

June 8, 2021

PFC2021-1235  
Attachment 4

# Bridgeland-Riverside Multimodal Bridge

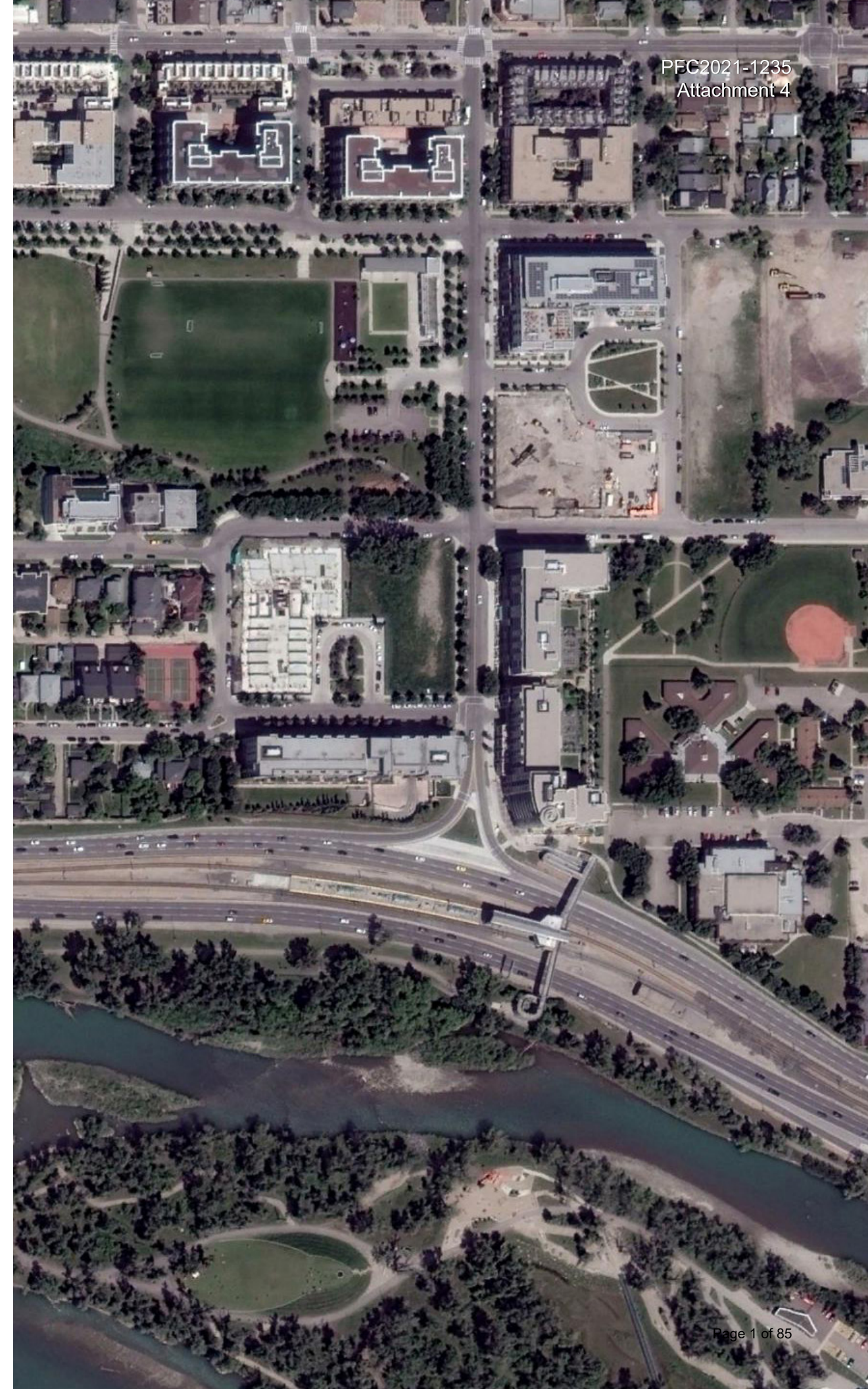
Feasibility Report



Perkins&Will

ISC: UNRESTRICTED

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# A bridge of two halves.



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# Section 1.

# Introduction

# Introduction



## Background

The Calgary General Hospital Legacy Fund Committee commissioned a feasibility study to create an accessible, multi-modal connection between the Bridgeland-Riverside Neighbourhood and St. Patrick's Island to replace the existing Bridgeland/Memorial LRT bridge. The proposed bridge is envisioned to enhance and improve the existing connection to the LRT Station and the Bow River Pathway and to provide a connection from the Bridgeland-Riverside neighbourhood to St. Patrick's Island. The bridge is intended to stimulate business in the Bridgeland-Riverside Community, improve access for seniors and the general public to the LRT Station and surrounding amenities and build upon the approach taken in the redevelopment of St. Patrick's Island to minimize disruption of and impact on the island's natural and existing ecology.

This project has been identified as a "healthy Calgary initiative" to enhance the connection between the Bridgeland-Riverside Community and St. Patrick's Island. As a "healthy Calgary initiative" this project will be funded through the Calgary General Hospital Legacy Fund.

## Methodology

The feasibility study was informed through the Bridgeland-Riverside Community Association, Ward 9 Councillor's office, and the City of Calgary's Transportation Infrastructure division.

The feasibility study consisted of two phases, an alignment study phase and a conceptual design phase. The alignment study phase examined a number of bridge alignments, potential touch points, connections and landing opportunities to determine the alignment that best suited the project goals. This phase included a high level cost estimate to understand the overall project costs and establish budgetary constraints. The conceptual design phase was used to develop resolution of the architectural concept to meet the project goals and phasing strategies, establish a general structural approach and through a Class D cost estimate ensure that the project can be delivered within the established project budget.

## Purpose

This report is prepared for the Calgary General Hospital Legacy Fund Committee to establish an understanding of the feasibility, opportunities and costs for improving the connection between the Bridgeland-Riverside Community and the existing Bridgeland Memorial LRT Station and creating a new connection between the community and St. Patrick's Island.

During the initial phase of the study and through discussions with the stakeholder group, the team identified a number of objectives driving the preliminary design investigations of the bridge. These objectives include:

- Improve universal accessibility to/from the bridge
- Provide an improved experience for users
- Address multi-modal challenges striving to reduce potential bike/ped conflicts
- Address CPTED considerations in the design of the bridge
- Be mindful of cost and budgetary considerations
- Create a gateway to the community
- Build upon the ecological mission and natural protection strategy built into the design of St. Patrick's Island,

With these objectives providing direction to the design team the following Design Principles were drafted to guide the visioning effort of the bridge:

## Design Principles

### Community Building / Placemaking

To create a connection between the Bridgeland-Riverside Community, the existing LRT Station and St. Patrick's island that celebrates the community's unique location and provides access to surrounding amenity while establishing a gateway along Memorial Drive.

- Support the improvement of the neighbourhood experience as a destination
- Provide opportunities for viewpoints and pause along the bridge
- Recognize the legacy potential of the bridge structure as an image of the community
- Explore opportunities to incorporate public art
- Promote neighbourhood connectivity by responding to desired paths of travel for different modes and user types
- Create a gateway to the community along Memorial Drive

### Sustainability

To re-naturalize the connection between the community and the Bow River focussed around resilience, community experience and wellbeing.

- Bring natural landscape to the urban environment
- Incorporate native and hearty landscape on the bridge design
- Provide resiliency to Calgary weather events
- Pursue a similar approach towards ecological protection as was taken in the redevelopment of St. Patrick's Island by minimizing footprint and disruption to existing natural context

### Accessibility

To improve the connection to public transit and provide access to St. Patrick's Island allowing for universal access between the community and the surrounding amenities.

- Incorporate universally accessible design
- Promote strong connections between the community and St. Patrick's Island
- Incorporate safe design for all users and modes

### Implementation

To maximize continuity of service and access to community and existing LRT station.

- Allow for phasing opportunities
- Allow LRT station to remain operational during construction
- Promote commercial activities along 9th Street

### Economic

To create a bridge that helps define the success and identity of the community and encourages future development in the area.

- Economic driver with strong connections to Bridgeland-Riverside
- Enhance commercial activities developing along 9th Street
- Potential to increase tourism activity and faster access from Downtown to St. Patrick's Island and Calgary Zoo due to C-Train Station

## Project Team

Client	Calgary General Hospital Legacy Fund Committee
Project Manager	Calgary Municipal Land Corporation (CMLC)
Architect	Perkins&Will
Structural Engineer	Fast + Epp
Quantity Surveyor	BTY Group

## Reference Documents

The proposed alignment and bridge concept has been designed in accordance with the following documents:

### 1. National Building Code –2019 Alberta Edition:

The proposed bridge design conforms to the governing code to the level of detail explored at this stage of the design in regards to:

- › life safety
- › accessibility
- › guard and handrail design
- › vertical circulation requirements
- › structural requirements

### 2. City of Calgary Transportation Infrastructure Design Guidelines for Bridges and Structures 2020

The proposed bridge design conforms to this design guideline to the level of detail explored at this stage of the design in regards to:

- › structural requirements
- › design and service life
- › design quality
- › clearance requirements
- › grading and slopes
- › durability
- › drainage

Specifications and details to be coordinated as design develops in future phases of the project.

### 3. Province of Alberta Water Act

The Water Act regulates all activities conducted in and around surface water and groundwater within the Province of Alberta. All development in proximity to public waterways, including the Bow River that may affect the land or vegetation under or around a water body or affect the location, flow or quality of the water or aquatic environment shall be designed in accordance with the Alberta Water Act and under the act requires authorization and approval from Alberta Environment.

### 4. City of Calgary Access Design Standards:

The proposed bridge was coordinated with the accessibility design standards where applicable. Continued coordination in terms of ramp slopes, handrail design, lighting requirements, material specification and barrier free design integration to continue as the design develops in future phases of the project.

# Section 2.

## Site Analysis



# Community Context

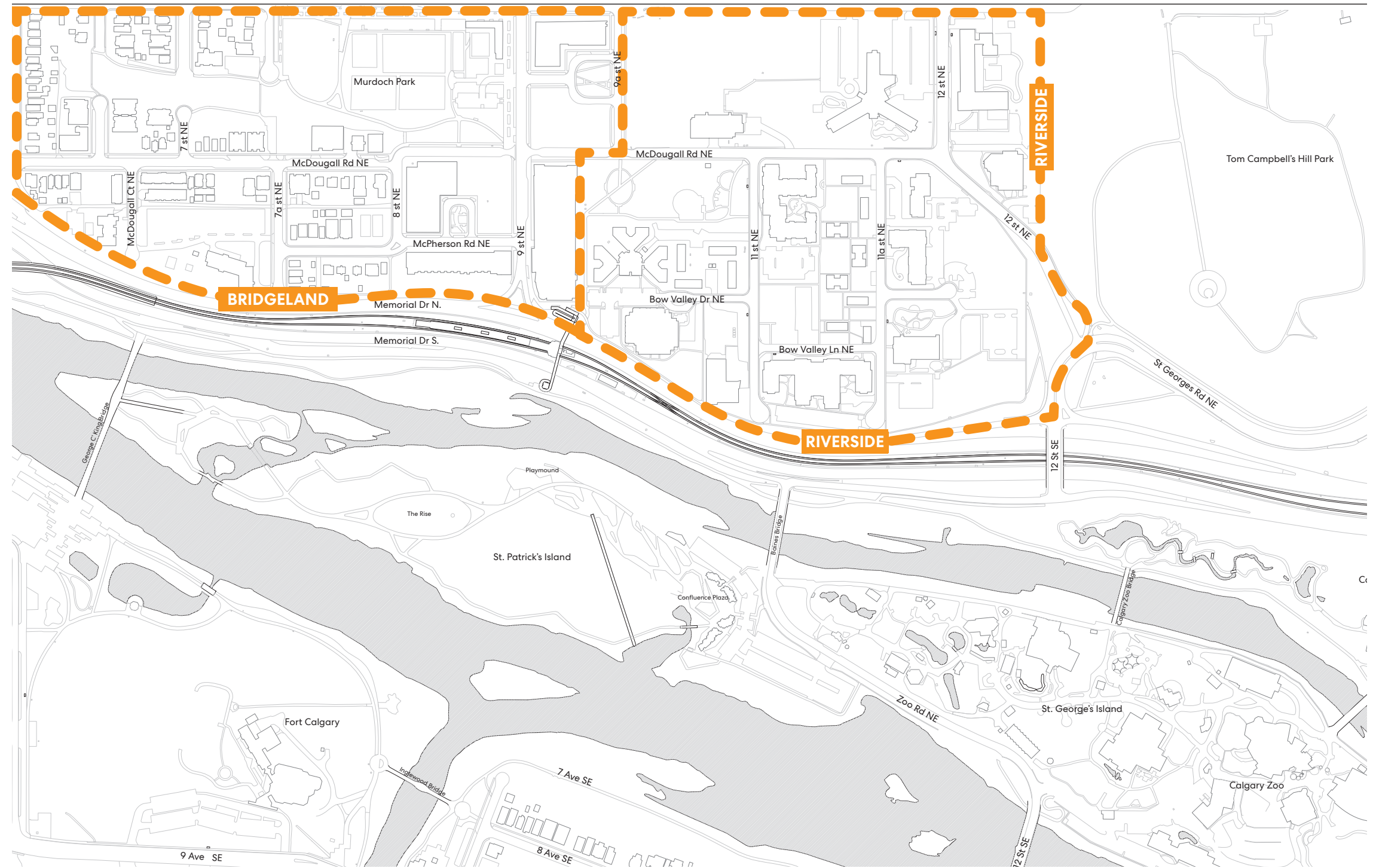
## Bridgeland-Riverside Community

The Bridgeland-Riverside neighbourhood is located northeast of Downtown Calgary and was the site of the Calgary General Hospital. In 1998 the Hospital was decommissioned and demolished bringing with this an era of adaptation of the neighbourhood to assimilate new land uses in order to promote redevelopment.

Bridgeland-Riverside is bound by Memorial Drive NE to the south, 4 Street NE to the west and Tom Campbell Hill to the east. The Bridgeland Memorial LRT station sits at the southern edge of the community and is located in the centre of Memorial Drive NE.

Riverside is an underdeveloped subarea within the neighbourhood, consisting primarily of a mix of low and medium density senior's housing (with varying levels of care provided) and low-income housing. Recent development activity has started to provide indications of the growing interest for densification of the area.

The Bow River pathways, Calgary Zoo, and St. Patrick's Island are all south of the plan area across Memorial Drive. Since 2007, the CMLC has committed \$396 million into the revitalization of the Rivers District including infrastructure and development programs such as the redevelopment of St Patrick's Island, the George C. King Bridge and the East Village. Currently, the Bridgeland-Riverside Community is isolated by the existing infrastructure from these desirable amenities. The introduction of a direct connection between the community and St. Patrick's Island would not only provide access between the community to the Bow River, St. Patrick's Island and the East Village, it would further stimulate development in the Bridgeland-Riverside Community by improving access to desirable amenities and support equitable access to St. Patrick's Island through the provision of a direct connection to the existing Bridgeland Memorial LRT station.



Site Context Map

### Bridgeland Memorial LRT Station

The Bridgeland Memorial LRT Station opened in 1985 as part of the original Northeast Blue Line. The station is an at grade platform located in the median of Memorial Drive NE. The station is accessed from either side of Memorial Drive by pedestrian bridges which connect to the upper level of the station.

Upgrades were made to the station in 2005 including the demolition and re-construction of a new pedestrian bridge connection between the station and the Bridgeland-Riverside Community. In addition to these upgrades, Calgary Transit has identified this station to be in need of repair and is slated for further upgrades and revitalization in the coming years. Timing for these upgrades is not yet determined.



South side of station from Memorial Drive NE



North side of station from Memorial Drive NE- existing structure infilled to meet current code requirements as part of station upgrade



View along Memorial Dr N looking west



Station entrance and platform

## Existing Pedestrian Bridge

Access to the station is provided by pedestrian bridges from the Bow River Pathway to the south and the Bridgeland-Riverside Community to the north. Both the north and south are currently considered to be inaccessible to many users with mobility challenges as they were designed with long, uninterrupted steep (1:12 slope) ramps. There are also issues with the current bridge design and vertical circulation configuration as it creates conflict between modes of travel and crossing circulation paths for pedestrians and cyclists.

The pedestrian bridge to the south terminates with a spiral ramp providing access down to the Bow River Pathway. As there are no stairs provided at this location this area is prone to conflicts between cyclists and pedestrians.

The upgraded pedestrian bridge to the north terminates with a switchback ramp and set of stairs leading town to a small under-utilized plaza. The plaza includes very minimal landscaping and is abutted on the north by an adjacent residential development and to the south by the turning lane from Memorial Drive NW to 9th St NE. At the base of the ramp and stairs, cyclists often connect either to 9th St NE or to the greenway which provides access to the community to the north east. With both routes, cyclists are forced to cross the pedestrian path of travel.

This existing pedestrian bridges are highly used for commuter traffic between the down town core and Bridgeland-Riverside and surrounding communities.



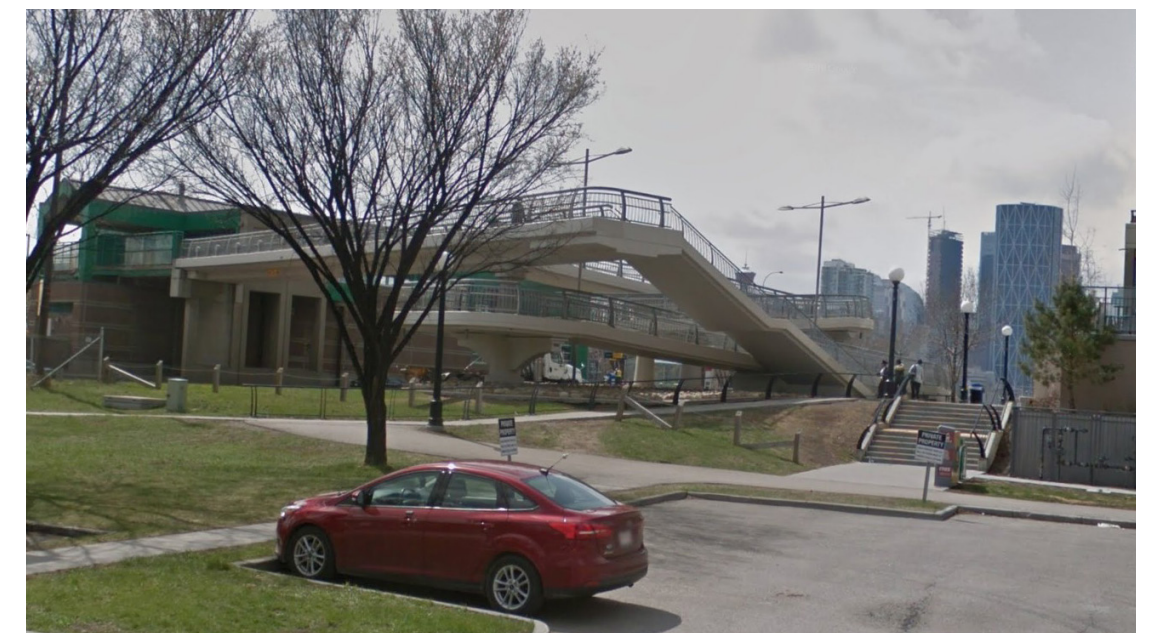
View along westbound Memorial Dr NE looking east



View along eastbound Memorial Drive NE looking east



Existing Bridgeland LRT Plaza looking east from 9th St NE



View from parking lot looking west to existing bridge vertical circulation

## St. Patrick's Island

St Patrick's Island (SPI) is a 30 acre island located in the middle of the Bow River north east of the downtown core and is one of Calgary's oldest parks. Development of the island as a public space began in the late 1890s and gained momentum with construction of a bridge to the island in the early 1900s.

In 2015, more than a century later, this all-but-forgotten treasure at the city's centre was redeveloped by the CMLC and has re-emerged as an amenity-rich, family-friendly—and National Urban Design Award winner—park space for all Calgarians to enjoy.

The redevelopment of the island focused on restoring the natural hydrology and plant ecology systems that have been upset by a century's worth of human intervention. The design worked towards reinstating the rich mosaic of plant communities and embracing the hydrological cycles that lead to a natural, resilient, diverse and authentic habitat.

Reinstating the natural process meant changing grades, soils, fluvial and hydrologic and hydraulic processes back to their original state to allow the life cycle patterns of the Living River to return. Through this process, excavated soil was used to form natural features on the island including a 10 meter high mound coined The Rise, which provides views upriver and to downtown.

The island serves as a natural amenity that allows people of all ages to interact with the river, the natural landscape, a preserved old growth cottonwood forest, wetlands, and a variety of activities in the amphitheater, picnic grove, and playground. St Patrick's Island is enjoyed by more than 20,000 visitors per year.

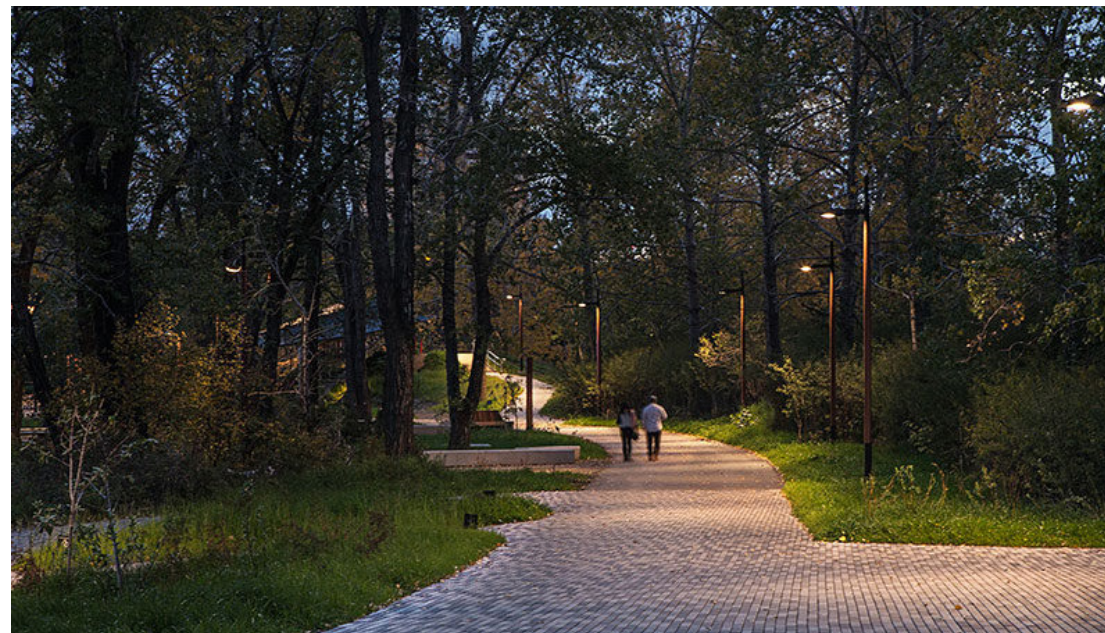
Currently access to the island is provided by the George C. King Bridge to the west or the Baines Bridge to the East.



Aerial view of west end of SPI looking west



Access to SPI from the George C. King Bridge



Pathway in the forest on SPI



View from The Rise looking west



- |                          |                      |
|--------------------------|----------------------|
| 1. The Tip               | 9. Picnic Area       |
| 2. George C. King Bridge | 10. Lowland Channel  |
| 3. The Lawn              | 11. Transect         |
| 4. The Beach             | 12. Sun Deck         |
| 5. The Breach            | 13. The Amphitheater |
| 6. King's Hideaway       | 14. Boat Launch      |
| 7. The Rise              | 15. The Lookout      |
| 8. Play Mound            |                      |

# Site Analysis








## Mobility & Transit

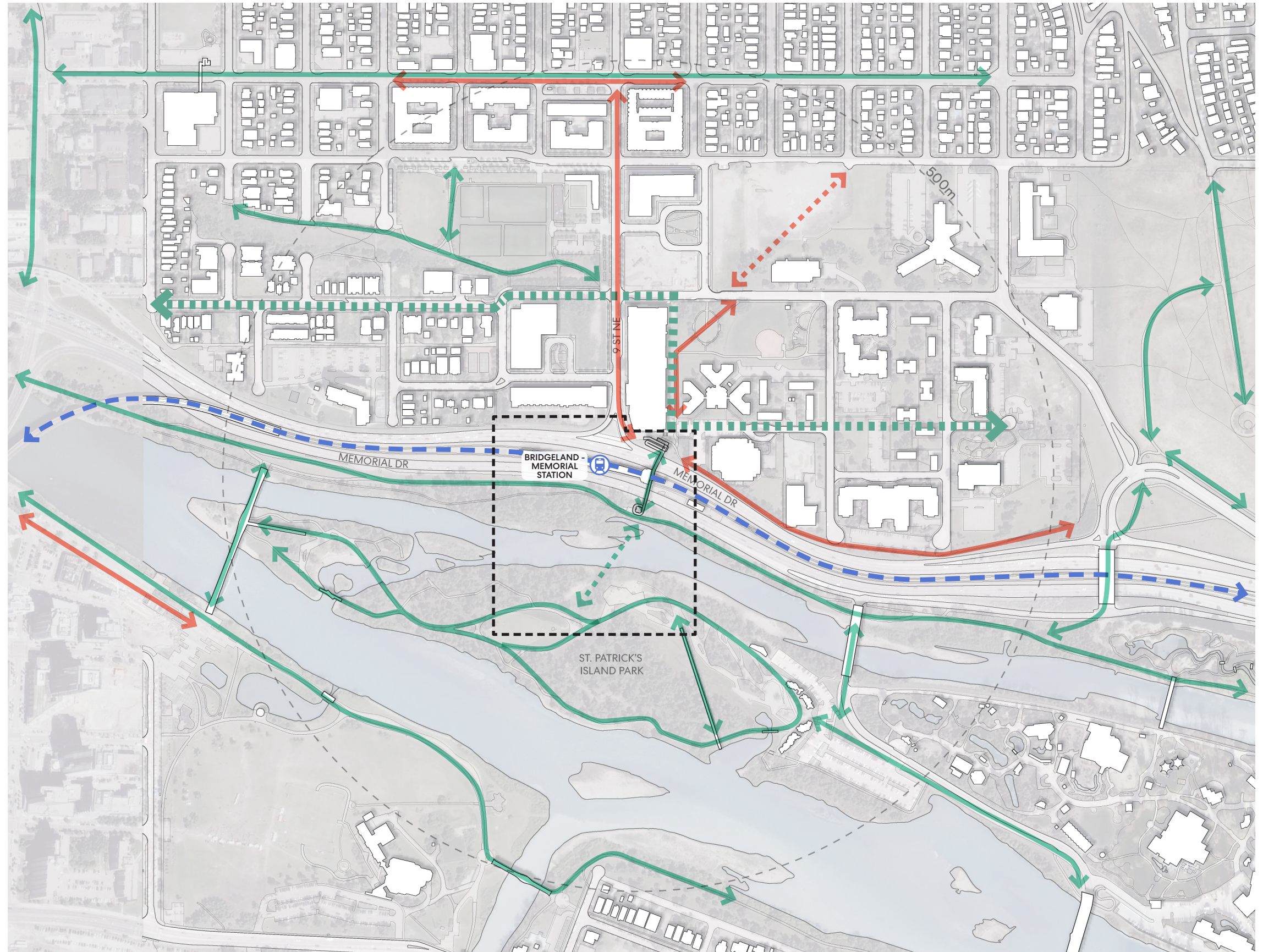
To the north of the bridge site, recent and proposed development in the Bridgeland-Riverside neighbourhood is resulting in the creation of an accessible and multimodal supportive mobility network. This includes plans for a future multi-use path which would provide connection to the bridge and station from both east and west within the community.

To the south, the Bow River Pathway (part of the City of Calgary Regional Pathway system) and the recent redevelopment of St Patrick's Island has resulted in the creation of a strong multi-use path system with multiple connections to downtown Calgary to the east and west.

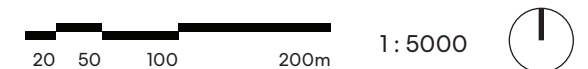
Mobility connections between these two areas is currently extremely limited by Memorial Drive and St. Patrick's Island. St. Patrick's Island is only accessible via the George C King Bridge to the west of the Baines Bridge to the east. With the current infrastructure, Bridgeland-Riverside residents have to walk approximately 1km to access the centre of St Patrick's Island from the southern edge of the Bridgeland-Riverside Community using either the George C King Bridge or the Baines Bridge. The new bridge is poised to become the key threshold between the neighbourhood and St. Patrick's Island for all active modes of travel.

### Legend

-  CTrain Station
-  CTrain Line
-  Bike Route / Multi-Use Path
-  Future Bike Route / Multi-Use Path
-  Pedestrian Route
-  Future Pedestrian Route / Desire Path
-  Subject Site



Mobility Map



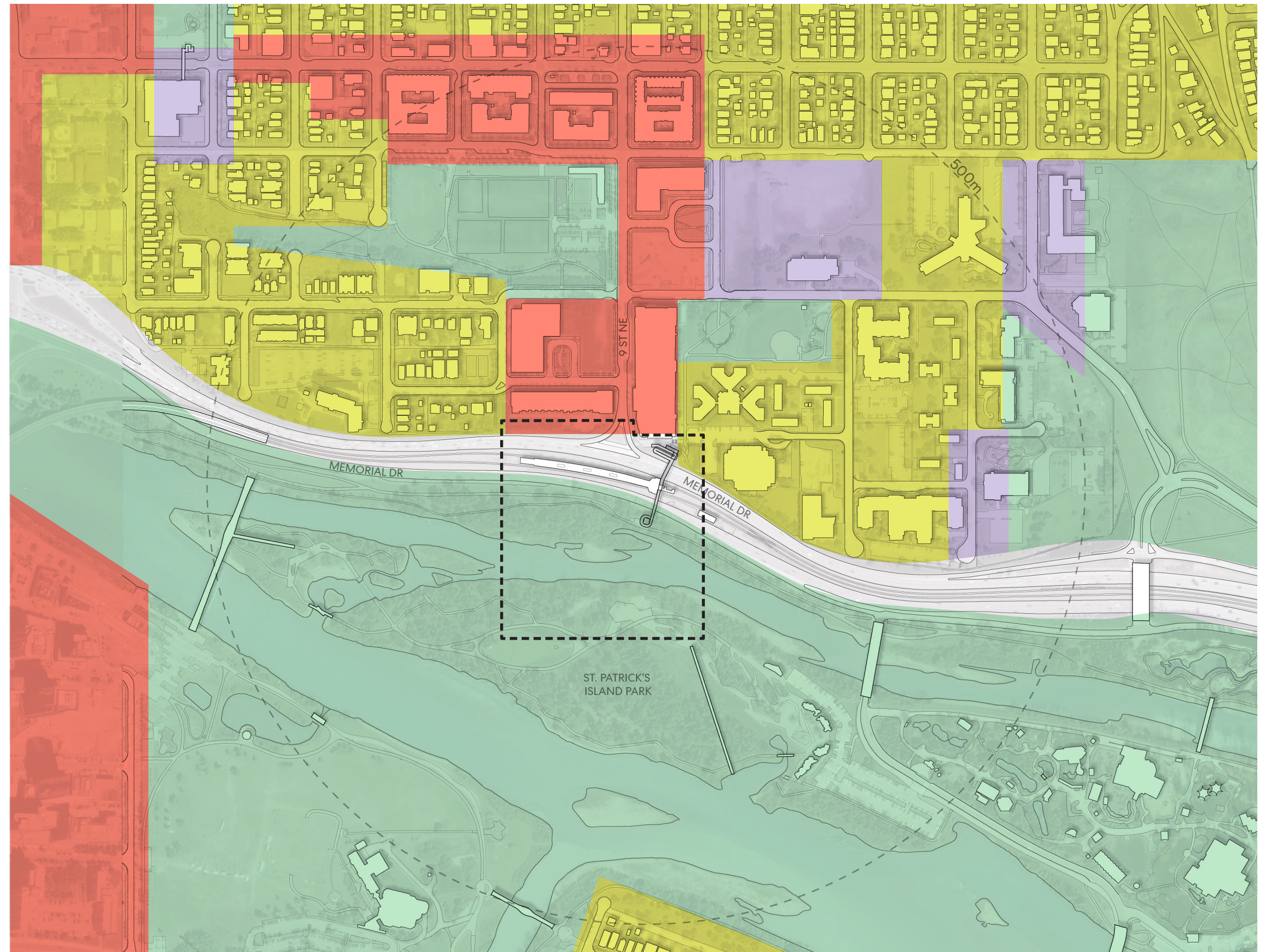
## Land Use

Spanning the transportation corridor of Memorial Dr, the bridge site sits on the threshold between the residential/mixed-use neighbourhoods to the north and extensive parkland/open space of the Bow River and St Patrick's Island to the south.

