

Memo



Stantec

To:	Scott Roepke Cannon Valley Trail Association	From:	Gary Morien Authors: Gary Morien, John Smyth, Mark Statz, Dan Edgerton
File:	Stantec Project No. 193801880	Date:	August 22, 2013

Reference: Technical Memorandum - Cannon Valley Trail Erosion Repairs

Background

At four specific locations in the City of Redwing and along the Cannon Valley Trail, the landscape has experienced significant erosion from stormwater accumulating in residential and commercial areas and draining down over the bluffs. The water flowing in the ravine continues to erode the sandy soils and in some cases depositing large volumes of sediment on the trail and into the wetland complex on the other side. A map showing the general location of each site is included (Figure 1). The Cannon Valley Trail Joint Powers Board, in partnership with the City of Red Wing and Goodhue County, authorized a study to recommend solutions to prevent future erosion by slowing the runoff and promoting upstream infiltration.

To assist with this effort, Stantec visited each site and conducted an analysis of the ravine and watershed areas draining into the ravine. The study included walking the ravines and documenting erosion locations and potential causes. A global positioning system (GPS) with submeter accuracy was utilized to locate erosion sites. Areas for potential improvements were noted. Representative photos of the sites are included with this memo. As part of the watershed analysis, opportunities for storage and infiltration were noted. Soil pits were dug to a depth of approximately 24 inches to review the soil texture and determine if potential storage areas had the ability to infiltrate stormwater.

This technical memorandum provides mapping, a discussion of problem areas, recommendations for potential repairs and estimate project costs.

Erosion Site Description and Recommendations

Sites 1 & 2

Sites 1 and 2 are located north of TH 61 and southwest of Cannon View Drive. Both ravines take drainage from a large upstream area, consisting mostly of residential land uses and the TH 61 right-of-way. These drainage areas are generally lacking

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stormwater management infrastructure such as retention ponds or infiltration areas to control peak runoff rates or reduce runoff volumes.

The strategy to prevent future erosion on these two sites should be two-fold. First, opportunities to capture and slow runoff in the upstream areas of the watershed should be sought. Second, various best management practices (BMPs) should be installed at the erosion sites themselves. This dual approach offers the best chance for success.

One of the challenges with upper watershed retention is finding suitable land to hold the water. In Figure 2, a number of locations along either ditch of TH 61 were identified as potential infiltration areas. A common method of retaining water in roadside ditches is to create small earthen or rock dams in the ditch. The dams would have very gradual slopes to prevent them from being a hazard to cars which have left the roadway or to ATVs and snowmobiles. These types of treatments could be used or modifications to the existing driveway culverts in the area could be made to simply use the driveways as dams, instead. Simply raising the upstream end of each driveway culvert by a foot or so can create shallow basins in the ditch where infiltration can occur and water can be slowed before getting to the erosion sites. If the small dams are created instead of utilizing the driveways, care will need to be taken to monitor the integrity of these dams over time. Snowmobiles can quickly scar and damage the dams, rendering them ineffective. For this reason, the driveway treatments are preferred.

The second part of our approach at these two sites is a set of BMPs which include slope stabilization, rock checks, inline infiltration basins and sediment traps. Figure 2 shows the proposed location of these treatments. The concept for these BMPs is much the same as the upstream approach, slow the water down and utilize the sandy soils to infiltrate as much as possible. Figure 5 illustrates in detail some of the specific recommended BMP's.

Near the bottom of the bluff and along the south edge of the trail, sediment basins would be created to catch and retain any sediment that makes it through the upstream efforts.

Site 3

Site 3 is a location north of Moundview Drive where the eroded ravine is fed by a 24-inch pipe leading from an existing dry pond. The 24-inch pipe is set near the bottom of the basin, and extends through the berm to the ravine. The pipe is of such size and elevation that it does not offer much in the way of slowing the water down. At this location we recommend constructing an outlet control structure for this normally dry pond. The structure would be built over the top of the existing pipe and with a weir wall which would set the outlet elevation much higher than it is currently. With the sandy soils in the area, we estimate that the pond will continue to draw down and empty within a few days. However, if the pond over time takes longer to drain out, a hole could be

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drilled in the weir to allow a controlled and slow drain-down through the outlet control structure.

A manually controlled flap gate could also be installed so that a choice could be made as to whether or not to drain the pond through the weir. HydroCAD modeling was performed to analyze and size the outlet, and it was determined that this improvement will allow the 2-year storm event to be contained without further modification to the pond (about 4 acre-feet of storage).

In order to minimize the frequency of discharge and resulting erosion, it may be desirable to increase the storage capacity of the basin, beyond the 2-year event. This could be done with two different strategies. First, the berm between the basin and the ravine could be raised by 2 feet without any significant impact to the pond. This would add about 0.5 acre-feet of storage. In order to store the 5-year event, a total of about 8 acre-feet of storage is needed and for the 10-year event, about 12 acre-feet is needed. To achieve levels of storage for this magnitude, significant expansion of the pond would be necessary.

For the purposes of this study, we estimated an expansion of the pond to store the 5-year event without discharge. Our goal was to cost-effectively maximize the size of rain event that would be captured, so as to minimize the frequency of overflows and subsequent erosion. We found that the five-year event could be captured with an increase in berm height and a modest expansion of pond capacity. We felt that the benefit of further expansion of the pond to capture the ten-year event was not justified by the significant additional cost.

Runoff from the parking lot immediately east of the pond currently drains to the north directly into the ravine. This direct runoff is also a likely contributor to the erosion problem in this ravine. Hydraulic analysis of this area was performed, and a 12-inch storm sewer would be sufficient to convey the 10-year runoff west from the parking lot and into the pond.

Similar to Sites 1 and 2, ditch checks and other inline BMPs will also help control the erosion of this ravine. Locations and notes are illustrated in Figure 3.

