

RIVER VALLEY PLANNING MODERNIZATION

Ribbon of Green & River Valley ARP

Central Reach Report

March 2021

The Edmonton logo, featuring the word "Edmonton" in white text on a dark blue square background. A decorative green ribbon graphic runs vertically along the right side of the page, partially overlapping the logo area.

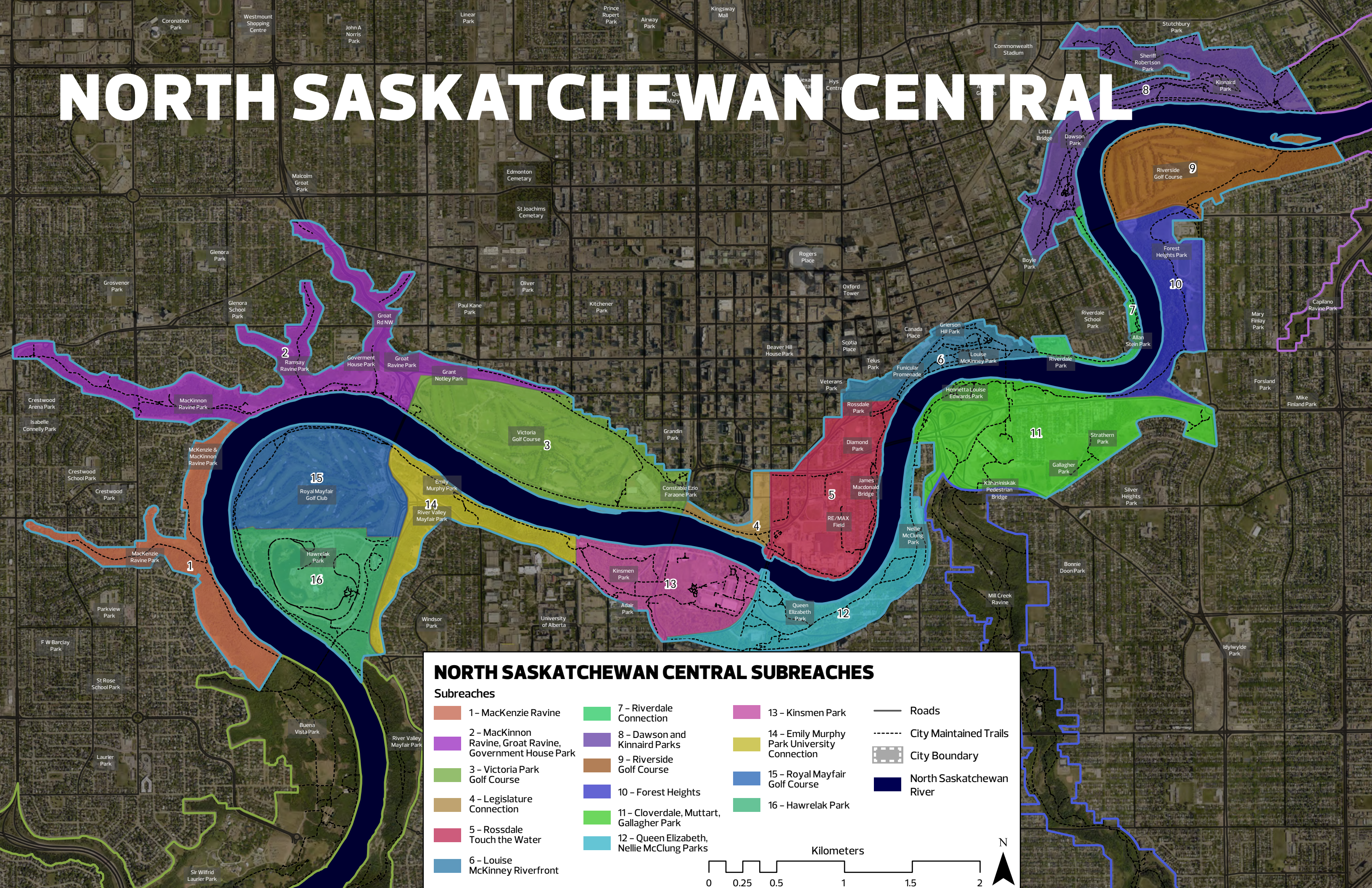
Edmonton

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OVERVIEW








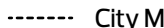












This document provides an initial breakdown of the Central Reach into distinct sub-reach planning units. The following map denotes the sub-reach boundaries, and subsequent pages describe each sub-reach in turn: Key network connections with surrounding neighbourhoods, approved planning direction, parks and other important areas, and identified open space needs and opportunities. Appendices contain the environmental overview of the Central Reach (collated from existing city Environmental Impact Assessments in conjunction with input from City engineers), and a geotechnical overview describing key challenges from a slope stability risk perspective.

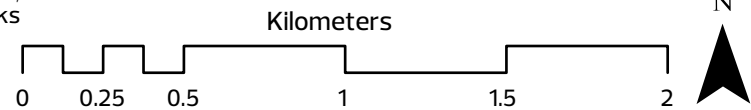
NORTH SASKATCHEWAN CENTRAL



NORTH SASKATCHEWAN CENTRAL SUBREACHES

Subreaches

- | | | | |
|--|--|--|--|
|  1 - MacKenzie Ravine |  7 - Riverdale Connection |  13 - Kinsmen Park |  Roads |
|  2 - MacKinnon Ravine, Groat Ravine, Government House Park |  8 - Dawson and Kinnaird Parks |  14 - Emily Murphy Park University Connection |  City Maintained Trails |
|  3 - Victoria Park Golf Course |  9 - Riverside Golf Course |  15 - Royal Mayfair Golf Course |  City Boundary |
|  4 - Legislature Connection |  10 - Forest Heights |  16 - Hawrelak Park |  North Saskatchewan River |
|  5 - Rossdale Touch the Water |  11 - Cloverdale, Muttart, Gallagher Park | | |
|  6 - Louise McKinney Riverfront |  12 - Queen Elizabeth, Nellie McClung Parks | | |



SUB-REACH DEFINITION CRITERIA

The sub-reaches were defined so as to create a simple and relevant balance that captures key planning and management boundaries, while respecting the inherent variability of the central reach landscape. These boundaries include:

- + Existing parks
- + Biophysical boundaries (narrow landscape elements, rivers, slopes)
- + Planning boundaries

SUB-REACHES

1 – MacKenzie Ravine

The MacKenzie Ravine Sub-Reach Includes the MacKenzie Ravine and a Natural Area Park providing connection to Buena Vista Park. Almost all of the Sub-Reach is designated as a Preservation land use, with some Active/Working Landscapes/Working Landscapes land use on the western edges at the Central Reach Boundary. The Sub-Reach Boundary is delineated by the North Saskatchewan River, Central Reach Boundary, and the MacKinnon Ravine Park boundary.

There are several natural and gravel trail connections to the Crestwood Neighbourhood and the Parkview Neighbourhood and south to the North Saskatchewan West Reach. There is no designated connection between the MacKenzie Ravine Sub-Reach and the MacKinnon Ravine, Groat Ravine, Government House Park Sub-Reach, although an informal trail exists. Formalization of this connection may be explored, but increased usage may impact wildlife movement through these lands. There is no vehicular access into the MacKenzie Ravine Sub-Reach.

Sub-Reach Boundary

- + North Saskatchewan River
- + Central Reach Boundary
- + MacKenzie and MacKinnon Ravine Boundary

Sub-Reach Includes

- + Natural Area Park connection to Buena Vista Park.
- + MacKenzie Ravine

Key Open Space Needs & Opportunities

- + Maintain wildlife connectivity along this side of the river.
- + Explore impacts of informal trail use, and feasibility of formalizing the connection northwards towards the MacKinnon Ravine.

2 – MacKinnon Ravine, Groat Ravine, Government House Park

The MacKinnon Ravine, Groat Ravine, Government House Park Sub-Reach Includes MacKinnon Ravine Park, Government House Park, Ramsay Ravine, and Groat Ravine. Most of the land use in this Sub-Reach falls under Preservation, with small areas of Conservation and Active/Working Landscapes/Working Landscapes land use located at Government House Park, buffering the paved trails and along the Central Reach Boundary. The Sub-Reach is delineated by the North Saskatchewan River, Central Reach Boundary, Groat Road NW, 100 Avenue NW, and MacKenzie Ravine boundary. The planned Touch the Water promenade recommends daylighting of Groat Creek through the Government House Park area, along with restoration and improvements to the promenade connection eastwards.

There are several trail connections that would serve Grovenor, Canora, West Jasper Place, and Crestwood neighbourhoods at the western boundary of MacKinnon

Ravine Park. Ramsay Ravine has a trail connection to the Glenora Neighbourhood and Groat Ravine connects to the Westmount Neighbourhood; however, these two ravines don't have any designated trails, requiring pedestrians to use Groat Road NW. There is a paved trail connection to the Victoria Park Golf Course Sub-Reach, however, there is no network connection to MacKenzie Ravine Sub-Reach to the south. There is vehicular access to parking and drop off areas at Government House Park and a small drop off pull through located at the western edge of MacKinnon Ravine Park.

Sub-Reach Boundary

- + North Saskatchewan River
- + Central Reach Boundary
- + Groat Road NW
- + 100th Avenue NW
- + MacKenzie and MacKinnon Ravine Boundary

Sub-Reach Includes

- + MacKinnon Ravine Park
- + Government House Park
- + Ramsay Ravine
- + Groat Ravine.

Key Open Space Needs & Opportunities

- + Improve wildlife connectivity through this sub-reach through re-naturalization of riparian vegetation along the river and daylighting of Groat Creek.
- + Improve Active/Working Landscapes transportation connections via the promenade, explore improved connections southwards.
- + Extensive informal trails throughout the ravines in this sub-reach require inventory and assessment to rationalize this trail system, minimize ecological impacts and ensure adequate maintenance, wayfinding signage, and oversight.

3 – Victoria Park Golf Course

The Victoria Park Golf Course Sub-Reach Includes the Victoria Park Golf Course and the Constable Ezio Faraone Park. Almost all the Sub-Reach is designated as Active/Working Landscapes land use with some small areas of Preservation land use with Conservation land use buffers. The Sub-Reach Boundary is delineated by the North Saskatchewan River, Central Reach Boundary, 109 Street NW, Groat Road NW, and 100 Avenue NW.

There is a paved pathway that runs along the southern portion of the Sub-Reach that creates a connection to MacKinnon Ravine, Groat Ravine, Government House Park Sub-Reach and the Legislature Connection Sub-Reach. Paved pathway connections on the northern part of the Sub-Reach create connections to the Oliver Neighbourhood and Downtown Edmonton. There is a pedestrian bridge that connects the Sub-Reach to the southern side of the North Saskatchewan River and to Kinsmen Park Sub-Reach. There are three vehicular connections from River Valley Road NW to access the Victoria Park Golf Course, Victoria Park, and the Royal Glenora Club.

The Downtown Public Places Plan addresses the intersection of 109 Street NW and 97 Avenue NW to create a better east to west pedestrian and cycling connection between Constable Ezio Faraone Park and the Legislature Grounds and will ultimately create a connection from Constable Ezio Faraone Park east to Dawson Park.

Sub-Reach Boundary

- + North Saskatchewan River
- + Central Reach Boundary
- + 109th Street NW
- + Groat Road NW
- + 100th Avenue NW

Sub-Reach Includes

- + Victoria Park
- + Constable Ezio Faraone Park
- + Victoria Iceway
- + Royal Glenora Club

Key Open Space Needs & Opportunities

- + Improved pedestrian access from the Downtown/Oliver neighbourhoods.
- + Balance public use of the area with the need to ensure wildlife connectivity through the golf course grounds, and along the riparian edge.
- + Explore opportunities to increase year-round use of golf course grounds for public events and more equitable recreation opportunities.

4 – Legislature Connection

The Legislature Connection Sub-Reach includes the Legislature Grounds and undesignated park land and is a mix of Active/Working Landscapes/Working Landscapes, Conservation, and Preservation land use. The Sub-Reach Boundary is delineated by the North Saskatchewan River, Central Reach Boundary, 109 Street NW, and 105 Street NW.

There is a paved pathway that connects the Rossdale Touch the Water Sub-Reach and Victoria Park Golf Course Sub-Reach. River Valley Road NW runs directly through the site and connects with the Alberta Legislature Building.

The Downtown Public Places Plan addresses the intersection of 109 Street NW and 97 Avenue NW to create a better east to west pedestrian and cycling connection between Constable Ezio Faraone Park and the Legislature Grounds and will ultimately create a connection from Constable Ezio Faraone Park east to Dawson Park.

