquids and cleaning materials.

Visit: **www.clearchoicescleanwater.org** to learn more about how you can make a difference and **sign up for a clean water pledge!**

Appendix D
Macroinvertebrate Subsample Data

Olin-Raber Wetlands	
Date Sampled	
Data Collectors[1]	AD, JB
Family	Quantity
Baetidae	7
Chironomidae	5
Elmidae	9
Gamaridae	78
Hydrophilidae	1
Hydropsychidae	37
Physidae	4
Tipulidae	4
Total	145
Square Sorted	11

[1]Alicia Douglass (AD), Jacob Bannister (JB)

Regulated Drain 45	
Date Sampled	
Data Collectors[1]	AD, JB
Family	Quantity
Baetidae	5
Chironomidae	6
Gamaridae	28
Hydropsychidae	76
Planorbidae	1
Tipulidae	2
Total	118
Square Sorted	12

[1]Alicia Douglass (AD), Jacob Bannister (JB)

Appendix E
Habitat Evaluations

Project 2: Regulated Drain 45

OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

Sample #	bioSample #	Stream Name	Location
			Regulated Drain 45

Surveyor	Sample Date	County	Macro Sample Type	☐ Habitat Complete	QHEI Score:
AD	7/26/12				59

(Good)

1] *SUBSTRATE* Check ONLY Two predominant substrate TYPE BOXES; estimate % and check every type present

BEST TYPES	PREDOMINANT P	PRESENT R	TOTAL %
BLDR/SLABS [10]	☐	☐	
BOULDER [9]	☐	☐	
COBBLE [8]	☐	■	
GRAVEL [7]	☐	☐	
SAND [6]	■	☐	
BEDROCK [5]	☐	☐	

OTHER TYPES	PREDOMINANT P	PRESENT R	TOTAL %
HARDPAN [4]	☐	☐	
DETRITUS [3]	☐	☐	
MUCK [2]	☐	☐	
SILT [2]	■	☐	
ARTIFICIAL [0]	☐	☐	

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ■ 3 or less [0]

Check ONE (Or 2 & average)

ORIGIN
- ☐ LIMESTONE [1]
- ■ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTRINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☐ HEAVY [-2]
- ■ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☐ EXTENSIVE [-2]
- ■ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ NONE [1]

Substrate Maximum 20: 12

Comments

2] *INSTREAM COVER* Indicate presence 0 to 3 and estimate percent: **0**–Absent; **1**–Very small amounts or if more common of marginal quality; **2**-Moderate amounts, but not of highest quality or in small amounts of highest quality; **3**-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed root wad in deep/fast water, or deep, well-defined, functional pools.)

	%	Amount
UNDERCUT BANKS [1]	90	3
OVERHANGING VEGETATION [1]	85	3
SHALLOWS (IN SLOW WATER) [1]		
ROOTMATS [1]	5	1
POOLS > 70cm [2]		
ROOTWADS [1]		
BOULDERS [1]		
OXBOWS, BACKWATERS [1]		
AQUATIC MACROPHYTES [1]	2	1
LOGS OR WOODY DEBRIS [1]	5	1

AMOUNT

Check ONE (Or 2 & average)
- ☐ EXTENSIVE > 75% [11]
- ■ MODERATE 25 - 75% [7]
- ☐ SPARSE 5 - < 25% [3]
- ☐ NEARLY ABSENT < 5% [1]

Cover Maximum 20: 13

Comments

3] *CHANNEL MORPHOLOGY* Check ONE in each category (Or 2 & average)

SINUOSITY
- ☐ HIGH [4]
- ☐ MODERATE [3]
- ■ LOW [2]
- ☐ NONE [1]

DEVELOPMENT
- ☐ EXCELLENT [7]
- ■ GOOD [5]
- ☐ FAIR [3]
- ☐ POOR [1]

CHANNELIZATION
- ☐ NONE [6]
- ■ RECOVERED [4]
- ☐ RECOVERING [3]
- ☐ RECENT OR NO RECOVERY [1]

STABILITY
- ☐ HIGH [3]
- ■ MODERATE [2]
- ☐ LOW [1]

Channel Maximum 20: 13

Comments

4] *BANK EROSION AND RIPARIAN ZONE* Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

L	R	EROSION
■	■	NONE/LITTLE [3]
☐	☐	MODERATE [2]
☐	☐	HEAVY/SEVERE [1]

L	R	RIPARIAN WIDTH
☐	☐	WIDE > 50m [4]
■	■	MODERATE 10-50m [3]
☐	☐	NARROW 5-10m [2]
☐	☐	VERY NARROW [1]
☐	☐	NONE [0]

L	R	FLOOD PLAIN QUALITY
☐	■	FOREST, SWAMP [3]
☐	☐	SHRUB OR OLD FIELD [2]
☐	■	RESIDENTIAL, PARK, NEW FIELD [1]
☐	☐	FENCED PASTURE [1]
■	☐	OPEN PASTURE, ROWCROP [0]

L	R	
☐	☐	CONSERVATION TILLAGE [1]
☐	☐	URBAN OR INDUSTRIAL [0]
☐	☐	MINING/CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Riparian Maximum 10: 7

Comments

5] *POOL/GLIDE AND RIFFLE/RUN QUALITY*

MAXIMUM DEPTH Check ONE (ONLY!)
- ☐ > 1m [6]
- ☐ 0.7 - < 1m [4]
- ☐ 0.4 - < 0.7m [2]
- ☐ 0.2 - < 0.4m [1]
- ■ < 0.2m [0]

CHANNEL WIDTH Check ONE (Or 2 & average)
- ■ POOL WIDTH > RIFFLE WIDTH [2]
- ☐ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☐ FAST [1]
- ■ MODERATE [1]
- ■ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach – pools and riffles.

Recreation Potential (Circle one and comment on back)
- ☐ Primary Contact
- ☐ Secondary Contact

Pool/ Current Maximum 12: 4

Comments

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:

☐ NO RIFFLE [metric = 0]

RIFFLE DEPTH
- ☐ BEST AREAS > 10cm [2]
- ☐ BEST AREAS 5 - 10cm [1]
- ■ BEST AREAS < 5cm [metric = 0]

RUN DEPTH
- ☐ MAXIMUM > 50cm [2]
- ■ MAXIMUM < 50cm [1]

RIFFLE/RUN SUBSTRATE Check ONE (Or 2 & average)
- ☐ STABLE (e.g., Cobble, Boulder) [2]
- ■ MOD. STABLE (e.g., Large Gravel) [1]
- ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE/RUN EMBEDDEDNESS
- ☐ NONE [2]
- ■ LOW [1]
- ☐ MODERATE [0]
- ☐ EXTENSIVE [-1]

Riffle/ Run Maximum 8: 3

Comments

6] *GRADIENT* (31 ft/mi)

DRAINAGE AREA (3.03 mi²)

- ☐ VERY LOW - LOW [2–4]
- ☐ MODERATE [6 - 10]
- ■ HIGH - VERY HIGH [10 - 6]

%POOL: 20 %GLIDE: 15 %RUN: 40 %RIFFLE: 25

Gradient Maximum 10: 8

IDEM OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

Circle some & COMMENT _____

A-CANOPY

- ☐ > 85% - Open
- ☐ 55% - < 85%
- ☒ 30% - < 55%
- ☐ 10% - < 30%
- ☐ < 10% - Closed

B-AESTHETICS

- ☐ Nuisance algae
- ☐ Invasive macrophytes
- ☐ Excess turbidity
- ☐ Discoloration
- ☐ Foam/Scum
- ☐ Oil sheen
- ☐ Trash/Litter
- ☐ Nuisance odor
- ☐ Sludge deposits
- ☐ CSOs/SSOs/Outfalls

C-RECREATION

	Area	Depth
Pool:	☐ > 100 ft^2	☐ > 3 ft

D-MAINTENANCE

- ☐ Public ☐ Private
- ☐ Active ☐ Historic
- Succession: ☐ Young ☐ Old
- ☐ Spray ☐ Islands ☐ Scoured
- Snag: ☐ Removed ☐ Modified
- Leveed: ☐ One sided ☐ Both banks
- ☐ Relocated ☐ Cutoffs
- Bedload: ☐ Moving ☐ Stable
- ☐ Armoured ☐ Slumps
- ☐ Impounded ☐ Desiccated
- ☐ Flood control ☐ Drainage

E-ISSUES

- ☐ WWTP ☐ CSO ☐ NPDES
- ☐ Industry ☐ Urban
- ☐ Hardened ☐ Dirt & Grime
- ☐ Contaminated ☐ Landfill
- BMPs: ☐ Construction ☐ Sediment
- ☐ Logging ☐ Irrigation ☐ Cooling
- Erosion: ☐ Bank ☐ Surface
- ☐ False bank ☐ Manure ☐ Lagoon
- ☐ Wash H_2O ☐ Tile ☐ H_2O Table
- Mine: ☐ Acid ☐ Quarry
- Flow: ☐ Natural ☐ Stagnant
- ☐ Wetland ☐ Park ☐ Golf
- ☐ Lawn ☐ Home
- ☐ Atmospheric deposition

Looking upstream (> 10m, 3 readings; < 10m, 1 reading in middle); Round to the nearest whole percent

	Left	Middle	Right	Total Average
% open	___ %	___ %	___ %	___ %

Stream Drawing:

Project 3: Olin Lake Nature Preserve

OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

Sample #	bioSample #	Stream Name	Location
			OL Nature Preserve

Surveyor	Sample Date	County	Macro Sample Type	☐ Habitat Complete	QHEI Score:
AD	7/26/12				54

Fair

1] *SUBSTRATE* Check ONLY Two predominant substrate TYPE BOXES; estimate % and check every type present

Check ONE (Or 2 & average)

BEST TYPES	PREDOMINANT P	PRESENT R	TOTAL %	OTHER TYPES	PREDOMINANT P	PRESENT R	TOTAL %
BLDR/SLABS [10]	☐	☐		HARDPAN [4]	☐	☐	
BOULDER [9]	☐	☐		DETRITUS [3]	☐	☐	
COBBLE [8]	☐	■		MUCK [2]	☐	☐	
GRAVEL [7]	☐	☐		SILT [2]	☐	☐	
SAND [6]	■	☐		ARTIFICIAL [0]	☐	☐	
BEDROCK [5]	☐	☐		(Score natural substrates; ignore sludge from point-sources)			

NUMBER OF BEST TYPES: ☐ 4 or more [2] ■ 3 or less [0]

ORIGIN
- ☐ LIMESTONE [1]
- ■ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTRINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☐ HEAVY [-2]
- ☐ MODERATE [-1]
- ■ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☐ EXTENSIVE [-2]
- ■ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ NONE [1]

Substrate 13 Maximum 20

Comments

2] *INSTREAM COVER* Indicate presence 0 to 3 and estimate percent: **0**–Absent; **1**–Very small amounts or if more common of marginal quality; **2**-Moderate amounts, but not of highest quality or in small amounts of highest quality; **3**-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed root wad in deep/fast water, or deep, well-defined, functional pools.)

% Amount		% Amount		% Amount	
___	UNDERCUT BANKS [1]	___	POOLS > 70cm [2]	___	OXBOWS, BACKWATERS [1]
___	OVERHANGING VEGETATION [1]	___	ROOTWADS [1]	___	AQUATIC MACROPHYTES [1]
___	SHALLOWS (IN SLOW WATER) [1]	___	BOULDERS [1]	70 2	LOGS OR WOODY DEBRIS [1]
___	ROOTMATS [1]				

AMOUNT

Check ONE (Or 2 & average)
- ☐ EXTENSIVE > 75% [11]
- ■ MODERATE 25 - 75% [7]
- ☐ SPARSE 5 - < 25% [3]
- ☐ NEARLY ABSENT < 5% [1]

Cover 8 Maximum 20

Comments

3] *CHANNEL MORPHOLOGY* Check ONE in each category (Or 2 & average)

SINUOSITY
- ☐ HIGH [4]
- ■ MODERATE [3]
- ☐ LOW [2]
- ☐ NONE [1]

DEVELOPMENT
- ☐ EXCELLENT [7]
- ■ GOOD [5]
- ☐ FAIR [3]
- ☐ POOR [1]

CHANNELIZATION
- ■ NONE [6]
- ☐ RECOVERED [4]
- ☐ RECOVERING [3]
- ☐ RECENT OR NO RECOVERY [1]

STABILITY
- ☐ HIGH [3]
- ☐ MODERATE [2]
- ■ LOW [1]

Channel 15 Maximum 20

Comments

4] *BANK EROSION AND RIPARIAN ZONE* Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)
- ☐☐ NONE/LITTLE [3]
- ☐☐ MODERATE [2]
- ■■ HEAVY/SEVERE [1]

RIPARIAN WIDTH (L R)
- ■■ WIDE > 50m [4]
- ☐☐ MODERATE 10-50m [3]
- ☐☐ NARROW 5-10m [2]
- ☐☐ VERY NARROW [1]
- ☐☐ NONE [0]

FLOOD PLAIN QUALITY (L R)
- ■■ FOREST, SWAMP [3]
- ☐☐ SHRUB OR OLD FIELD [2]
- ☐☐ RESIDENTIAL, PARK, NEW FIELD [1]
- ☐☐ FENCED PASTURE [1]
- ☐☐ OPEN PASTURE, ROWCROP [0]

(L R)
- ☐☐ CONSERVATION TILLAGE [1]
- ☐☐ URBAN OR INDUSTRIAL [0]
- ☐☐ MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Riparian 8 Maximum 10

Comments

5] *POOL/GLIDE AND RIFFLE/RUN QUALITY*

MAXIMUM DEPTH Check ONE (ONLY!)
- ☐ > 1m [6]
- ☐ 0.7 - < 1m [4]
- ☐ 0.4 - < 0.7m [2]
- ☐ 0.2 - < 0.4m [1]
- ■ < 0.2m [0]

CHANNEL WIDTH Check ONE (Or 2 & average)
- ☐ POOL WIDTH > RIFFLE WIDTH [2]
- ■ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ■ FAST [1]
- ■ MODERATE [1]
- ☐ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach – pools and riffles.