Site 4

Site 4, is just to the west of Site 3 and is a shorter section of ravine with erosion downstream of an existing 16-inch culvert. In this area, the top of the bluff is a flat plateau, sloping gradually toward the bluff. The flow channelizes in some locations and leads to the culvert inlet. There are two recommendations here to help minimize erosion. First, the extension of the 16-inch culvert to the bottom of the bluff would eliminate the current situation where the pipe outlets in the middle of the slope. There is an opportunity to install a manhole near the bottom to allow a grade break in the pipe in order to flatten it out, slowing the water down before it exits onto the ground.

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Second, excavating a shallow infiltration area below the elevation of the existing inlet pipe would also eliminate some of the runoff. The spoil from this excavation could be used to create a low berm along the edge of the bluff to eliminate surface runoff from going over the top. Recommended improvements are illustrated in Figure 4. Energy reducers in the pipe and dissipaters at the outlet could be considered also.

Sediment Reduction

Using Minnesota Board of Water and Soil Resources (BWSR) methodology, we estimate the proposed sediment reduction to be as follows:

Site	Annual Sediment Reduction (T/yr)	Annual Phosphorus Reduction (lb/yr)
1	91	78
2	96	82
3	34	29
4	33	28

Project Funding

As part of this project Stantec will assist the Cannon Valley Trail Association with applications for a BWSR Clean Water Assistance Grant. This grant program is used to fund projects to protect, enhance and restore water quality in lakes, rivers and streams and to protect groundwater and drinking water. Activities include structural and vegetative practices to reduce runoff and retain water on the land, feedlot water quality projects, SSTS abatement grants for low income individuals, and stream bank, stream channel and shoreline protection projects.

Under this grant program local government units (LGUs) are eligible to receive grant funds if they are working under a current state approved and locally adopted local water management plan or implementing an approved total maximum daily load (TMDL). All activities must be consistent with a current watershed management plan, county comprehensive local water management plan, metropolitan local water plan, metropolitan groundwater plan, and surface water intake plan or well head protection plan that has been state approved and locally adopted by October 1, 2011.

It's anticipated the City of Red Wing would act as the LGU and is currently looking into the requirements necessary to act in this capacity.

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The grant requires a non-state match equal to at least 25% of the amount of Clean Water Funds (CWF) requested and/or received. Matching cash or in-kind cash value provided by a landowner, land occupier, local government or other non-state source may be used to match CWF grants.

The request for proposals for this annual grant program typically comes out in August and is due by the end of September.

Costs

Stantec has prepared budget level construction cost estimate for each of the sites based on our recommended set of improvements. These costs are summarized below:

Summary of Estimated Project Costs

Total Site 1	\$78,460.00
Total Site 2	\$100,530.00
Total Site 3	\$80,545.00
Total Site 4	\$39,575.00
<hr/>	
Total Construction Costs	\$299,110.00
Construction Contingency (15%)	\$44,866.50
<hr/>	
Construction Total	\$343,976.50
Engineering, Legal, Admin., Fiscal (25%)	\$85,994.13
<hr/>	
TOTAL PROJECT COSTS	\$429,970.63

A detailed breakdown of budget level estimated costs is attached as Figure 6 to this memorandum.

STANTEC CONSULTING SERVICES INC.



Gary Morien
Project Manager
gary.morien@stantec.com

Reference: Technical Memorandum - Cannon Valley Trail Erosion Repairs

Attachments: Figure 1 – Site Locations Map
Figure 2 – Sites 1 & 2
Figure 3 – Site 3
Figure 4 – Site 4
Figure 5 – Typical BMP's
Figure 6 – Budget Level Cost Estimate
Site Photos

c. Jay Owens - City of Red Wing
Greg Isakson - Goodhue County
Dan Edgerton - Stantec
John Smyth - Stantec
Mark Statz - Stantec



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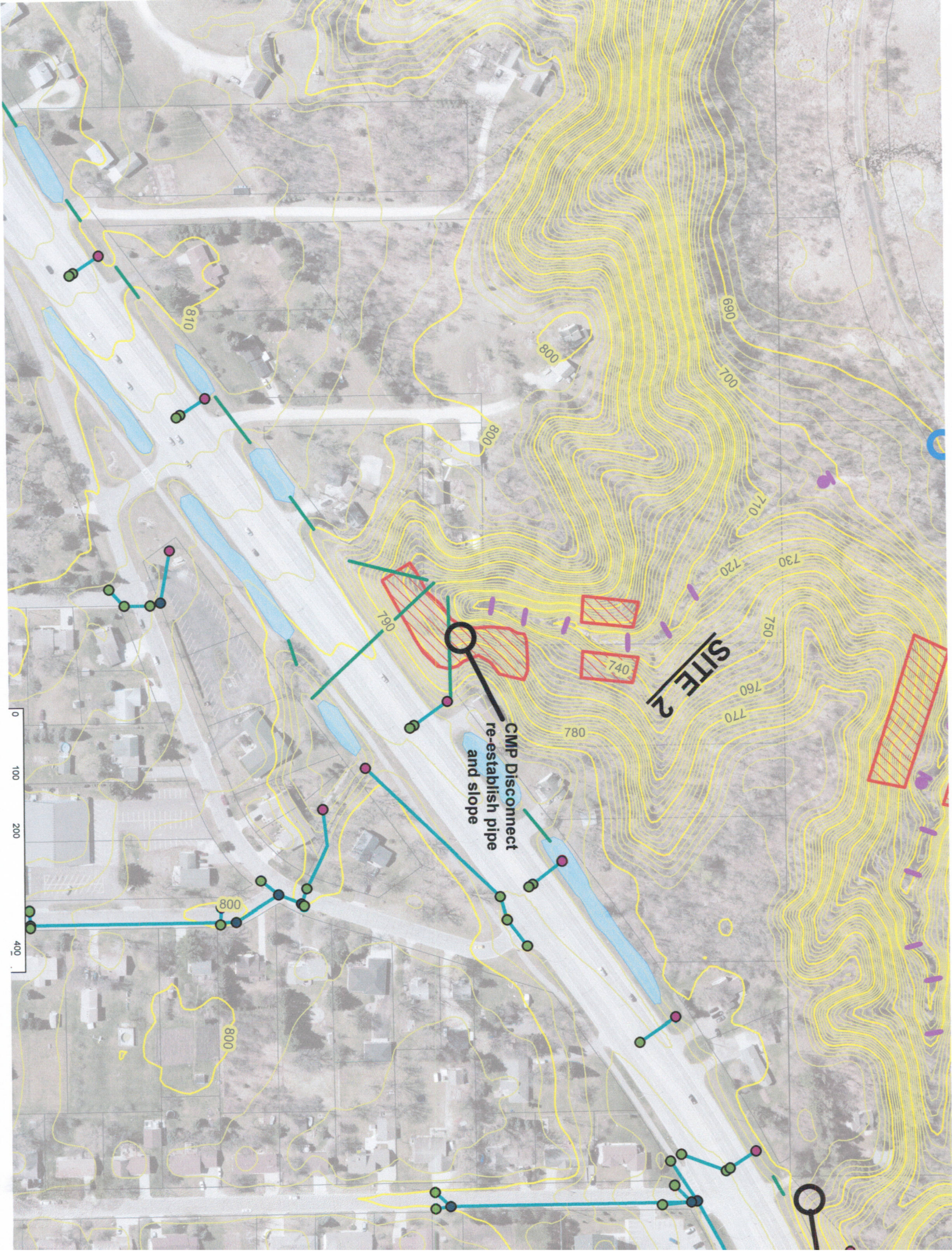
RAVINE IMPROVEMENTS Site Locations Map

