CITY OF KNOXVILLE
DRAFT DESIGN PROGRAM
EXECUTIVE REPORT

PEDESTRIAN / BICYCLE BRIDGE
CONCEPTUAL DESIGN PHASE

KNOXVILLE SOUTH WATERFRONT REDEVELOPMENT AREA

TDOT Project PIN No. 113061.00
Federal Project No. TSCP-9TN(2)
State Project No. 47LPLM-FO-038

LAWRIE & ASSOCIATES + WILBUR SMITH ASSOCIATES
+ CRJA + S&ME + SANDERS PACE ARCHITECTURE

SEPTEMBER 2011

Introduction

The following report has been produced as part of the Conceptual Design and Environmental Documentation contract between the City of Knoxville and Lawrie Associates, authorized by the Knoxville City Council in October 2010.

The South Waterfront – University of Tennessee Pedestrian / Bicycle Bridge is a project identified in the adopted 2006 Knoxville South Waterfront Vision Plan. The bridge was included in the Vision Plan to provide connectivity between the South Waterfront and the University of Tennessee as a way to improve access between the north and south sides of the Tennessee River and to stimulate investment and redevelopment interest in the South Waterfront area. The project has required analysis of several complex factors, including evaluation of potential landing areas, minimizing environmental impact, meeting vertical clearance requirements over the river's barge channel, respecting existing structures and utilities, and at all times keeping cost in mind. The overriding goal is to design **and build** a bridge that reflects the quality expected by Knoxvillians in a manner that is feasible and cost effective. There is much more work to be done, and bridge construction is 2-4 years away at the very least.

The bridge project has now progressed to a point where public review is appropriate. The draft Design Program is one product intended to show, at least in summary, the breadth and scope of issues addressed by the City's consultant team thus far. This report will remain a draft until public and Knoxville City Council comments are added.

Two public review sessions have been scheduled: (1) a Public Open House, set for Monday, October 10, 2011, and (2) a Knoxville City Council Workshop, set for Thursday, October 13, 2011.

Review, discussion, and feedback regarding the bridge's Conceptual Design will focus on the following information that will be presented at the Public Open House, on the City's South Waterfront Website, and at the City Council Workshop:

- Draft Design Program
- Recommended Conceptual Design for the Bridge Structure, South Landing, and North Landing
- Display of Alternatives Considered as Part of the Design Process
- Recommended Project Boundaries Needed for Formal Submittal of Environmental Review Applications
- Preliminary Estimate of Probable Cost

The purpose of the City Council Workshop on October 13th will be to assess the recommended Conceptual Design for the bridge, and to receive consensus on moving forward into a more detailed Design Development phase.

Public comments are welcomed regarding the bridge project. Written comments may be mailed to Dave Hill, South Waterfront Dept., 400 Main Street, Rm. 503, Knoxville, TN 37902, or via e-mail to dhill@cityofknoxville.org.

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PEDESTRIAN / BICYCLE BRIDGE
KNOXVILLE SOUTH WATERFRONT REDEVELOPMENT AREA

1.0 EXECUTIVE SUMMARY

The proposed Pedestrian / Bicycle Bridge will connect the Knoxville South Waterfront Redevelopment Area and the north waterfront, in the vicinity of the University of Tennessee. This project has many challenges that must be considered, these include:

Functional

- Creating functional and economic development linkages to the South Waterfront Redevelopment Area and the UT campus (students, faculty, and visitors)
- Expanding the pedestrian / bicycle network, connecting existing greenways, Volunteer Landing, and the planned South Waterfront Riverwalk
- Providing a safe environment for the users
- Providing universal accessibility
- Addressing Environmental Issues
- Providing required clearances: Tennessee River Barge Channel, Neyland Drive and Gulf & Ohio RR
- Addressing the utilities
- Minimizing property acquisitions

Aesthetic

- Providing an iconic design element visible throughout the waterfront viewshed
- Aesthetically addressing the north and south landings, which requires accommodation of a large vertical gap between the bridge deck and the at-grade elevations.

While addressing the above challenges, the project must also focus on aesthetics, technical excellence, long-term and short-term durability, and economics.

Interviews were held with many local stakeholders:

- City of Knoxville Officials
- South Waterfront Working Group
- Transportation Planning Organization Staff
- University of Tennessee Officials
- South Waterfront Property Owners
- Environmental and Project Regulators (TDOT, USACE, TVA, and TDEC)
- Gulf & Ohio Railroad Representatives
- Members of the general public

The site conditions and initial findings are shown in Exhibit 1, Summary Analysis

2.0 EXISTING CONDITIONS

2.1 Location

The proposed bridge connects the South Waterfront Redevelopment Area with the north waterfront area, in the vicinity of the University of Tennessee. Exhibit 2 shows the study area, and the two preferred alignments in red. The south landing is at Clancy Avenue for both alignments. The north landing will be in the vicinity of the pedestrian concourse between Thompson-Boling Arena and the Pratt Pavilion or at Lake Loudoun Boulevard. Aesthetically, the bridge must complement the family of nearby historic bridges (Henley Street Bridge and Gay Street Bridge), the nearby downtown buildings, and the University of Tennessee campus, yet be designed to speak to its own time.

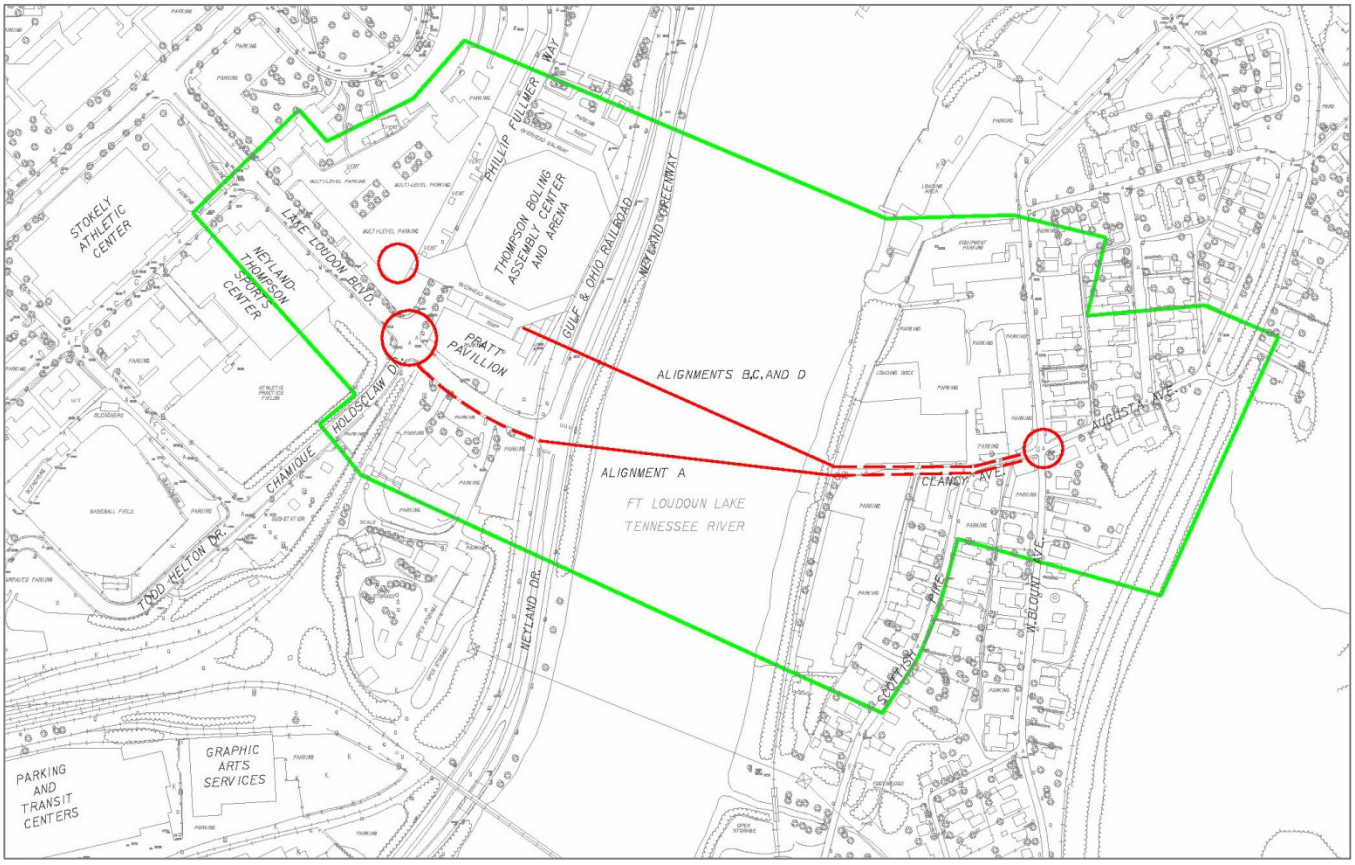


Exhibit 2: Preferred Alignments of Proposed Bridge

The proposed bridge must provide the following minimum clearance envelopes:

<u>Neyland Drive:</u> 18-ft (vertical) and 30-ft (horizontal from edge of closest traffic lane)

<u>Gulf & Ohio Railroad:</u> 25-ft (vertical) and 25-ft (horizontal from center line of track to front face of pier)

<u>Tennessee River Barge Channel:</u> 60-ft (vertical above the 813.5 mean summer pool elevation of the Tennessee River) and 300-ft (horizontal)

2.2 Utilities

There is significant existing utility infrastructure in the project area. The concepts will be developed with an expectation of minimizing utility impacts and responsibly mitigating impacts that are unavoidable. The south landing appears to be in unavoidable conflict with a 12" sanitary sewer; the likely solution being to relocate a section of that sanitary line.

In the vicinity of the north landing there are several utilities which must be factored into the design process: a 78" sanitary line, a 30" water line, a 36" storm drain running perpendicular to Neyland Drive from the river into the UT campus, the G&O Railroad, underground electric, overhead electric, and communications facilities.

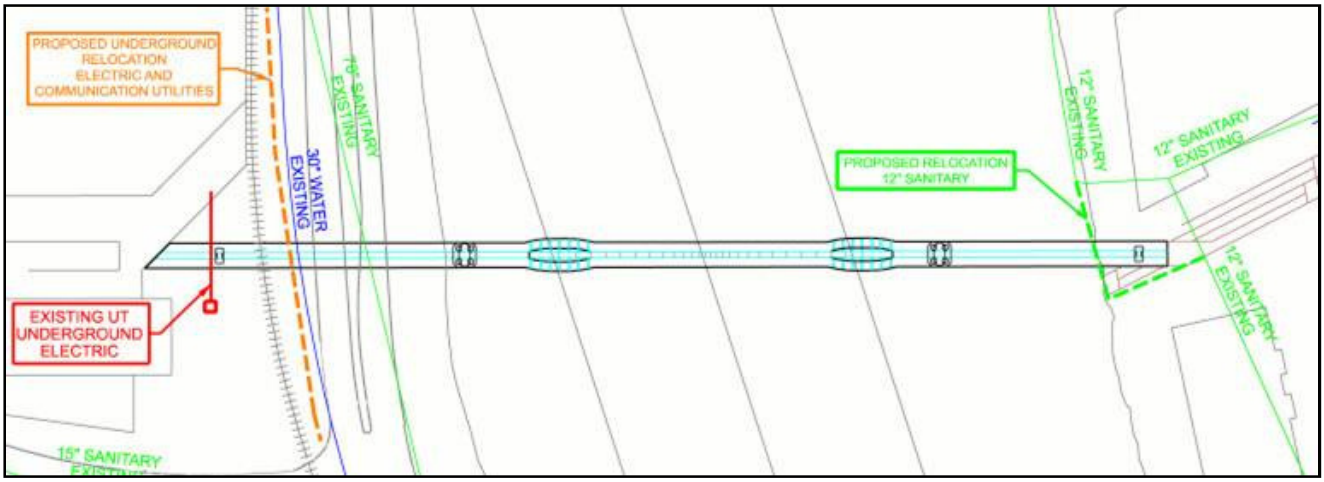


Exhibit 3: Location of Existing Utilities

2.3 Pedestrian and Bicycle Access Needs and Safety

There is an existing network of trails for pedestrians and bicyclists, including Neyland Greenway and the network of walkways on the UT campus. There are also numerous proposed trails, including the Riverwalk in South Knoxville. The City's accepted standards for multi-use trails is 10-ft, but since the bridge connects to the campus and the greater network of paths and greenways, a higher volume of pedestrians and bicyclists is anticipated, and therefore, an increased width may be required. Connections between the bridge and the existing and future network of paths need to be seamless. Options for connections include at-grade extensions, ramps (switchback, elliptical, and spiral) and towers.

2.4 Environmental Documentation & Permitting Process

There are significant environmental considerations. The regulatory process will begin with the submission of a *Purpose and Need Statement* to TDOT, who will act as the lead agency for coordination of the environmental document. It is anticipated that the project will be eligible for Categorical Exclusion (CE). In the early stages of the project, the "Area of Potential Effect" (APE) will be determined based on a "worst-case" footprint of the project. TVA will review the flowage easement and right-of-way issues to determine the permits and easements that will be required. The Tennessee Department of Environment and Conservation (TDEC) may require an individual Aquatic Resources Alteration Permit (ARAP) if PCBs are encountered during the sediment sampling of the river.

3.0 INTERVIEWS HELD

A series of interviews and informal discussions have been completed as part of the Program Development process. Its purpose was to give the design team a more in-depth understanding of the project vision and goals, opportunities, concerns and constraints from the perspective of stakeholders and others who have been instrumental in developing the project to its current status. This was viewed as a means of establishing the more detailed program elements associated with the established goals and vision for the project.

3.1 Groups and Individuals Interviewed

- City of Knoxville Officials
- South Waterfront Working Group
- Transportation Planning Organization Staff
- University of Tennessee Officials
- South Waterfront Property Owners
- Environmental and Project Regulators (TDOT, USACE, TVA, and TDEC)
- Gulf & Ohio Railroad Representatives
- Members of the general public

3.2 Summary of Comments by each person/group interviewed

City of Knoxville Officials --

- City Councilmen Nick Pavlis, Duane Grieve, and Chris Woodhull
- David Brace, *Deputy Director of Public Works*
- Dave Hill, John Hunter, and Steve King, *City of Knoxville* (numerous informal discussions)

Councilmen Pavlis, Grieve and Woodhull expressed strong support for the project. Councilman Pavlis noted that the project was in his district, and that he would be happy to serve as an advocate for it. All were desirous of significant redevelopment on the south waterfront and felt that the UT connection would be helpful in that regard. There is strong interest in the facility having a "sense of place" and that crossing the bridge would provide a quality experience, a "happening" as it were. The discussion with David Brace primarily related to long term operations and maintenance and design "do's and don'ts." A particular point of emphasis was the type and extent of access for service, maintenance and emergency vehicles. David asked that an operations and maintenance budget be included as a part of the design documentation.

South Waterfront Working Group (SWWG) –

A formal meeting was held with the SW Working Group on November 9, 2010, along with follow-up conversations with several individual members.

The meeting with the SWWG was held at the initiation of the planning phase, during which time the design team was introduced. A PowerPoint presentation was used to explain that several basic types of bridges would be considered that could produce a desired "iconic" structure. The on-going environmental work and anticipated NEPA process was also explained. There were resulting dialogues with several SWWG members including Councilman Woodhull who indicated that he preferred an iconic structure that would provide a "sense of who we are." David Cook indicated a preference for an arch type structure. Ellen Zavisca noted that the design must fully respond to the needs of pedestrians as well as bikers. And Mark Rauhuff, of KUB, noted that significant utility facilities were located in the vicinity of both proposed landing areas.

Transportation Planning Organization (TPO) Staff –

- Ellen Zavisca and Kelly Segars, *Transportation Planning Organization*
- Will Skelton and Stephanie Welch, *Bike Coalition*

The team led a general discussion about applicable design principles and relevant design manual documents for both shared use (cyclists and pedestrians) and separated paths. The TPO staff shared their thoughts on several aspects of the project including the need to have seamless, clearly defined connection (without elevators) to existing greenways on both sides of the river, safety matters related to surface type and bike speed, the need for amenities such as trash cans and electric power and a recommendation against allowing motorized vehicles of any kind except for service and maintenance vehicles.

University of Tennessee (UT) Officials –

- A formal meeting chaired by Jeff Maples, *Vice Chancellor for Finance and Administration*, was held on November 16, 2010, which included staff from Facilities Planning, Facilities Services, and the Athletic Department.

- Follow-up meetings were held with Jeff Maples, Mike Hamilton, and Kevin Zurcher of the Athletic Department, and Mike Cate of Facilities Planning.

The initial meeting was led by Jeff Maples, who indicated that UT was supportive of the project but noted that the connection to the arena and the campus in general will require careful coordination including recognition of limitations and resolution of issues that no doubt will surface along the way. He recognized the importance of the bridge to the City and felt that it will benefit the campus over the long term as well. There followed a discussion of several specific issues and opportunities associated with the campus connection. During a later meeting Mike Hamilton expressed strong support for the project, saying that he was amenable to a bridge connection to the west concourse and felt it would be an asset to both the arena and the campus at large. Mike Cate provided information relating to as-built documents of University-owned structures within the proposed area of work.

South Waterfront Property Owners –

- Bill Taylor, *Specialty Metals*
- Hoyle Gill, *Valley Apparel*
- Joe Fowler, *USA Concrete*

Mr. Taylor and Mr. Gill own the properties on either side of the anticipated location of the south landing of the bridge at Clancy Avenue extended. Both gentlemen are supportive of the project, recognizing that long term, redevelopment involving their properties will occur. Bill Taylor indicated that he was very flexible schedule-wise, already anticipating a relocation of his business. Mr. Gill's property is currently leased to an excellent tenant, Valley Apparel, so he expressed a more cautious approach to potential redevelopment. The USA Concrete property is located along the waterfront east of Mr. Gill's property, and thus could be involved in potential redevelopment. Mr. Fowler indicated that this had been previously discussed to the extent of looking at other suitable property, though none had been located to date. He indicated that a pending sale of the company would limit any discussion for several months.

Environmental and Project Regulators –

- Joe Matlock, *Tennessee Department of Transportation* (TDOT)
- Cathy Elliott, *US Army Corps of Engineers* (USACE)
- Debbie Rutherford, *Tennessee Valley Authority* (TVA)
- Larry Everett, *Tennessee Department of Environment and Conservation* (TDEC)
- Dave Hill and John Hunter, *City of Knoxville*

This meeting included key representatives of the agencies that must approve the environmental and design documentation for the project to move forward. The discussion primarily dealt with the process of obtaining environmental approval as well as permit approval from agencies which control the environs of the river from the standpoint of flood control and navigation. The general feeling is that NEPA and permit approval will be granted in time, but that the project development schedule will probably be dictated by this process. TDOT policies promulgated by their Local Programs Office govern overall project development including the environmental element along with design and right-of-way acquisition.

Gulf & Ohio Railroad Representatives –

Pete Clausen and Doc Clausen, *Gulf & Ohio Railroad*

The G&O Railroad owns the rail line which runs parallel to Neyland Drive in the vicinity of Thompson Boling Arena, including an at-grade crossing of Lake Loudoun Boulevard. Both gentlemen voiced their strong support for the project with Doc Clausen noting that he was a participating member of the Working Group. They expressed an interest in somehow developing a north landing connection to the greenway that could also serve as a small depot for the Three Rivers Rambler excursion train. Mr. Clausen noted that the proposed bridge structure must include a grade separated crossing of the railroad on air rights, and that obtaining this approval requires strict adherence to vertical and horizontal clearance regulations.

