CENTENNIAL LAKES PEDESTRIAN BRIDGE CONCEPT DESIGN STUDY

City of Edina
Parks and Recreation Department
December 2, 2015

AECOM
800 LaSalle Avenue
Minneapolis, MN 55402

I. Introduction

The following report was prepared for the City of Edina to explore potential concepts and feasibility of the replacement of two existing steel pedestrian bridges located within Centennial Lakes Park. The existing bridges have identical construction and provide crossings of the central pond system within the park. The existing bridges include twelve steps on each side of a short deck and present difficult access for able bodied park patrons and do not provide severely limited access (or no for patrons with mobility disabilities or bikes/strollers to transit between east and west activity centers in the park. The existing bridges also present a barrier to park maintenance equipment which results in additional staff and equipment time to transit around the pond system from the central maintenance facility.

This report is organized as follows:

- Project Introduction
- Concept Development Discussion
  - Bridget Structure Type and Materials
  - Bridge Approach Improvements
  - Bridge Façade Options
  - Bridge Railing Options
- Estimated Cost
- Summary and Next Steps

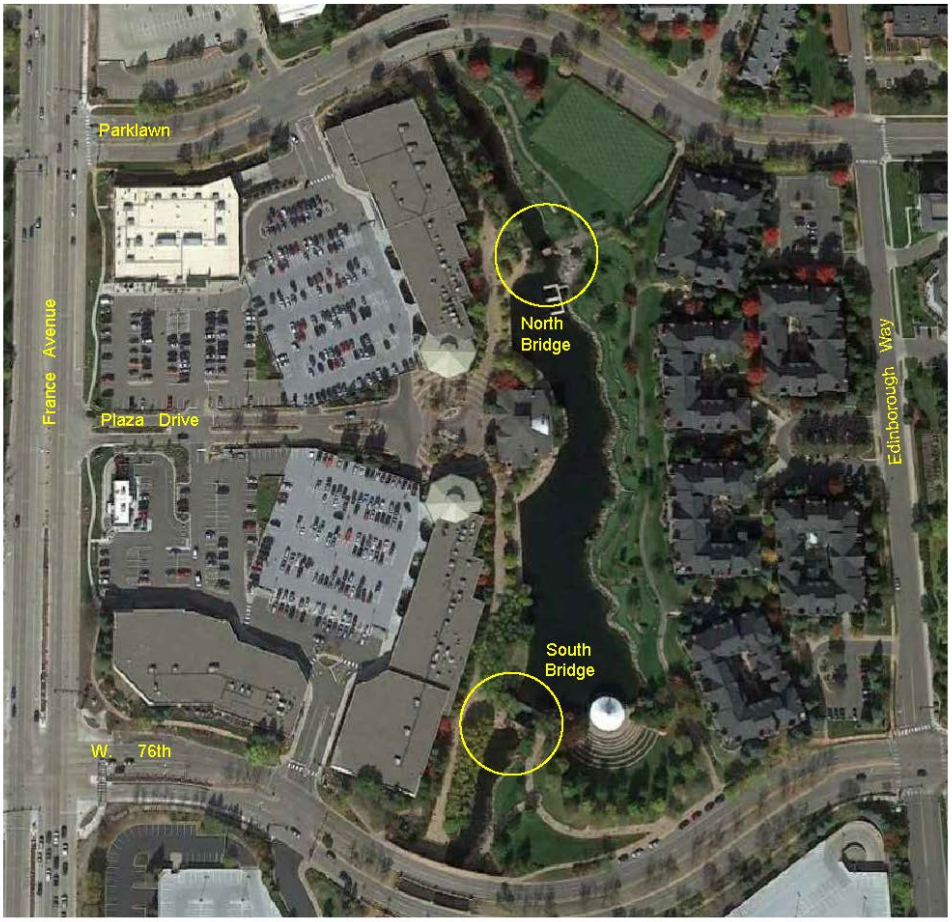


Figure 1 – Project Location Map

The City had previously authorized a study (January 2014) to develop a scope of work and costs to rehabilitate the existing steel bridges. Per the January 2014 report, the primary bridge structural elements are classified as fair to good condition however the several stair treads and the top surface decks are exhibiting a significant amount of surface deterioration and were recommended to be replaced. The January 2014 report estimated construction cost was $54,900 (2014 dollars). This estimated construction cost translates to a total project cost (including 30% engineering and administration costs) of approximately $80,000 (2016 dollars).