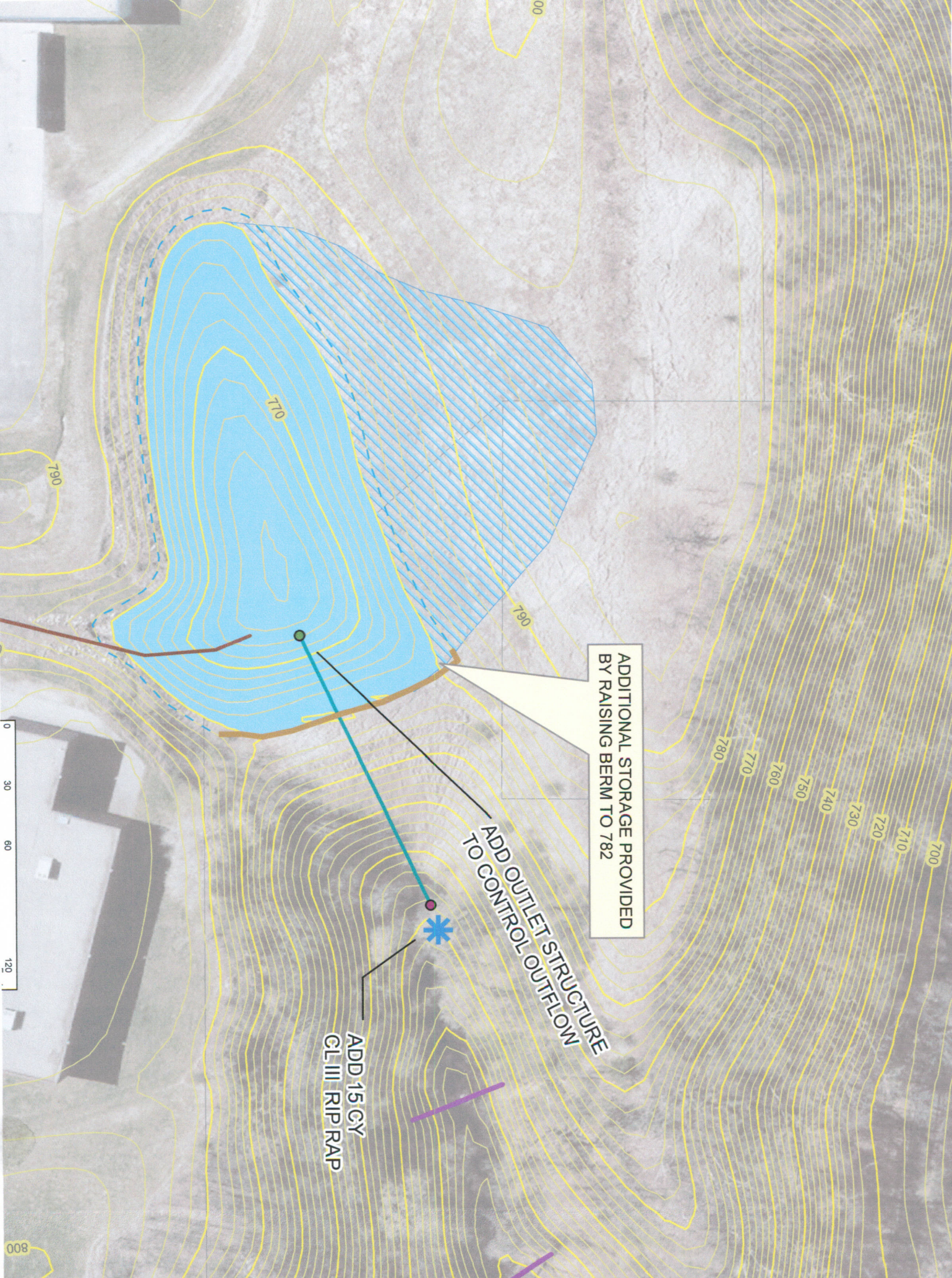
Red Wing, Minnesota

Figure 1

The information on this map has been compiled by Stantec staff from a variety of sources and is subject to change without notice. Stantec makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information.