Sub-Reach Boundary

- + North Saskatchewan River
- + Central Reach Boundary
- + 109th Street NW
- + 105th Street NW

Sub-Reach Includes

- + Legislature Grounds
- + Undesignated Park Land

Key Open Space Needs & Opportunities

- + Improved pedestrian connections from the Legislature grounds across 106th Street, 105th Street, and River Valley Road will provide downtown residents with a safe means of accessing the Touch the Water area, while also providing a significant crossing structure to enable wildlife movement through the Rossdale area
- + Explore scenic quality improvements to the area should the existing Alberta Treasury Board building be repurposed

5 – Rossdale / Touch the Water

The Rossdale / Touch the Water Sub-Reach includes Rossdale Park, Diamond Park, Telus B, Telus Field, Irene Parby Multi-Purpose Trail Park Land, and undesignated park land. Most of the Sub-Reach is designated as an Active/Working Landscapes land use, with small areas of Conservation land use and minimal Preservation land use present at the site. The Sub-Reach Boundary is delineated by the North Saskatchewan River, Central Reach Boundary, Rossdale Park Boundary, and 105 Street NW.

There are several trails throughout the Sub-Reach with connections to the Louise McKinney Riverfront Sub-Reach and the Legislature Connection Sub-Reach. This Sub-Reach has a variety of vehicular access points at the eastern, northern, and western boundaries.

Sub-Reach Boundary

- + North Saskatchewan River
- + Central Reach Boundary
- + Rossdale Park Boundary
- + 105th Street NW

Sub-Reach Includes

- + Rossdale Park
- + Diamond Park
- + Remax Field

- + Irene Parlby Multi-Purpose Trail Park Land
- + Undesignated Park Land
- + Residential Areas

Key Open Space Needs & Opportunities

The Touch the Water project provides an excellent opportunity for recreational and commercial improvements to the Rosssdale Power Plant area. These lands provide important interpretive / educational opportunities to speak to the cultural history of the area.

This area is in need of improvements to facilitate wildlife movement. The Walterdale Bridge is a significant barrier to movement along the river's edge, and heavy traffic impacts movement through the Rosssdale neighbourhood. Improvements to riparian vegetation along the river's edge, coupled with incentives for native vegetation on private residential lands may improve matters. Renaturalization of city-owned lands surrounding Enmax field would also improve the ecological function of the area.

The River Crossing Business Plan identified three main improvement areas throughout the Sub-Reach and proposes to:

- + Improve connectivity within the development. Interior arterial roadways to be redesigned as people first places that safely and comfortably accommodate movement by a variety of modes.
- + Wide accessible sidewalks
- + Safe and convenient crossings
- + Bike lanes
- + Bike parking
- + Bike share docking stations (potentially)
- + Buildings oriented to street
- + Enhance transit services during special events
- + Connection to Gondola across river valley
- + Potential river access and docking
- + Improve open spaces and other amenities to create a destination within Edmonton
- + Critical mass of amenities accessible by foot and bicycle
- + Amenities to service city-wide as well as neighborhood needs
- + Interpretive Park
- + Urban Plaza

- + Revitalize RE/MAX Field: variety of sports, cultural, entertainment, and community events for year-round use
- + EPCOR Water Reservoir: events, movable furniture, lightweight play structures, and temporary installations

The Downtown Public Places Plan considers Downtown Edmonton and the Quarters, at the northern and western borders of the Rosssdale / Touch the Water Sub-Reach, with multiple proposed improvements that will improve the connections between the Rosssdale Neighbourhood and the River Valley. Two of these areas include the River Crossing Initiative and the Touch the Water Initiative.

River Crossing is a long-term city-building initiative that will provide signature open spaces and community gathering spaces, activate the riverfront, and link people to the downtown and the river valley system. The neighbourhood's main street on 104 Street will link the Rosssdale Power Plant, ballpark and Touch the Water Promenade to the 104 Street Grand Staircase. 96 Avenue will serve as an enhanced connection between the Legislature Grounds and Rosssdale neighbourhood.

The Touch the Water Promenade will create a waterfront public space that connects the existing river valley trail, Rosssdale Generating Station/pump houses, and the new Walterdale Bridge. The promenade is planned to create a series of spaces that can be used for public gathering and individual enjoyment of the river and River Valley. To the west, there are plans to expand the promenade along the north bank of the North Saskatchewan River adjacent to River Valley Road, between Government House Park and the Walterdale Bridge. The promenade would include features such as areas to gather, viewing points, paths for pedestrians, cyclists and other wheeled users, seating and enhanced public access points.

6 – Louise McKinney Riverfront

The Louise McKinney Riverfront Sub-Reach Includes Louise McKinney Riverfront Park, McDougall Hill Park, and undesignated land. The Sub-Reach is designated into a mix of Active/Working Landscapes, Conservation, and Preservation land use and was delineated by the North Saskatchewan River, Central Reach Boundary, Rossdale Park Boundary, and the Louise McKinney Riverfront Park Boundary. There are multiple vehicular access points throughout the Sub-Reach.

There are a variety of trails south of Grierson Hill NW with connections to the Riverdale Connection Sub-Reach and the Rossdale Touch the Water Sub-Reach; however, there are no designated trails north of Grierson Hill NW, which impacts pedestrian access from the downtown.

The Downtown Public Places Plan proposes a variety of connections to the Louise McKinney Riverfront Sub-Reach that include:

- + A link from the Quarters at the 96 Street Armature over Grierson Hill Road NW to increase public access to the River Valley.
- + Creating safer pedestrian and cyclist access across McDougall Hill Road and Rossdale Road to the River Valley, including the Louise McKinney Riverfront Sub-Reach.
- + A link from the planned South Edge Promenade boardwalk.

The Louise McKinney Park Vision was developed in 1997 and it is recommended that the City of Edmonton update the vision for the park. The ongoing construction of the LRT connection on the east side of the park will provide an important access point and river crossing structure, connecting Louise McKinney Park with Henrietta Muir Edwards Park. This will undoubtedly impact circulation through these parks.

Sub-Reach Boundary

- + North Saskatchewan River
- + Central Reach Boundary
- + Rossdale Park Boundary
- + Louise McKinney Riverfront Park Boundary

Sub-Reach Includes

- + Louise McKinney Riverfront Park
- + McDougall Hill Park and Drive

- + Undesignated Park Land

Key Open Space Needs & Opportunities

- + Improvements to riparian vegetation along the river's edge would facilitate wildlife movement through this sub-reach.
- + Re-naturalization of turf areas throughout the park would improve ecological function and scenic quality of the area.
- + Pathway connections from Jasper Avenue across Grierson Hill would improve the accessibility of these lands from the downtown.
- + Signage and Wayfinding would improve the connection between Rossdale and Riverdale, and increase overall usage of this area.

7 – Riverdale Connection

The Riverdale Connection Sub-Reach Includes Allan Stein Park, Riverdale Park, and undesignated park land. This Sub-Reach Includes a mix of Preservation land use along the river, Active/Working Landscapes land use on the Central Reach Boundary, and Conservation land use that acts as a buffer along the regional pathway. The Sub-Reach Boundary is delineated by the North Saskatchewan River, Central Reach Boundary, Dawson Park Boundary, and Louise McKinney Riverfront Park Boundary.

There are several trail connections from the Riverdale Neighbourhood that connect with the gravel trail running along the river on the east side of the Sub-Reach and the paved trail running along the southern part of the Sub-Reach and into Allan Stein Park. The only vehicular access is to Riverdale Park that connects with a parking area serving the Riverdale Community League.

Sub-Reach Boundary

- + North Saskatchewan River

- + Central Reach Boundary
- + Dawson Park Boundary
- + Louise McKinney Riverfront Park Boundary

Sub-Reach Includes

- + Unnamed Park Land
- + Allan Stein Park
- + Riverdale Park

Key Open Space Needs & Opportunities

- + As the Ribbon of Green boundary covers only a small portion of the Riverdale area, future redevelopment plans will need to ensure they closely align with the policy and intent of the Ribbon of Green.
- + Opportunities to improve the ecological function of residential lands should be explored through incentives and partnerships.
- + Wayfinding and signage should be used to highlight connections between Riverdale Park and Dawson Park, and communicate recreational opportunities throughout the reach.

8 – Dawson and Kinnaird Parks

Dawson and Kinnaird Parks Sub-Reach Includes Dawson Park and Kinnaird Park and is made up of a majority of Preservation land use with some Conservation land use buffers along the main corridor pathway and Active/Working Landscapes land use along the edges. The Sub-Reach Boundary is delineated by the North Saskatchewan River, Central Reach Boundary, and the Riverdale Connection Sub-Reach Boundary.

The Dawson and Kinnaird Parks Sub-Reach has a wide variety of trail connections to the surrounding areas that include Virginia Park, McCauley, Boyle Street, and Riverdale neighbourhoods, as well as the North Saskatchewan East Reach and Riverdale Connection Sub-Reach. The Downtown Public Places Plan proposes a planned Heritage Trail which will act as an active transportation route that will run parallel with the western border as well as connecting into Dawson Park at

the south point that will functionally link the downtown area with the Dawson and Kinnaird Parks Sub-Reach.

Vehicular access is located at the southern side of the Sub-Reach off 103A Avenue NW that provides access to a parking area servicing Dawson Park.

Sub-Reach Boundary

- + North Saskatchewan River
- + Central Reach Boundary
- + Undesignated Lands

Sub-Reach Includes

- + Highlands Golf Club
- + Kinnaird Park
- + Dawson Park

Key Open Space Needs & Opportunities

- + Improved eastward connections should be explored to better connect the Dawson/Kinnaird area with Rundle Park.
- + Wayfinding and Signage can improve active transportation flow through to other portions of the River Valley, including across the river into Gold Bar Park.
- + Active use of the off-leash area of this park will have an ongoing impact on wildlife movement through the River Valley.
- + Trail use along the slopes may also impact wildlife movement.
- + Informal trails running through the Rat Creek Ravine portion of Kinnaird Park require assessment and formal maintenance or potentially closure.

9 – Riverside Golf Course

The Riverside Golf Course Sub-Reach Includes the Riverside Golf Course and has a mix of Active/Working Landscapes and Preservation land use with some Conservation buffers. The park boundary is delineated by the North Saskatchewan River, the Central Reach boundary, and Rowland Road NW.

The Riverside Golf Course Sub-Reach has trails that connect to the Forest Heights Sub-Reach and Forest Heights Neighbourhood, as well as to the North Saskatchewan East Reach. Vehicles can access the Riverside Golf Course off Rowland Road NW on the south side of the Sub-Reach.

Sub-Reach Boundary

- + North Saskatchewan River
- + Central Reach Boundary
- + Rowland Road NW

Sub-Reach Includes

- + Riverside Golf Course

Key Open Space Needs & Opportunities

- + Balance public use of the area with the need to ensure wildlife connectivity through the golf course grounds, and along the riparian edge.
- + Explore opportunities to increase year-round use of golf course grounds for public events and more equitable recreation opportunities.
- + Ensure adequate wayfinding and signage to ensure that active transportation routing options are clearly communicated.
- + Winter use of the golf course lands should be encouraged.

10 – Forest Heights

The Forest Heights Sub-Reach Includes Newman Theological College, Forest Heights Park, and active It is a mix of Active/Working Landscapes and Conservation land use on the eastern side of the Sub-Reach, as well as Preservation land use along the western side of the Sub-Reach and North Saskatchewan River.

There are trail connections to the Forest Heights Neighbourhood as well as to the Riverside Golf Course Sub-Reach and the Cloverdale, Muttart, Gallagher Park Sub-Reach. Vehicles are able to access the Sub-Reach at the Newman Theological College, McNally High School, and Forest Heights Park, as well as a parking area located at the northern park of the Sub-Reach.

Sub-Reach Boundary

- + North Saskatchewan River
- + Central Reach Boundary
- + 98th Avenue NW
- + Rowland Road NW

Sub-Reach Includes

- + Newman Theological College
- + Forest Heights Park
- + Active Land

Key Open Space Needs & Opportunities

- + A high density of informal trails run through these lands. A comprehensive inventory and assessment of these trails should be prioritized to rationalize this trail system to mitigate impacts to wildlife connectivity and ensure adequate maintenance, wayfinding signage, and oversight.
- + The narrow, steeply sloped landscape is an important recreational resource for the area, but requires a balance to ensure enjoyment, accessibility, and safety through management, maintenance, and enforcement.

11 – Cloverdale,

Muttart, Gallagher Park

Cloverdale, Muttart, Gallagher Park Sub-Reach Includes Henrietta Muir Edwards Park, Gallagher Park, the Muttart Conservatory Park, and Strathearn Park. The land-use in the Sub-Reach is divided between Active/Working Landscapes, Conservation, and Preservation and the Sub-Reach boundary are delineated by the North Saskatchewan River, the Central Reach boundary, 98th Avenue NW, and Connors Road.

