



February 14, 2019

Mr. Steve Lillehaug, PE
Public Works Director/ City Engineer
City of Shakopee
485 Gorman Street
Shakopee, MN 55379

Re: Feasibility Study – Reroute Stormwater to Protect Historic Sites
WSB Project No. 013233

Dear Mr. Lillehaug:

The following is a feasibility study addressing stormwater improvements for the Amazon Distribution Center discharge in the City of Shakopee. The proposed improvements include storm sewer, culvert and ditch improvements. This project was initiated to provide protection from stormwater discharge for documented cultural resources in the area.

We are available at your convenience to discuss this report. Please do not hesitate to contact me at (651) 286-8474 if you have any questions regarding this report.

Sincerely,

WSB

Jeffry S. Sandberg, PE
Senior Project Manager

Enclosure

1.0 EXECUTIVE SUMMARY

The following is a feasibility study addressing proposed improvements to reroute stormwater discharge from the Amazon Distribution Center Parcel to protect historic sites in the City of Shakopee.

Of the three options analyzed, the most feasible options appear to be Option 2, which conveys stormwater discharges through commercial sites to the east, and Option 3, which redirects stormwater discharges to the east generally within the Hwy 101 Right-Of-Way (ROW). Currently, full project funding sources have not been identified. These options will be discussed with project stakeholders, and the preferred option will be dependent on stakeholder input and identifying additional funding sources. The total estimated project costs for the most-feasible options varies from \$1,093,000 to \$1,224,000. Both of these figures includes 20% indirect costs.

These options are feasible and cost-effective from an engineering standpoint. It is our recommendation that the improvements be implemented as outlined in this report once an option is selected by stakeholders and complete project funding becomes available.

2.0 INTRODUCTION

In 2015, the Amazon Distribution Center site plans were approved, and the site developed. As a part of the City development review, stormwater management plans were determined to meet established criteria for rate control and water quality. Because of the proximity of bedrock and the potential for karst conditions, volume control was not feasible. Due to this site limitation, in accordance with City policy, the Developer was permitted to use filtration in lieu of infiltration. Peak discharge rates that were first established in the City's 1995 Comprehensive Surface Water Management Plan (CSWMP) were maintained, and existing culverts under the railroad and Hwy 101 were utilized for conveyance of flows that historically went north through Three Rivers Park (See Figure 1, in Appendix A).

Despite flow rates meeting established criteria, volume has increased so water flows through the existing culverts for much longer periods of time. This increase in volume and duration of flow has created a potential for degradation of cultural resources that are in the flow path on the north side of Hwy 101 in the Three Rivers Park property. In 2016, WSB and Shakopee Public Works designed and installed two short-term improvements in the Three Rivers Park, one to stabilize the flow path adjacent to burial sites, and the other to place culverts under the park access road to remediate flooding of the road.

Since early 2016, WSB and City staff have had at numerous meetings with stakeholders from Three Rivers Parks, Scott County, the Mdewakanton Sioux Community, and the State Archeological office to determine suitable alignments for a conveyance system that would divert water away from sensitive cultural resources in the area (See Figure 2). At their May 3, 2016 City Council meeting, the City authorized a drainage study to identify options and provide recommendations on preferred alternatives.

On June 15, 2016, WSB and City staff met with the above-mentioned stakeholders to propose the preferred alternative, a combination of new culverts and ditches to convey the Amazon discharge to the east in the Scott County Hwy 101 ROW, using existing culverts and flow paths as much as possible. All stakeholders were not in agreement that this option was the best available option.

In early 2017 WSB was directed to look at alternatives outside of the Hwy 101 ROW and outside of known cultural resources. Survey work was initiated, and concept plans were developed that

indicate a potential gravity solution through existing ponds and drainage networks within the commercial properties on the south side of Hwy 101.

In early 2018, WSB was directed to consider options that involved a lift station. This option was presented to stakeholders in August, 2018, but because events greater than the 10-year event would continue to flow along the existing route, this option was determined unsuitable to meet the needs of the project.

In December 2018, WSB was directed to perform a detailed evaluation of the remaining options, including hydraulic modeling to determine flood impacts and more detailed easement needs for each option. The stakeholders determined that a successful project will reroute flows from the Amazon site up to and including the 100-YR Atlas 14 event around the sensitive cultural resource areas.

2.1 Scope

This report investigates the feasibility of proposed storm sewer and ditch improvements and appurtenant work for the Amazon Distribution Center site discharge that currently flows north through Three Rivers Parks. Three alternatives were explored for feasibility. A map of the project area addressed in this feasibility study can be found on Figure 1 in Appendix A of this report.

2.2 Data Available

Information and materials used in the preparation of this report include the following:

- City of Shakopee Record Drawings and GIS Mapping
- Scott County As-builts
- XPSWMM results from the Shakopee City Plan
- Field Survey Data
- Field Observations of the Area and Discussions with City Staff
- Meetings with Three Rivers Parks staff, Scott County, Mdewakanton Sioux Community, State Historic Preservation Office
- Figures provided by Three Rivers Parks depicting Previously Identified Archaeological Sites
- Discussions with Contractors

3.0 EXISTING CONDITIONS

3.1 Storm Water Discharges

The Amazon Distribution Center has two points of discharge; approximately 26 acres flows to the west, and approximately 39 acres flows to the north. The 26-acre area flowing west was originally designed to flow north through Three Rivers Park. In 2016, as part of the Shenandoah Road reconstruction and Gateway site improvements, the Amazon flow was redirected to flow west through new culverts under Shenandoah, along a drainage ditch on the Gateway site, and through a culvert under the UP Railroad. The flow is then directed to the south Hwy 101 ditch west to the Sarazin Pond, and ultimately discharges to the Minnesota River (See Figure 3).

The 39 acres that discharges to the north flows through a UP Railroad culvert and into the Hwy 101 ditch. A county culvert in the Hwy 101 ditch directs the flows north and

discharges into the Three Rivers Park property. Two documented Indian burial mounds are located within 100' of the discharge point.

The allowable discharge rates from the tributary areas that now includes the Amazon Distribution center was first established in the City of Shakopee 1995 CSWMP, and has been documented in each subsequent revision to the Shakopee CSWMP including the 2019 update. The 100-year peak discharge at the point that flows north from the Amazon distribution center is 14 cubic feet per second (cfs). Hwy 101 runoff adds to that discharge that is directed into the Three Rivers Park property. Only the Amazon discharge runoff is being considered for being redirected in this study. The Hwy 101 runoff would continue to flow into the Three Rivers Park even after implementation the alternatives considered under this study.

3.1 WORK WITHIN ROW, PRIVATE PROPERTIES

Depending upon the option chosen, work will likely need to occur within existing easements and ROW, private property, Three Rivers Parks, and various commercial properties in the area. Permits will need to be acquired from UP Railroad, Three Rivers Parks, and Scott County for any work performed within their jurisdiction. Options that require easements to be dedicated on private property or that require a permit from the UP Railroad will likely add cost and delay to the project start.

3.2 PRIVATE UTILITIES

There are currently public and private utilities within the proposed project area. Known utilities include:

- Telephone
- Communication
- Television/Communication
- Gas
- Electric
- Fiber
- Watermain
- Sanitary sewer
- Storm sewer

Utility poles and lines that must be moved or held in order to construct the improvements as proposed should be coordinated with utility companies ahead of the project.

4.0 OPTIONS CONSIDERED

4.1 Storm Sewer Options

Three options have been reviewed for feasibility as part of this study. Additional options were considered previously, however, through meetings with the various stakeholders it was determined that options that directed flows through Three Rivers Park are not desired. These options included jacking a pipe straight north under the Three Rivers Park and creating an above-ground conveyance through the Three Rivers Park. Additionally, a lift station option was considered to direct flows up to the 10-year event around the

Three Rivers Park Property. The consensus has been that re-routing all flows from the Amazon site up to and including the 100-year event around the Three Rivers Park is the most desired solution.

4.1.1 Option #1: Direct Flows to the West Through Existing Storm Ponds and Piping Networks (FIGURE 4).

To bring flows west from the east Amazon Pond, a new conduit (a combination of pipes and ditching) was considered. The flow path will follow the gravity flow of the existing west pond, however, pipes and ditching will need to be 1-3' lower along the entire alignment to provide a gravity outlet to existing drainage systems west of Sarazin Avenue and ultimately to the Minnesota River.

Estimated cost: \$2,000,000

Pros: It has been determined that the capacity of the system to the west is adequate to handle the additional flows. This option has minimal potential for disturbance of archaeological areas (the route for this alignment has been previously disturbed).