Recreation Potential (Circle one and comment on back)
- ☐ Primary Contact
- ☐ Secondary Contact

Pool/ Current 3 Maximum 12

Comments Dry at time of sample

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:

☐ NO RIFFLE [metric = 0]

RIFFLE DEPTH
- ☐ BEST AREAS > 10cm [2]
- ■ BEST AREAS 5 - 10cm [1]
- ☐ BEST AREAS < 5cm [metric = 0]

RUN DEPTH
- ■ MAXIMUM > 50cm [2]
- ☐ MAXIMUM < 50cm [1]

RIFFLE/RUN SUBSTRATE Check ONE (Or 2 & average)
- ☐ STABLE (e.g., Cobble, Boulder) [2]
- ☐ MOD. STABLE (e.g., Large Gravel) [1]
- ■ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE/RUN EMBEDDEDNESS
- ☐ NONE [2]
- ■ LOW [1]
- ☐ MODERATE [0]
- ☐ EXTENSIVE [-1]

Riffle/ Run 3 Maximum 8

Comments Some metrics scored from previous QHEI

6] *GRADIENT* (76 ft/mi)

DRAINAGE AREA (0.06 mi²)

- ☐ VERY LOW - LOW [2–4]
- ☐ MODERATE [6 - 10]
- ☐ HIGH - VERY HIGH [10 - 6]
- ■ Exceeds Very High [4]

%POOL: ___ %GLIDE: ___ %RUN: ___ %RIFFLE: ___

Gradient 4 Maximum 10

IDEM OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

Circle some & COMMENT ______________________________

A-CANOPY
- ☐ > 85% - Open
- ☐ 55% - < 85%
- ☐ 30% - < 55%
- ☐ 10% - < 30%
- ☑ < 10% - Closed

Looking upstream (> 10m, 3 readings; < 10m, 1 reading in middle); Round to the nearest whole percent

	Left	Middle	Right	Total Average
% open	X %	X %	X %	___ %

B-AESTHETICS
- ☐ Nuisance algae
- ☐ Invasive macrophytes
- ☐ Excess turbidity
- ☐ Discoloration
- ☐ Foam/Scum
- ☐ Oil sheen
- ☐ Trash/Litter
- ☐ Nuisance odor
- ☐ Sludge deposits
- ☐ CSOs/SSOs/Outfalls

C-RECREATION

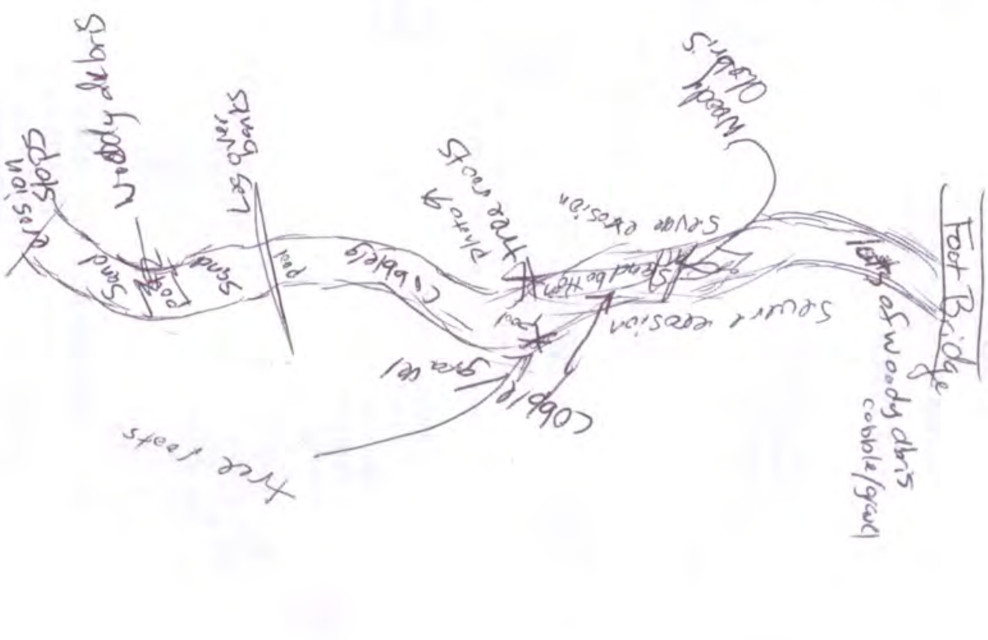
Area / Depth

Pool: ☐ > 100 ft^2 ☐ > 3 ft

D-MAINTENANCE
- ☐ Public ☐ Private
- ☐ Active ☐ Historic
- Succession: ☐ Young ☐ Old
- ☐ Spray ☐ Islands ☐ Scoured
- Snag: ☐ Removed ☐ Modified
- Leveed: ☐ One sided ☐ Both banks
- ☐ Relocated ☐ Cutoffs
- Bedload: ☐ Moving ☐ Stable
- ☐ Armoured ☐ Slumps
- ☐ Impounded ☐ Desiccated
- ☐ Flood control ☐ Drainage

E-ISSUES
- ☐ WWTP ☐ CSO ☐ NPDES
- ☐ Industry ☐ Urban
- ☐ Hardened ☐ Dirt & Grime
- ☐ Contaminated ☐ Landfill
- BMPs: ☐ Construction ☐ Sediment
- ☐ Logging ☐ Irrigation ☐ Cooling
- Erosion: ☐ Bank ☐ Surface
- ☐ False bank ☐ Manure ☐ Lagoon
- ☐ Wash H_2O ☐ Tile ☐ H_2O Table
- Mine: ☐ Acid ☐ Quarry
- Flow: ☐ Natural ☐ Stagnant
- ☐ Wetland ☐ Park ☐ Golf
- ☐ Lawn ☐ Home
- ☐ Atmospheric deposition

Stream Drawing:



Herb layer
- Vit creeper
- Viola sp.
- Stinging nettle
- Small geum
- Polygonum
- Pokeweed
- Enchanter's nightshade
- Leersia
- Ribes (no orange glads)
- multiflora
- hystrix patula

OHWM #1/3 = 9.5"
#2/3 = 8.5"
#3 = 9"

Canopy
- Sugar maple
- KY Coffe
- Ironwood
- tight bark hickory
- red oak?
- Cottonwood
- tulip
- walnut
- Ash
- Cherry

Sapling layer
- Mostly Sugar maple
- Some KY coffee
- Pawpaw
- hackberry

OhioEPA Primary Headwater Habitat Evaluation Form

HHEI Score (sum of metrics 1, 2, 3) : 34

SITE NAME/LOCATION: Olin Lake Nature Preserve

SITE NUMBER: | RIVER BASIN: | DRAINAGE AREA (mi²): 0.06

LENGTH OF STREAM REACH (ft): | LAT.: | LONG.: | RIVER CODE: | RIVER MILE:

DATE: 07/26/12 | SCORER: AD | COMMENTS: Dry

NOTE: Complete All Items On This Form - Refer to "Field Evaluation Manual for Ohio's PHWH Streams" for Instructions

STREAM CHANNEL MODIFICATIONS: ☐ NONE / NATURAL CHANNEL ☐ RECOVERED ☐ RECOVERING ☐ RECENT OR NO RECOVERY

1. **SUBSTRATE (Estimate percent of every type of substrate present.** Check *ONLY* two predominant substrate *TYPE* boxes (Max of 32). Add total number of significant substrate types found (Max of 8). Final metric score is sum of boxes A & B.

TYPE		PERCENT	TYPE		PERCENT
☐	BLDR SLABS [16 pts]	0%	☐	SILT [3 pt]	0%
☐	BOULDER (>256 mm) [16 pts]	0%	☐	LEAF PACK/WOODY DEBRIS [3 pts]	10%
☐	BEDROCK [16 pt]	0%	☐	FINE DETRITUS [3 pts]	0%
☐	COBBLE (65-256 mm) [12 pts]	5%	☐	CLAY or HARDPAN [0 pt]	0%
☑	GRAVEL (2-64 mm) [9 pts]	15%	☐	MUCK [0 pts]	0%
☐	SAND (<2 mm) [6 pts]	70%	☐	ARTIFICIAL [3 pts]	0%

Total of Percentages of Bldr Slabs, Boulder, Cobble, Bedrock: 5.00% (A) | 100% (B)

SCORE OF TWO MOST PREDOMINATE SUBSTRATE TYPES: 15 **TOTAL NUMBER OF SUBSTRATE TYPES:** 4

HHEI Metric Points

Substrate Max = 40: 19

A + B

2. **Maximum Pool Depth** ***(Measure the maximum pool depth within the 61 meter (200 ft)*** evaluation reach at the time of evaluation. Avoid plunge pools from road culverts or storm water pipes) (Check *ONLY* one box):

☐ > 30 centimeters [20 pts]
☐ > 22.5 - 30 cm [30 pts]
☐ > 10 - 22.5 cm [25 pts]
☐ > 5 cm - 10 cm [15 pts]
☐ < 5 cm [5 pts]
☑ NO WATER OR MOIST CHANNEL [0 pts]

COMMENTS: Dry **MAXIMUM POOL DEPTH (centimeters):**

Pool Depth Max = 30: 0

3. **BANK FULL WIDTH (Measured as the average of 3-4 measurements)** **(Check *ONLY* one box):**

☐ > 4.0 meters (> 13') [30 pts]
☐ > 3.0 m - 4.0 m (> 9' 7" - 13') [25 pts]
☐ > 1.5 m - 3.0 m (> 9' 7" - 4' 8") [20 pts]
☑ > 1.0 m - 1.5 m (> 3' 3" - 4' 8") [15 pts]
☐ ≤ 1.0 m (<=3' 3") [5 pts]

COMMENTS: **AVERAGE BANKFULL WIDTH (meters):**

Bankfull Width Max=30: 15

This information must also be completed

RIPARIAN ZONE AND FLOODPLAIN QUALITY ☆NOTE: River Left (L) and Right (R) as looking downstream☆

RIPARIAN WIDTH (Per Bank) L	R	FLOODPLAIN QUALITY (Most Predominant per Bank) L	R		L	R	
☑	☑	Wide >10m	☑	☑	Mature Forest, Wetland	☐	☐	Conservation Tillage
☐	☐	Moderate 5-10m	☐	☐	Immature Forest, Shrub or Old Field	☐	☐	Urban or Industrial
☐	☐	Narrow <5m	☐	☐	Residential, Park, New Field	☐	☐	Open Pasture, Row Crop
☐	☐	None	☐	☐	Fenced Pasture	☐	☐	Mining or Construction

COMMENTS:

FLOW REGIME *(At Time of Evaluation)* (Check *ONLY* one box):

☐ Stream Flowing
☐ Subsurface flow with isolated pools (Interstitial)
☐ Moist Channel, isolated pools, no flow (Intermittent)
☑ Dry channel, no water (Ephemeral)

COMMENTS:

SINUOSITY (Number of bends per 61 m (200 ft) of channel) (Check *ONLY* one box):

☐ None ☐ 0.5 ☐ 1.0 ☐ 1.5 ☐ 2.0 ☐ 2.5 ☐ 3.0 ☑ >3

STREAM GRADIENT ESTIMATE

☐ Flat (0.5 ft/100 ft) ☐ Flat to Moderate ☐ Moderate (2 ft/100 ft) ☑ Moderate to Severe ☐ Severe (10 ft/100 ft)

ADDITIONAL STREAM INFORMATION (This Information Must Also be Completed):

QHEI PERFORMED? - [✓] Yes [ ] No QHEI Score **54.0** (If Yes, Attach Completed QHEI Form)

DOWNSTREAM DESIGNATED USE(S)

[ ] WWH Name: _____ Distance from Evaluated Stream _____

[ ] CWH Name: _____ Distance from Evaluated Stream _____

[ ] EWH Name: _____ Distance from Evaluated Stream _____

MAPPING: ATTACH COPIES OF MAPS, INCLUDING THE ENTIRE WATERSHED AREA. CLEARLY MARK THE SITE LOCATION

USGS Quadrangle Name: _____ NRCS Soil Map Page: _____ NRCS Soil Map Stream Order _____

County: **Wyandot** Township / City: _____

MISCELLANEOUS

Base Flow Conditions? (Y/N): **Y** Date of last precipitation: _____ Quantity: **0.00**

Photograph Information: _____

Elevated Turbidity? (Y/N): **Y** Canopy (% open): **0%**

Were samples collected for water chemistry? (Y/N): **Y** (Note lab sample no. or id. and attach results) Lab Number: _____

Field Measures: Temp (°C) _____ Dissolved Oxygen (mg/l) _____ pH (S.U.) _____ Conductivity (µmhos/cm) _____

Is the sampling reach representative of the stream (Y/N) **Y** If not, please explain: _____

Additional comments/description of pollution impacts: _____

BIOTIC EVALUATION

Performed? (Y/N): **Y** (If Yes, Record all observations. Voucher collections optional. NOTE: all voucher samples must be labeled with the site ID number. Include appropriate field data sheets from the Primary Headwater Habitat Assessment Manual)

Fish Observed? (Y/N) **Y** Voucher? (Y/N) **Y** Salamanders Observed? (Y/N) **Y** Voucher? (Y/N) **Y**

Frogs or Tadpoles Observed? (Y/N) **Y** Voucher? (Y/N) **Y** Aquatic Macroinvertebrates Observed? (Y/N) **Y** Voucher? (Y/N) **Y**

Comments Regarding Biology: _____

DRAWING AND NARRATIVE DESCRIPTION OF STREAM REACH (This must be completed):

Include important landmarks and other features of interest for site evaluation and a narrative description of the stream's location

FLOW →

Save as pdf Reset Form

Project 5: Olin-Raber Wetlands

OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

Sample #	bioSample #	Stream Name	Location
		TNC (Upstream of Silver Maple)	

Surveyor	Sample Date	County	Macro Sample Type	☐ Habitat Complete	QHEI Score:
AD	7/27/12		Kick		32

Poor

1] *SUBSTRATE* Check ONLY Two predominant substrate TYPE BOXES; estimate % and check every type present

BEST TYPES	PREDOMINANT P	PRESENT P	TOTAL %
BLDR/SLABS [10]	☐	☐	
BOULDER [9]	☐	☐	
COBBLE [8]	☐	☐	
GRAVEL [7]	☐	☐	
SAND [6]	☐	■	1
BEDROCK [5]	☐	☐	

OTHER TYPES	PREDOMINANT P	PRESENT P	TOTAL %
HARDPAN [4]	☐	☐	
DETRITUS [3]	■	☐	4
MUCK [2]	☐	☐	
SILT [2]	■	☐	95
ARTIFICIAL [0]	☐	☐	

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ■ 3 or less [0]

Check ONE (Or 2 & average)

ORIGIN
- ☐ LIMESTONE [1]
- ☐ TILLS [1]
- ■ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTRINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ■ HEAVY [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ■ EXTENSIVE [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ NONE [1]

Substrate: 0 (Maximum 20)

Comments

2] *INSTREAM COVER* Indicate presence 0 to 3 and estimate percent: **0**–Absent; **1**–Very small amounts or if more common of marginal quality; **2**-Moderate amounts, but not of highest quality or in small amounts of highest quality; **3**-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed root wad in deep/fast water, or deep, well-defined, functional pools.)

%	Amount	
5	1	UNDERCUT BANKS [1]
95	3	OVERHANGING VEGETATION [1]
		SHALLOWS (IN SLOW WATER) [1]
		ROOTMATS [1]
		POOLS > 70cm [2]
		ROOTWADS [1]
		BOULDERS [1]
		OXBOWS, BACKWATERS [1]
		AQUATIC MACROPHYTES [1]
		LOGS OR WOODY DEBRIS [1]

AMOUNT Check ONE (Or 2 & average)
- ☐ EXTENSIVE > 75% [11]
- ☐ MODERATE 25 - 75% [7]
- ■ SPARSE 5 - < 25% [3]
- ☐ NEARLY ABSENT < 5% [1]

Cover Maximum 20: 5

Comments

3] *CHANNEL MORPHOLOGY* Check ONE in each category (Or 2 & average)

SINUOSITY
- ☐ HIGH [4]
- ☐ MODERATE [3]
- ■ LOW [2]
- ☐ NONE [1]

DEVELOPMENT
- ☐ EXCELLENT [7]
- ☐ GOOD [5]
- ☐ FAIR [3]
- ■ POOR [1]

CHANNELIZATION
- ☐ NONE [6]
- ☐ RECOVERED [4]
- ■ RECOVERING [3]
- ☐ RECENT OR NO RECOVERY [1]

STABILITY
- ☐ HIGH [3]
- ☐ MODERATE [2]
- ■ LOW [1]

Channel Maximum 20: 7

Comments

4] *BANK EROSION AND RIPARIAN ZONE* Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

L	R	EROSION
■	■	NONE/LITTLE [3]
☐	☐	MODERATE [2]
☐	☐	HEAVY/SEVERE [1]

L	R	RIPARIAN WIDTH
☐	■	WIDE > 50m [4]
■	☐	MODERATE 10-50m [3]
☐	☐	NARROW 5-10m [2]
☐	☐	VERY NARROW [1]
☐	☐	NONE [0]

L	R	FLOOD PLAIN QUALITY
■	■	FOREST, SWAMP [3]
☐	☐	SHRUB OR OLD FIELD [2]
☐	☐	RESIDENTIAL, PARK, NEW FIELD [1]
☐	☐	FENCED PASTURE [1]
☐	☐	OPEN PASTURE, ROWCROP [0]

L	R	
☐	☐	CONSERVATION TILLAGE [1]
☐	☐	URBAN OR INDUSTRIAL [0]
☐	☐	MINING / CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Riparian Maximum 10: 10

Comments

5] *POOL/GLIDE AND RIFFLE/RUN QUALITY*

MAXIMUM DEPTH Check ONE (ONLY!)
- ☐ > 1m [6]
- ☐ 0.7 - < 1m [4]
- ■ 0.4 - < 0.7m [2]
- ☐ 0.2 - < 0.4m [1]
- ☐ < 0.2m [0]

CHANNEL WIDTH Check ONE (Or 2 & average)
- ☐ POOL WIDTH > RIFFLE WIDTH [2]
- ■ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☐ FAST [1]
- ☐ MODERATE [1]
- ■ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach – pools and riffles.