The trail connections to the Cloverdale, Muttart, Gallagher Park Sub-Reach include connections from Connors Road NW, the Strathearn Neighbourhood, and 98 Avenue NW as well as the Queen Elizabeth and Nellie McClung Park Sub-Reach and Forest Heights Sub-Reach.

The Gallagher Park Concept Plan proposes enhancements to the park that support festivals and events, improve pathways and trails, build stronger community connections, enhance the landscape and amenities within the park, protect and enhance the ecological integrity, and establish a sense of place through improved safety, interpretation of the site history and ecology, and promote events and experiences. A major component of park improvements is to promote the park as a destination for pedestrians and cyclists and to provide a strong connection to the new LRT Station that will access the park.

Sub-Reach Boundary

- + North Saskatchewan River
- + Central Reach Boundary
- + 98th Avenue NW
- + Connors Road NW

Sub-Reach Includes

- + Henrietta Muir Edwards Park
- + Gallagher Park
- + Muttart Conservatory Park
- + Strathearn Park
- + Residential Lands

Key Open Space Needs & Opportunities

- + The new LRT connection will provide an important staging area for use of the river valley by residents and visitors alike. Aim to cater for park visitors arriving primarily via the LRT, bicycle, or foot, as well as local.
- + Muttart Conservatory is an iconic recreational, educational, and cultural resource for the city. Picnic Sites and Seating Areas proposed on the south side of Muttart Conservatory could be integrated into Muttart activities (including outdoor eateries) and could be developed for future upgrades. Additional sidewalks, bike lanes, and shared use paths for access to Muttart Conservatory are proposed for improvements to the pedestrian and cyclist circulation.
- + The Edmonton Ski Club Building provides an ice rink, ice shack, City-operated playground and spray park, as well as a public toboggan hill and skiing in winter months. A warming hut would facilitate greater winter use.
- + Industrial remains of a brick factory can add to heritage and interpretive value.
- + Viewpoints have been proposed along Connors Road and Cloverdale Hill Road
- + Gallagher Park is an important park supporting the recreation needs of the local Cloverdale community.
- + Improvements proposed for north entrance and Cloverdale Hill Road entrance with identification signage, directional signage, interpretive signage, seating, and bike racks.
- + The Edmonton Folk Music Festival is a key recreational and cultural attraction for the city, that nevertheless has the potential for environmental impact due to disturbance and degradation. Planning and design approaches should favour long-lasting and sustainable event infrastructure that minimize impacts to surrounding natural lands.
- + Gallagher Park enhancements to support festivals and events include improved infrastructure (drainage and power) for organized and spontaneous recreation, and community events.
- + New shared use paths with sidewalk linkages are to be developed to improve connections through and along the edges of Gallagher park. This will facilitate enhanced access to both active and passive recreational activities

- + Gallagher Park would benefit from an enhanced sense of place – revitalized park amenities, improved safety, and interpretation of site history and ecology will assist in establishing the sense of place that is defined by the programs, events, and experiences that take place in the park.
- + Protect existing treed areas throughout the sub-reach and enhance portions of the landscape through naturalization.

- + 98th Avenue NW
- + Walterdale Hill NW
- + Connors Road NW

Sub-Reach Includes

- + Queen Elizabeth Park
- + Nellie McClung Park
- + Residential Lands

12 – Queen Elizabeth and Nellie McClung Park

The Queen Elizabeth and Nellie McClung Park Sub-Reach includes Queen Elizabeth Park, Nellie McClung Park, and active lands. The Sub-Reach includes a mix of Preservation, Conservation, and Active/Working Landscapes land uses. The Sub-Reach boundary was delineated by the North Saskatchewan River, the Central Reach Boundary, 98 Avenue NW, Walterdale Hill NW, and Connors Road NW.

There is pedestrian access to the north side of the North Saskatchewan River via the Walterdale Bridge, as well as several trail connections from Saskatchewan Drive NW, the Kinsmen Park Sub-Reach, and the Cloverdale, Muttart, Gallagher Park Sub-Reach. Vehicular access to the Sub-Reach is available at multiple locations along Saskatchewan Drive NW and Walterdale Hill NW.

The Queen Elizabeth Park Master Plan provides an overview of improvements that are proposed for Queen Elizabeth Park. Improvements at the upper park include an Indigenous Art Park, upgraded or new lookouts along Saskatchewan Drive, new shade shelter and picnic tables, and a new accessible trail access into the park. Improvements at the lower park include a bike skills park, toboggan hill, improved picnic and play areas, new washroom building, and a new pedestrian overpass that will connect the upper and lower parks.

Sub-Reach Boundary

- + North Saskatchewan River
- + Central Reach Boundary

Key Open Space Needs & Opportunities

The steep and narrow natural setting of this landscape pose challenges to trail connectivity in this sub-reach. A balance must be taken to ensure safety and accessible travel through this area, while ensuring wildlife connectivity is improved.

Informal trails occur throughout the west and east of this sub-reach. A comprehensive inventory and assessment of these trails should be prioritized to rationalize this trail system to mitigate impacts to wildlife connectivity and ensure adequate maintenance, wayfinding signage, and oversight.

Residential properties further constrain land use and management decisions, creating a significant pinch-point through the river valley in this area.

Park improvements planned for Elizabeth Park will lead to increased public use of these lands. The upper park includes a new Indigenous Art Park, upgraded/new lookouts along Saskatchewan Drive, a new shade shelter and picnic tables, and a new accessible trail into the park. The lower park includes a bike skills park, toboggan hill, improved picnic and play areas, new washroom building, new pedestrian overpass to connect upper and lower parks.

13 – Kinsmen Park

The Kinsmen Park Sub-Reach is made up of a majority of Active/Working Landscapes and Conservation land use, with small areas of Preservation identified within the more

ecologically sensitive areas. The Sub-Reach Boundary is delineated by the North Saskatchewan River, the Central Reach boundary, Walterdale Hill NW, and University of Alberta Land.

There are several trail connections from Saskatchewan Drive NW as well as between the Emily Murphy Park University Connection Sub-Reach and the Queen Elizabeth and Nellie McClung Park Sub-Reach. There is a pedestrian bridge that connects Kinsmen Park Sub-Reach with the Victoria Park Golf Course Sub-Reach. Vehicles can access the park in multiple locations along Walterdale Hill NW to access various parking areas located throughout the park.

Sub-Reach Boundary

- + North Saskatchewan River
- + Central Reach Boundary
- + University of Alberta Land
- + Walterdale Hill NW

Sub-Reach Includes

- + Kinsmen Park

Key Open Space Needs & Opportunities

The Kinsmen Park area sees extensive use as an sporting and cultural event space, hosting the second largest number of events each year within the central reach (bested only by Hawrelak Park). While the park has sufficient parking and other infrastructure to accommodate these uses, its prominence places pressure on its ability to sustain this use. The park receives regular requests for additional events, placing increased pressure on resources and infrastructure. Finding new areas to accommodate desired public events is necessary.

Informal trails occur throughout the west of this sub-reach. A comprehensive inventory and assessment of these trails should be prioritized to rationalize this trail system to mitigate impacts to wildlife connectivity and ensure adequate maintenance, wayfinding signage, and oversight.

Wildlife connectivity through this area is seriously impacted by existing infrastructure, significantly impacting ecological function in the central reach. Wildlife crossing structure

improvements should be considered during any subsequent infrastructure replacement or improvement.

14 – Emily Murphy Park University Connection

The Emily Murphy Park University Connection Sub-Reach Includes Emily Murphy Park as well as privately owned University of Alberta lands and is made up of mostly Preservation land use, with some Active/Working Landscapes land use found in the western region of the Sub-Reach and Conservation acting as a buffer along the trail systems. The Sub-Reach Boundary is delineated by the North Saskatchewan River, the Central Reach boundary, Groat Road NW and Kinsmen Park.

Vehicular access is off Emily Murphy Park Road NW to a small parking area that serves the Emily Murphy Park Canoe Launch. There is a trail connection off Emily Murphy Park Road NW as well as connections to the Royal Mayfair Golf Course Sub-Reach and the Kinsmen Park Sub-Reach.

Sub-Reach Boundary

- + North Saskatchewan River
- + Central Reach Boundary
- + Groat Road NW
- + Kinsmen Park

Sub-Reach Includes

- + Emily Murphy Park
- + University of Alberta Land
- + Natural Area

Key Open Space Needs & Opportunities

- + This area has limited pathway connectivity due to steep slopes, stairs, and unimproved trails. Accessibility is therefore a concern.

- + The steep slopes result in similar restrictions to wildlife connectivity in this area. Trail use must be balanced against impacts to wildlife movement.
- + The steep lands below the University of Alberta are owned by the University, and management and maintenance efforts require coordination.
- + The stretch of land bordering Hawrelak Park to the east of Groat Road is a very important wildlife corridor which nevertheless contains numerous informal trails. A comprehensive inventory and assessment of these trails should be prioritized to rationalize this trail system to mitigate impacts to wildlife connectivity and ensure adequate maintenance, wayfinding signage, and oversight.
- + Core habitat in this area should be preserved to ensure that maintenance of the golf course does not degrade it.
- + Balance public use of the area with the need to ensure wildlife connectivity through the golf course grounds, and along the riparian edge.
- + Explore opportunities to increase year-round use of golf course grounds for public events and more equitable recreation opportunities.
- + Ensure adequate wayfinding and signage to ensure that active transportation routing options are clearly communicated.
- + Winter use of the golf course lands should be encouraged.

15 – Royal Mayfair Golf Course

The Royal Mayfair Golf Course Sub-Reach has a mix of Active/Working Landscapes and Preservation land use with some Conservation buffers. The park boundary is delineated by the North Saskatchewan River, the Central Reach boundary, Groat Road NW and Hawrelak Park.

The Royal Mayfair Golf Course Sub-Reach has trail connections along the riverbank that connect with the Hawrelak Park Sub-Reach and the Emily Murphy Park University Connection Sub-Reach. Vehicles are able to access a parking area off of Groat Road NW, however, there is no vehicular access throughout the Sub-Reach.

Sub-Reach Boundary

- + North Saskatchewan River
- + Central Reach Boundary
- + Groat Road NW
- + Hawrelak Park

Sub-Reach Includes

- + Royal Mayfair Golf Club

Key Open Space Needs & Opportunities

16 – Hawrelak Park

The Hawrelak Park Sub-Reach has a mix of Active/Working Landscapes and Preservation land use with some Conservation buffers. The Sub-Reach Boundary is delineated by the North Saskatchewan River, the Central Reach boundary, Groat Road NW and the Royal Mayfair Golf Club boundary.

Existing network connections to Hawrelak Park include the Buena Vista/Hawrelak Park Footbridge as well as various trail connections from Groat Road NW and the Royal Mayfair Golf Club. Vehicles can access Hawrelak Park by the William Hawrelak Par Road NW, which creates a circular loop of the park. Although Hawrelak Park is part of Edmonton's existing regional trail network, the park does not have a strong internal pathway system. The only paved path within the park is jointly used by vehicles, pedestrians, and cyclists, with limited paths that link amenities and open spaces. The Hawrelak Park Rehabilitation Project identifies a 10-year rehabilitation plan to guide the renewal of Hawrelak Park to ensure the park continues to serve the recreational and event needs of Edmontonians. Proposed upgrades to the park include:

- + A new internal pathway system creating connections to various amenities and providing safe paths of travel around the park

- + A new accessible waterfront walk to link major lakefront amenities
- + Improve winter recreational access with new pathways considered for cross country ski trails and to maximize use and access to waterfront amenities
- + Improve and rehabilitate all event spaces within the park

Sub-Reach Boundary

- + North Saskatchewan River
- + Central Reach Boundary
- + Groat Road NW
- + Royal Mayfair Golf Club

Sub-Reach Includes

- + Hawrelak Park

Key Open Space Needs & Opportunities

Hawrelak Park experiences the highest number of events and other social bookings of any park in the city, matched only by Rundle Park during some years. This high density of use and visitation place pressure on the parks infrastructure, highlighting the need for well-funded maintenance and oversight.

At the same time, the park is incredibly important as habitat, especially along the riparian edges, and forest stands along the west side of the artificial lake. Ongoing maintenance and rehabilitation is important to balance against disturbance from active use.

Wildlife connectivity in these lands is very important, as wildlife travel between the Whitemud Ravine to the south, and river valley lands to the east. Connections along the riparian edge, and across Groat Road are important to maintain.