With ongoing rezoning and redevelopment plans underway the land use immediately surrounding the site is evolving:

- 9th St NE has recently emerged as an important mixed use corridor connecting the 1st Ave neighbourhood centre to transit and the river.
- The residential neighbourhood to the east of the site currently consists of significant seniors supportive housing, but recent planning efforts for the area have resulted in the identification of this area as a new, denser, mixed-use neighbourhood hub.

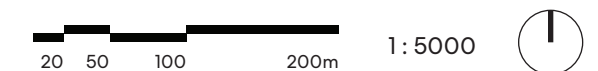
The implications of this land use condition is that the bridge site's role in the community is increasing in importance and will continue to rise in prominence as the neighbourhood develops.



Land Use Map

### Legend

- Residential
- Commercial / Mixed-Use
- Civic
- Park / Open Space
- Subject Site



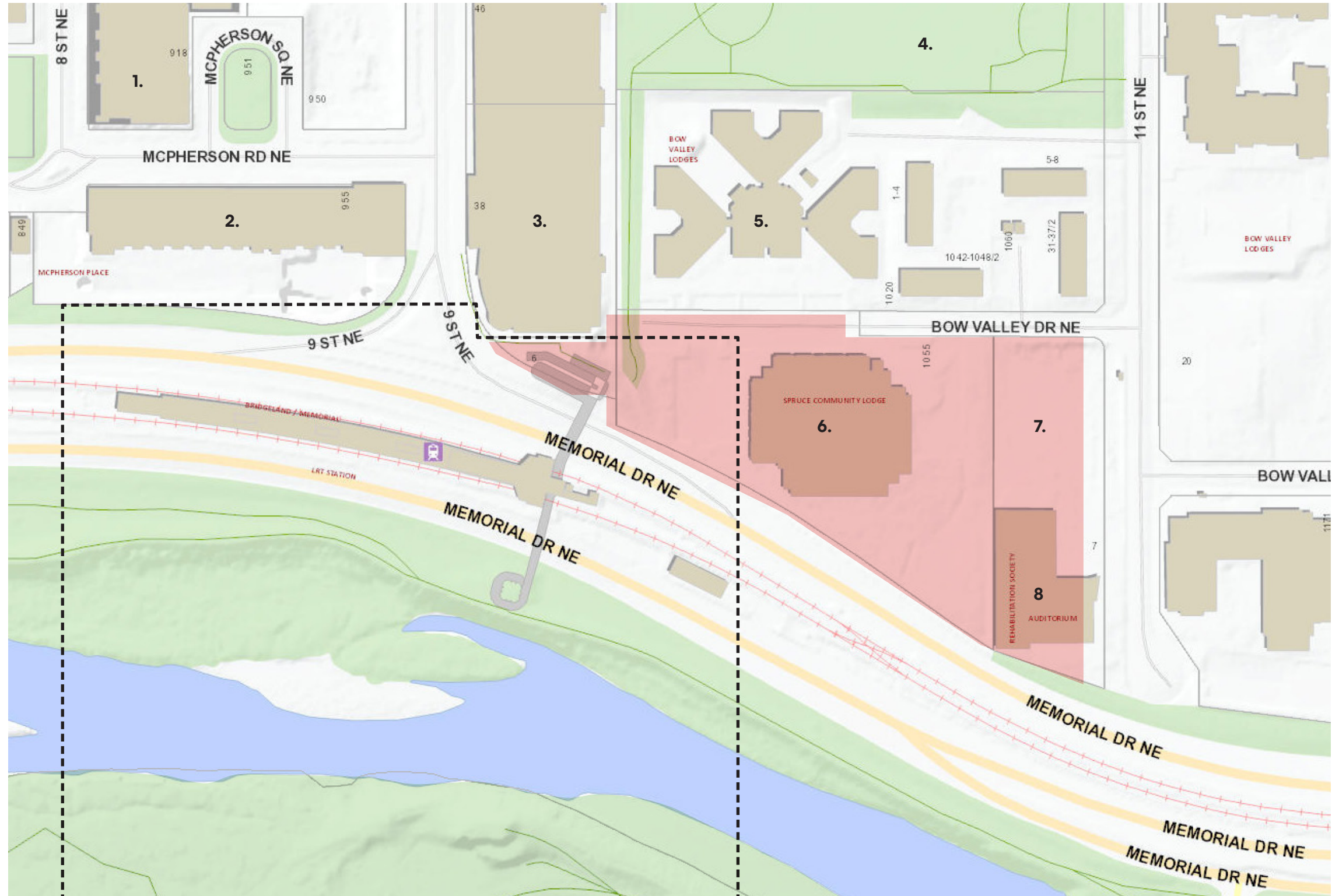
### Property Ownership

The City of Calgary (Real Estate & Development Services) owns the land to the east of the LRT station highlighted in red. The land is currently leased to the Silvera Spruce Community and the Rehabilitation Society of Calgary.

1. The Bridges
2. McPherson Place
3. Bridgeland Crossings
4. McDougall Park
5. Silvera - Spruce Community
6. Silvera - Bow Valley Community
7. City of Calgary Recycling
8. The Rehabilitation Society of Calgary

#### Legend

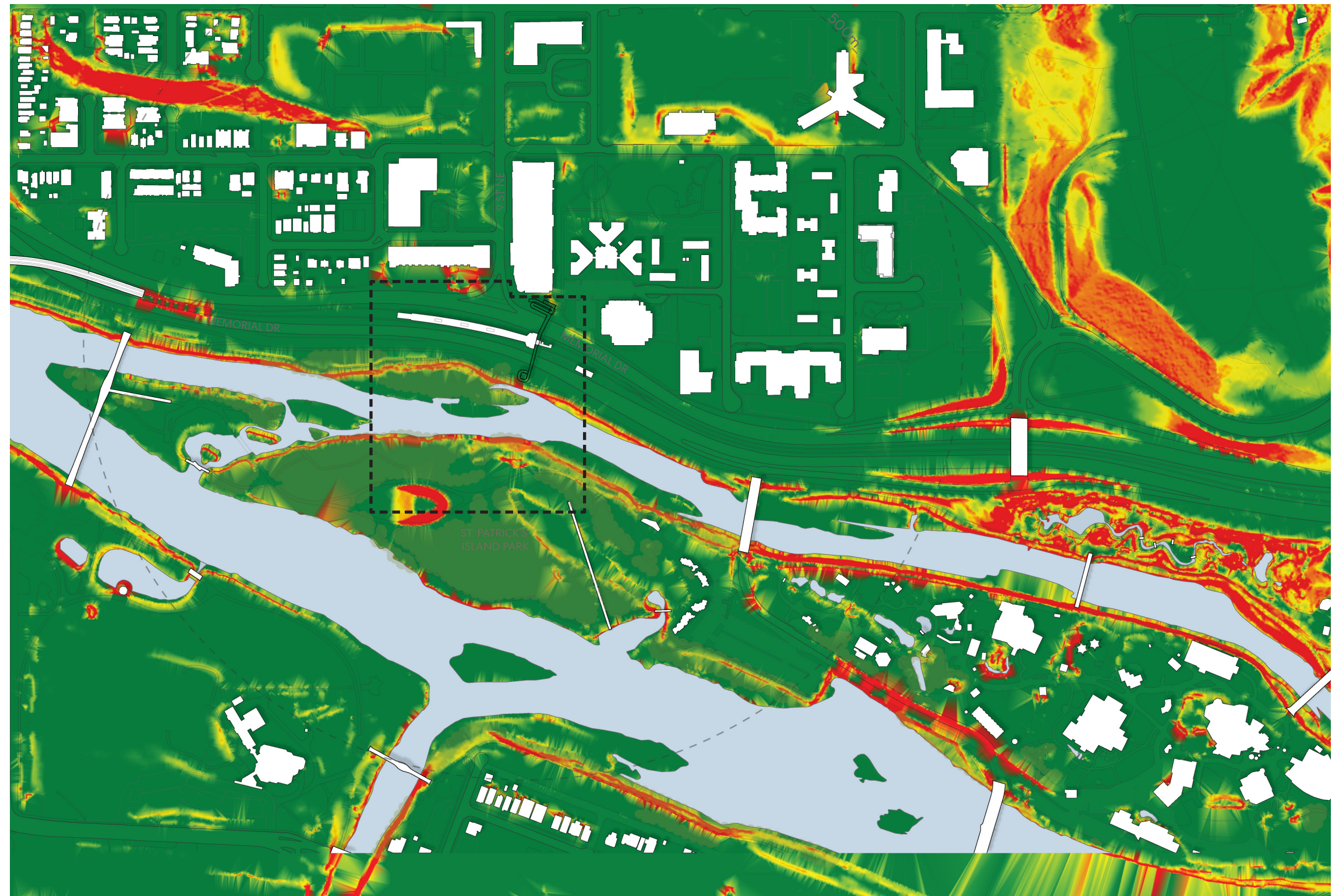
- Park
- Private Property
- City Owned Land - RE&DS
- Subject Site





### Topography - Slope

The bridge site is relatively level with the exception of the banks of the Bow River and “The Rise”, a notable man-made feature in the centre of St. Patrick’s Island.



Area Topography Map

- Topography**
- <5% Slope
  - 10% Slope
  - 15% Slope
  - 20% Slope
  - >25% Slope
  - Subject Site

**Flood Zone**

The entirety of the site south of the Bow River embankment is within the floodway zone as per the City of Calgary Regulatory Flood Map (June 06, 2014). This includes the majority of St Patrick's Island. The ongoing design of the bridge must be designed to accommodate unpredictable water and flooding events and ensure resilience of the bridge and the surrounding landscape into the future.

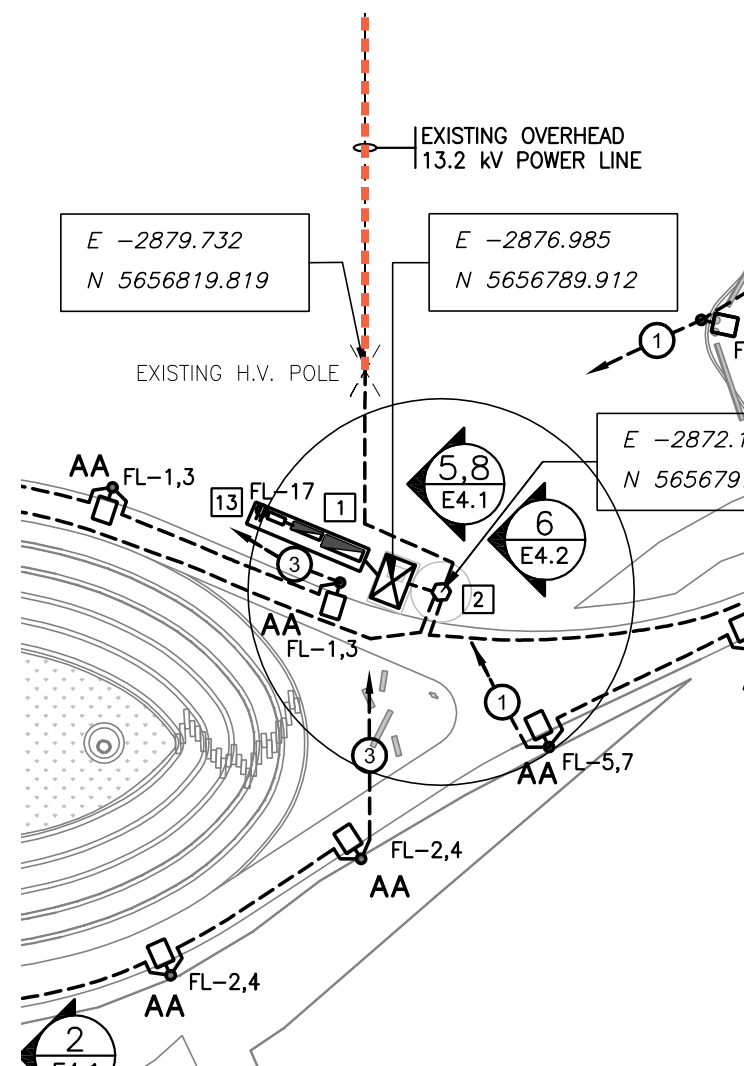


City of Calgary Flood Hazard Map (June 06, 2014)

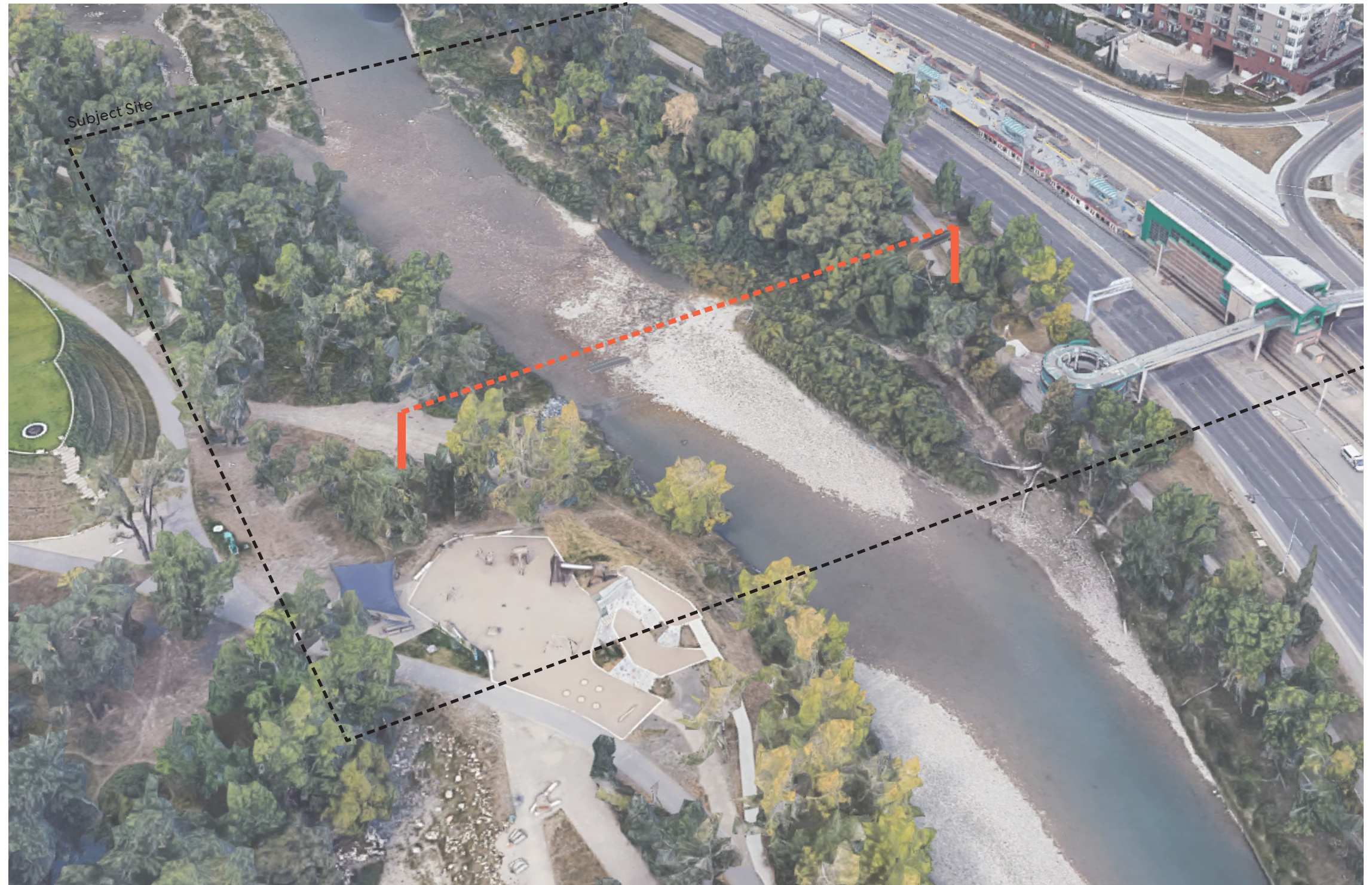
- Legend**
- Floodway
  - Floodplain
  - Overland Flow
  - Step Line
  - 1050.2 Water Elevation Between Step Lines
  - Subject Site

### Existing Utilities

An existing 13.2kv overhead power line crosses the north channel of the Bow River to the west of the existing Bridgeland Memorial LRT Station south access ramp. Opportunities to integrate the existing power line into the bridge design should be explored in future phases of this project. For the purposes of this Feasibility Report, an allowance was held to relocate the utility in the cost estimate. As the project advances, further design refinement will be required to identify relocation and integration of the power line.



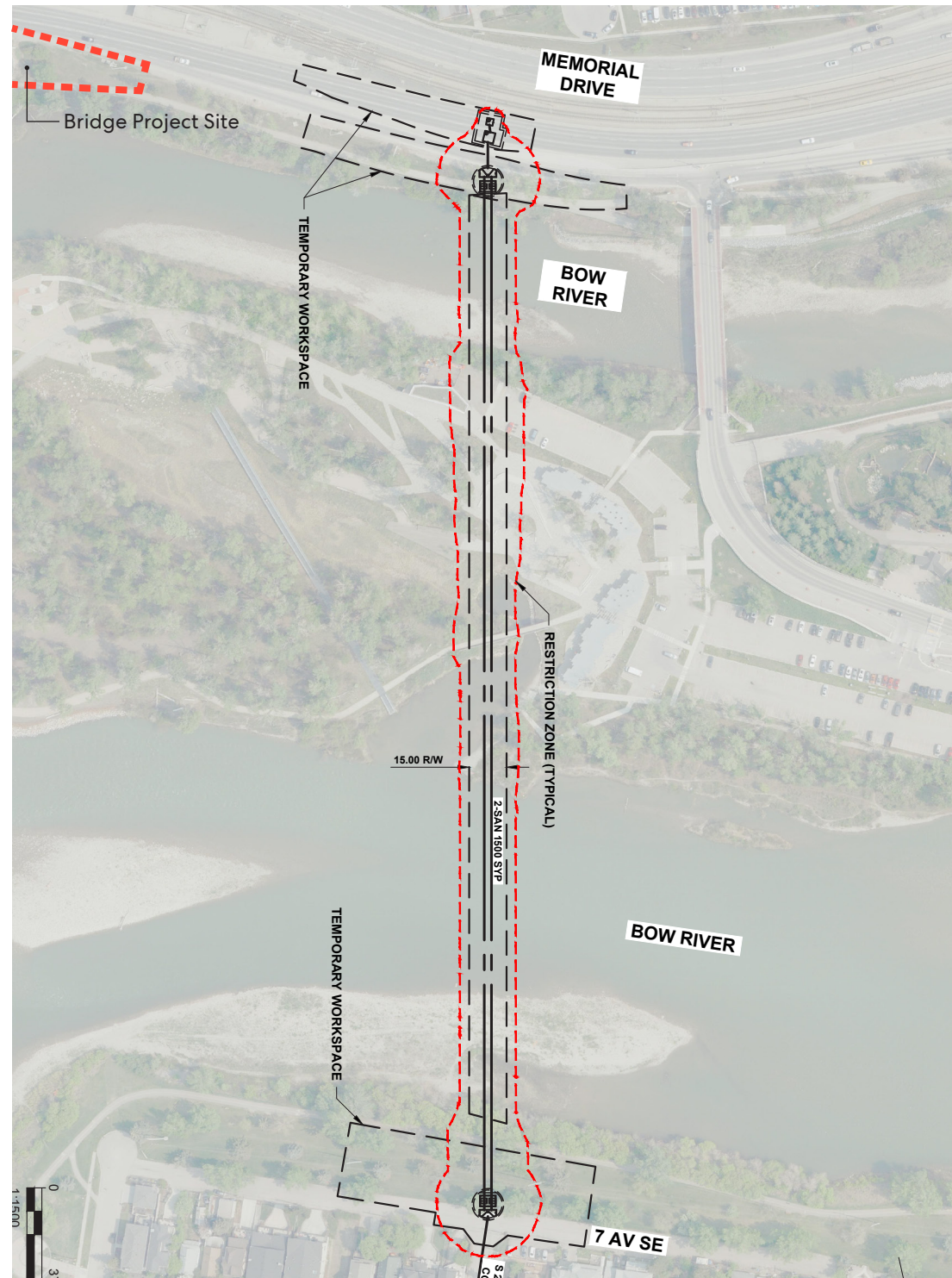
St. Patrick's Island Site - Power, Lighting and Systems drawings  
 ISC: UNRESTRICTED



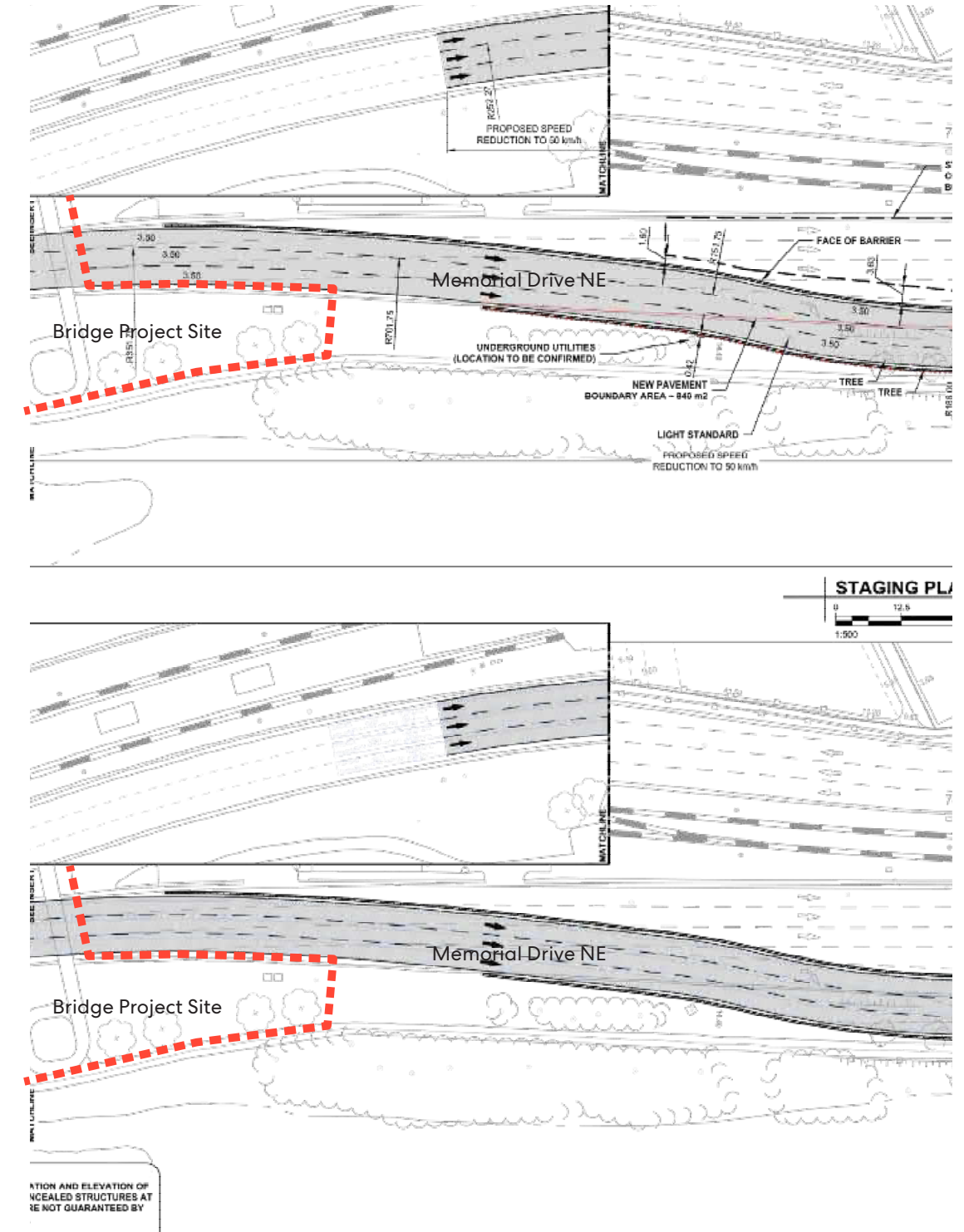
Overhead power line location

### Proposed Infrastructure

City of Calgary Water Resources is in the process of designing phase 2 of the Inglewood Sanitary Trunk Line. The sanitary line will run north-south under the Bow River and St. Patrick's Island. The project is located to the east of the proposed bridge site. The current design, associated staging area and traffic re-routing plans do not present any conflicts with the current bridge siting.



Inglewood Sanitary Trunk Phase 2



Inglewood Sanitary Trunk Phase 2 Staging and traffic routing plan

# Section 3.

## Site Opportunities

# Site Opportunities

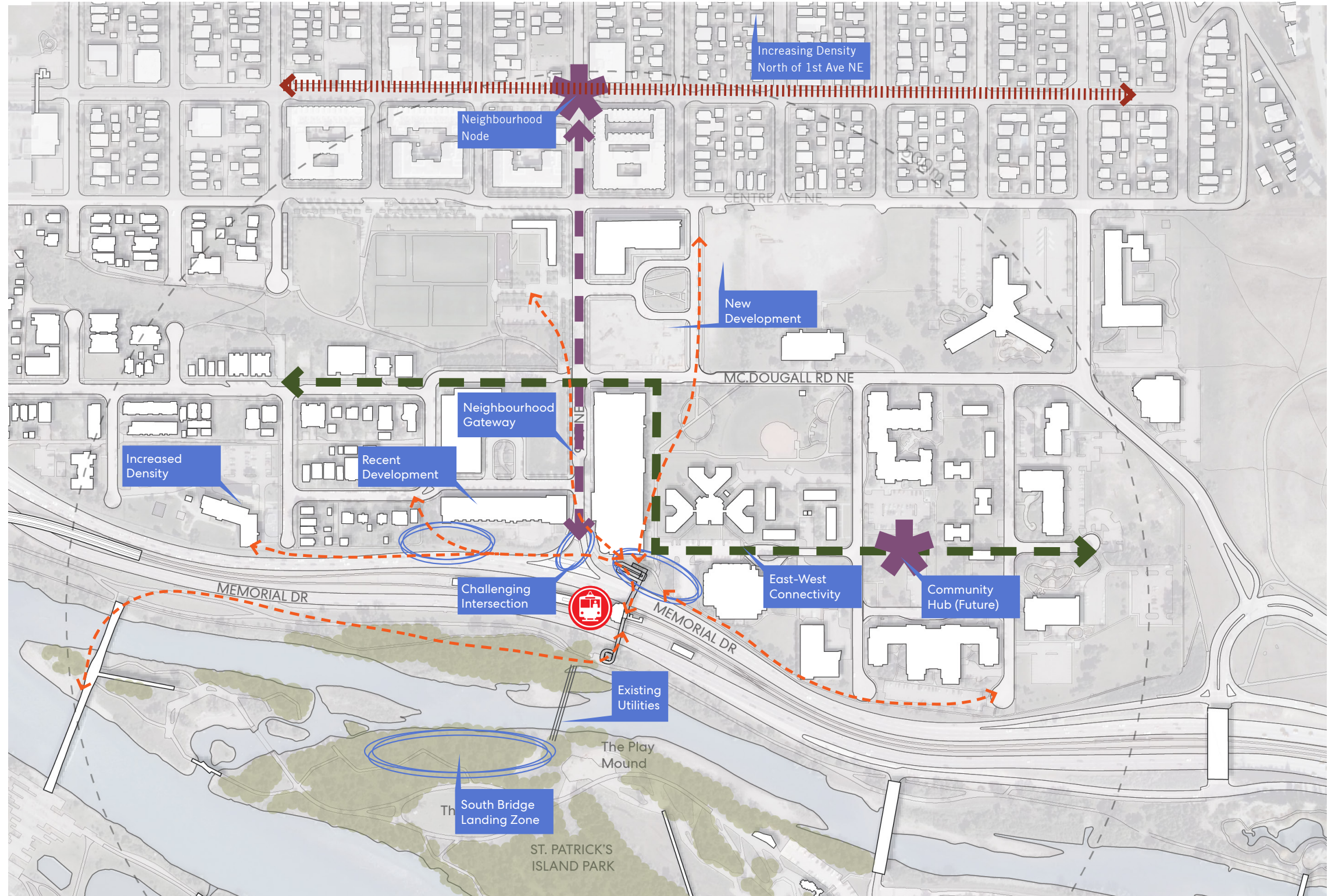
## Opportunities and Constraints

The Bridgeland-Riverside neighbourhood is under transition. Development activity along the main spines of 9th St NE and 1st Ave NE provide the clues of the increasing interest in densification and growth within the neighbourhood.

As this transformation continues, new and improved amenities and services will be needed to serve a growing population and potentially new demographics.

Improved mobility and connectivity within the neighbourhood will be developed as development continues. A new east-west greenway along Bow Valley Dr NE and McDougall Rd NW will further this and will increase access demand to the LRT station.

The new proposed bridge will not only provide a much desired connection to recreation amenities on St Patrick's Island it will also create a safe, accessible and visually appealing means of connection across the barrier that is Memorial Dr.



Site Analysis Map

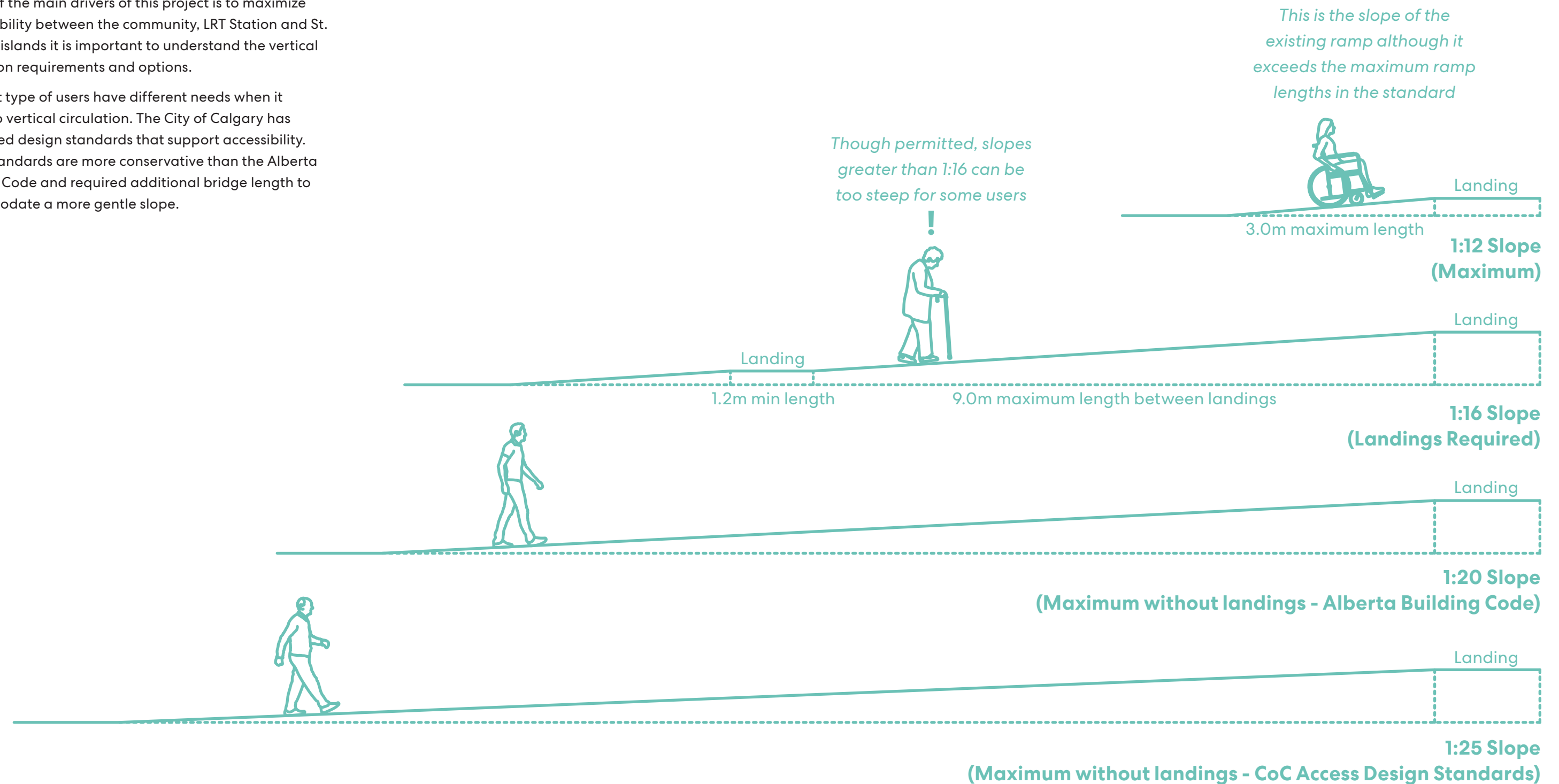
Legend	
Commercial Street	
Neighbourhood Gateway	
Proposed Greenway	
Desired Line of Travel	

# Accessibility

## Universal Accessibility

As one of the main drivers of this project is to maximize access ability between the community, LRT Station and St. Patrick's islands it is important to understand the vertical circulation requirements and options.