Cons: This option will require that a new pipe crossing be placed under the UP Railroad, which will require review, approval and securing a permit from the UP Railroad. Additionally, the new pipe and ditches will generally be installed in bedrock, which significantly increases the cost of this option. This option will be disruptive to the Amazon Distribution Center operation temporarily during construction. Lastly, in addition to the UP Railroad permit, this option will require permitting from Scott County, and assumes easements will be donated from Amazon, UP Rail, and SPUC.

4.1.2 Option #2: Direct Flows East through Existing Storm Ponds and Piping Networks (FIGURE 5.)

This option considers redirecting flows to go east through a new 24-inch diameter pipe constructed at the outlet of the east pond on the Amazon property and would extend across the Dorn commercial property. The pipe would be routed underneath the existing 27" sanitary sewer interceptor with 22 inches of vertical clearance and discharge into the existing stormwater pond on the Dorn Property. From there flows would be directed east through a new 760' long 24" pipe into the existing Scherer Bros. stormwater pond. Flows would discharge through two new 480' long 24" pipes and into an improved channel on the eastern boundary of the western CertainTeed property and to existing storm ponds. These ponds would be proposed to be modified to create more depth and storage. Finally, the flow will outlet via two new, 120' long 24" culverts and into an improved channel on the eastern CertainTeed property, then into the existing pipe and ditch network that directs discharge north through Hwy 101 culverts and ultimately to the existing drainage ravine on the extreme east end of the Three Rivers Parks property that discharges into the Minnesota River. We do not believe the ravine would need to be improved and stabilized because flows would have a longer flow route and will be attenuated through the ponds. The existing peak discharges in the 2, 10, and 100-YR events are 25, 32, and 35 cfs, respectively. With this improvement, the peak discharges would be 27, 32, and 35 cfs for the 2, 10, and 100-YR events.

Estimated cost: \$1,093,000

Pros: This option appears to have low potential for disturbance of archaeologically sensitive areas. Additionally, much of the conveyance system is already in place. This option meets the project objectives outlined by the stakeholders.

Cons: Easement acquisition from private properties may be time consuming and costly. Additionally, the work has the potential to disrupt the operations of several businesses, which could add more costs to the project.

4.1.3 Option #3: Direct Flows to the East within the Hwy 101 Right-of-Way – (FIGURE 6)

This option consists of improvements almost entirely within the Hwy 101 ROW, directing flows east along the Hwy 101 alignment and north to directly discharge into the existing natural drainage ravine along the extreme east side of the Three Rivers Parks property. While not required, we would recommend that as part of this project the natural drainage ravine be improved and stabilized. The existing peak discharges to the ravine in the 2, 10, and 100-YR events are 25, 32, and 35 cfs, respectively. With this improvement, the peak discharges would be 31, 38, and 42 cfs for the 2, 10, and 100-YR events – approximately a 16% to 20% increase in peak discharge for each event. We have included costs for ravine stabilization in the cost estimates for this option.

WSB initially considered three options for this alignment. One option was an all ditch option, with ditches excavated within UP Railroad and Scott County ROW limits. The second option was a combination of ditch and pipe, again within UP Railroad and Scott County ROW limits. The third option was an all pipe option with improvements made only in Scott County ROW limits. Geotechnical and Survey work was completed in 2016 and it was determined that the depth to bedrock was 0 – 4'. Due to the proximity of bedrock and requirements for ditch widths and depths to meet County standards, rock excavation for ditches was determined to significantly increase the cost of the project. We recommend an all-pipe option to keep costs and ground disturbance at a minimum and to avoid work in the UP Railroad ROW.

Estimated cost: \$1,224,000

Pros: This option generally has low potential for disturbance of archaeologically sensitive areas because the alignment is wholly in previously disturbed areas. In the alignment presented to stakeholders in 2016, it was determined that a burial mound would be impacted located on the south side of Hwy 101 in the County ROW. We have modified the alignment to avoid this sensitive area. No easement acquisition would be required for this option. No railroad permit is anticipated to be required for this option. No increase in flooding of County ROW occurs with this option.

Appendix C shows the hydraulic modeling results for this option. In the existing condition, discharge to Three Rivers Park is 26 AF in the 100-Yr Atlas 14 event (includes the Amazon site, Scott County ROW and watersheds south of the Amazon site). With the implementation of this option, that volume is reduced to 12 AF for the 100-YR event, which will result in flow volumes that are reduced from the existing condition prior to the development of the Amazon site. This option meets the project objectives outlined by the stakeholders.

Cons: This option will have significant temporary disruption in the Highway 101 ROW during construction. This option will require review, approval, and permitting from Scott County as well as Three Rivers Parks.

5.0 PERMITS/ APPROVALS

5.1 Scott County Right-of-Way Permit

All three options presented in this report would likely need permitting and/or approval from Scott County. The options certainly have varying levels of impact on Scott County ROW, so the approval process may vary in timing, coordination, and application detail. Option #3 presented above would likely have the most impact on Scott County ROW/infrastructure. A Right-of-Way and Utility Permit will need to accompany the final plan set to receive Scott County approval. We expect the Scott County approval process to take between 30 and 60 days.

5.2 Union Pacific Rail Permit

Option 1 was the only option presented that would need permitting and/or approvals from the Union Pacific Railroad. It is our experience that the permitting and approval process through Union Pacific is lengthy, expensive, and not guaranteed. Applicants should expect a 9-12 month review time once an application is submitted.

5.3 Three Rivers Park Permit

Three Rivers Park District will require a standard access permit for the proposed improvements for Option #3, specifically, the ravine stabilization portion of the project. In discussions with District staff, the expected approval timeline would be less than 45 days.

5.4 NPDES Permit

The recommended improvements will disturb more than one acre of underlying soils and therefore a Storm Water Pollution Prevention Plan (SWPPP) will need to be prepared to secure a National Pollution Discharge Elimination Systems (NPDES) General Storm Water Permit.

5.5 Mdewakanton Sioux

We recommend continued communications and consultation with the Mdewakanton Sioux Community throughout the feasibility, design, and construction process for any of the alternatives chosen.

5.6 Lower Minnesota River Watershed District

We recommend continued communications and consultation with the LMRWD throughout the feasibility, design, and construction process for any of the alternatives chosen.

5.7 State Historic Preservation Office

Because the routes chosen for the three alternatives all generally avoid known areas of archaeological significance, or are within areas that have already been cleared, we do not believe approval from the SHPPO is required. We do recommend continued courtesy communications and consultation with the SHPPO throughout the feasibility, design, and construction process for any of the alternatives chosen.

We have included a line item for Archaeological Investigations in all three options presented.

6.0 OPINION OF PROBABLE COSTS

Easement acquisition has been estimated and associated costs have been included in alternatives that will require easement acquisition from private properties. Land values were obtained from the Scott County website, and it was assumed the acquisition cost would be 20% of the land value.

A detailed breakdown of the cost opinion for each of the four options can be found in Appendix B. The opinion of cost incorporates estimated 2019 construction costs. Indirect costs are projected at 20% of the estimated construction cost and include legal, engineering, permitting, administrative, and financing. A summary of costs for each option are listed below.

Option #1: \$2,000,000
Option #2: \$1,093,000
Option #3: \$1,224,000

See Appendix B for detailed cost estimates for each option.

7.0 PROJECT SCHEDULE

The proposed project schedule for the improvements is as follows:

Accept Feasibility Report.....	March 2019
60% Construction Plans.....	May 2019
Apply for Permits.....	May 2019
100% Construction Plans.....	July 2019
Project Bidding.....	August 2019
Begin Construction.....	September 2019

8.0 FUNDING

The project is proposed to be funded through a combination of grants, the City of Shakopee Stormwater Fund, and stakeholders. A preliminary application for Option #3 was submitted by the City for this project in May 2018 through the Minnesota Historical and Cultural Heritage Grant. This grant provides funding to projects that preserve the state's historical and cultural resources. The City requested \$336,406 from the grant, to be matched with \$458,968 through the City Stormwater Fund. The final application was submitted in July 2018, and the project has been selected for grant funding. With the combination of grant funding and the City Stormwater Fund, the city has a total of \$900,000 available for funding. Additional funding is needed for the city to advance the project.

9.0 FEASIBILITY AND RECOMMENDATION

This study investigates the feasibility of re-routing stormwater discharge for a portion of the Amazon Distribution Center to help protect and preserve archaeologically significant sites in the area.