APPENDIX A – ENVIRONMENTAL OVERVIEW

Environmental Overview

As the Central Reach has seen extensive historic commercial and industrial use over the years, much of the area has environmental concerns that must be taken into account when planning for further developments. The following table provides a high-level summary of key environmental contamination concerns that should influence the nature of recommended developments. These concerns stem from historical land uses and industrial developments that have left

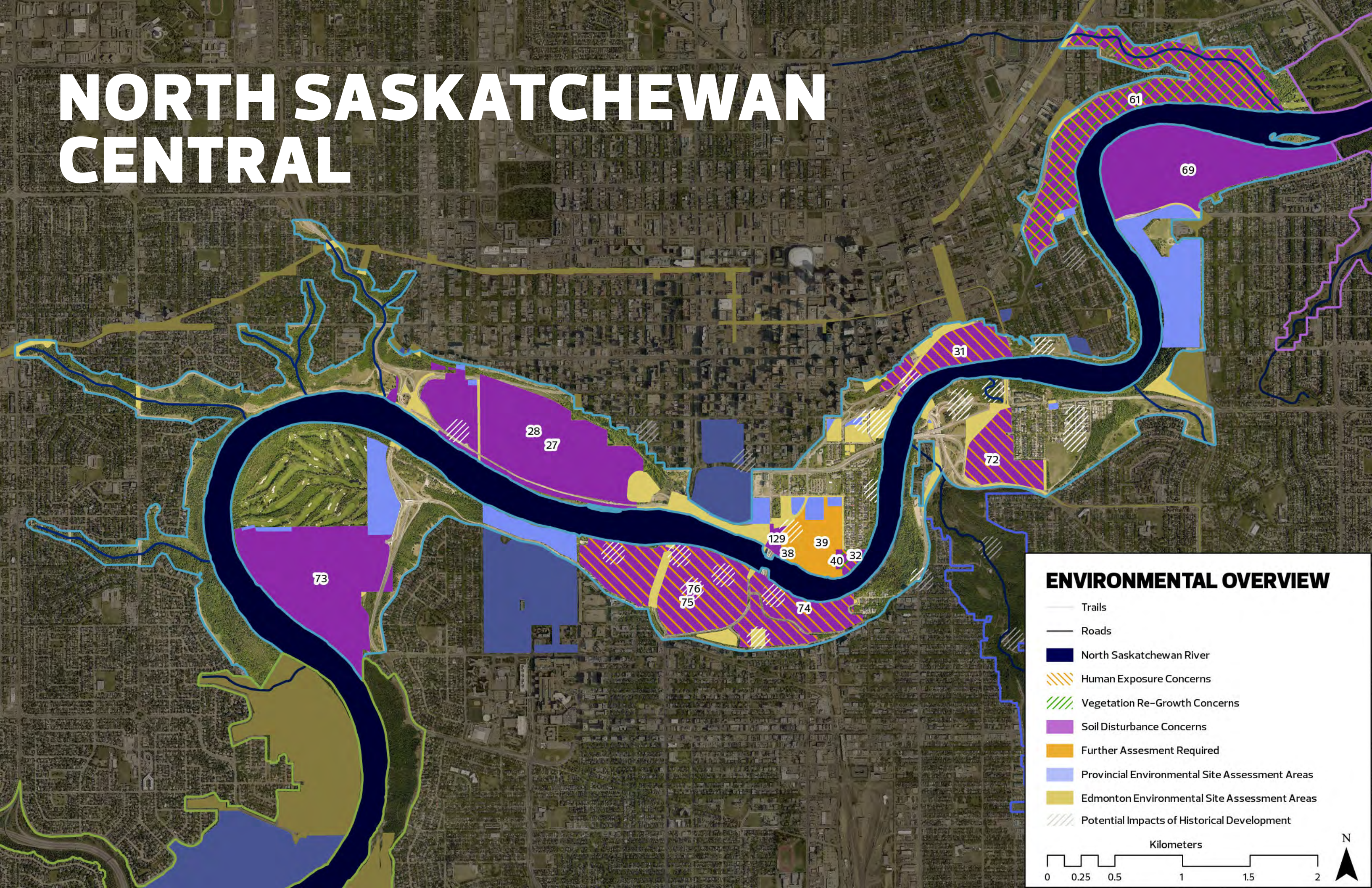
problematic contaminants that could pose human health risks if disturbances are not properly managed. **These concerns only affect development, disturbance, or restoration activities and these lands do not pose human health risks at present.** Other Environmental Site Assessments for sites that are currently not considered problematic are included in the mapping, along with sites that may contain hazards associated with historic activities.

CSMP ID*	PROPERTY NAME	BRIEF SUMMARY	CATEGORY
27 & 28	Victoria Golf Course	Creosote timber at several tee boxes; Further contamination can be expected due to the presence of rail ties and fill material; Mercury exceeding Alberta Tier 1 Soil Remediation Guidelines from fungicide in use until the late 1990s – Concentrations below recommended guideline: no risk for human receptors	Soil Disturbance Concerns
31	Louise McKinney Riverfront Park	PAHs and metals from past landfilling activities; All soil material disturbed must be treated as contaminated and disposed of appropriately	Soil Disturbance Concerns Human Exposure Concerns (during disturbance)
32	Fire Station 21 (Rossdale)	Hydrocarbons BTEX, F1-F4, lead, iron, and manganese from historical underground storage tanks and fire training burn pits from the 1950s; Currently Risk Managed by Engineering Services	Soil Disturbance Concerns Human Exposure Concerns (during disturbance) Vegetation Re-Growth Concerns
38	Rossdale Power Holdings	Contamination from historical industrial activities	Further Assessment Required
39	Rossdale Water Holdings	Contamination from historical industrial activities	Further Assessment Required

* identified locations within the Central Reach project area that are managed as part of the City of Edmonton's Contaminated Site Management Program (CSMP).

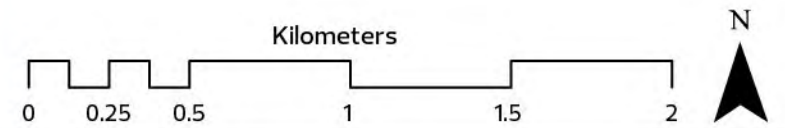
40	Rossdale Watermark Building	Contamination from historical fire training activities. Remediation planned by early 2022	Soil Disturbance Concerns Vegetation Re-Growth Concerns
61	Dawson Park/ Kinnaird Park	Hydrocarbon (F2/F3) and metal exceedances that may be related to fill material, coal mining, or historic industrial activity	Soil Disturbance Concerns Human Exposure Concerns (during disturbance) Vegetation Re-Growth Concerns
69	Riverside Golf Course	Mercury exceedances from a fungicide that was used until the late 1990s – Concentrations below recommended guideline: no risk for human receptors	Soil Disturbance Concerns
72	Gallagher Park	Metals, hydrocarbons, and PAHs in soil and groundwater from waste and ash deposition from the Cloverdale Incinerator, brickyard, and clay borrow pit	Soil Disturbance Concerns Human Exposure Concerns (during disturbance)
73	Hawrelak Park	PAHs and metals from a gravel extraction and crushing operation (1950–1967), fill materials, current storage of diesel fuels, and an underground storage tank; Remediation has occurred on site	Soil Disturbance Concerns
74	Queen Elizabeth Wastewater Treatment Plant	Barium, zinc, and SAR exceedances identified in the soil	Soil Disturbance Concerns
75	Land Under the High Level Bridge (Kinsmen Park)	Lead in soils from lead paint historically used as a bridge coating	Soil Disturbance Concerns Human Exposure Concerns (during disturbance)
76	Kinsmen Park/Queen Elizabeth Park	Lead in soils from lead paint historically used as bridge coating; Soil disturbance may encounter contamination	Soil Disturbance Concerns Human Exposure Concerns (during disturbance)
129	Rossdale 105 Street Burial Ground	Zinc in soils; Historical and cultural significance from presence of a First Nations burial ground on-site	Soil Disturbance Concerns

NORTH SASKATCHEWAN CENTRAL



ENVIRONMENTAL OVERVIEW

- Trails
- Roads
- North Saskatchewan River
- Human Exposure Concerns
- Vegetation Re-Growth Concerns
- Soil Disturbance Concerns
- Further Assessment Required
- Provincial Environmental Site Assessment Areas
- Edmonton Environmental Site Assessment Areas
- Potential Impacts of Historical Development



APPENDIX B – GEOTECHNICAL SUMMARY

**RIBBON OF GREEN AND NORTH SASKATCHEWAN RIVER
VALLEY AREA REDEVELOPMENT PLAN INTEGRATION
PROJECT
CENTRAL REACH
PRELIMINARY GEOTECHNICAL
DESKTOP ASSESSMENT**



THURBER ENGINEERING LTD.



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**RIBBON OF GREEN AND NORTH SASKATCHEWAN RIVER VALLEY AREA
REDEVELOPMENT PLAN INTEGRATION PROJECT
CENTRAL REACH
PRELIMINARY GEOTECHNICAL
DESKTOP ASSESSMENT
REVISION 2**

Report

to

O2 Planning + Design Inc.

Stephen Coulter, M.Eng., P.E., P.Eng.
Associate | Senior Geotechnical Engineer

Date: May 6, 2022
File: 29863

Robin Tweedie, P.Eng.
Review Engineer



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STATEMENT OF LIMITATIONS AND CONDITIONS

APPENDICES

APPENDIX A

Drawing No. 29863-1 – Central Reach – Topography Map

Drawing No. 29863-2 – Central Reach – Topography Slope Map

Drawing No. 29863-3A – Central Reach West – Surficial Geology and Geotechnical Hazard Map

Drawing No. 29863 - 3B - Central Reach East - Surficial Geology and Geotechnical Hazard Map



1. INTRODUCTION

This report presents the results of a preliminary geotechnical desktop assessment carried out by Thurber Engineering Ltd. (Thurber) in support of the Ribbon of Green Project for the North Saskatchewan River Valley and Ravine System in the Central Reach portion of Edmonton, Alberta.

The scope and requirements of this study were outlined in a proposal letter from Thurber to O2 Planning + Design Inc. (O2) dated August 27, 2020. Authorization to complete the project was provided by O2 in a correspondence dated November 27, 2020.

Thurber provided the initial findings of the desktop study in a report dated April 15, 2021. At the request of City of Edmonton (City) during a meeting held with O2, and Thurber in late 2021, this Revision 1 provides additional information on known areas of past instability which may represent areas of elevated geotechnical risk.

It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

2. PROJECT BACKGROUND

It is understood that the City of Edmonton (City) is planning to undertake the consolidation of previously completed master and concept plans for the North Saskatchewan River Valley and Ravine system in the Central Reach portion of Edmonton.

The Central Reach consists of the North Saskatchewan River Valley (and associated tributary ravines) located in the central portion of Edmonton from approximately the Whitemud Drive bridge crossing in the southwest to the twinned Yellowhead Trail bridge crossings in the northeast. A topography map of the study area is provided in Drawing No. 29683-1 in Appendix A.

The overall goals of the project include developing integrated conceptual level plans for these areas; the creation and implementation of engagement plans for internal, external, and regional stakeholders; and to support and sustain a River Valley system that meets the needs of all identified users and stakeholders.

As part of this work a geotechnical desktop study was required to identify and evaluate feasible access routes and infrastructure. No site reconnaissance for field truthing nor test hole drilling were part of the current scope of work.



This report provides a preliminary desktop review of available information to aid in the high-level assessment of possible areas of future development. Once key areas are identified during the ongoing screening process, Thurber can undertake more focused ground truthing of specific areas.

3. METHODOLOGY

The desktop study comprised of the following tasks:

- Review of published geological maps within the study area.
- Review of available general geotechnical information from Thurber's in-house files.
- Review of current LiDAR maps provided to Thurber by O2 to provide information on topographic features and slope instabilities.
- Identify known areas of past instabilities within the project limits

The overall project limits are extensive and cover sizable portions of the North Saskatchewan River Valley. More focused studies on selected areas, including limited site reconnaissance, will be undertaken as the overall project moves forward and prospective sites for future development are identified.

4. SITE DESCRIPTION

4.1 Geological Setting

The geological assessment of the project area is based on the review of available existing maps, lexicons, and water well records, including:

- L.A. Bayrock. Surficial Geology Edmonton. NTS 83H. Alberta Research Council. 1972.
- R. Bibby. Report 74-10. Hydrogeology of the Edmonton Area (Northwest Segment), Alberta. Alberta Research, Alberta. 1974.
- C.P. Kathol and R.A. McPherson. Urban Geology of Edmonton. Bulletin 32. Alberta Research Council. 1975.
- W.J. Ceroici. Report 78-5. Hydrogeological Map Edmonton Area (Southwest Segment), Alberta. Alberta Research Council. 1978.
- L.D. Andriashek. Bedrock Topography and Valley Thalwegs of the Edmonton Map Area. NTS 83H. Alberta Research Council. 1987.