R:\client\municipal\new_hope_ci_mn\34MAP\GISDATA\Projects\Population Map.mxd

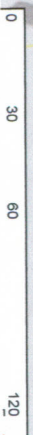




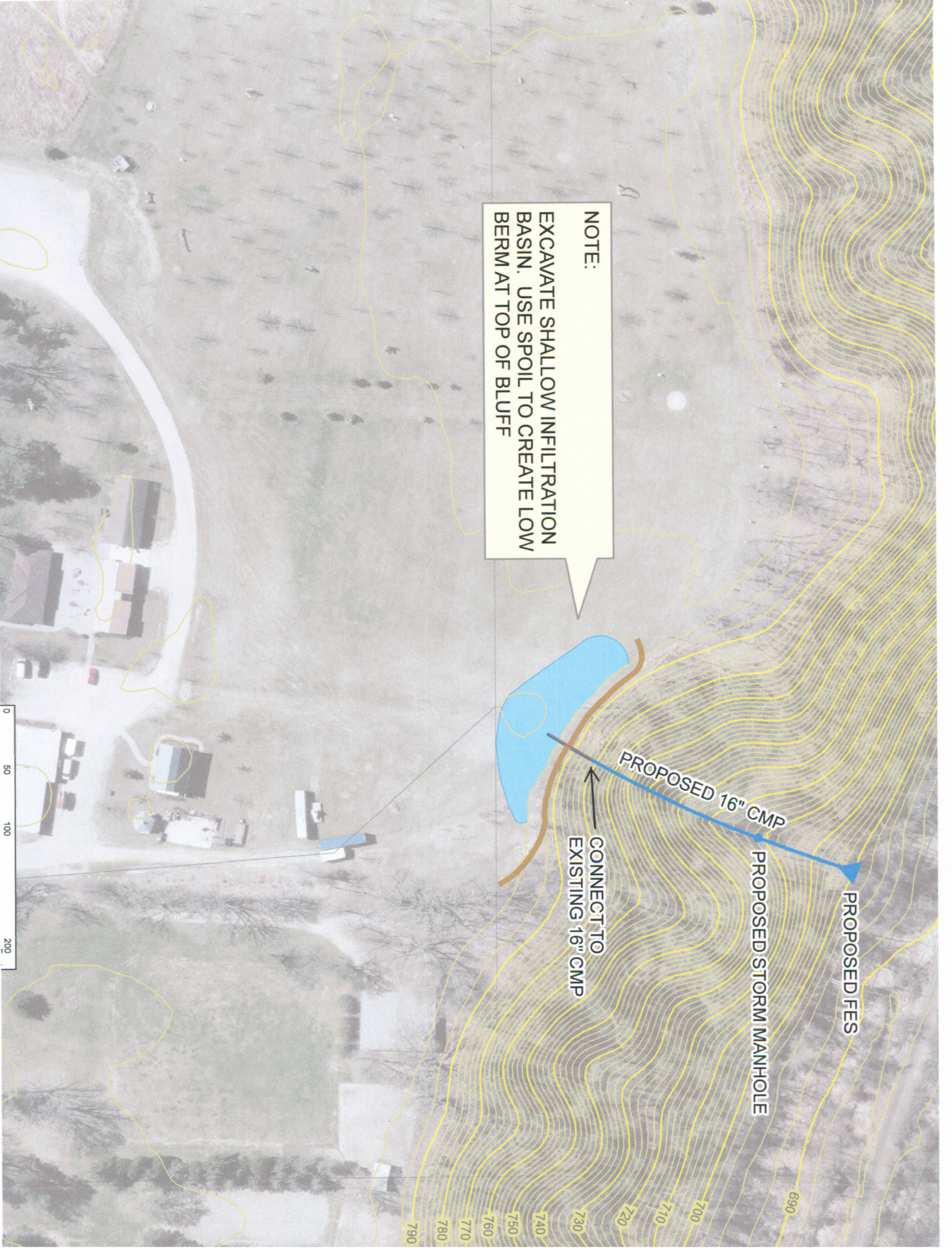
ADDITIONAL STORAGE PROVIDED
BY RAISING BERM TO 782

ADD OUTLET STRUCTURE
TO CONTROL OUTFLOW

ADD 15 CY
CL III RIP RAP



NOTE:
EXCAVATE SHALLOW INFILTRATION
BASIN. USE SPOIL TO CREATE LOW
BERM AT TOP OF BLUFF



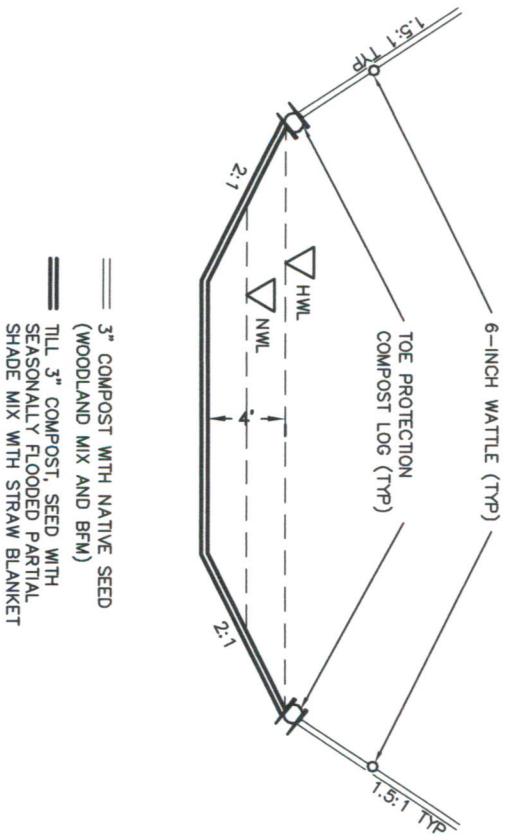
PROPOSED FES

PROPOSED STORM MANHOLE

PROPOSED 16" CMP

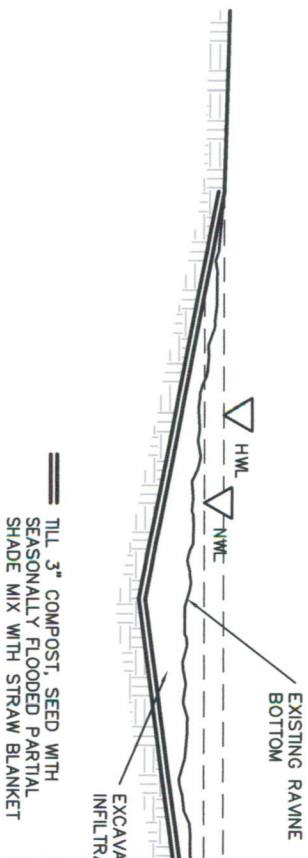
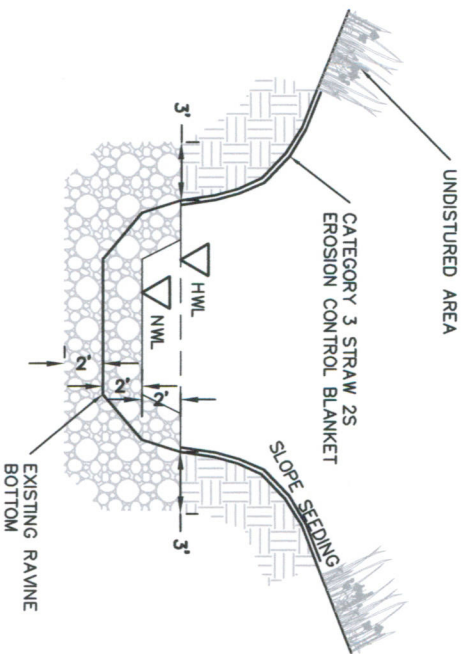
CONNECT TO
EXISTING 16" CMP

0 50 100 200



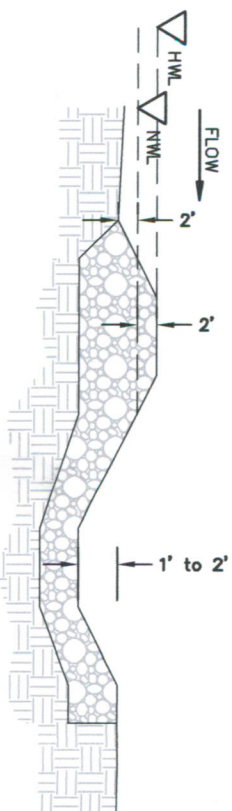
TYPICAL CROSS SECTION

CHECK DAM



TYPICAL PROFILE

CHECK DAM





Project Name: **Cannon Valley Trail - Ravine Erosion Repairs**

Client **Cannon Valley Trail Association**

Estimate Date **19-Jul-13**

Opinion of Probable Costs

Item Num	Item	Units	Qty	Unit Price	Total
SITE 1					
1	MOBILIZATION	LS	1	\$3,700.00	\$3,700.00
2	CLEAR AND GRUB	LS	1	\$5,000.00	\$5,000.00
3	SITE GRADING	LS	1	\$10,000.00	\$10,000.00
4	ROCK CHECK	EA	8	\$1,500.00	\$12,000.00
5	SEDIMENT TRAP	EA	1	\$3,000.00	\$3,000.00
6	INLINE INFILTRATION BASIN	EA	3	\$3,500.00	\$10,500.00
7	6" WATTLE	LF	900	\$5.00	\$4,500.00
8	COMPOST (1.5" THICK)	CY	232	\$55.00	\$12,760.00
9	SEEDING	AC	1.7	\$3,000.00	\$5,100.00
10	BONDED FIBER MATRIX	AC	1.7	\$7,000.00	\$11,900.00
SUBTOTAL CONSTRUCTION COSTS SITE 1					\$78,460.00
CONSTRUCTION CONTINGENCY (15%)					\$11,769.00
CONSTRUCTION TOTAL					\$90,229.00
ENGINEERING, LEGAL, ADMIN., FISCAL (25%)					\$22,557.25
TOTAL PROJECT COSTS - SITE 1					\$112,786.25
SITE 2					
1	MOBILIZATION	LS	1	\$4,800.00	\$4,800.00