General Public –

- Joe Hulquist, *Former City Councilman and South Knoxville Resident*
- Kevin Hill, O*wner of Several Properties and Resident, South of Blount Avenue*

Mr. Hulquist and Mr. Hill requested a meeting with team representatives to provide insight into their vision for waterfront redevelopment. Mr. Hill described his vision for a mixed use development (hotel, condo, restaurant, retail) near the water, with a world class sports medicine complex further from the water. He sees a physical connection in the form of the bridge as well as a business/research connection to the university as crucial. Mr. Hulquist offered several additional thoughts about the bridge and south landing area, including a preference for linear rather than switchback connection to the bank elevation, a causeway type connection up Clancy Avenue with eventual connection to the Legacy Parks area and Fort Dickerson, as well as a desire that the bridge generate a sense of ownership within the South Knoxville community and not be totally dependent on waterfront redevelopment.

All of these groups and individuals were very forthcoming in discussing the project and in providing valuable insights that are proving extremely beneficial in moving the project forward.

4.0 OPTIONS / ISSUES AND CHALLENGES

4.1 Overall Objectives

The primary objectives of the proposed South Waterfront Development Area – University of Tennessee pedestrian / bicycle bridge are:

1. To create a functional and economic development linkage to the South Waterfront Redevelopment Area,
2. To create a functional and economic development linkage to the UT campus (students, faculty, and visitors),
3. To expand the pedestrian/bicycle network envisioned as a major loop connecting existing greenways, Volunteer Landing, and the planned South Waterfront Riverwalk, and
4. To provide a bridge to serve as an iconic design element, visible throughout the waterfront viewshed.

While meeting these primary objectives and providing the best balance between quality and economy, several considerations need to be taken into account:

- Aesthetics
- Technical Excellence
- Long-term and Short-term Durability
- Economics

Several alignments were identified (Exhibit 4) and an initial evaluation was made. It was determined that the best alignments to stimulate growth in the South Waterfront Redevelopment Area, and create functional and economic development linkages between the UT campus and the South Waterfront Redevelopment Area, as well as expand the pedestrian / bicycle network, connecting existing greenways, Volunteer Landing, and the planned South Waterfront Riverwalk, included alignments A thru D. As a result, Alignments E, F and G were eliminated from further study.

To assist in addressing the first three primary objectives, a Cultural Analysis is underway, which investigates the circulation of the different users within the study area (pedestrians, bicycles, and vehicles) and the locations of their interactions. Preliminary findings of this analysis are summarized on Exhibit 5.

Exhibit 6 is a summary of the preliminary viewshed analysis, which addresses the fourth of the primary objectives. The best vantage points to and of the bridge are shown, as are the gateway nodes. It also shows some of the local landmarks and points of interest, such as the Thompson Boling Arena, the Railcar, Circle Park and Fort Dickerson.

The project consists of three areas of focus:

1. River Crossing
2. North Landing (connection to the UT Campus)
3. South Landing (connection to the South Waterfront Redevelopment Area)

The challenges associated with each of these sections are described below, followed by possible options. Included are examples of existing projects that share similar traits.

4.2 River Crossing

Primary Objective: To create an iconic, safe, and cost-effective bridge for pedestrians and bicyclists

Considerations

In developing options for the main river crossing, considerations fall into two primary categories:

1. Functional
2. Aesthetic

Functional considerations include:

- Provide a structurally efficient bridge (long-term and short-term durability, strength, and economy)
    - Foundations
    - Span arrangement
    - Materials
    - Cross sections (main river spans and approach spans)
    - Profile grade
    - Appropriate bridge width for structural stability
- Provide technical excellence
    - Incorporate design details that are constructible
    - Use of materials that promote sustainability
    - Redundant design
- Provide required clearances:
    - Tennessee River Barge Channel,
    - Neyland Drive, and
    - Gulf & Ohio Railroad
- Provide for safe movement of the pedestrian and cyclists
    - Consider vertical and/or horizontal separation of different user groups,
    - Manage pedestrian/cyclist gathering, movement and conflicts, and
    - Provide universal accessibility

Aesthetic considerations include:

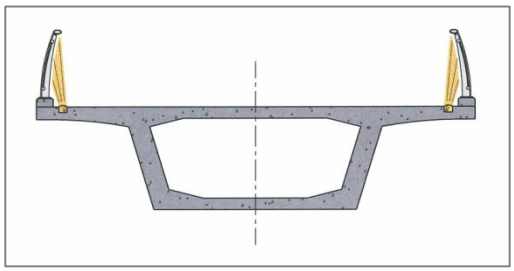
- Provide a bridge that is an iconic design element visible throughout the waterfront viewshed
- Provide a bridge that complements the nearby historic Gay Street and Henley Street Bridges
- Provide a bridge that blends in with the downtown buildings and the UT campus
- Integration of lighting on the bridge (deck lighting and under-bridge lighting)
    - Promotes linkages between north and south ends of the bridge
    - Creates an identity for the space lit
    - Provides a means of shaping one's experience

Possible Cross Sections

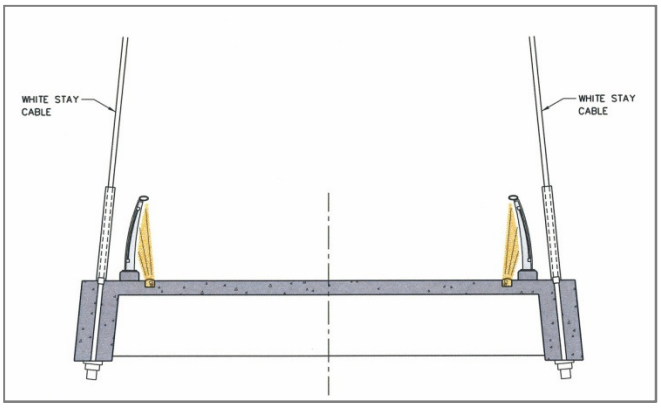
We believe the cross sections for the walkway could be either concrete or steel. The concrete could be precast or cast in place. The steel must be more carefully evaluated for wind buffeting and deflection issues due to vibration. This could be a factor for both types, but certainly would be more critical with a steel option. Also, steel will require a more stringent consideration of long-term cost and life cycle comparisons.

Typical concrete sections include the following:

- A concrete box girder, probably a single cell that would be post-tensioned in order to attain adequate strength
- Edge girder system with transverse floorbeams and a longitudinal slab system. This would be particularly suitable for a cable-stayed structure and other types of structures involving hangers, such as the arch structure.



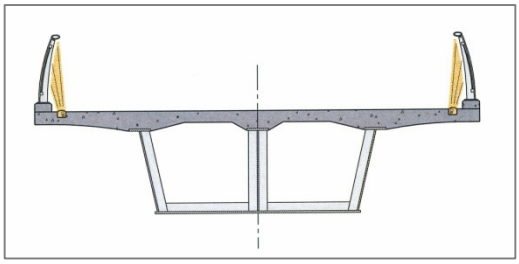
Concrete Box Girder



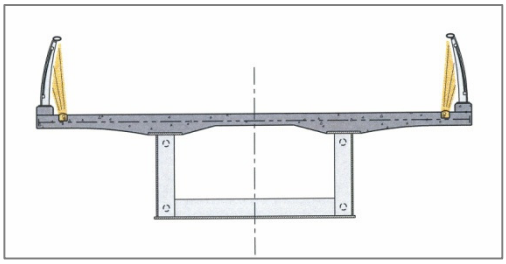
Edge Girder System

Structural Steel alternatives include:

- A two cell box
- A single-cell box girder - The single cell box has certain issues with fatigue and redundancy requirements and therefore, would be best if it were cable-stressed. Cable-stressed bridges offer a redundancy and a very much improved fatigue characteristic when evaluating the long-term durability of the structure. Cable-stressing is a means of gaining the required redundancy when having only two webs.



Two-Cell Steel Box Girder

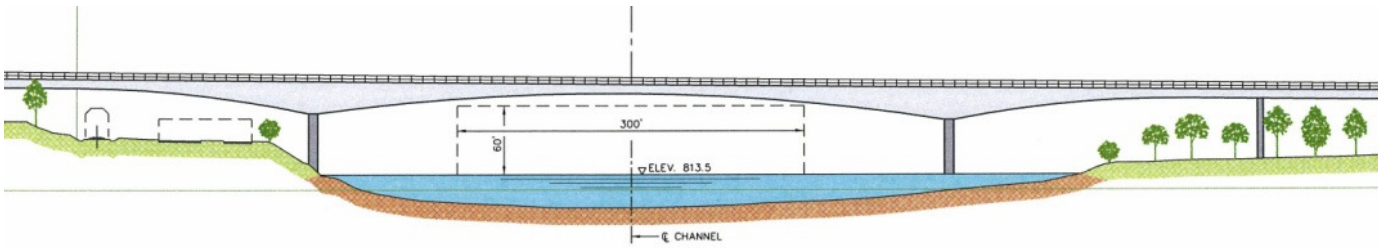


Single-Cell Steel Box Girder

In many regards, these cross sections would be suitable for a number of the possible alternatives.

Option 1, Haunched Box Girder

This structure is a 550-ft haunched girder span, probably a concrete box girder, although it could be built as a steel box girder. It is anticipated that it would be constructed using balanced cantilever construction and cast-in-place concrete, which is a more standard procedure used for this type of structure throughout the United States. It is constructed segmentally with segments probably in the order of 16 to 20 feet. The weight is essentially balanced out from the pier in each direction, and a small stability bracing system is provided to handle any unbalance that occurs during construction. Once the cantilevers are completed on both sides of the piers, closure pours are made at mid-span and near the end of the side-span areas, this then becomes a continuous monolithic structure for the three main spans. This type of structure generally shows a fairly large mass at the piers but a very slender cross section at mid-span, offering the appearance of strength at the piers, but clear and openness at the mid-span area.



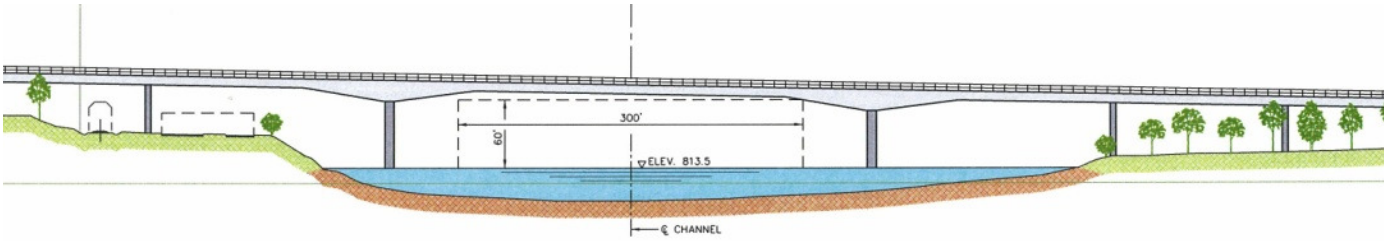
The approaches on the south waterfront side should have a pleasant aesthetic presentation compatible with that of the main span; therefore making it appear as one unified-type structure. On the north side, we are showing it landing on the Thompson Boling Arena platform area and crossing the parking garage area and into the parking area on the other side of Phillip Fulmer Way.

<u>Precedence:</u>

Lewiston – Clarkston Bridge

Option 2, Box Girder, with a Straight Tapered Haunch

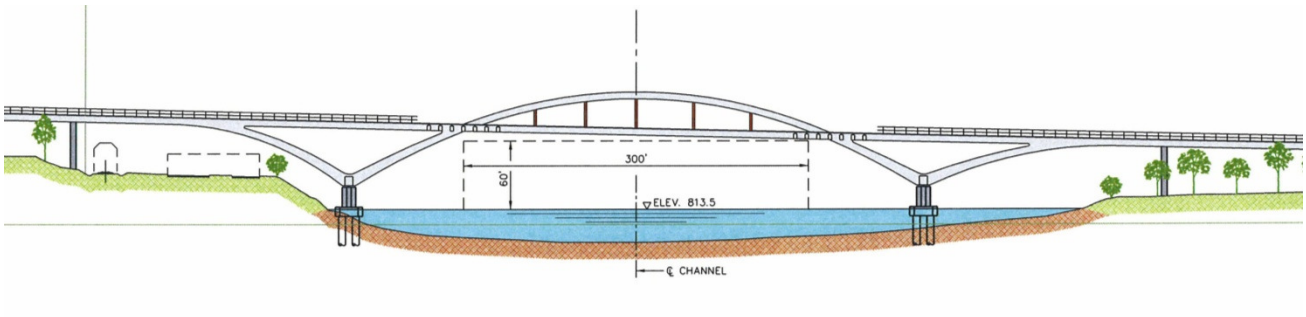
This option would likely utilize a steel box girder. The main span is approximately 420-ft, clearing the channel, with a straight tapered haunch at the pier areas. This is probably the most basic type of structure that could be reasonably proposed at this site and still maintain adequate clearances at the channel area. However, being a basic type structure does not mean that it cannot have a pleasing appearance. Proper span lengths, due to proper location of the piers to be compatible with the approach areas, will enable one to have evidence of good structural efficiency and aesthetics.



Option 3, 500-ft Arch

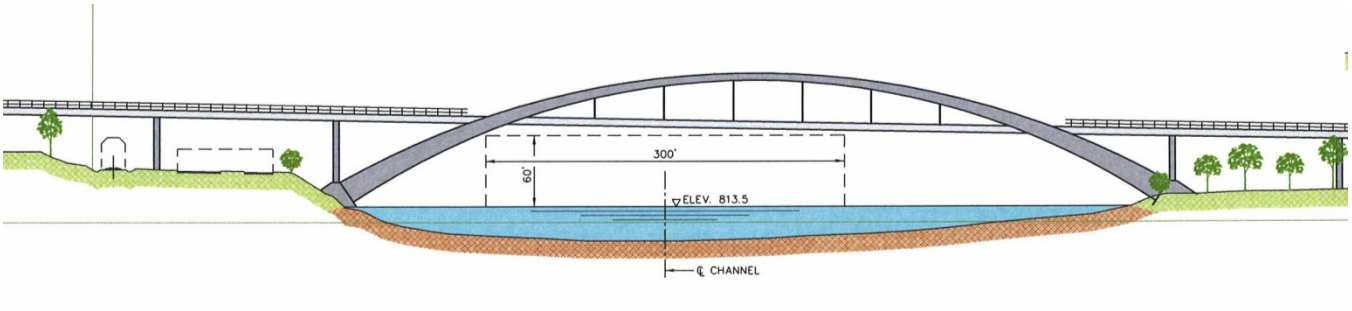
This option utilizes an arch span of about 500-ft for the main span. Initial proportioning of this structure would be that it would be built using structural steel boxes for both the superstructure and the arch rib. The structural steel boxes for the main superstructure would have longitudinal cable stressing inside the boxes in order to provide additional strength and redundancy offering long-term safety. In the case of a crack occurring in one member, it then does have a redundant load path to protect the structure.

This structure offers the possibility of being relative simple and easy to erect, thus enhancing the potential for greater speed of construction and the resultant cost savings which could make it very price competitive. On this particular structure, the arch rib passes through the center of the structure and there is a single rib. The rib is a natural flare in the superstructure deck surface which naturally offers an enhanced alignment feature that will make the structure interesting for the pedestrians and cyclists crossing the bridge. Vibration, wind buffeting, and corrosion resistance are major considerations with this option.



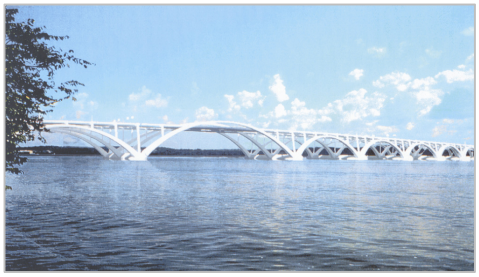
Option 4, Long-span Arch

This is a long span option spanning the entire river with one single arch. It can be made to essentially have zero impact on the river environment. The general anticipation is that this would be done utilizing a series of towers and tie-backs, and cantilevering out from the skew-backs on the riverbanks on each side of the river. This would most likely be built using cast-in-place or precast concrete, although steel is certainly an option. The arch rib is tapered in the vertical and horizontal directions, giving it a more massive appearance at the skew-back and a very slender appearance in the mid-span area. Visually, this alternative offers much for the improvement to the site and would not necessarily be significantly more expensive. The most challenging part of this alternative might be to provide a suitable and economical foundation, but we do believe that this is possible. Some initial thought has already been given towards the foundation. We are investigating the use of a sloped drilled caisson at each end to handle the arch thrust.



Precedence: Arches

Qatar-Bahrain Connector

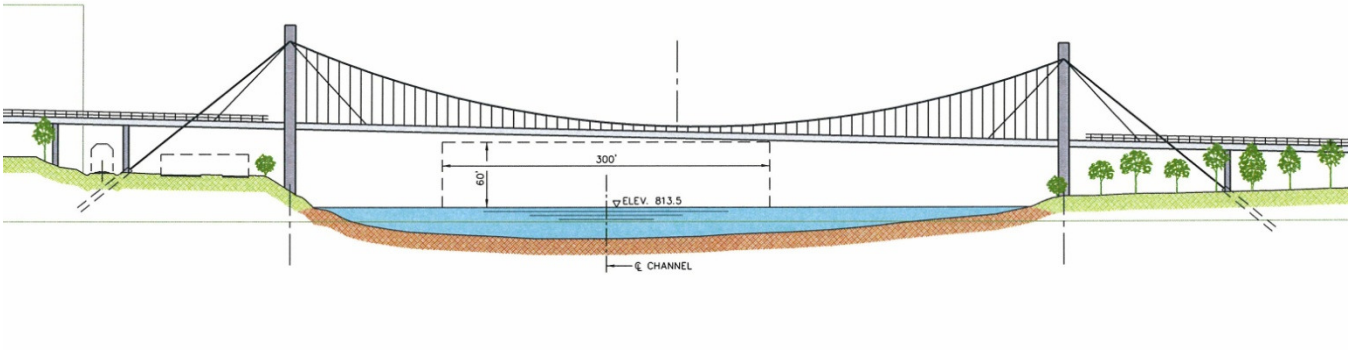


Woodrow Wilson Memorial Bridge

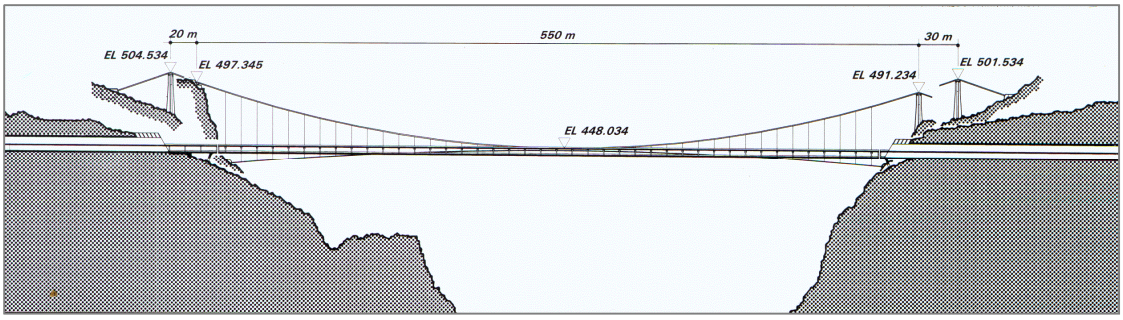
Hoover Dam Bypass

Option 5, Suspension Bridge

This option utilizes a main span of approximately 700-ft, spanning the entire river, with no impact to the river area. Again, this would be erected utilizing prefabricated cables, which would be anchored on both sides of the river in an underground area. Additional stays are included with a suspension cable in order to eliminate the requirement for some piers that might be objectionable in appearance, and also might interfere with the established traffic patterns on the north side. The cables are curved and flared in order to provide a lateral stability for the rather flexible structure in the transverse direction.