Recreation Potential (Circle one and comment on back)
- ☐ Primary Contact
- ☐ Secondary Contact

Pool/Current Maximum 12: 4

Comments

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:

☐ NO RIFFLE [metric = 0]

RIFFLE DEPTH
- ☐ BEST AREAS > 10cm [2]
- ☐ BEST AREAS 5 - 10cm [1]
- ■ BEST AREAS < 5 cm [metric = 0]

RUN DEPTH
- ☐ MAXIMUM > 50cm [2]
- ■ MAXIMUM < 50cm [1]

RIFFLE/RUN SUBSTRATE Check ONE (Or 2 & average)
- ☐ STABLE (e.g., Cobble, Boulder) [2]
- ☐ MOD. STABLE (e.g., Large Gravel) [1]
- ■ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE/RUN EMBEDDEDNESS
- ☐ NONE [2]
- ☐ LOW [1]
- ☐ MODERATE [0]
- ■ EXTENSIVE [-1]

Riffle/Run Maximum 8: 0

Comments

6] *GRADIENT* (6.0 ft/mi)

DRAINAGE AREA (0.11 mi²)

- ☐ VERY LOW - LOW [2–4]
- ■ MODERATE [6 - 10]
- ☐ HIGH - VERY HIGH [10 - 6]

%POOL: ☐ %GLIDE: ☐ %RUN: ☐ %RIFFLE: ☐

Gradient Maximum 10: 6

IDEM OWQ Biological Studies QHEI (Qualitative Habitat Evaluation Index)

Circle some & COMMENT _____

A-CANOPY
- ☒ > 85% - Open
- ☐ 55% - < 85%
- ☐ 30% - < 55%
- ☐ 10% - < 30%
- ☐ < 10% - Closed

B-AESTHETICS
- ☐ Nuisance algae
- ☐ Invasive macrophytes
- ☐ Excess turbidity
- ☐ Discoloration
- ☐ Foam/Scum
- ☐ Oil sheen
- ☐ Trash/Litter
- ☐ Nuisance odor
- ☐ Sludge deposits
- ☐ CSOs/SSOs/Outfalls

C-RECREATION

Area Depth

Pool: ☐ > 100 ft² ☐ > 3 ft

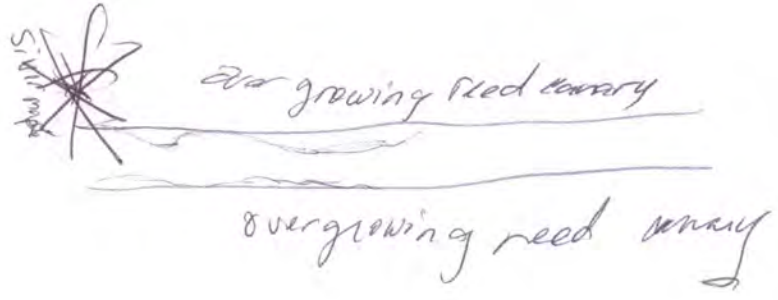
D-MAINTENANCE
- ☐ Public ☐ Private
- ☐ Active ☐ Historic
- Succession: ☐ Young ☐ Old
- ☐ Spray ☐ Islands ☐ Scoured
- Snag : ☐ Removed ☐ Modified
- Leveed: ☐ One sided ☐ Both banks
- ☐ Relocated ☐ Cutoffs
- Bedload: ☐ Moving ☐ Stable
- ☐ Armoured ☐ Slumps
- ☐ Impounded ☐ Desiccated
- ☐ Flood control ☐ Drainage

E-ISSUES
- ☐ WWTP ☐ CSO ☐ NPDES
- ☐ Industry ☐ Urban
- ☐ Hardened ☐ Dirt & Grime
- ☐ Contaminated ☐ Landfill
- BMPs: ☐ Construction ☐ Sediment
- ☐ Logging ☐ Irrigation ☐ Cooling
- Erosion: ☐ Bank ☐ Surface
- ☐ False bank ☐ Manure ☐ Lagoon
- ☐ Wash H_2O ☐ Tile ☐ H_2O Table
- Mine: ☐ Acid ☐ Quarry
- Flow: ☐ Natural ☐ Stagnant
- ☐ Wetland ☐ Park ☐ Golf
- ☐ Lawn ☐ Home
- ☐ Atmospheric deposition

Looking upstream (> 10m, 3 readings; < 10m, 1 reading in middle); Round to the nearest whole percent

	Left	Middle	Right	Total Average
% open	___ %	___ %	___ %	___ %

Stream Drawing:



OhioEPA Primary Headwater Habitat Evaluation Form

HHEI Score (sum of metrics 1, 2, 3) : 39

SITE NAME/LOCATION: Olin-Raber Wetlands (Unstream of Silvermaple)

SITE NUMBER: ____ RIVER BASIN: ____ DRAINAGE AREA (mi²): 0.11

LENGTH OF STREAM REACH (ft): ____ LAT.: ____ LONG.: ____ RIVER CODE: ____ RIVER MILE: ____

DATE: 07/27/12 SCORER: AD COMMENTS: ____

NOTE: Complete All Items On This Form - Refer to "Field Evaluation Manual for Ohio's PHWH Streams" for Instructions

STREAM CHANNEL MODIFICATIONS: ☐ NONE / NATURAL CHANNEL ☐ RECOVERED ☑ RECOVERING ☐ RECENT OR NO RECOVERY

1. SUBSTRATE (Estimate percent of every type of substrate present. Check *ONLY* two predominant substrate *TYPE* boxes (Max of 32). Add total number of significant substrate types found (Max of 8). Final metric score is sum of boxes A & B.

TYPE		PERCENT	TYPE		PERCENT
☐☐	BLDR SLABS [16 pts]	0%	☑☑	SILT [3 pt]	95%
☐☐	BOULDER (>256 mm) [16 pts]	0%	☐☐	LEAF PACK/WOODY DEBRIS [3 pts]	0%
☐☐	BEDROCK [16 pt]	0%	☐☐	FINE DETRITUS [3 pts]	4%
☐☐	COBBLE (65-256 mm) [12 pts]	0%	☐☐	CLAY or HARDPAN [0 pt]	0%
☐☐	GRAVEL (2-64 mm) [9 pts]	0%	☐☐	MUCK [0 pts]	0%
☐☐	SAND (<2 mm) [6 pts]	1%	☐☐	ARTIFICIAL [3 pts]	0%

Total of Percentages of Bldr Slabs, Boulder, Cobble, Bedrock: 0.00% (A) 100% (B)

SCORE OF TWO MOST PREDOMINATE SUBSTRATE TYPES: 6 **TOTAL NUMBER OF SUBSTRATE TYPES:** 3

HHEI Metric Points

Substrate Max = 40

9

A + B

2. Maximum Pool Depth ***(Measure the maximum pool depth within the 61 meter (200 ft)*** evaluation reach at the time of evaluation. Avoid plunge pools from road culverts or storm water pipes) (Check *ONLY* one box):

☐	> 30 centimeters [20 pts]	☐	> 5 cm - 10 cm [15 pts]
☐	> 22.5 - 30 cm [30 pts]	☐	< 5 cm [5 pts]
☑	> 10 - 22.5 cm [25 pts]	☐	NO WATER OR MOIST CHANNEL [0 pts]

COMMENTS: ____ **MAXIMUM POOL DEPTH (centimeters):** ____

Pool Depth Max = 30

25

3. BANK FULL WIDTH (Measured as the average of 3-4 measurements) **(Check *ONLY* one box):**

☐	> 4.0 meters (> 13') [30 pts]	☐	> 1.0 m - 1.5 m (> 3' 3" - 4' 8") [15 pts]
☐	> 3.0 m - 4.0 m (> 9' 7" - 13') [25 pts]	☑	≤ 1.0 m (<=3' 3") [5 pts]
☐	> 1.5 m - 3.0 m (> 9' 7" - 4' 8") [20 pts]		

COMMENTS: ____ **AVERAGE BANKFULL WIDTH (meters):** ____

Bankfull Width Max=30

5

This information must also be completed

RIPARIAN ZONE AND FLOODPLAIN QUALITY ☆NOTE: River Left (L) and Right (R) as looking downstream☆

RIPARIAN WIDTH (Per Bank) L	R	FLOODPLAIN QUALITY (Most Predominant per Bank) L	R		L	R	
☑	☑	Wide >10m	☑	☑	Mature Forest, Wetland	☐	☐	Conservation Tillage
☐	☐	Moderate 5-10m	☐	☐	Immature Forest, Shrub or Old Field	☐	☐	Urban or Industrial
☐	☐	Narrow <5m	☐	☐	Residential, Park, New Field	☐	☐	Open Pasture, Row Crop
☐	☐	None	☐	☐	Fenced Pasture	☐	☐	Mining or Construction

COMMENTS: ____

FLOW REGIME *(At Time of Evaluation)* (Check *ONLY* one box):

☑	Stream Flowing	☐	Moist Channel, isolated pools, no flow (Intermittent)
☐	Subsurface flow with isolated pools (Interstitial)	☐	Dry channel, no water (Ephemeral)

COMMENTS: Appears to be groundwater fed

SINUOSITY (Number of bends per 61 m (200 ft) of channel) (Check *ONLY* one box):

☑	None	☐	1.0	☐	2.0	☐	3.0
☐	0.5	☐	1.5	☐	2.5	☐	>3

STREAM GRADIENT ESTIMATE

☐ Flat (0.5 ft/100 ft) ☐ Flat to Moderate ☑ Moderate (2 ft/100 ft) ☐ Moderate to Severe ☐ Severe (10 ft/100 ft)

ADDITIONAL STREAM INFORMATION (This Information Must Also be Completed):

QHEI PERFORMED? - [✓] Yes [ ] No QHEI Score 33.0 (If Yes, Attach Completed QHEI Form)

DOWNSTREAM DESIGNATED USE(S)

[ ] WWH Name: _____ Distance from Evaluated Stream _____

[ ] CWH Name: _____ Distance from Evaluated Stream _____

[ ] EWH Name: _____ Distance from Evaluated Stream _____

MAPPING: ATTACH COPIES OF MAPS, INCLUDING THE ENTIRE WATERSHED AREA. CLEARLY MARK THE SITE LOCATION

USGS Quadrangle Name: _____ NRCS Soil Map Page: _____ NRCS Soil Map Stream Order _____

County: LaGrange Township / City: _____

MISCELLANEOUS

Base Flow Conditions? (Y/N): Y Date of last precipitation: 07/26/12 Quantity: 0.09

Photograph Information: _____

Elevated Turbidity? (Y/N): N Canopy (% open): 90%

Were samples collected for water chemistry? (Y/N): Y (Note lab sample no. or id. and attach results) Lab Number: _____

Field Measures: Temp (°C) 13.80 Dissolved Oxygen (mg/l) 6.70 pH (S.U.) 7.19 Conductivity (µmhos/cm) 598

Is the sampling reach representative of the stream (Y/N) Y If not, please explain: _____

Additional comments/description of pollution impacts: _____

BIOTIC EVALUATION

Performed? (Y/N): Y (If Yes, Record all observations. Voucher collections optional. NOTE: all voucher samples must be labeled with the site ID number. Include appropriate field data sheets from the Primary Headwater Habitat Assessment Manual)

Fish Observed? (Y/N) N Voucher? (Y/N) N Salamanders Observed? (Y/N) N Voucher? (Y/N) N

Frogs or Tadpoles Observed? (Y/N) N Voucher? (Y/N) N Aquatic Macroinvertebrates Observed? (Y/N) Y Voucher? (Y/N) Y

Comments Regarding Biology: _____

DRAWING AND NARRATIVE DESCRIPTION OF STREAM REACH (This must be completed):

Include important landmarks and other features of interest for site evaluation and a narrative description of the stream's location

FLOW →

See QHEI Form

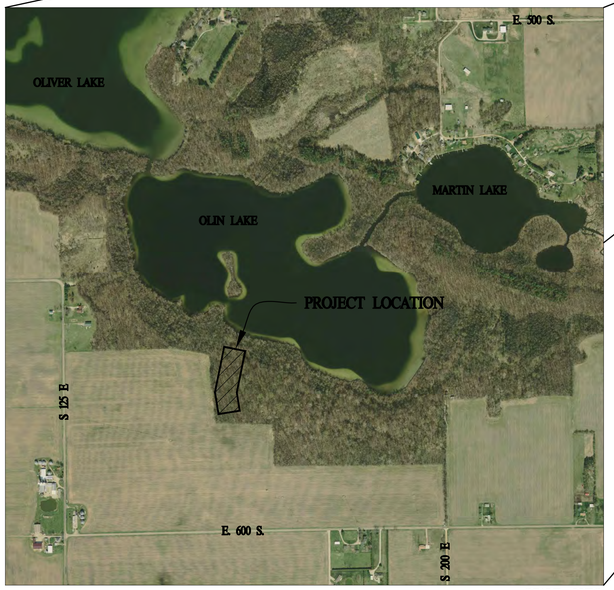
Save as pdf Reset Form

Appendix F
Olin Lake Nature Preserve Engineered Design Plans

OLIN LAKE NATURE PRESERVE
EROSION CONTROL PROJECT

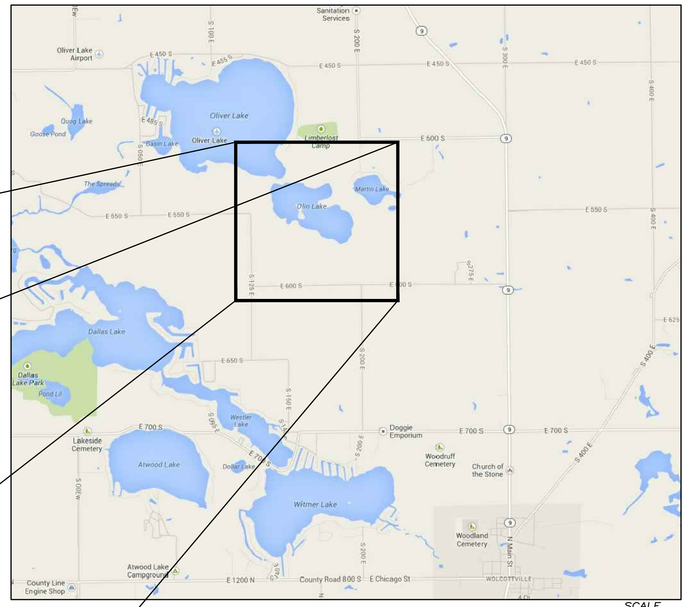
SECTION 20, T36N, R10E, LAGRANGE COUNTY
S. 125 E., WOLCOTTVILLE, IN

OLIN LAKE NATURE PRESERVE
EROSION CONTROL PROJECT
S 125 E, WOLCOTTVILLE, IN
DECEMBER 19, 2013



SCALE N.T.S.

LOCATION MAP



SCALE N.T.S.