2	CLEAR AND GRUB	LS	1	\$5,000.00	\$5,000.00
3	SITE GRADING	LS	1	\$10,000.00	\$10,000.00
4	RECONNECT STORM SEWER AND REPAIR SLOPE	LS	1	\$5,000.00	\$5,000.00
5	ROCK CHECK	EA	8	\$1,500.00	\$12,000.00
6	SEDIMENT TRAP	EA	1	\$3,000.00	\$3,000.00
7	INLINE INFILTRATION BASIN	EA	2	\$3,500.00	\$7,000.00
8	DRIVEWAY CULVERT MODIFICATION	EA	8	\$2,500.00	\$20,000.00
9	6" WATTLE	LF	800	\$5.00	\$4,000.00
10	COMPOST (1.5" THICK)	CY	186	\$55.00	\$10,230.00
11	PRAIRIE SEEDING FOR INFILTRATION AREAS	AC	1	\$2,500.00	\$2,500.00
12	SEEDING	AC	1.7	\$3,000.00	\$5,100.00
13	BONDED FIBER MATRIX	AC	1.7	\$7,000.00	\$11,900.00
SUBTOTAL CONSTRUCTION COSTS SITE 2					\$100,530.00
CONSTRUCTION CONTINGENCY (15%)					\$15,079.50
CONSTRUCTION TOTAL					\$115,609.50
ENGINEERING, LEGAL, ADMIN., FISCAL (25%)					\$28,902.38
TOTAL PROJECT COSTS - SITE 2					\$144,511.88
SITE 3					
1	MOBILIZATION	LS	1	\$3,800.00	\$3,800.00
2	CLEAR AND GRUB	LS	1	\$5,000.00	\$5,000.00
3	ROCK CHECK	EA	5	\$1,500.00	\$7,500.00
4	SEDIMENT TRAP	EA	1	\$3,000.00	\$3,000.00
5	INLINE INFILTRATION BASIN	EA	1	\$3,500.00	\$3,500.00
6	CLASS III RANDOM RIPRAP	TN	15	\$65.00	\$975.00
7	OUTLET CONTROL STRUCTURE W/WEIR	EA	1	\$15,000.00	\$15,000.00
8	MODIFICATIONS TO EXISTING BERM (RAISE TO 782)	LS	1	\$5,000.00	\$5,000.00
9	EXCAVATION FOR POND EXPANSION (TO MEET 5-YR)	CY	6000	\$6.00	\$36,000.00
10	SEEDING	AC	0.07	\$4,000.00	\$280.00
11	BONDED FIBER MATRIX	AC	0.07	\$7,000.00	\$490.00
SUBTOTAL CONSTRUCTION COSTS SITE 3					\$80,545.00
CONSTRUCTION CONTINGENCY (15%)					\$12,081.75
CONSTRUCTION TOTAL					\$92,626.75
ENGINEERING, LEGAL, ADMIN., FISCAL (25%)					\$23,156.69
TOTAL PROJECT COSTS - SITE 3					\$115,783.44