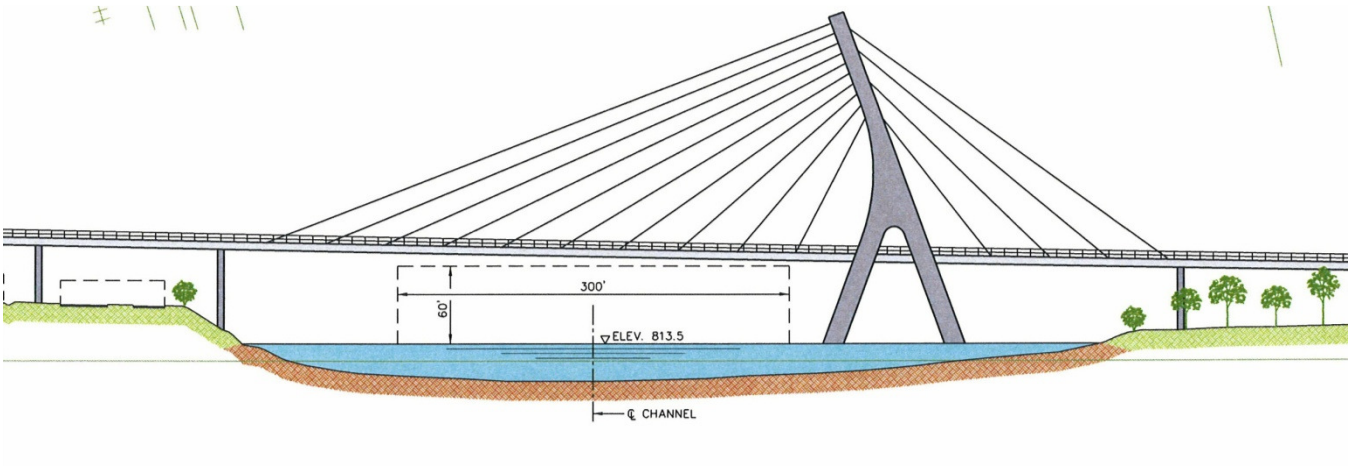


Precedence: *Hoover Dam Bypass, AZ-NV (Proposed)*



Option 6, Cable-Stayed Bridge

This is a cable-stayed structure with a tower tilted toward the longer side span. In addition to providing a more interesting-looking tower than the traditional towers, this configuration will better balance the vertical and horizontal thrust. We anticipate that this structure would be built utilizing a cast-in-place alternative for the superstructure that uses concrete edge beams as shown in the section details. It is important to point out that in some elevation views this structure would be quite impressive; however, particularly in a close-up view it does become much more massive in appearance. Experience shows that the actual tower does become a very dominant feature in the visual effects resulting from this type of bridge.



Precedence: Cable-Stayed

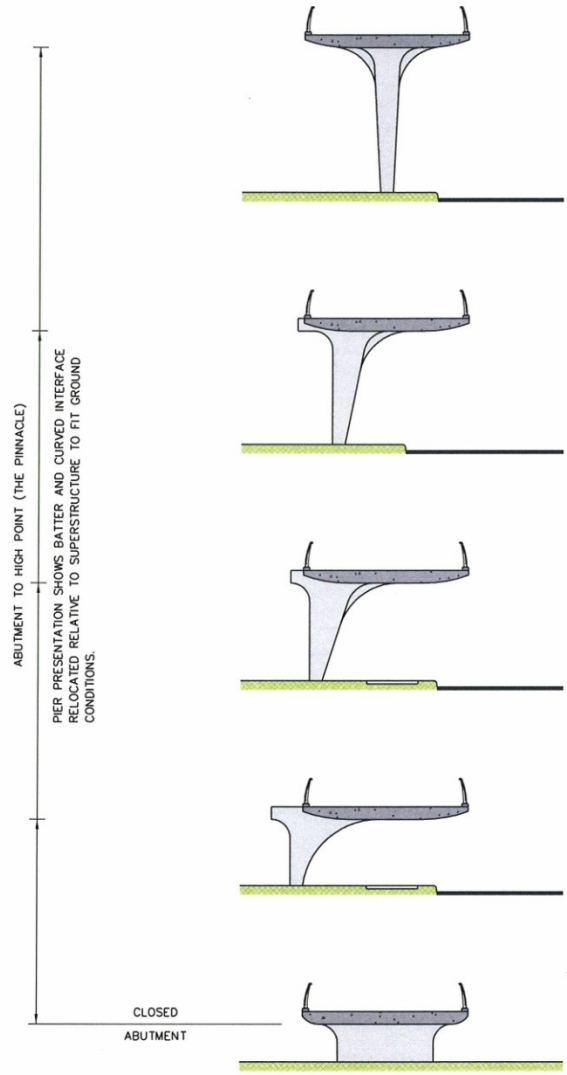
Maumee River Bridge, OH

Charles River Bridge, MA

Plan and Elevations of the six options discussed above are on the following pages (Exhibits 7 thru 13).

Structural Form for Approach Spans

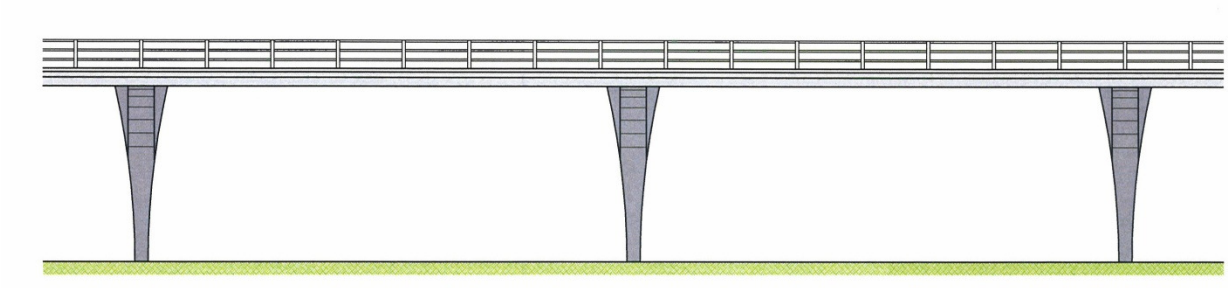
This section is intended to highlight the important considerations which will be put into the final form for approach span structures as needed. Initial investigation should include some serious consideration of the structural form needed for various possible approach spans on both the north and south approaches. Due to their proximity to the public and being most visible to the public, these spans could have significant impact on the visual impression left by the overall project. The thoughts here are intended to fit a multitude of possibilities that could be finally incorporated into the final approach arrangement.



Important to the underside bridge area, is the pier configuration, soffit shape, soffit lighting, and the arrangement of the piers in order to avoid possible pier column conflict with exiting function and existing views. Therefore, considerations of positioning of the piers, shape of the piers, and clearance around the piers and the superstructure are worthy of incorporation into the final design.

An open appearance is also very important to the overall impression left by the structure. Significant openness can minimize the magnitude of the impact of any structure on a site, leaving the environment of the given area to control the final solution. A typical standard for openness is to use a span of three to four times the vertical clearance. Proper underside lighting and openings allowing light from above to shine below will enhance the openness effect. Glass panels in the superstructure deck have often been used to accomplish such.

The elevation view should offer a light, ribbon effect, which can be accomplished by using a curved fascia, which, in essence eliminates a solid line for the structural soffit. Pedestrian and bicycle amenities should be added to the superstructure, both in elevation and on the travel-way.



4.3 North Landing

Primary Objective: Activate the bridge deck with multiple user groups by making physical connection to the UT Campus and Neyland Greenway.

Considerations

- Show overall design excellence and sustainable practice
- Provide universal accessibility including ramps, elevator, and parking
- Bypass or tie to Thompson Boling Arena deck
- Manage pedestrian/cyclist gathering, movement and conflicts
- Acknowledge future planned development patterns from UT's Master Plan
- Enhance the existing Campus gateway and UT Athletics' front door
- Provide required horizontal and vertical clearances for ROWs, RR and utilities
- Create gathering nodes and views out from landings
- Conceptualize on-grade improvements outside project boundary
- Integrate nearby campus projects into bridge programming
- Manage storm water creatively
- Address maintenance access and current methods

Options:

Option	Advantages	Disadvantages	User Groups
N-01: At-Grade Extension	- Utilization of existing structure - Direct connection to Campus - Accommodates all user groups	- No direct connection to Greenway - Access to bridged via existing parking deck / impacts Campus parking	All
N-02: At-Grade Extension	- Direct connection to Campus - At-grade landing connecting to existing intersection - Accommodates all user groups	- No direct connection to Greenway - Impacts recent Campus improvement at Lake Loudoun Blvd and Campus parking	All
N-03: Switchback Ramp	- No work on Campus property - Direct access to Greenway	- No direct access to Campus - Limits bike usage	All, but limited bike usage
N-04: Tower	- No work on Campus property - Direct access to Greenway	- No direct access to Campus - Cyclists must dismount	Pedestrian, ADA

Schematics of the above north landing options are on the following pages (Exhibits 14 thru 17).

4.4 South Landing

Primary Objective: Provide Physical Connection to Ground from High Bridge Deck, and Set Stage to Spur Economic Development for the South Waterfront District

Considerations

- Show overall design excellence and sustainable practice
- Provide universal accessibility including ramps, elevator, parking
- Manage pedestrian/cyclist gathering, movement and conflicts
- Resolve large difference in elevation between bridge deck, ground and potential for a new building connection
- Connectivity to Fort Dickerson open space (Urban Wilderness & Historic Corridor) and elements proposed in the SW Vision Plan such as the Riverwalk
- Adhere to the form-based code as applicable
- Limit development footprint on private property
- Provide safe access to the water's edge
- Avoid impact to the floodway
- Create gathering nodes and views out from landings
- Conceptualize on-grade improvements and new building blocks outside project boundary
- Manage storm water creatively
- Address maintenance access and current methods

Options:

Option	Advantages	Disadvantages	User Groups
S-01: Elliptical Ramp	- Direct access to waterfront - Accommodates all user groups	- Substantial property acquisition - No direct access to Blount Avenue	All
S-02: At-Grade Extension	- Direct connection to Blount Ave - At-grade landing connecting to existing intersection - Accommodates all user groups	- Long span of extension - Multiple parcel acquisition	All
S-03: Switchback Ramp	- Direct access to waterfront	- No direct connection to Blount Ave - Substantial property acquisition - Limits bike usage	All, but limited bike usage
S-04: Spiral Ramp	- Limited property acquisition - Direct access to waterfront	- No direct connection to Blount Ave - Narrow radius limits bike usage	All, but limited bike usage
S-05: Tower	- Limited property acquisition - Direct access to waterfront - Lowest front-end cost	- No direct connection to Blount Ave - Cyclists must dismount	Pedestrian, ADA

Schematics of the above south landing options are on the following pages (Exhibits 18 thru 22).

Precedents of the above landing options follow the south landing options (Exhibits 23 thru 32).

4.5 Environmental Documentation/Permitting

Although the proposed pedestrian bridge is still in the early planning stages, efforts are underway to initiate the regulatory review process. The bridge will require permits from the Tennessee Department of Environment and Conservation (TDEC), the U.S. Army Corps of Engineers (USACE), and the Tennessee Valley Authority (TVA). The Tennessee Department of Transportation (TDOT) will also require an environmental clearance document. Given the location and nature of the structure, USACE will also require coordination with the U.S. Coast Guard (USCG). During the permit review, these regulatory agencies will also seek comments from the U.S. Fish and Wildlife Service, the Tennessee Wildlife Resources Agency, and the State Historic Preservation Office (SHPO).

In an effort to begin the regulatory coordination, a meeting was held with USACE, TDOT, TDEC, TVA, the City of Knoxville, and the City's design team on November 17, 2010. A summary of the meeting notes is included in Section 3.2, and also summarized herein. Mr. Joe Matlock (TDOT) indicated that the first step would be coordinated through TDOT as the lead agency for the environmental document, to be evaluated through TDOT Local Programs. Based on the information discussed, Joe Matlock anticipates that the project will be eligible for a Categorical Exclusion (CE). Compliance with TDOT public hearing guidelines will be required, and Mr. Matlock stressed the importance of making sure the guidelines are followed. Once TDOT has approved the CE, the document will be forwarded to the Federal Highway Administration (FHWA) for their review and approval.

In addition to the TDOT and FHWA environmental approvals, permits from the USACE, TDEC and TVA will also be required, as mentioned above. Permit applications will require specific details on factors such as the pier placement, construction equipment laydown areas, access routes for work in the river, bridge design and proposed construction methods. TVA indicated that once the USCG has reviewed and signed off on the project, including bridge span and clearance issues, it is likely that TVA will take the lead on the permitting effort. Once the impact footprint is defined, TVA will evaluate flowage easement and right-of-way (ROW) issues to determine their requirements for permits and easements. TVA stated an easement is needed even to span their property.

The USACE will be primarily concerned with navigation information and barge alignment issues. They will require that the bridge be designed to meet USCG parameters to address these issues. Larry Everett (TDEC) indicated that PCBs may be encountered during the sediment sampling in the river, and if that is the case, TDEC will require an individual Aquatic Resources Alteration Permit (ARAP), since they cannot issue a general permit when contaminated sediment is involved. It is planned to sample the sediment for environmental contaminants during the geotechnical investigations for the piers. The individual ARAP, if required, would be issued out of TDEC Nashville.

Section 106 cultural resource issues were also discussed during the November regulatory meeting. The permitting effort and TDOT environmental clearance will require definition of a Section 106 Area of Potential Effect (APE) which encompasses the area to be impacted by the proposed bridge. The APE will be determined by cultural resource staff at TDOT, SHPO, TVA, and possibly the USACE depending on their level of involvement in the permitting process. To begin this process, the design team has defined a "worst-case" construction footprint for the proposed bridge (Exhibit 2). S&ME is currently assembling the TDOT Purpose and Need Statement, which will include photographs of the existing conditions within the construction footprint. This will include photographs of the proposed landing areas to identify the extent of impacts already in place on both river banks. In addition, S&ME will submit the Natural Features Analysis (Exhibit 33) prepared by the team to further illustrate the existing conditions in the vicinity of the proposed bridge. Vegetative cover and existing topography both impact the viewshed from the proposed bridge, and these factors will be considered by the regulatory agencies in their determination of the APE. This information will be evaluated by SHPO and the other agencies in accordance with the previously established Memorandum of Agreement associated with prior South Waterfront improvements.

Once the APE has been defined, and TDOT has defined scopes for their respective areas of responsibility (including but not limited to hazardous materials, air and noise, Section 106, and threatened and endangered species), S&ME will work to address the regulatory permitting and environmental clearance requirements. Based on our experience on other permitting efforts, the TDOT CE review and the TVA permits will likely be the regulatory approvals requiring the most effort. These two components of the project can generally run simultaneously to a certain extent, and S&ME will attempt to keep all agencies engaged during the regulatory review, so that issues can be addressed in an efficient and timely manner.

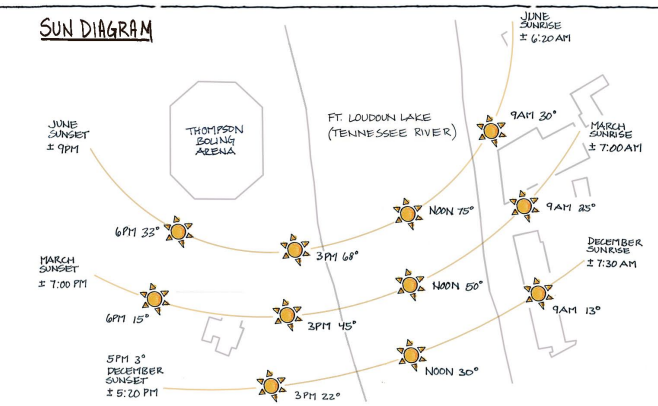
Exhibits

Exhibit 1 Summary Analysis
Exhibit 2 Preferred Alignments of Proposed Bridge
Exhibit 3 Location of Existing Utilities
Exhibit 4 Conceptual Bridge Alignments
Exhibit 5 Cultural Analysis
Exhibit 6 Imageability Analysis
Exhibit 7 River Crossing - Typical Sections
Exhibit 8 River Crossing – Option 1, Haunched Box Girder
Exhibit 9 River Crossing – Option 2, Box Girder with Straight Tapered Haunch
Exhibit 10 River Crossing – Option 3, 500-ft Arch
Exhibit 11 River Crossing – Option 4, Long-Span Arch
Exhibit 12 River Crossing – Option 5, Suspension Bridge
Exhibit 13 River Crossing – Option 6, Cable-Stayed Bridge
Exhibit 14 North Landing – Option N-01, At-Grade Extension
Exhibit 15 North Landing – Option N-02, At-Grade Extension
Exhibit 16 North Landing – Option N-03, Switchback Ramp
Exhibit 17 North Landing – Option N-04, Tower
Exhibit 18 South Landing – Option S-01, Elliptical Ramp
Exhibit 19 South Landing – Option S-02, At-Grade Extension
Exhibit 20 South Landing – Option S-03, Switchback Ramp
Exhibit 21 South Landing – Option S-04, Spiral Ramp
Exhibit 22 South Landing – Option S-05, Tower
Exhibit 23 Landing Precedents – Elliptical Ramp
Exhibit 24 Landing Precedents – Elliptical Ramp
Exhibit 25 Landing Precedents – At-Grade Extension
Exhibit 26 Landing Precedents – At-Grade Extension
Exhibit 27 Landing Precedents – Switchback Ramp
Exhibit 28 Landing Precedents – Switchback Ramp
Exhibit 29 Landing Precedents – Spiral Ramp
Exhibit 30 Landing Precedents – Spiral Ramp
Exhibit 31 Landing Precedents – Tower
Exhibit 32 Landing Precedents – Tower
Exhibit 33 Natural Features Analysis

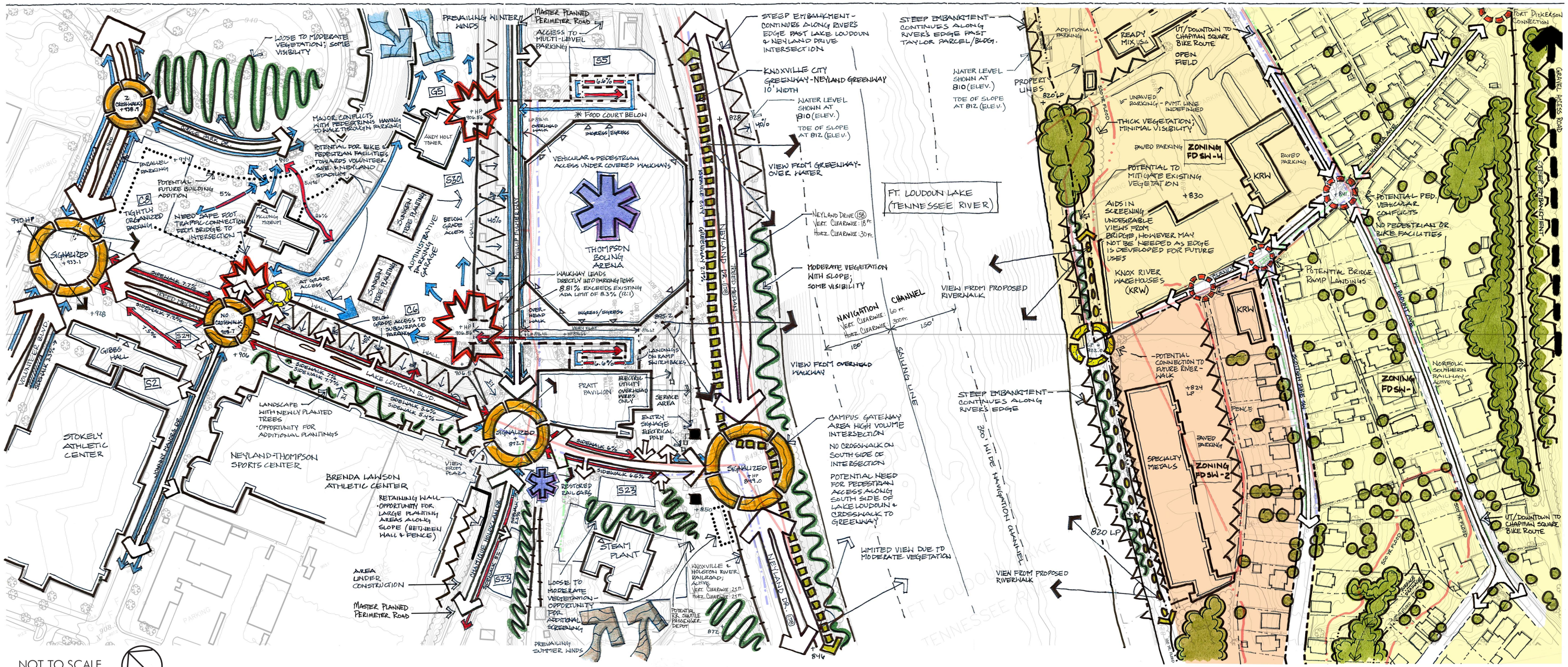
LEGEND

- INTERSECTION
- POTENTIAL PEDESTRIAN CONNECTION
- POTENTIAL PEDESTRIAN/ VEHICULAR CONFLICTS
- POINT OF INTEREST/ LANDMARK
- DESIGN REQUIRED FOR PEDESTRIAN SAFETY
- VEHICULAR CIRCULATION
- SIDEWALK CIRCULATION
- SIDEWALK CIRCULATION - NOT ADA COMPLIANT
- KNOXVILLE CITY GREENWAY - NEYLAND GREENWAY
- PROPOSED RIVERWALK
- DENSE VEGETATION - MINIMAL VISIBILITY
- MODERATE VEGETATION - SOME VISIBILITY
- PREVAILING SUMMER WINDS
- PREVAILING WINTER WINDS
- STEEP EMBANKMENT
- FENCE
- RAIL ROAD TRACKS
- UTILITY - SEWER
- UTILITY - WATER
- UTILITY - GAS
- POSITIVE VIEWS
- LIMITED VIEWS
- PROPERTY LINE
- FEMA 100 YR. FLOODPLAIN
- FEMA 500 YR. FLOODPLAIN
- MASTER PLAN BUILDING ADDITION
- GRAVEL ACCESS ROAD
- +HP HIGH POINT
- +LP LOW POINT
- UT PARKING FACILITIES
- ZONING FD SW-1
- ZONING FD-SW-2
- ZONING FD SW-4