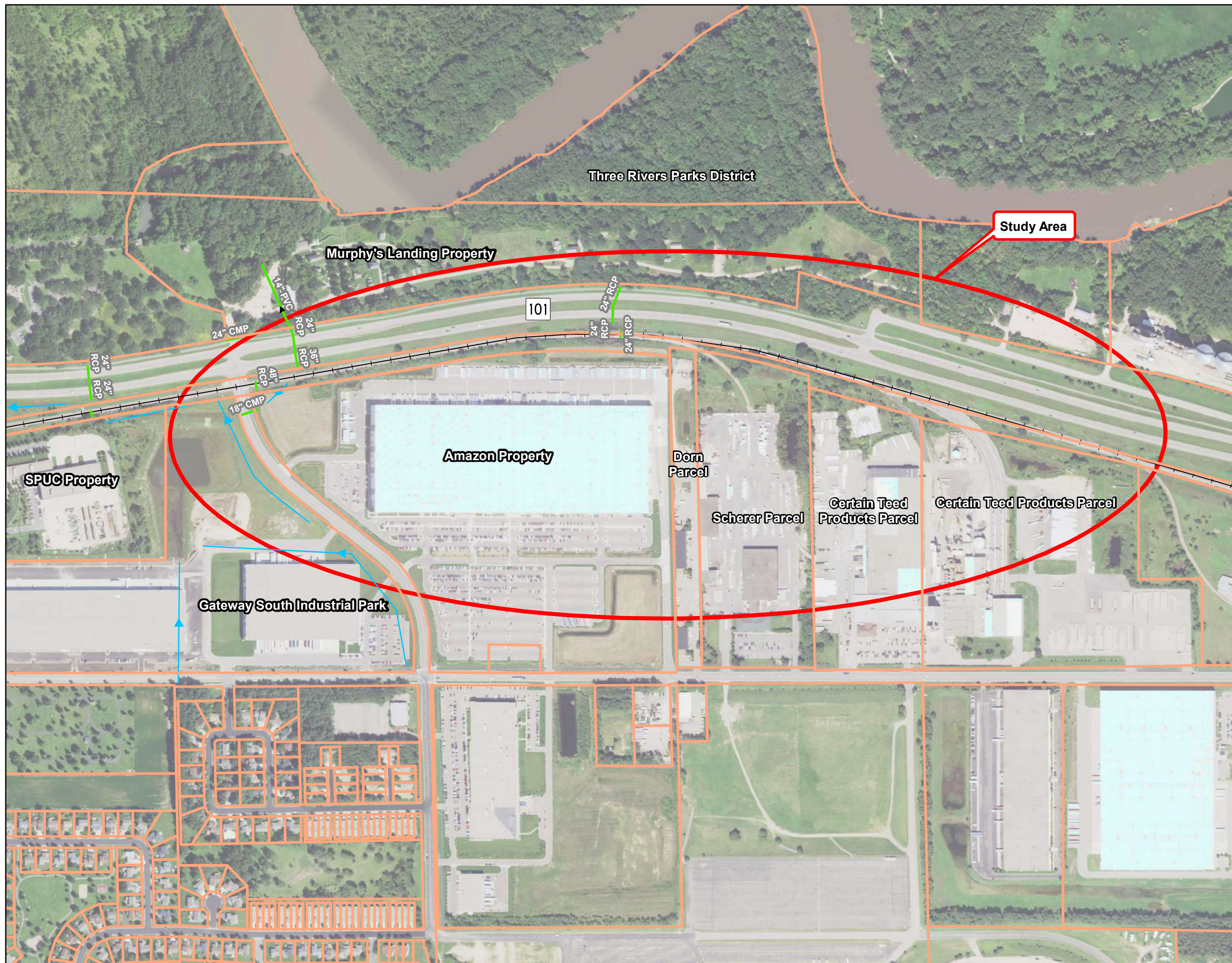
The project poses several challenges for design, permitting, coordination, and construction phasing. The most feasible options appear to be Options 2 and 3. These options will be discussed with the project stakeholders, and the preferred option will be dependent on stakeholder input and identifying additional funding sources.

From an engineering standpoint, Options 2 and 3 are feasible and cost-effective options. It is our recommendation that the options be presented to project stakeholders and that additional funding sources be identified. The improvements should be implemented as outlined in this study once an option is selected and additional funding sources are identified.





Appendix A

REPORT FIGURES

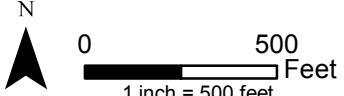
Figure 1- Project Location
 Feasibility Report - Rerouting of Stormwater to Protect Historic Sites
 City of Shakopee



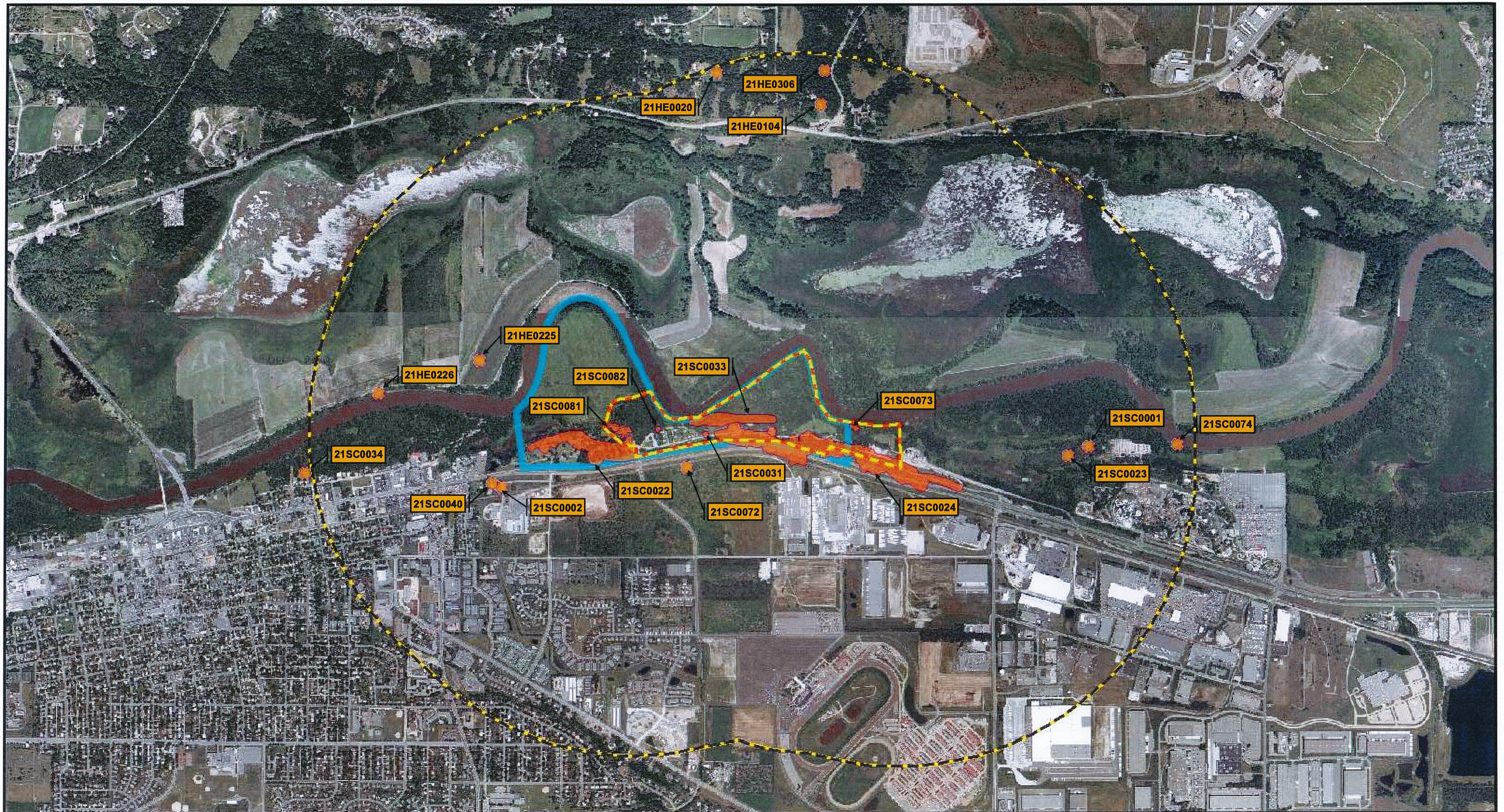
Legend

-  Stormsewer
-  Railroad
-  Flow Direction
-  Property Boundaries

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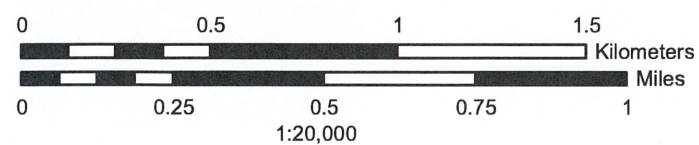