Different type of users have different needs when it comes to vertical circulation. The City of Calgary has developed design standards that support accessibility. These standards are more conservative than the Alberta Building Code and required additional bridge length to accommodate a more gentle slope.



## Vertical Circulation: Elevators and Stairs

During the course of this study the consultant team evaluated different means of vertical circulation comparing elevators versus ramps of differing slopes.

While ramps are accessible for all when designed properly, the more accessible they're made (shallower slope) the more length they require which can in itself become a barrier to access. At a certain point an elevator and stair are more feasible from a space and accessibility perspective

One of the key decisions made in consultation with the stakeholder team was to develop the vertical circulation to/from the bridge with ramps only. Even though elevators could serve the purpose, the maintenance, operations and capital costs associated with elevators make it prohibitive for this urban facility.



*A bicycle runnel on stairs to facilitate the vertical circulation of cyclists.*



*Exterior elevators can be designed to withstand extreme weather but are costly from an installation and operation and maintenance perspective.*



# Section 4.

## Alignment Studies

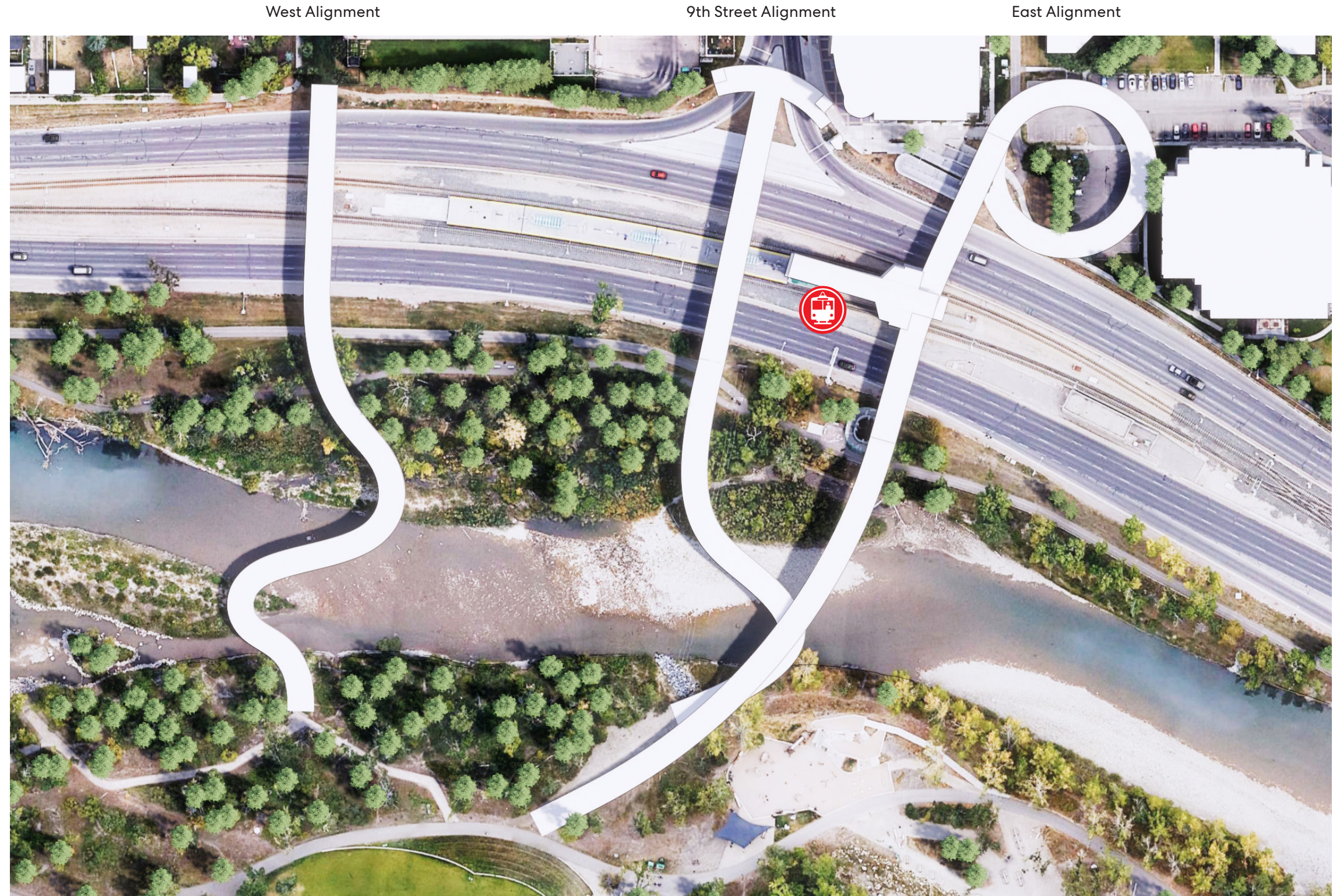
# Alignment Studies

## Proposed Alignments

From the outset of the study one of the first tasks consisted of identifying a bridge alignment that would best satisfy the project objectives and design principles.

Alignments explored included:

- **West Alignment:** Located generally following the 8 St NE alignment on the north side spanning over the LRT station on the west end of the platform and landing on SPI to connect to the existing trail system.
- **9th Street Alignment:** Located to follow the general alignment of 9th Street NE on the north side, spanning over the LRT station mid-point of the platform.
- **East Alignment:** Located to replace the existing overpass with a north landing located on an existing the parking lot within City owned property.



Alignment Options

## Proposed Alignments and Landing Opportunities

During this part of the study the team explored multiple landing opportunities including vertical circulation alternatives and connections to the existing LRT Station. The following page serves to illustrate a number of explorations carried during this study.

North Memorial Connection



South Memorial Connection



St. Patrick's Island Connection

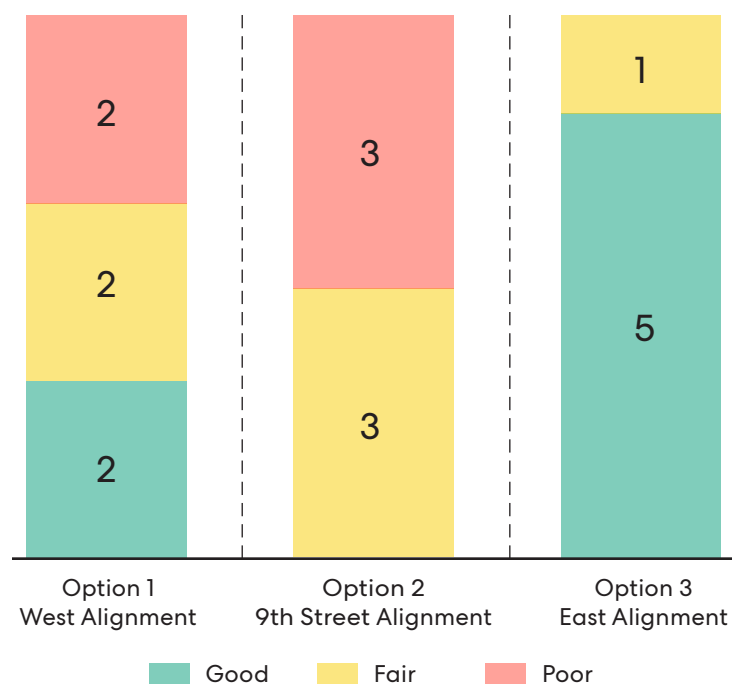


### Comparative Analysis

In order to facilitate decision making and provide an objective evaluation the team provided a multiple account evaluation to document the performance of each of the alignments explored against criteria discussed with the stakeholder team.

Using this evaluation criteria the East Alignment resulted in the option that would provide the most benefits.

### Summary Results



Design Principle	Option 1 West Alignment	Option 2 9th Street Alignment	Option 3 East Alignment
<b>COMMUNITY BUILDING/PLACEMAKING</b> Does the bridge facilitate the desired neighbourhood connectivity? Does the alignment improve neighbourhood connectivity and station access?	Only supports connectivity on the west side of the neighbourhood and LRT Station integration is not inherently supported	Provides an opportunity to reinforce 9th Street NE as a neighbourhood gateway however pedestrian access to island between on/off ramps are an urban design challenge	Provides an opportunity to integrate bridge access directly into the greenway network and connects with existing LRT station access
<b>IMPLEMENTATION</b> Are there any major phasing and implementation challenges related to interface with existing infrastructure?	Minor, challenges. Bridge alignment can be implemented without impact to existing LRT station.	It would be beneficial for this alignment to build a new station house while decommissioning the existing station house and its bridge. Requires relocation of overhead powerline.	Provides opportunities to tie-in to existing station house. Challenges associated with phasing and space constraints with existing ramps. Requires relocation of overhead powerline.
<b>ECONOMIC</b> Are there any major cost implications beyond the baseline cost of the bridge	Cost challenges will be associated with property acquisition as it impacts private property.	Potentially the highest cost of the three alignments due to intersection interface premiums and the need for a new station house.	Structural cost would be mid range due to tie-ins to existing and challenging implementation. No property acquisition costs would balance that out
Does the alignment impact existing private property	Property acquisition will be required to accommodate the north landing and close proximity of the access may have negative impacts to adjacent property.	No property acquisition will be required however the close proximity of the alignment and access to existing buildings may have negative impacts to adjacent properties	No property acquisition will be required and the space provided by the City-owned parking lot should be able to minimize proximity issues to adjacent property.
Are there any major structural challenges associated with this alignment	No major challenges, alignment is relatively straight forward from a structural standpoint.	No major challenges from a structural standpoint. The only challenge anticipated is the potential space constraints for supports at the north plaza	No major challenges, alignment is relatively straight forward from a structural standpoint other than additional coordination required for tie-in to existing Station
Does the alignment impact the existing LRT station house or would require significant upgrades to the existing station?	Would require a new station house at the west end of the platform with minor impact to platform. The existing east station house can remain operational.	Would require a new station house and demo of existing station house. This would require significant coordination with Calgary Transit and funding agreements.	Alignment can be delivered independent of the station bridge with minor tie-in to the existing station. Demo of existing bridge can be done after completion of the bridge and tie-ins to existing.

# Preferred Alignment

## RECOMMENDED ALIGNMENT

WEST ALIGNMENT



9TH STREET ALIGNMENT



EAST ALIGNMENT



<b>COMMUNITY BUILDING &amp; PLACEMAKING</b>	●	●	●
<b>IMPLEMENTATION:</b> Phasing Challenges	●	●	●
<b>ECONOMIC:</b> Cost Implications	●	●	●
<b>ECONOMIC:</b> Property Impacts	●	●	●
<b>ECONOMIC:</b> Structural Implications	●	●	●
<b>ECONOMIC:</b> LRT Interface	●	●	●

West Alignment provides connectivity improvement to the west side of the neighbourhood only and a potential new station house that can be delivered as a separate project when funding becomes available. Major downside of this alignment is the constrained location impacting existing private property.

The 9th Street Alignment could be an opportunity to reinforce 9th street as the main north-south neighbourhood street however space is considerably constrained and landing opportunities are severely restricted. Transit integration would require demolition of existing station house and construction of an entirely new infrastructure.

The East Alignment creates an opportunity to provide a direct connection to the proposed neighbourhood greenway. The main downside of this alignment is the phasing challenges to tie-in to the existing station house and the space constraints posed by the existing ramps and staircase on the north side. Land availability is a major positive of this alignment.

### East Alignment Concept

The east alignment concept was developed to establish a first understanding of potential cost, a structural approach and potential phasing strategies.

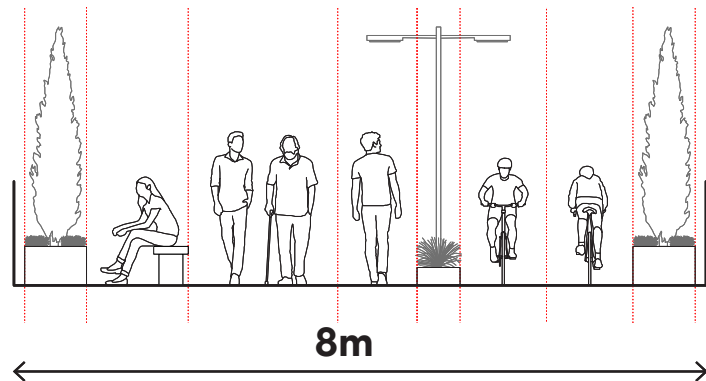
The team prepared the following concept and a preliminary cost estimate for review and discussion by the stakeholder team in order to facilitate decision making regarding funding agreements and opportunities.

The bridge design and approaches are envisioned with gradual slopes and with landscape integration to ease and soften the experience of reaching the bridge elevation.

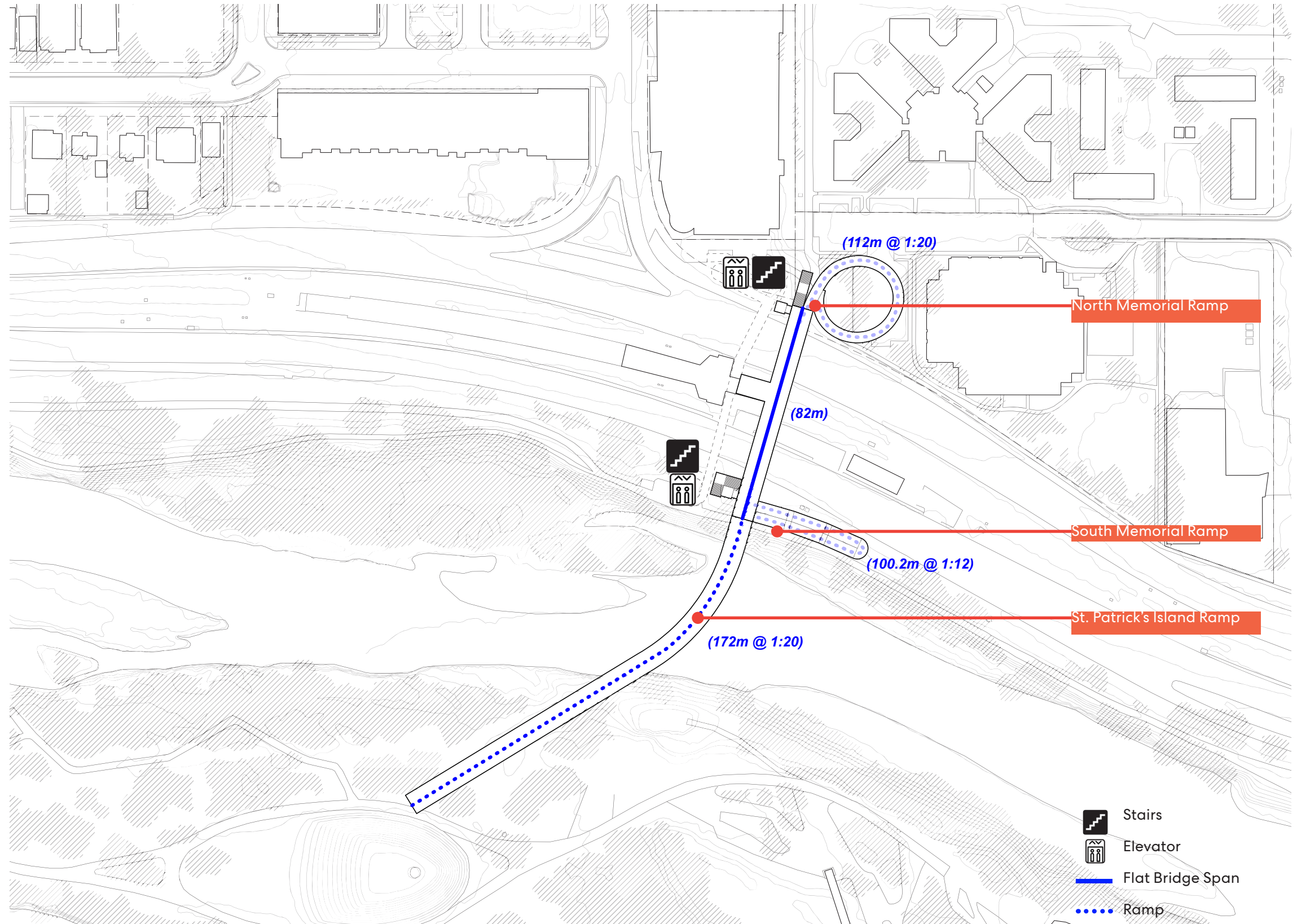
The North Memorial Landing was designed as generous central plaza and spiral ramp and envisioned as a placemaking opportunity. North Memorial Ramp assumes ramp could be built on City land owned by REDS. There is the potential to integrate the north ramping as part of a future building to make more efficient use of valuable city owned land.

The South Memorial landing includes a stair elevator and ramp to provide access to directly below the bridge and a gentle ramp would provide access to St. Patrick's Island across the Bow River.

In this early concept the cross section of the bridge envisioned an 8m cross section in order to respond to one of the key visioning principles, the notion of landscape integration on the bridge.



ISC: UNRESTRICTED



# Alignment Optimization

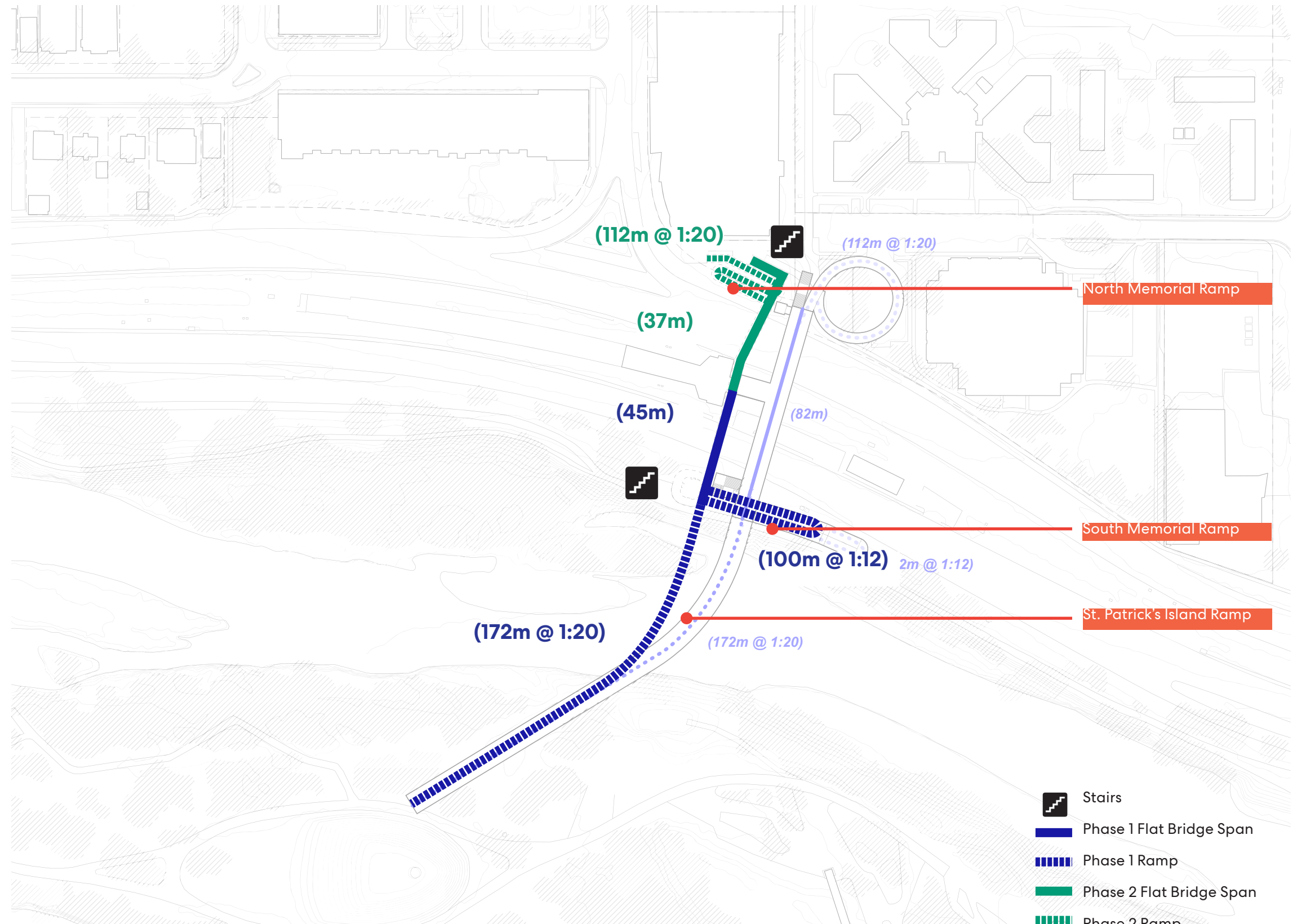
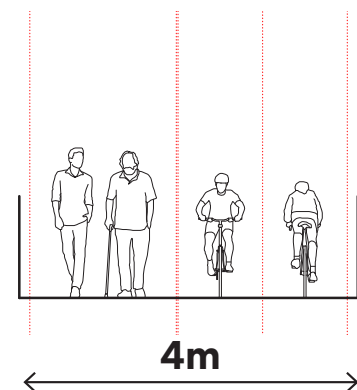
## East Alignment - Phased Approach

After a value engineering exercise to investigate potential cost savings measures and implementation strategies it was agreed to pursue a concept design developed in two phases.

A first phase would see the alignment replace the south leg of the existing bridge across Memorial Dr and extend further south to a touch point on SPI near the playground area.

A second phase would replace the north span of the existing bridge across Memorial Dr as well as the ramps and stairs that provide current station access. The second phase would be undertaken and funded as part of the upcoming Bridgeland Memorial Station upgrades.

Both phases of the bridge would be developed with ramps and stairs only (no elevators) and with a typical 4m wide cross section.



# Budget 1 - Alignment Estimate

## Phased Cost Breakdown Based on Alignment Cost Estimate

### Phase 1 (LRT Station to SPI)

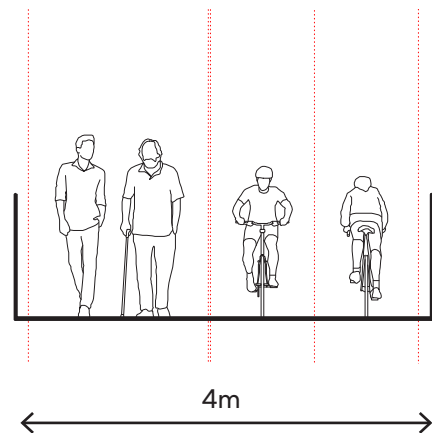
Bridge:	
4m wide	
217m total length	
45m @ flat	\$2,700,000
172m @ 1:20	\$10,320,000
Stairs(1):	\$184,000
South Memorial Ramp:	
4m wide	
South Ramp 100m @1:12	\$6,012,000
Touchdown Landscaping:	\$560,000
Existing Bridge Demolition:	\$478,800
<b>Total Construction Cost:</b>	<b>\$19,694,800</b>
Escalation Allowance (2% at 1 year)	\$393,896
<b>Construction Cost with Escalation</b>	<b>\$20,088,696</b>
Soft Costs (20%)	\$4,017,700
<b>Total Phase 1 Project Cost:</b>	<b>\$24,106,396</b>
Bridge Length:	217m
Linear Project Cost:	\$111,089/m

### Phase 2 (LRT Station to N Memorial Dr)

Bridge:	
4m wide	
37m @ flat	\$2,220,000
Stairs (1):	\$147,200
North Memorial Ramp:	
4m wide	
North Ramp 112 @1:20	\$6,720,000
Touchdown Landscaping:	\$840,000
Existing Bridge Demolition:	\$478,800
<b>Total Construction Cost:</b>	<b>\$9,566,000</b>
Escalation Allowance (construction within 6 months)	\$0
<b>Construction Cost with Escalation</b>	<b>\$9,566,000</b>
20% Soft Costs	\$1,913,200
<b>Total Project Cost:</b>	<b>\$11,479,200</b>
Bridge Length:	137m
Linear Project Cost:	\$83,789/m

<b>Combined Total Construction Cost:</b>	<b>\$29,260,800</b>
Escalation Allowance	\$393,896
<b>Construction Cost with Escalation</b>	<b>\$29,654,696</b>
Combined 20% Soft Costs	\$5,930,900
<b>Combined Total Project Cost:</b>	<b>\$35,585,596</b>
Bridge Length:	354m
Linear Project Cost:	\$100,524/m

**Original Project Budget \$36,000,000**



Indicative Bridge Use Cross Section  
ISC: UNRESTRICTED



## Budget 1 Assumptions

- 2% construction escalation held from 2021 pricing as a separate line item to the construction estimate
- City of Calgary's public art requirements are not applicable to this project
- 20% soft costs held at the request of Transportation Infrastructure, City of Calgary
- \$0 for land cost
- Soft costs include construction contingency, permits, consultant fees, insurance, and PM fees

## Construction Cost Estimate Assumptions

BTY Group included the following assumptions in the construction opinion of probable cost estimate:

- 15% design contingency and 5% construction contingency
- Estimate 1 is a high level estimating exercise for alignment comparison only with a cost variance of +/- 30%. At this level of detail the cost estimate does not include for:
  - global pandemic market uncertainty
  - specialized foundation, staging or environmental requirements associated with construction in proximity to waterway
  - existing utility relocation

# Section 5.

## Concept Design

# Revised Concept

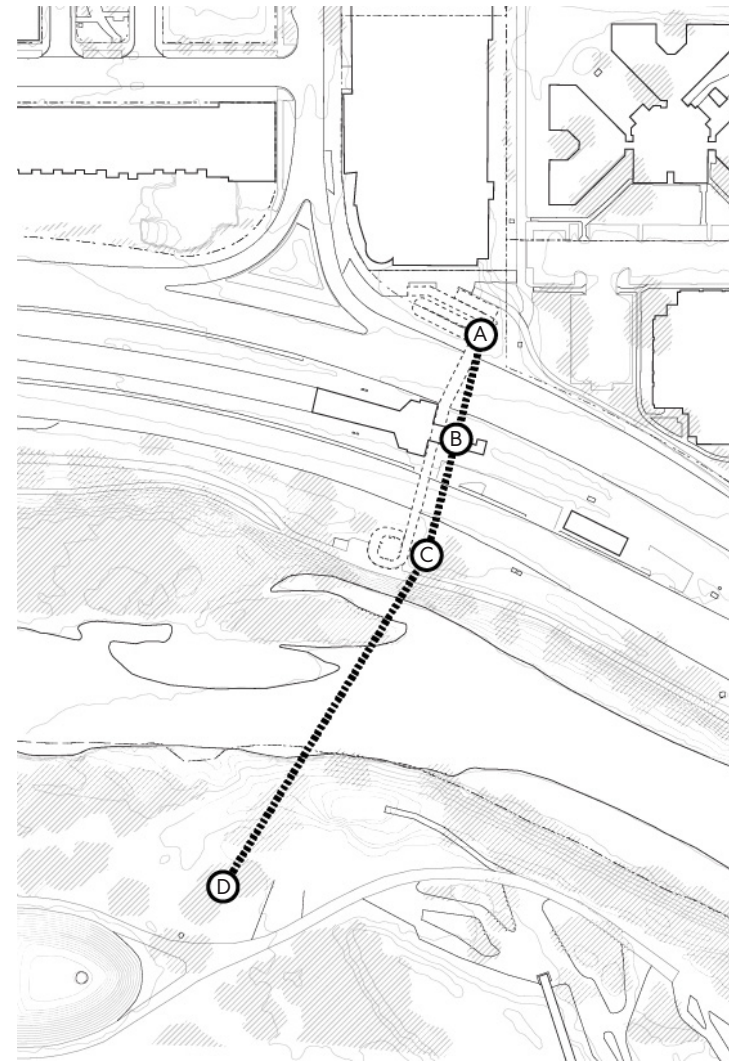
## Contextual Approach

With the East alignment selected as the preferred alignment, connection points were established at Memorial Drive (A), the Bridgeland Memorial LRT Station (B), the south side of Memorial Drive (C) and St. Patrick's Island (D).

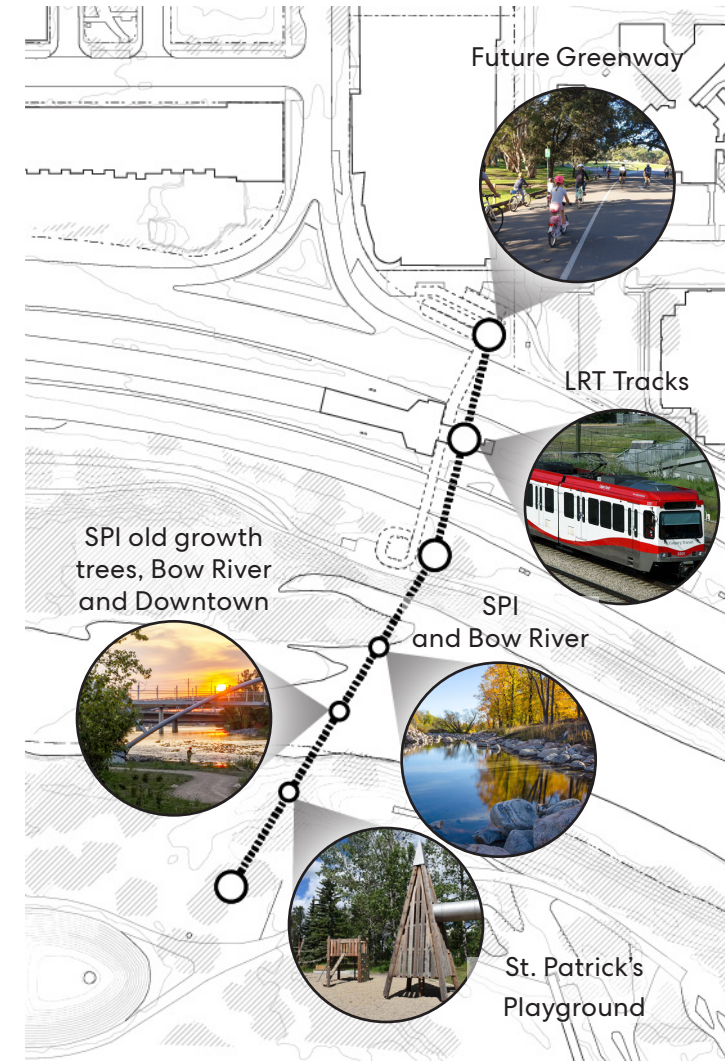
View points were identified along the alignment which created a series of regularized nodes and spans along the bridge. The nodes were pushed and pulled in response to the specific opportunities at each location articulating the bridge in plan. This not only allows for the bridge to celebrate these key points of the journey but breaks down the perception of the journey into small lengths rather than one 300m journey from north to south.