Project Name: **Cannon Valley Trail - Ravine Erosion Repairs**

Client: **Cannon Valley Trail Association**

Estimate Date: **19-Jul-13**

Opinion of Probable Costs

Item Num	Item	Units	Qty	Unit Price	Total
SITE 4					
1	MOBILIZATION	LS	1	\$1,900.00	\$1,900.00
2	CLEAR AND GRUB	LS	1	\$5,000.00	\$5,000.00
3	ROCK CHECK	EA	0	\$1,500.00	\$0.00
4	INLINE SEDIMENT TRAP	EA	1	\$3,000.00	\$3,000.00
5	CONNECT TO EXISTING STORM SEWER	EA	1	\$500.00	\$500.00
6	16" CMP STORM SEWER	LF	250	\$35.00	\$8,750.00
7	16" CMP FLARED END SECTION, INCL TRASH GUARD	EA	1	\$500.00	\$500.00
8	4' DIAMETER STORM SEWER MH	EA	1	\$5,000.00	\$5,000.00
9	CLASS III RANDOM RIPRAP	TN	20	\$65.00	\$1,300.00
10	BERM	LF	250	\$20.00	\$5,000.00
11	EXCAVATE INFILTRATION AREA	CY	250	\$8.00	\$2,000.00
12	PRAIRIE SEEDING FOR INFILTRATION AREAS	AC	0.5	\$4,000.00	\$2,000.00
13	CATEGORY 3 STRAW 2S EROSION CONTROL BLANKET	SY	1066	\$2.50	\$2,665.00
14	BONDED FIBER MATRIX	AC	0.28	\$7,000.00	\$1,960.00
SUBTOTAL CONSTRUCTION COSTS SITE 4					\$39,575.00
CONSTRUCTION CONTINGENCY (15%)					\$5,936.25
CONSTRUCTION TOTAL					\$45,511.25
ENGINEERING, LEGAL, ADMIN., FISCAL (25%)					\$11,377.81
TOTAL PROJECT COSTS - SITE 4					\$56,889.06
TOTAL SITE 1					\$78,460.00
TOTAL SITE 2					\$100,530.00
TOTAL SITE 3					\$80,545.00
TOTAL SITE 4					\$39,575.00
TOTAL CONSTRUCTION COSTS					\$299,110.00
CONSTRUCTION CONTINGENCY (15%)					\$44,866.50
CONSTRUCTION TOTAL					\$343,976.50
ENGINEERING, LEGAL, ADMIN., FISCAL (25%)					\$85,994.13
TOTAL PROJECT COSTS					\$429,970.63