SUN DIAGRAM



APPROXIMATE BRIDGE LOCATION: VIEW FROM FT. LOUDOUN LAKE TO UT CAMPUS & THOMPSON BOLING ARENA



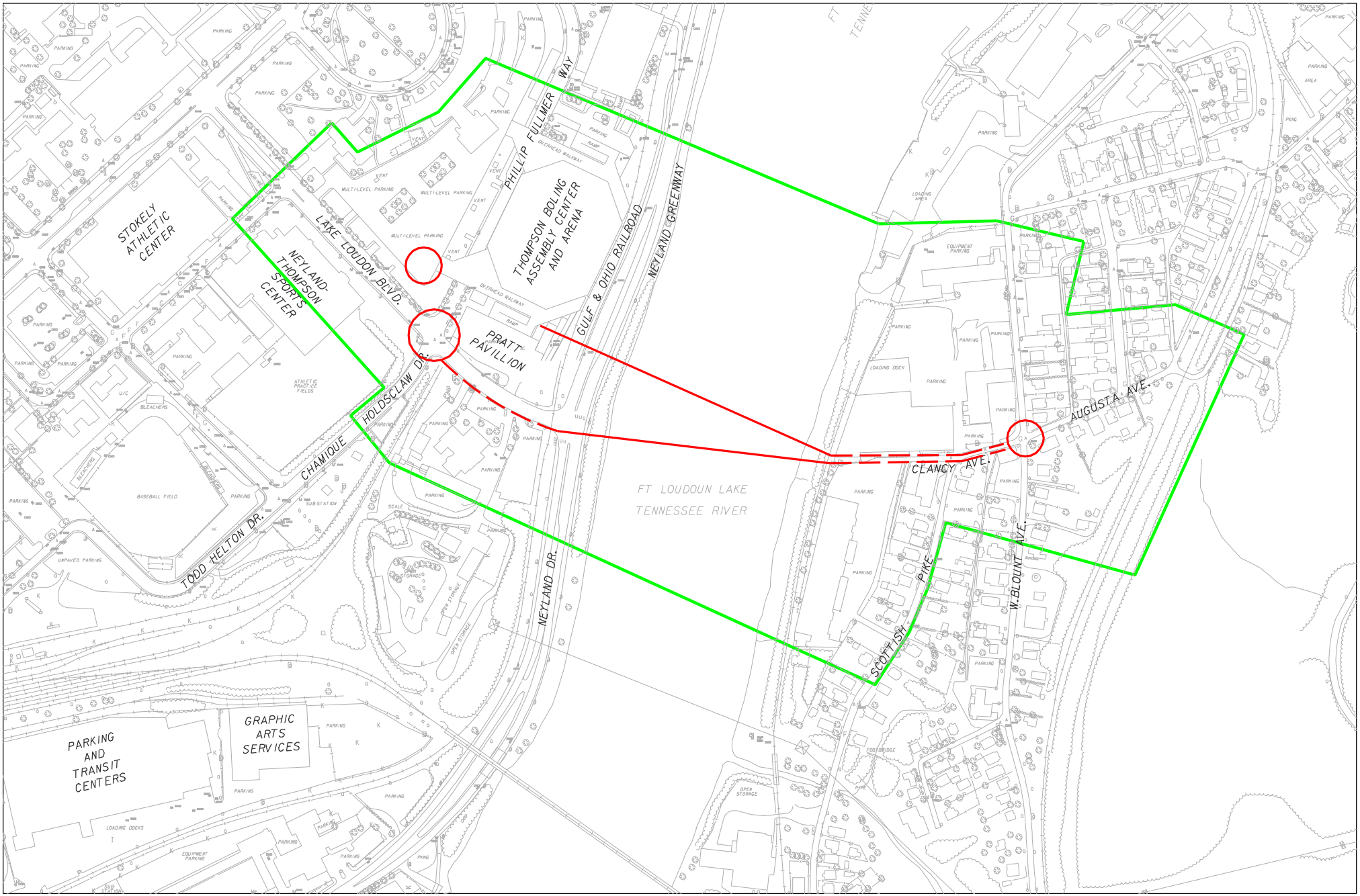
CITY OF KNOXVILLE

SUMMARY ANALYSIS

PEDESTRIAN/BICYCLE BRIDGE

KNOXVILLE SOUTH WATERFRONT REDEVELOPMENT AREA

LAWRIE AND ASSOCIATES CRJA WILBUR SMITH ASSOCIATES S&ME SANDERS PACE ARCHITECTURE



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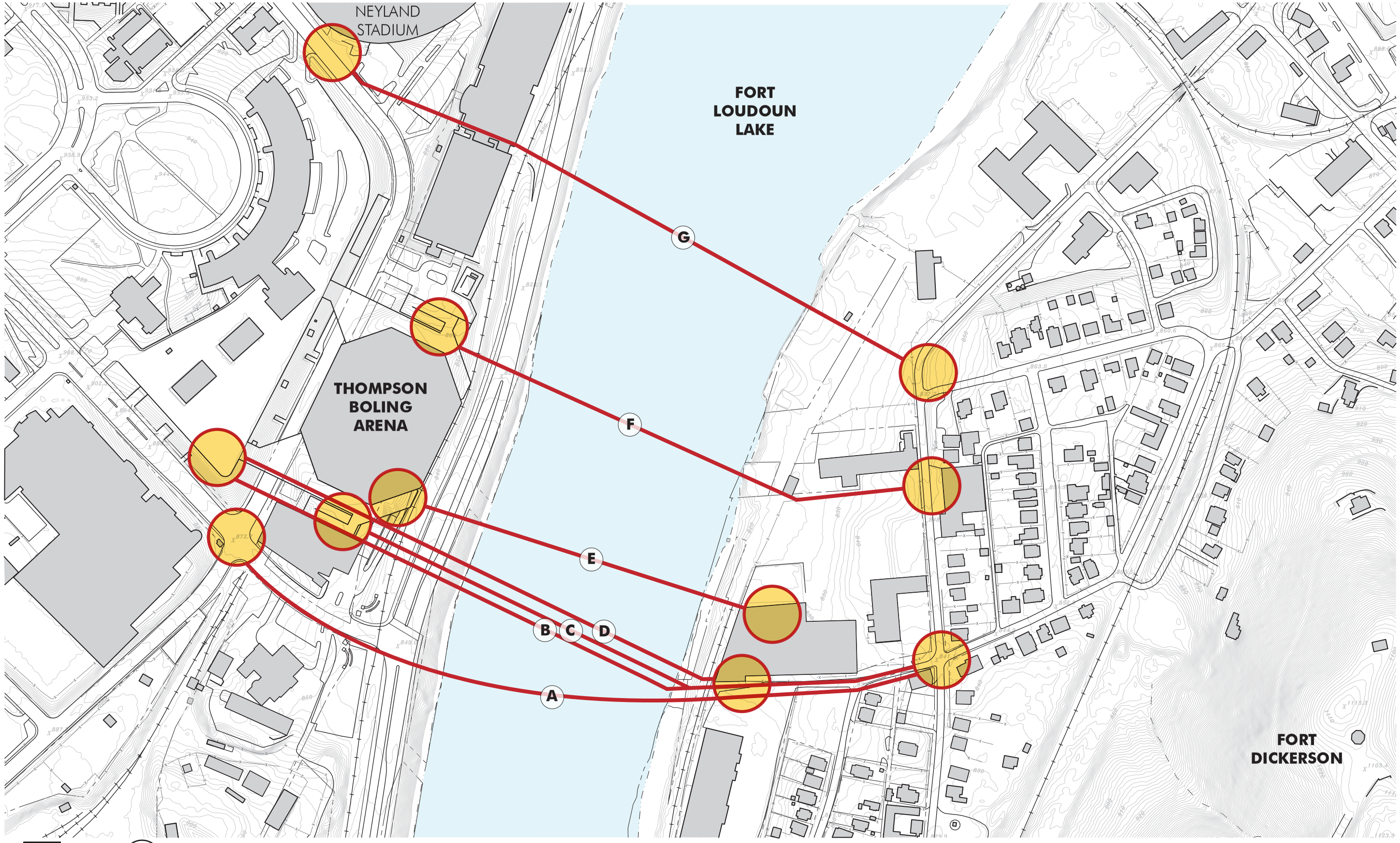


0' 50' 150' 250'

LEGEND

BRIDGE ALIGNMENT

LANDING NODE

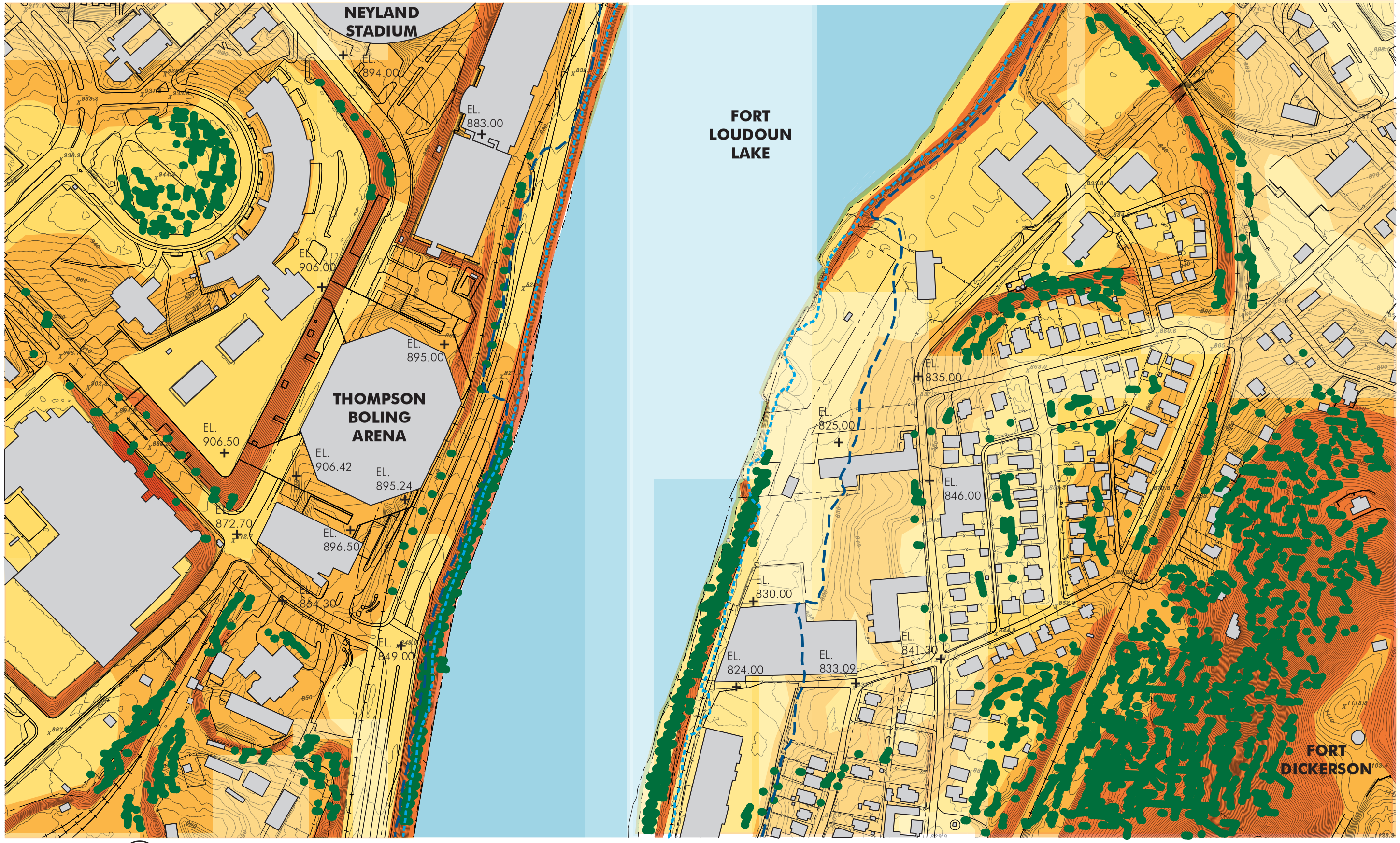
CITY OF KNOXVILLE

CONCEPTUAL BRIDGE ALIGNMENTS

PEDESTRIAN/BICYCLE BRIDGE

KNOXVILLE SOUTH WATERFRONT REDEVELOPMENT AREA

LAWRIE AND ASSOCIATES CRJA WILBUR SMITH ASSOCIATES S&ME SANDERS PACE ARCHITECTURE



0' 50' 150' 250'

LEGEND

- 0% - 5% SLOPE
- 5% - 20% SLOPE
- 20%+ SLOPE
- +800 KEY ELEVATIONS
- VEGETATION
- 100 YEAR FLOODPLAIN
- 500 YEAR FLOODPLAIN

CITY OF KNOXVILLE

NATURAL FEATURES ANALYSIS

PEDESTRIAN/BICYCLE BRIDGE

KNOXVILLE SOUTH WATERFRONT REDEVELOPMENT AREA

LAWRIE AND ASSOCIATES CRJA WILBUR SMITH ASSOCIATES S&ME SANDERS PACE ARCHITECTURE

0' 50' 150' 250'

LEGEND

- POINT OF INTEREST / LANDMARK
- GOOD VIEWS
- GATEWAY NODE
- SW -1 ZONING
- SW-2 ZONING
- SW-4 ZONING
- SW-6 ZONING

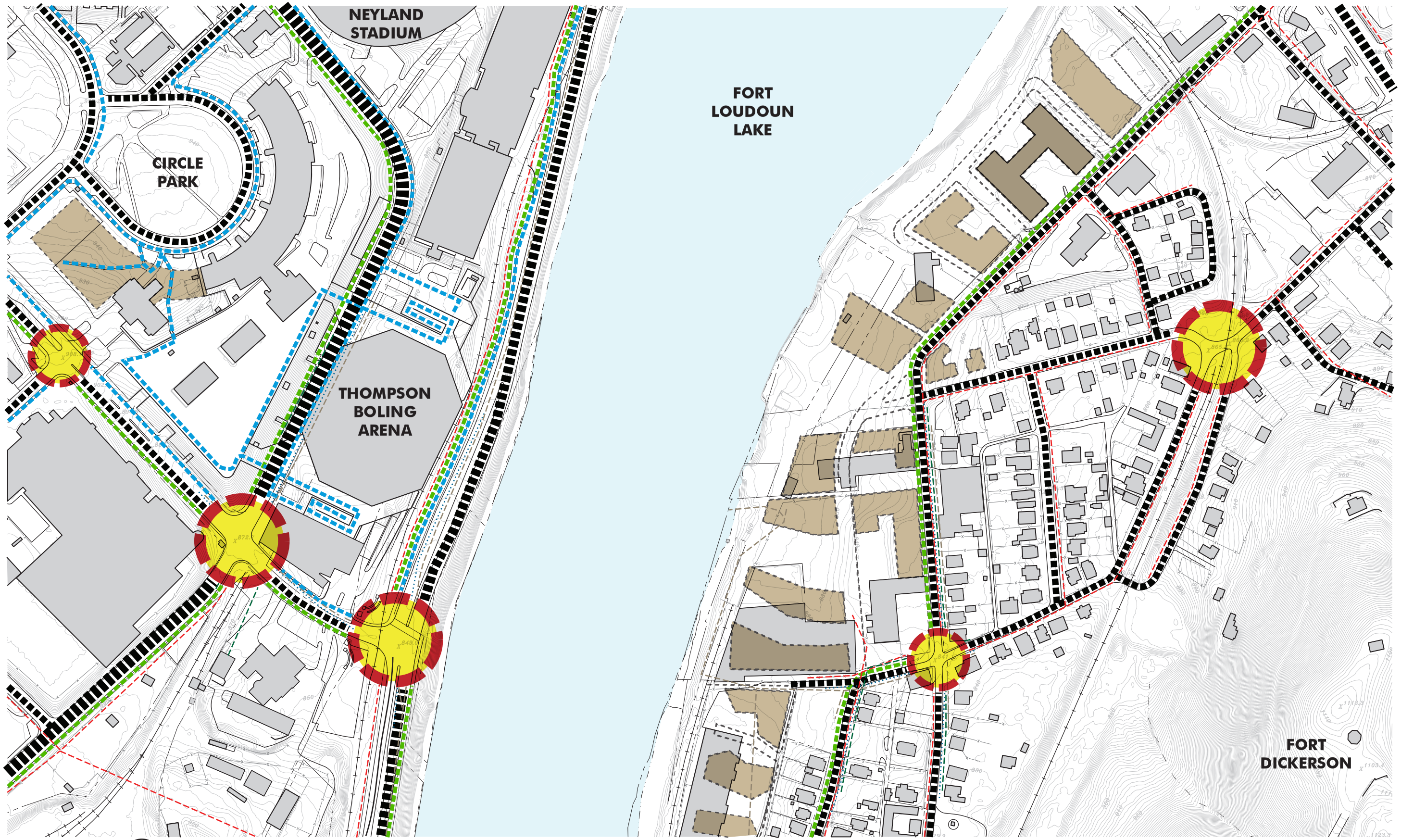
CITY OF KNOXVILLE

IMAGEABILITY ANALYSIS

PEDESTRIAN/BICYCLE BRIDGE

KNOXVILLE SOUTH WATERFRONT REDEVELOPMENT AREA

LAWRIE AND ASSOCIATES CRJA WILBUR SMITH ASSOCIATES S&ME SANDERS PACE ARCHITECTURE



0' 50' 150' 250'

NORTH

LEGEND

- VEHICULAR CIRCULATION
- BICYCLE CIRCULATION
- PEDESTRIAN CIRCULATION
- TRAFFIC NODE
- PROPOSED BUILDING
- UTILITY - SEWER
- UTILITY - GAS
- UTILITY - WATER
- UTILITY - ELECTRICAL