This node and span approach allows the spanning sections between nodes to be reduced to a consistent length therefore reducing their structural requirement and complexity. All curves in the bridge are located at the nodes which creates a simple, regularized system. Bridge spans are no more than 35m in length and structural loads are transferred down to the ground at the nodes.

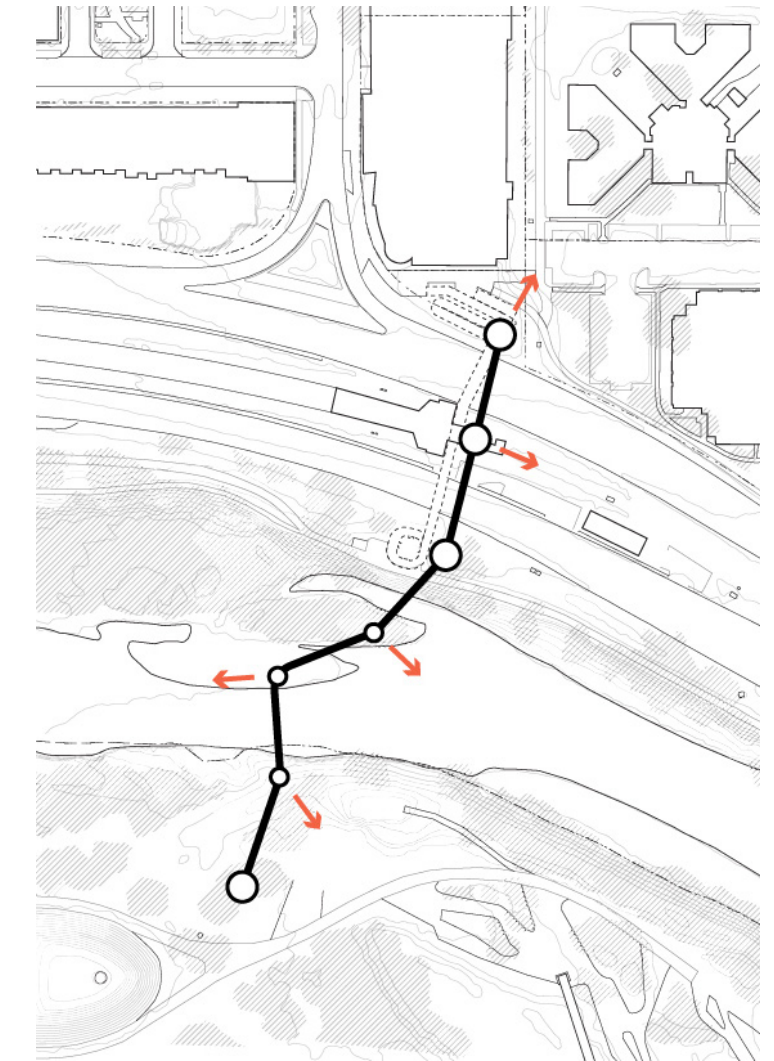
This approach aligns with the conceptual approach used for the design of the pathways on St. Patrick's Island. On SPI, all paths, other than the main east/west pathway were informed by, and designed around specific moments within the landscape. This created a series of meandering paths with short straight segments that articulate with radiused corners around trees, views and other natural elements within the landscape.



**Required Connections**



**Viewpoints**



**Alignment of Nodes in Response to Views**

### Responsive Balustrade

In addition to the bridge articulating in plan around specific moments, the balustrade builds on a similar concept by responding to, and celebrating the varying conditions and opportunities along the length of the bridge.

The balustrade and structural edge beams were designed as an integrated system that modulates in response to structural requirements and views to the surrounding context and environment. The top of the structural balustrade lifts in areas where structural depth is required to support the span and lowers to open up to views in specific locations. The vertical modulation of the balustrade also allows for the mitigation of environmental concerns like predominant winter winds and noise from vehicles below.

The use of an edge beam system to support the bridge spans allows for the structure to be sectionally located in plane and above the walking surface. This allows for a minimal bridge deck depth which is required to meet clearance requirements over Memorial Drive and the LRT tracks.

The material of the balustrade and the structural steel material are one and the same. Given that this bridge will serve as a gateway to the community, which will be experienced by pedestrians and cyclist on the Bow River Pathway as well as motorist on Memorial Drive and the occasional strayed river rafter on the Bow River the treatment of the underside of the bridge is of equal importance as the experience from on the bridge. The material expression of the balustrade has been continued on the underside of the bridge as a wrap tying the two edge beams together to create a simple and unified expression.

### Strategic Planting

One of the initial goals of the project was to bring the natural landscape back to the urban environment through the incorporation of landscape into the bridge design. It became apparent through the value engineering effort that the inclusion of meaningful landscape within the bridge would be challenging. The bridge width had been optimized to reduce cost, which reduced opportunities for significant areas for planting and the addition of planting and required growing medium resulted in a significant additional load on the bridge that would require additional structural depth to accommodate. In addition to these constraints, the operation and maintenance of the planting was a concern as well as its associated cost.

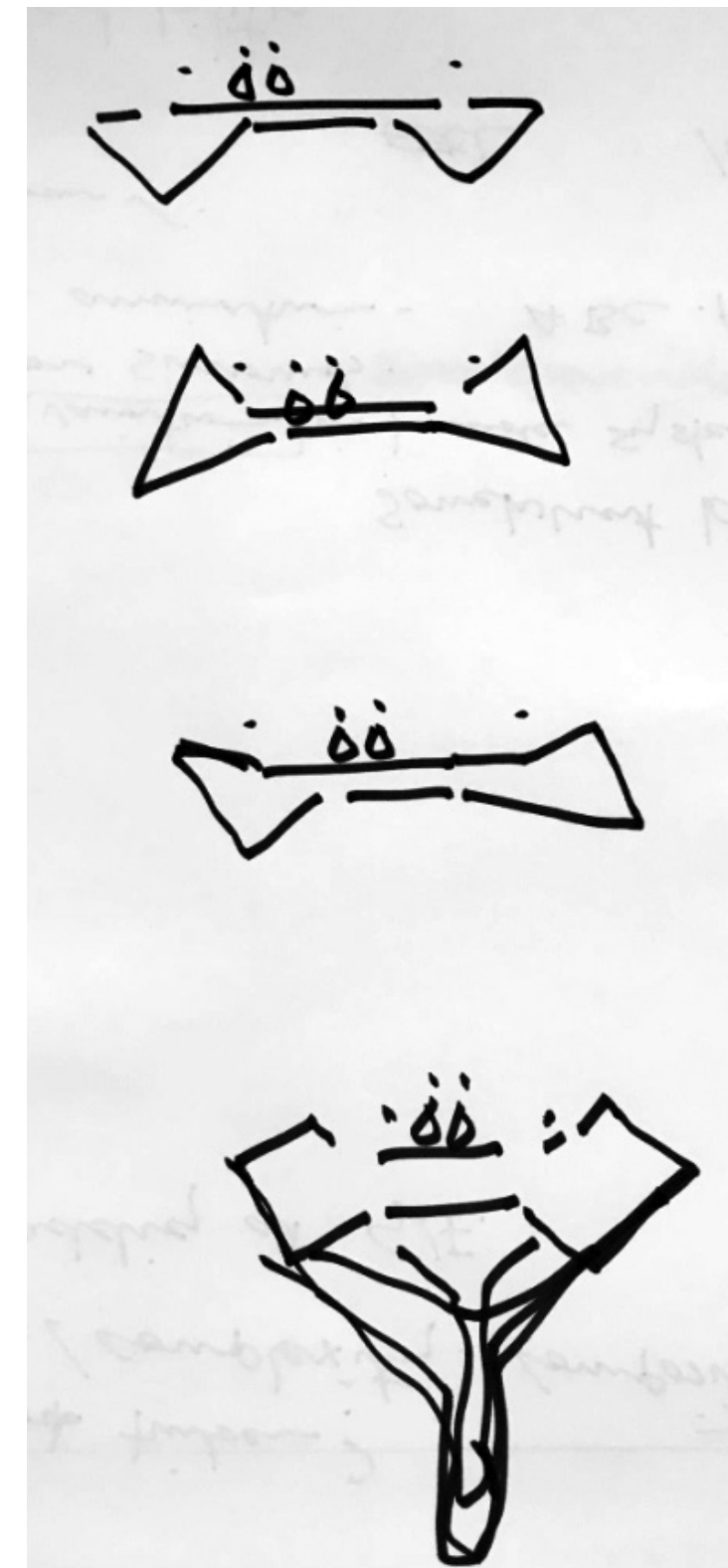
With these constraints in mind an alternative, more impactful and cost-effective strategy of landscape integration has been proposed. Rather than incurring the cost and complexity of integrating small patches of landscape within the bridge, planting of tall trees are proposed in strategic locations around the bridge so that the bridge exists within the canopy of the trees. This allows for a powerful interaction with landscape and also serves as an opportunity to punctuate or highlight particular moments as wayfinding and landmarking elements along the journey.

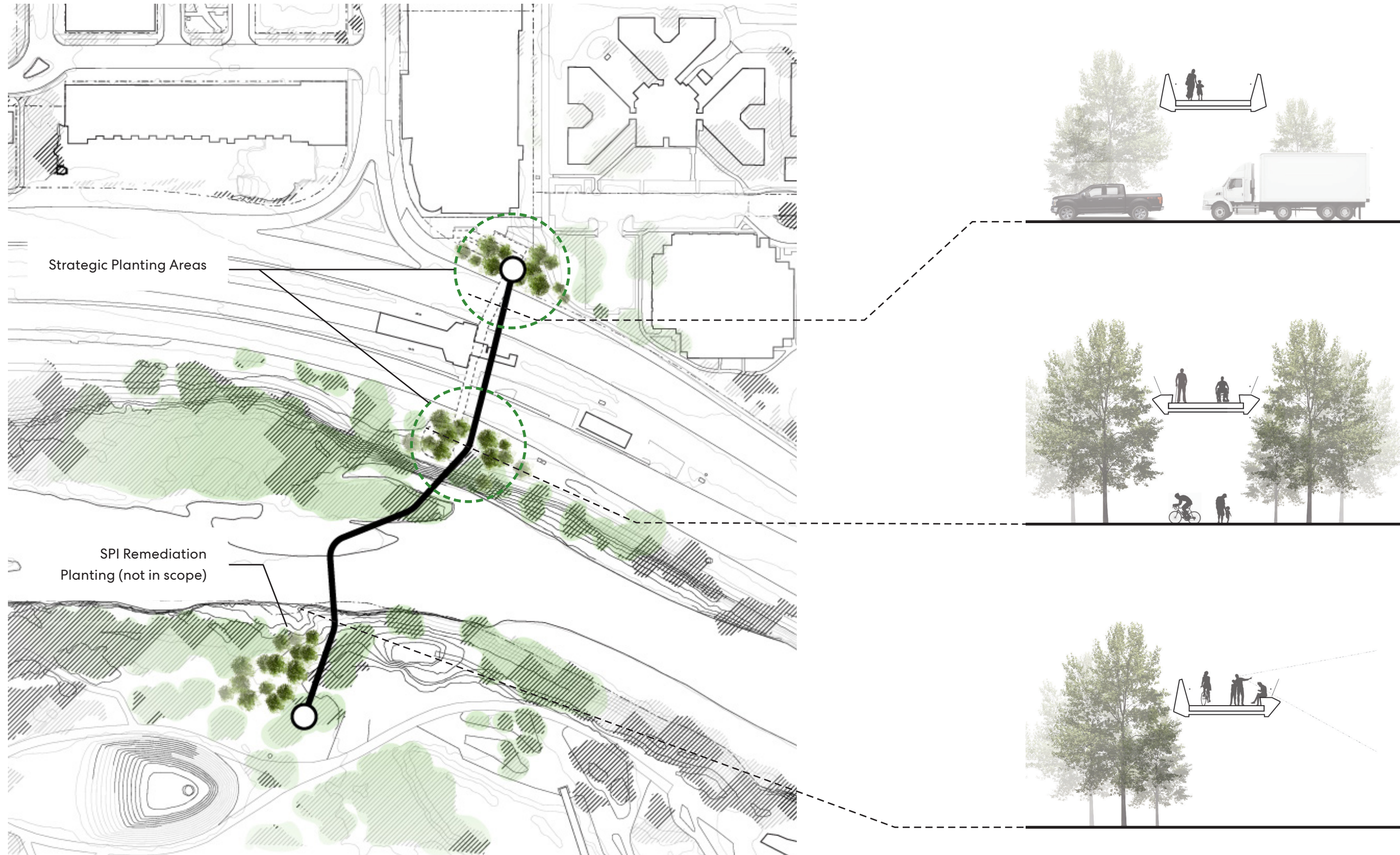
Two areas have been proposed for this planting one on the north and one on the south side of Memorial Drive. The trees on the south side of Memorial Dr are a natural extension of the existing trees found along the pathway and the landscaping to the north would be incorporated into the plaza design which would help improve the harsh urban plaza condition, softening the interaction between pedestrian and vehicles. Planting in this location could also serve to enhance the entrance to the community and gateway condition at grade as well as at the bridge deck level.

### Minimize Ecological Disruption

The conceptual design for the redevelopment of St. Patrick's Island in 2015 focused on rehabilitation and restoration of the natural landscape. To respect and build upon this strategy on the island a similar conceptual approach was used for the bridge touchdowns and structural piers. The intent is to create a light touch on the surrounding environment and minimize the impact and disruption of the natural vegetation and land form.

By reducing the spans between nodes, structural forces associated with bridge spans can be reduced and distributed among multiple smaller structural piers. The intent is to create a single, slender pier at each node that splays to support for the bridge structure above.





### Material Continuity

From the Bridgeland-Riverside Community to St. Patrick's Island through to the East Village, wood has been the predominant material used in landscape features and furniture in the urban realm. In a similar fashion and to create continuity through the tourism corridor, wood was used as a pedestrian facing material on the inside of the balustrades as well as for seating elements at the nodes on the bridge. The use of wood helps re-naturalize the urban experience through the introduction of a natural material and starts to formalize the tourism corridor by creating a consistent element along the corridor.



St Patrick's Island Bench



River Walk

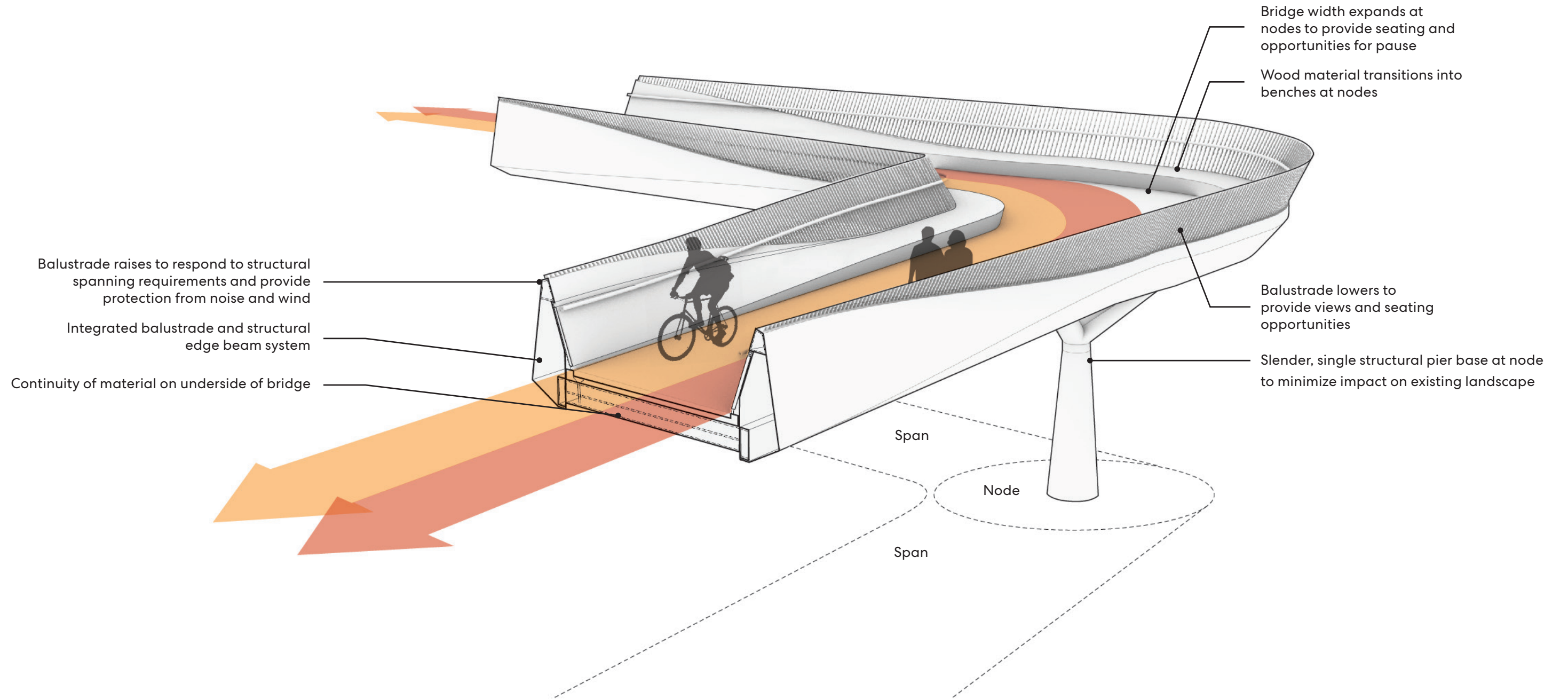


Bow River Pathway - Eau Claire



C-Square

### Conceptual Bridge Design



Precedent Images



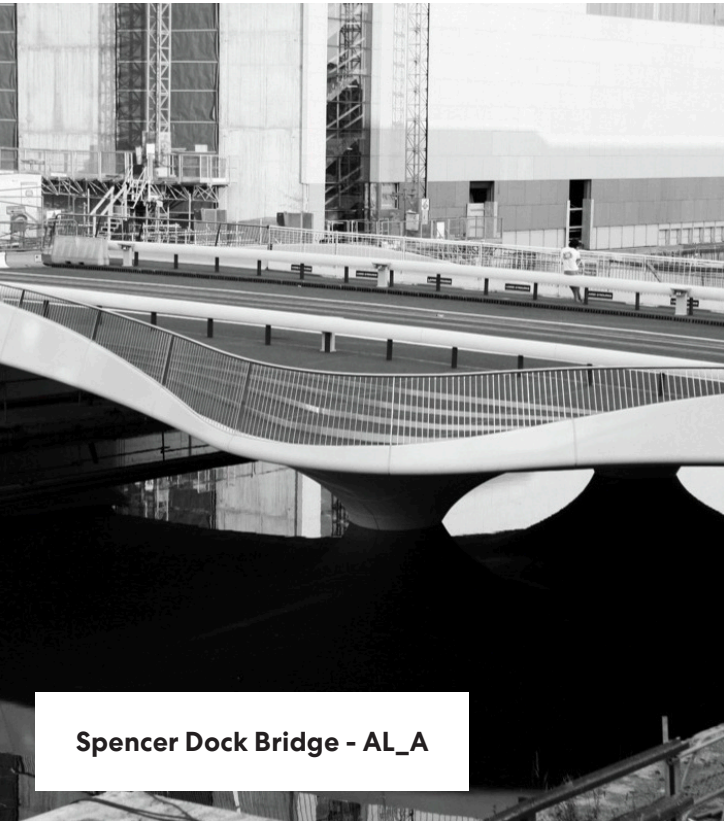
The Claude Bernard Overpass - DVVD Engineers Architects Designers



Martutene Footbridge - Anta



Olhafen Bridge - Schneider + Schumacher



Spencer Dock Bridge - AL\_A



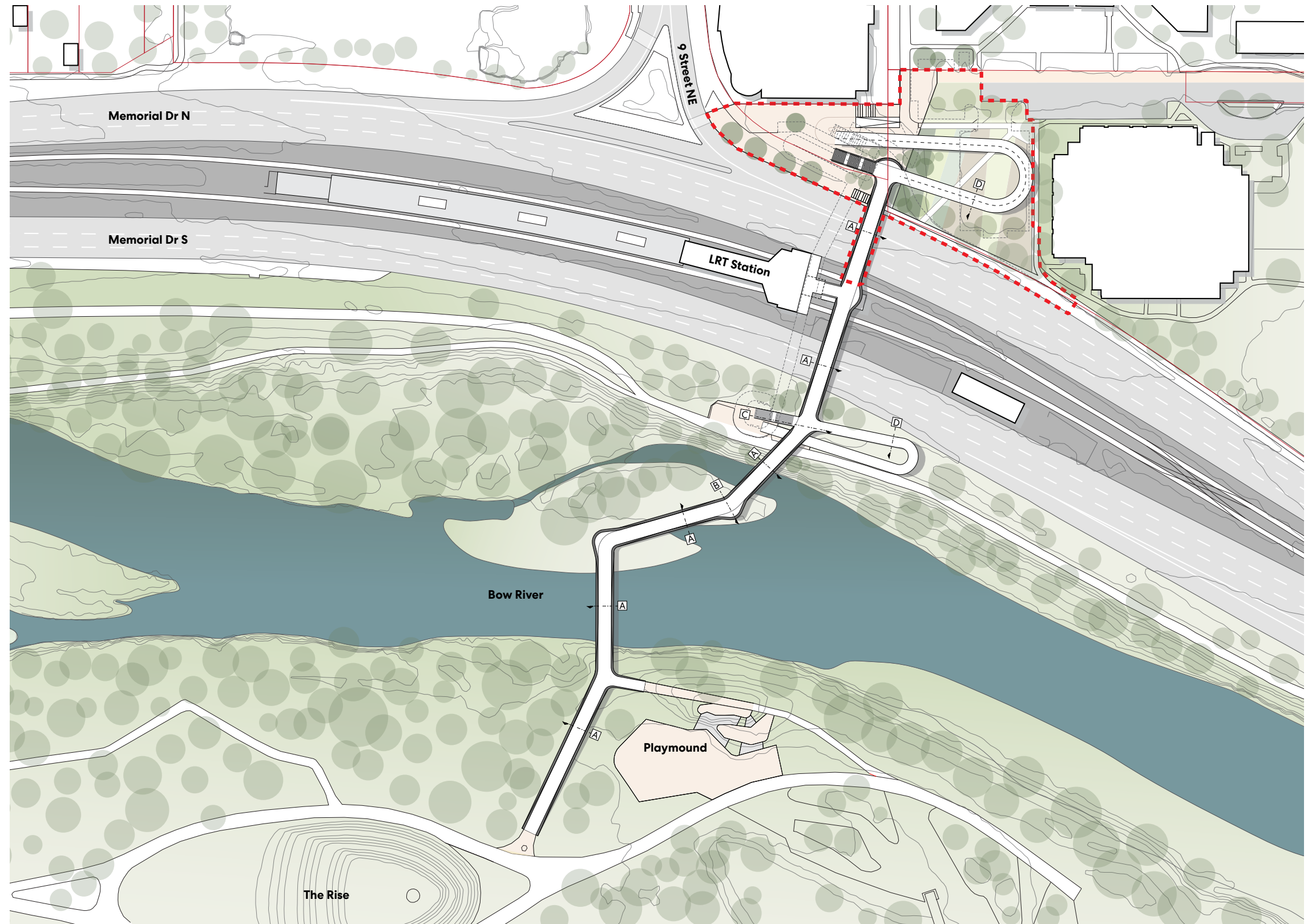
# Site Plans

## Illustrative Site Plan

The concept design for the bridge creates a path that gently winds through canopies of trees and landscape, celebrating specific moments within the existing context along the journey from the Bridgeland-Riverside Community to St. Patrick's Island. The articulation of the bridge in plan allows for the creation of nodes at a regular rhythm which provide opportunities for pause, vertical circulation to the ground and structural columns designed to minimize impact on existing landscape and vegetation. This regularized node spacing breaks down the spans of the bridge into shorter segments reducing the perceived length of the bridge while simultaneously reducing its structural spanning requirements allowing for a thinner, more delicate bridge profile.

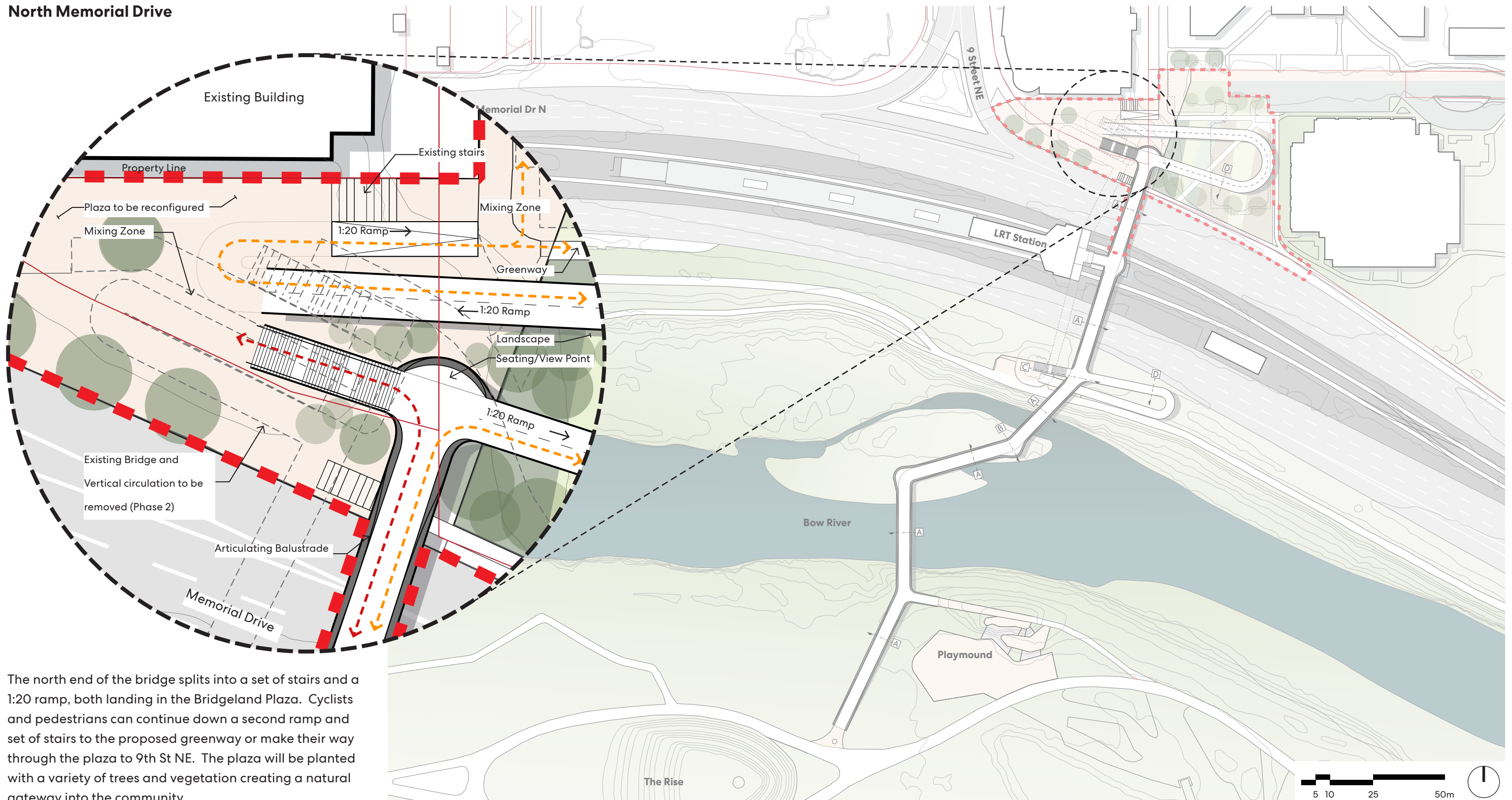
Accessible connections are created at the north side of Memorial Drive to the Bridgeland Plaza and proposed multimodal greenway, to the existing Bridgeland Memorial LRT Station, at the south side of Memorial Drive to the Bow River Pathway System and to St Patrick's Island between The Rise and St Patrick's Playground.

The bridge alignment has been offset to the east of the existing Bridgeland Memorial LRT bridge to allow the station to remain operational during the construction of the proposed bridge.