- D.J. Glass. Lexicon of Canadian Stratigraphy. Volume 4. Western Canada. Canadian Society of Petroleum Geologists. Calgary, Alberta. 1990 and 1997.
- Atkinson, N. and Lyster S. Thickness and Distribution of Quaternary and Neogene Sediments in Alberta, (Canada). Alberta Geological Survey. 2012.
- Alberta Energy Regulator/ Alberta Geological Survey. Bedrock Geology of Alberta. Map 600. 2013.
- Alberta Government. Alberta Environment and Parks. Alberta Water Well Information Database. www.groundwater.alberta.ca/WaterWells/d/. 2021.

4.1.1 Bedrock Geology

The North Saskatchewan River has downcut rapidly through the surficial geological deposits in post glacial times and is incised into the underlying Upper Cretaceous bedrock of the Horseshoe Canyon Formation throughout the project area.

The Horseshoe Canyon formation which underlies the study area consists of deltaic and fluvial deposits of interbedded fresh and brackish water sandstone, siltstone, and shale with coal and bentonite beds.

Typical sediments consist of soft grey, greenish and white weathered bentonitic feldspathic sandstone, brown bentonitic shales, coal seams and beds of carbonaceous shale. Less common within the formation are concretions and beds of hard calcareous sandstone, thin nodular beds of red-brown ironstone and thin beds of bentonite. At its southern portion in the Edmonton area, the Bearpaw formation underlies the Horseshoe Canyon. The Bearpaw formation is composed of marine shale, open sea dark grey clays, claystones, shales, silt, and siltstone with subordinate sands and sandstones, concretionary beds, and thin beds of bentonite.

The Bearpaw Formation is traced from Montana to north of Edmonton. In the Edmonton Area, the formation becomes wedge-like in shape and then terminates. At the termination point, the Belly River Group underlies the Horseshoe Canyon formation.

Bedrock is frequently exposed on the North Saskatchewan valley slopes and tributary valley slopes, particularly on the exposed slopes of outside meander bends in the river and is generally present at shallow depth below the river channel.



4.1.2 Bedrock Topography

The North Saskatchewan River Valley, and Edmonton in general, features many large, buried valleys. The largest buried valley in the area is the Beverly Valley which is located beneath the central portion of the City of Edmonton and extends into the northeast study area generally following the present-day North Saskatchewan River Valley.

In the southwest portion of the study area, the Stony Valley follows the North Saskatchewan River Valley and the New Sarepta Valley is located within the vicinity of Whitemud and Blackmud Creeks.

These buried valleys represent the broad pre-glacial valleys that existed prior to glaciation and the lower parts of these valleys are infilled with alluvial sand and gravel deposits of the Empress Formation. These valleys were infilled with glacial deposits during glacial and post times.

Today's North Saskatchewan River Valley and tributary creeks are incised through these glacial deposits into the buried valleys deposits and into the bedrock formation.

Due to this, bedrock escarpments as well as surficial deposits dating from preglacial to more recent time can be observed on the river valley slopes.

4.1.3 Surficial Geology

In the study area, the bedrock is covered by surficial deposits composed of late Tertiary and Quaternary period deposits.

These deposits consist of five major surficial deposit units, as follows: Empress formation, glacial till deposits, glaciolacustrine deposits, alluvium, and colluvium, as shown on Drawing Nos. 29863-3A and 29863-B, in Appendix A. The project area has been divided into two portions, West and East, in these drawings to show greater detail across the project area. These drawings also show the various alignments of informal trails and trail forks that have been provided to Thurber by O2.

The alluvium is located on the low-level terraces and river channel at the bottom of the North Saskatchewan River Valley and tributary creeks, while all the other units are exposed at the river and creeks banks.



Alluvium is composed of gravel, sand, silt, and clay deposits, generally fining upwards. The alluvium in the North Saskatchewan River is composed mostly of gravel and sand while alluvium in the tributary creeks is composed of silt and clay with some sand and gravel.

Glacial till is composed of mixture of clay, silt, and sand with pebbles, cobbles, boulders, and bedrock blocks. These deposits were laid down directly over the bedrock surface (or buried Empress formation channel deposits where present) during the glacial advance and retreat and can be relatively thick (tens of metres) through the study area.

Glaciolacustrine deposits are composed of bedded silt and clay with sand and were laid down in a large post glacial lake (Lake Edmonton) that formed at the ice front over the Edmonton area, during the ice retreat (i.e., some ten thousand years ago).

Colluvium is a gravitationally moved material due to landslides and mass movements and is comprised of bedrock or other surficial geology units. It is located on the valley slopes and it is composed of gravitationally moved mixture of clay, silt, and sand. Widespread landslides are present in these colluvial soils along the river valley and creek valley slopes.

Towards the northeast portion of the study area, Tertiary and early Quaternary deposits include the Empress formation. In the Edmonton Area, preglacial sands and gravels are part of the Empress formation and they are also known locally as “Saskatchewan gravels and sands”.

The Empress formation sands and gravels are primarily quartzite with minor chert, ironstone, and coal fragments. This gravel and sand material originates from the Canadian Rockies to the west. The Empress formation is exposed in the northeast portion along the bottom of North Saskatchewan River Valley banks or is covered by recent alluvium deposits. The sand and gravel of Empress formation are commonly extracted as building materials in large sand and gravel pit spread throughout the alluvial plain. Glacial till formations are also found overlying the Empress formation or the bedrock in area where the Empress formation is not present.

4.2 Topography and Surface Features

The project area is relatively large and consists of the portion of the North Saskatchewan River Valley from Whitemud Drive in the southwest to Yellowhead Trail in the northeast as well as tributary valleys that drain into the river on both banks. The general layout and derived topography of the project area is shown on Drawing No. 29863-1 in Appendix A.

The river flows in a generally northeasterly direction with numerous large meander bends and travels through diverse urban and suburban terrain, encompassing adjacent river valley parks,



golf courses, residential areas, and Edmonton's developed downtown core. Numerous highways, arterial road, and pedestrian bridges also cross the river through the study area.

The river valley slope profiles, as shown in Drawing No. 29863-2 in Appendix A, are indicative of past major slope instabilities which occurred because of the rapid downcutting of the river valley through the weak surficial and bedrock deposits. These are further discussed in Section 4.3.

The slope angle of the river valley in the study area ranges from approximately 10 to 20 degrees in the upper portion of the river valley, while the lower portion of the valley slopes are greater than 30 degrees and may approach more than 40 to 50 degrees in some areas. Lower portions of steep slopes are typically bare of vegetation. The steeper slopes tend to be situated on the outside of bends where active erosion has taken place.

4.3 Results of LiDAR Interpretation

An interpretation of bare earth LiDAR imagery provided to Thurber by O2 was carried out to provide information on the slope morphology and the presence of landslides along the valley slopes.

The study indicated the presence of many landslides along the valley slopes of the North Saskatchewan River valley and its tributary valleys. Approximate locations of these landslide features are shown on Drawing Nos. 29863-3A and 29863-B in Appendix A.

The observed landslide features based on the results of the LiDAR interpretation are described below and further description of these features are presented in Section 5. These landslide features include (a) active or recent landslides, (b) old or inactive landslides, or (c) debris slides, as follows:

a) Active or Recent Landslides

Generally, these landslide areas are located at the outside bends of the North Saskatchewan River valley between the valley crest and the riverbed. At these locations, the river has actively eroded the toe of the slope, undermining of the upper slope occurs, triggering slumping of the upper portions of the slope. Active or recent landslides can also be developed as small, isolated soil slumping or as thin colluvium creeping and sliding down the slope.

b) Old Landslides - Inactive or Minor Landslides

Large scale ancient or apparently inactive landslides exist along the river valley at various locations where active scarps and cracks are visible. It is believed that the intensive sliding



processes in the areas of inactive landslides occurred a long time ago (thousands of years) during the valley incision after the drainage of glacial Lake Edmonton. These large ancient sliding areas are apparently dormant, but the steep slide surface is prone to surficial creep movement and local shallow slumping.

c) Debris Sliding

Most of the slope colluvium material present in the river valley is thin and it is moving slowly downhill (slope creep). These areas can feature large slope areas of debris that can be connected to each other and are slowly creeping downhill.

It is difficult to differentiate the age and relative activity (i.e., active, or dormant) of a slide from the LiDAR imagery. To delineate and assess this further, temporal air photo interpretation (API) will need to be undertaken, where stereo air photo pairs are examined from different time periods. A full API of the overall project sites is beyond the scope of this current report. However, it should be undertaken when the study becomes more focused on selected development areas.

4.4 Identification of Areas of Known Geotechnical Hazards

Numerous areas of past and present slope instability have been identified within the study area, and many of these have been the subject of past geotechnical studies and in some cases slope remediation.

The major areas of known slope instabilities within the river valley and tributaries are highlighted on Drawing Nos. 29863-A and 29863-B and are summarized in Table 4.1 with their identifying numbers on the drawings. The table also indicates the assessed relative activity level with respect to the current rate and amount of slope movement.

It must be recognized that the relative rating is on a qualitative basis only, as most areas are not actively monitored at the present time. In general, a high relative activity rating indicates that the area is currently active and extensive study and possibly slope remediation may be required in order to ensure the long-term operation of facilities within and around these areas. A medium rating would indicate that slope instabilities have existed in the past and there may exist local zones of instability that require further study, stabilization, or route detouring. A low rating would indicate that the slopes are relatively stable/dormant at the present time and hence there is a relatively low geotechnical slope risks related to these areas; however, the current condition of these slopes in selected development areas should be further understood during the design process.

**TABLE 4.1
SUMMARY OF IDENTIFIED GEOTECHNICAL HAZARD ZONES**

MAP ID NUMBER	DRAWING NO.	SITE NAME	RELATIVE ACTIVITY RATING
1	29863-A	Rio Terrace/Quesnell Heights	MEDIUM
2		Mackenzie Ravine	MEDIUM
3		Slopes Between Mackenzie/MacKinnon Ravines	MEDIUM-HIGH
4		MacKinnon Ravine	LOW
5		Ramsey Ravine	MEDIUM-HIGH
6		Groat Road Ravine	LOW
7		Keillor Road/Saskatchewan Drive	MEDIUM
8		University Area/Saskatchewan Drive	MEDIUM
9		Victoria Park Hill	LOW
10	29863-B	Lavigne Subdivision/Skunk Hollow/Pioneer Cabin	MEDIUM-HIGH
11		Mill Creek Ravine	HIGH
12		Grierson Hill	LOW
13		Strathearn Neighbourhood	LOW
14		McNally/Forest Heights Park	HIGH
15		Kinnaird Ravine/Dawson Park	LOW-MEDIUM
16		Riverside Trail	MEDIUM
17		Rowland Road/Riverside Golf Course Trail	HIGH

Each of these sites is briefly discussed within this section following the table. Thurber has also provided a selected list of references regarding major river valley slope stability issues for future reference.

It should be recognized that other areas of less significant slope instabilities may exist within the project limits that have not been specifically identified in the above table.

Rio Terrace/Quesnell Heights

The Laurier Drive site is situated on the north slope of the river valley on the south side of the Rio Terrace and Quesnell Heights neighbourhoods. The slopes here are relatively high (on the order of 50 m) and steep. The condition of these slopes has been created by ongoing



erosion caused by increased river flow velocity along the outside of a bend. In these areas, many residential homes along Rio Terrace Road and Quesnell Crescent are situated near the crest of the river valley and some areas have experienced ongoing creep movements. There is minimal opportunity for trail development in this zone and the current trail network travels along the existing streets.

Mackenzie Ravine

Mackenzie Ravine is a tributary that descends from approximately 148 Street in the west to the North Saskatchewan River, for a total elevation drop of about 65 m. This ravine currently features an existing trail, elevated wooden walkway, and stairs through the forested ravine. Most of the previous instability in this area has been triggered by periods of increased rainfall and surface drainage runoff in localized areas. Future trail development in this ravine will have to consider any local slope instabilities.

Slopes Between Mackenzie and MacKinnon Ravines

The slopes between these two ravines on the west side of the river valley extend approximately 1 km, with steeper and higher slopes located closer to the southern end of the area near Mackenzie Ravine, with slope heights on the order of 50 m to 60 m. An existing trail descends this slope from Riverside Drive in the Crestwood neighbourhood southward towards the end of the wooden walkway of Mackenzie Ravine. The development of trails along these slopes that connect the two ravines is possible. However, previous landslides are visible in the LiDAR imagery. It is likely that these landslides have been caused by oversteepening due to toe erosion from the river flow.

MacKinnon Ravine

Like Mackenzie Ravine, MacKinnon Ravine is a generally west-east tributary ravine. It descends approximately 55 m from its western end at the intersection of 149 Street and Stony Plain Road down to the North Saskatchewan River. The ravine has an existing trail network and other open meadow space among the wooded ravine slopes. Most of the slopes along this ravine have been stable in recent history and hence represent relatively minimal risk for future instability assuming appropriate trail designs.