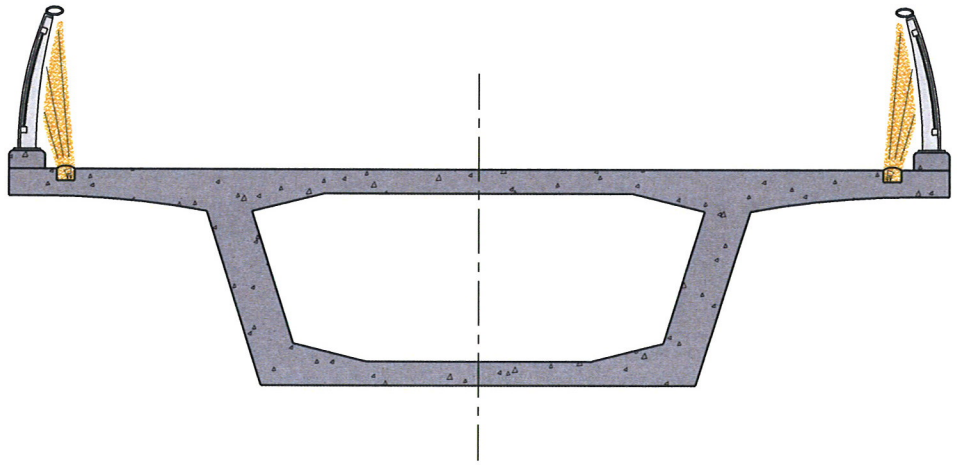
CITY OF KNOXVILLE

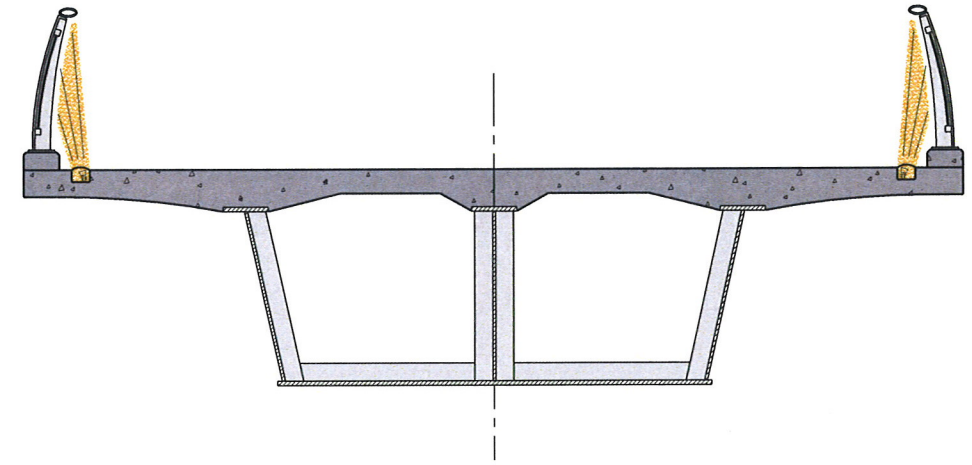
CULTURAL ANALYSIS

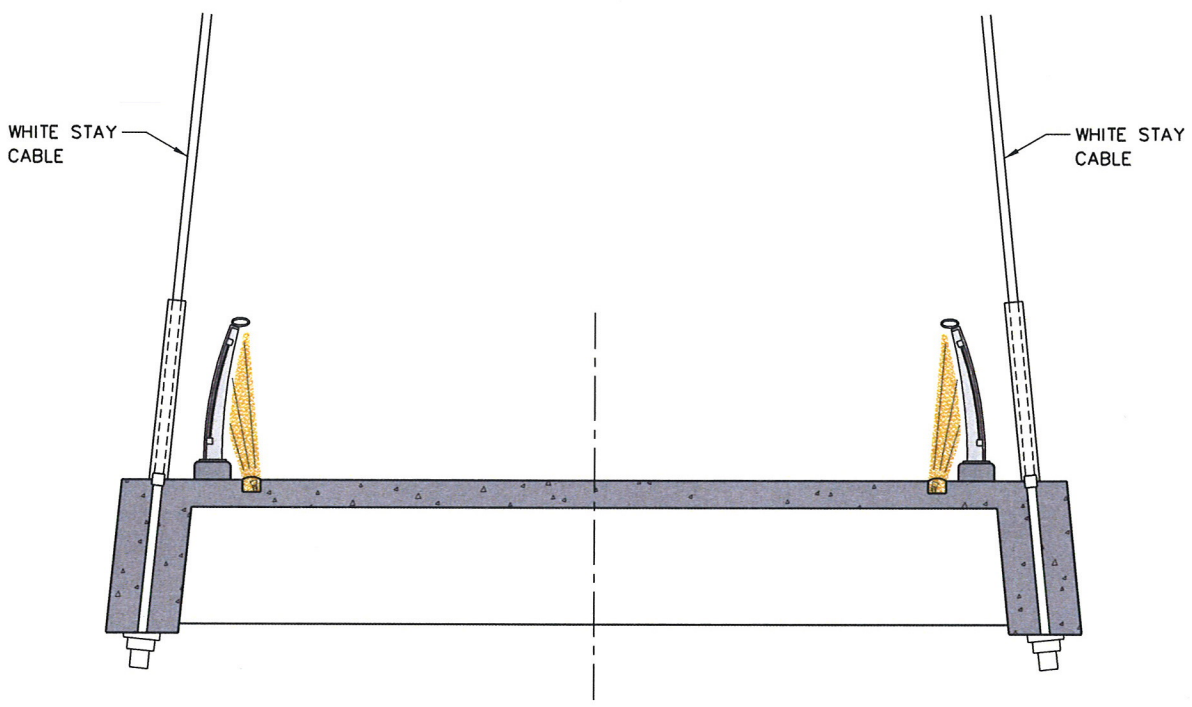
PEDESTRIAN/BICYCLE BRIDGE

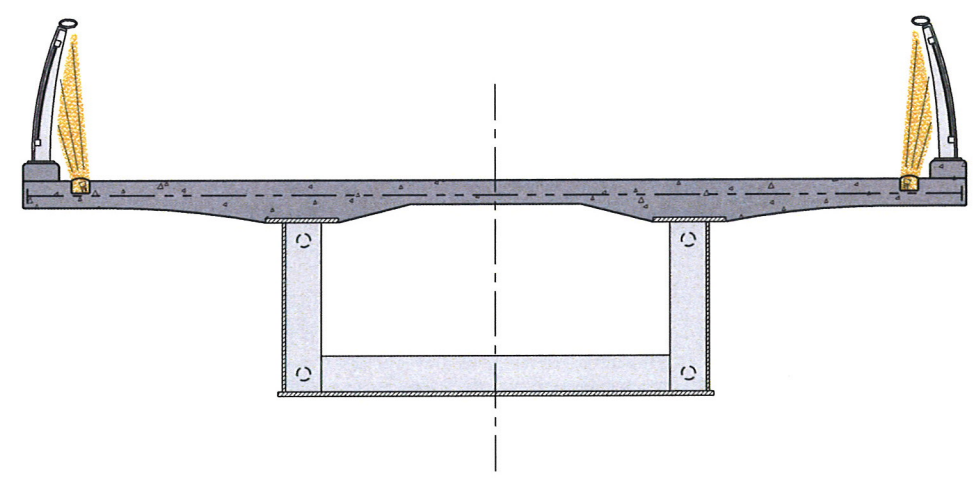
KNOXVILLE SOUTH WATERFRONT REDEVELOPMENT AREA

LAWRIE AND ASSOCIATES CRJA WILBUR SMITH ASSOCIATES S&ME SANDERS PACE ARCHITECTURE









2' 0 2' 4' 6'
SCALE IN FEET

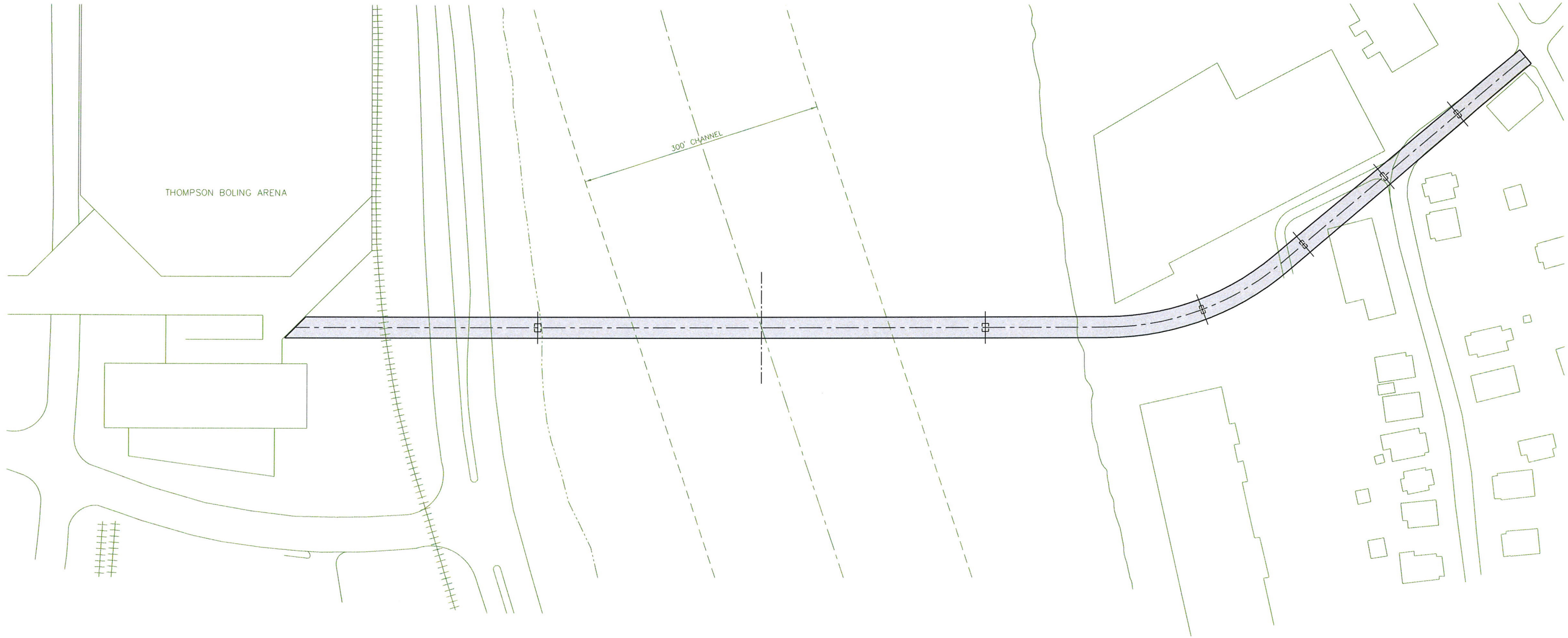
CITY OF KNOXVILLE

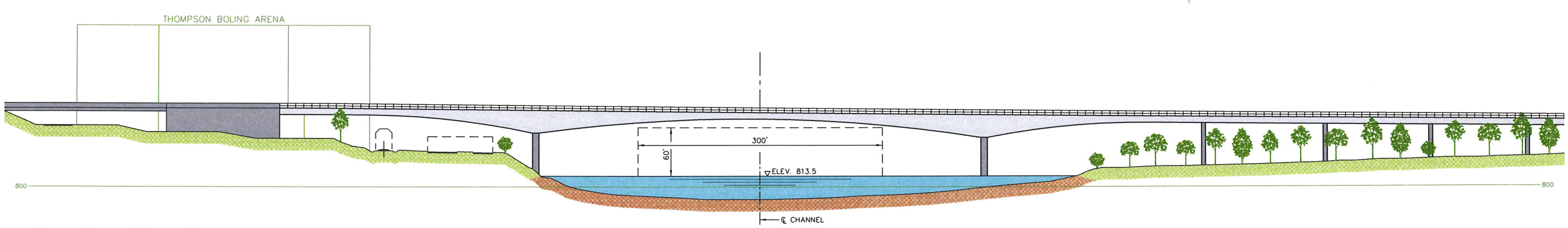
TYPICAL SECTIONS

PEDESTRIAN / BICYCLE BRIDGE

KNOXVILLE SOUTH WATERFRONT REDEVELOPMENT AREA

LAWRIE AND ASSOCIATES CRJA WILBUR SMITH ASSOCIATES S&ME SANDERS PACE ARCHITECTURE





60' 0 60' 120'
SCALE IN FEET

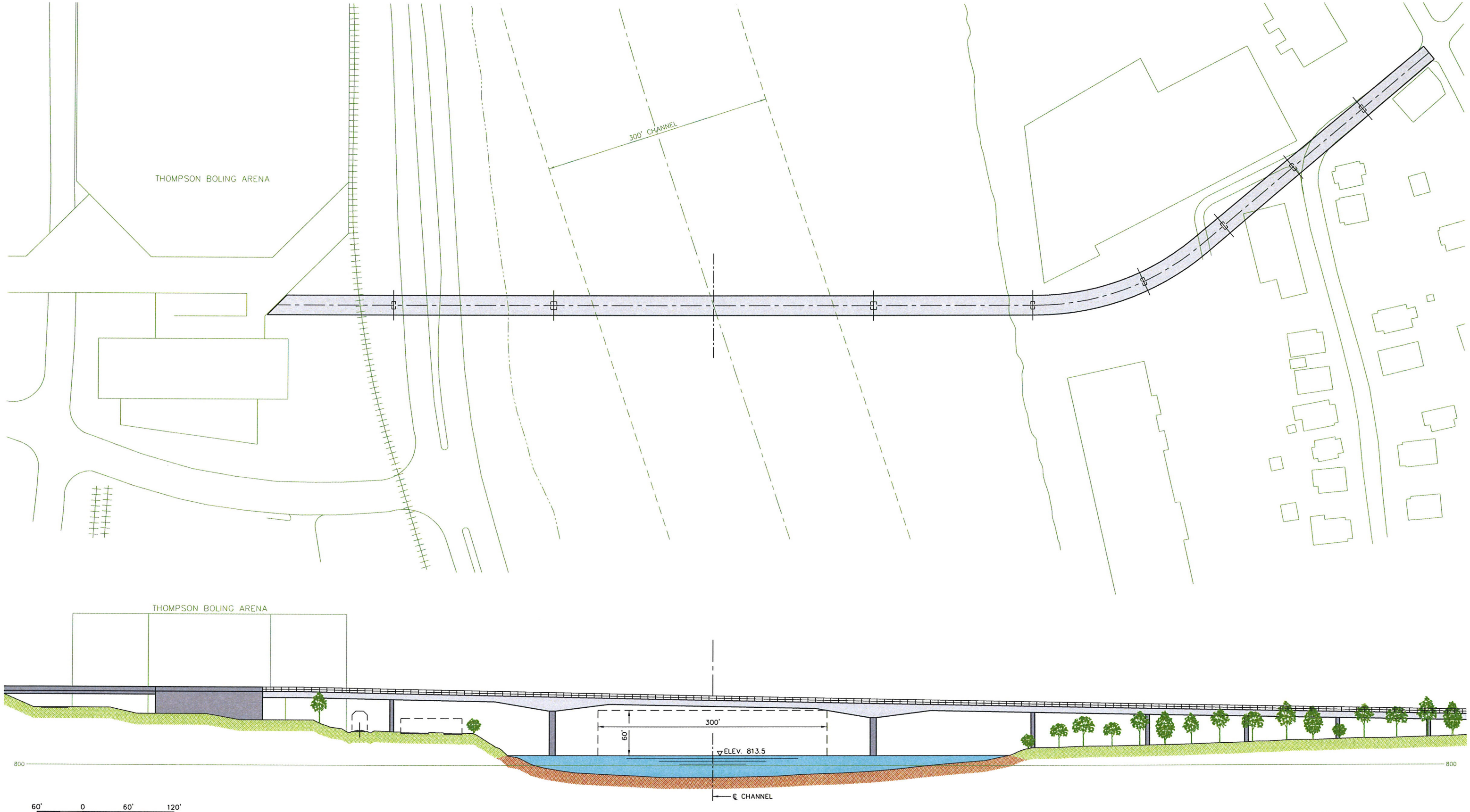
CITY OF KNOXVILLE

OPTION 1 HAUNCHED BOX GIRDER

PEDESTRIAN / BICYCLE BRIDGE

KNOXVILLE SOUTH WATERFRONT REDEVELOPMENT AREA

LAWRIE AND ASSOCIATES CRJA WILBUR SMITH ASSOCIATES S&ME SANDERS PACE ARCHITECTURE



60' 0 60' 120'
SCALE IN FEET

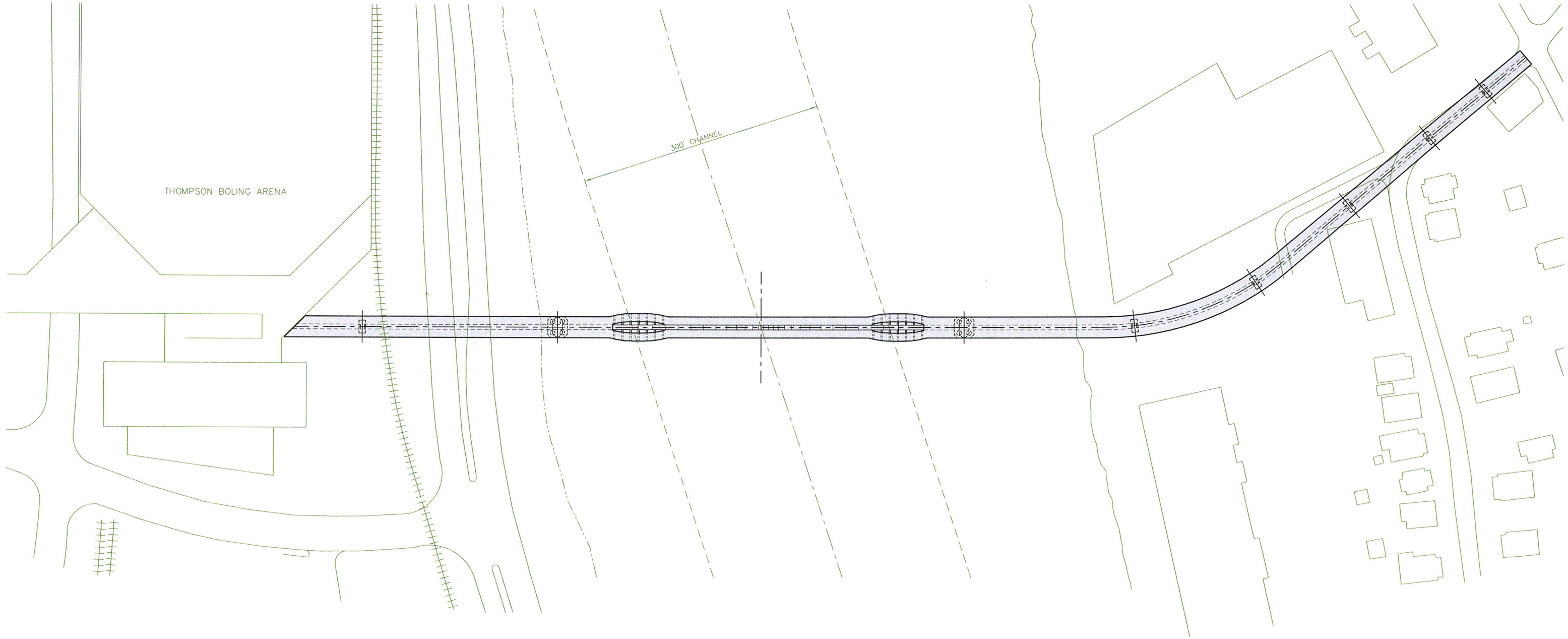
CITY OF KNOXVILLE

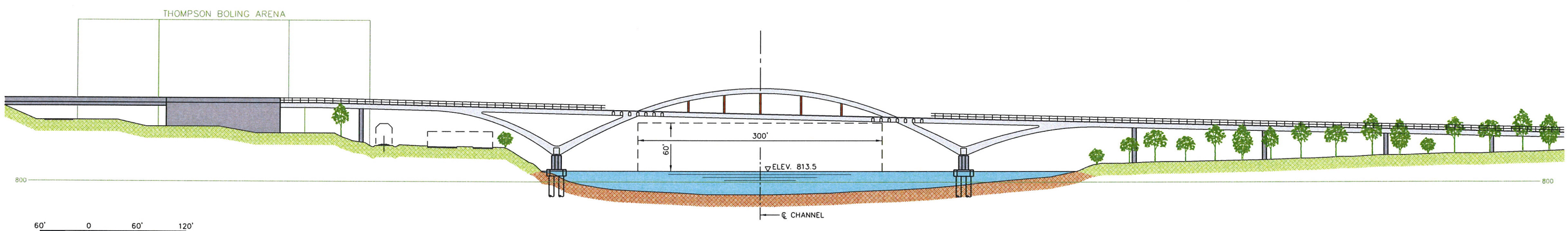
OPTION 2 BOX GIRDER TAPERED HAUNCHED

PEDESTRIAN / BICYCLE BRIDGE

KNOXVILLE SOUTH WATERFRONT REDEVELOPMENT AREA