Technical Memorandum - Cannon Valley Trail Erosion Repairs

August 22, 2013

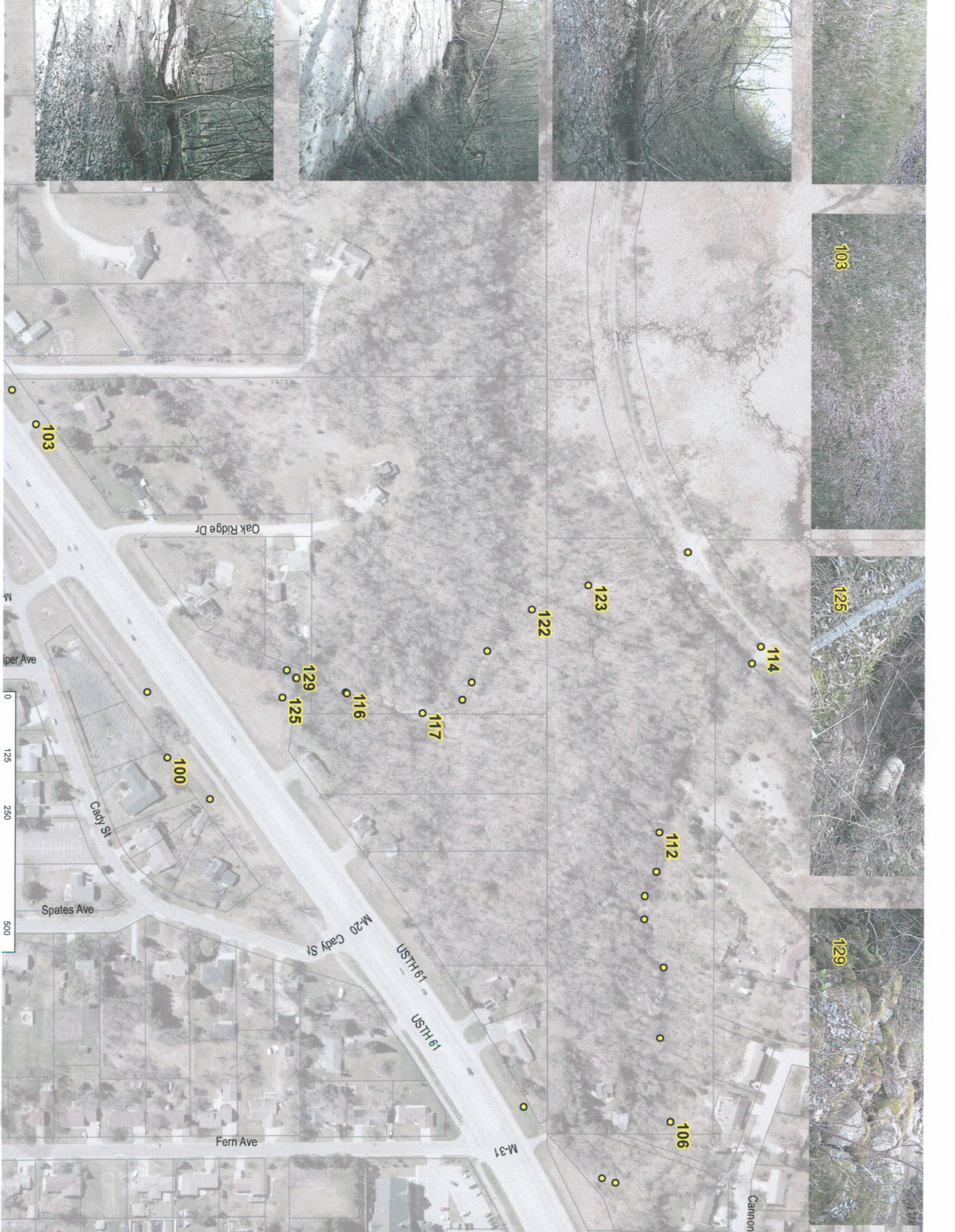
Photos

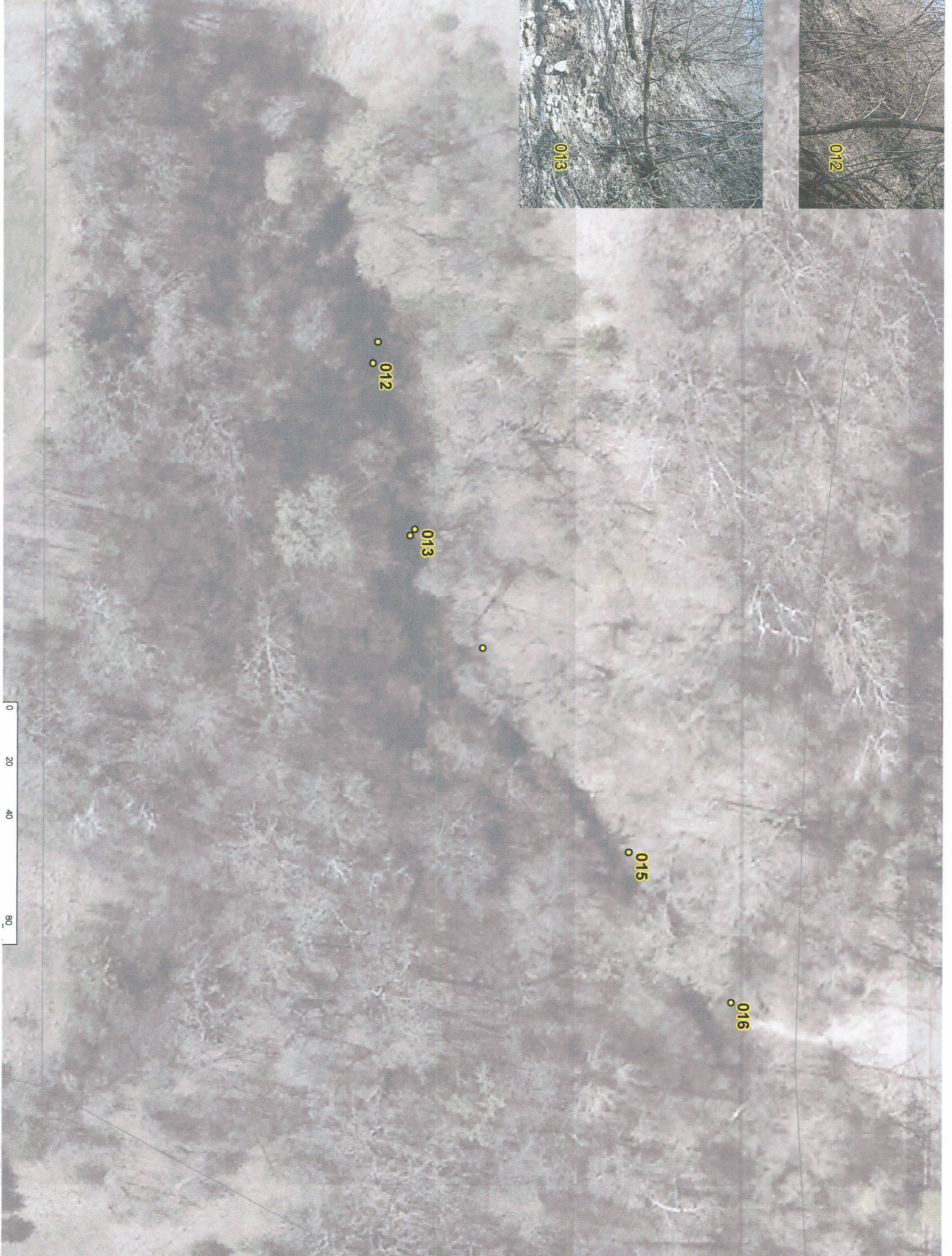
Map of Sites 1 & 2 with selected photos

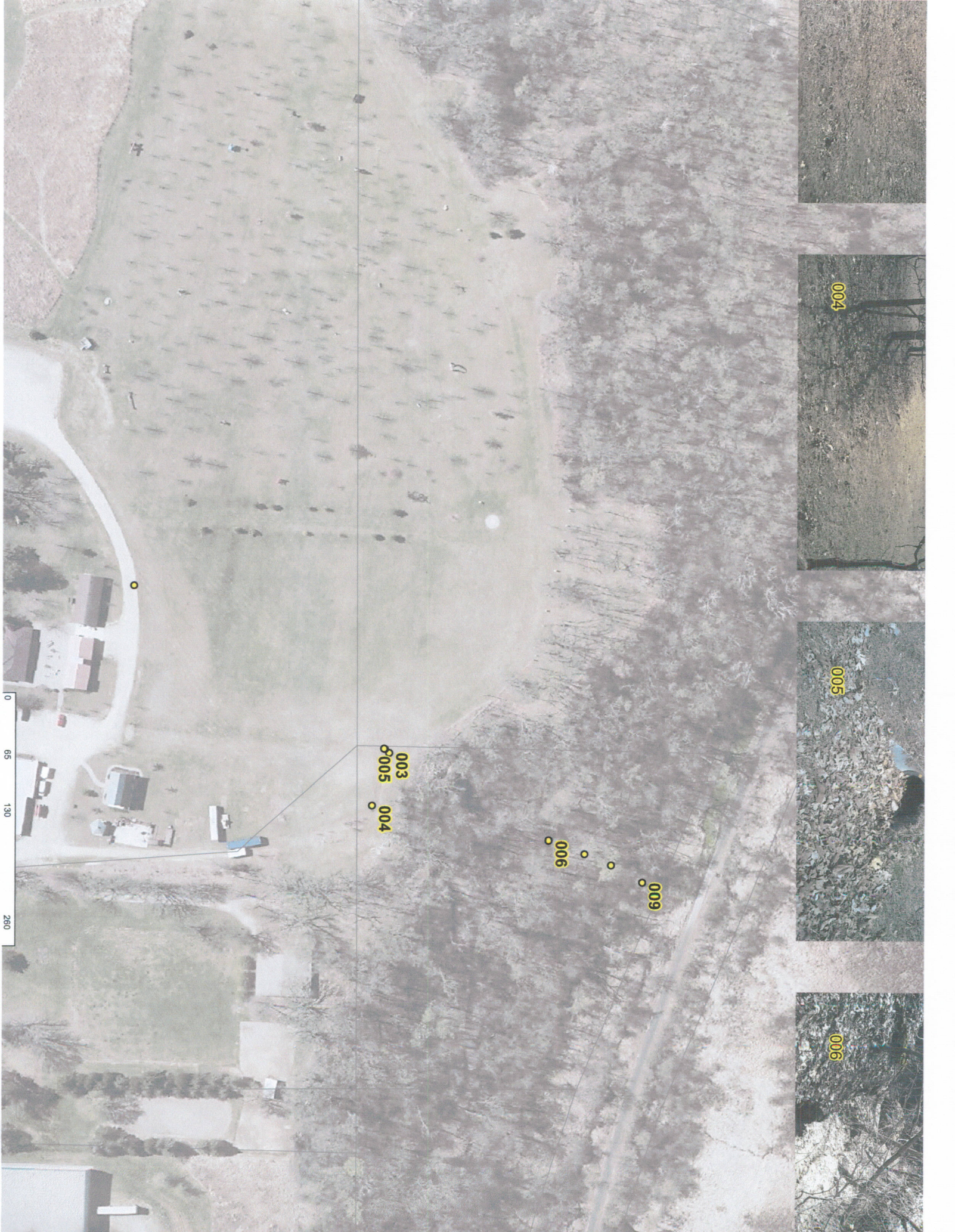
Map of Site 3 with selected photos

Map of Site 4 with selected photos

Photos with descriptions







8/15/2013

Project Area: SITE 1



Photo File Name: **107**

Notes: **Rock bottom, stable, looking upstream**



Photo File Name: **111**

Notes: **Back erosion, potential rock check, 16-ft bottom**

8/15/2013

Project Area: SITE 1



Photo File Name: **114**

Notes: **Sand wash, looking upstream**

8/15/2013

Project Area: SITE 2



Photo File Name: **100**
Notes: **Outlet end, no storage**



Photo File Name: **103**
Notes: **Typical road swale**

8/15/2013

Project Area: SITE 2



Photo File Name: **116**
Notes: **Sand slope, 1.5:1**



Photo File Name: **119**
Notes: **channel looking upstream**

8/15/2013

Project Area: SITE 2



Photo File Name: **122**

Notes: **sediment deposits, looking upstream**



Photo File Name: **123**

Notes: **Looking upstream, potential sediment trap**

8/15/2013

Project Area: SITE 2



Photo File Name: **125**

Notes: **Pipe outlets**



Photo File Name: **127**

Notes: **Culvert pipe ends**

8/15/2013

Project Area: SITE 3



Photo File Name: 12

Notes: **Side channel looking upstream**



Photo File Name: 13

Notes: **Channel cutting**

8/15/2013

Project Area: SITE 3



Photo File Name: 15
Notes: **channel cut - 17-ft wide**



Photo File Name: 16
Notes: **Sandy soil outwash**

8/15/2013

Project Area: SITE 4



Photo Label No.: 2

Notes: **Drainage swale leading to the ravine, looking south**



Photo File Name: 4

Notes: **Drainage swale leading to the ravine, looking south**

8/15/2013

Project Area: SITE 4



Photo File Name: 5
Notes: culvert end



Photo File Name: 6
Notes: Main erosion, drop structure pipe, sandy soil

8/15/2013

Project Area: SITE 4



Photo File Name: 9

Notes: **Sand deposits, lower end**