0 500 Feet
 1 inch = 500 feet



Source: Three Rivers Park District; Minnesota SHPO; Office of the State Archaeologist, Farm Services Administration 2003-2004

**The Landing Development Project
Phase I Archaeological Survey and Monitoring
Scott County, Minnesota**



- Project Area
- Context Study Area
- Previously Identified Archaeological Site
- Shakopee Historic District

Previously Identified Archaeological Sites

Figure 2 – Previously Identified Archaeological Sites
Feasibility Report – Re-Routing of Amazon Parcel Discharge
City of Shakopee





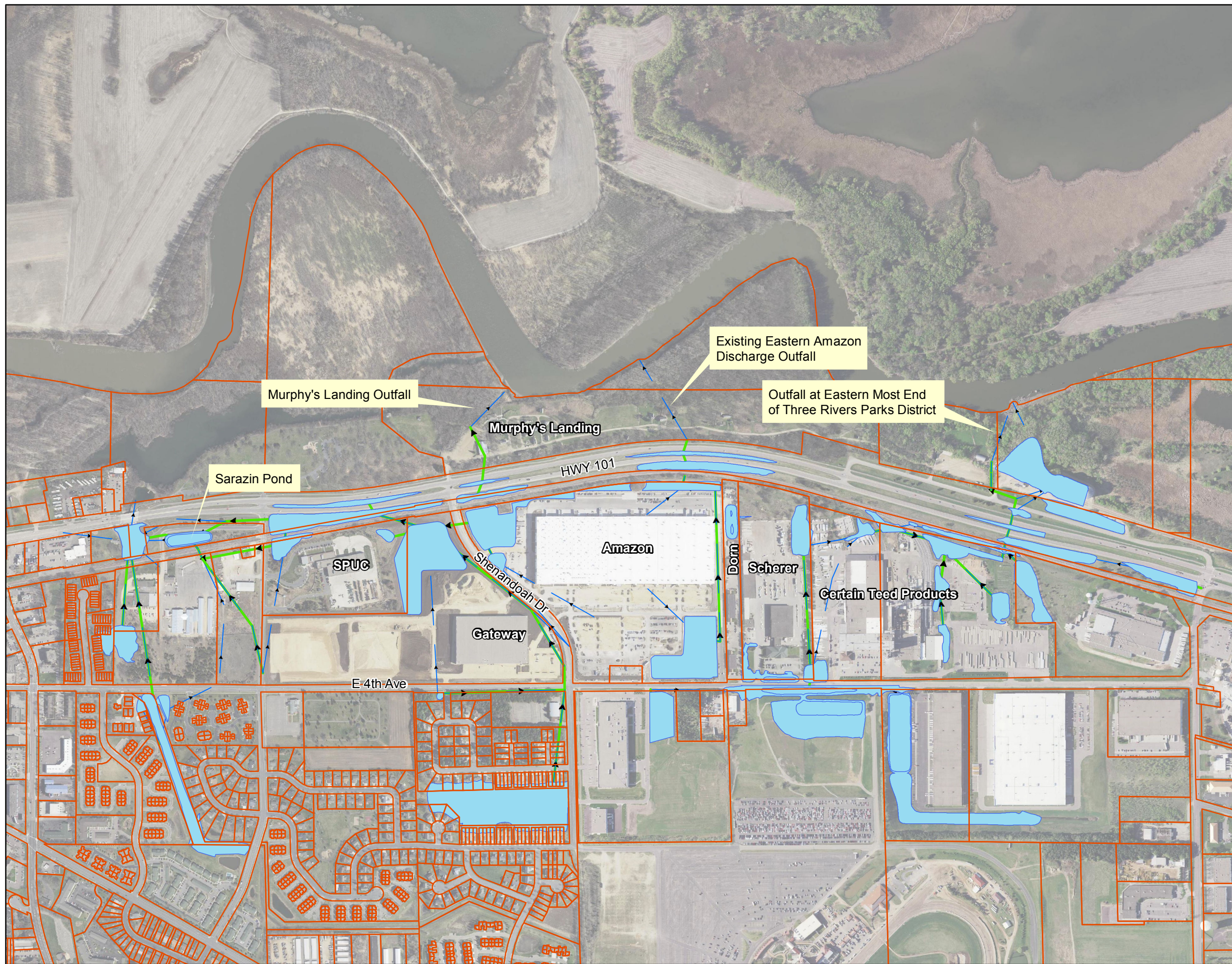
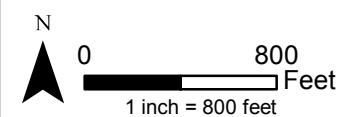
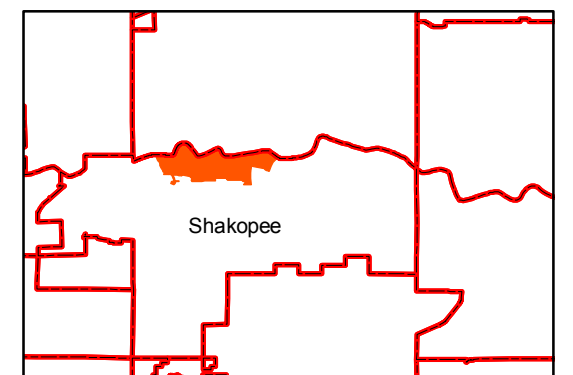
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Figure 3- Existing Discharge Conditions

Feasibility Report - Rerouting of Stormwater to Protect Historic Sites
City of Shakopee

Legend

- Existing Storm Sewer
- Overland Flow Paths
- Existing Ponds
- Property Boundaries