VICINITY MAP

LAGRANGE COUNTY, INDIANA

SHEET INDEX

FLOOD PLAIN PANEL

Community Panel Number:
180125 0004 A
Effective Date:
July 1, 1977

ENVIRONMENTAL CONSULTANTS :

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ENGINEER :

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Phone - (260) 489-7643

CONTACTS:

US ARMY CORPS
OF ENGINEERS
AARON DAMRILL
US ACOE, DETROIT DISTRICT
MICHIANA BRANCH OFFICE
2422 VIRIDIAN DRIVE, SUITE 200
SOUTH BEND, INDIANA 46628
PHONE: (574) 232-1952

INDIANA 811 Know what's below. Call before you dig

REVISIONS	DATE	COMMENT	SHEETS REVISED

DATE: DECEMBER 19, 2013

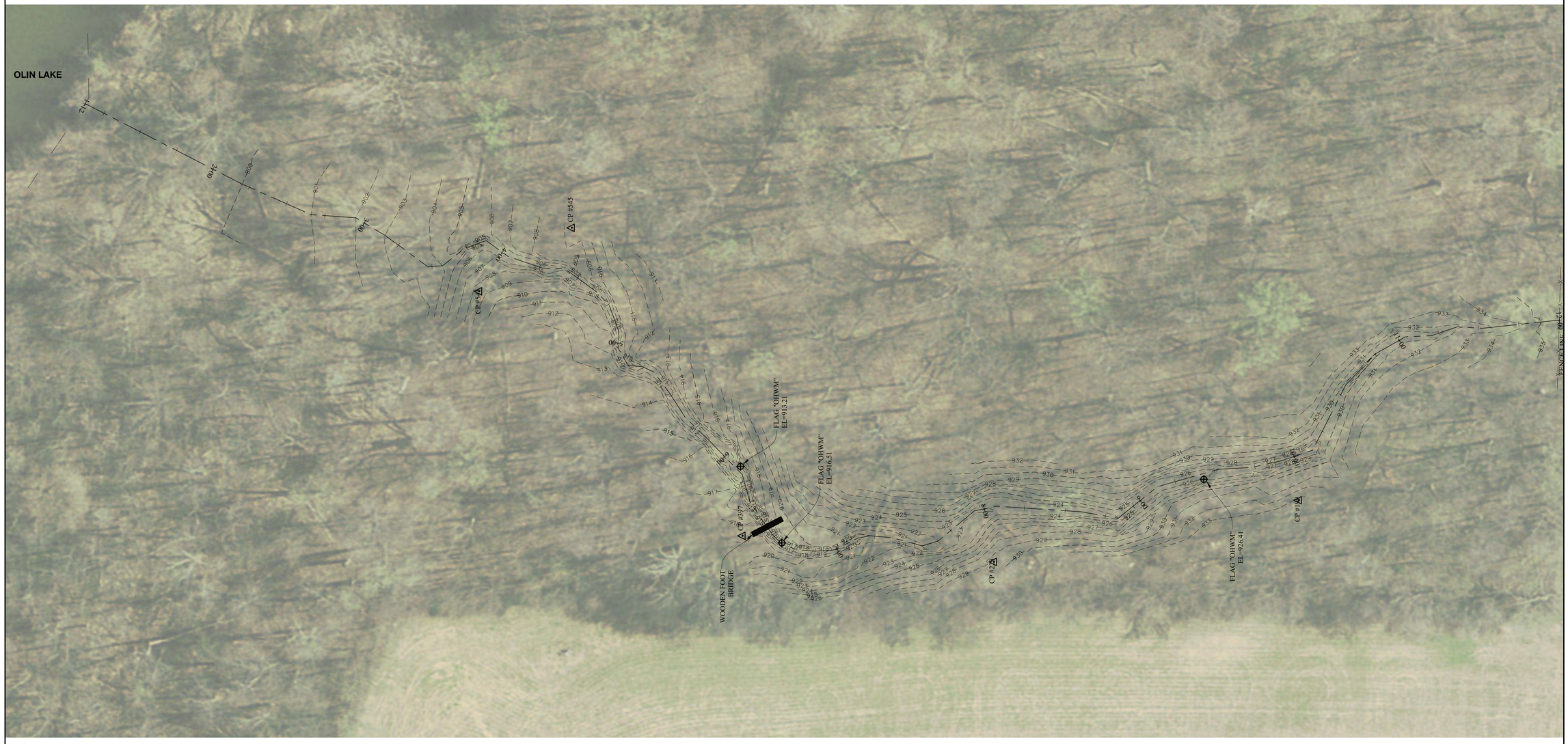
PROJECT BENCHMARK

DNR TBM LLK 140, 1976
In Lagrange County, Oliver Lake Quadrangle, in the NW ¼ of Sec. 18, T. 36 N., R. 10 E., 2nd PM, about 4.35 miles northwest of Wolcottville; at the 450 South Road 12-foot steel pipe culvert over Dove Creek; set in the top of the south end of the culvert, 200 feet east from T-road south (50 East Road), 24 feet south from the center line of the road, 4 feet below the roadway; the center of two filed notches.

Elevation: 904.504 feet NGVD 1929

Source: *http://www.in.gov/dnr/water/files/bm_lagrange.pdf*

30 15 0 30
Scale 1" = 30'



TOPOGRAPHIC SURVEY
PROVIDED BY DAVEY GROUP

Data used to produce this map were collected on December 2, 2011, and February 2, and March 28, 2012

LEGEND

- CONTOUR
- FENCE
- CENTERLINE OF DITCH

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SEAL

CONTACT

REVISIONS

OLIN LAKE NATURE PRESERVE EROSION CONTROL PROJECT

EXISTING TOPOGRAPHY

SEC. 20, T36N, R10E – S. 125 E. WOLCOTTVILLE, IN 46795

DATE : 12-19-13
SCALE : 1" = 30'
DRAWN BY : PMG
CHK'D BY : MJG

SHEET
2

GENERAL CONSTRUCTION NOTES:

1. THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING AND/OR VERIFYING THAT ALL PERMITS AND APPROVALS ARE OBTAINED FROM ALL LOCAL, STATE, AND FEDERAL AGENCIES PRIOR TO STARTING CONSTRUCTION.
3. THE OWNER AND CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING QUALITY CONTROL AT ALL TIMES DURING THE CONSTRUCTION PROCESS.
4. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) STANDARDS FOR EXCAVATIONS. FINAL RULE 29 CFR PART 1926, SUBPART "P" APPLIES TO ALL EXCAVATIONS EXCEEDING FIVE (5) FEET IN DEPTH.
5. CONTACT OWNER IMMEDIATELY IF CONTAMINATED SOILS ARE ENCOUNTERED DURING CONSTRUCTION. CONTAMINATED SOILS MUST BE HAULED OFF-SITE AND LEGALLY DISPOSED.
6. DISCREPANCIES OR CONFLICTS IN THE PLANS AND/OR ON-SITE SHALL BE COMMUNICATED TO THE DESIGN ENGINEER TO ENSURE THAT CLARIFICATIONS AND/OR REVISIONS CAN BE MADE PRIOR TO CONSTRUCTION.

WEIR CONSTRUCTION NOTES:

1. THE INTENT OF THESE PLANS IS TO PROVIDE GUIDELINES FOR THE CONSTRUCTION OF EROSION CHECK STRUCTURES TO ALLEVIATE GULLY EROSION IN THE OLIN LAKE NATURE PRESERVE.
2. ROCK AND WOOD WEIR STRUCTURES ARE DESIGNED AND LOCATED TO REDUCE CHANNEL EROSION BY PROVIDING A SERIES OF ARMORED GRADE DROPS. FLOW VELOCITY UPSTREAM FROM EACH WEIR STRUCTURE WOULD BE REDUCED, THUS LIMITING EROSION POTENTIAL AND PROMOTING SEDIMENT DEPOSITION IN THE CHANNEL RESULTING IN A REDUCED CHANNEL GRADE.
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TOPOGRAPHIC SURVEY
PROVIDED BY DAVEY GROUP

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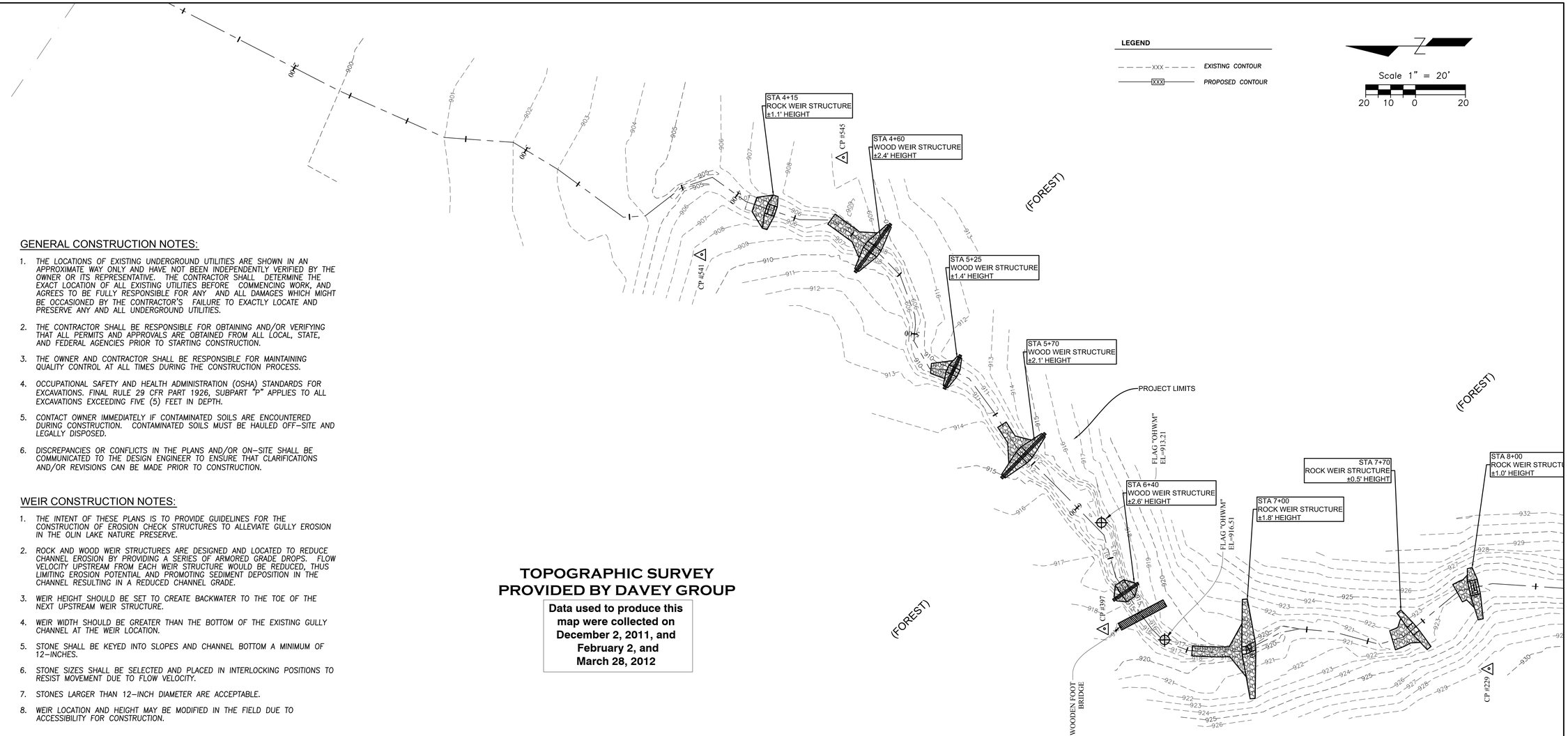

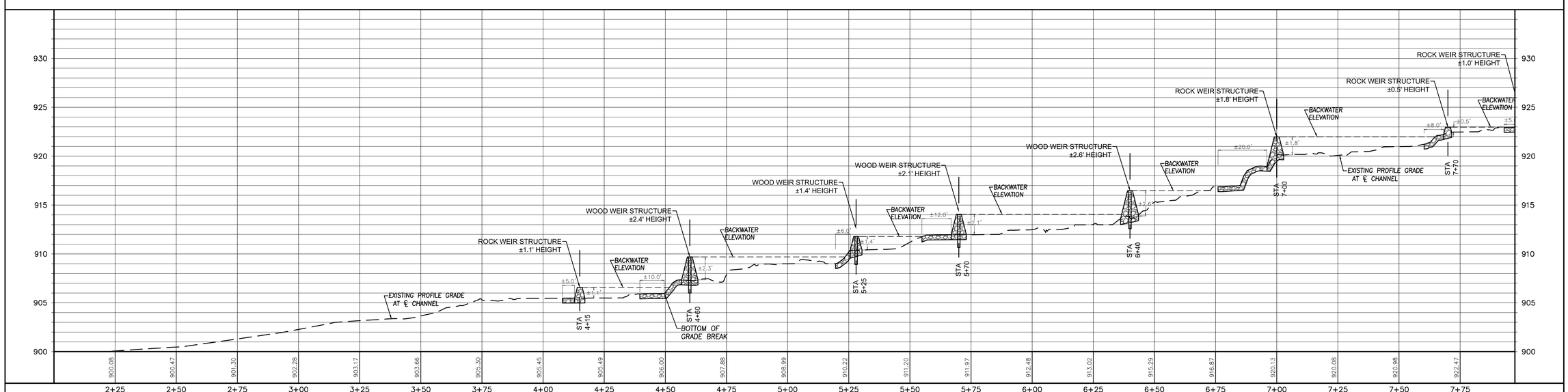

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CONTACT

REVISIONS

OLIN LAKE NATURE PRESERVE EROSION CONTROL PROJECT

PLAN AND PROFILE

SEC. 20, T36N, R10E - S. 125 E. WOLCOTTVILLE, IN 46795

DATE : 12-19-13
SCALE : 1" = 20'
DRAWN BY : PMG
CHK'D BY : MJG

SHEET 3

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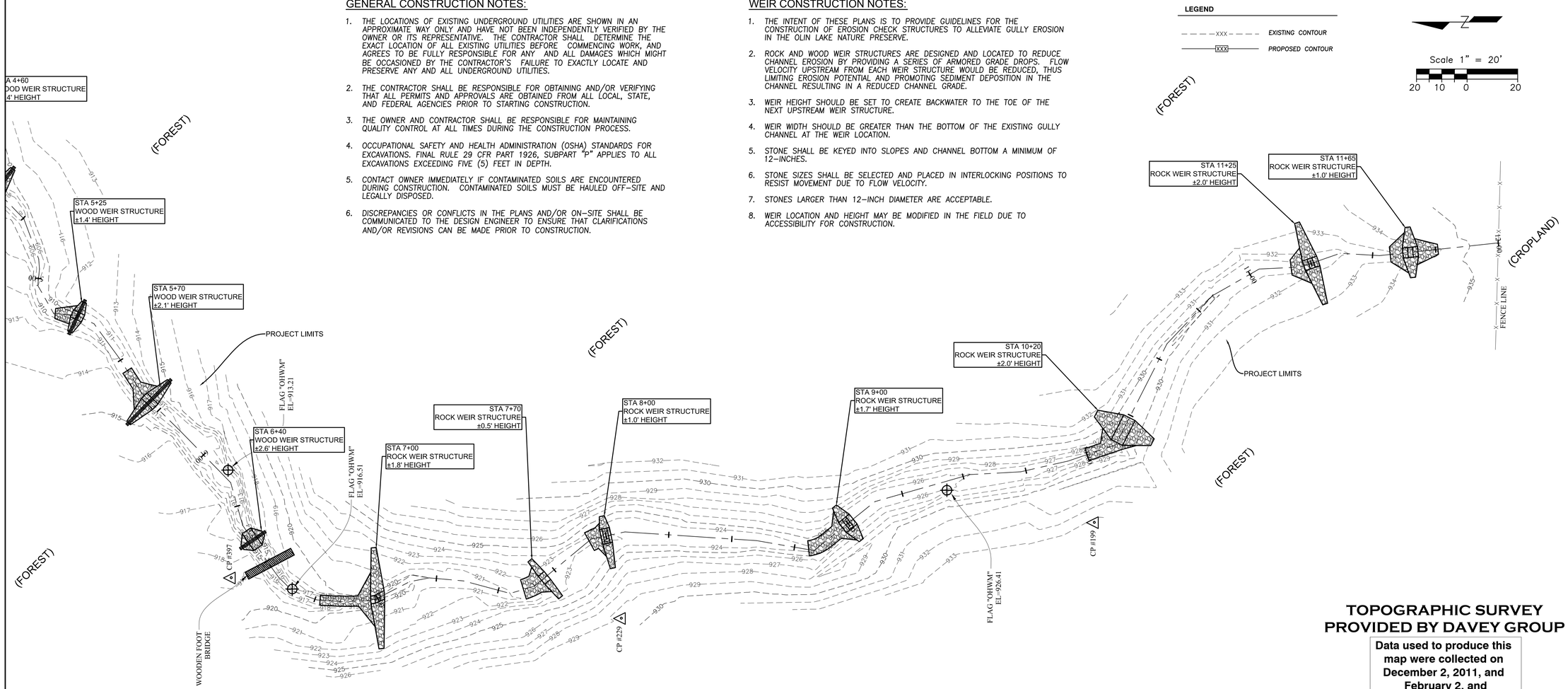