Ramsey Ravine

Ramsey Ravine is a generally north-south running tributary ravine that features relatively steep wooded slopes and an existing trail alignment along the eastern slopes. The ravine descends



approximately 60 m from its northern end at 104 Avenue down to the North Saskatchewan River. The existing trails in this ravine have experienced recent slumping prior to 2017 (Ref 1) that was exacerbated into washouts from a heavy rain event that occurred in the summer of 2018. Permanent repairs to this trail are currently underway by the COE. This ravine has relatively steep slopes that are affected by the runoff, both overland and from constructed outfalls, from the surrounding residential areas and should thus be considered sensitive.

Groat Road Ravine

The Groat Road Ravine has been highly developed in the past into a major roadway corridor, descending approximately 35 m from 106 Avenue down to the North Saskatchewan River in the area of Groat Road Bridge and Government House Park. There is an existing sidewalk/trail on the western side of Groat Road that connects the upland areas with the river valley trail network. The existing ravine slopes are a mix of developed residential areas and forested slopes. These slopes have been affected by old landslides along the ravine but are not currently active. Special attention would be required for any likely impacts or modifications to the existing slopes.

Keillor Road/Saskatchewan Drive

The Keillor Road and Saskatchewan Drive area is a known active slope instability area on the outside bend of the North Saskatchewan River along the western edge of the Belgravia neighbourhood. The slopes extend for approximately 1.7 km from the Whitemud Equestrian Park in the south to Hawrelak Park in the north, with slope heights of 50 m to 60 m. This area has a relatively extensive trail network that is present along the slopes, at the crest, and descending down to the riverside elevations. A large and noteworthy landslide (known locally as the Keillor Road landslide) occurred along the previous Keillor Road alignment north of the Whitemud Equine Centre which has required near continuous repairs due to creep and landslide movements, eventually requiring the closure of the road in 1995. A major landslide took place in 2002 that essentially removed Keillor Road and some trails. This landslide resulted in the exposure of a series of concrete stabilization piles that had been installed along the river valley for Keillor Road. The landslide required the realignment of the trail network in this area and the landslide is still active as toe erosion continues to destabilize the area over time. Recent work at the site has focused on stabilizing the area and allowing for the public to access it in a safe way via the developed Keillor Point Lookout (Ref 2).



University Area/Saskatchewan Drive

This area is situated on the south side of the river valley and extends eastward from Emily Murphy Park for approximately 800 m towards Kinsmen Park. These slopes are approximately 55 m in height from the river valley crest at Saskatchewan Drive down to the river elevation. The slopes are heavily forested and there is an existing trail network with numerous entry points and trails ascending and descending the slopes. However, the LiDAR imagery indicates that the area has numerous local small landslides and slumps that have been moderately active in the recent past. Ongoing creep movements can be observed along steeper sections and the instability has also been increased by surface water flow and groundwater seepage in this area. There are several springs that emerge at trail level at the toe of these slopes

Victoria Park Hill

The Victoria Park Hill site consists of the slopes descending from Victoria Park Road to Victoria Golf Course and the adjacent Victoria Park within the river valley. This slope is approximately 35 m in height. This site has experienced historic landslides. Most recently, a landslide affected the slope in the 1990s. This landslide was repaired by excavating the landslide material and replacing with competent and compacted material. There is an existing trail that connects from Victoria Park Road and follows near the crest of the river valley to Constable Ezio Faraone Park west of the High-Level Bridge. These slopes are presently dormant but are expected to be sensitive to slope modifications. There are numerous highrise residential development along the crest of these slopes.

Lavigne Subdivision/Skunk Hollow/Pioneer Cabin

This area on the south side of the river valley between Queen Elizabeth part at the west end and Scona Road at the east end is within an ancient but currently dormant deep seated translational landslide that extended from below Saskatchewan Drive to above current riverbed level. The Lavigne Subdivision/Skunk Hollow area consists of residential neighbourhood situated on the river valley slopes on 90 Avenue and 91 Avenue north of Saskatchewan Drive. The total height of the river valley slope in this area is approximately 55 m to 60 m. The landslide on the valley slope consists of an ancient large translational slide that was mobilized along a weak bentonite layer located in the midslope area, where the houses are currently located. This slide is currently inactive and existing trails travel eastward from Queen Elizabeth Park along the river valley slopes and north of this neighbourhood and turns towards the northeast towards the Pioneers Cabin through Nellie McClung Park.



At the location of the Pioneers Cabin, on the west side of Scona Road, the North Saskatchewan River turns closer to a north-south route, creating a 40 m high relatively steep slope directly below (and to the west) of the cabin location and the homes located on 99A Street. This slope has been susceptible to toe erosion in recent years due to river flow along the outside of this bend. The most recent of these movements caused a failure of the upper part of the valley slope and the closure of the existing trail in this area, which was repaired using the construction of a major pile stabilization wall that reopened in 2020. There is limited area to re-route trails in this area and continued erosion could lead to increased risk to other adjacent areas of this trail west of the Low-Level Bridge.

Mill Creek Ravine

Mill Creek Ravine is a lengthy tributary ravine, the lower part of which extends approximately 4 km northward from Argyll Park to the south side of North Saskatchewan River near the Low-Level Bridge. Mill Creek no longer daylight to the river and is routed through a tunnel to an outfall partway up the slope south of the Dawson bridge. The depth of the ravine varies with a maximum slope height of approximately 35 m to 40 m towards the northern end where it is bounded by the Strathcona residential neighbourhood to the west and the Bonnie Doon neighbourhood to the east. The ravine has vegetated slopes throughout most areas and an extensive trail network with a system of pedestrian bridges that cross Mill Creek as it meanders northward through the ravine. Like other ravines that connect to the river valley, the slopes of the ravine are susceptible to toe erosion, specifically during high runoff events following rainstorms or during the spring thaw. The runoff enters the ravine either over land or via a system of storm sewer outfalls that daylight on the slopes. In turn, the increased flow within the creek lead to toe erosion of local steep ravine slopes and subsequent failures. Mill Creek Ravine has experienced numerous instabilities, loss of bank, and trail closures in the recent past which required ongoing maintenance and creek bank stabilization measures (Refs 3 and 4). Rerouting and development of trails within the ravine will need to consider all these instabilities and the nature of the slopes and erosion in those areas.

Grierson Hill

Grierson Hill is located on the north side of the river valley and is bounded by Jasper Avenue to the north, and the new LRT bridge (Tawatina Bridge) to the east and the Low-Level bridge to the west. This area of the river valley has experienced documented stability issues over the past century owed to a variety of causes, including coal mining, landfilling, groundwater seepage issues, and a transitional slide that has moved on an identified low strength bentonite seam located near river level. The river valley slope is approximately 60 m in height in this area and is currently occupied by Grierson Hill Road, the Edmonton Convention Center, the 100 Street



Funicular, Louise McKinney Park, and the Chinese Gardens, and has a well-established east west trail network that connects to bridges at both ends of the area. In addition, on the eastern side of Grierson Hill is the location of the portal to the underground section of the newly constructed Valley Line LRT.

The most notable slide occurred in 1901 and the slide has remained variably active until the early 1910's when a toe berm was constructed to buttress the slide area. This slide has been extensively studied during the construction of both Grierson Hill Road and the Edmonton Convention Centre. Various remediation measures have taken place over the years, including dewatering wells and drainage tunnels and constructions of stability toe berms. Today, the slopes in this area are monitored with the installation of surface monitoring points and slope inclinometers in order to assess the creep movement of the slope in an ongoing fashion (Refs. 5 and 6). The slopes are expected to undergo ongoing slow creep movements.

Strathearn Neighbourhood

This area includes the river valley slopes that separate the Strathearn neighbourhood located at the valley crest from the Cloverdale neighbourhood on the lower river terrace and run northeast from Gallagher Park to 98 Avenue. These slopes are approximately 30 m to 35 m in height and are vegetated with mature trees and woodlands. An existing trail runs along the crest of the slope through Strathearn park. Although this site has been identified from the LiDAR as experiencing previous landslides, we are not aware of any zones of active movement in this area at the present time.

McNally/Forest Heights Park

The McNally/Forest Heights Park area slopes are situated directly on the east bank of the river valley, north of 98 Avenue. This bank is approximately 40 m to 50 m in height and located along the outside of a sharp bend in the river as it curves from running west to running north. At the crest of the slope are the western edges of the St. Joseph Seminary, Forest Heights Park, and McNally High School. The riverbank slopes are covered with mature forest vegetation and an existing number of trails that have experienced various slope movements and ongoing creep in landslides that can extend from river level to the valley crest. A major slide extending from the crest of slope to river level has occurred in recent years causing the slope crest along Forest Heights Park to drop by several metres. The existing top of bank trail is situated beyond the crest of slope. In some locations on the slope directly below McNally high school there has been previous trail disruptions and ongoing erosion. It is believed that these slope movements are due to groundwater seepage and previous coal mining in the area, Stabilization of this major



slide is considered impractical and any future development and repair of the trails in this area would need to understand these deep-seated movements and the risks they pose to the trails.

Kinnaird Ravine/Dawson Park

Dawson Park is located on the north bank of the North Saskatchewan River on the river terrace area east and south of Jasper Avenue. The river valley slopes above the park are approximately 40 m in height. Kinnaird Ravine is immediately adjacent to Dawson Park to the east and descends approximately 40 m in elevation from its western end near the intersection of 112 Avenue and Jasper Avenue down to the river level. The area has been developed with numerous existing trails, with some informal trails ascending the valley from the park areas up to Jasper Avenue. The park areas are a mix of open areas on the terraces and more rugged forested areas on the slopes. The valley slopes around both Dawson Park and Kinnaird Ravine show some indications of local surficial slope movements in the recent past. In addition, some of the park footprint is situated over abandoned coal mine workings (Ref 7). As is typical with most of the drainage ravines in the river valley, the slopes are susceptible to erosion from surface runoff and developed storm sewer outfalls. The slopes in this area should be considered sensitive and marginally stable due to their past landsliding activity and possible effects of the abandoned underlying coal mining workings. Future trail development will have to further investigate the impact of these effects in this area.

Riverside Trail

Riverside Trail is located along the top of the south bank of the North Saskatchewan River opposite to Dawson Park and the Kinnaird Ravine and runs for approximately 2 km from the Dawson Bridge on Rowland Road at the west end, around the perimeter of Riverside Golf Course towards the Capilano Bridge on Wayne Gretzky Drive in the east. The trail is located on a low-level river terrace that vary between 2 m to 6 m above the river elevation. The trail has experienced numerous slumps over the past decade where riverbank erosion has caused the closure and/or detour of the trail. The erosion continues in identified areas and is expected to continue as the river flows and changes the alignment of the banks in this area (Ref 8). Minor relocations of the trail away from these slumps will be constructed over the coming years. Future trail development will have to consider the ongoing evolution of the banks and if future detours and realignments will be necessary.



Rowland Road/Riverside Golf Course Trail

Directly south and east of Riverside Golf Course and the Riverside Trail are the upper river valley slopes that run in an east-west alignment between Rowland Road in the west and Wayne Gretzky Drive in the east. The height of these slopes varies in the range of 40 m to 50 m and form the northern boundary of the Forest Heights neighbourhood. The slopes are heavily vegetated with mature trees and feature an established undulating trail that traverses the slope and intercepts the Riverside Trail at its eastern end. In 2020, a landslide affected a 100 m long section of the asphalt trail at a location approximately 200 m west of the Capilano Bridge resulting in the failure of existing timber retaining walls as well as cracks and soil subsidence and heave along the trail alignment. Head scarps up to 4 m in height were also noted at different elevations above and below the trail elevation. Further investigation indicated that the site has been affected by former underground coal mine workings and ancient and recent deep-seated translation slides along midslope low strength bentonite seams (Ref 9). Major construction to restore the asphalt trail and stabilize the lower slopes with cast in place concrete pile retaining walls is planned to start in Spring 2022. There is potential for similar landslides to occur in this area in the future and will need to be considered in any future development along these slopes.

5. PRELIMINARY GEOTECHNICAL EVALUATION

Currently, only preliminary information is available on the proposed future developments within the North Saskatchewan River valley and its tributaries. It is anticipated, however, that most recreational opportunities for the public would involve developments in the flatter low level terraces near the base of the valley slopes, similar to many of the existing parks and public facilities as illustrated on Drawing Nos. 29863-A and 29863-B, Appendix A. However, these will require access from the uplands by way of the valley slopes. In addition, future trails are being planned that may traverse sections of the valley slopes.

A detailed slope stability assessment for the entire project area is beyond the scope of this current work. Following are some preliminary evaluations and recommendations based on the results of the desktop study to this point.

- a) Various existing access roads and trails exist within the project study area, it is expected that trail development along these routes should not negatively impact the existing valley slopes, assuming that these trails are performing to a satisfactory level at the current time, and any future trail developments are properly planned to consider the slope morphology and current slope stability conditions. These areas should be inspected and evaluated on a case-by-case basis.