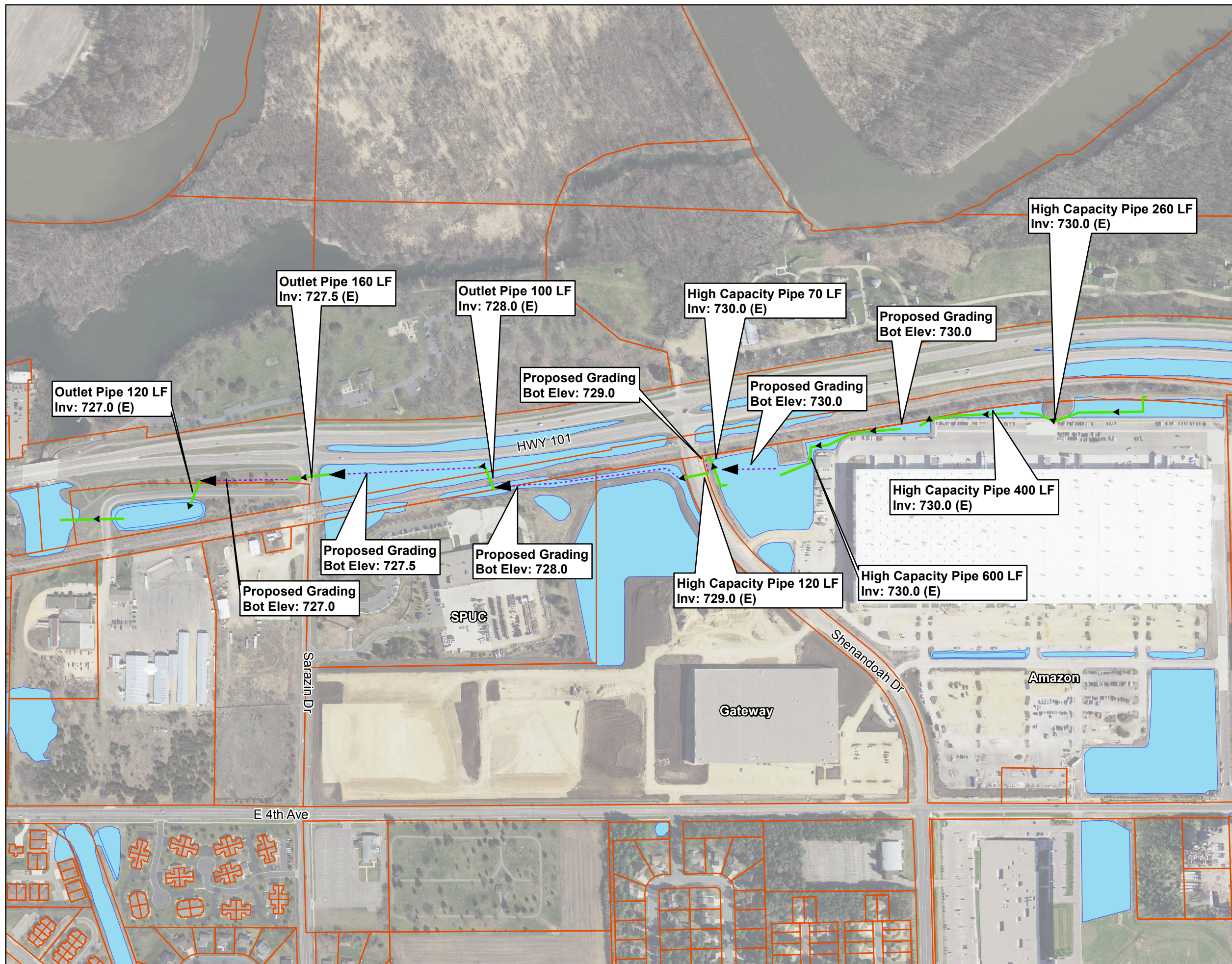




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Figure 4- Proposed Option 1

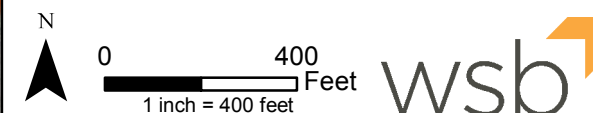
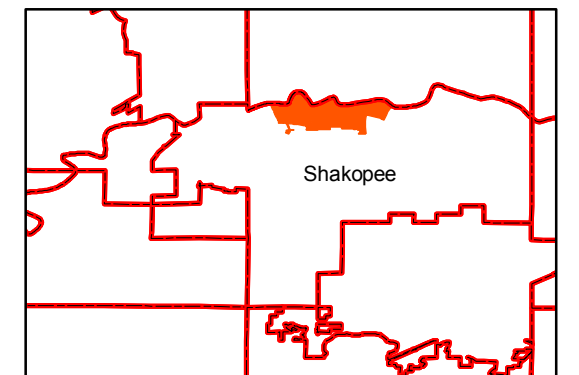
Feasibility Report - Rerouting of Stormwater to Protect Historic Sites
City of Shakopee



Legend

Option 1 Proposed Routing

- Excavated Ditch
- Proposed Pipe
- Existing Pond Limits
- Property Boundaries

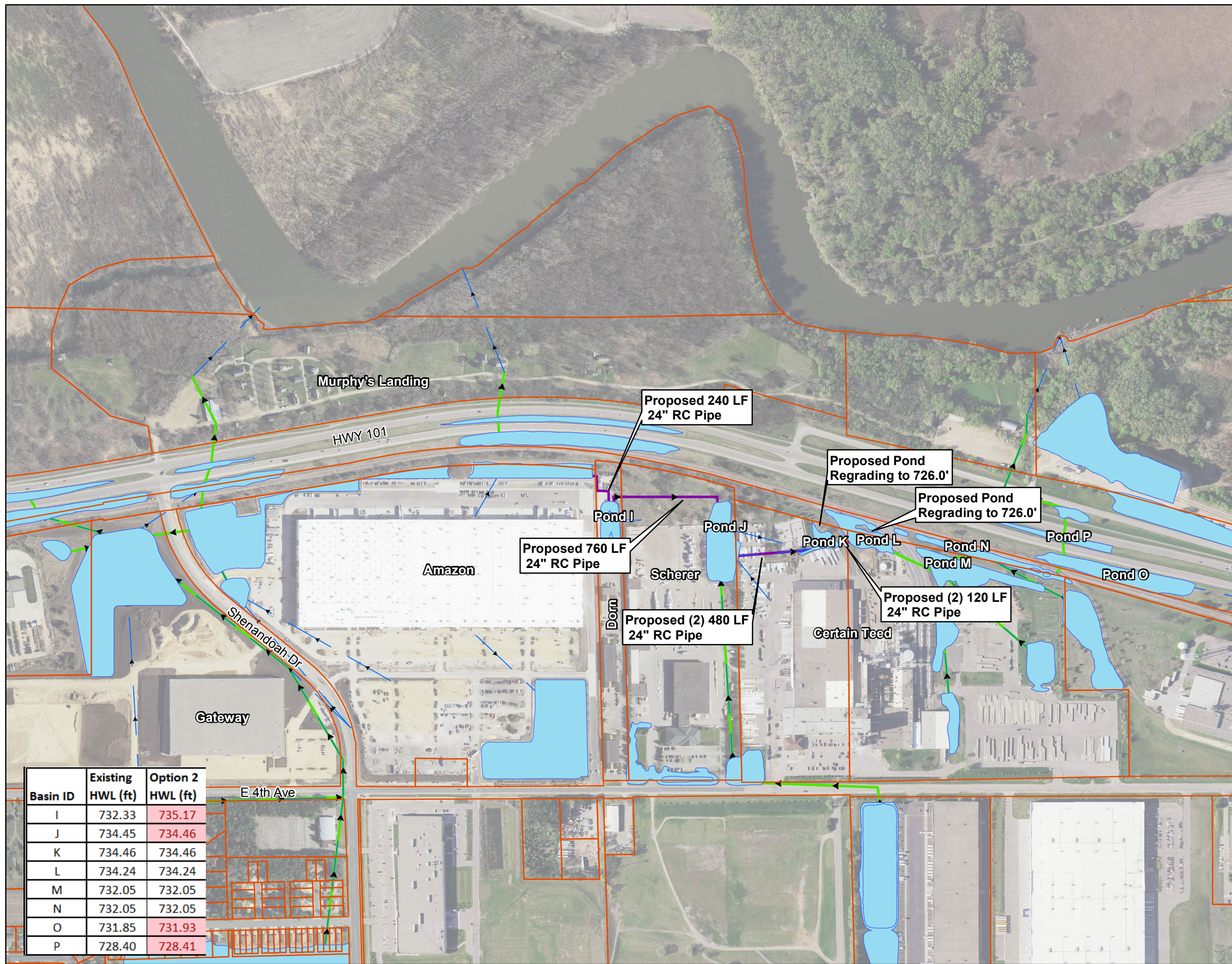




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Figure 5 - Proposed Option 2

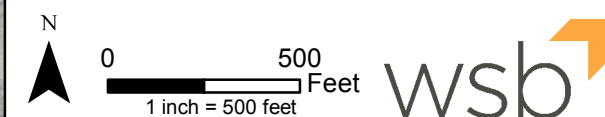
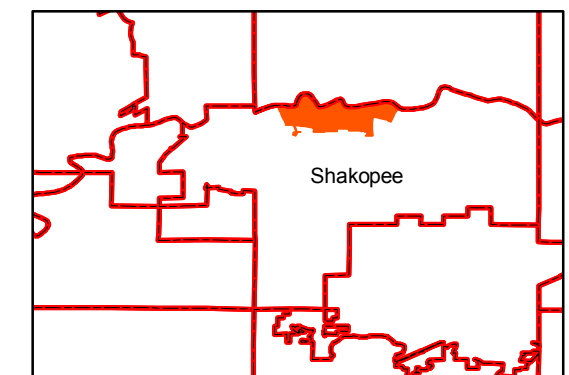
Feasibility Report - Rerouting of Stormwater to Protect Historic Sites
City of Shakopee



Legend

- Proposed Storm Sewer
- Existing Storm Sewer
- Overland Flow Paths
- Proposed Ponding Limits
- Property Boundaries

Basin ID	Existing HWL (ft)	Option 2 HWL (ft)
I	732.33	735.17
J	734.45	734.46
K	734.46	734.46
L	734.24	734.24
M	732.05	732.05
N	732.05	732.05
O	731.85	731.93
P	728.40	728.41