TOPOGRAPHIC SURVEY PROVIDED BY DAVEY GROUP

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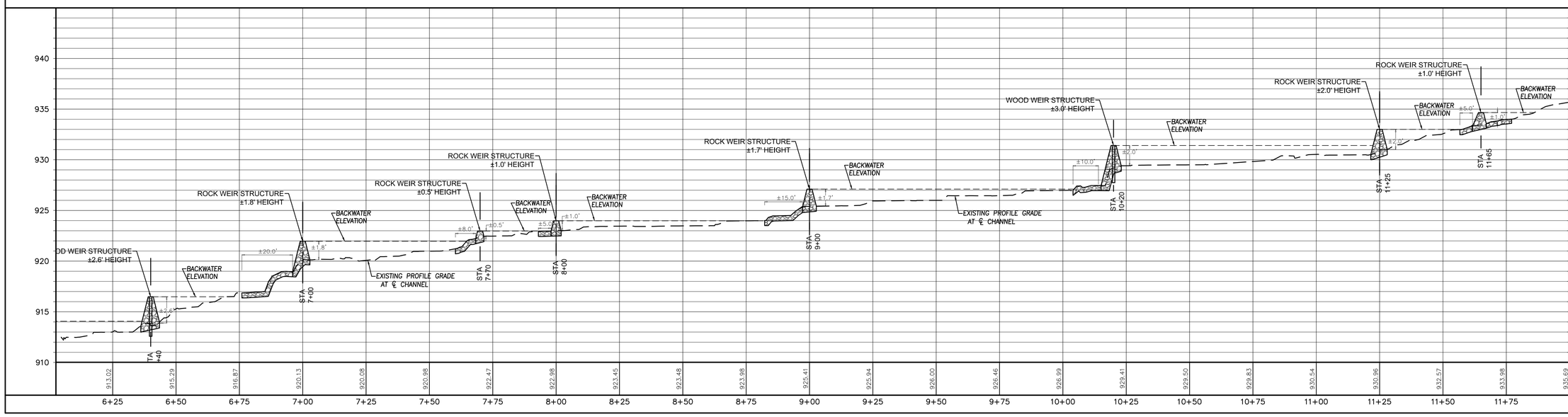

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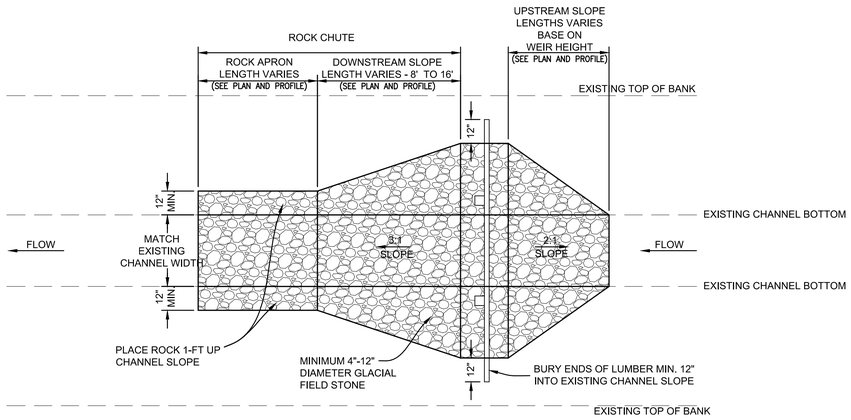
PLAN AND PROFILE

SEC. 20, T36N, R10E - S. 125 E. WOLCOTTVILLE, IN 46795

DATE : 12-19-13
SCALE : 1" = 20'
DRAWN BY : PMG
CHK'D BY : MJG

SHEET 4



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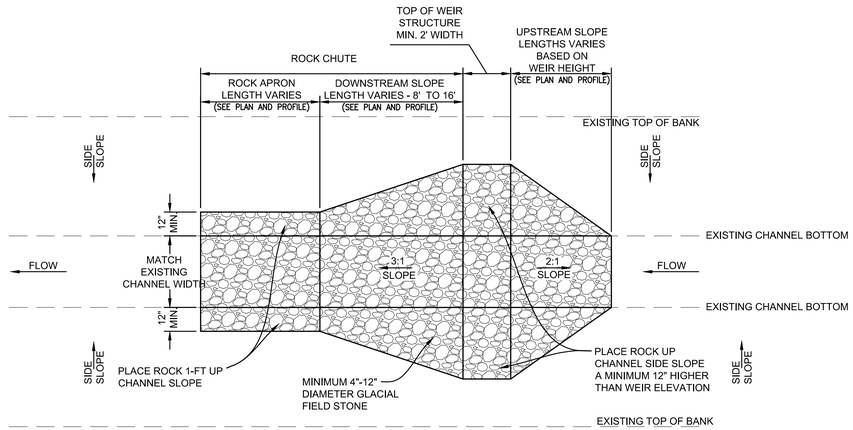

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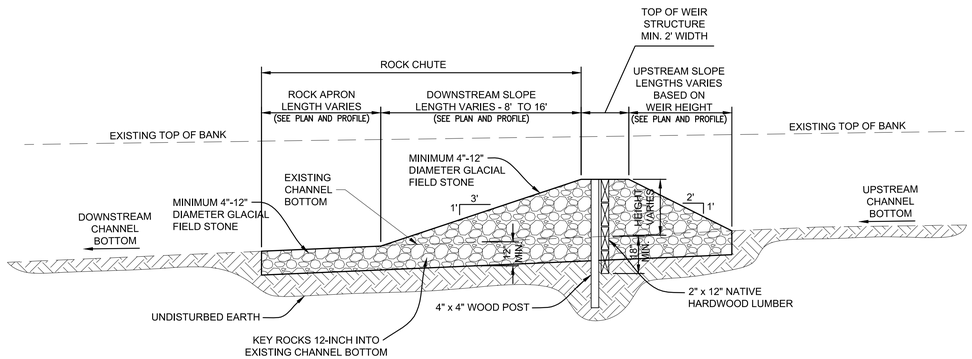
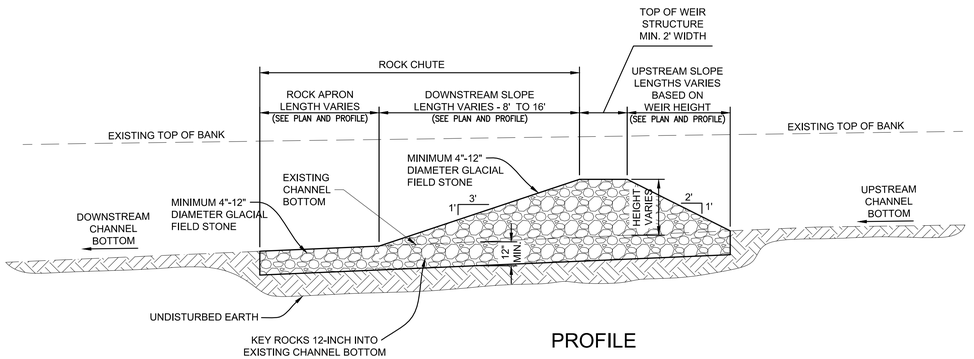


PROFILE



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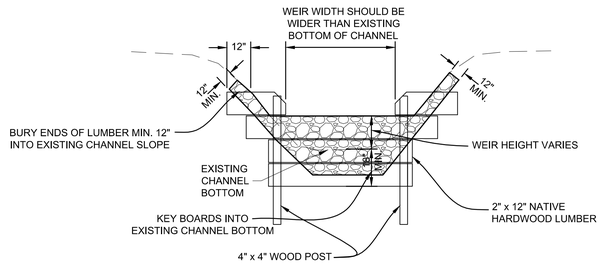
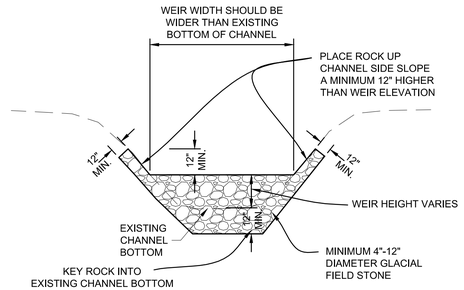


CROSS SECTION

WOOD WEIR STRUCTURE
TYPICAL SECTION

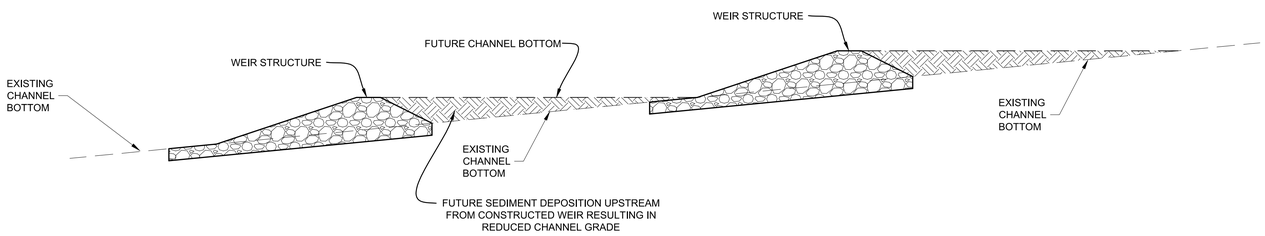
SCALE: 1" = 3'



CROSS SECTION

ROCK WEIR STRUCTURE
TYPICAL SECTION

SCALE: 1" = 3'



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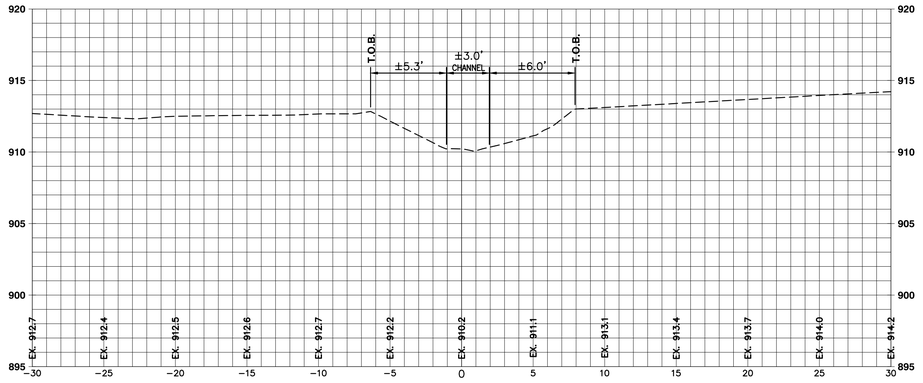
OLIN LAKE NATURE PRESERVE EROSION CONTROL PROJECT

DETAILS & TYPICAL SECTIONS

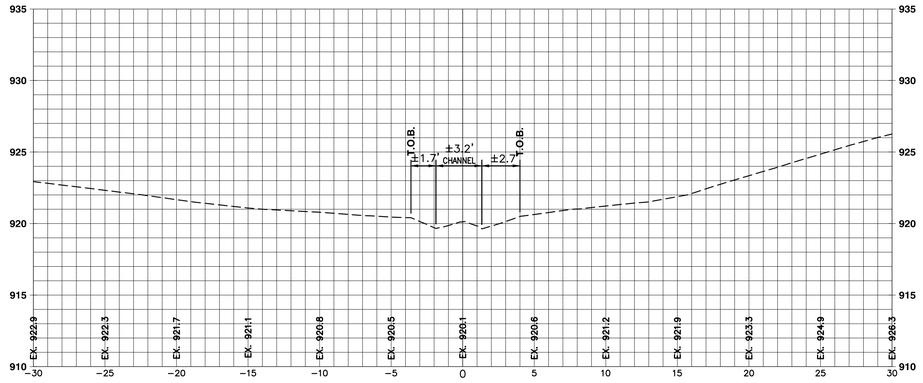
SEC. 20, T36N, R10E – S. 125 E. WOLCOTTVILLE, IN 46795

DATE : 12–19–13
SCALE : N/A
DRAWN BY : PMG
CHK'D BY : MJG

SHEET 5



5+25



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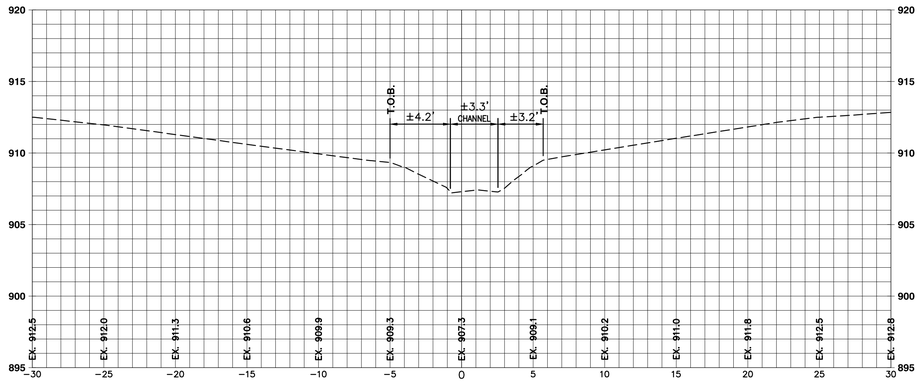

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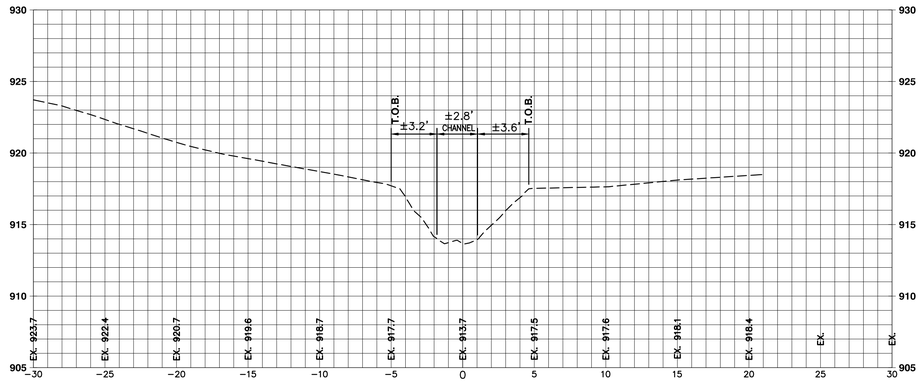

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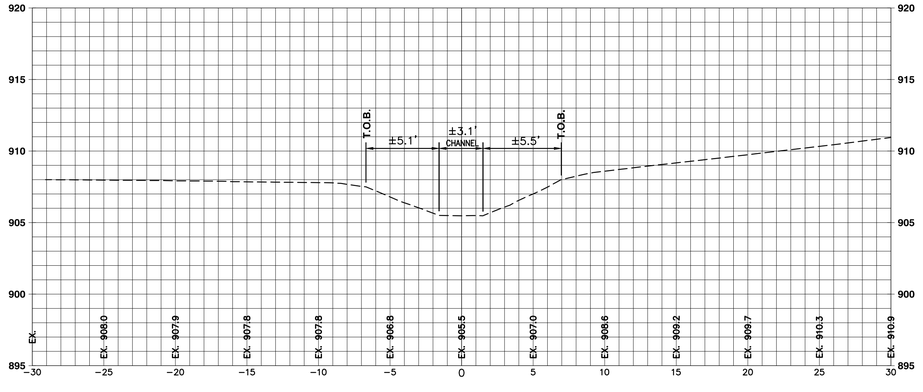

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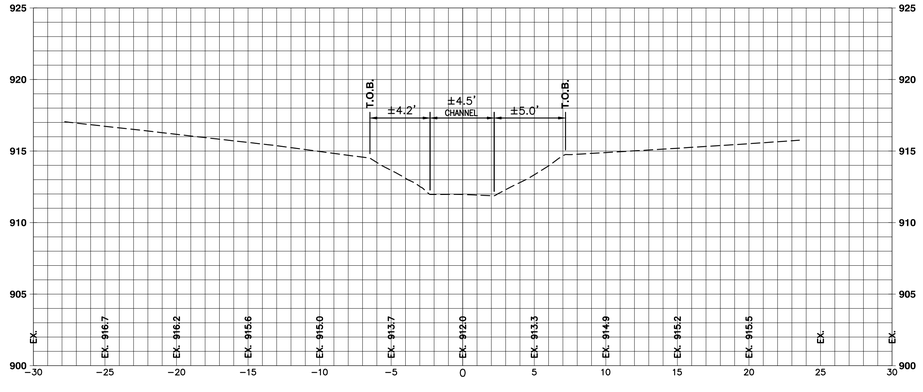

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CHANNEL CROSS SECTIONS PREPARED FROM TOPOGRAPHIC SURVEY PROVIDED BY DAVEY GROUP

Data used to produce this map were collected on December 2, 2011, and February 2, and March 28, 2012