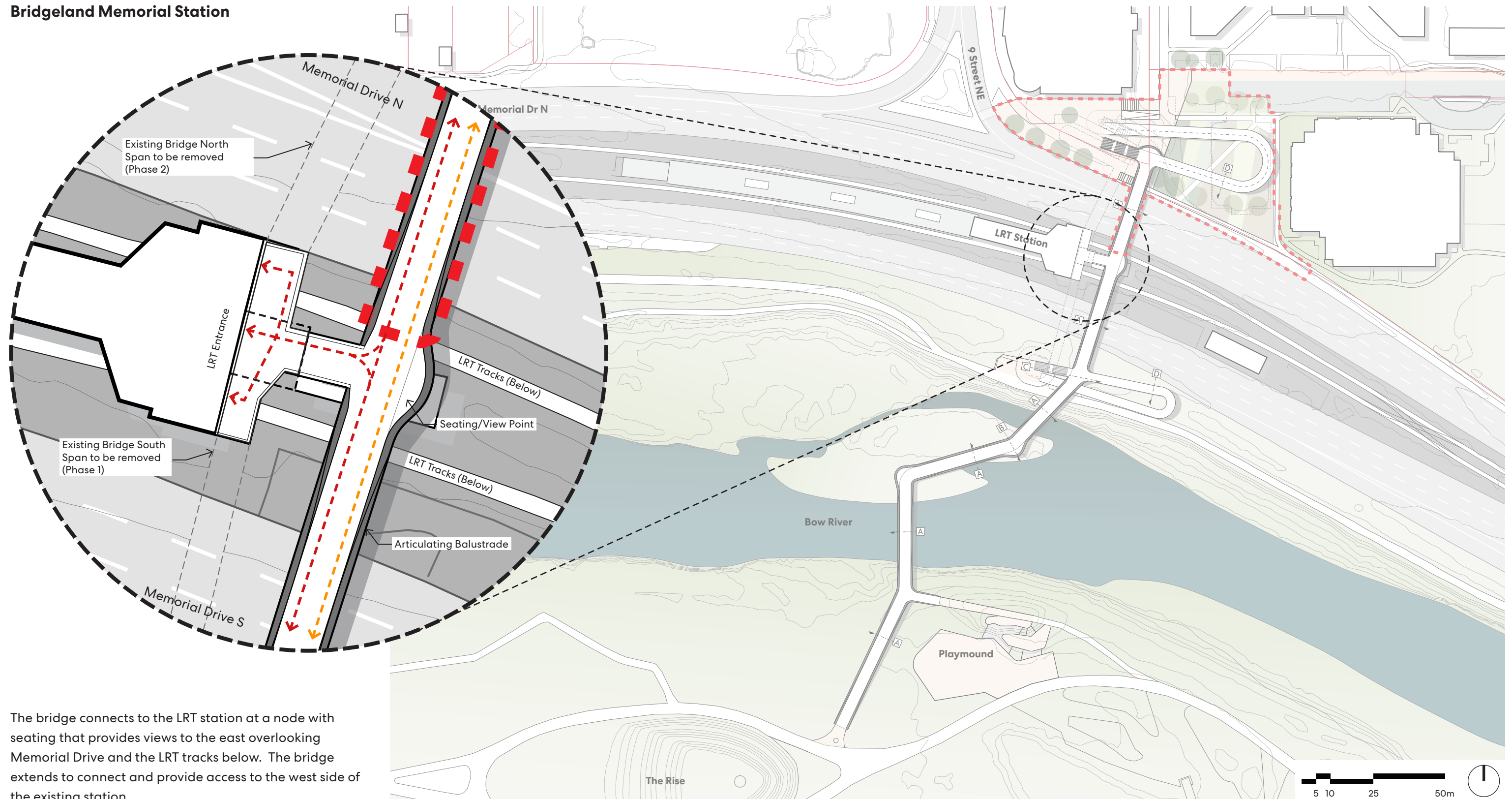
ISC: UNRESTRICTED

North Memorial Drive



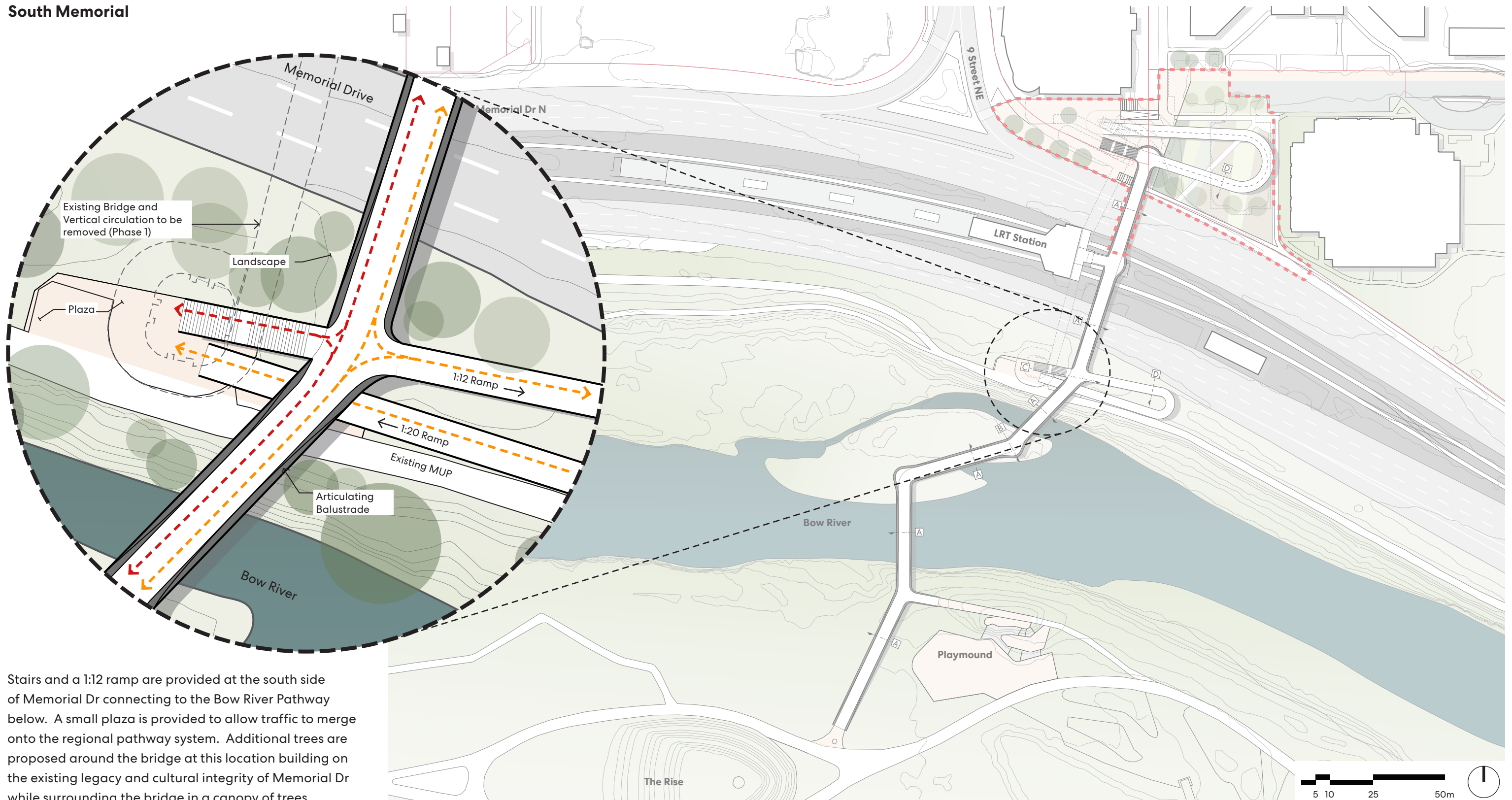
The north end of the bridge splits into a set of stairs and a 1:20 ramp, both landing in the Bridgeland Plaza. Cyclists and pedestrians can continue down a second ramp and set of stairs to the proposed greenway or make their way through the plaza to 9th St NE. The plaza will be planted with a variety of trees and vegetation creating a natural gateway into the community.  
ISC: UNRESTRICTED

**Bridgeland Memorial Station**



The bridge connects to the LRT station at a node with seating that provides views to the east overlooking Memorial Drive and the LRT tracks below. The bridge extends to connect and provide access to the west side of the existing station.  
 ISC: UNRESTRICTED

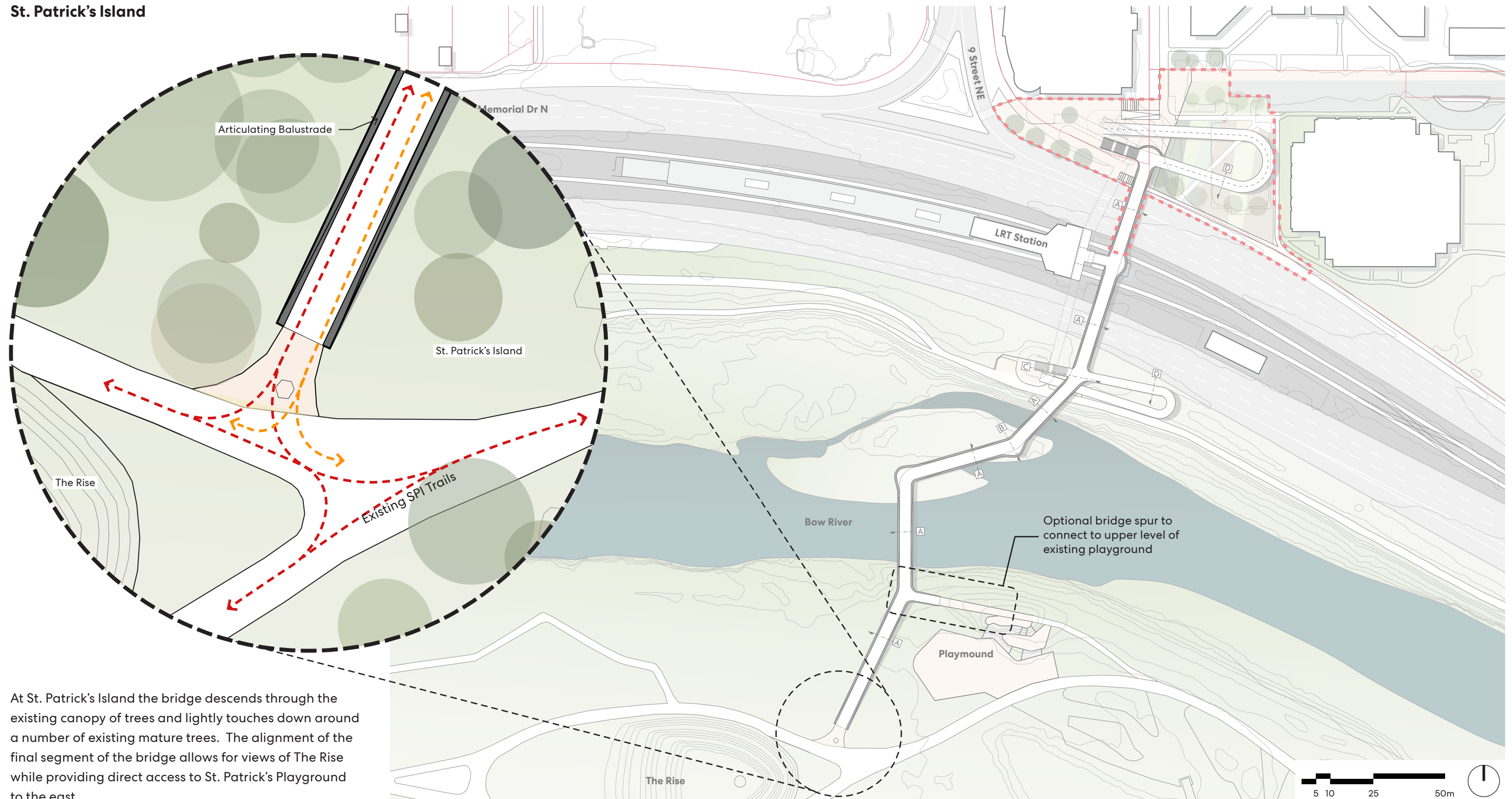
South Memorial



Stairs and a 1:12 ramp are provided at the south side of Memorial Dr connecting to the Bow River Pathway below. A small plaza is provided to allow traffic to merge onto the regional pathway system. Additional trees are proposed around the bridge at this location building on the existing legacy and cultural integrity of Memorial Dr while surrounding the bridge in a canopy of trees.  
ISC: UNRESTRICTED



**St. Patrick's Island**



At St. Patrick's Island the bridge descends through the existing canopy of trees and lightly touches down around a number of existing mature trees. The alignment of the final segment of the bridge allows for views of The Rise while providing direct access to St. Patrick's Playground to the east.

ISC: UNRESTRICTED

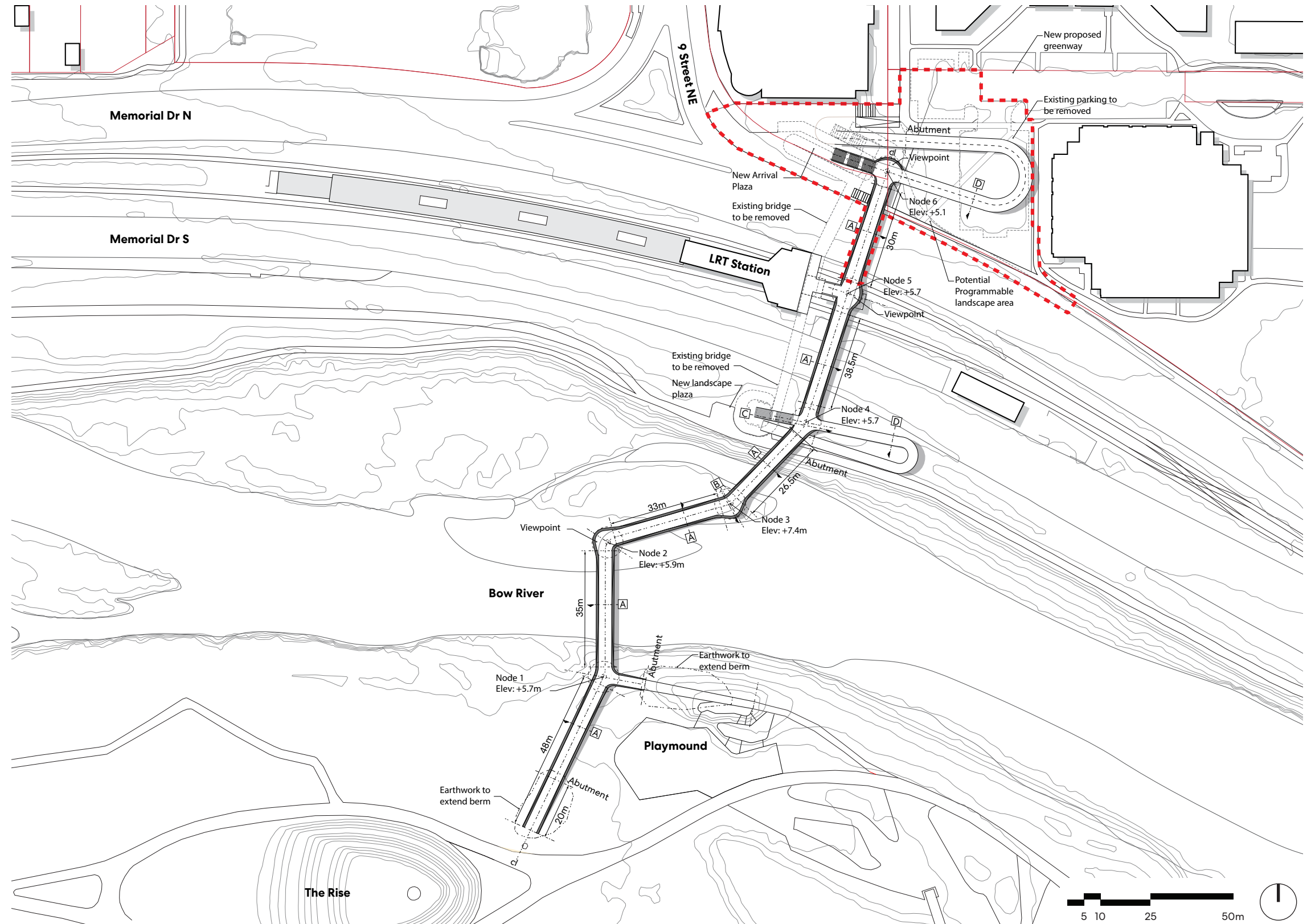


### Site Plan

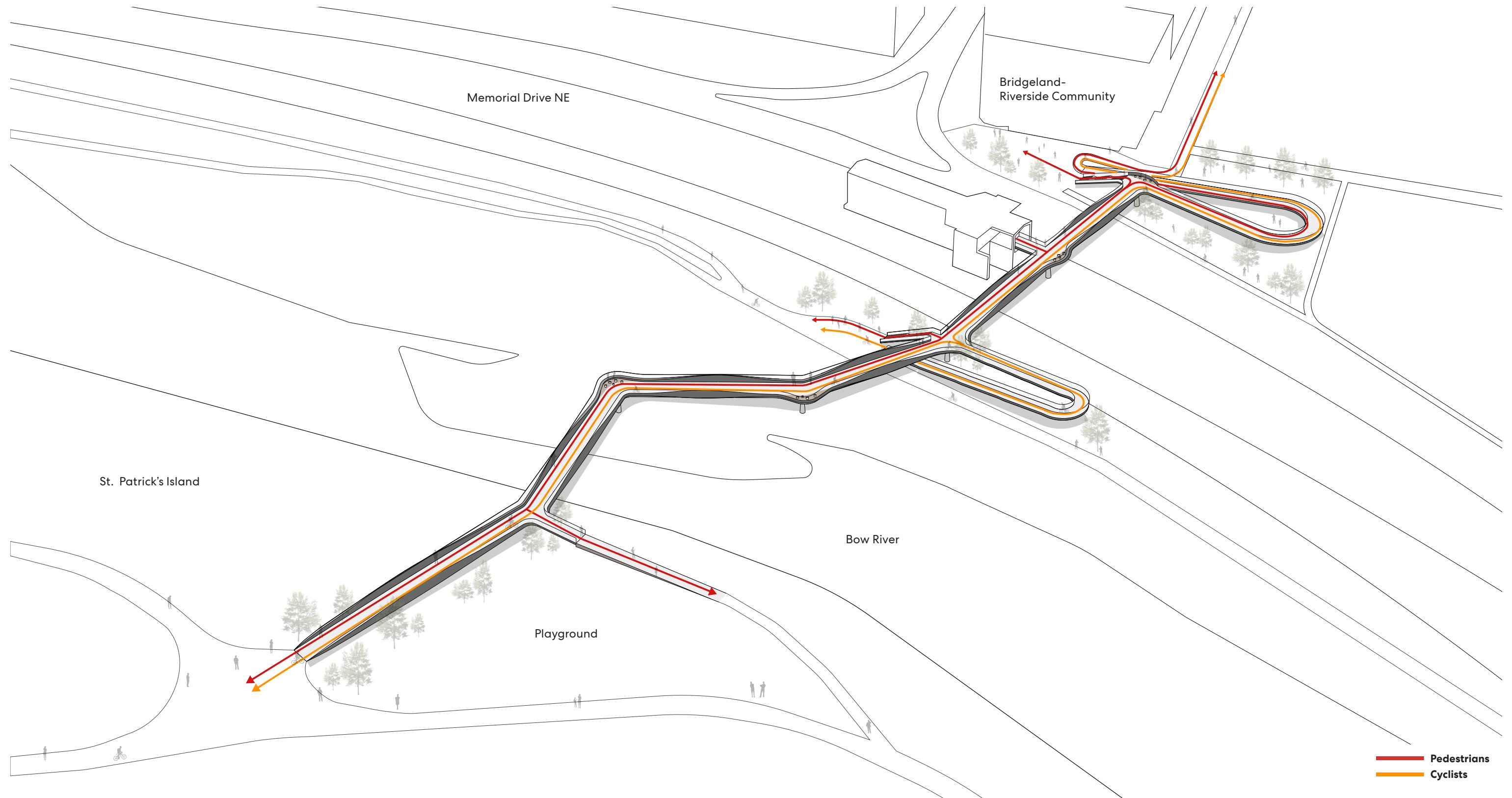
The Bridge is composed of two distinct bridge typologies. The primary bridge typology, which forms the main span of the bridge from the Bridgeland-Riverside Community to St. Patrick's Island and the secondary typologies which is used for the stairs and ramps which are connected to the main span. The primary typology is defined by an integrated structural balustrade system and is supported by splayed steel and concrete columns at each of the nodes. The secondary system is a minimal steel picket guardrail system sitting on a steel box beam supported by steel columns located approximately 10m on centre. In all cases the lower 20m of the ramps are supported on bermed earth or formed concrete abutments to reduce the structural spanning requirements.

The location of each node was chosen to celebrate a specific element in the context but also to reduce the span between nodes to no more than 35m. This alignment allows the bridge to span across a narrow section of the Bow River avoiding the need to locate columns within the River and the associated environmental concerns. The height of each node was established to achieve the clearance requirements and desired slope which informed the length of the ramp as it descends onto St. Patrick's Island.

The location of the structural column to the east of the Bridgeland Memorial LRT station is to be confirmed and requires further investigation and survey information in future phases of this project.

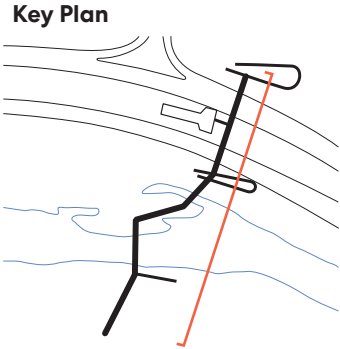
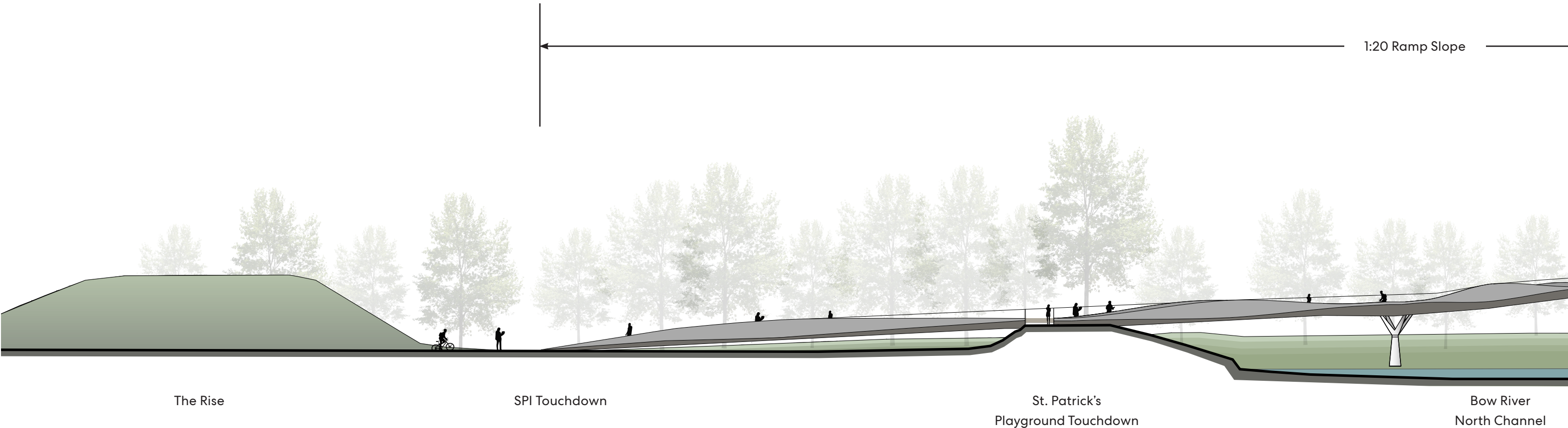


# Bridge Circulation



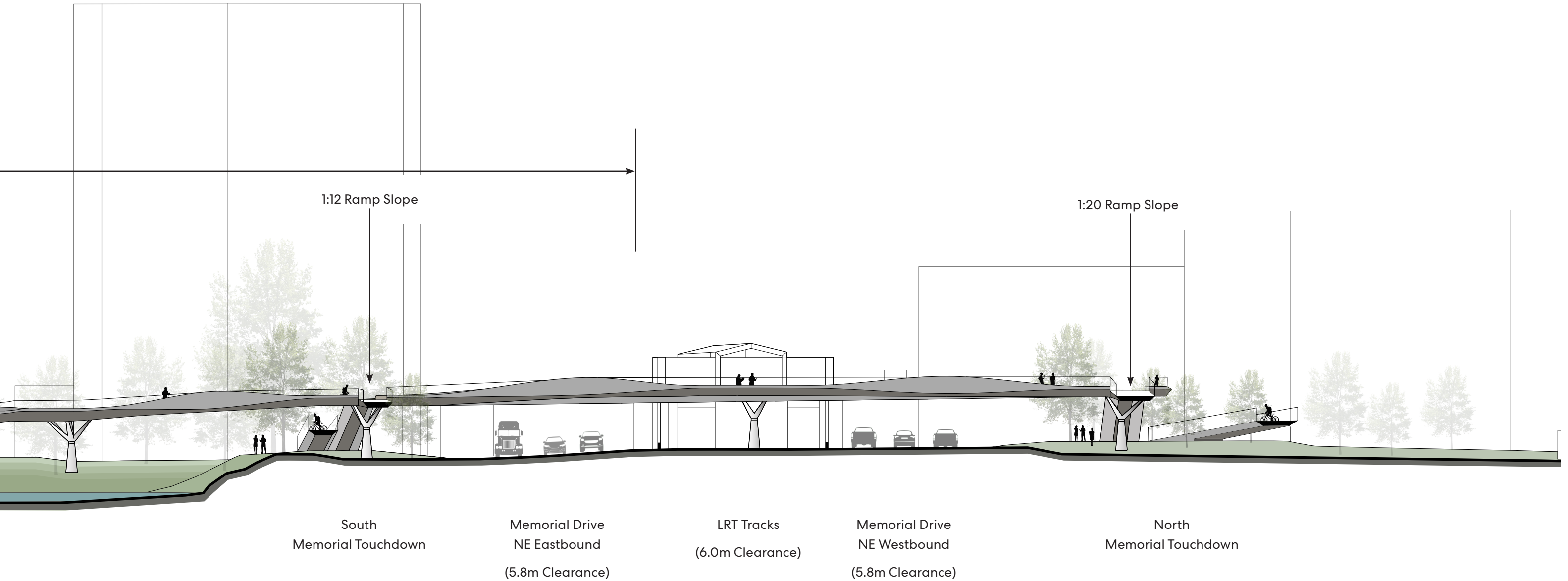
# Bridge Sections

## Longitudinal Section

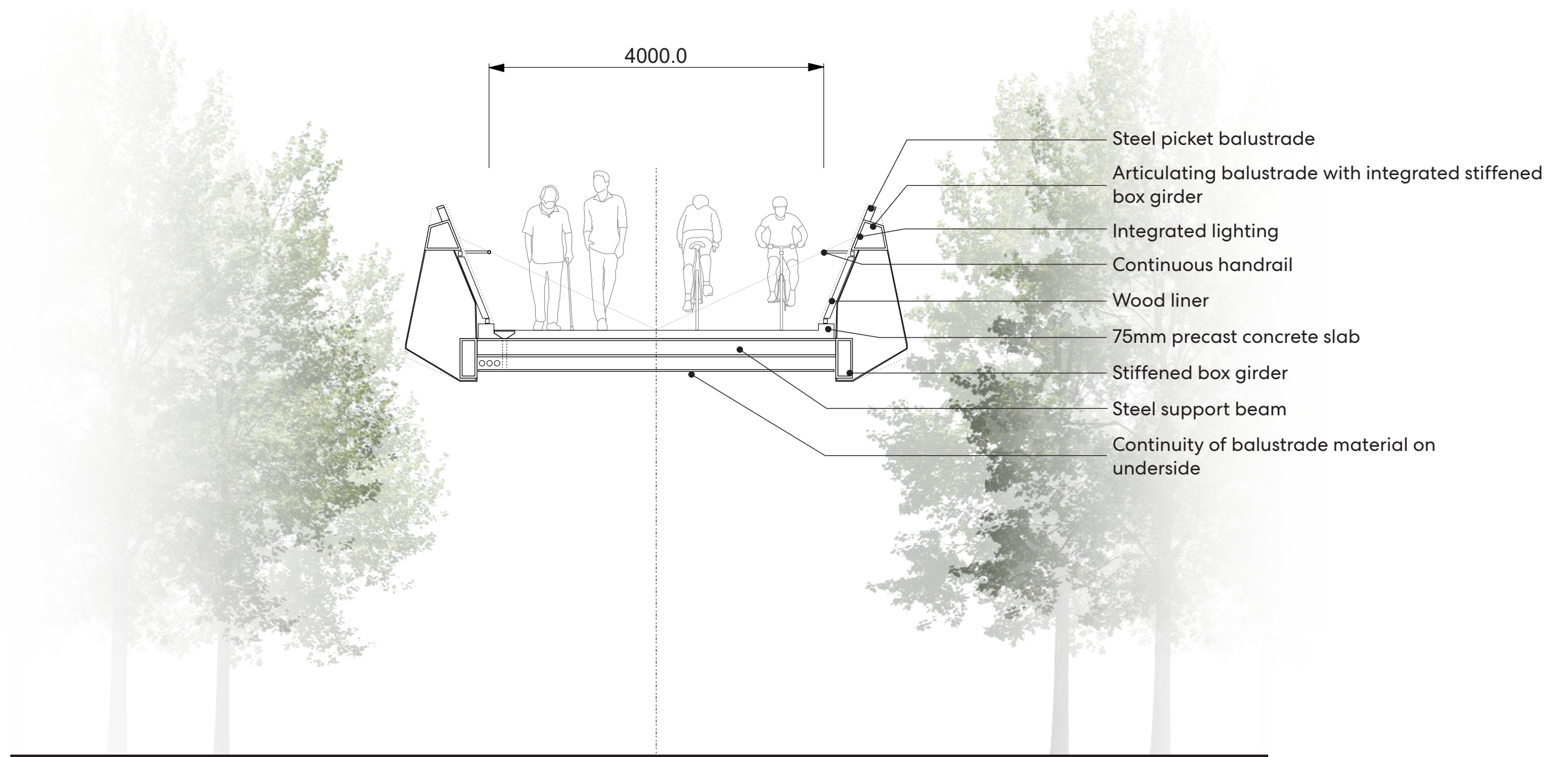


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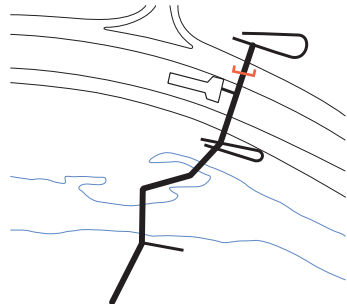