Figure 2 – View of Existing North Bridge (Looking North)

Given the substantial investment noted to maintain the existing bridges with no improvement to the access constraints the City requested AECOM to develop new bridge concepts and estimated costs to provide crossings that meet current ADA requirements versus expending funds on maintenance. Concerns related to the existing bridges include:

Non accessibility due to steps on bridges (elderly, strollers, wheelchairs, young children)
Concrete surfaces are slippery in winter conditions
Snow removal is difficult and labor intensive with steps (mechanized equipment cannot be used)
Lighting maintenance is labor intensive and parts are no longer in production

II. Concept Development Discussion

AECOM considered the following guiding principles in the development of new bridge concepts:

Improve overall accessibility through reduction or elimination of stairs
Deck surface that is more slip resistant
Bridge lighting utilizing LED fixtures
Bridge aesthetic should complement park amenities
Bridge construction should minimize impacts to existing landscape/hardscape
Bridge should provide adequate clearance for pond channel
Bridge should be approximately 8 feet wide
Bridge capital cost should be reasonable
Bridge maintenance cost should be minimized

A. Bridge Structure Type and Materials

The general structural bridge type evaluated is the deck arch. This structure type is the most appropriate for the crossing as it provides for sloping approaches and is provides a pleasant aesthetic similar to the roadway bridges that cross the pond.

Three potential structure material options were evaluated from cost and constructability perspective. The following is a synopsis of the attributes of each considered:

1) Cast-in Place Concrete
   a) Requires temporary falsework and would require closing of the channel during construction which would conflict with peak recreation season.
   b) Thin depth at top of bridge (6”) results in least amount of approach trail reconstruction.
   c) Highest volume of concrete to be transported to the site which could result in higher costs if pumping was required or damage to existing sidewalks from trucks.
   d) Highest cost option.
2) Precast Concrete
   a) Installation would require minimal disruption to recreation activities on pond.
   b) Structure depth at top of bridge approximately 12” which results in longer approach ramps (10 feet longer than Cast in Place).
   c) Installation requires large crane due to heavy structural elements – this could result in damage to existing plaza pavements and additional costs.
   d) Medium - high cost option.
3) Structural Plate Arch
   a) Installation would require minimal disruption to recreation activities on pond.
   b) Structure depth at top of bridge approximately 12” which results in longer approach ramps (10 feet longer than Cast in Place).
   c) Installation requires relatively small equipment due to light weight of structural elements – minimal potential damage to existing plaza pavement.
   d) Lowest cost option.

Based on the attributes of the three options the preferred bridge structure material is the Steel Plate Arch due to the ease of construction, limited impact on existing park plazas and relatively low cost..

B. Bridge Approaches

Limits of reconstruction of approach walks to the bridges were determined based on the following criteria:

1. Provide 7.5 feet of clearance for Zamboni ice preparation machine

2. Provide maximum of 5% profile grades from top of bridge to match points on either side of bridge to achieve ADA compliance.

3. Provide 2% profile grades at landing locations along approach walks to achieve ADA compliance.

4. Maintain existing connections to activity centers or trails on bridge approaches. The use of stairs to achieve cross connections is allowed.

5. Maximize use of natural landscaping vs. formal retaining walls on bridge approaches.

Figures 3 and 4 on the following pages illustrate the anticipated limits of construction associated with achieving ADA compliance on each of the bridge approaches. The North Bridge would require reconstruction of walks to a point approximately 70 feet east of the bridge and 90 feet west of the bridge. The South Bridge would require reconstruction of approximately 100 linear feet sidewalk on the east approaches to the bridge and construction of approximately 100 feet of approach walk on the west side of the bridge. Both concepts result in more landscape area than existing on bridge approaches to assist with the necessary grade change between the higher walk and existing park features. Figures 2 and 3 illustrate the anticipated limits of construction associated with achieving ADA compliance on each of the bridge approaches.