EXISTING CHANNEL CROSS SECTIONS AT PROPOSED WEIR LOCATIONS (LOOKING UPSTREAM)

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REVISIONS

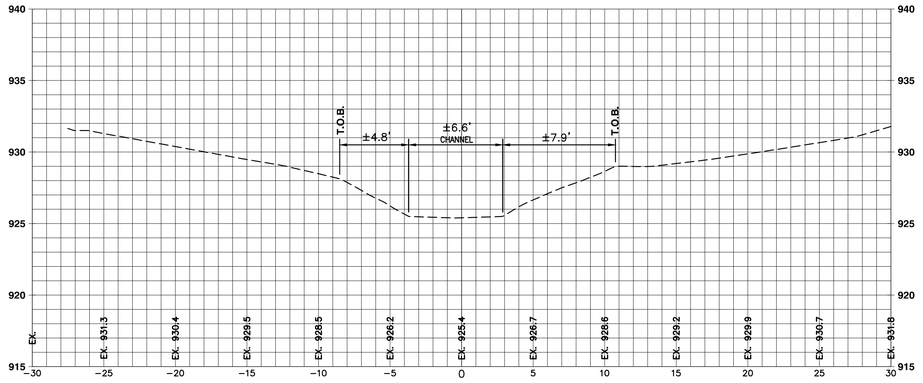
OLIN LAKE NATURE PRESERVE
EROSION CONTROL PROJECT

EXISTING CHANNEL CROSS SECTIONS

SEC. 20, T36N, R10E - S. 125 E. WOLCOTTVILLE, IN 46795

DATE : 12-19-13
SCALE : 1" = 5'
DRAWN BY : PMG
CHK'D BY : MJG

SHEET
6



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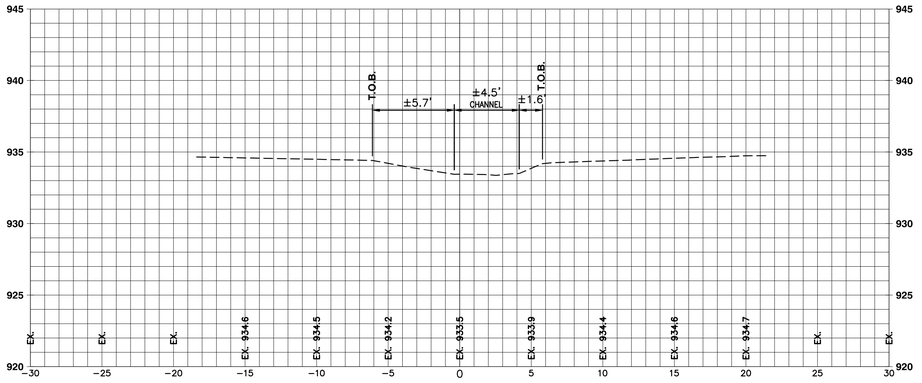

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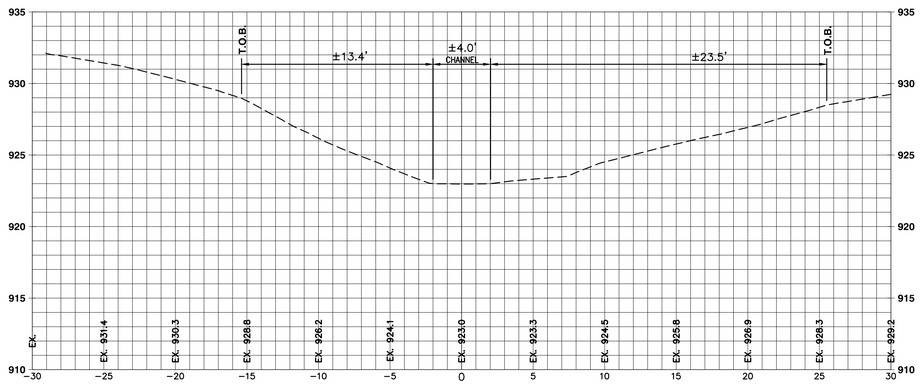

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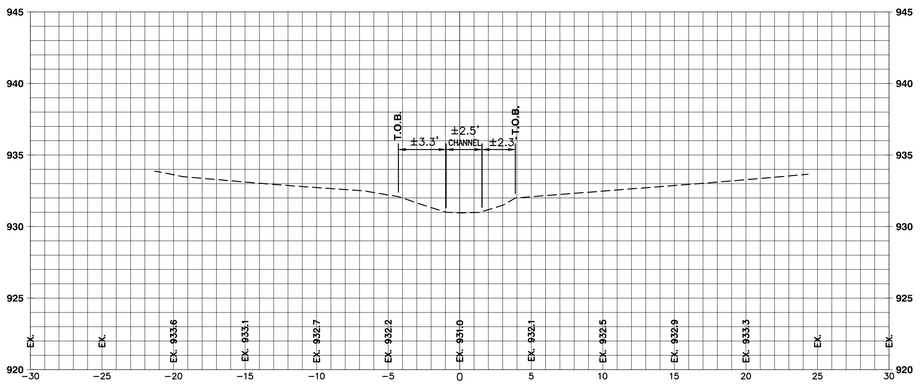

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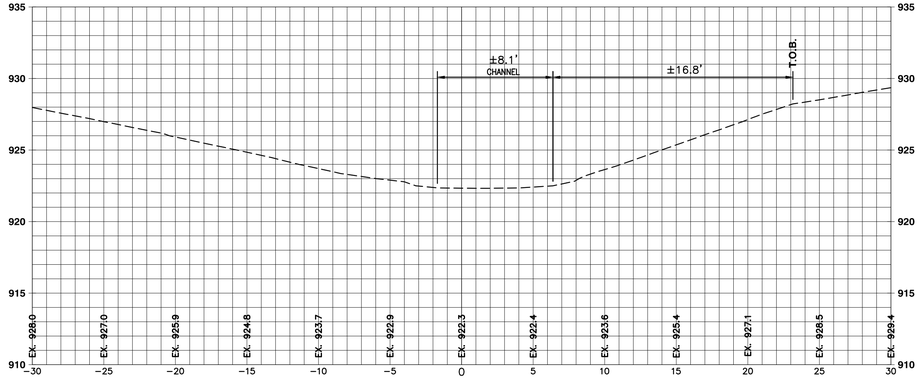

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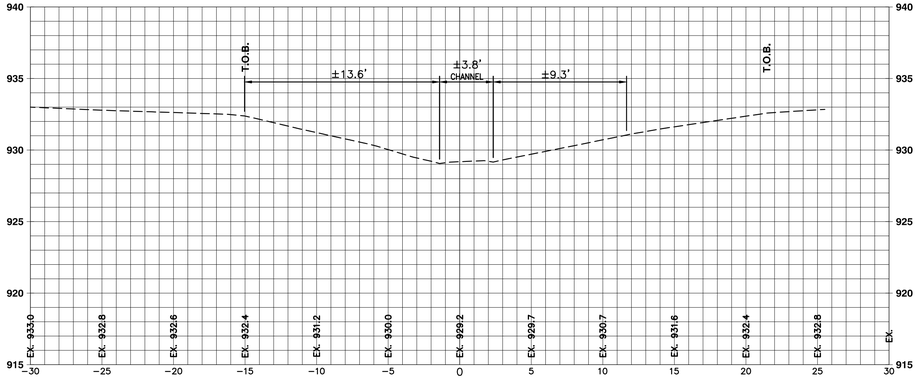

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CHANNEL CROSS SECTIONS PREPARED FROM TOPOGRAPHIC SURVEY PROVIDED BY DAVEY GROUP

Data used to produce this map were collected on December 2, 2011, and February 2, and March 28, 2012

EXISTING CHANNEL CROSS SECTIONS AT PROPOSED WEIR LOCATIONS (LOOKING UPSTREAM)

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OLIN LAKE NATURE PRESERVE
EROSION CONTROL PROJECT

EXISTING CHANNEL CROSS SECTIONS

SEC. 20, T36N, R10E - S. 125 E. WOLCOTTVILLE, IN 46795

DATE : 12-19-13
SCALE : 1" = 5'
DRAWN BY : PMG
CHK'D BY : MJG

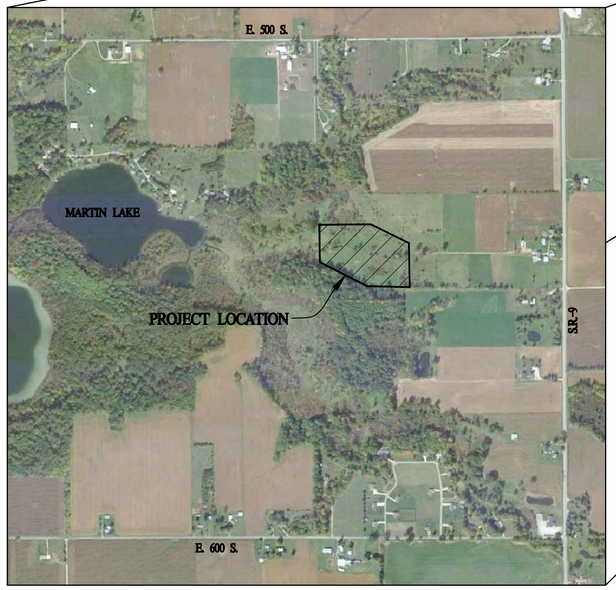
SHEET 7

Appendix G
Olin-Raber Wetlands Hydrological Enhancement Engineered Design Plans

OLIN – RABER WETLAND RESTORATION PROJECT

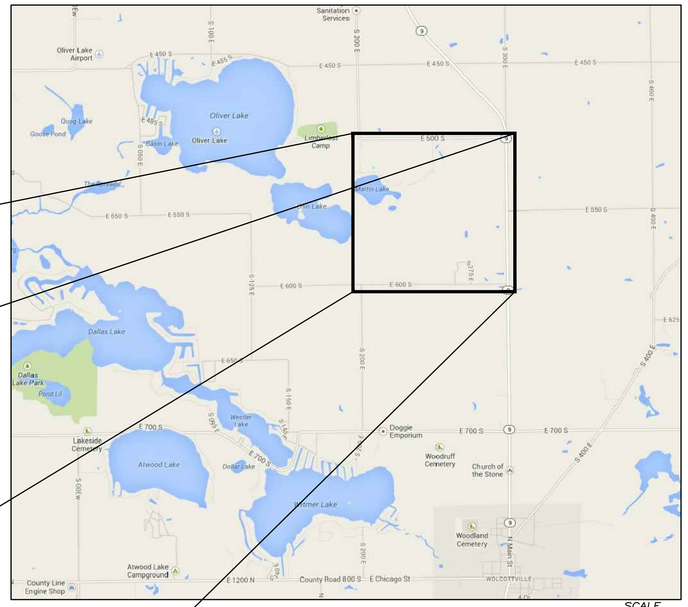
SECTION 21, T36N, R10E, LAGRANGE COUNTY
E. 500 S., WOLCOTTVILLE, IN

OLIN – RABER WETLAND
RESTORATION PROJECT
E. 500 S., WOLCOTTVILLE, IN
DECEMBER 13, 2013



SCALE N.T.S.

LOCATION MAP



SCALE N.T.S.

VICINITY MAP

LAGRANGE COUNTY, INDIANA

SHEET INDEX

FLOOD PLAIN PANEL

Community Panel Number:
180125 0004 A
Effective Date:
July 1, 1977

ENVIRONMENTAL CONSULTANTS :

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REX PRANGER
114 WEST MICHIGAN STREET
LAGRANGE, IN 46761
PHONE: (260) 499-6307

ARMY CORPS OF ENGINEERS
AARON DAMRILL
US ACOE, DETROIT DESTRICT
SOUTH BEND FIELD OFFICE
2422 VIRIDIAN DRIVE, SUITE 101
SOUTH BEND, INDIANA 46628-3489
PHONE: (574) 232-1952

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
HEATHER PARSONS
100 N. SENATE AVE.
MC 65-42 WQS IGCN 1255
INDIANAPOLIS, IN 46204
PHONE: (317) 234-2482

IDNR - DIVISION OF FISH & WILDLIFE
LAKE AND RIVER ENHANCEMENT PROGRAM
DOUG NUSBAUM
1353 S GOVERNORS DRIVE
COLUMBIA CITY, INDIANA 46725
(260) 244-6805 EXT. 239

Know what's below. Call before you dig. INDIANA 811

DATE: DECEMBER 13, 2013

REVISIONS	DATE	COMMENT	SHEETS REVISED

GENERAL SITE NOTES:

1. ALL BRUSH AND VEGETATION MATERIAL TO BE CLEARED AND GRUBBED SHALL BE REMOVED AND PROPERLY DISPOSED OFF-SITE
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING AND/OR VERIFYING THAT ALL PERMITS AND APPROVALS ARE OBTAINED FROM ALL LOCAL, STATE, AND FEDERAL AGENCIES PRIOR TO STARTING CONSTRUCTION.
3. THE OWNER AND CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING QUALITY CONTROL AT ALL TIMES DURING THE CONSTRUCTION PROCESS.
4. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) STANDARDS FOR EXCAVATIONS. FINAL RULE 29 CFR PART 1926, SUBPART "P" APPLIES TO ALL EXCAVATIONS EXCEEDING FIVE (5) FEET IN DEPTH.
5. CONTACT OWNER IMMEDIATELY IF CONTAMINATED SOILS ARE ENCOUNTERED DURING CONSTRUCTION. CONTAMINATED SOILS MUST BE HAULED OFF-SITE AND LEGALLY DISPOSED.
6. DISCREPANCIES OR CONFLICTS IN THE PLANS AND/OR ON-SITE SHALL BE COMMUNICATED TO THE DESIGN ENGINEER TO ENSURE THAT CLARIFICATIONS AND/OR REVISIONS CAN BE MADE PRIOR TO CONSTRUCTION.