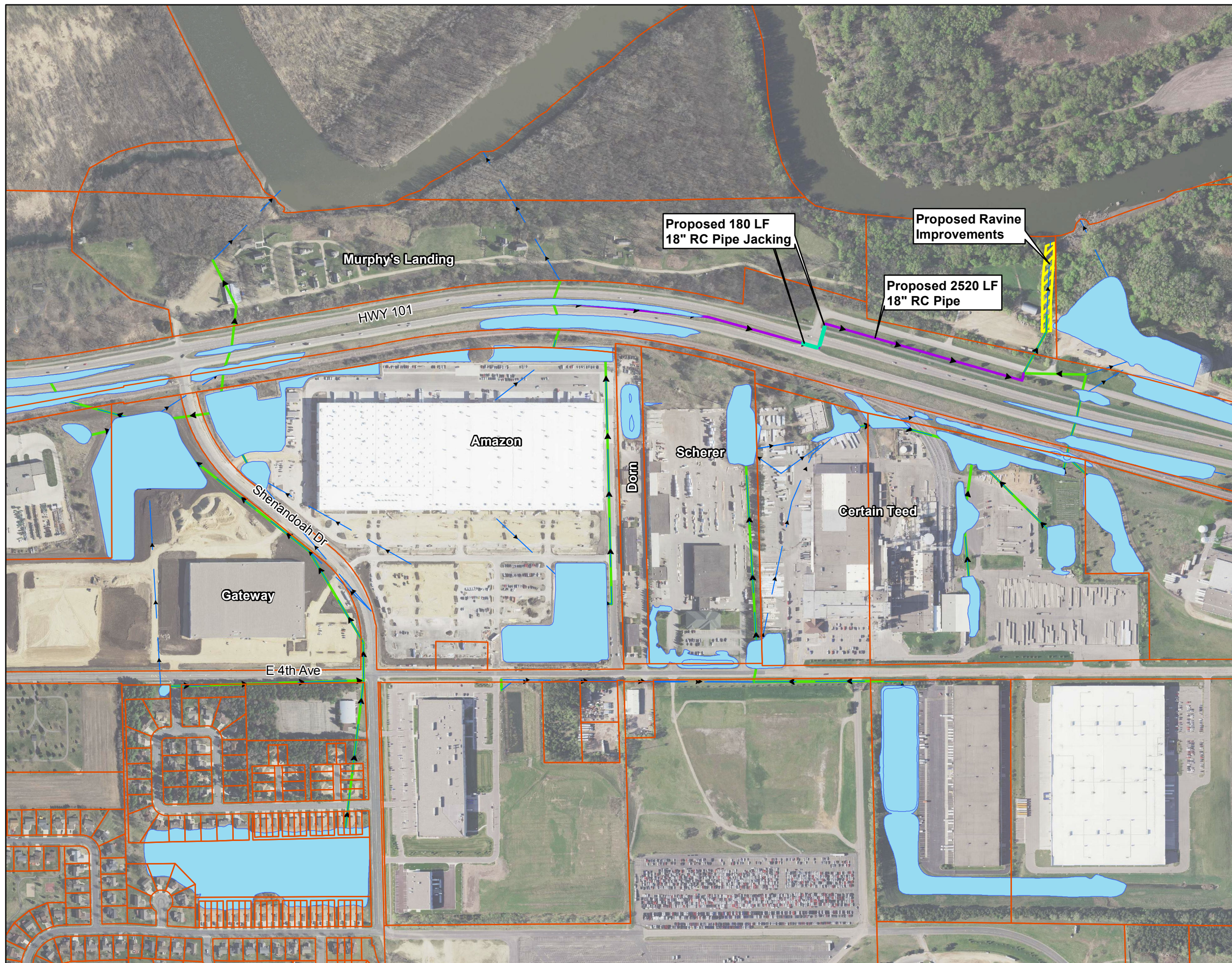




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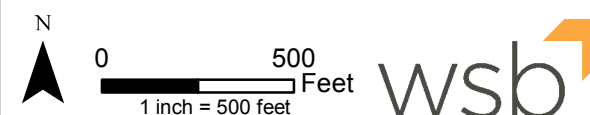
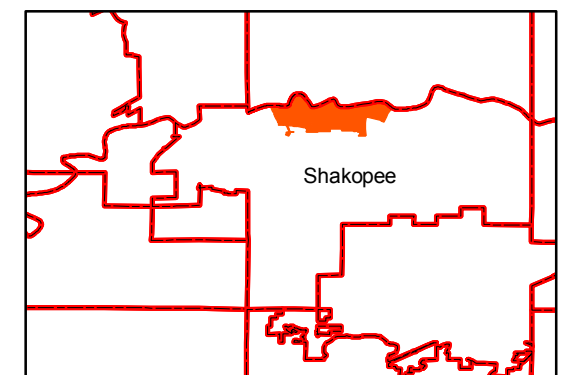
Figure 6- Proposed Option 3

Feasibility Report - Rerouting of Stormwater to Protect Historic Sites
City of Shakopee



Legend

- Proposed Storm Sewer
- Existing Storm Sewer
- Overland Flow Paths
- Proposed Pipe Jack
- Existing Ponding Limits
- Proposed Ravine Improvements
- Property Boundaries



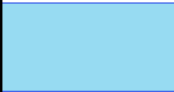

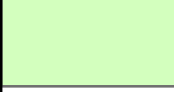




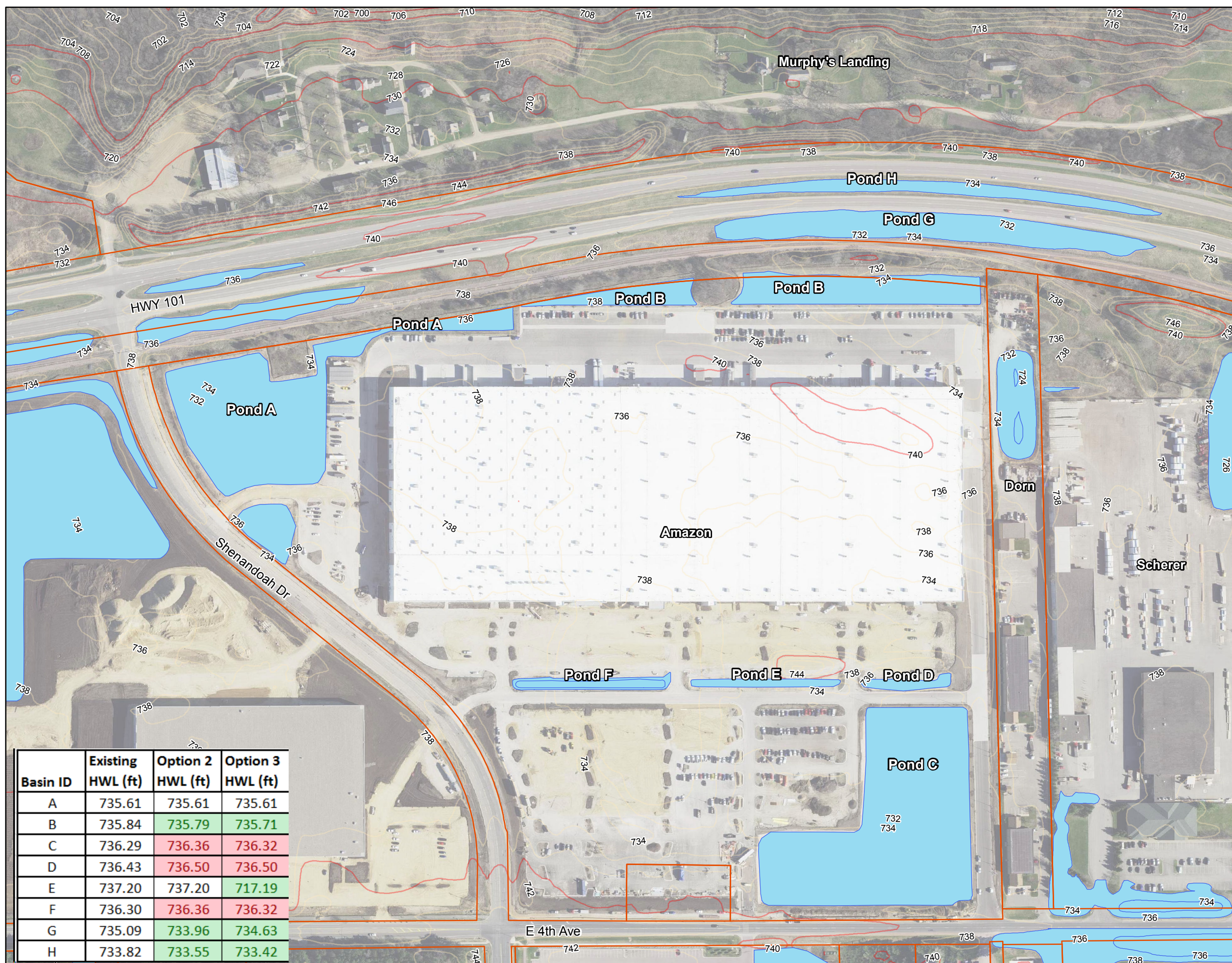
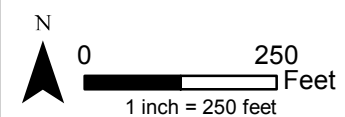
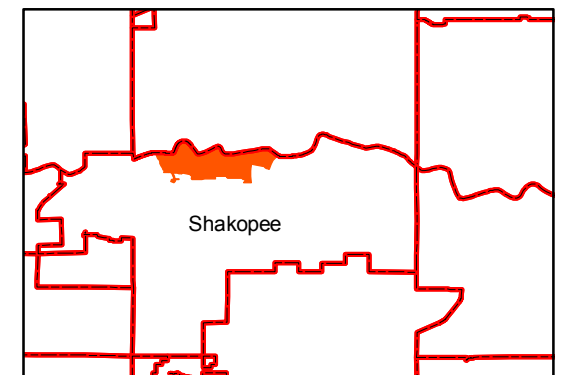
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Figure 7- Modeled Pond Basin 100-Year High Water Levels