LAWRIE AND ASSOCIATES CRJA WILBUR SMITH ASSOCIATES S&ME SANDERS PACE ARCHITECTURE





60' 0 60' 120'
SCALE IN FEET

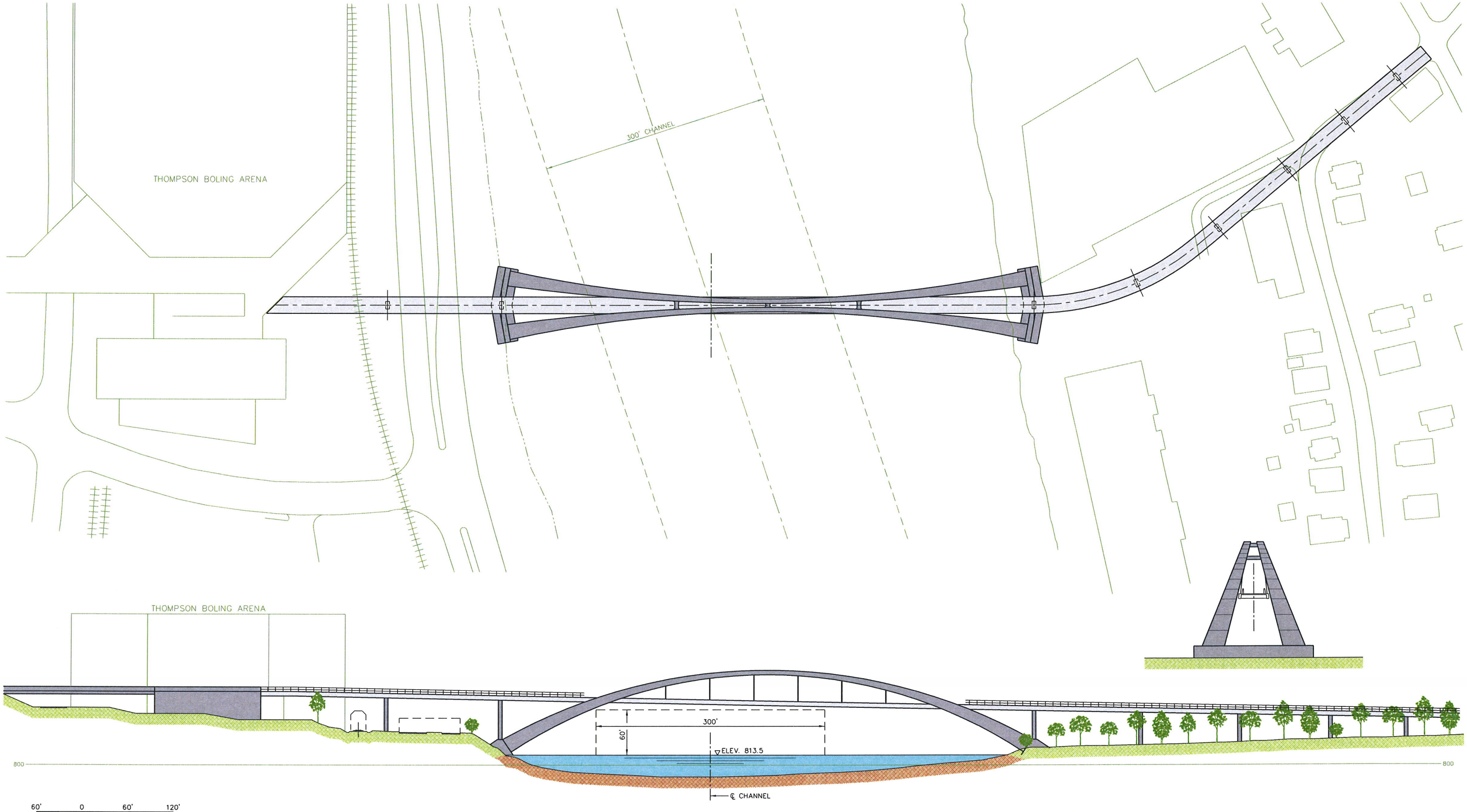
CITY OF KNOXVILLE

OPTION 3 500-FT ARCH

PEDESTRIAN / BICYCLE BRIDGE

KNOXVILLE SOUTH WATERFRONT REDEVELOPMENT AREA

LAWRIE AND ASSOCIATES CRJA WILBUR SMITH ASSOCIATES S&ME SANDERS PACE ARCHITECTURE



60' 0 60' 120'
SCALE IN FEET

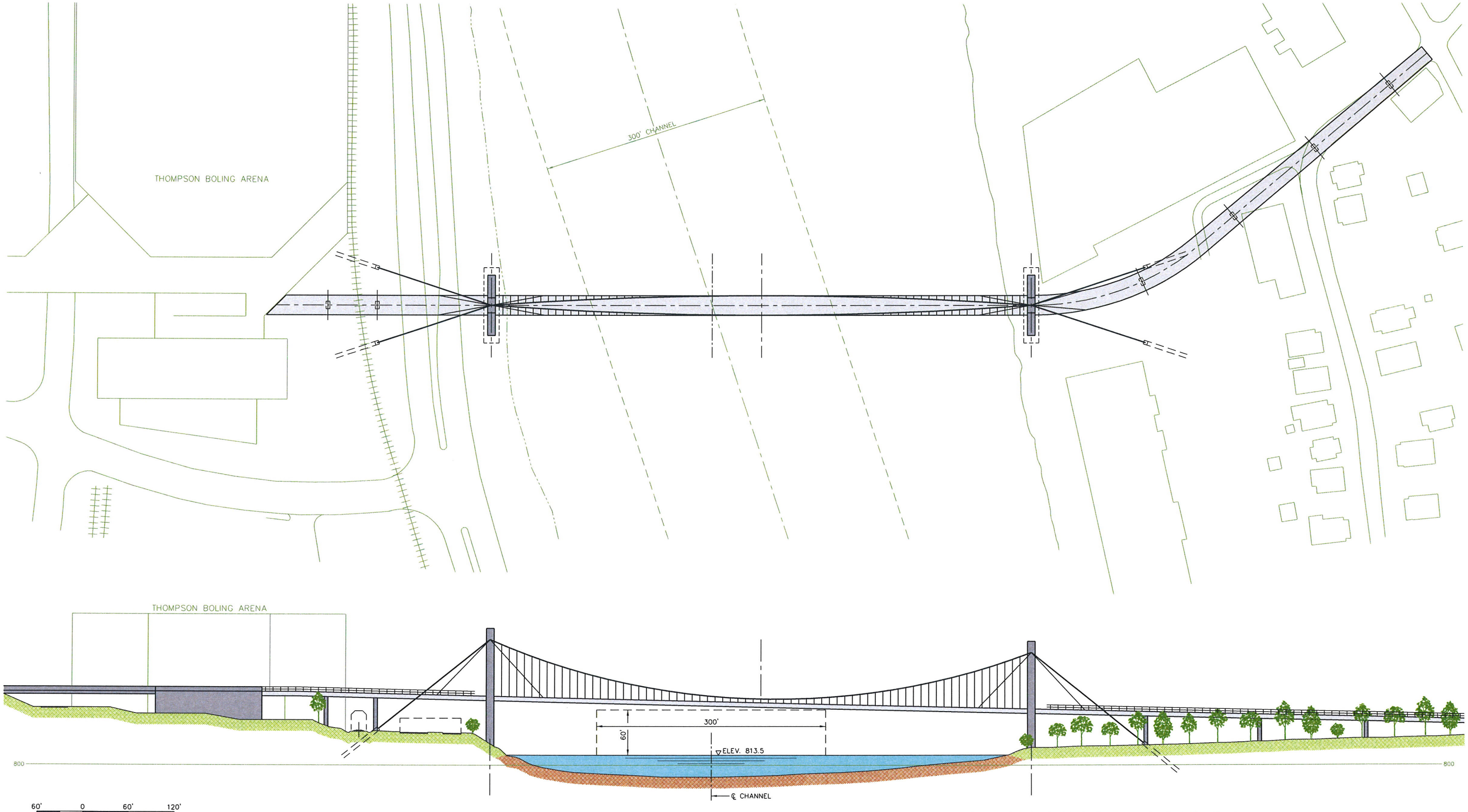
CITY OF KNOXVILLE

OPTION 4 LONG SPAN ARCH

PEDESTRIAN / BICYCLE BRIDGE

KNOXVILLE SOUTH WATERFRONT REDEVELOPMENT AREA

LAWRIE AND ASSOCIATES CRJA WILBUR SMITH ASSOCIATES S&ME SANDERS PACE ARCHITECTURE



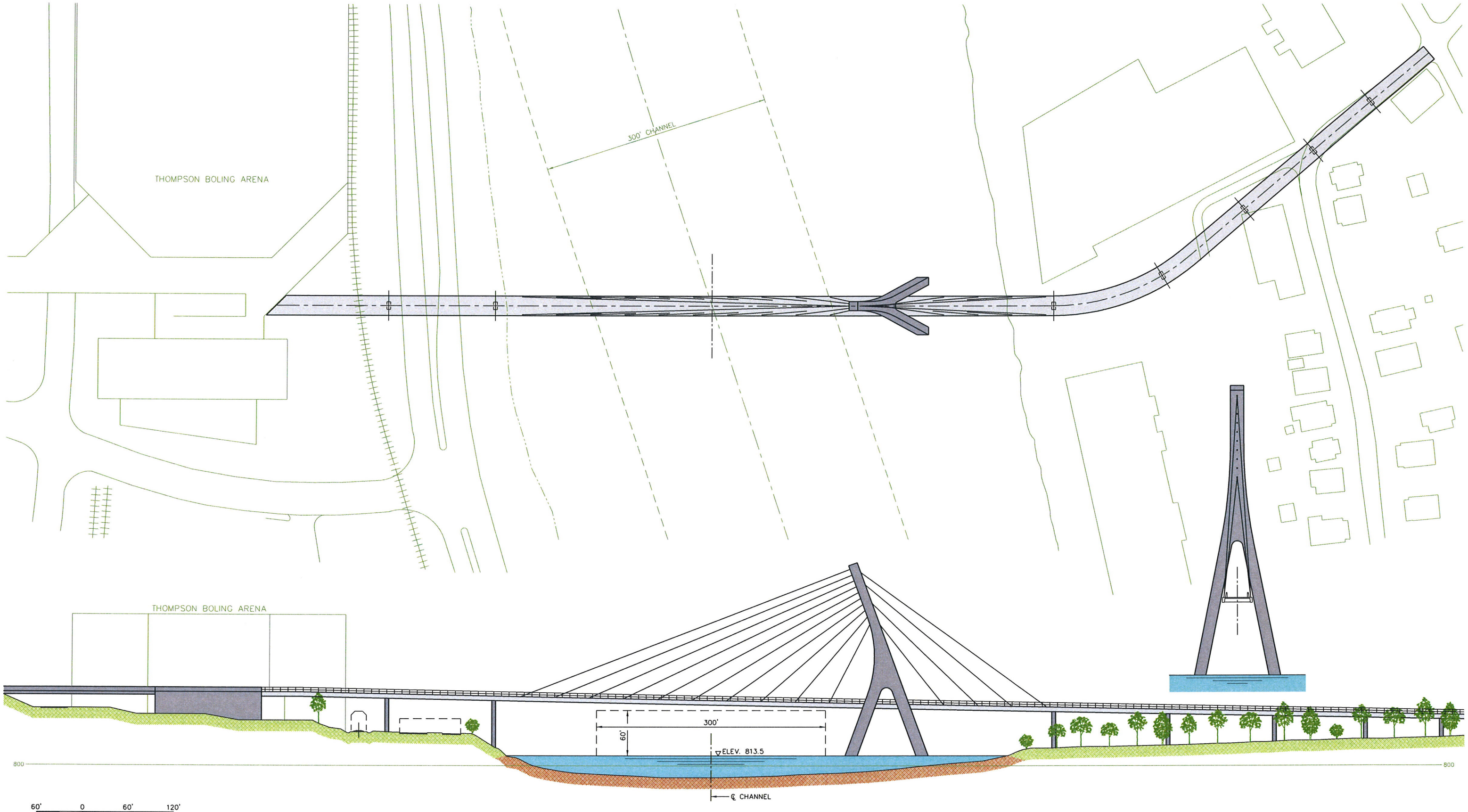
CITY OF KNOXVILLE

OPTION 5 SUSPENSION BRIDGE

PEDESTRIAN / BICYCLE BRIDGE

KNOXVILLE SOUTH WATERFRONT REDEVELOPMENT AREA

LAWRIE AND ASSOCIATES CRJA WILBUR SMITH ASSOCIATES S&ME SANDERS PACE ARCHITECTURE



60' 0 60' 120'
SCALE IN FEET

CITY OF KNOXVILLE

OPTION 6 CABLE-STAYED BRIDGE

PEDESTRIAN / BICYCLE BRIDGE

KNOXVILLE SOUTH WATERFRONT REDEVELOPMENT AREA

LAWRIE AND ASSOCIATES CRJA WILBUR SMITH ASSOCIATES S&ME SANDERS PACE ARCHITECTURE

NORTH LANDING OPTIONS

LANDING TYPE: AT-GRADE EXTENSION

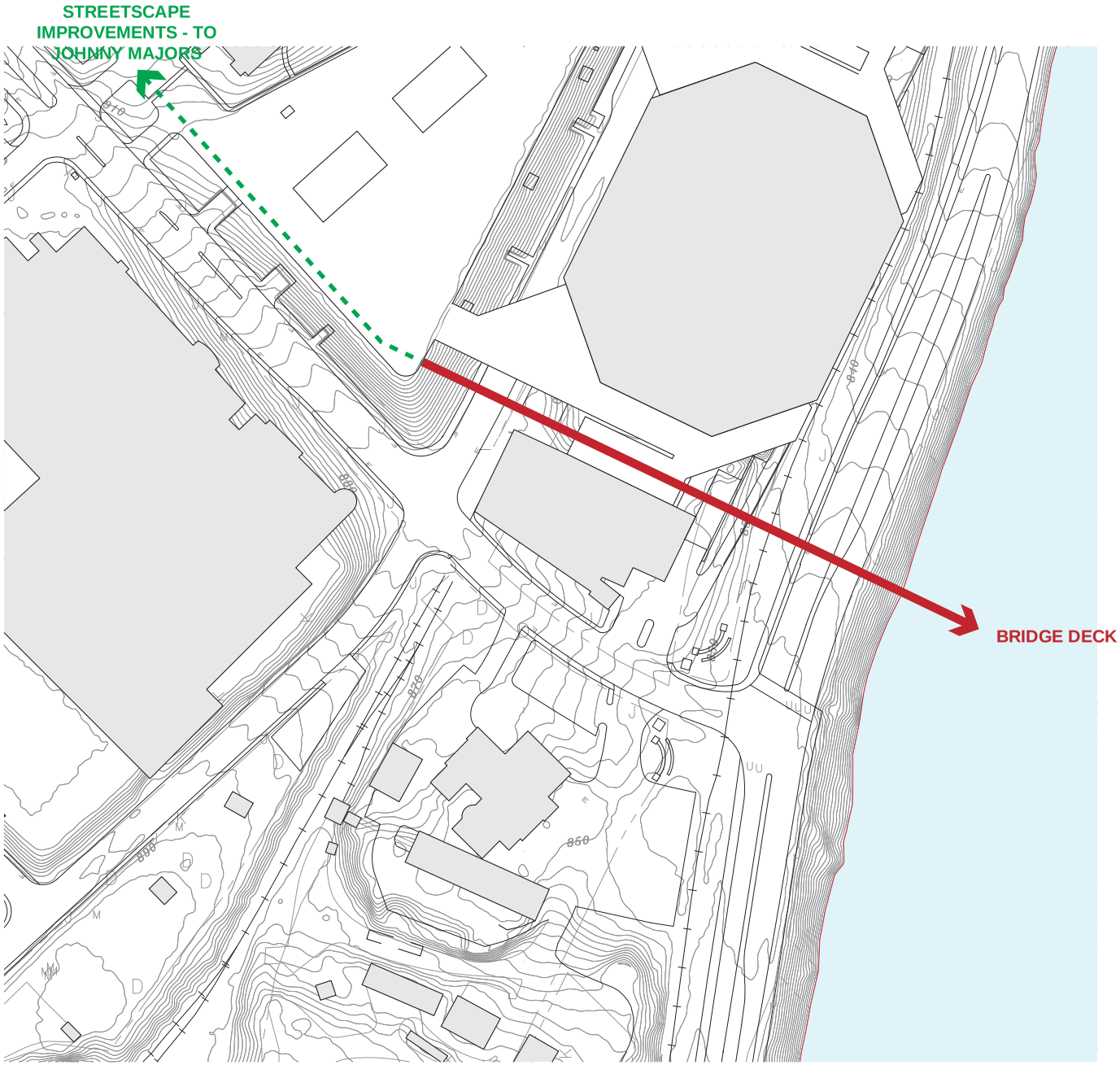
STRUCTURED LENGTH: 780 FT.