LEGEND

- CONTOUR
- FENCE
- CENTERLINE OF DITCH
- EDGE OF WOODS
- PROPOSED CONSTRUCTION LIMITS
- FEN WETLAND

40 20 0 40
Scale 1" = 40'

CONSTRUCTION LIMITS

CONSTRUCTION LIMITS

CONSTRUCTION LIMITS

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REVISIONS

OLIN - RABER WETLAND RESTORATION PROJECT

EXISTING TOPOGRAPHY

SEC. 21, T36N, R10E – E. 500 S. WOLCOTTVILLE, IN 46795

DATE : 12-13-13
SCALE : 1" = 40'
DRAWN BY : GML
CHK'D BY : MJG

SHEET 2

Scale 1" = 30'

30 15 0 30

N

HABITAT POOL (H-1N)
WATER SURFACE ELEV. = 903.5±
SURFACE AREA = 0.14 AC.
BOTTOM ELEVATION = 900.00
EXCAVATION VOLUME = 630 CYS

EDGE OF HABITAT POOL

CONSTRUCTION LIMITS

SWALE

CHANNEL (C-1N)
BOTTOM ELEVATION = 901.5
EXCAVATION VOLUME = 150 CYS

TOP OF BERM (B-1)
ELEVATION = 905.00

EXISTING CENTERLINE OF DITCH

CHANNEL (C-1S)
BOTTOM ELEVATION = 901.5
EXCAVATION VOLUME = 430 CYS

SWALE

EDGE OF HABITAT POOL

HABITAT POOL (H-1S)
WATER SURFACE ELEV. = 903.5±
SURFACE AREA = 0.11 AC.
BOTTOM ELEVATION = 900.00
EXCAVATION VOLUME = 1,200 CYS

EDGE OF HABITAT POOL

HABITAT POOL (H-2N)
WATER SURFACE ELEV. = 906.5±
SURFACE AREA = 0.15 AC.
BOTTOM ELEVATION = 903.00
EXCAVATION VOLUME = 690 CYS

SWALE

CHANNEL (C-2N)
BOTTOM ELEVATION = 904.5
EXCAVATION VOLUME = 120 CYS

CONSTRUCTION LIMITS

TOP OF BERM (B-2)
ELEVATION = 908.00

FLAG - (OHWM)
ORDINARY HIGH WATER MARK
ELEVATION = 905.24

SWALE

CHANNEL (C-2S)
BOTTOM ELEVATION = 904.5
EXCAVATION VOLUME = 120 CYS

HABITAT POOL (H-2S)
WATER SURFACE ELEV. = 906.5±
SURFACE AREA = 0.04 AC.
BOTTOM ELEVATION = 904.00
EXCAVATION VOLUME = 230 CYS

EDGE OF HABITAT POOL

EDGE OF HABITAT POOL

HABITAT POOL (H-3N)
WATER SURFACE ELEV. = 907.5±
SURFACE AREA = 0.12 AC.
BOTTOM ELEVATION = 904.00
EXCAVATION VOLUME = 560 CYS

CONSTRUCTION LIMITS

SWALE

CHANNEL (C-3N)
BOTTOM ELEVATION = 905.5
EXCAVATION VOLUME = 220 CYS

TOP OF BERM (B-3)
ELEVATION = 910.00

WOOD DAM - WATER CONTROL STRUCTURE

CHANNEL (C-3S)
BOTTOM ELEVATION = 905.5
EXCAVATION VOLUME = 290 CYS

SWALE

HABITAT POOL (H-3S)
WATER SURFACE ELEV. = 907.5±
SURFACE AREA = 0.14 AC.
BOTTOM ELEVATION = 904.00
EXCAVATION VOLUME = 760 CYS

EDGE OF HABITAT POOL

FENCE

EXISTING CENTERLINE OF DITCH

FLAG - (OHWM)
ORDINARY HIGH WATER MARK
ELEVATION = 907.66

15" CMP CULVERT
INVERT = 911.83
TOP OF PIPE = 913.08
(3.5' DROP FROM INVERT)

LEGEND

- EXISTING CONTOUR
- PROPOSED CONTOUR
- DRAINAGE SWALE
- CONSTRUCTION LIMITS
- HABITAT POOLS
- SURFACE FLOW

SITE NOTES:

1. ALL ELEVATIONS AT CONSTRUCTION LIMITS SHALL MATCH EXISTING GRADE.
2. CONTOURS SHOW GRADING INTENT. SEE TYPICAL SECTIONS AND DETAILS ON SHEET #4.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR CHECKING THAT STAKED GRADES MATCH DESIGN ELEVATIONS.
4. ANY DISCREPANCIES OR CONFLICTS WHICH BECOME APPARENT BEFORE OR DURING CONSTRUCTION SHALL BE BROUGHT TO THE ATTENTION OF THE DESIGN ENGINEER PRIOR TO CONSTRUCTION FOR CLARIFICATION OR REDESIGN.
5. HABITAT POOL AND CHANNEL EXCAVATION ITEMS SHALL INCLUDE BERM CONSTRUCTION, HAULING EXCESS EXCAVATED MATERIAL OFF-SITE, GRADING, AND PREPARATION OF SEEDING AND PLANTING AREAS.

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REVISIONS

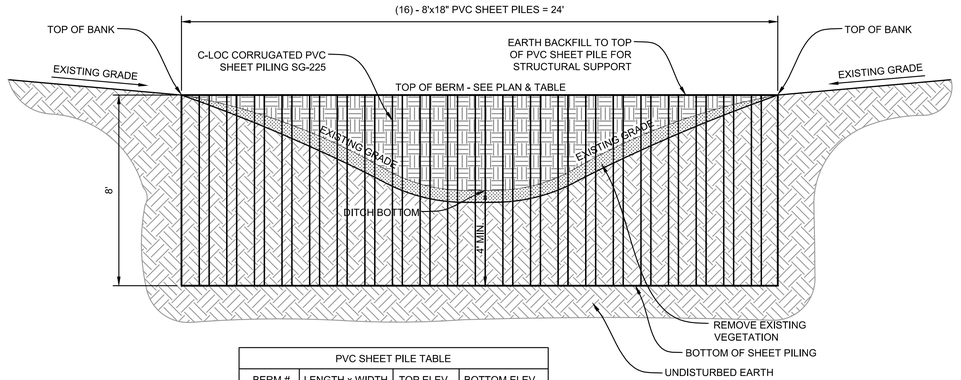
OLIN - RABER WETLAND RESTORATION PROJECT

SITE PLAN

SEC. 21, T36N, R10E - E. 500 S. WOLCOTTVILLE, IN 46795

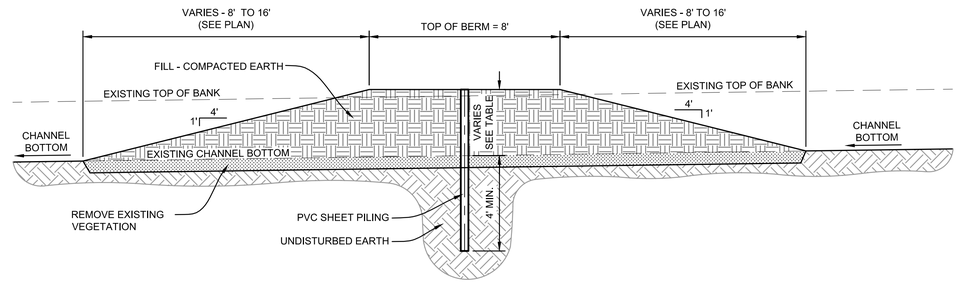
DATE : 12-13-13
SCALE : 1" = 30'
DRAWN BY : GML
CHK'D BY : MJG

SHEET
3

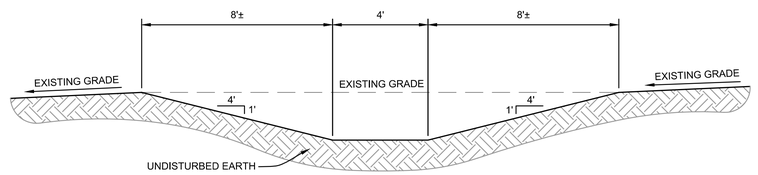


PVC SHEET PILE TABLE			
BERM #	LENGTH x WIDTH	TOP ELEV.	BOTTOM ELEV.
B-1	8' x 24'	905.00	897.00
B-2	8' x 24'	908.00	900.00
B-3	8' x 24'	910.00	902.00

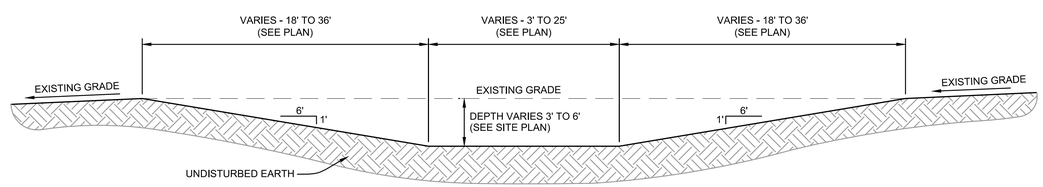
4/4 PVC SHEET PILE
TYPICAL SECTION SCALE: 1" = 3'



3/4 EARTH BERM & PVC SHEET PILE
TYPICAL SECTION SCALE: 1" = 3'



2/4 CHANNEL
TYPICAL SECTION SCALE: 1" = 3'



1/4 HABITAT POOL
TYPICAL SECTION SCALE: 1" = 3'

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REVISIONS

OLIN - RABER WETLAND
RESTORATION PROJECT

DETAILS & TYPICAL SECTIONS

SEC. 21, T36N, R10E – E. 500 S. WOLCOTTVILLE, IN 46795

DATE : 12-13-13
SCALE : N/A
DRAWN BY : GML
CHK'D BY : MJG

SHEET
4

Scale 1" = 30'

30 15 0 30

N

EXISTING WETLANDS

UPLAND OLD FIELD

WORK ZONE 1-N (0.339 ACRE)
SEDGE MEADOW SEED ZONE (0.165 ACRE)
SUBMERGENT PLUG ZONE (0.019 ACRE)

WORK ZONE 2-N (0.356 ACRE)
SEDGE MEADOW SEED ZONE (0.167 ACRE)
SUBMERGENT PLUG ZONE (0.024 ACRE)

WORK ZONE 3-N (0.364 ACRE)
SEDGE MEADOW SEED ZONE (0.192 ACRE)
BARE-ROOT ZONE A (0.018 ACRE)

BERM/DITCH PLUG (B-1)
SEDGE MEADOW SEED AND PLUG ZONE (0.018 ACRE)

BERM/DITCH PLUG (B-2)
SEDGE MEADOW SEED AND PLUG ZONE (0.025 ACRE)

BERM/DITCH PLUG (B-3)
SEDGE MEADOW SEED AND PLUG ZONE (0.023 ACRE)

WORK ZONE 1-S (0.475 ACRE)
SEDGE MEADOW SEED ZONE (0.305 ACRE)
BARE-ROOT ZONE A (0.019 ACRE)

WORK ZONE 2-S (0.171 ACRE)
SEDGE MEADOW SEED ZONE (0.094 ACRE)
BARE-ROOT ZONE B (0.010 ACRE)

WORK ZONE 3-S (0.416 ACRE)
SEDGE MEADOW SEED ZONE (0.215 ACRE)
BARE-ROOT ZONE A (0.023 ACRE)

UPLAND WOODS

= SEDGE MEADOW SEED ZONE (1.138 ACRES)

= SEDGE MEADOW SEED AND PLUG ZONE (0.066 ACRE)

= SUBMERGENT PLUG ZONE (0.043 ACRE)

= BARE-ROOT ZONE A (0.060 ACRE)

= BARE-ROOT ZONE B (0.010 ACRE)

LEGEND

- EXISTING CONTOUR
- PROPOSED CONTOUR
- DRAINAGE SWALE
- WORK ZONES
- HABITAT POOLS
- EXISTING WETLANDS
- SURFACE FLOW

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REVISIONS

OLIN - RABER WETLAND RESTORATION PROJECT

PLANTING PLAN

SEC. 21, T36N, R10E – E. 500 S. WOLCOTTVILLE, IN 46795

DATE : 1-14-14
SCALE : 1" = 30'
DRAWN BY : GML
CHK'D BY : MJG

SHEET 5

Sheet 6 – Planting Plan Notes

Timeline

- Planting of the sedge meadow seed mix shall be conducted between late April and mid-August.
- Planting of plugs and bare-roots shall be conducted between mid-April and late September.

Planting Methods

- Plant species per zone and densities are included in tables on this sheet.

Seed

- Seed shall be planted in the Sedge Meadow Seed Zone and the Sedge Meadow Seed and Plug Zone as indicated in the Timeline.
- A broadcast spreader shall be used to plant seed to ensure it is uniformly spread.
- Seed shall be mixed with an inert, sterile carrier such as a fine grade vermiculite or sand prior to planting to facilitate broadcasting.
- Small and large seed shall be broadcast separately.
- The Sedge Meadow seed shall be planted at a rate of 9 PLS pounds per acre.
- A cover crop of *Avena sativa* (common oats) shall be planted at a rate of 20 pounds per acre.

Plugs

- Plugs shall be planted in the Sedge Meadow Seed and Plug Zone and the Submergent Plug Zone.
- A dibble bar shall be used to plant all plugs.
- Plugs shall be spaced 12 inches on-center in the Sedge Meadow Seed and Plug Zone.
- Plugs shall be spaced 24 inches on-center in the Submergent Plug Zone.
- Plugs planted in the Submergent Plug Zone should be mature enough to be above the water line when planted.
- Evenly distribute each plant species within the planting zone.
- Plugs shall be planted level with the existing soil grade.
- Soil shall be placed around the plugs and shall be firmed into place.

Herbaceous Bare-roots

- Bare-roots shall be planted in the Bare-root Zone A and B.
- In Bare-root Zone A, bare-roots shall be planted 24 inches on-center.
- In Bare-root Zone B, bare-roots shall be planted 36 inches on-center.
- A weight of sufficient size to firmly hold the bare-root to the soil surface shall be securely attached to each bare-root prior to planting.
- Bare-roots along with attached weights shall be pressed into the soil surface in areas where water depth allows.
- Bare-roots along with attached weights may be dropped into deeper water.

Other Project Notes:

1. Existing wetland in work zones and surrounding area is predominantly a *Phalaris arundinacea* (reed canary grass) monoculture.
2. Habitat pools and swales shall be excavated using a one-step process. Excavated soils not used in construction of the berms will be hauled off-site and deposited in an upland location.
3. Work shall be conducted when soils are dry or frozen and appropriate equipment shall be used to minimize unintended rutting and impacts.

Sedge Meadow Seed and Plug Zone - Seed		
Species	**Common Name**	**Quantity**
Grasses and Sedges		
Carex comosa	bristly sedge	1
Carex cristatella	crested sedge	1
Carex frankii	Frank's sedge	5
Carex granularis	meadow sedge	1.5
Carex hystericina	porcupine sedge	2
Carex lurida	lurid sedge	2
Carex tribuloides	pointed oval sedge	1
Carex vulpinoidea	fox sedge	4
Elymus virginicus	Virginia wild rye	64
Glyceria striata	fowl manna grass	4
Leersia oryzoides	rice cut grass	4
Panicum virgatum	switchgrass	4
Scirpus atrovirens	dark green bulrush	0.5
Spartina pectinata	prairie cordgrass	2
	Total per acre	**96**
Forbs		
Angelica atropurpurea	angelica	2
Asclepias incarnata	swamp milkweed	2
Aster firmus	shining aster	1
Aster novae-angliae	New England aster	1
Aster puniceus	swamp aster	1
Aster umbellatus	flat-topped aster	1
Boltonia latisquama	false aster	1
Cassia hebecarpa	wild senna	3
Eupatorium maculatum	spotted joe-pye weed	2
Eupatorium perfoliatum	boneset	2
Helenium autumnale	autumn sneezeweed	2
Liatris spicata	dense blazing star	2
Lobelia cardinalis	cardinal flower	0.25
Lobelia siphilitica	great blue lobelia	0.25
Mimulus ringens	monkey flower	0.5
Penstemon digitalis	foxglove beardtongue	1
Pycnanthemum virginianum	mountain mint	1
Rudbeckia fulgida speciosa	showy black-eyed susan	3
Rudbeckia hirta	black-eyed susan	4
Rudbeckia subtomentosa	sweet black-eyed susan	3
Silphium integrifolium	rosinweed	2
Silphium perfoliatum	supplant	2
Silphium terebinthinaceum	prairie dock	2
Solidago patula	swamp goldenrod	1
Solidago riddellii	riddell's goldenrod	2
Verbena hastata	blue vervain	2
Vernonia fasciculata	smooth ironweed	2
Veronicastrum virginicum	culver's root	1
Zizia aurea	golden alexanders	1
	Total per acre	**48**

Bare-root Zone A		
Species	**Common Name**	**Quantity**
Pontederia cordata	pickerelweed	220
Sagittaria latifolia	broadleaf arrowhead	220
Sparganium eurycarpum	broadfruit bur-reed	220

Bare-root Zone B		
Species	**Common Name**	**Quantity**
Nuphar lutea	yellow pond-lily	50

Sedge Meadow Seed and Plug Zone - Plugs		
Species	**Common Name**	**Quantity**
Carex stricta	upright sedge	960
Spartina pectinata	prairie cordgrass	960
Scirpus cyperinus	woolgrass	960

Submergent Plug Zone		
Species	**Common Name**	**Quantity**
Iris virginica	Virginia iris	96
Schoenoplectus fluviatilis	river bulrush	128

DAVEY RESOURCE GROUP
A Division of The Davey Tree Expert Company
1000 Airport North Office Park
Suite A
Fort Wayne, Indiana 46825
(260) 903-3990

Gensic Engineering Inc
Civil Engineers
311 Airport North Office Park
Fort Wayne, IN 46825
Phone - (260) 489-7643

SEAL

CONTACT
IDNR – FISH & WILDLIFE
LARE PROGRAM
CONTACT: DOUG NUSBAUM
1353 S GOVERNORS DRIVE
COLUMBIA CITY, INDIANA 46725
PHONE: (260) 244-6805 EXT.239

REVISIONS

OLIN - RABER WETLAND
RESTORATION PROJECT

PLANTING PLAN NOTES

SEC. 21, T36N, R10E – E. 500 S. WOLCOTTVILLE, IN 46795

DATE : 1–14–14
SCALE : 1" = 30'
DRAWN BY : GML
CHK'D BY : MJG

SHEET
6

Appendix H
Olin-Raber Wetlands Hydrological Enhancement Site Walking Easement

#93-8-89
RECOR[illegible]S OFFICE
LaGrange County, Indiana } SS.
Received for Record on 10 day of Aug
A.D. 1993 AT 3:10 P M
Sharon Strayer
RECORDER OF LAGRANGE COUNTY