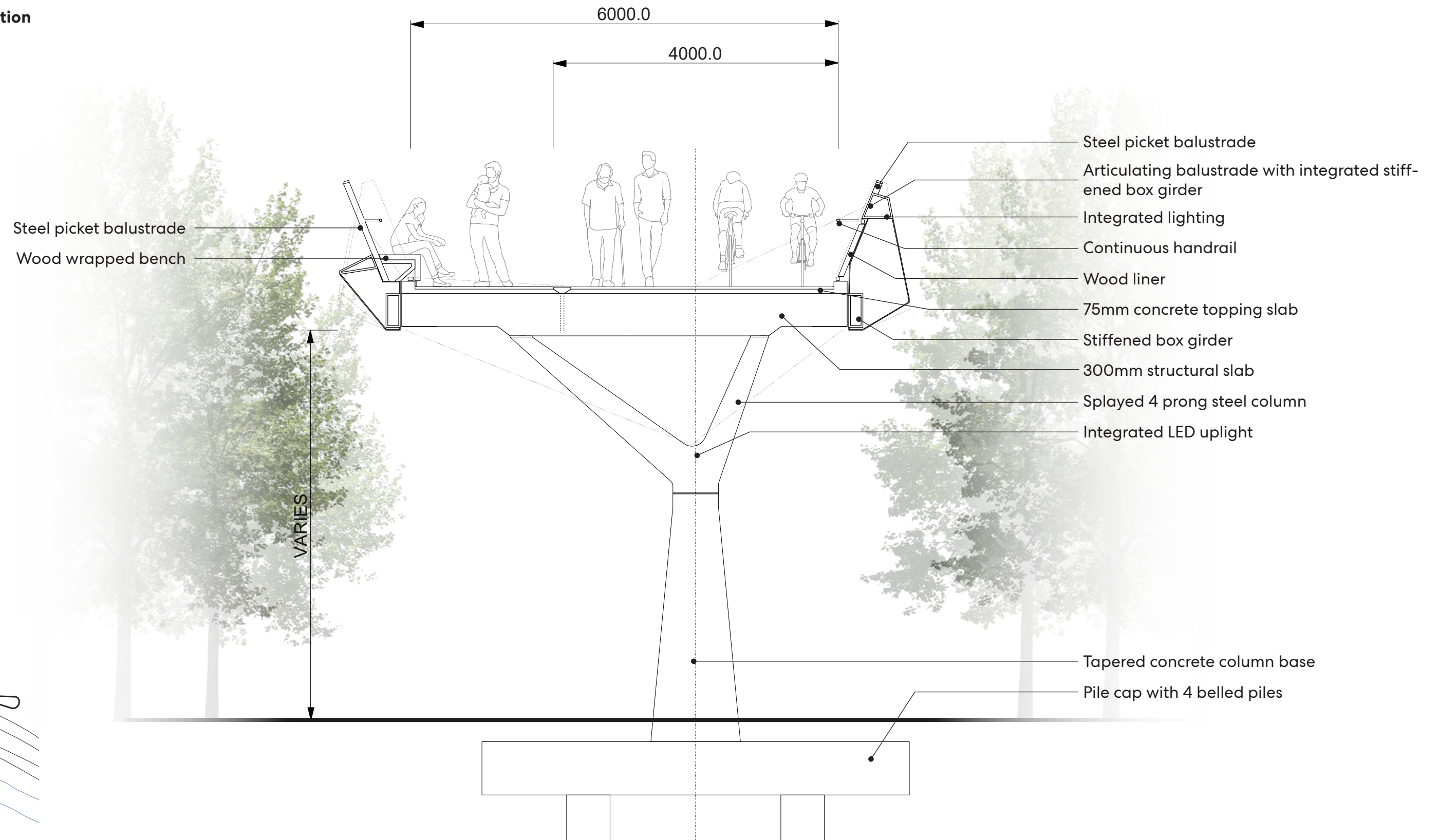
### Typical Main Bridge Span Section



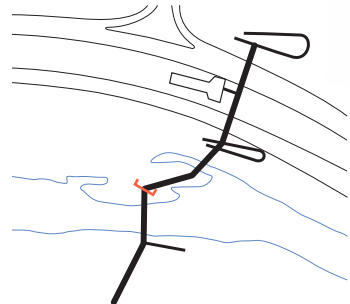
Key Plan



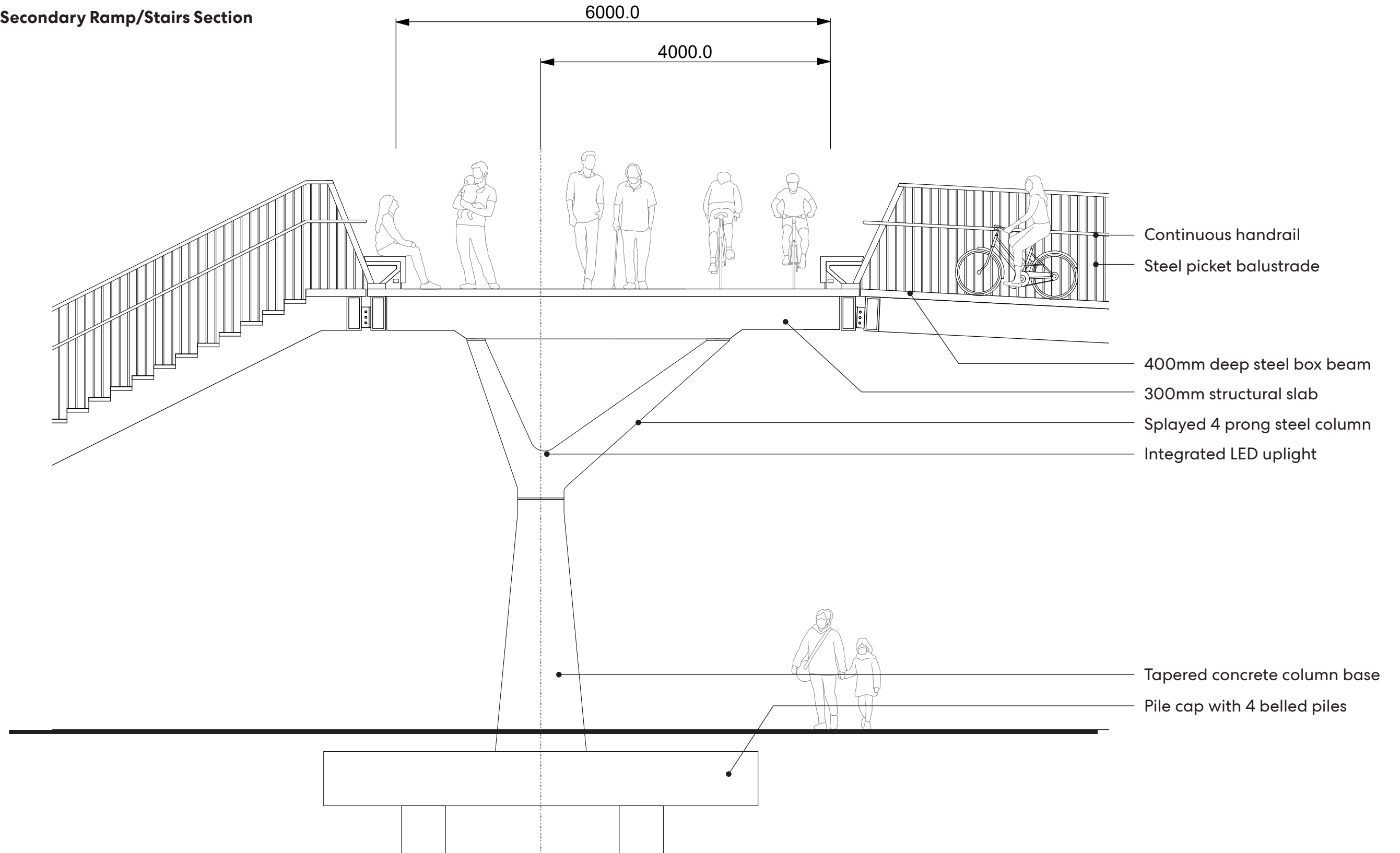
Typical Node Section



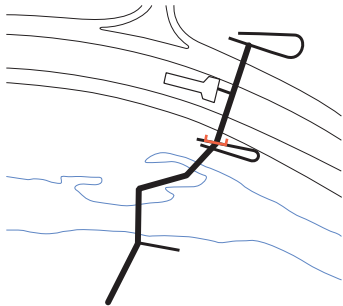
Key Plan



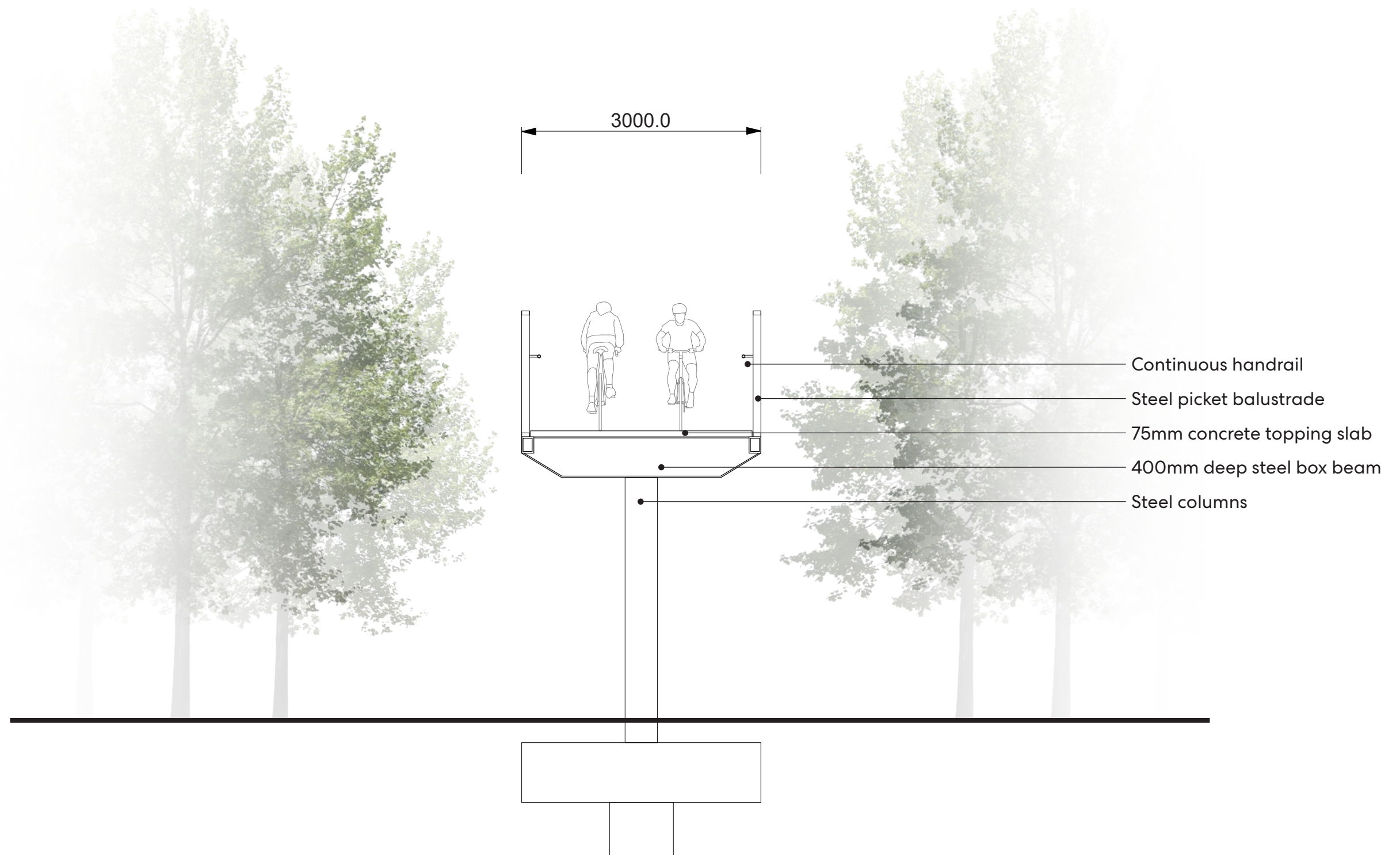
Node with Connection to Secondary Ramp/Stairs Section



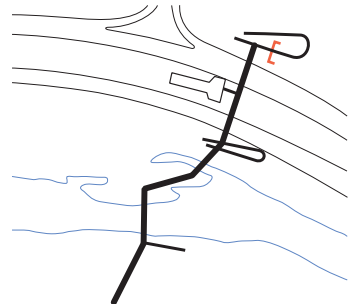
Key Plan



### Typical Secondary Ramp Section

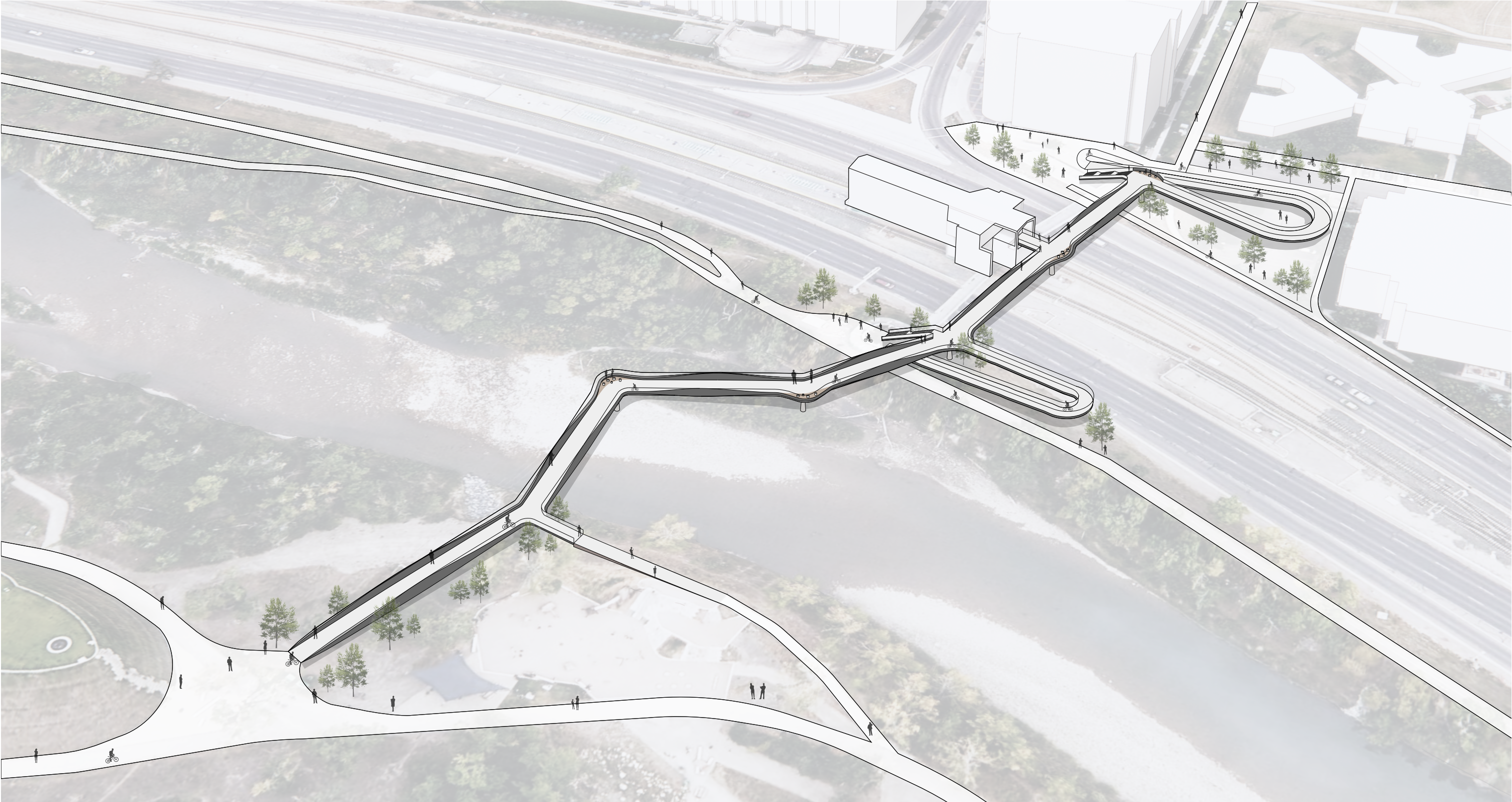


Key Plan



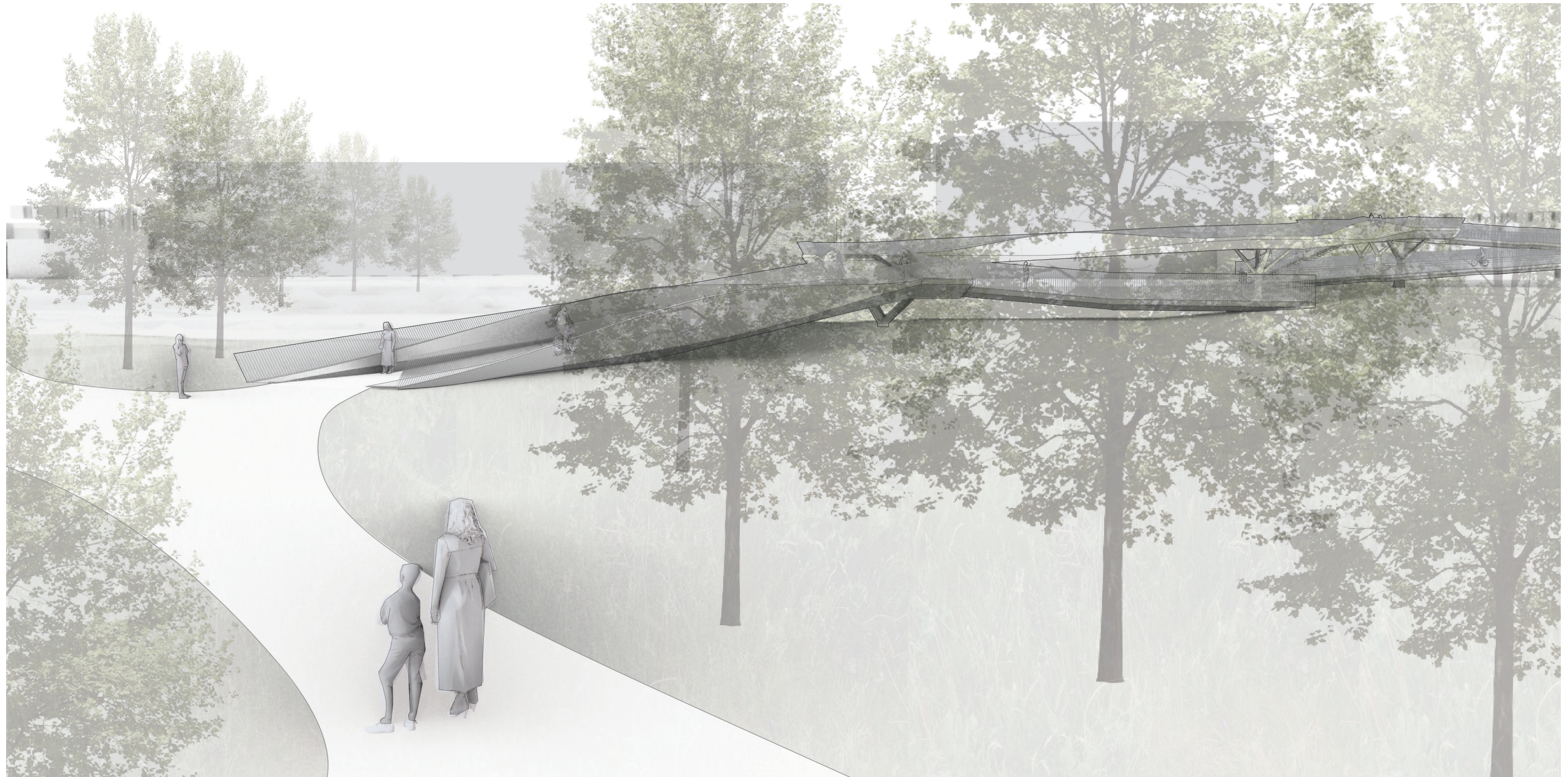
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# Overall 3D View

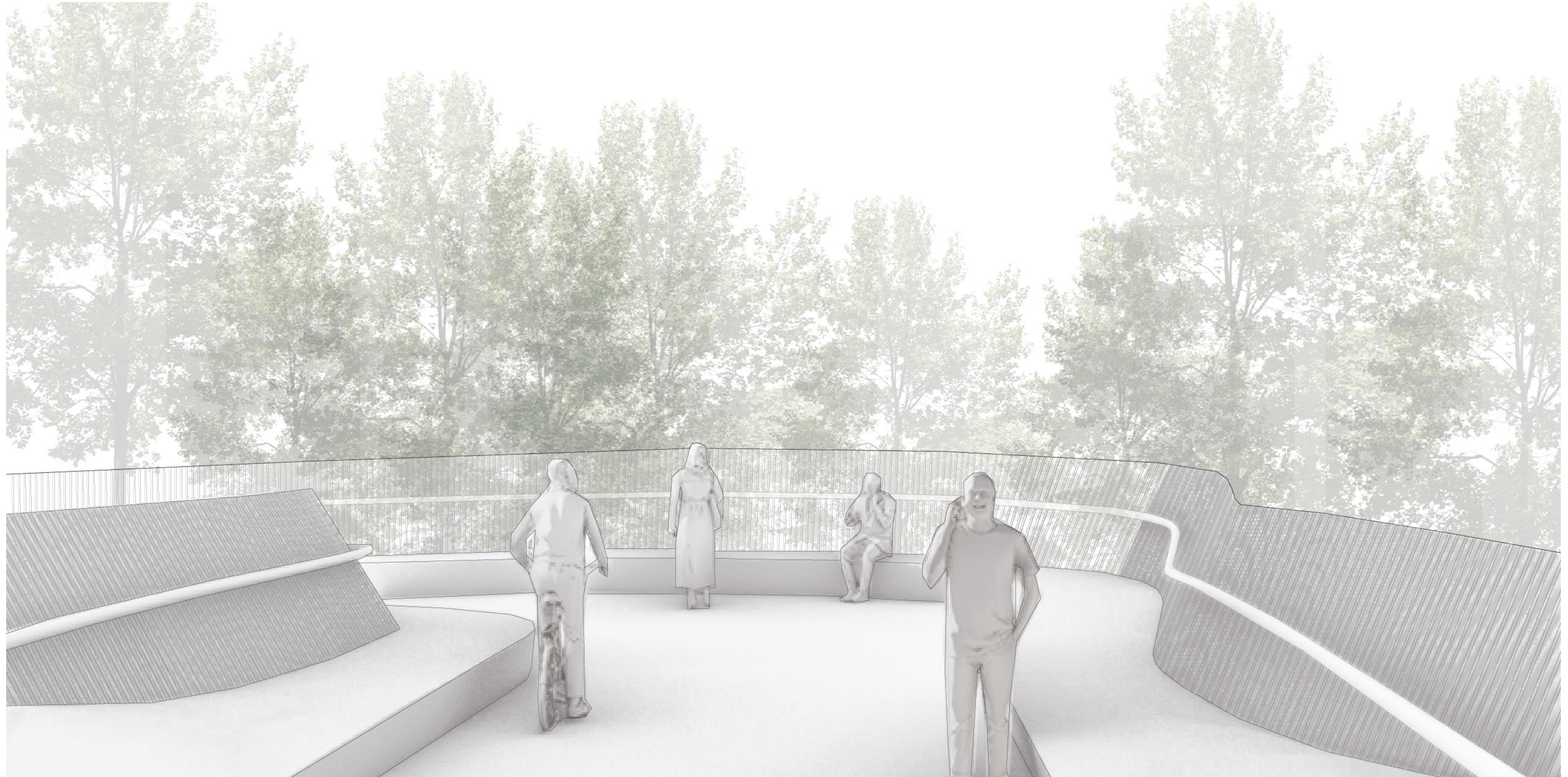


# 3D Views

View from St. Patrick's Island

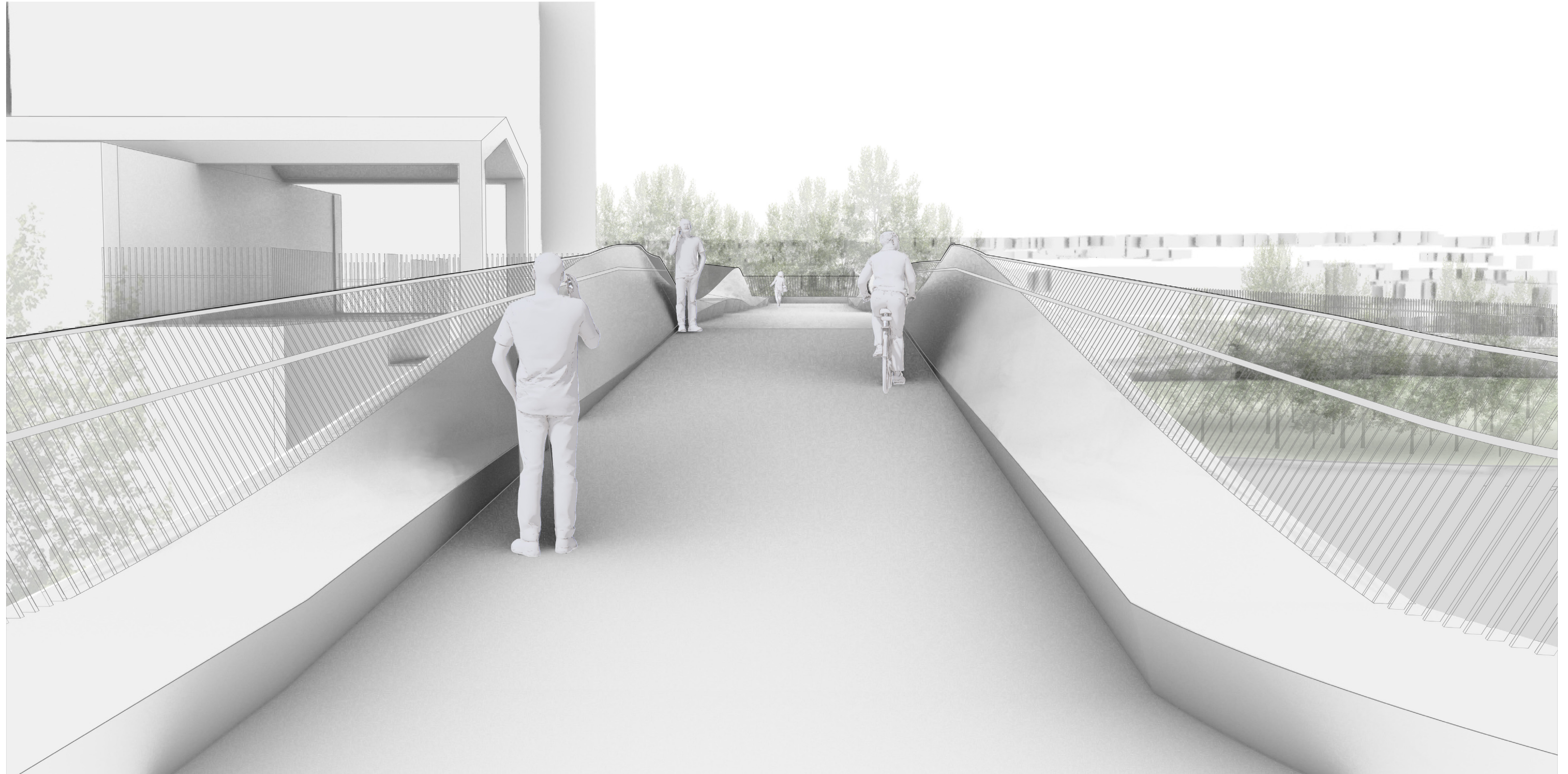


**View from on Bridge**





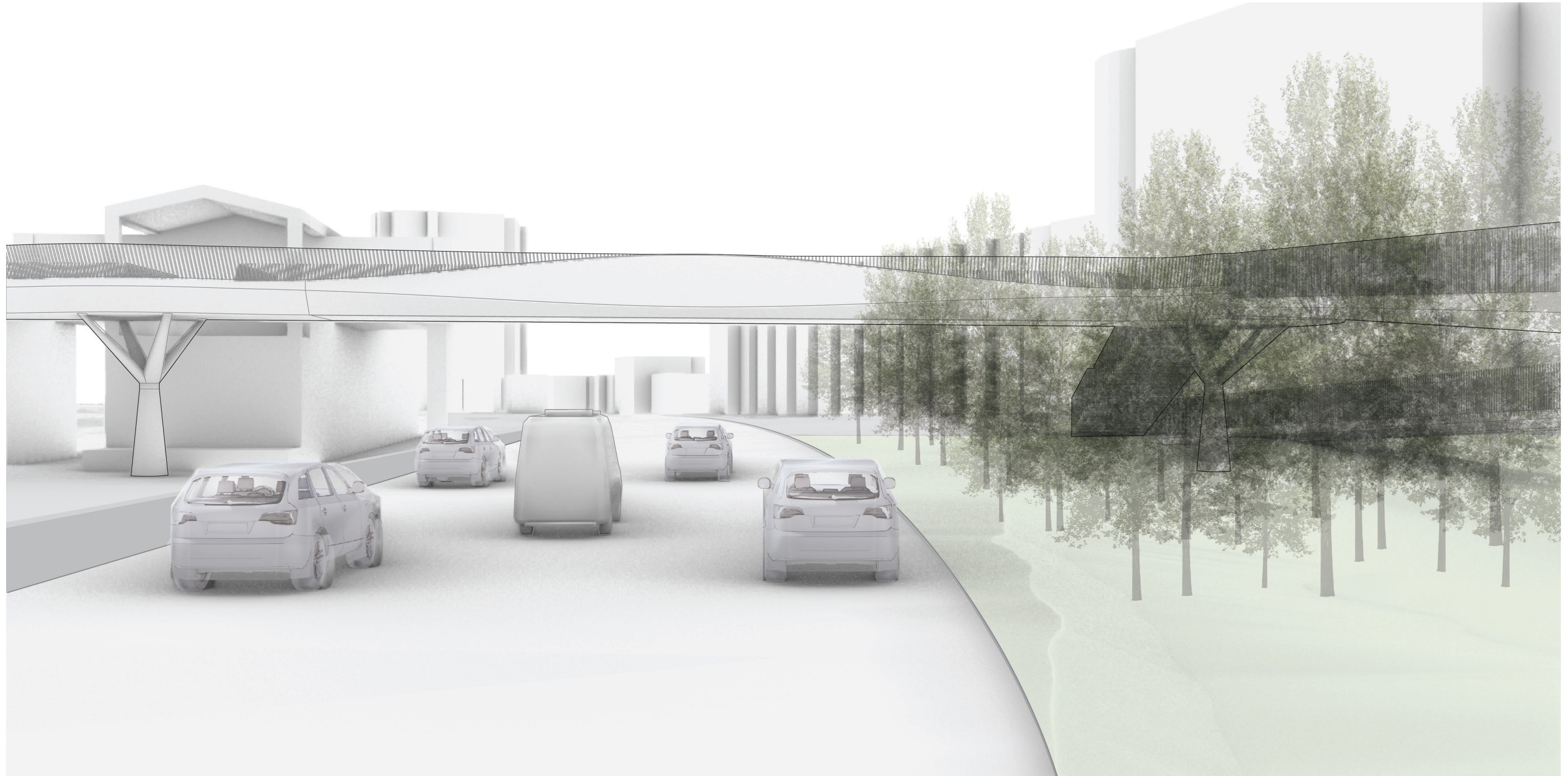
View from on Bridge at LRT Station



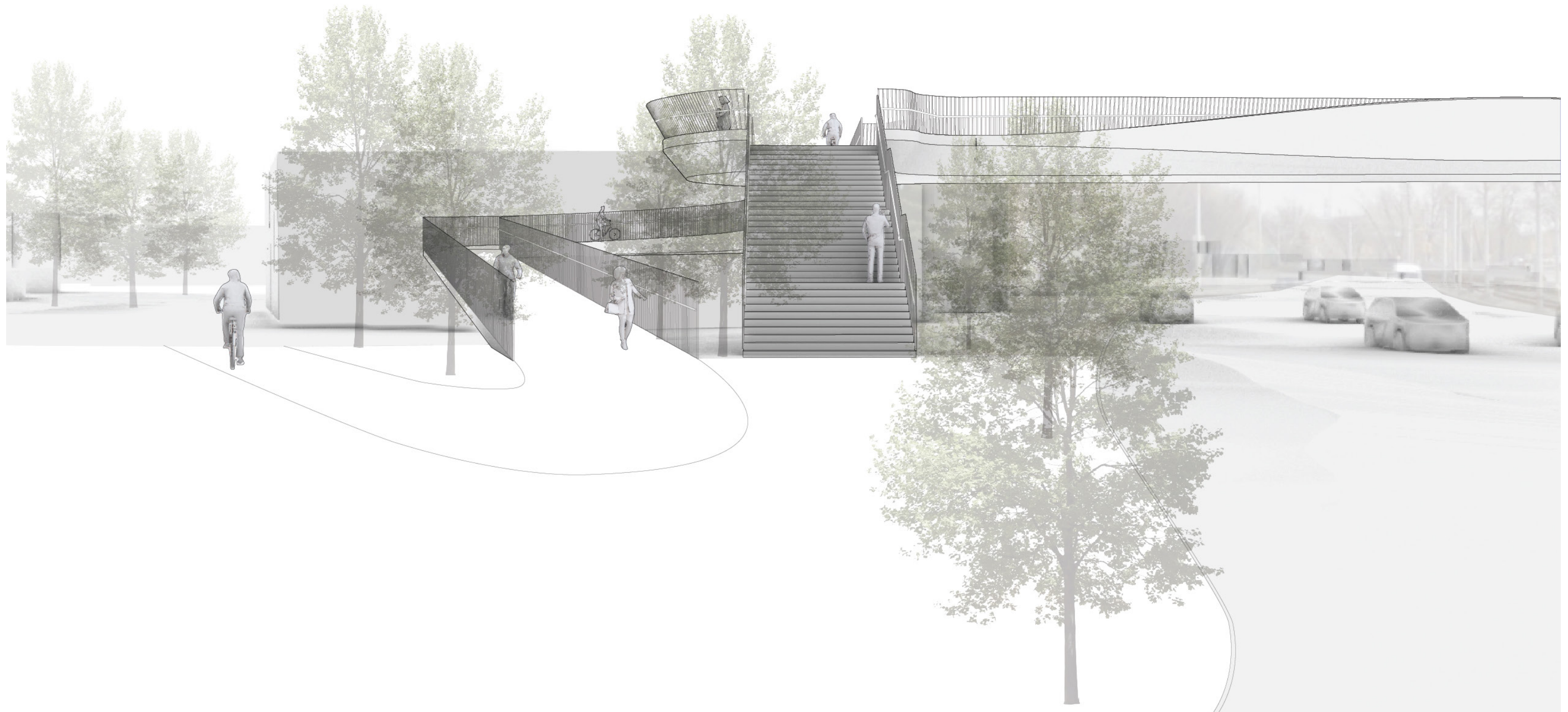
**View from Bow River Pathway**



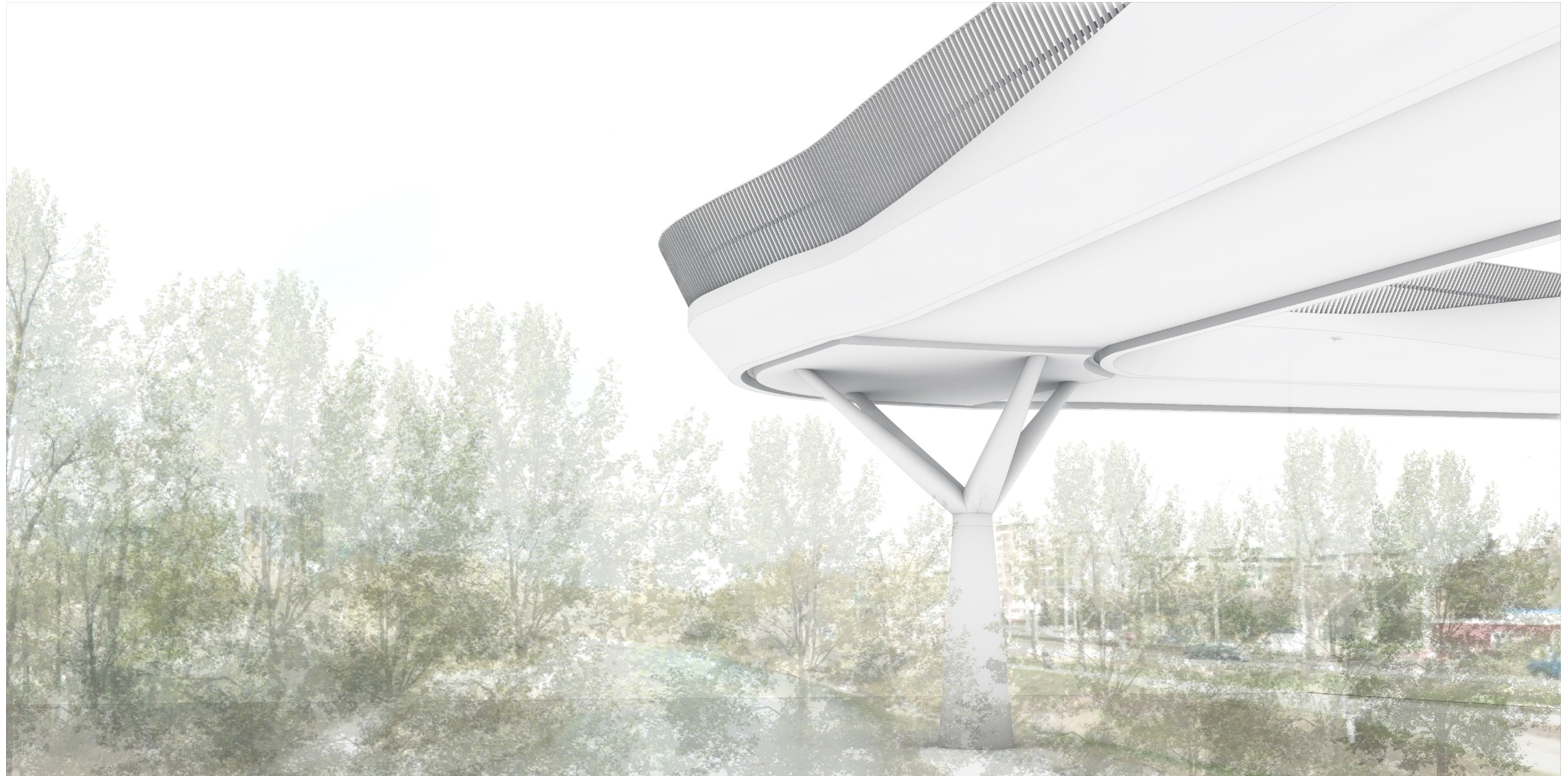
View from westbound Memorial Drive



View from Bridgeland-Riverside Plaza



**View from under the Bridge**



# Project Phasing

## Phasing Strategy

The project has been designed as one bridge but intended to be constructed in two phases:

**Phase 1:** The proposed bridge would be constructed adjacent to the existing bridge to allow for the station to remain operational during the bridge construction. Upon completion of the phase 1, station access would be provided through the new bridge and the existing south pedestrian bridge would be demolished. A temporary guard would be installed to close off the opening where phase 2 would connect in the future.