Feasibility Report - Rerouting of Stormwater to Protect Historic Sites
City of Shakopee

Legend

	Existing Pond Limits
	Property Boundaries
Table Legend	
	High Water Level Decrease
	High Water Level Increase
	No Impact on High Water Level



Basin ID	Existing HWL (ft)	Option 2 HWL (ft)	Option 3 HWL (ft)
A	735.61	735.61	735.61
B	735.84	735.79	735.71
C	736.29	736.36	736.32
D	736.43	736.50	736.50
E	737.20	737.20	717.19
F	736.30	736.36	736.32
G	735.09	733.96	734.63
H	733.82	733.55	733.42

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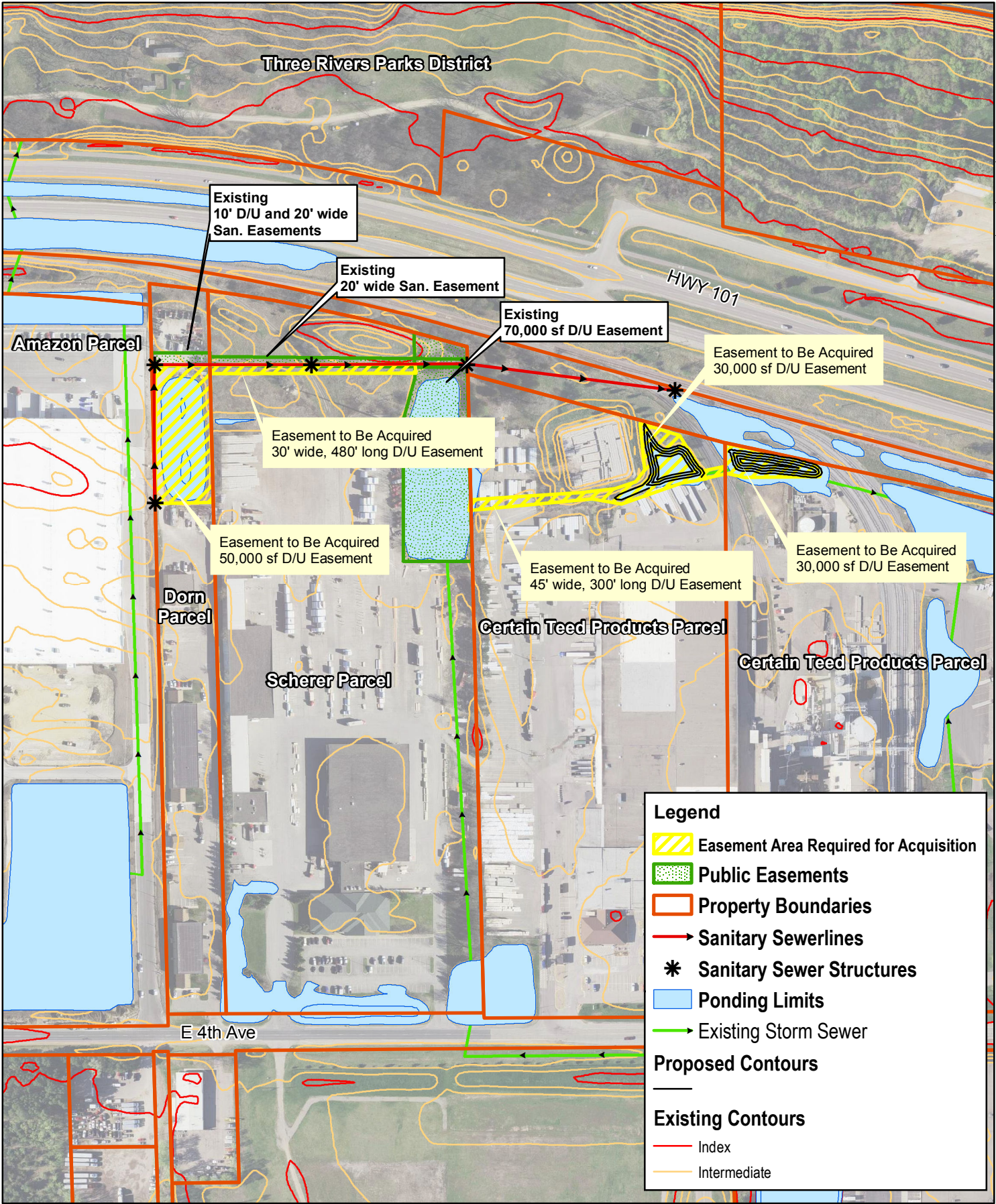
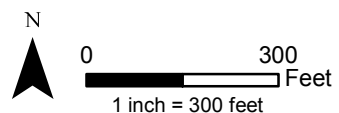


Figure 8 -Option 2 Easements Exhibit

Feasibility Report - Rerouting of Stormwater to Protect Historic Sites
City of Shakopee



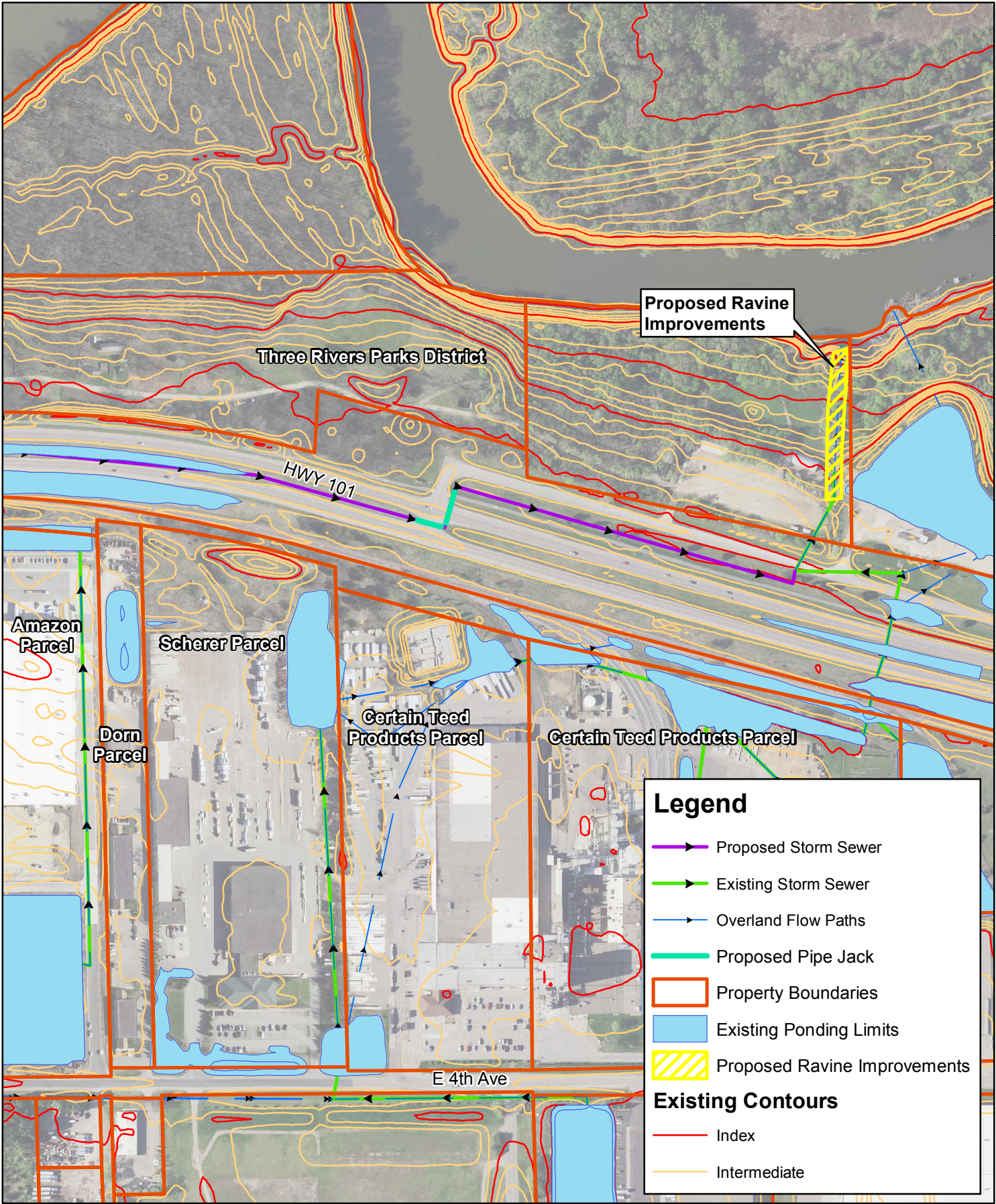
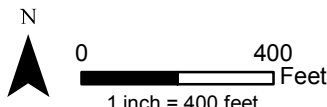