TA. USM/01 # 2480
DULY ENTERED FOR TAXATION
AUG 6 1993
Billie E. Wiard
LAGRANGE COUNTY AUDITOR JK

WARRANTY DEED

THIS INDENTURE WITNESSETH: That Levi M. Raber and Irene H. Raber, husband and wife, both competent adults of LaGrange County, State of Indiana,

CONVEY AND WARRANT TO: The Nature Conservancy, a Non-Profit Forporation of the District of Columbia, whose mailing address is: The Indiana Field Office, 1330 West 38th Street, Indianapolis, IN 46208, for the sum of-- One and no/100ths----------------DOLLARS, ------ And Other Valuable Consideration ------------------------- the receipt whereof is hereby acknowledged, the following described Real Estate in LaGrange County, in the State of Indiana, to-wit:

Part of Section Twenty-one (21), Township Thirty-six (36) North, Range Ten (10) East, LaGrange County, Indiana, more fully described as follows:
Commencing at the East Quarter (1/4) corner of said Section 21; thence North along the Section line ten hundred two and sixty two hundredths (1002.62) feet; thence West, two thousand seventy and eighty three hundredths (2070.83) feet; thence North forty two degrees (42°) twenty three minutes (23') fourteen seconds (14") West, one hundred forty seven and twenty two hundredths (147.22) feet for the place of beginning; thence North zero degree (0°) forty three minutes (43') thirty four seconds (34") West, four hundred sixteen and fifty five hundredths (416.55) feet; thence South forty-eight degrees (48°) forty six minutes (46') thirty three seconds (33") West, two hundred seventeen and fifty four hundredths (217.54) feet; thence South forty nine degrees (49°) sixteen minutes (16') twenty seven seconds (27") West, one hundred eighty eight and eighty four hundredths (188.84) feet; thence South eighty eight degrees (88°) forty eight minutes (48') forty nine seconds (49") West, one hundred seventy one and fifty three hundredths (171.53) feet; thence South zero degree (0°) zero minutes (00') nine seconds (09") East, six hundred fifty one and fifty hundredths (651.50) feet; thence North eighty nine degrees (89°) forty four minutes (44') twelve seconds (12") West, six hundred sixty (660.00) feet; thence South zero (0°) degree zero minutes (00") nine seconds (09") East, five hundred ninety four (594.00) feet; thence South eighty nine degrees (89°) forty four minutes (44') twelve seconds (12") East, six hundred sixty (660.00) feet; thence South sixty two degrees (62°) forty four minutes (44') fifty seconds (50") East, three hundred five (305.00) feet; thence South eighty nine degrees (89°) forty four minutes (44') twelve seconds (12") East, six hundred seventy three and fifty hundredths (673.50) feet; thence North two degrees (2°) thirteen minutes (13') East, one hundred thirty eight and fifty hundredths (138.50) feet; thence North two degrees (2°) thirty eight minutes (38') sixteen seconds (16") East, seventy eight and forty-six hundredths (78.46) feet; thence North seven degrees (7°) forty eight minutes (48') fifteen seconds (15") East, three hundred thirty nine and ten hundredths (339.10) feet; thence North fifty nine degrees (59°) fourteen minutes (14') seventeen seconds (17') West, three hundred seventy and ninety one hundredths (370.91) feet; thence North fifty seven degrees (57°) thirty seven minutes (37') twenty one seconds (21") West, eighty four and eighty five hundredths (84.85) feet; thence North fifty one degrees (51°) fifty eight minutes (58') forty seven seconds (47") West, sixteen and twenty five hundredths (16.25) feet;thence North forty-four degrees (44°) twenty six minutes (26') twenty nine seconds (29")

West, one hundred sixty and twenty two hundredths (160.22) feet; thence North twenty six degrees (26°) fifteen minutes (15') forty-five seconds (45") West, two hundred sixty three and sixty two hundredths (263.62) feet; thence North fifty one degrees (51°) five minutes (05') three seconds (03") East, one hundred fifty four and twenty two hundredths (154.22) feet to the place of beginning.
ALSO
Having the right of Ingress and Egress over a walking easement ten (10) feet in width described as follows: The ten (10) foot wide walking easement is directly South and Southwest of the following described line: Beginning at a point on the Section line ten hundred two and sixty two hundredths (1002.62) feet North of the said East Quarter (1/4) corner of said Section 21; thence West along a line fence two thousand seventy and eighty two hundredths (2070.82) feet; thence North forty two degrees (42°) twenty three (23') minutes fourteen seconds (14") West, one hundred forty seven and twenty two hundredths (147.22) feet to the terminus.

Subject to highways, easements, covenants, restrictions and conditions of record including:

A. Subject to Classification of Land as Wildlife Habitat on 33.9 acres in the Southwest part of this real estate as evidenced by application and report dated February 23, 1990 and recorded February 26, 1990 as Instrument No. 90-2-238. Partial release of the real estate dated August 30, 1991 and recorded November 6, 1991 as Instrument No. 91-11-88.

B. Subject to a fencing and maintenance agreement as originally set out in Deed Record 96, page 141 in which the owners of this real estate are to maintain the fence on the North and West side of the 40 x 36 rod tract located in the Southwest corner.

C. Subject to legal highways being State Road 9 off the East side.

D. Subject to a legal easement for maintenance of an open ditch.

Subject to unpaid taxes and assessments, if any.

This conveyance is exempt from the Subdivision Control Ordinance because the tract contains more than 5 acres of land and will not be used for any building site.

IN WITNESS WHEREOF, The said grantors above named have hereunto set their hands and seals this 28th day of July, 1993.

#93-8-89

Levi M. Raber

Irene H. Raber

STATE OF INDIANA, LAGRANGE COUNTY, SS:

Before me, the undersigned, a Notary Public, in and for said County and State, this 28th day of July, A.D. 1993, personally appeared the within named Levi M. Raber and Irene H. Raber, husband and wife, both competent adults, Grantors in the above conveyance, and acknowledged the execution of the same to be their voluntary act and deed.

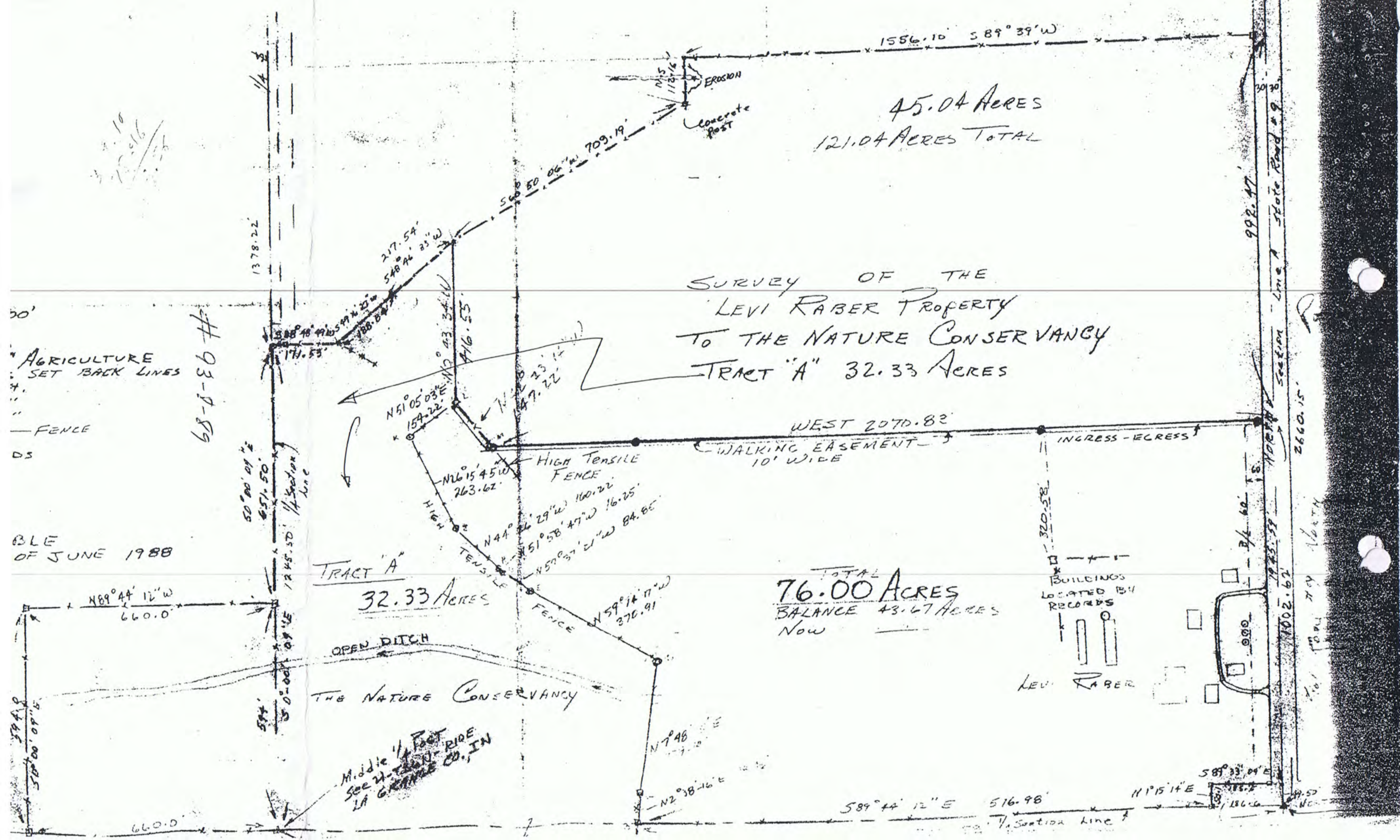
In Witness Whereof, I have hereunto subscribed my name and affixed my official seal.

Harold L. Weaver

Notary Public HAROLD L. WEAVER
Resident of ~~LaGrange~~ ELKHART County

My Commission Expires
2-3-94

This Instrument Prepared By
Jeffrey A. James, Attorney
115 West Spring Street
LaGrange, IN 46761
219 - 463-4004


SURVEY OF THE
LEVI RABER PROPERTY
TO THE NATURE CONSERVANCY
TRACT "A" 32.33 ACRES
45.04 ACRES
121.04 ACRES TOTAL
1556.10' S 89° 39' W
EROSION
Concrete Post
709.19'
217.54'
S 48° 46' 33" W
188.84'
171.53'
416.53'
N51°05'03"E
154.22'
N26°15'45"W
263.62'
HIGH TENSILE FENCE
N44° 26' 29" W 160.22'
N51°58'47"W 16.25'
N59°14'17"W
370.91
N7°48
N2°38'16"E
WEST 2070.82'
WALKING EASEMENT 10' WIDE
INGRESS - EGRESS
320.58
BUILDINGS LOCATED BY RECORDS
TOTAL
76.00 ACRES
BALANCE 43.67 ACRES
Now
LEVI RABER
TRACT "A"
32.33 ACRES
OPEN DITCH
THE NATURE CONSERVANCY
Middle 1/4 Post
See U-TRONT RIDE
LA GRANGE CO., IN
N89° 44' 12" W
660.0'
660.0
1378.22'
651.50
50° 00' 09" E
1/4 Section Line
1245.50
594'
594.0
S 89° 44' 12" E 516.98'
1/4 Section Line
N1°15'14"E
S 89° 33' 09" E
186.6
992.47'
1925.59
1002.62
2660.15'
State Road # 9
Section Line
30 30
North
1/4
#93-8-89
AGRICULTURE
SET BACK LINES
FENCE
OF JUNE 1988

Appendix I
Olin-Raber Signed Site Access Letter

DAVEY
RESOURCE GROUP
A Division of The Davey Tree Expert Company

Corporate Headquarters

1500 North Mantua Street

P.O. Box 5193

Kent, Ohio 44240-5193

330.673.5685

Toll Free 1.800.828.8312

Fax: 330.673.0860

Local Office

1000 Airport North Office Park, Suite A

Fort Wayne, Indiana 46825

260.969.5990

Fax: 260.969.5992

September 24, 2013

Wilber Miller
5400 South State Road 9
Wolcottville, Indiana 46795

RE: *Site Access*—Olin-Raber Property, State Road 9, Lagrange County, Indiana

Dear Mr. Miller:

Davey Resource Group, a division of The Davey Tree Expert Company, in conjunction with the Oliver & Martin Lakes Conservation and Improvement Association, Inc., is completing an Engineering and Feasibility Study for water quality improvent in the Oliver, Martin, and Olin lakes watershed. This study is being funded by an Indiana Department of Natural Resources (IDNR), Division of Fish and Wildlife Lake and River Enhancement (LARE) grant.

To complete a project that is being proposed for the Olin-Raber Wetland located just west of your property, the use of certain heavy equipment will be necessary. To get the equipment on and off of the site, an access point will need to be established. As per our conversation on Wednesday September 18, 2013, Davey Resource Group is proposing the use of your property as an access to move equipment on and off of the Olin-Raber Wetland.

An effort will be made to minimize the traffic passing through your property, and precautions will be taken to protect the current state of said property. The plans will include a clause stating that any areas damaged during construction will be restored to pre-construction conditions. The construction contractor will contact you at 260-242-9221 prior to construction to confirm dates and times that the site will be accessed using your property.

If you will agree to this proposal, and will allow access to your property, please sign and date in the box below. Thank you for your consideration in this matter.

Sincerely,

Jacob Bannister

Jacob Bannister
Biologist/Urban Forester

PROPOSAL FOR SITE ACCESS
5400 South State Road 9, Wolcott, IN

By signing this form, I do hereby acknowledge acceptance of the terms described above and authorize the construction contractor access to the Olin-Raber Wetlands through my property during construction of a LARE funded project.

Authorized Signature: Wilber T. Miller Title: _____

Date: 11-6-13

Appendix J
Olin-Raber Wetlands Hydrological Enhancement Project
Signed Soil Disposal Site Letter

DAVEY
RESOURCE GROUP
A Division of The Davey Tree Expert Company

Corporate Headquarters

1500 North Mantua Street

P.O. Box 5193

Kent, Ohio 44240-5193

330.673.5685

Toll Free 1.800.828.6312

Fax: 330.673.0860

Local Office

1000 Airport North Office Park, Suite A

Fort Wayne, Indiana 46825

260.969.5990

Fax: 260.969.5992

September 25, 2013

RE: *Available Top Soil*—Olin-Raber Property, State Road 9; Lagrange County, Indiana

To Whom it May Concern:

Davey Resource Group, a division of The Davey Tree Expert Company, in conjunction with the Oliver & Martin Lakes Conservation and Improvement Association, Inc., is completing an Engineering and Feasibility Study for water quality improvement in the Oliver, Martin, and Olin lakes watershed. The purpose of this study is to identify areas within the lakes' watershed where projects can be implemented to improve water quality. This study is being funded by an Indiana Department of Natural Resources (IDNR), Division of Fish and Wildlife Lake and River Enhancement (LARE) grant.

Soil is proposed to be excavated within the Olin-Raber Wetlands located near your property. Davey Resource Group is searching for a property owner near the wetland who would be willing to receive said soil. The soil being excavated is Houghton Muck, and will be fertile, black soil. Approximately 60-75 cubic yards of soil will be removed from the site, and will be available at no cost. Excavation is anticipated to begin in late 2014 to early 2015.

If you would be interested in receiving soil excavated from the wetland, please sign this form and include a contact number where the construction contractor will be able to reach you. No soil will be deposited without written permission, and the construction contractor will contact you prior to construction to confirm the location where said soil will be deposited. Thank you for your consideration in this matter.

Sincerely,

Jacob Bannister

Jacob Bannister
Biologist/Urban Forester

Print Name: Mike Baird

Signature: Michael L Baird

Date: 10-9-13 Contact # 260 854 4100

Print Name: Wilbur T. Miller

Signature: Wilbur T. Miller

Date: 11-26-13 Contact # 260-242-9221

Print Name: _____

Signature: _____

Date: _____ Contact # _____

Print Name: _____

Signature: _____

Date: _____ Contact # _____

Print Name: _____

Signature: _____

Date: _____ Contact # _____