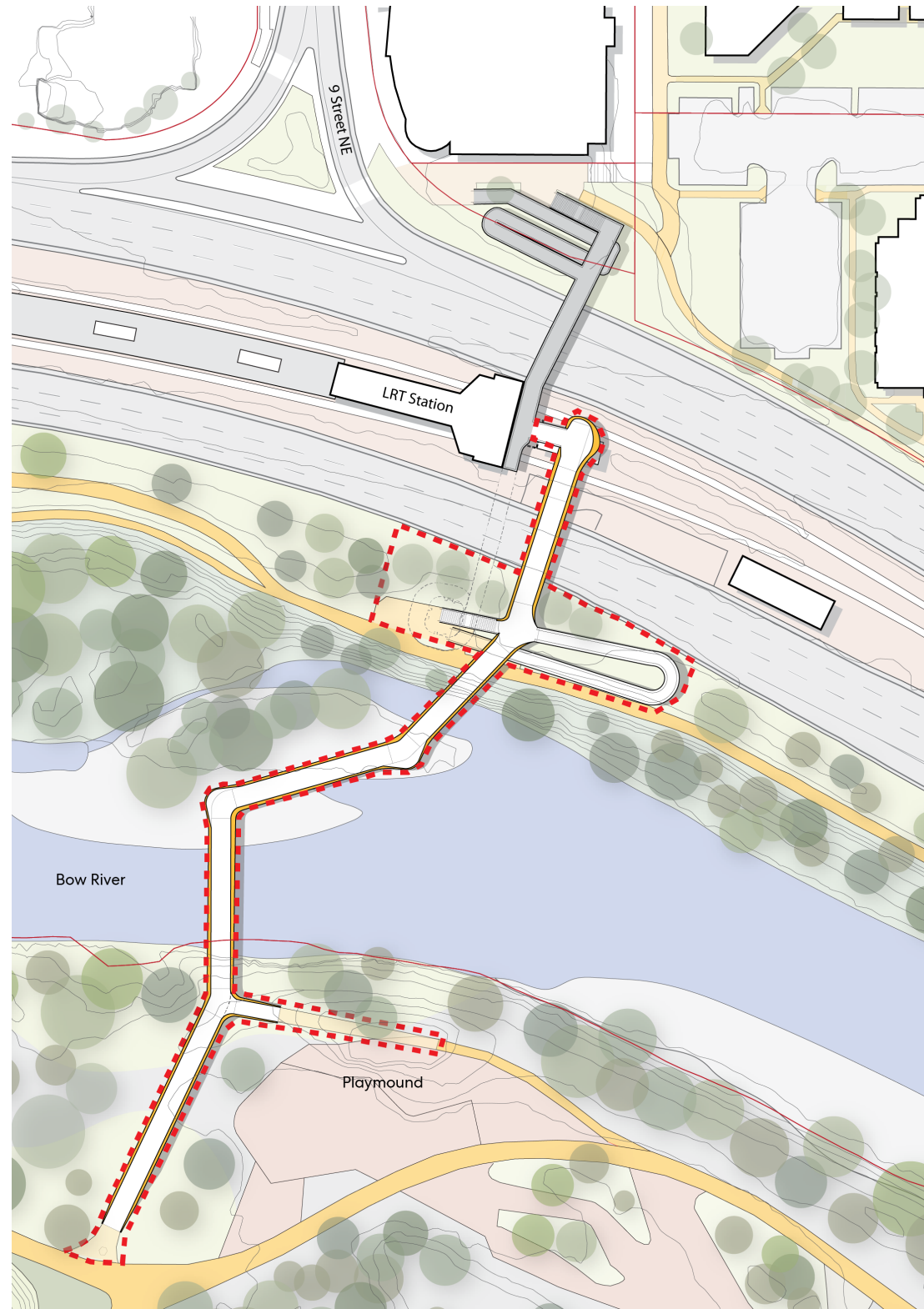
**Phase 2:** The full build out of the bridge would be constructed as part of the upgrade to the Bridgeland Memorial LRT Station. Phase 2 would be a seamless continuation of the bridge, connecting to the opening provided in phase 1.

Offsetting the proposed bridge from the existing bridge not only allows for efficiencies in operation during construction but it also allows the bridge to not have to rely on the existing LRT station columns for support. The existing station columns, which were design to meet code requirements in 1985 and support a much narrower bridge would have to be significantly upgraded and extended to accommodate the new bridge design and meet current code requirements.

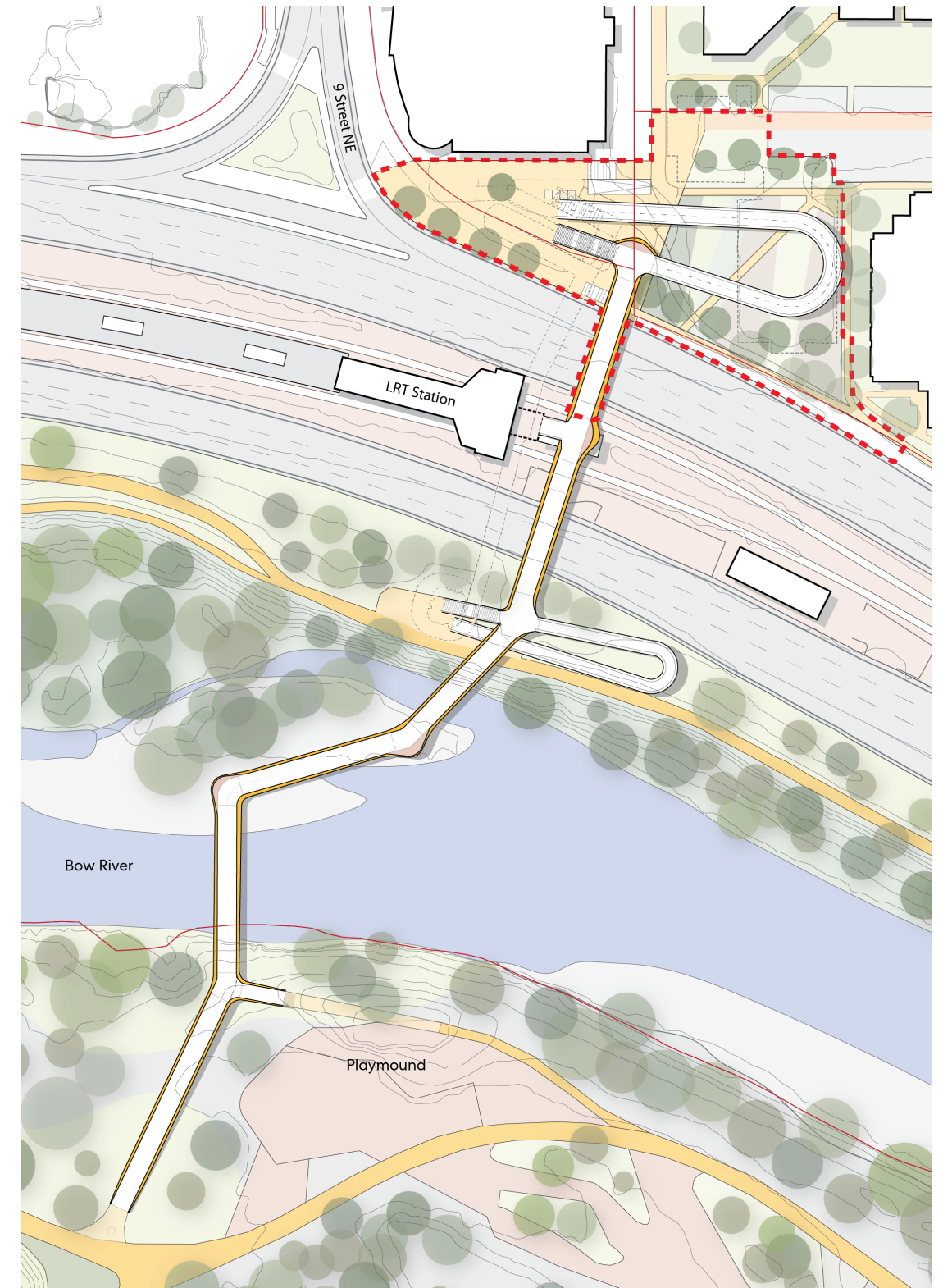
## Estimated Construction Duration

Phase 1	12-14 months
Phase 2	4-6 months

Ideal construction start is August to align with seasonal temperatures and minimize additional flood protection measures and mitigation requirements.



Phase 1



Phase 2

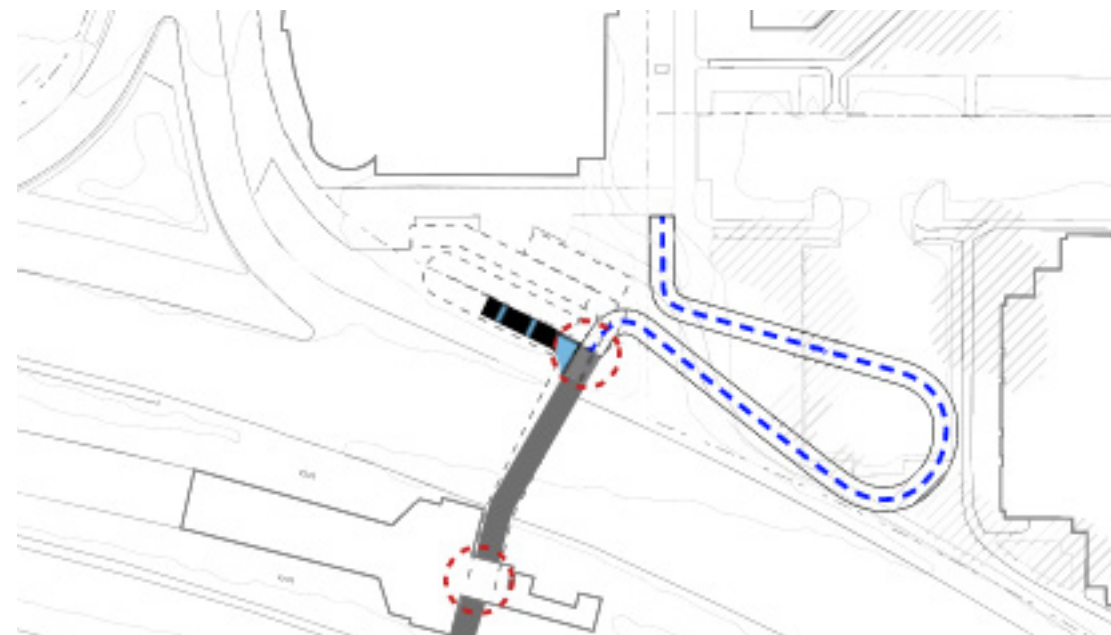
# Integration with Future Development

Throughout the alignment and bridge design process many ramping solutions were explored for the north Memorial ramp. One of the proposed solutions explored the opportunity for the ramp to be integrated into an adjacent development. The property to the north east of the ramp and Bridgeland Plaza is owned by the City of Calgary and currently leased to a seniors living provider.

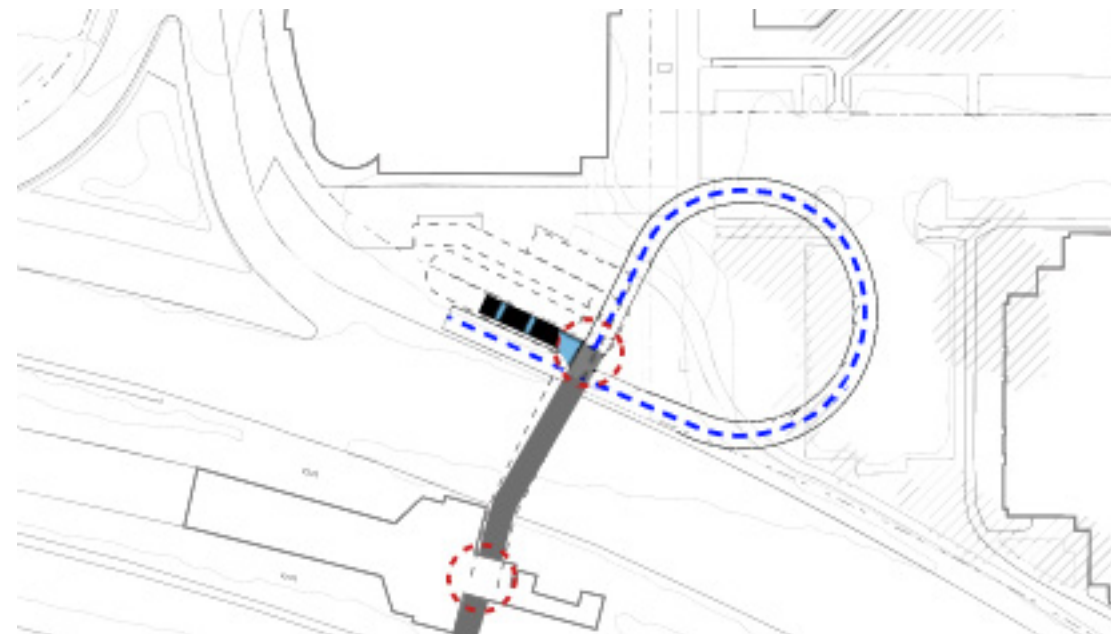
There are many examples internationally where ramping has been integrated into the architectural form. This strategy has the potential to not only activate and enliven the ramp connection but also act as a landmark for the community along Memorial Drive and truly formalize a gateway to the neighbourhood. There may also be some economic benefit to sharing the cost of the ramp for the project.

Ramping solutions for phase 2 of the project and opportunities for integration with adjacent developments should be revisited in future phases of this project when more certainty has been reached regarding of property acquisition, redevelopment plans and land deal opportunities.

The cost estimate for the proposed bridge design does not included for the integration with adjacent buildings and assumes a land cost of \$0 given by the City to advance this project.



North Memorial Ramp - Switchback



North Memorial Ramp - Spiral



Audemars Piguet Swiss Hotel - BIG



Audemars Piguet Building - BIG

# Structure

## Structural Approach

The connection from the Memorial C-Train station to St Patrick's Island is being achieved by a series of pedestrian bridges landing on sculpted concrete and steel node supports. The nodes allow the path to change direction without requiring a curved bridge structure. The individual bridges are composed of a pair of edge beams supporting a precast concrete walking surface. The edge beams are being used as the primary structural support, as well as backing guardrails and seating along the bridge. The edge beams are internally stiffened steel plate box beams that are sculpted to follow the lines of maximum stress to achieve greater efficiency. The precast walking surface is supported on regular cross members that tie the edge beams together. This arrangement allows for easier installation and future maintenance on the walking surface.

The nodes are composed of a concrete base to provide good durability, especially in high water events, and a sculpted steel upper portion with four splayed arms that reduce the bridge spans and provide maximum support for the node slabs. The nodes are founded on a group of piles that are tied together with a pile cap just below grade. The concrete base is a round tapered section that starts on a pile cap and extends up to at least the maximum anticipated water height. The four splayed steel arms are mounted on top of the concrete pedestal and pick up the reinforced concrete walking surface. At each node a reinforced concrete slab sits on the steel arms and extends out to pick up the bridge sections. By cantilevering the concrete the bridge spans are reduced and the structure becomes lighter.

To access the bridge, ramps and stairs are provided at each end. These are made of a stiffened steel plate box beams underneath a concrete topping slab. The box beams are supported by round steel columns at approximately 10m intervals. The steel guardrails are mounted on continuous HSS supports that are built into the sides of the steel box beam. This gives the ramps and stairs a robust structure and a similar underside profile to the bridges without the additional cost and complexity of the longer spans.

## Embodied Carbon

As part of the initial design phase, the potential to re-use of the existing bridge was analyzed as a way to reduce the embodied carbon of the project. The existing 1985 south bridge structure was determined to be at the end of its life span and would have to be replaced. The 2005 bridge was designed with a single column that supports the bridge deck, ramp and stairs. This structural design challenged the ability to reuse the existing bridge as it is interconnected with the ramp and stairs. Given that one of the main priorities of this project is to improve accessibility at the ramp and stairs in this location it was decided that reuse of the existing bridge, stairs and ramp would compromise the goals and vision for the project and was not pursued.



Existing 2005 north LRT pedestrian bridge and ramp



# Budget 2 - Concept Design Estimate

## Phased Cost Breakdown Based on Concept Design Class D Estimate

### Phase 1 (LRT Station to SPI)

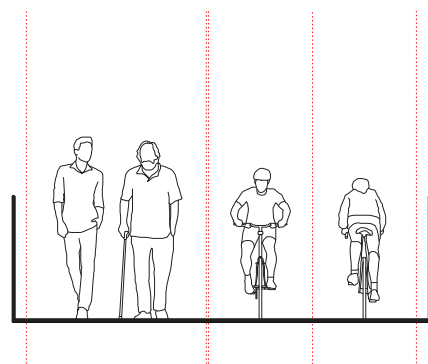
<b>Total Construction Cost:</b>	<b>\$20,924,200</b>
Escalation Allowance (2% at 1 year)	\$418,484
<b>Construction Cost with Escalation</b>	<b>\$21,342,684</b>
Soft Costs (20%)	\$4,268,500
<b>Total Phase 1 Project Cost:</b>	<b>\$25,611,184</b>
Bridge Length:	190m
Linear Project Cost:	\$134,796/m

### Phase 2 (LRT Station to N Memorial Dr)

<b>Total Construction Cost:</b>	<b>\$5,925,700</b>
Escalation Allowance (construction within 6 months)	0
<b>Construction Cost with Escalation</b>	<b>\$5,925,700</b>
Soft Costs (20%)	\$1,185,100
<b>Total Phase 2 Project Cost:</b>	<b>\$7,110,800</b>
Bridge Length:	115m
Linear Project Cost:	\$61,833/m

### Combined

<b>Total Combined Construction Cost:</b>	<b>\$26,849,800</b>
Escalation Allowance	\$418,484
<b>Combined Const. Cost with Escalation</b>	<b>\$27,268,284</b>
Soft Costs (20%)	\$5,453,700
<b>Total Combined Project Cost:</b>	<b>\$32,721,984</b>
Bridge Length:	305m
Linear Project Cost:	\$107,285/m
<b>Original Project Budget</b>	<b>\$36,000,000</b>



← 4m →  
 Indicative Bridge Use Cross Section  
 ISC: UNRESTRICTED

## Budget 2 Assumptions

- 2% construction escalation held from 2021 pricing as a separate line item to the construction estimate
- City of Calgary's public art requirements are not applicable to this project
- 20% soft costs held at the request of Transportation Infrastructure, City of Calgary
- \$0 for land cost
- Soft costs include construction contingency, permits, consultant fees, insurance, and PM fees

## Construction Cost Estimate Assumptions

BTY Group included the following assumptions in the Class-D construction opinion of probable cost estimate (+/-25% variance):

- 10% contingency on bridge unit rate included in estimate to account for the Piles and Piers and Pile Cap installation in proximity to Bow River and potential need for specialized foundation construction, staging and environmental requirements
- 5% additional contingency held for price escalation and market uncertainty as a result of the 2020/2021 global pandemic
- 15% design contingency and 5% construction contingency
- Estimate is for alignment comparison only with a cost variance of +/- 30%
- A \$100,000 allowance included for the relocation of the overhead power line

## Project Cost Comparison

### Budget 1 - Alignment Cost Estimate

#### Phase 1 (LRT Station to SPI)

<b>Total Construction Cost:</b>	<b>\$19,694,800</b>
Escalation Allowance (2% at 1 year)	\$393,896
<b>Construction Cost with Escalation</b>	<b>\$20,088,696</b>
Soft Costs (20%)	\$4,017,700
<b>Total Phase 1 Project Cost:</b>	<b>\$24,106,396</b>
Bridge Length:	217m
Linear Project Cost:	\$111,089/m

**68%** of total project cost

#### Phase 2 (LRT Station to N Memorial Dr)

<b>Total Construction Cost:</b>	<b>\$9,566,000</b>
Escalation Allowance (construction within 6 months)	\$0
<b>Construction Cost with Escalation</b>	<b>\$9,566,000</b>
20% Soft Costs	\$1,913,200
<b>Total Project Cost:</b>	<b>\$11,479,200</b>
Bridge Length:	137m
Linear Project Cost:	\$83,789/m

**32%** of total project cost

#### Combined

<b>Combined Total Construction Cost:</b>	<b>\$29,260,800</b>
Escalation Allowance	\$393,896
<b>Construction Cost with Escalation</b>	<b>\$29,654,696</b>
Combined 20% Soft Costs	\$5,930,900
<b>Combined Total Project Cost:</b>	<b>\$35,585,596</b>
Bridge Length:	354m
Linear Project Cost:	\$100,524/m

### Budget 2 - Concept Design Estimate

#### Phase 1 (LRT Station to SPI)

<b>Total Construction Cost:</b>	<b>\$20,924,200</b>
Escalation Allowance (2% at 1 year)	\$418,484
<b>Construction Cost with Escalation</b>	<b>\$21,342,684</b>
Soft Costs (20%)	\$4,268,500
<b>Total Phase 1 Project Cost:</b>	<b>\$25,611,184</b>
Bridge Length:	190m
Linear Project Cost:	\$134,796/m

**78%** of total project cost

#### Phase 2 (LRT Station to N Memorial Dr)

<b>Total Construction Cost:</b>	<b>\$5,925,700</b>
Escalation Allowance (construction within 6 months)	0
<b>Construction Cost with Escalation</b>	<b>\$5,925,700</b>
Soft Costs (20%)	\$1,185,100
<b>Total Phase 2 Project Cost:</b>	<b>\$7,110,800</b>
Bridge Length:	115m
Linear Project Cost:	\$61,833/m

**22%** of total project cost

#### Combined

<b>Total Combined Construction Cost:</b>	<b>\$26,849,800</b>
Escalation Allowance	\$418,484
<b>Combined Const. Cost with Escalation</b>	<b>\$27,268,284</b>
Soft Costs (20%)	\$5,453,700
<b>Total Combined Project Cost:</b>	<b>\$32,721,984</b>
Bridge Length:	305m
Linear Project Cost:	\$107,285/m

**Comparative Bridges**



**9 Ave S.E. Bridge**  
 Year: Under Construction  
 Span: 65m  
 Width: ~24m  
 Total Project Cost: \$23,000,000  
**Linear Cost: \$353,847/m**  
 \* Vehicular bridge, no additional ramping to bridge



**Banff Animal Crossing**  
 Year: 2006  
 Span: 80m  
 Width: ~50m  
 Total Project Cost: \$4,000,000  
**Linear Cost: \$50,000/m**  
 \* Animal crossing bridge, landscape bermed up to structure



**George C. King Bridge**  
 Year: 2012-2014  
 Span: 190m  
 Width: Varies ~7.5m - 10.5m  
 Total Project Cost: \$25,000,000  
**Linear Cost: \$131,579/m**  
 \* Pedestrian footbridge, no additional ramping to bridge



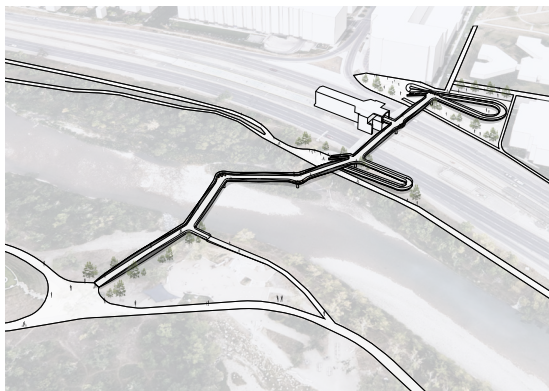
**Calgary Zoo Bridge**  
 Year: 2018  
 Span: 60m  
 Width: ~3m  
 Total Project Cost: \$3,000,000  
**Linear Cost: \$50,000/m**  
 \* Pedestrian footbridge, no additional ramping to bridge



**Peace Bridge**  
 Year: 2010 - 2012  
 Span: 130m  
 Width: 6.2m  
 Total Project Cost: \$25,000,000  
**Linear Cost: \$192,308/m**  
 \* Pedestrian footbridge, no additional ramping to bridge



**Jaipur Bridge**  
 Year: N/A  
 Span: 60m  
 Width: 6m  
 Total Project Cost: \$9,600,000  
**Linear Cost: \$160,000/m**  
 \* Pedestrian footbridge



**Bridgeland-Riverside Bridge Project**  
 Year: N/A  
 Span: 305m  
 Width: 4m  
 Total Project Cost: \$32,721,984  
**Linear Cost: \$107,285/m**  
 \* Pedestrian footbridge includes demolition, ramping to bridge, LRT connection

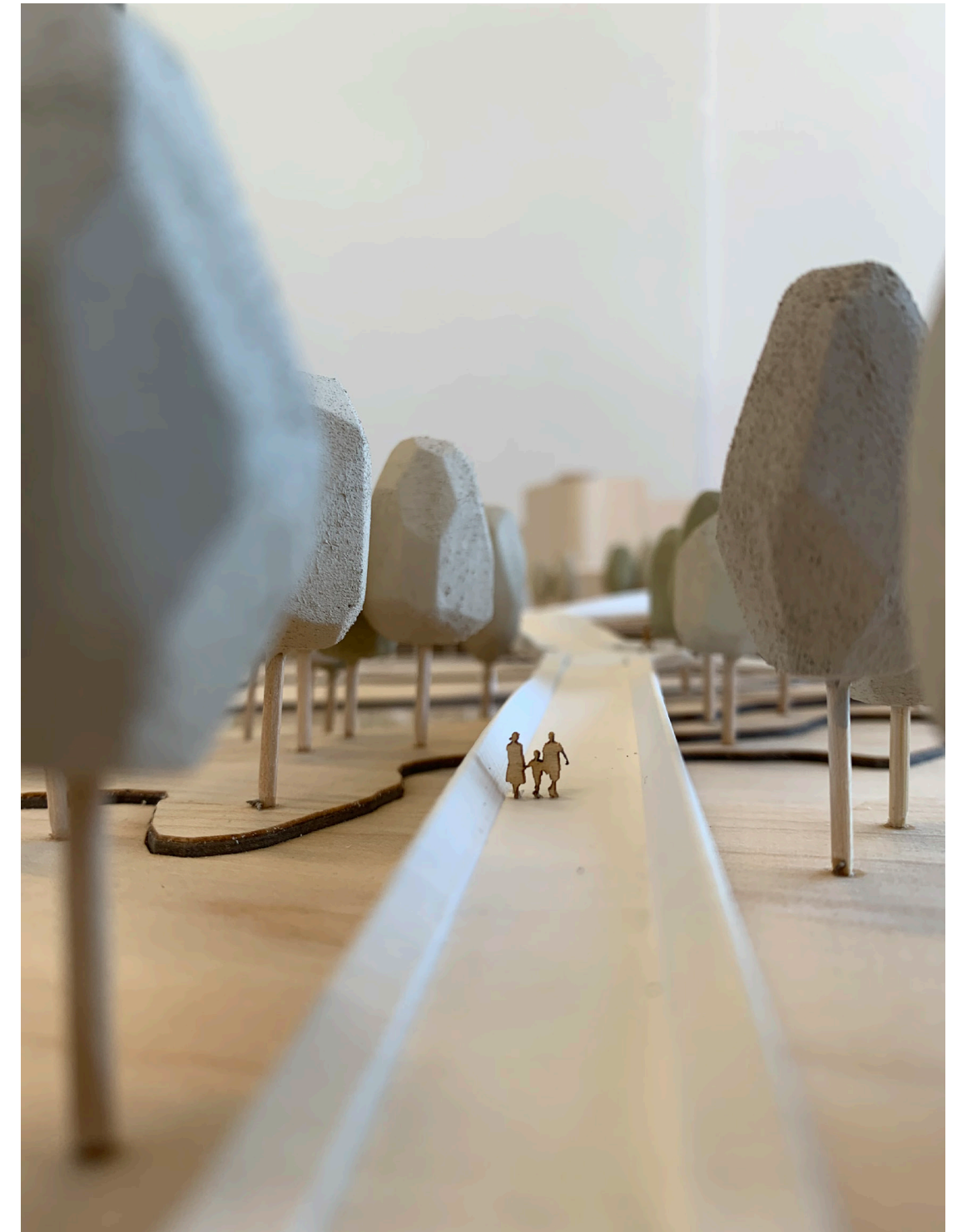
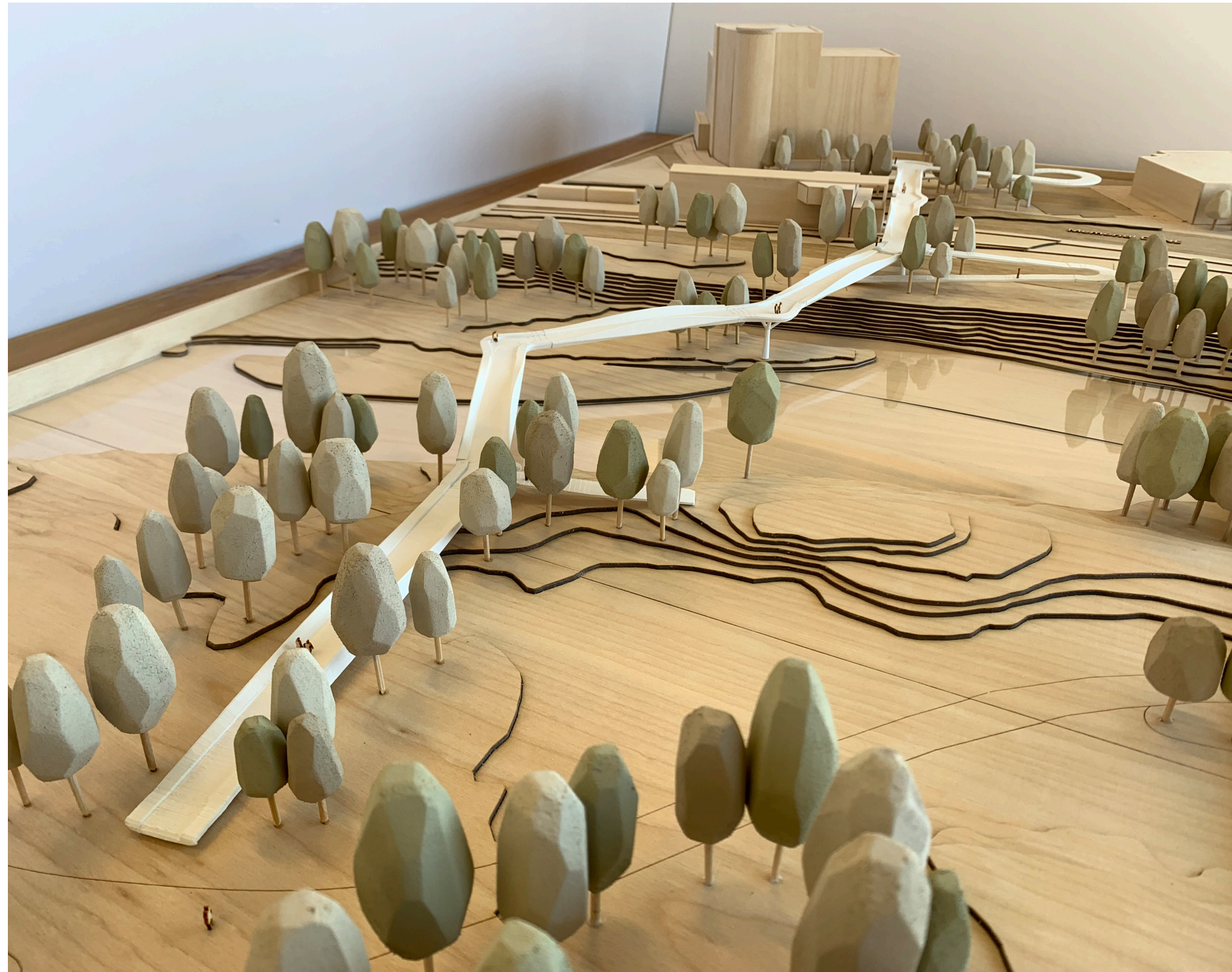