PROPERTY ACQUISITION:
EXISTING NON-COMPLIANT THOMPSON BOLING ARENA RAMPS

ADVANTAGES:
* UTILIZATION OF EXISTING STRUCTURE
* DIRECT CONNECTION TO CAMPUS
* ACCOMODATES ALL USER GROUPS

DISADVANTAGES:
* NO DIRECT CONNECTION TO GREENWAY
* ACCESS TO BRIDGE VIA EXISTING PARKING DECK / IMPACTS CAMPUS PARKING

USER GROUPS :



SCALE 1” = 200’

N-01

NORTH LANDING OPTIONS

LANDING TYPE: AT-GRADE EXTENSION

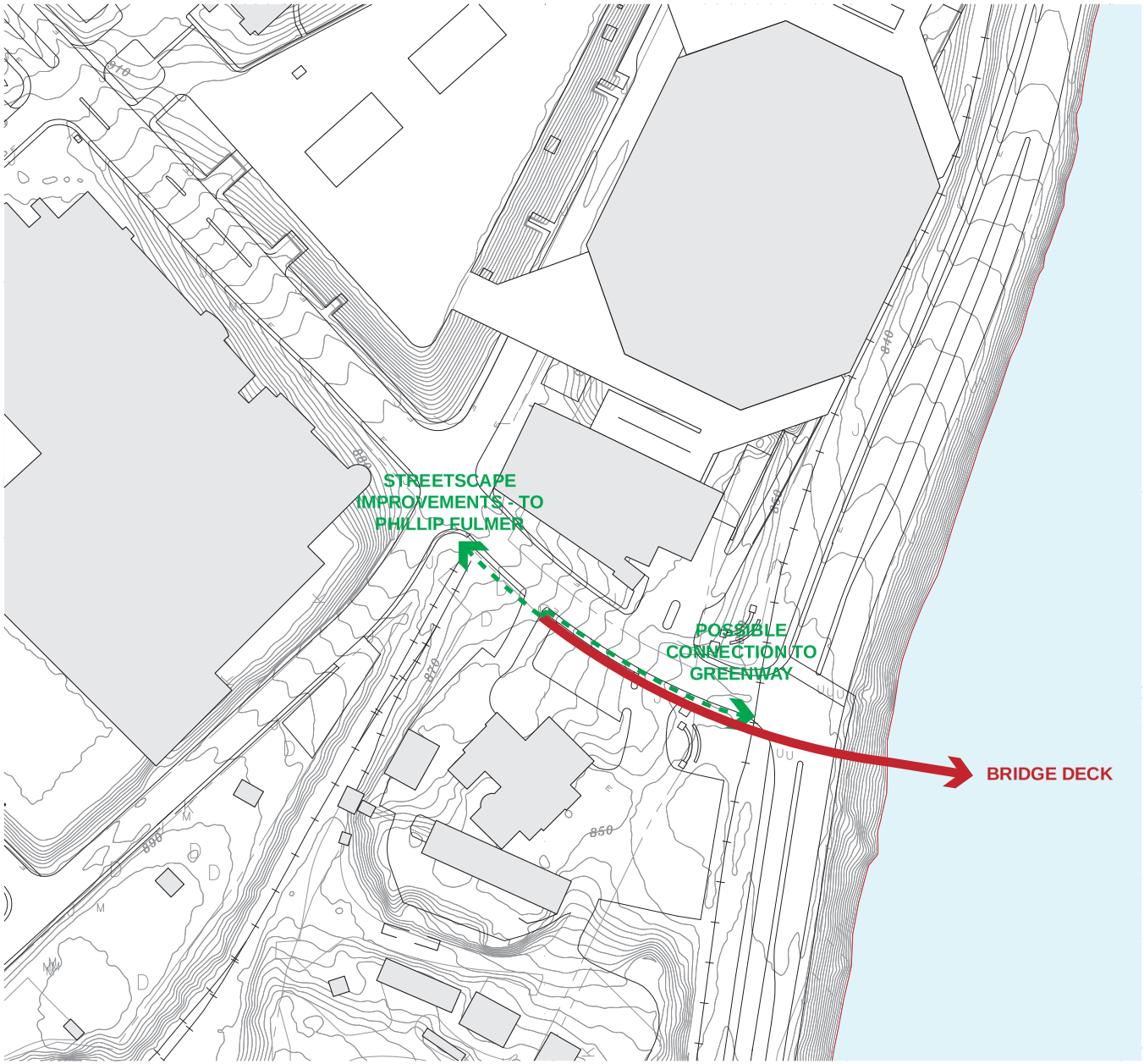
STRUCTURED LENGTH: 560 FT.

PROPERTY ACQUISITION:
RIGHT OF WAY AT UNIVERSITY STEAM PLANT PROPERTY

ADVANTAGES:
* DIRECT CONNECTION TO CAMPUS
* ACCOMODATES ALL USER GROUPS
* AT-GRADE LANDING CONNECTING TO EXISTING INTERSECTION

DISADVANTAGES:
* NO DIRECT CONNECTION TO GREENWAY
* IMPACTS RECENT CAMPUS IMPROVEMENTS AT LAKE LOUDOUN BLVD & CAMPUS PARKING

USER GROUPS :



SCALE 1” = 200’

N-02

NORTH LANDING OPTIONS

LANDING TYPE: SWITCHBACK RAMP

STRUCTURED LENGTH: 600 FT.

PROPERTY ACQUISITION:
NEYLAND RIGHT OF WAY ONLY

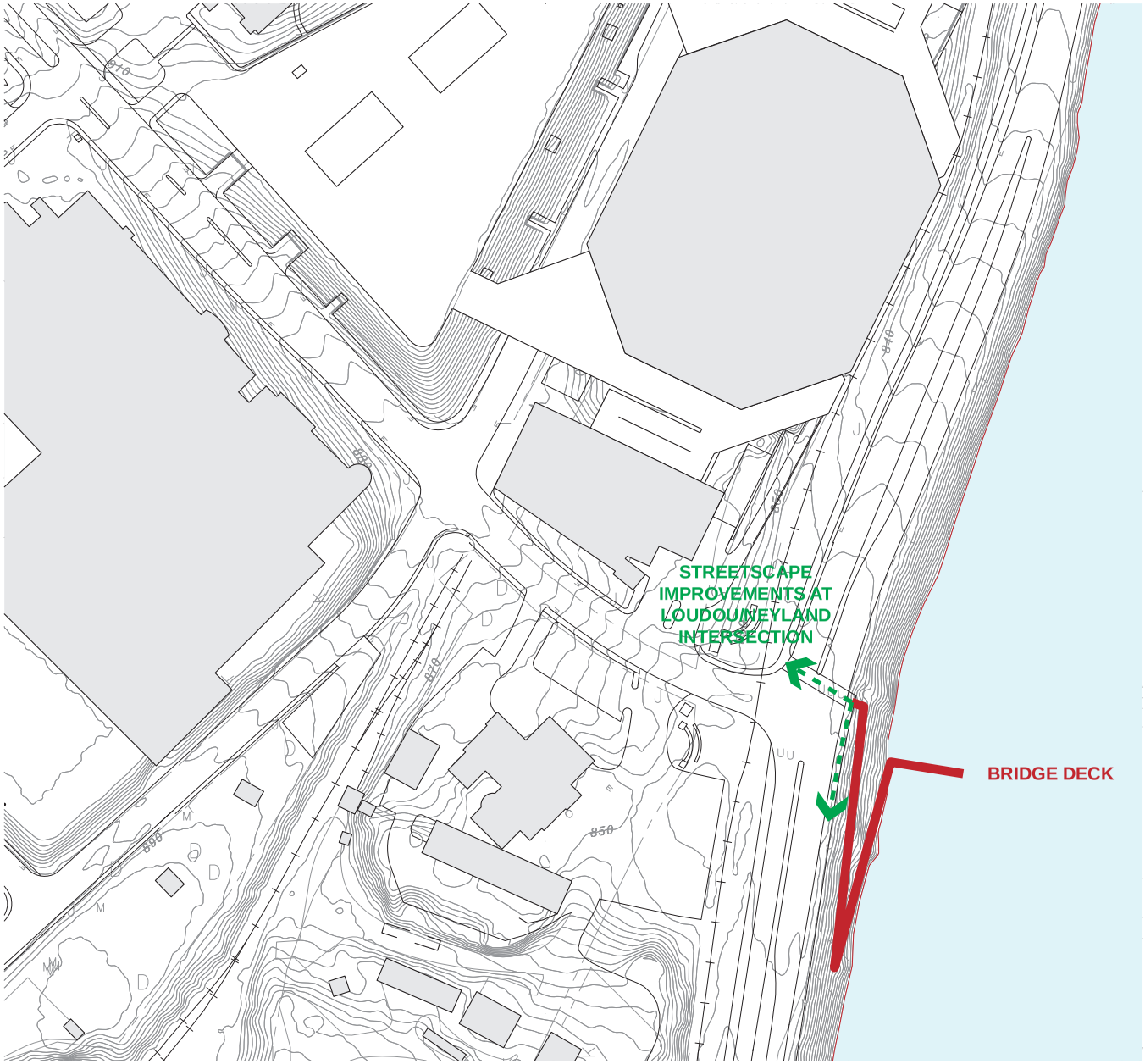
ADVANTAGES:
* NO WORK ON CAMPUS PROPERTY
* DIRECT ACCESS TO GREENWAY

DISADVANTAGES:
* NO DIRECT ACCESS TO CAMPUS
* SWITCHBACK LIMITS BIKE USAGE

USER GROUPS :

* DESIGN SPEED NOT MAINTAINED

N-03



SCALE 1” = 200’

NORTH LANDING OPTIONS

LANDING TYPE: TOWER

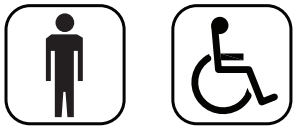
STRUCTURED LENGTH: 40 FT.

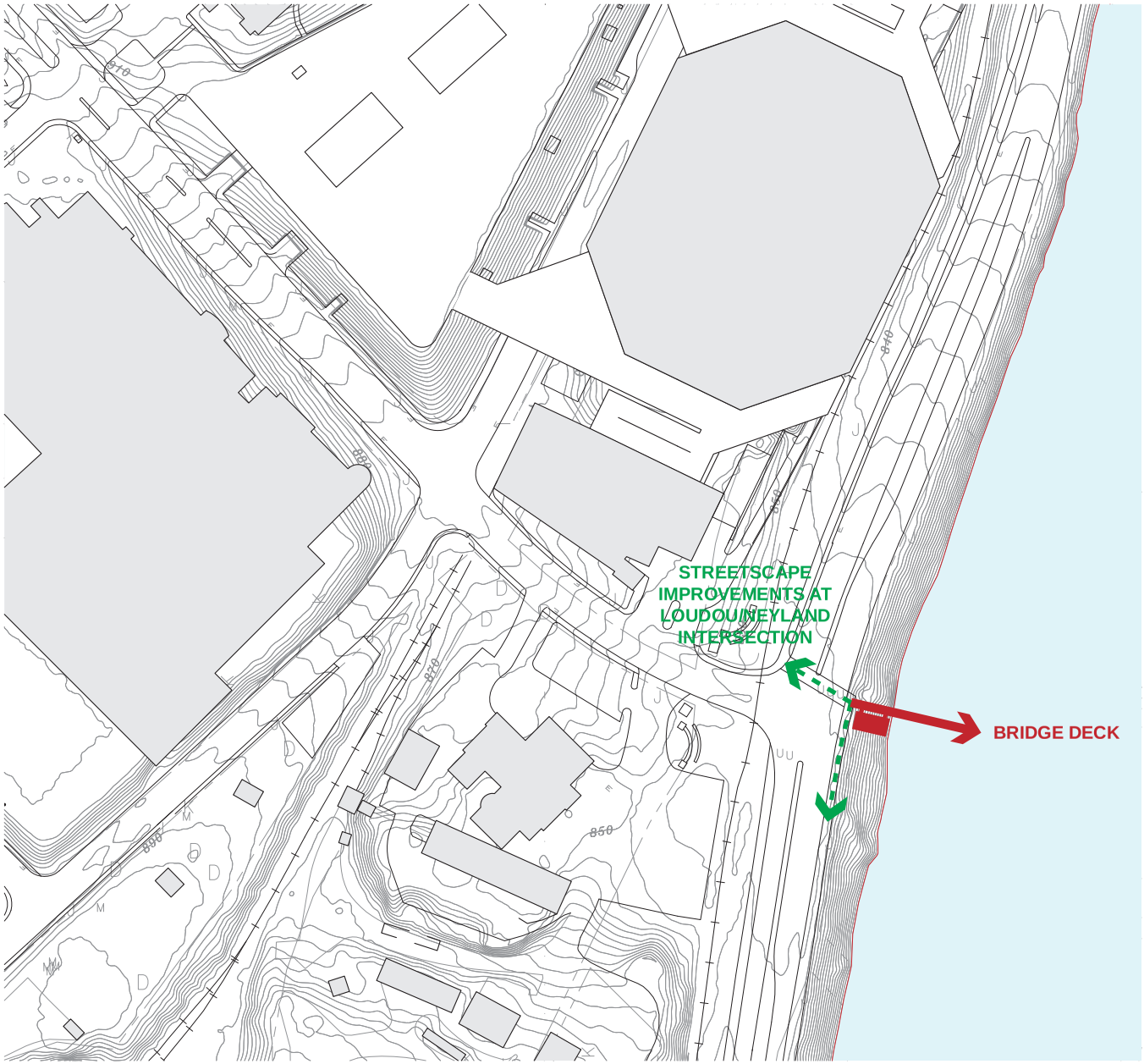
PROPERTY ACQUISITION:
NEYLAND RIGHT OF WAY ONLY

ADVANTAGES:
* NO WORK ON CAMPUS PROPERTY
* DIRECT ACCESS TO GREENWAY

DISADVANTAGES:
* NO DIRECT ACCESS TO CAMPUS
* BICYCLISTS MUST DISMOUNT

USER GROUPS :





SCALE 1” = 200’

N-04

SOUTH LANDING OPTIONS

LANDING TYPE: ELLIPTICAL RAMP

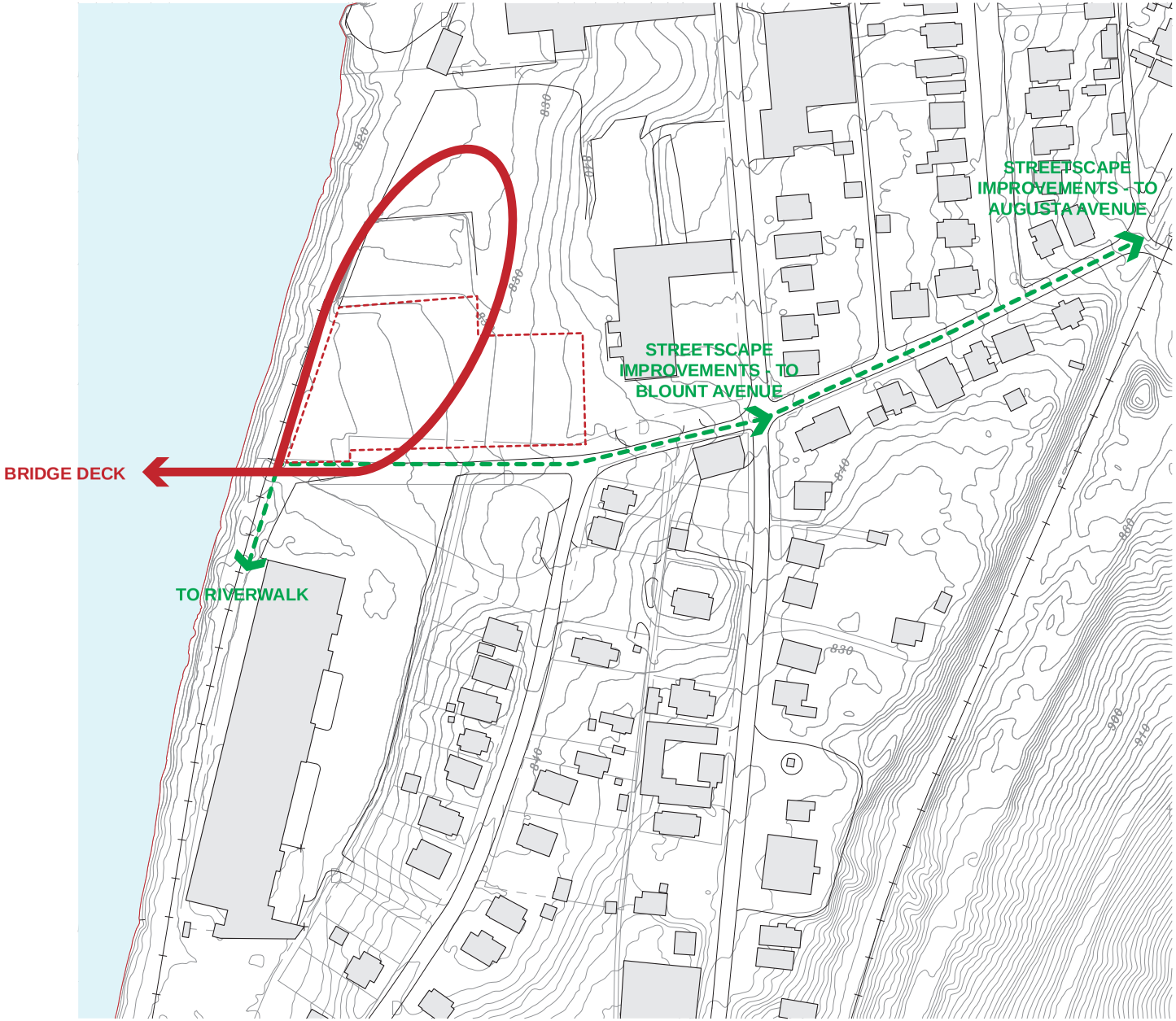
STRUCTURED LENGTH: 1000 FT.

PROPERTY ACQUISITION:
HOYLE GILL PARCEL

ADVANTAGES:
* ACCOMMODATES ALL USER GROUPS
* DIRECT ACCESS TO WATER

DISADVANTAGES:
* SUBSTANTIAL PROPERTY ACQUISITION
* NO DIRECT ACCESS TO BLOUNT AVE

USER GROUPS :



SCALE 1” = 200’

S-01

SOUTH LANDING OPTIONS

LANDING TYPE: AT-GRADE EXTENSION

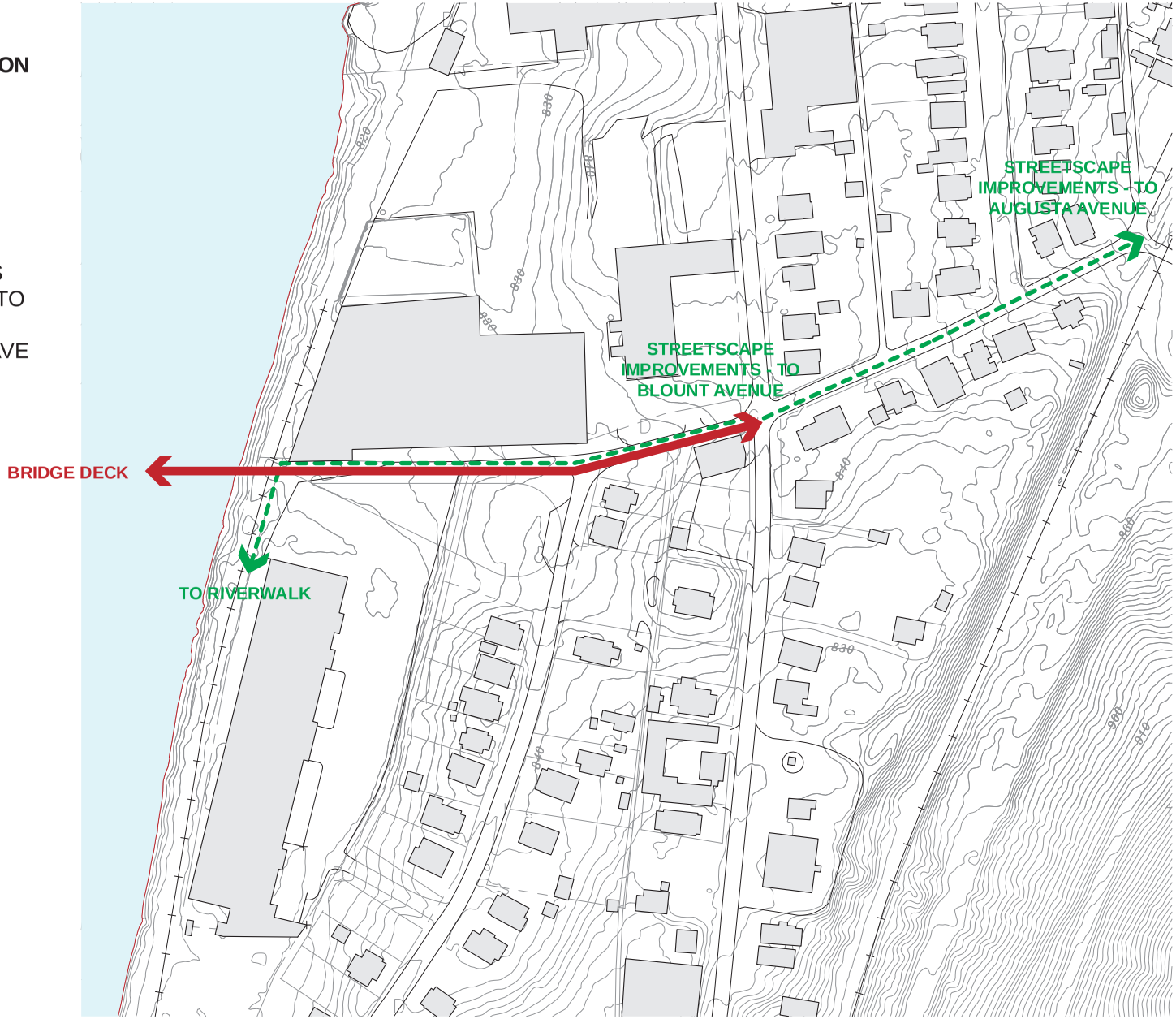
STRUCTURED LENGTH: 1000 FT.