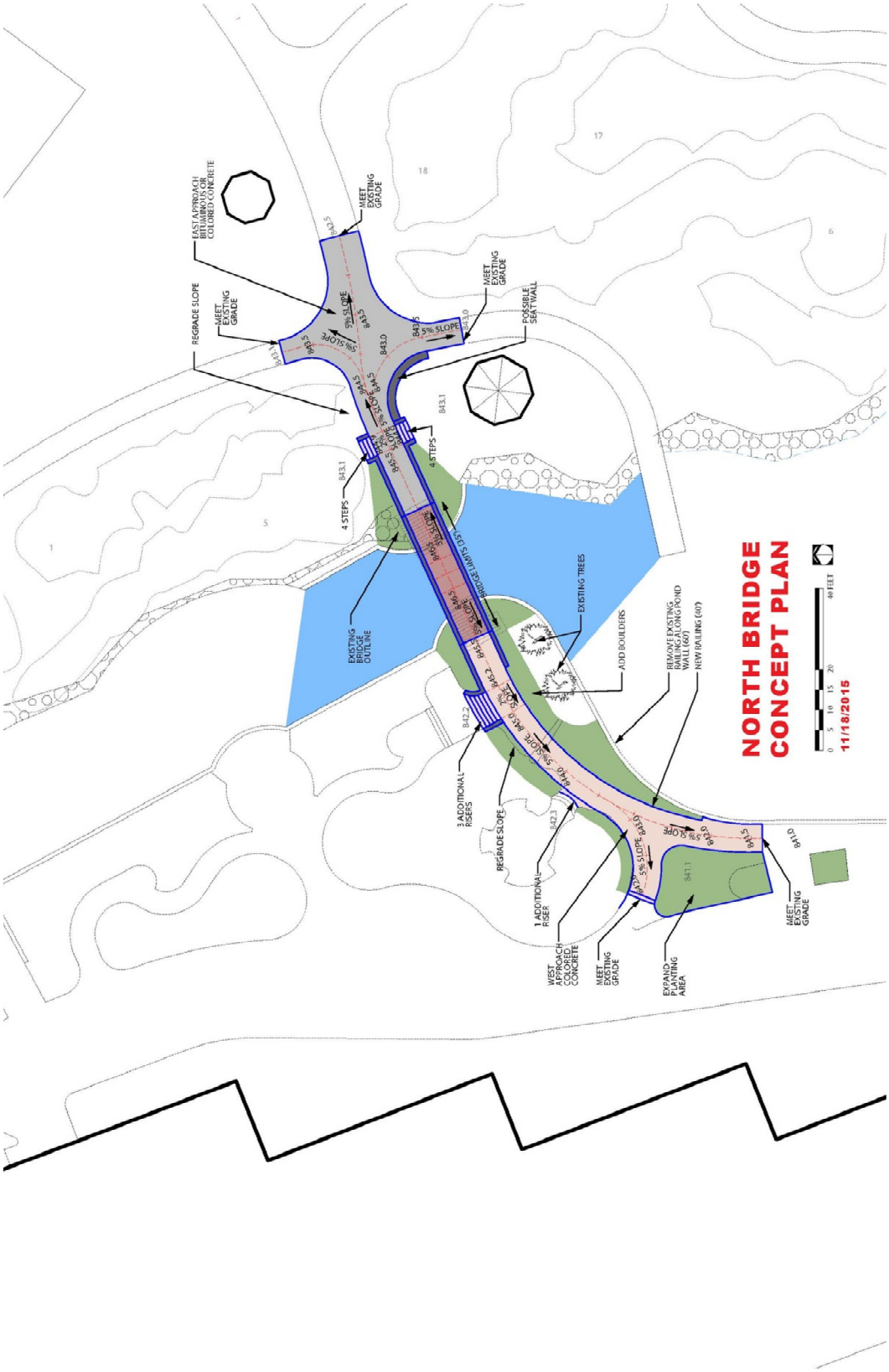


Figure 3 – North Bridge Concept Layout

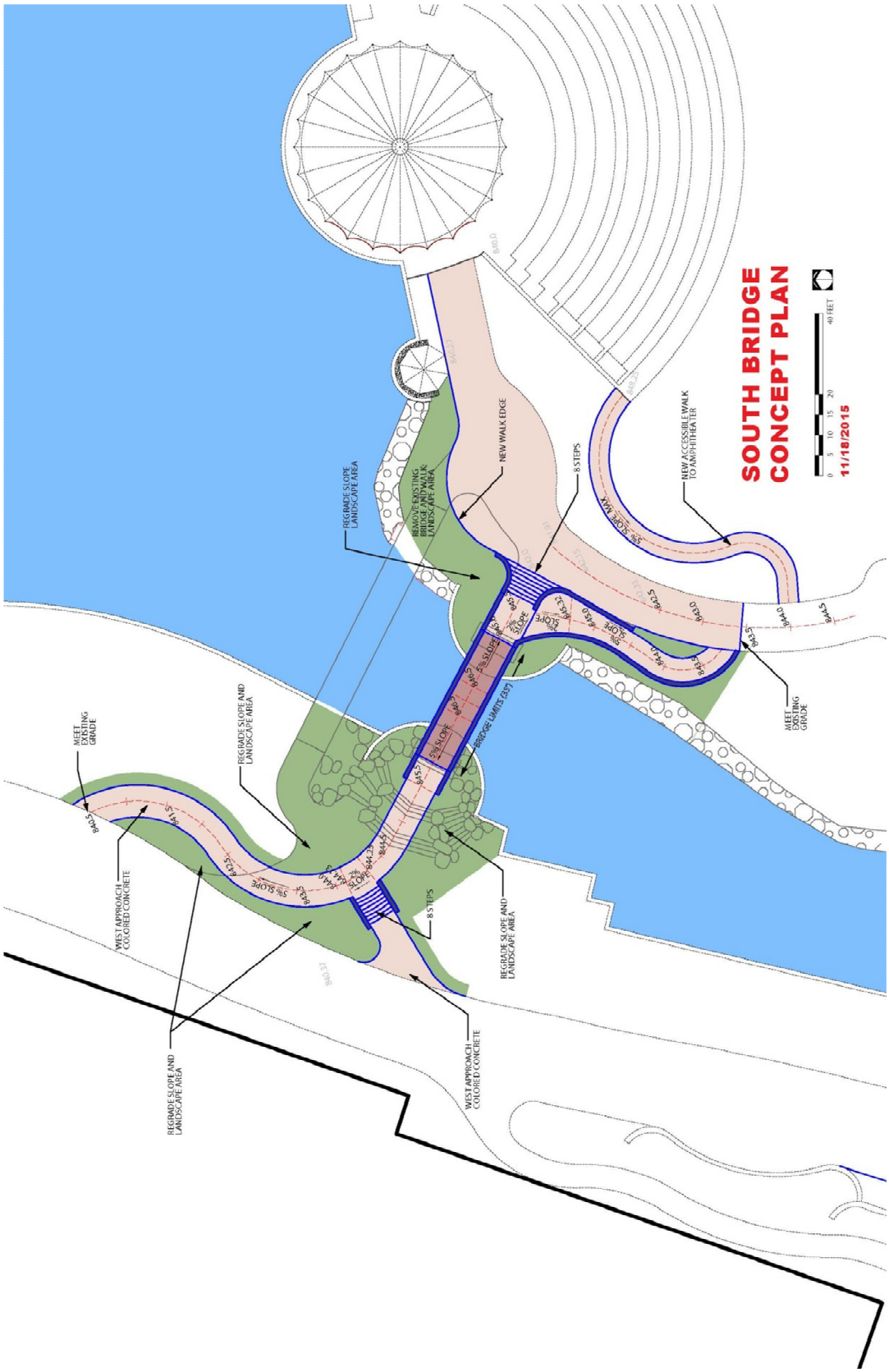


Figure 4 South Bridge Concept Layout

C. Bridge Façade Design Options

The proposed bridges will include a concrete headwall/façade which could be constructed by precast or cast in place type construction. The shape of the headwall is defined by the trail grade along the top and the steel arch shape on the bottom. The headwall façade finish is the primary aesthetic element of the bridge due to its visibility from other areas of the park as well as boaters on the pond. The potential concrete headwall finishes include the following:

1. Smooth colored concrete (either integrally colored or painted/stained). This option could be designed to match with existing pond and bridge walls. This style is illustrated in Option 1 and 2 below.
2. Concrete formliner patterns with single or multi colored finishes. Options 3, 4 and 5 illustrate potential formliner patterns that could be incorporated into the bridge.
3. Natural stone façade placed on concrete headwall. Options 3, 4 or 5 could be constructed with natural stone in lieu of formliner and colored finishes.

Option 1 Colored concrete to match existing pond walls with 4" parapet.

Option 2 Plain concrete with no parapet.

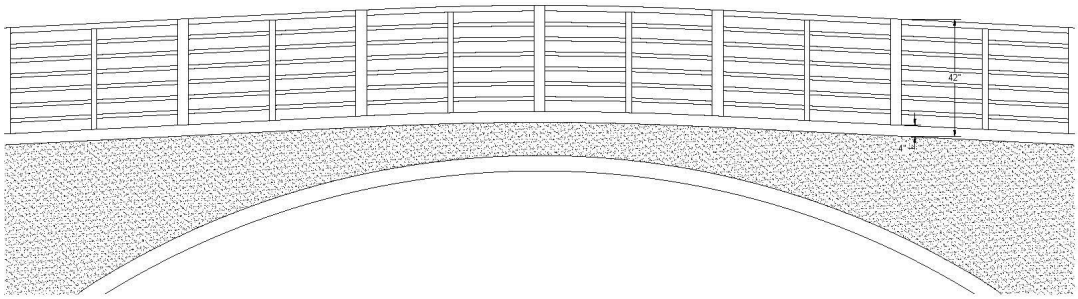
Option 3 Cobblestone formliner, painted, with 6" parapet.

Option 4 Dry-stacked formliner, painted, with 6" parapet.

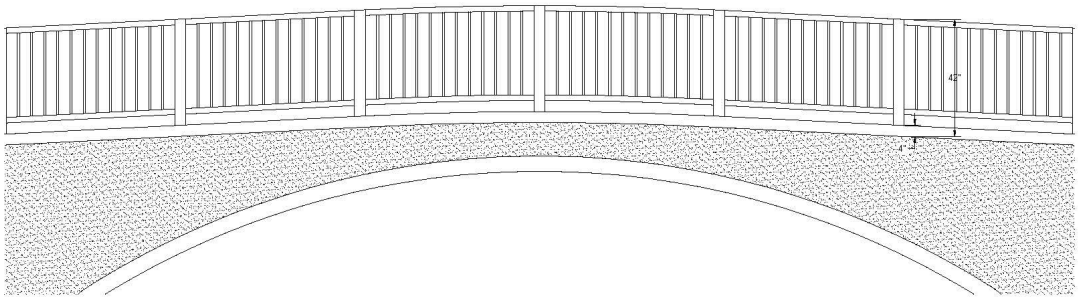
Option 5 Limestone formliner, painted, with 6" parapet.

D. Railing Design

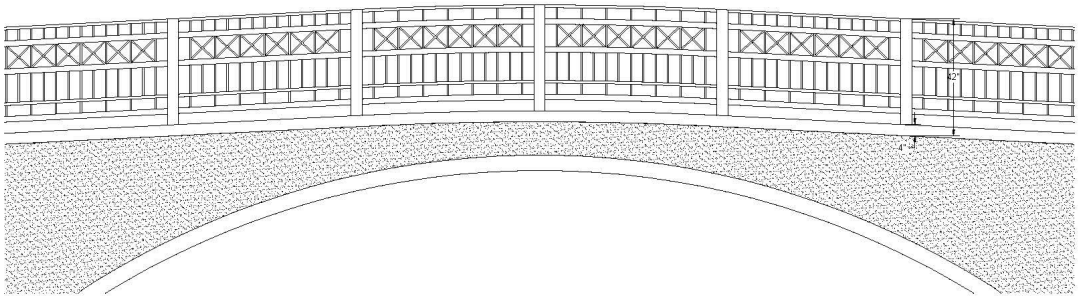
The proposed bridges will require metal handrails to a height of 42” above the deck. The railings will extend beyond the bridge as required to provide for safety. Use of landscaped slopes to the extent possible will reduce the need for railings beyond the bridge decks. Three general railing styles are illustrated in Figure 6 below:



HORIZONTAL RAILS (4" PARAPET)



VERTICAL PICKETS (4" PARAPET)



RAILING IN THE STYLE OF EXISTING BRIDGE RAILINGS (4" PARAPET)

PEDESTRIAN BRIDGE RAILING OPTIONS

Figure 6 – Railing Options

III. Estimated Construction Cost

We have prepared budget cost estimates for each bridge. The estimates are based on using steel arch design and the approach improvements as illustrated in Figures 3 and 4. The actual bridge related costs are approximately 40% of the overall cost, with approach related improvements representing approximately 60% of the overall cost. The estimates include allowances for landscape restoration (boulders, trees, shrubs and turf) as well as a $5,000 allowance for accent lighting of the bridge. The cost estimates are based on formliner type finish options. Using natural stone in lieu of formliner would add approximately $25,000 to $30,000 to the project cost. The following is a summary of the project cost. More detailed cost estimates are included in the appendix to the report.

North Bridge Construction Cost	$250,000
South Bridge Construction Cost	$290,000
Subtotal Construction Cost	$540,000
Contingency (20%)	$110,000
Subtotal Construction + Contingency	$650,000
Engineering and Administration Cost	$170,000
Total Estimated Project Cost	**$820,000***

*Does not include estimated premium for natural stone finish ($25,000-$30,000)

IV. Summary and Next Steps

The bridge concepts developed and presented in this report will greatly enhance the connectivity within Centennial Lakes Park between the east and west sides of the pond and channel feature. The proposed bridge and approach improvements meet ADA design requirements and are designed to provide an attractive feature to the existing park landscape. The proposed steel arch bridge structure systems are the most economically feasible, provide for low-impact construction and will result in low maintenance costs to the City over the lifetime of the structures.

The following is a list of actions needed to progress the project.

1) City to determine whether adequate funding is available for the project and authorize final design and bidding of the project.
2) City to provide feedback on design elements including:
    a. Bridge headwall design (smooth concrete, formliner or natural stone)
    b. Bridge railing design
3) Final design and bidding documents to be prepared (approximately 8 weeks)
4) Advertisement and solicitation of construction bids (approximately 6 weeks)
5) Review bids and award bid (4 weeks)
6) Construct project (approximately 16 weeks)

Assuming final design activities are initiated in early January, 2016, the bridges could be designed and bid in the winter/spring of 2016 and construction completed by October, 2016.