**Vancouver, WA Land Bridge**  
 Year: 2006  
 Span: 60m  
 Width: 12m  
 Total Project Cost: \$12,000,000 USD  
**Linear Cost: \$200,000 USD/m**  
 \* Pedestrian footbridge, includes ramping to bridge

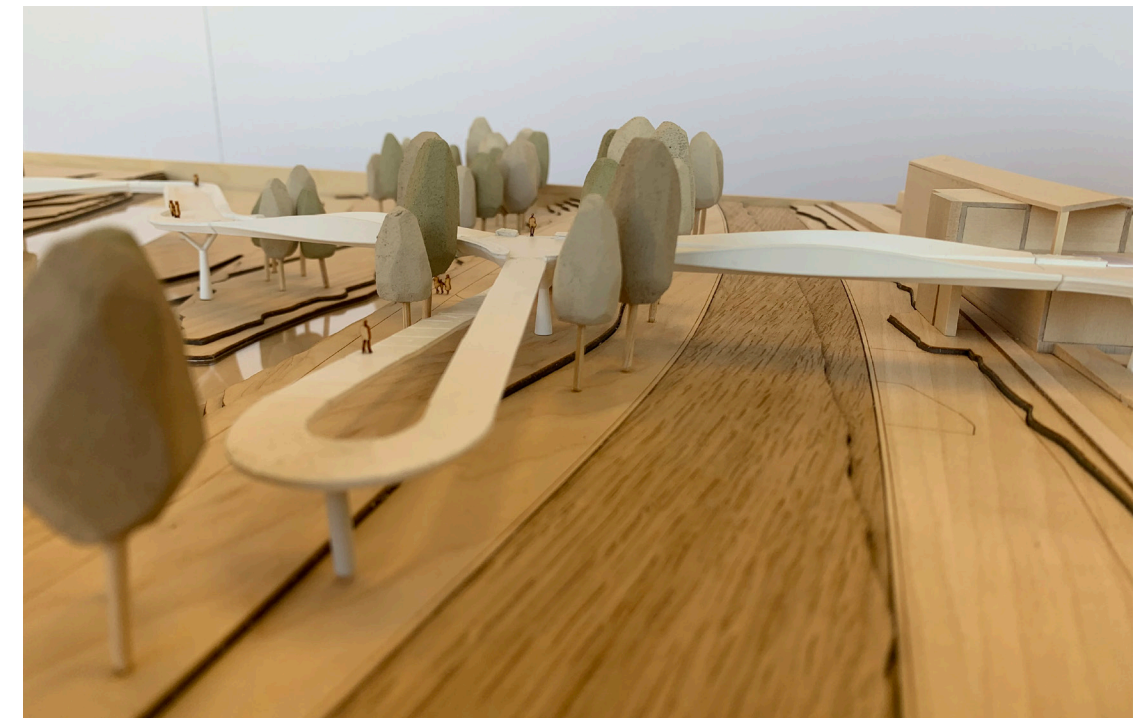
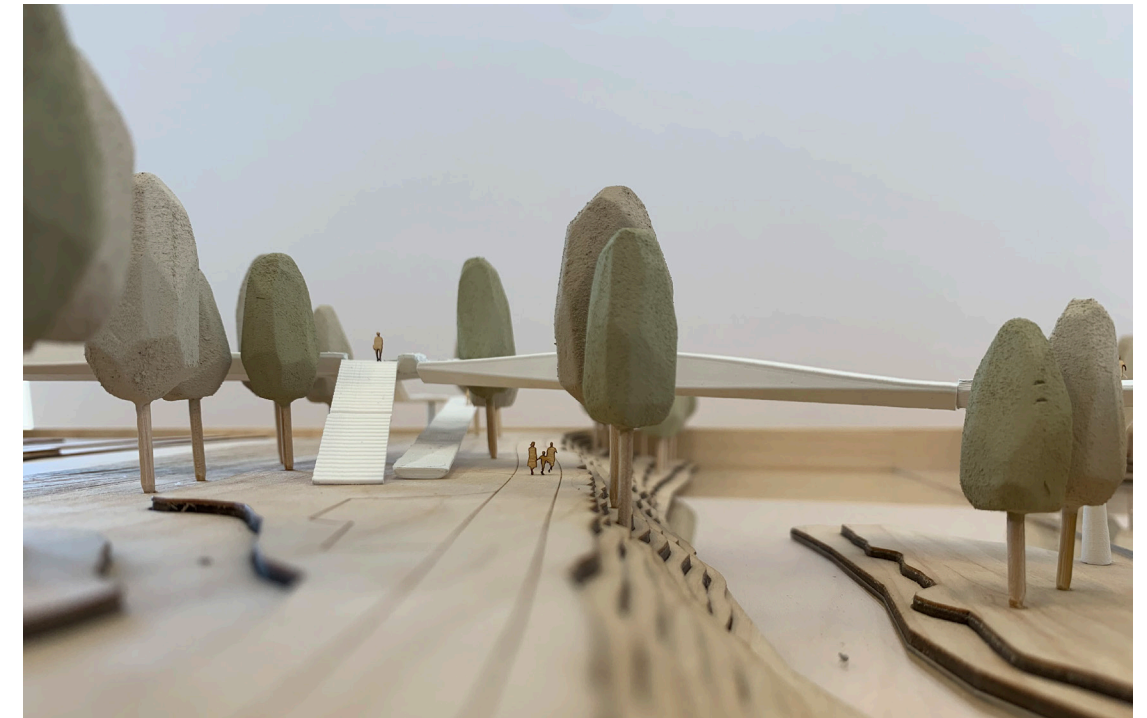
# Model



St. Patrick's Island



**Crossing the North Channel of the Bow River and South Memorial Connection**



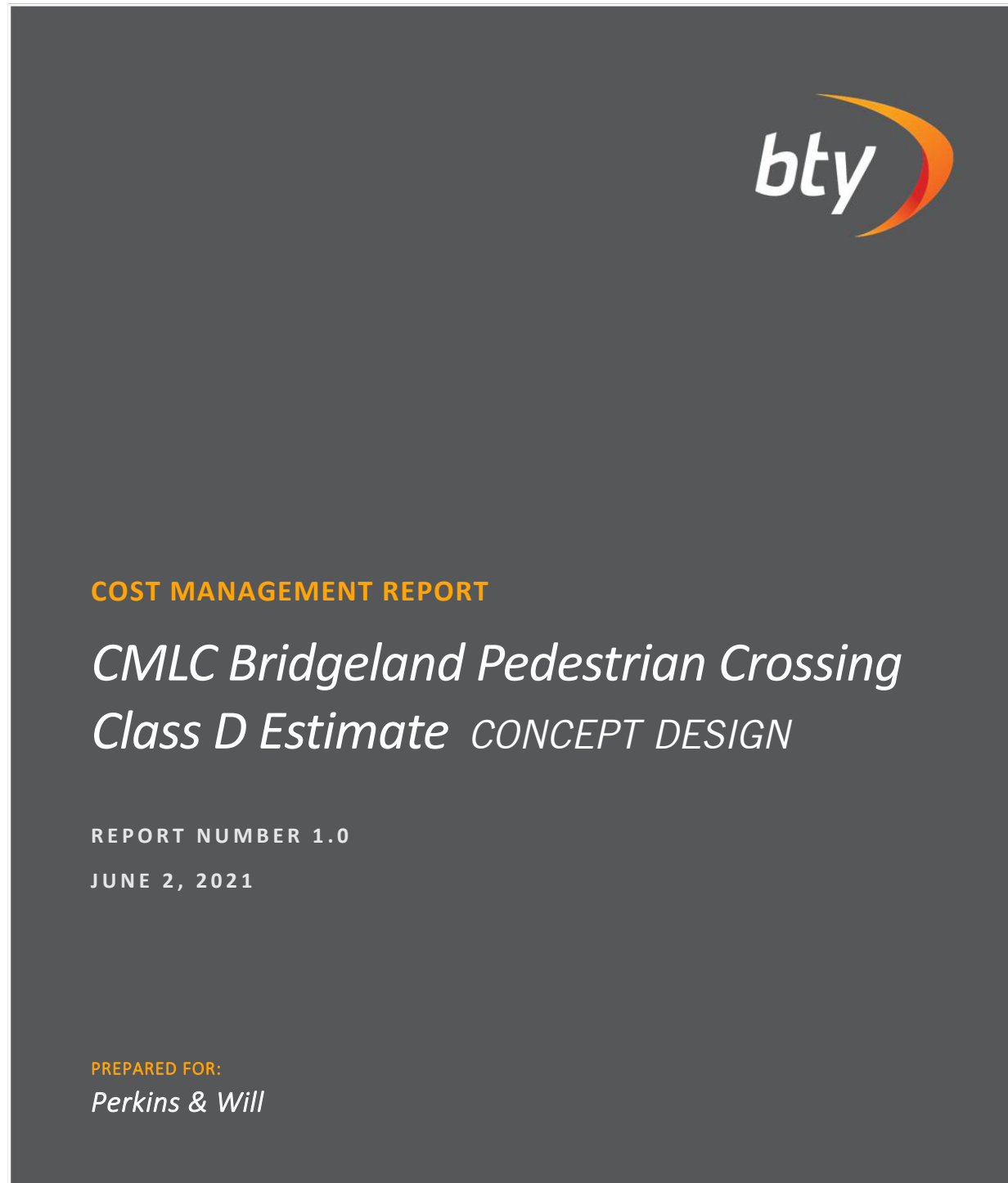
Crossing Memorial Drive and the Bridgeland-Riverside Plaza





# Appendix A.

## Cost Estimate



Perkins & Will | CMLC Bridgeland Pedestrian Crossing - Class D Estimate  
Report Number 1.0 | June 2, 2021



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Prepared By	Reviewed By	Date
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## 1.0 Introduction

### 1.1 Instructions Received

This report has been prepared by BTY Group ("BTY") at the request of Perkins & Will (the "Client").

Perkins & Will has appointed BTY to provide a Class D estimate developed for the project at CMLC Bridgeland Pedestrian Crossing (the "Project"), located at Bridgeland-Riverside, Calgary, AB. we assume the Project will be delivered using a Stipulated Price Contract construction model and, therefore, BTY strongly recommends that estimates are prepared at each of the key design milestones.

Information related to the Project for the purposes of this report was received by BTY on May 1<sup>st</sup>, 2021. Please refer to Section 13.0 for a list of information received in producing this report.

### 1.2 Report Reliance

This report has been prepared in accordance with the scope of our Fee Proposal, dated October 9, 2020. This report is for the sole and confidential use and reliance of Perkins & Will. BTY Group, Directors, staff or agents do not make any representation or warranty as to the factual accuracy of the information provided to us on behalf of Perkins & Will or other third-party consultants or agents. BTY Group will not be liable for the result of any information not received which, if produced, could have materially changed the opinions or conclusions stated in this report. This report shall not be reproduced or distributed to any party without the express permission of BTY Group.

Any advice, opinions, or recommendations within this document should be read and relied upon only in the context of the report as a whole. The contents do not provide legal, insurance or tax advice or opinion. Opinions in this report do not advocate for any party and if called upon to give oral or written testimony it will be given on the same assumption.

### 1.3 Contacts

Should you have any queries regarding the content of this report, please do not hesitate to contact either of the following:

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## 2.0 Executive Summary

### 2.1 Report Purpose

The purpose of this report is to provide a realistic estimate of the Project cost based on the information available at the time of writing.

The opinion expressed in this report has been prepared without the benefit of detailed architectural, structural, mechanical, electrical or processing system drawings and should, therefore, be considered a Class D estimate. Based on the documents reviewed, our estimate should be correct within a range of approximately +/- 20% to 25%.

In order to provide an accurate cost estimate for the Project, BTY Group strongly recommends that a professional Quantity Surveying organization, such as BTY Group, be retained to provide a detailed analysis of any design information produced on behalf of the Client during the remaining stages of design.

### 2.2 Project Background and Description

The proposed development consists of the construction of a total 211 meters of pedestrian footbridge. The project includes the removal of existing bridge, stairs, paving and parking surface and the construction of new pedestrian bridge in two phases.

The structure will be piles and pile caps with column bases and steel columns. The construction works include new footbridge, stairs, installation of balustrade with railings as well as wood benches, etc. The works also include the installation of drainage, site lighting, landscape work, berm extension and asphalt pathways.

### 2.3 Project Overview

Construction Budget Status	Details
Budget	Not Specified
Current Estimate	\$26,849,800
Current Cost / m <sup>2</sup>	\$10,731 /m <sup>2</sup>
Project Specifics	
GFA	2,502 m <sup>2</sup>
Construction Start	Not Specified
Construction Completion	Not Specified
Duration	Not Specified
Escalation	Excluded
Design Contingency	15.00%
Construction Contingency	5.00%

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### 3.0 Development Cost Summary

The current estimated cost of the project may be summarized as follows:

Item	Estimated Costs (\$)
A Land Cost (Excluded)	0
B Construction	22,235,800
C Contingencies	4,614,000
D Professional Fees	0
E Municipal & Connection Fees	0
F Management & Overhead	0
G Project Contingency	0
H Furnishing, Fittings & Equipment	0
I Financing Costs	0
J Goods & Services Tax	0
<b>Total Project Cost (May 2021 Dollars)</b>	<b>\$26,849,800</b>
K Escalation (excluded)	0
<b>Escalated Project Cost (May 2021 Dollars)</b>	<b>\$26,849,800</b>

Please note that, where zero dollar values are stated, BTY has excluded these costs and the values should be carried in a separate budget (if applicable).

### 4.0 Basis & Assumptions

The construction estimate is based on the following list of assumptions:

1. Foundations are Pile Caps, and Piles
2. Supporting structure to be Splayed Steel columns over Tapered Concrete columns
3. Precast slab for bridge deck is assumed to be 100mm thick
4. Typical Nodes deck to include for 75mm topping on 300mm Structural Slab and required integral structural steel
5. Assumed CIP piles at various heights for ramps and stairs for phase 1 and phase 2
6. LRT connection platform assumed to be 60m2 and of similar construction
7. Allowances included for benches and bike racks
8. Allowances included for Mechanical and electrical systems including relocation of 13.2 kVA HV line
9. Allowances are included for site hard and soft landscapes
10. 10% contingency on bridge unit rate to account for foundation installation in proximity to Bow River which may require specialized construction, staging and environmental requirements
11. 5% contingency on bridge unit rate to account for Covid-19 market uncertainty.

Please note that BTY is not qualified to act as design consultant. The assumptions in our estimate should be reviewed and corrected by the design team.

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### 5.0 Exclusions

The construction estimate includes all direct and indirect construction costs derived from the drawings and other information provided by the Consultants, with the exception of the following:

1. Land costs
2. Professional fees and disbursements
3. Planning, administrative and financing costs
4. Legal fees and agreement costs / conditions
5. Construction Bonds and Insurance(s)
6. Building permits and development cost charges
7. Temporary facilities for user groups during construction
8. Removal of hazardous materials from existing site
9. Loose furnishings and equipment
10. Unforeseen ground conditions and associated extras
11. Environmental remediation outside the project site footprint
12. Servicing outside the project site boundary (Main hydro service)
13. Phasing of the works and accelerated schedule
14. Decanting & moving
15. Costs associated with "LEED" certification
16. Project commissioning
17. Erratic market conditions, such as lack of bidders, proprietary specifications
18. Potential ground improvements
19. Cost escalation.

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## 6.0 Construction Cost Summary

The estimated construction cost of the project may be summarized as follows:

Description	Estimated Cost (\$)			Cost/GFA \$/m <sup>2</sup>	%
	Phase 1	Phase 2	Total		
Structural	13,868,900	3,378,500	17,247,400	6,893	78%
Architectural	147,200	139,600	286,800	115	1%
Mechanical	15,000	35,000	50,000	20	0%
Electrical	160,000	110,000	270,000	108	1%
Site Development	393,600	86,800	480,400	192	2%
Ancillary Work (Incl. Demolition)	226,000	444,400	670,400	268	3%
General Requirements & Fees	2,517,800	713,000	3,230,800	1,291	15%
<b>Net Construction Cost</b>	<b>\$17,328,500</b>	<b>\$4,907,300</b>	<b>\$22,235,800</b>	<b>\$8,887 /m<sup>2</sup></b>	<b>100%</b>
Design Contingency (15%)	2,599,300	736,100	3,335,400	1,333	
Construction Contingency (5%)	996,400	282,300	1,278,600	511	
<b>Total Construction Cost</b>	<b>\$20,924,200</b>	<b>\$5,925,700</b>	<b>\$26,849,800</b>	<b>\$10,731 /m<sup>2</sup></b>	
Escalation Allowance (excluded)	0	0	0	0	
<b>Escalated Construction Cost</b>	<b>\$20,924,200</b>	<b>\$5,925,700</b>	<b>\$26,849,800</b>	<b>\$10,731 /m<sup>2</sup></b>	
Gross Floor Area (m <sup>2</sup> )	1,704 m <sup>2</sup>	798 m <sup>2</sup>	2,502 m <sup>2</sup>		
Net Construction Cost /m <sup>2</sup>	\$10,169 /m <sup>2</sup>	\$6,149 /m <sup>2</sup>	\$8,887 /m <sup>2</sup>		
Total Construction Cost /m <sup>2</sup>	\$12,279 /m <sup>2</sup>	\$7,426 /m <sup>2</sup>	\$10,731 /m <sup>2</sup>		
Escalated Construction Cost /m <sup>2</sup>	\$12,279 /m <sup>2</sup>	\$7,426 /m <sup>2</sup>	\$10,731 /m <sup>2</sup>		

## 7.0 Areas

The gross floor area of the project, measured in accordance with the guidelines established by the Canadian Institute of Quantity Surveyors, is:

Location	Phase 1	Phase 2	Total
South	1,704 m <sup>2</sup>	0 m <sup>2</sup>	1,704 m <sup>2</sup>
North	0 m <sup>2</sup>	798 m <sup>2</sup>	798 m <sup>2</sup>
<b>Total Gross Site Area</b>	<b>1,704 m<sup>2</sup></b>	<b>798 m<sup>2</sup></b>	<b>2,502 m<sup>2</sup></b>

## 8.0 Taxes

The estimate excludes the Goods & Services Tax (G.S.T.).



## 9.0 Project Schedule & Escalation

No cost escalation allowance has been included in the estimate. BTY strongly recommends that the client establish a separate budget to cover the escalation cost from the date of this estimate to the mid-point of construction for the project.

Our current projected escalation rates are shown below. In the event that there is slippage in the schedule, further escalation based on the projected escalation rate per annum should be included in the estimate.

Current BTY Group Forecast	2021	2022	2023
	2% - 4%	2% - 3%	3% - 4%

## 10.0 Pricing

This estimate has been priced at second quarter 2021 rates assuming a normal market. The unit rates utilized are considered appropriate for a project of this type, bid under a Stipulated Price Contract construction model in an open market, with a minimum of five (5) bids, supported by a sufficient number of sub-contractors to ensure competitiveness.

The estimate is based on current material, labour and productivity rates. It does not take into account extraordinary market conditions that may result due to the current pandemic such as site closures, shortages of specified materials no other issues that may be affecting productivity and capacity.

## 11.0 Risk Mitigation

BTY Group recommends that the Owner, Project Manager and Design Team carefully review this document, including exclusions, inclusions and assumptions, contingencies, escalation and mark-ups. If the project is over budget, or if there are unresolved budgeting issues, alternative systems/schemes should be evaluated before proceeding into the next design phase.

Requests for modifications of any apparent errors or omissions to this document must be made to BTY Group within ten (10) days of receipt of this estimate. Otherwise, it will be understood that the contents have been concurred with and accepted.

It is recommended that BTY Group design and propose a cost management framework for implementation. This framework would require that a series of further estimates be undertaken at key design stage milestones and a final update estimate be produced which is representative of the completed tender documents, project delivery model and schedule. The final updated estimate will address changes and additions to the documents, as well as addenda issued during the bidding process. BTY Group is unable to reconcile bid results to any estimate not produced from bid documents including all addenda.

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## 12.0 Contingencies

### 12.1 Design Contingency

A design contingency of Fifteen Percent (15%) has been included in the estimate to cover modifications to the program, drawings and specifications during the design.


### 12.2 Construction Contingency

An allowance of Five Percent (5%) has been included in the estimate for changes occurring during the construction period of the project. This amount may be expended due to site conditions or if there are modifications to the drawings and specifications.

## 13.0 Documents Reviewed

The list below confirms the information that we have reviewed in order to prepare our opinion contained within this report:

Description	Revised Date
Drawings & Specifications	
20210430 CMLC Ped Bridge Site Plan Costing	Not Specified



**COST MANAGEMENT REPORT**

# CMLC Bridgeland Pedestrian Crossing

**APPENDICES**

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APPENDIX II	Cost Plan	7 pages

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Class D Estimate  
June 02, 2021



### Construction Cost Summary

The estimated construction cost of the project may be summarized as follows:

Description		Phase 1	Phase 2	Total
		\$	\$	\$
<b>A. Structural</b>		<b>13,868,900</b>	<b>3,378,500</b>	<b>17,247,400</b>
<b>B. Architectural</b>		<b>147,200</b>	<b>139,600</b>	<b>286,800</b>
<b>C. Mechanical</b>		<b>15,000</b>	<b>35,000</b>	<b>50,000</b>
<b>D. Electrical</b>		<b>160,000</b>	<b>110,000</b>	<b>270,000</b>
<b>E. Site Development</b>		<b>393,600</b>	<b>86,800</b>	<b>480,400</b>
<b>F. Ancillary Works</b>		<b>226,000</b>	<b>444,400</b>	<b>670,400</b>
<b>H1. General Requirements</b>	12%	<b>1,777,300</b>	<b>503,300</b>	<b>2,280,600</b>
<b>H2. Fees</b>	5%	<b>740,500</b>	<b>209,700</b>	<b>950,200</b>
<b>SUB-TOTAL CONSTRUCTION COST</b>		<b>\$17,328,500</b>	<b>\$4,907,300</b>	<b>\$22,235,800</b>
<b>J. Contingencies</b>				
J1. Design Contingency	15%	2,599,300	736,100	3,335,400
J2. Construction Contingency	5%	996,400	282,200	1,278,600
<b>K. Goods &amp; Services Tax</b>	0%	0	0	0
<b>TOTAL CONSTRUCTION COST</b>		<b>\$20,924,200</b>	<b>\$5,925,600</b>	<b>\$26,849,800</b>
<i>Gross Floor Area (m<sup>2</sup>)</i>		<i>1,704</i>	<i>798</i>	<i>2,502</i>
<b>Unit Cost (\$/m<sup>2</sup>)</b>		<b>\$12,279</b>	<b>\$7,426</b>	<b>\$10,731</b>

## APPENDIX I

# Elemental Summary

1 PAGE

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APPENDIX II

Cost Plan

7 PAGES

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CMLC Bridgeland Pedestrian Crossing  
Class D Estimate

June 02, 2021

Description	Quantity	Unit	Rate	Amount
<b>A. Structural</b>				
<b>Phase 1</b>				
<b>Bridge Deck 4m wide</b>	181	m	71,969.02	13,026,400
100mm Precast Slab				
Steel support beams and Intergrated Structural Edge Beams				
Ballustrade Material on Underside				
slope to match bridge 20 M at each ramp				
<b>Bridge Deck At Nodes</b>	246	m2	incl	
75mm Topping on Slab				
300mm Structural Slab				
Steel support beams and Intergrated Structural Edge Beams				
<b>Typical Concrete Abutment 20 LM</b>	82	m	incl	
infrastructure allowances for retaining walls				
structure build up,landscaping at grade at pathway				
slope to match bridge 20 M at each ramp				
<b>Substructure:</b>			incl	
includes for belled piles and related works	20	ea		
CIP pile caps (6mx6mx500mm DP)	5	ea		
Splayed 4 Proing Steel Columns	5			
Anti Corrosion resistant coatings				
Excludes Potential ground improvements				
Floating docks if required				
<b>Superstructure:</b>			incl	
allowance for steel structure				
Steel guard frames				
Wood wrapping around Balustrade				
Wood Benching				
Temp Platforms for installation of pier caps				
Barge with crane rental for installation of Steel Beams				
movment joints and coverplates				
<b>Ramp Structure Down to Grade from Bridges</b>	187	m2	3,000.00	560,100
Complete Structure Concrete on metal Deck				
Structural Steel Support System				
Piles and Piers (10m o/c)				
<b>Stairs South</b>	35	risc	1,498.50	52,400
Concrete Stairs 2.8m wide				
Foundations For Stairs				
Assumption CIP Piles 9m deep to 3-4m above grade				
Assume 35 risers				



CMLC Bridgeland Pedestrian Crossing  
Class D Estimate

June 02, 2021

Description	Quantity	Unit	Rate	Amount
<b>A. Structural</b>				
<i>Phase 1 Continued</i>				
LRT Connection Platform assume 10mx20m	60	m2	3,000.00	180,000
Other Structural Allowance	1	sum	50,000.00	50,000
<i>Phase 2</i>				
<b><u>Bridge Deck 4m wide</u></b> 100mm Precast Slab Steel support beams and Intergrated Structural Edge Beams Ballustrade Material on Underside slope to match bridge 20 M at each ramp	30	m	71,969.02	2,159,100
<b><u>Bridge Deck At Nodes</u></b> 75mm Topping on Slab 300mm Structural Slab Steel support beams and Intergrated Structural Edge Beams	60	m2	incl	
<b><u>Typical Concrete Abutment 20 LM</u></b> infrastructure allowances for retaining walls structure build up,landscaping at grade at pathway slope to match bridge 20 M at each ramp	20	m	incl	
<b><u>Substructure:</u></b> includes for belled piles and related works CIP pile caps (6mx6mx500mm DP) Splayed 4 Proing Steel Columns Anti Corrosion resistant coatings Excludes Potential ground improvements Floating docks if required	4	ea		
	1	ea		
	1	ea		
<b>Ramp Structure Down to Grade from Bridges</b> Complete Structure Concrete on metal Deck Structural Steel Support System Piles and Piers (10m o/c)	382	m2	3,000.00	1,144,800
<b>Stairs South</b> Concrete Stairs (3.6m wide) Foundations For Stairs Assumption CIP Piles 9m deep to 3-4m above grade Assume 36 risers	36	risr	2,073.60	74,600
<b>Total Structural</b>				<b>\$17,247,400</b>

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CMLC Bridgeland Pedestrian Crossing  
Class D Estimate

June 02, 2021

Description	Quantity	Unit	Rate	Amount
<b>B. Architectural</b>				
<i>Phase 1</i>				
<b>Architectural Allowances: included in above</b> includes for benches/bike racks				
<b>Railings and Guards</b> Railings and Steel Guards at Stairs High and Low Balustrades are included in above structure	35	per tread	453.00	15,900
<b>Deck</b> Railings/Guards Steel Picket	269	lm	487.50	131,300
<i>Phase 2</i>				
<b>Architectural Allowances: included in above</b> includes for benches/bike racks				
<b>Deck</b> Railings/Guards Steel Picket	253	lm	487.50	123,300
<b>Railings and Guards</b> Railings and Steel Guards at Stairs High and Low Balustrades are included in above structure	36	per tread	453.00	16,300
<b>Total Architectural</b>				<b>\$286,800</b>

BTY GROUP

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CMLC Bridgeland Pedestrian Crossing  
Class D Estimate  
June 02, 2021

Description	Quantity	Unit	Rate	Amount
<b>C. Mechanical</b>				
<b>Phase 1</b>				
Drainage allowance to landscape area	1	sum	15,000.00	15,000
<b>Phase 2</b>				
Drainage allowance to landscape area	1	sum	35,000.00	35,000
Note: no allowance for drainage to bridge. If required assumed included in the bridge structure				

**Total Mechanical** **\$50,000**

CMLC Bridgeland Pedestrian Crossing  
Class D Estimate  
June 02, 2021

Description	Quantity	Unit	Rate	Amount
<b>D. Electrical</b>				
<b>Phase 1</b>				
<b>The following item included in Structural Unit Rate:</b>				
Electrical includes for Services and distribution				
Lighting and light fixtures				
CCTV systems and camera				
CCTV Monitoring				
WAP System				
Testing and Commissioning				
<b>Phase 1</b>				
Extra over for Integral Lighting to Stairs	1	sum	10,000.00	10,000
Site Lighting Allowance (at landscape areas)	1	sum	50,000.00	50,000
<b>Phase 1</b>				
Allowance to Relocate Existing 13.2 kVA high voltage line	1	sum	100,000.00	100,000
HV cabling 230m (170m+60m)				
PVC ducts (installed underside of bridge)				
Termination works (to HV cables & equipment c/W T&C)				
<b>Phase 2</b>				
Included in Structural Unit Rate				
Electrical includes for Services and distribution				
Lighting and light fixtures				
CCTV systems and camera				
CCTV Monitoring				
WAP System				
Testing and Commissioning				
<b>Phase 2</b>				
Integral Lighting Stairs	1	sum	10,000.00	10,000
Site Lighting Allowance (at landscape areas)	1	sum	100,000.00	100,000

**Total Electrical** **\$270,000**

CMLC Bridgeland Pedestrian Crossing  
 Class D Estimate  
 June 02, 2021

Description	Quantity	Unit	Rate	Amount
<b>E. Site Development</b>				
<b>Phase 1</b>				
Hard Landscape Allowance (Plaza Area) Node 4 includes site prep and removals	140	m2	418.81	58,600
Soft Landscape Allowance includes site prep and removals above	451	m2	92.68	41,800
<b>Phase 2</b>				
Hard Landscape Allowance (Plaza Area) Node 4 includes site prep and removals	700	m2	418.81	293,200
Hard Landscape Allowance (Asphalt Pathway) includes site prep and removals	70	m2	40.98	2,900
Soft Landscape Allowance includes site prep and removals above	759	m2	92.68	70,300
New Ramp	50	m2	176.00	8,800
Railings for above	26	lm	183.00	4,800
No furnishings or fixtures				
<b>Total Site Development</b>				<b>\$480,400</b>

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CMLC Bridgeland Pedestrian Crossing  
 Class D Estimate  
 June 02, 2021

Description	Quantity	Unit	Rate	Amount
<b>F. Ancillary Works</b>				
<b>Phase 1</b>				
Demo Existing LRT Bridge (allowance)	226	m2	1,000.00	226,000
<b>Phase 2</b>				
Demo Existing LRT Bridge (allowance)	360	m2	1,000.00	360,000
<b>Phase 2</b>				
removal of existing pathways assumed asphalt paths	61	m2	100.00	6,100
removal of Asphalt Parking lot	697	m2	100.00	69,700
removal of concrete curbs	115	lm	75.00	8,600
<b>Total Ancillary Works</b>				<b>\$670,400</b>

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