- b) Major landslide areas have been identified along the banks of the river valley as part of this study. Such areas are sensitive to slope movement and can be destabilized by slope construction activities that are not carefully planned. As options for development are considered, it would be prudent to avoid these landslide areas, to the extent possible.
- c) Major geotechnical risk hazard areas have also been identified along the river valley in this study. These areas have a history of slope movement and damage to existing infrastructure in conjunction with the identified landslide areas. Extra attention should be given to planning future trails or facilities in these areas and future study is required to understand the known risk levels based upon these known sensitive areas.
- d) Steep slope areas of the river valley have also been identified as part of this study. Like identified landslide zones, areas identified for future development should avoid these areas of steep slopes, for this study generally considered to slopes steeper than about 25 degrees. However, this is a generalization, and should be assessed on a site-specific basis.
- e) All potential future trails and access routes traversing valley and ravine slopes should be investigated on a site-specific basis. This would entail an evaluation of the current slope stability, the potential impact of the project on the current slope stability, and preferred routing of these trails and routes. At that time, any suggested modifications to the development locations, and possible mitigation measures, can be evaluated.
- f) Adequate setbacks from the crest and toes of slopes should be established for recreational development on a site-specific basis to avoid potential impacts from future slope instabilities.
- g) It should be recognized that, even with appropriate setbacks from landslide areas along the top of the North Saskatchewan River Valley, there is still considerable risk that future landslides could impact access points and paths, which would require future maintenance or the possibility of facility relocation.
- h) Future access construction may involve minor cuts and fills for maintaining widths and grades as well as clearing of vegetation. Regardless of whether upgrading an existing access or building a new one, construction along the top of the river valley slopes and ravine slopes will require care to avoid destabilizing the existing slopes. These should be evaluated on a site-specific basis and appropriate measures should be implemented to mitigate the potential effects of construction on or near slopes. Cuts and fills will generally require properly designed retaining structures to maintain the existing slope stability.



- i) No disturbance to existing slopes or bank by construction activities should be allowed during future development. Vegetation removal or construction activities should be limited to the facility footprint. Stockpiling should not be permitted on the top of slope and dumping and discharging water over slope should also be avoided. It is imperative that surface water runoffs be properly diverted away from the ravine slopes and top of bank, and no channelized flow should be allowed over the top of bank, to reduce the potential of future slope erosion and slope instability.

6. FUTURE WORK

Due to the extensive area currently under consideration, the scope of this desktop study involved a relatively high-level evaluation of the project area to identify areas of potential geotechnical constraints. As noted above, the major geotechnical constraint is the relatively widespread slope instabilities (both active and dormant) along the valley slopes. It is anticipated that the identification of these problematic landslide and steep slope areas in this report will inform the site selection process going forward.

Once key areas for access and infrastructure development are identified through the evaluation of geotechnical, as well as other important criteria, more focused review of these specific areas should be undertaken.

This will involve site specific desktop investigation, including review of any available geotechnical reports pertinent to these areas, possible API, site reconnaissance, and preliminary slope stability assessments. The results of this review should serve as a basis to further inform long term development plans, as well as highlight the geotechnical limitations, if any, for the proposed development concepts.

7. LIMITATION AND USE OF THIS REPORT

There is a possibility that this report may form part of the design and construction documents for information purposes. This report was issued before any final design or construction details have been prepared or issued. Therefore, differences may exist between the report recommendations and the final design, in the contract documents, or during construction. In such instances, Thurber Engineering Ltd. should be contacted immediately to address these differences.

Designers and contractors undertaking or bidding the work should examine the factual results of the investigation, satisfy themselves on the adequacy of the information for design and construction, and make their own interpretation of the data as it may affect their proposed scope of work, cost, schedule, safety, and equipment capabilities.



8. REFERENCES

- 1) Ramsey Ravine Trail Slumping (Two Locations), Government House Park, Edmonton, Alberta, Geotechnical Assessment and Conceptual Repair Options – Revised Report. Thurber Engineering, 2018.
- 2) City of Edmonton NRFP NO. 932509, Keillor Point Viewing Area, Geotechnical Drilling, Instrument Installation, and Monitoring Data Report. Thurber Engineering, 2018.
- 3) Mill Creek Pedestrian Bridges (B029, B032, B033, B198, B200) Replacements and Repairs, Geotechnical Investigation – Revision 1. Thurber Engineering, 2016.
- 4) Mill Creek Pedestrian Bridge B033 South Bank Slope Stabilization Using Micropiles, Thurber Engineering, 2017.
- 5) Edmonton Southeast LRT Expansion, Preliminary Study of the Stability of the North Valley Slope in Grierson Hill Slide Area. Thurber Engineering. 2012.
- 6) Louise McKinney Park Riverfront Plaza Expansion. Thurber Engineering, 2013.
- 7) Dawson Park/Kinnaird Ravine and Oleskiw Park Master Plans, Geotechnical Assessment. Edmonton, Alberta, 2017.
- 8) Riverside Trail Rehabilitation Geotechnical Assessment. Thurber Engineering, 2019.
- 9) Riverside Trail Instability West of Capilano Bridge, Edmonton, Alberta, Geotechnical Investigation and Preliminary Engineering Assessment. Thurber Engineering, 2021.



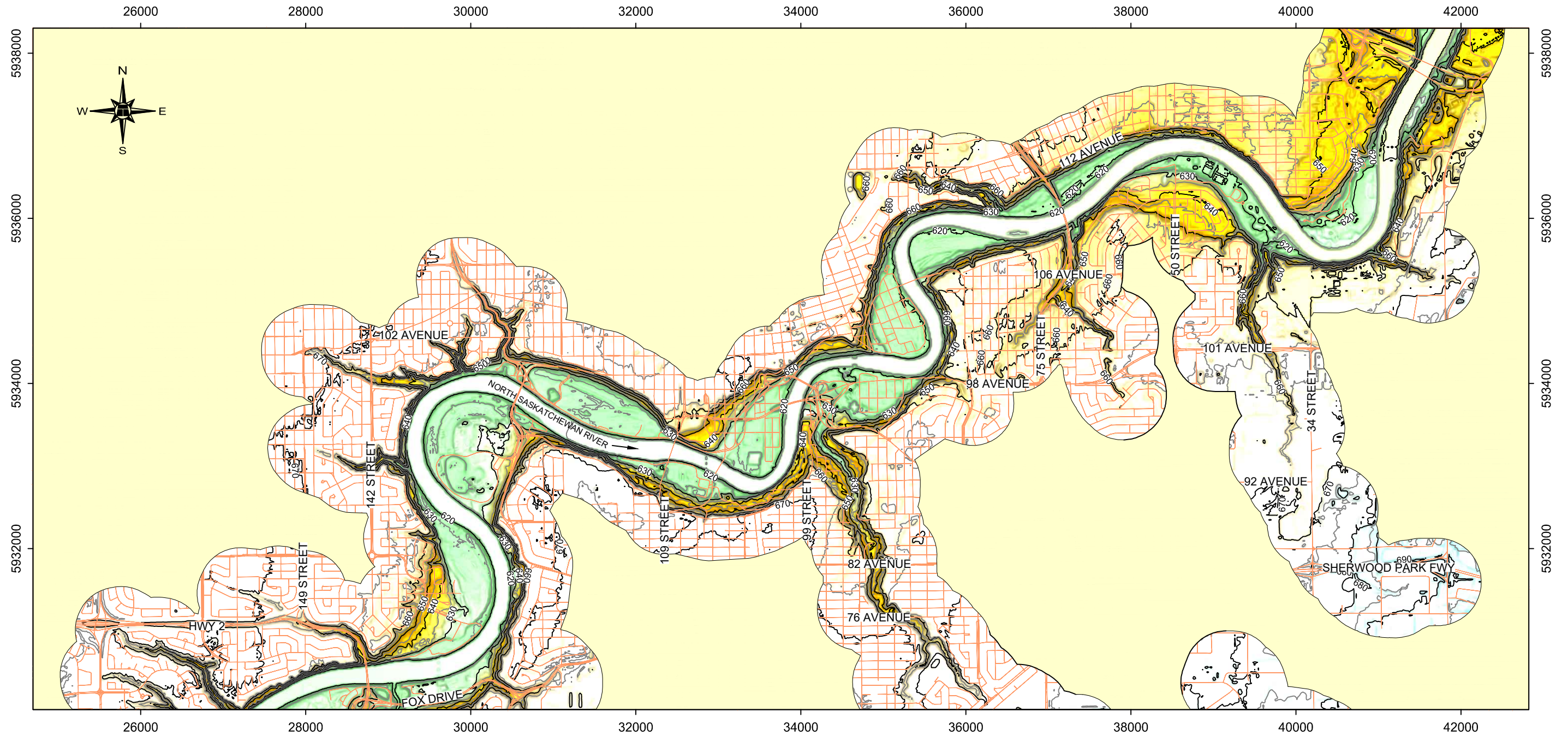
APPENDIX A

Drawing No. 29863-1 – Central Reach – Topography Map

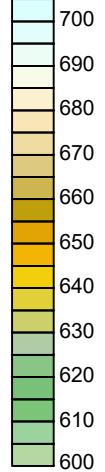
Drawing No. 29863-2 – Central Reach – Topography Slope Map

Drawing No. 29863-3A – Central Reach West – Surficial Geology and Geotechnical Hazard
Map


Drawing No. 29863-3B – Central Reach East – Surficial Geology and Geotechnical Hazard Map

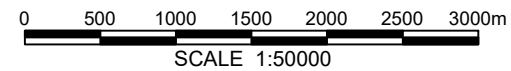


GROUND SURFACE
ELEVATIONS
(CONTOURS 5m)



LEGEND

 GROUND SURFACE CONTOUR
(CONTOUR INTERVAL = 5m)



SCALE 1:50000



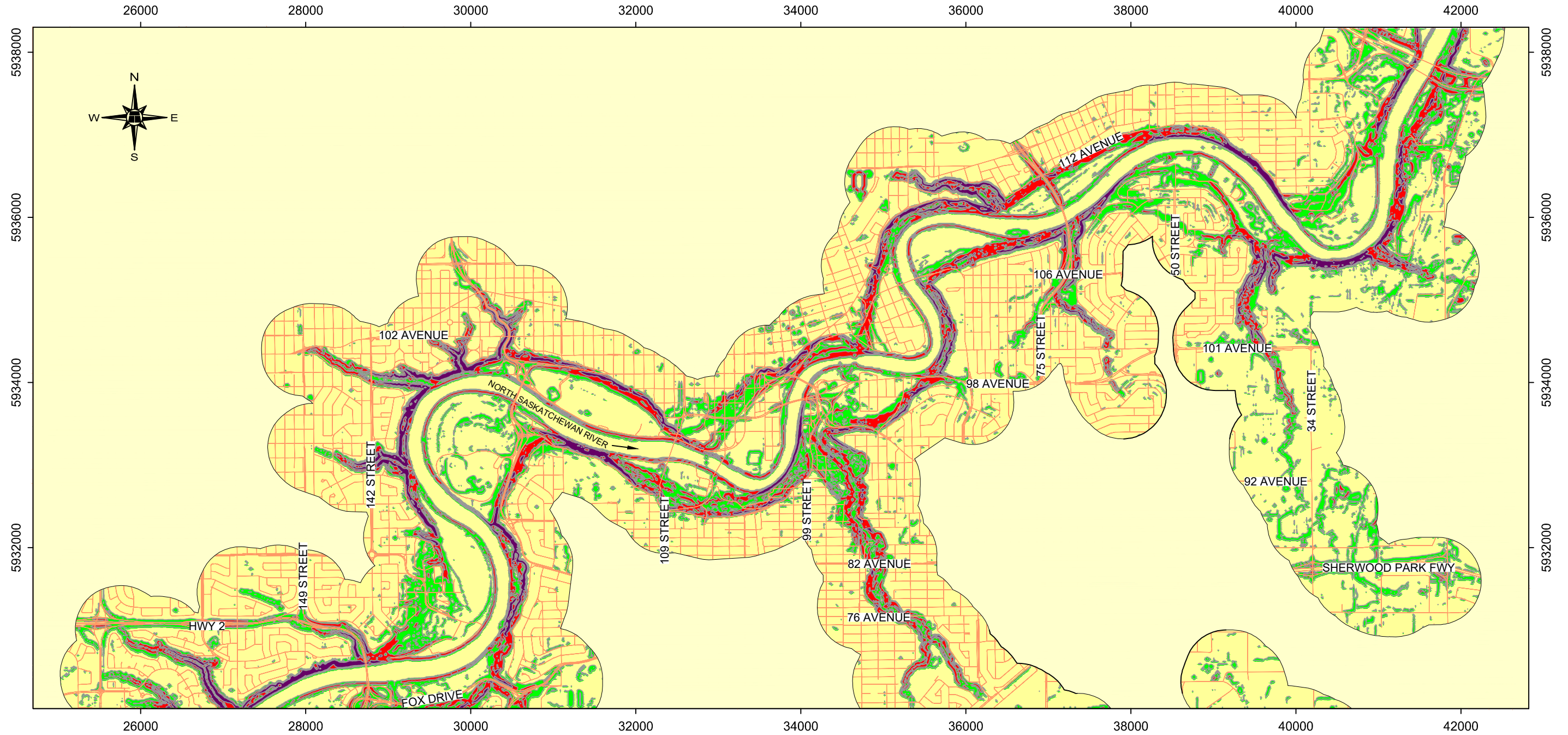
**GEOTECHNICAL DESKTOP STUDY
RIBBON OF GREEN AND NORTH SASKATCHEWAN
RIVER VALLEY AREA**