Figure 9 -Option 3 Easements Exhibit

Feasibility Report - Rerouting of Stormwater to Protect Historic Sites
City of Shakopee



Appendix B

DETAILED COST ESTIMATES

Option 1 - West Conveyance to Sarazin Pond

Item	Estimated Quantity	Unit	Unit Price	Estimated Price
Mobilization	1	LS	\$30,000	\$30,000
Traffic Control	1	LS	\$15,000	\$15,000
Erosion Control	1	LS	\$18,000	\$18,000
Rock Excavation	9590	CY	\$64	\$609,924
Common Excavation	8930	CY	\$21	\$189,316
24" RC Pipe	4850	LF	\$74	\$359,870
24" Pipe Casing	20	LF	\$400	\$8,000
24" RC Pipe Apron	34	EA	\$750	\$25,500
24" Trash Guard	34	EA	\$750	\$25,500
Parking Lot Repair	1	LS	\$40,000	\$40,000
City Road Repair	1	LS	\$30,000	\$30,000
Curb and Gutter	490	LF	\$25	\$12,250
Connect to DrainTile	3	EA	\$500	\$1,500
DrainTile Repair	5	EA	\$500	\$2,500
Pond Fabric Repair	6410	SY	\$5	\$32,050
Railroad Restoration	1	LS	\$20,000	\$20,000
Sarazin Pond Restoration	620	SY	\$10	\$6,200
Outlet Control Structure	4	EA	\$8,000	\$32,000
Restoration	4.6	AC	\$6,000	\$27,600
Topsoil	1830	CY	\$32	\$58,194
Amazon Easement Acquisition*	51530	SF	\$0	\$0
Gateway Easement Acquisition	19260	SF	\$4	\$77,425
SPUC Easement Acquisition*	9410	SF	\$0	\$0
Union Pacific Easement Acquisition*	2400	SF	\$0	\$0
Archeological Clearance	1	LS	\$45,000	\$45,000
				\$1,666,000
Subtotal				\$334,000
20% Indirect Costs				\$2,000,000
Grand Total				

*The City believes these easements will be granted at no cost based on their relationships with the entities

Option 2 - Outlet Alignment using Existing Systems to East

Item	Estimated Quantity	Unit	Unit Price	Estimated Price
Mobilization	1	LS	\$30,000	\$30,000
Clearing and Grubbing	1.9	AC	\$4,272	\$8,116
Rock Excavation	4200	CY	\$64	\$267,120
Common Excavation	3700	CY	\$21	\$78,440
Traffic Control	1	LS	\$8,533	\$8,533
Erosion Control	1	LS	\$18,285	\$18,285
24" RC Pipe	2200	LF	\$74	\$163,240
24" RC Pipe Apron	8	EA	\$912	\$7,293
24" Trash Guard	8	EA	\$912	\$7,293
48" Diameter MH	52.5	LF	\$424	\$22,260
Casting Assembly	7	EA	\$912	\$6,381
Riprap	50	CY	\$127	\$6,360
Geotextile Fabric	100	SY	\$11	\$1,060
Restoration	1.9	AC	\$3,053	\$5,800
Parking Lot Repair	1	LS	\$21,338	\$21,338
Railroad Removal and Replace	1	LS	\$18,285	\$18,285
Topsoil	250	CY	\$32	\$7,950
Drainage Easement Acquisition	1	LS	\$188,000	\$188,000
Archeological Clearance	1	LS	\$45,000	\$45,000
Subtotal				\$910,754
20% Indirect Costs				\$182,151
Grand Total				\$1,093,000

Option 2 Easement information

Cost information

Amazon Land Value	10,000,000
calculated acres	66.078
\$/sq ft	\$ 3.47
Sq of easement required	3500
Total cost of land	\$ 12,159.71
Total Cost of easement (25%)	\$ 3,100.00

Dorn Properties Parcel Land Value	1,650,000
calculated acres	5.29
\$/sq ft	\$ 7.16
Sq of easement required	53000
Total cost of land	\$ 379,503.92
Total Cost of easement (25%)	\$ 94,900.00

Sherer L.P. Parcel Land Value	3,930,000
calculated acres	22.43
\$/sq ft	\$ 4.02
Sq of easement required	15300
Total cost of land	\$ 61,541.32
Total Cost of easement (25%)	\$ 15,400.00

Certainteed Corp Parcel 1 Land Value	3,500,000
calculated acres	19.06
\$/sq ft	\$ 4.22
Sq of easement required	41300
Total cost of land	\$ 174,103.43
Total Cost of easement (25%)	\$ 43,600.00

Certainteed Corp Parcel 2 Land Value	6,000,000
calculated acres	35.34
\$/sq ft	\$ 3.90
Sq of easement required	31800
Total cost of land	\$ 123,943.56
Total Cost of easement (25%)	\$ 31,000.00

Total Cost	\$ 188,000.00
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Option 3 - Pipe Conveyance

Item	Estimated Quantity	Unit	Unit Price	Estimated Price
Mobilization	1	LS	\$30,000	\$30,000
Clearing and Grubbing	1.8	AC	\$4,272	\$7,689
Traffic Control	1	LS	\$18,285	\$18,285
Erosion Control	1	LS	\$18,285	\$18,285
Rock Excavation	5800	CY	\$64	\$368,880
Common Excavation	1200	CY	\$21	\$25,440
18" RC Pipe	2520	LF	\$64	\$160,272
18" RC Pipe Jack	180	LF	\$488	\$87,768
18" RC Pipe Apron	2	EA	\$912	\$1,823
18" Trash Guard	2	EA	\$912	\$1,823
48" Diameter MH	60	LF	\$424	\$25,440
Casting Assembly	8	EA	\$912	\$7,293
Riprap	50	CY	\$127	\$6,360
Geotextile Fabric	100	SY	\$11	\$1,060
Restoration	1.8	AC	\$3,053	\$5,495
Topsoil	275	CY	\$32	\$8,745
Ravine Stabilization	1	LS	\$200,000	\$200,000
Archeological Clearance	1	LS	\$45,000	\$45,000

Subtotal	\$1,019,658
20% Indirect Costs	\$203,932
Grand Total	\$1,224,000

Appendix C

OPTION 3 MODEL RESULTS

Discharge Through Three Rivers Park

Peak Flow* (Atlas-14)			
Rainfall Event	Existing Flow (cfs)	Proposed Flow (cfs)	Peak Flow Reduction (cfs)
2-year	7.6	2.5	5.1
10-year	11.9	8.5	3.5
100-year	18.6	16.2	2.4

Discharge Volume* (Atlas-14)			
Rainfall Event	Existing Discharge Volume (ac-ft)	Proposed Discharge Volume (ac-ft)	Discharge Volume Reduction (ac-ft)
2-year	6.17	0.48	5.69
10-year	11.33	3.18	8.14
100-year	25.98	11.79	14.19

*This includes all drainage areas tributary to the Three Rivers Park point of discharge