Appendix A

Detailed Cost Estimates

ENGINEER'S OPINION OF COST FOR 10% BUDGET LEVEL DESIGN - NORTH BRIDGE
25-Nov-15

	Item	Unit	Unit Price	Quantity	Amount
1	MOBILIZATION	LS	$15,000.00	1.00	$15,000.00
2	BRIDGE REMOVAL (INCLUDING FOOTINGS)	EA	$10,000.00	1.00	$10,000.00
3	PAVEMENT REMOVAL	SF	$2.50	2,000.00	$5,000.00
4	SALVAGE LIGHT	EA	$250.00	1.00	$250.00
5	REMOVE LIGHT BASE	EA	$250.00	1.00	$250.00
6	SALVAGE BOULDER	EA	$100.00	10.00	$1,000.00
7	RESET PAVERS	SF	$5.50	400.00	$2,200.00
8	REMOVE STEPS	SF	$10.00	50.00	$500.00
9	REMOVE HAND RAILING	LF	$50.00	60.00	$3,000.00
10	GRADING (STRIPPING, FOOTING EXCAVATION)	LS	$10,000.00	1.00	$10,000.00
11	BRIDGE FOOTING	CY	$800.00	24.00	$19,200.00
12	BRIDGE STEEL ARCH STRUCTURE	LS	$45,000.00	1.00	$45,000.00
13	BRIDGE CONCRETE HEADWALL	SF	$120.00	180.00	$21,600.00
14	APPROACH RETAINING WALL	SF	$100.00	300.00	$30,000.00
15	NEW BOULDERS	TON	$200.00	20.00	$4,000.00
16	INTEGRALLY COLORED CONCRETE WALK	SF	$12.00	1,800.00	$21,600.00
17	INTEGRALLY COLORED CONCRETE STEPS	SF	$30.00	112.00	$3,360.00
18	HAND RAILING	LF	$100.00	14.00	$1,400.00
19	BRIDGE/RETAINING WALL RAILING	LF	$200.00	160.00	$32,000.00
20	LANDSCAPE ALLOWANCE	LS	$15,000.00	1.00	$15,000.00
21	ACCENT LIGHTING ALLOWANCE	LS	$5,000.00	1.00	$5,000.00
22	INSTALL LIGHT BASE AND SALVAGED LIGHT	EA	$1,500.00	1.00	$1,500.00
	SUBTOTAL CONSTRUCTION COST (rounded)				**$250,000.00**
	20% Contingency				**$50,000.00**
	TOTAL				**$300,000.00**
	ENGINEERING AND ADMINISTRATION COSTS (25%) (rounded)				**$80,000.00**
	TOTAL ESTIMATED PROJECT COST - NORTH BRIDGE				**$380,000.00**

ENGINEER'S OPINION OF COST FOR 10% BUDGET LEVEL DESIGN - SOUTH BRIDGE
25-Nov-15

	Item	Unit	Unit Price	Quantity	Amount
1	MOBILIZATION	LS	$15,000.00	1.00	$15,000.00
2	BRIDGE REMOVAL (INCLUDING FOOTINGS)	EA	$10,000.00	1.00	$10,000.00
3	PAVEMENT REMOVAL	SF	$2.50	2,000.00	$5,000.00
4	SALVAGE LIGHT	EA	$250.00	1.00	$250.00
5	REMOVE LIGHT BASE	EA	$250.00	1.00	$250.00
6	SALVAGE BOULDER	EA	$100.00	20.00	$2,000.00
7	REMOVE STEPS	SF	$10.00	50.00	$500.00
8	REMOVE HAND RAILING	LF	$50.00	65.00	$3,250.00
9	GRADING (STRIPPING, FOOTING EXCAVATION)	LS	$15,000.00	1.00	$15,000.00
10	BRIDGE FOOTING	CY	$800.00	24.00	$19,200.00
11	BRIDGE STEEL ARCH STRUCTURE	LS	$45,000.00	1.00	$45,000.00
12	BRIDGE CONCRETE HEADWALL	SF	$120.00	180.00	$21,600.00
13	APPROACH RETAINING WALL	SF	$100.00	400.00	$40,000.00
14	NEW BOULDERS	TON	$200.00	40.00	$8,000.00
15	INTEGRALLY COLORED CONCRETE WALK	SF	$12.00	3,500.00	$42,000.00
16	INTEGRALLY COLORED CONCRETE STEPS	SF	$30.00	136.00	$4,080.00
17	HAND RAILING	LF	$100.00	50.00	$5,000.00
18	BRIDGE/RETAINING WALL RAILING	LF	$200.00	120.00	$24,000.00
19	LANDSCAPE ALLOWANCE	LS	$20,000.00	1.00	$20,000.00
20	ACCENT LIGHTING ALLOWANCE	LS	$5,000.00	1.00	$5,000.00
21	INSTALL LIGHT BASE AND SALVAGED LIGHT	EA	$1,500.00	1.00	$1,500.00
	SUBTOTAL CONSTRUCTION COST (rounded)				**$290,000.00**
	20% Contingency (rounded)				**$60,000.00**
	TOTAL				**$350,000.00**
	ENGINEERING AND ADMINISTRATION COSTS (25%) (rounded)				**$90,000.00**
	TOTAL ESTIMATED PROJECT COST - SOUTH BRIDGE				**$440,000.00**