PROPERTY ACQUISITION:
MULTIPLE SMALL PARCELS

ADVANTAGES:
* ACCOMODATES ALL USER GROUPS
* AT-GRADE LANDING CONNECTING TO EXISTING INTERSECTION
*DIRECT CONNECTION TO BLOUNT AVE

DISADVANTAGES:
* LONG SPAN OF EXTENSION - MULTIPLE PARCEL ACQUISITION

USER GROUPS :



SCALE 1” = 200’

S-02

SOUTH LANDING OPTIONS

LANDING TYPE: SWITCHBACK RAMP

STRUCTURED LENGTH: 1000 FT.

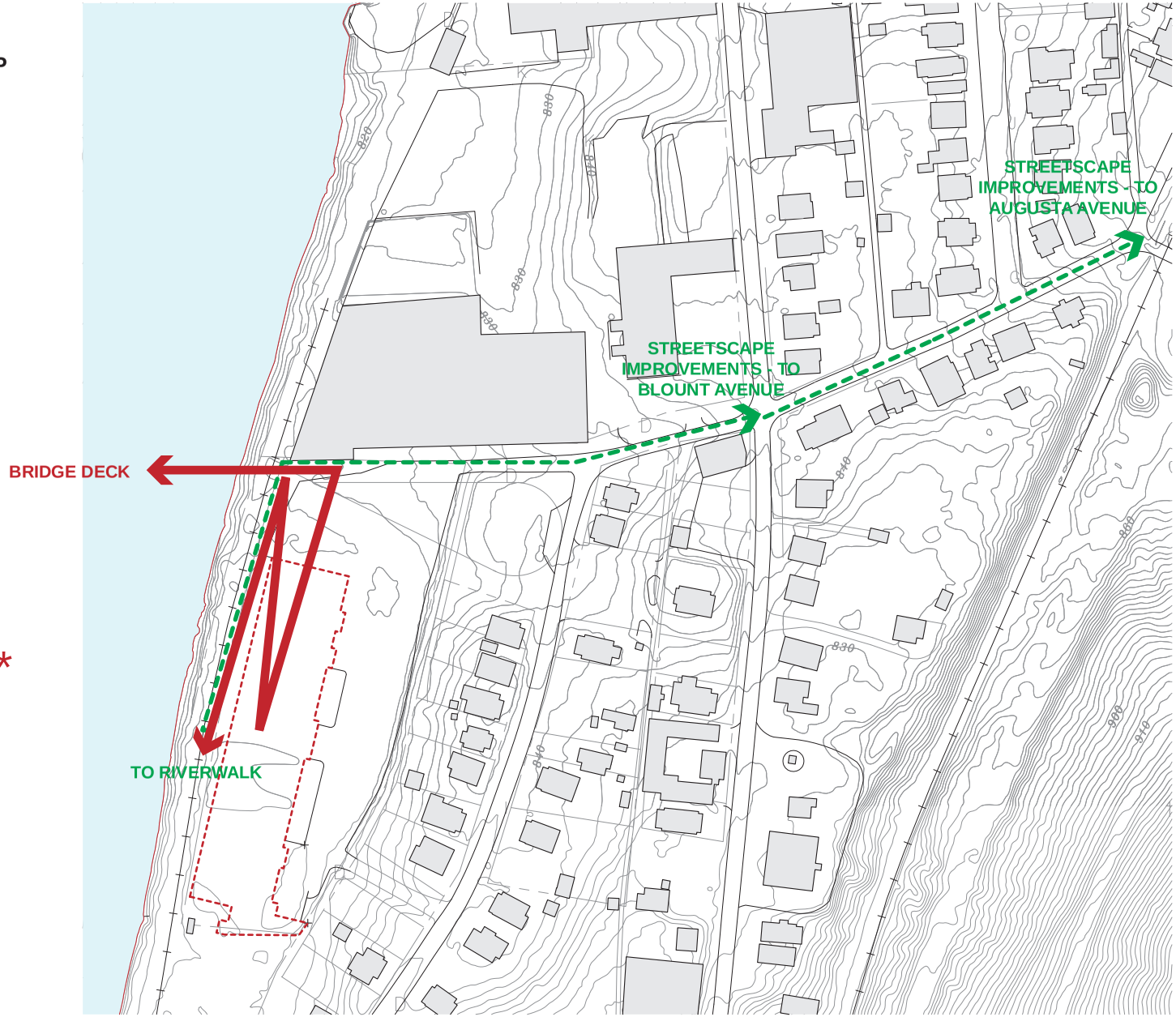
PROPERTY ACQUISITION:
BILL TAYLOR PARCEL

ADVANTAGES:
* DIRECT ACCESS TO WATERFRONT

DISADVANTAGES:
* NO DIRECT CONNECTION TO BLOUNT AVENUE
* SWITCHBACK LIMITS BIKE USAGE
* SUBSTANTIAL PROPERTY ACQUISITION

USER GROUPS :

* DESIGN SPEED NOT MAINTAINED



SCALE 1" = 200'

S-03

SOUTH LANDING OPTIONS

LANDING TYPE: SPIRAL RAMP

STRUCTURED LENGTH: 1000 FT.

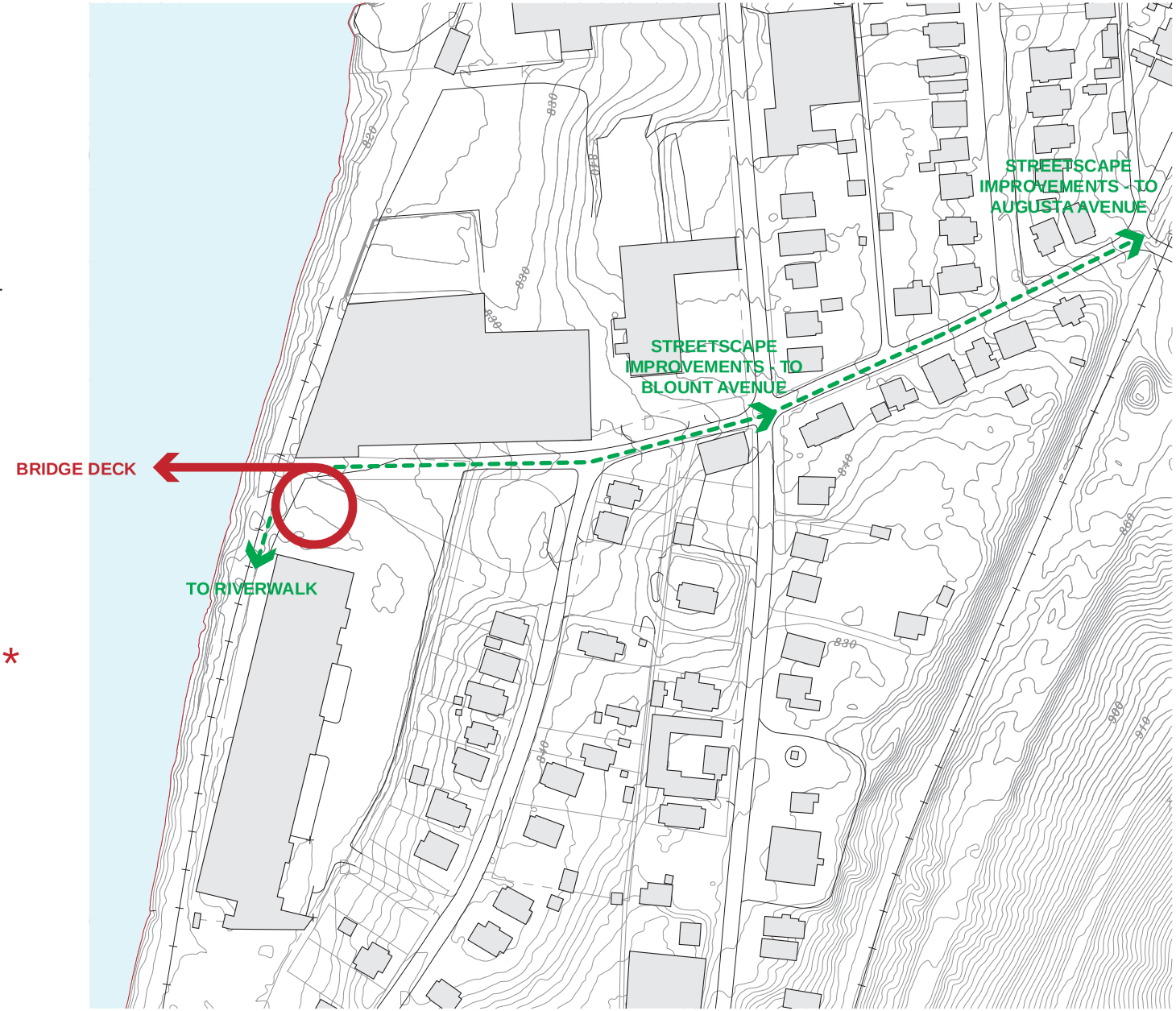
PROPERTY ACQUISITION:
BILL TAYLOR PARCEL

ADVANTAGES:
* LIMITED PROPERTY ACQUISITION
* DIRECT ACCESS TO WATERFRONT

DISADVANTAGES:
* NO DIRECT CONNECTION TO BLOUNT
* NARROW RADIUS LIMITS BIKE USAGE

USER GROUPS :

* DESIGN SPEED NOT MAINTAINED



SCALE 1” = 200’

S-04

SOUTH LANDING OPTIONS

LANDING TYPE: TOWER

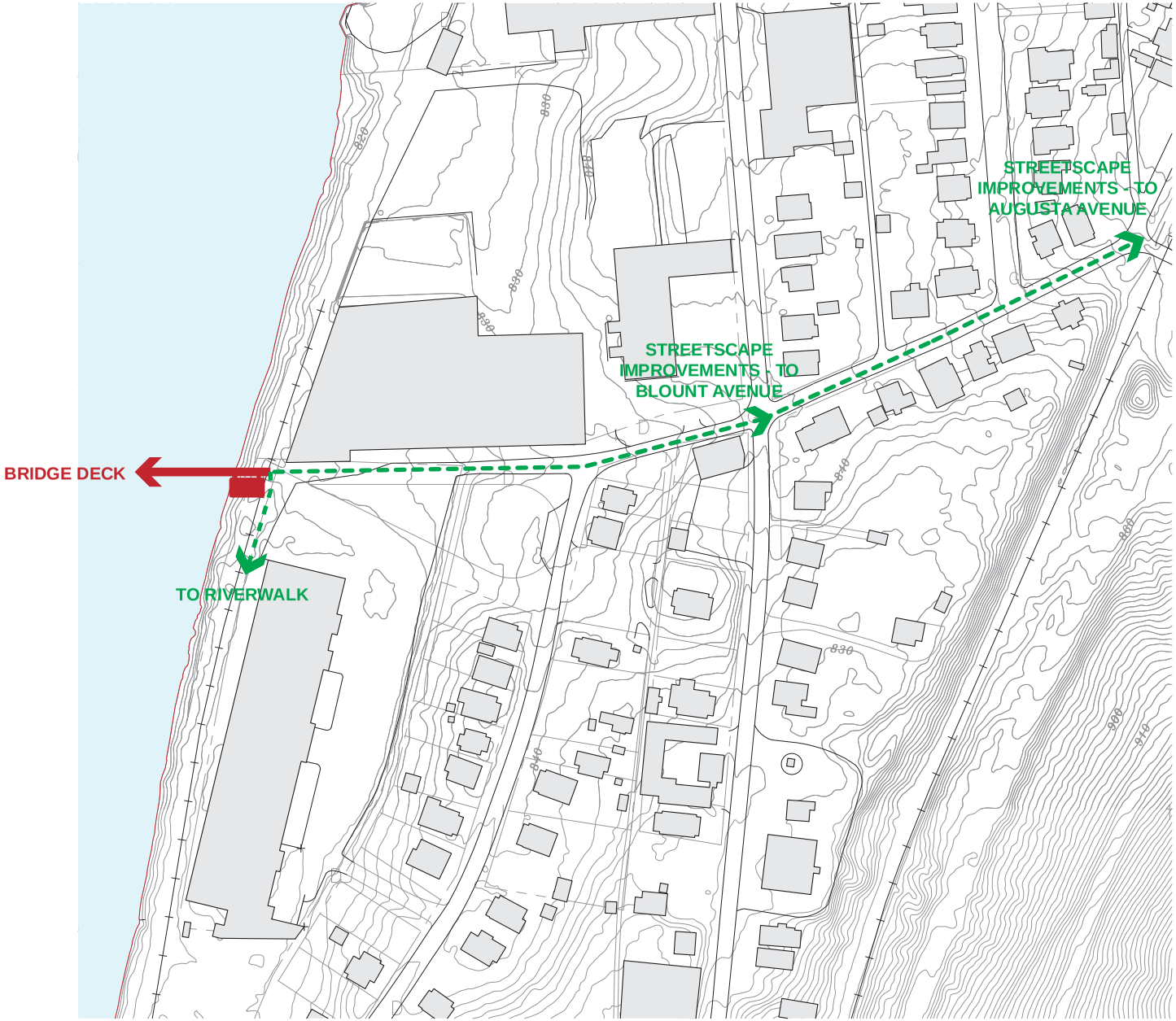
STRUCTURED LENGTH: 40 FT.

PROPERTY ACQUISITION:
RIGHT OF WAY ONLY

ADVANTAGES:
* LIMITED PROPERTY AQUISITION
* LOWEST FRONT-END COST
* DIRECT ACCESS TO WATERFRONT

DISADVANTAGES:
* NO DIRECT CONNECTION TO BLOUNT AVENUE
* BICYCLISTS MUST DISMOUNT

USER GROUPS :



SCALE 1” = 200’

S-05

LANDING PRECEDENTS

LANDING TYPE: ELLIPTICAL RAMP

BRIDGE: BIG FOUR PEDESTRIAN BRIDGE
LOCATION: LOUISVILLE, KY

LANDING DURING CONSTRUCTION

USER GROUPS :

COMPLETED LANDING

LANDING PRECEDENTS

LANDING TYPE: ELLIPTICAL RAMP

BRIDGE: BIG FOUR PEDESTRIAN BRIDGE
LOCATION: LOUISVILLE, KY

SITE PLAN **SCALE 1” = 200’**

LANDING PRECEDENTS

LANDING TYPE: AT-GRADE EXTENSION

BRIDGE: WALNUT STREET PEDESTRIAN BRIDGE
LOCATION: CHATTANOOGA, TN

VIEW OF PEDESTRIAN BRIDGE AND LANDING

USER GROUPS :

VIEW FROM PARK BELOW LANDING

LANDING PRECEDENTS

LANDING TYPE: AT-GRADE EXTENSION

BRIDGE: WALNUT STREET PEDESTRIAN BRIDGE
LOCATION: CHATTANOOGA, TN

SITE PLAN

SCALE 1” = 200’

LANDING PRECEDENTS

LANDING TYPE: SWITCHBACK RAMP

BRIDGE: MON WHARF SWITCHBACK (PROPOSED)
LOCATION: PITTSBURGH, PA

USER GROUPS :

* DESIGN SPEED NOT MAINTAINED

VIEW FROM PARK BELOW LANDING

LANDING PRECEDENTS

LANDING TYPE: SWITCHBACK RAMP

BRIDGE: MON WHARF SWITCHBACK (PROPOSED)
LOCATION: PITTBURGH, PA

SITE PLAN **SCALE 1" = 200'**

LANDING PRECEDENTS

LANDING TYPE: SPIRAL RAMP

BRIDGE: PFLUGER PEDESTRIAN BRIDGE
LOCATION: AUSTIN, TX

BRIDGE EXTENSION WITH SPIRAL RAMP BEYOND

USER GROUPS :

* DESIGN SPEED NOT MAINTAINED

INTERIOR VIEW OF SPIRAL RAMP

LANDING PRECEDENTS

LANDING TYPE: SPIRAL RAMP

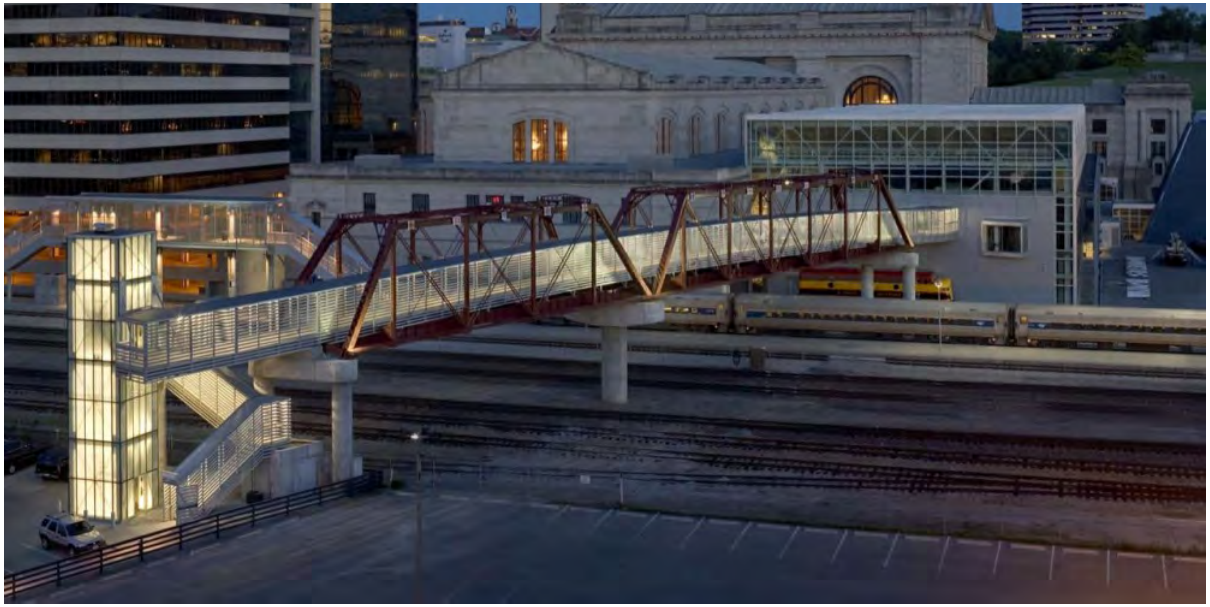
BRIDGE: PFLUGER PEDESTRIAN BRIDGE
LOCATION: AUSTIN, TX

SITE PLAN **SCALE 1” = 200’**

LANDING PRECEDENTS

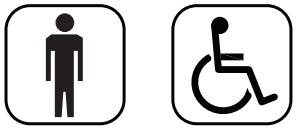
LANDING TYPE: TOWER

BRIDGE: FREIGHT HOUSE PEDESTRIAN BRIDGE
LOCATION: KANSAS CITY, MO



NIGHT VIEW OF BRIDGE AND TOWER LANDING

USER GROUPS :



TOWER LANDING FROM PARKING LOT

LANDING PRECEDENTS

LANDING TYPE: TOWER

BRIDGE: FREIGHT HOUSE PEDESTRIAN BRIDGE
LOCATION: KANSAS CITY, MO

SITE PLAN **SCALE 1” = 200’**