CENTRAL REACH - TOPOGRAPHY MAP

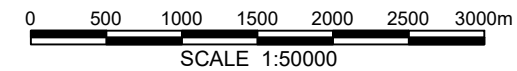
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DESIGNED BY	MLB
APPROVED BY	RWT
SCALE	1:50 000
DATE	MAY 2022
FILE No.	29863





GROUND SURFACE
SLOPE (DEGREES)






**GEOTECHNICAL DESKTOP STUDY
RIBBON OF GREEN AND NORTH SASKATCHEWAN
RIVER VALLEY AREA**

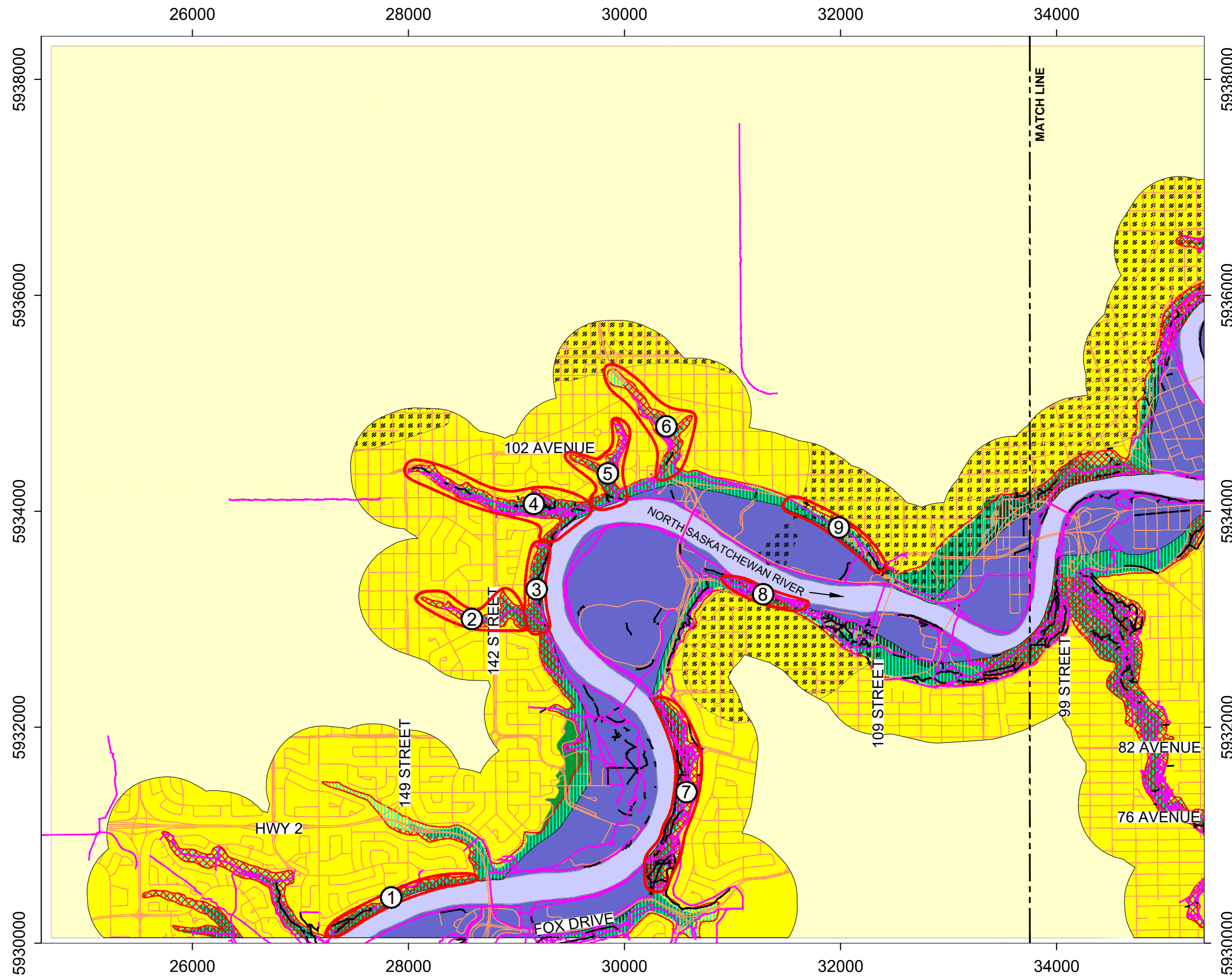
CENTRAL REACH - TOPOGRAPHY SLOPE MAP

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APPROVED BY	RWT
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FILE No.	29863

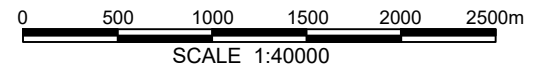



THURBER ENGINEERING LTD.



- LEGEND**
- MAJOR LANDSLIDE AREA
 - COLUVIUM
 - ALLUVIUM
 - GLACIOLACUSTRINE DEPOSITS
 - GLACIAL TILL DEPOSITS
 - EMPRESS FORMATION (SASKATCHEWAN SAND AND GRAVEL) EXTENT ORANGE COLOR WHERE FORMATION IS EXPOSED TO GROUND SURFACE.
 - BEDROCK
 - PREVIOUSLY IDENTIFIED AREA OF SLOPE INSTABILITY
 - INFORMAL TRAIL
 - TRAILFORKS

- ① RIO TERRACE/QUESNELL HEIGHTS
- ② MACKENZIE RAVINE
- ③ SLOPES BETWEEN MACKENZIE / MACKINNON RAVINES
- ④ MACKINNON RAVINE
- ⑤ RAMSEY RAVINE
- ⑥ GROAT ROAD RAVINE
- ⑦ KEILLOR ROAD / SASKATCHEWAN DRIVE
- ⑧ UNIVERSITY AREA/SASKATCHEWAN DRIVE
- ⑨ VICTORIA PARK HILL






**GEOTECHNICAL DESKTOP STUDY
RIBBON OF GREEN AND NORTH SASKATCHEWAN
RIVER VALLEY AREA**

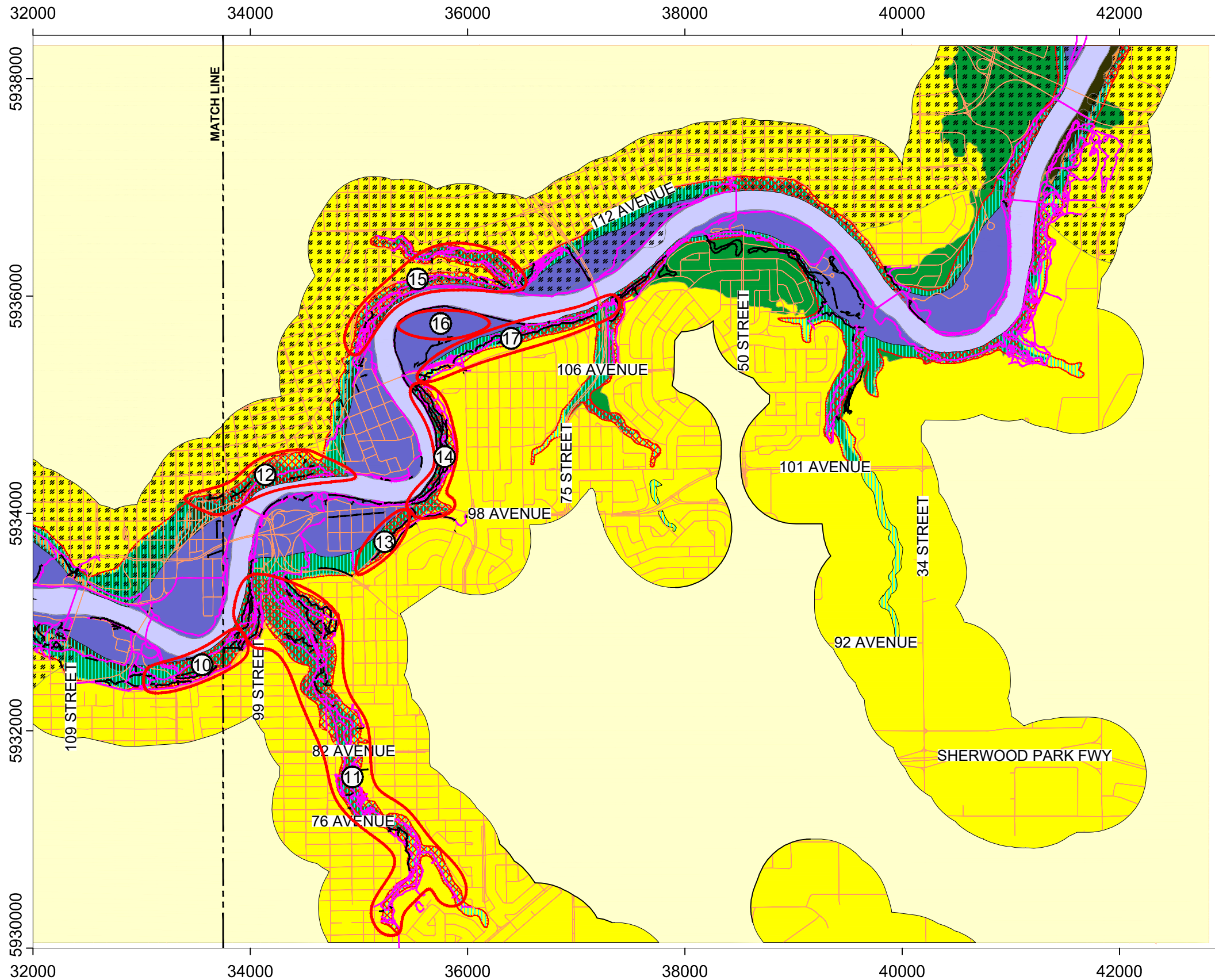
**CENTRAL REACH WEST - SURFICIAL GEOLOGY
AND GEOTECHNICAL HAZARD MAP**

DWG No. 29863-3A

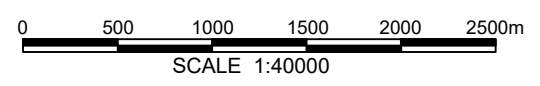
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APPROVED BY	RWT
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DATE	MARCH 2022
FILE No.	29863




THURBER ENGINEERING LTD.



- LEGEND**
- MAJOR LANDSLIDE AREA
 - COLUVIUM
 - ALLUVIUM
 - GLACIOLACUSTRINE DEPOSITS
 - GLACIAL TILL DEPOSITS
 - EMPRESS FORMATION (SASKATCHEWAN SAND AND GRAVEL) EXTENT ORANGE COLOR WHERE FORMATION IS EXPOSED TO GROUND SURFACE.
 - BEDROCK
 - PREVIOUSLY IDENTIFIED AREA OF SLOPE INSTABILITY
 - INFORMAL TRAIL
 - TRAILFORKS
 - 10 LAVIGNE SUBDIVISION/SKUNK HOLLOW / PIONEER CABIN
 - 11 MILL CREEK RAVINE
 - 12 GRIERSON HILL
 - 13 STATHEARN NEIGHBOURHOOD
 - 14 MCNALLY / FOREST HEIGHTS PARK
 - 15 KINNAIRD RAVINE / DAWSON PARK
 - 16 RIVERSIDE TRAIL
 - 17 ROWLAND ROAD / RIVERSIDE GOLF COURSE TRAIL






**GEOTECHNICAL DESKTOP STUDY
RIBBON OF GREEN AND NORTH SASKATCHEWAN
RIVER VALLEY AREA**

**CENTRAL REACH EAST - SURFICIAL GEOLOGY
AND GEOTECHNICAL HAZARD MAP**

DWG No. 29863-3B

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DESIGNED BY	MLB
APPROVED BY	RWT
SCALE	1:40 000
DATE	MARCH 2022
FILE No.	29863



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