March 2021

RED DEER RIVER HAZARD STUDY

Survey and Base Data Collection Report

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REPORT

Executive Summary

Alberta Environment and Parks (AEP) commissioned Golder Associates Ltd. (Golder) in August 2017 to conduct the Red Deer River Hazard Study. The primary purpose of the study is to assess and identify river and flood hazards along the Red Deer River reach from Township Road 380 to the Highway 11 Bridge, the Waskasoo Creek reach from the Highway 2A Bridge to its confluence with the Red Deer River, and the Piper Creek reach from Township Road 374 to its confluence with Waskasoo Creek. The study is being conducted under the provincial Flood Hazard Identification Program (FHIP), the goals of which include enhancement of public safety and reduction of future flood damages through the identification of river and flood hazards. Project stakeholders include the provincial government, local authorities, and the public. Key municipal stakeholders are the City of Red Deer, the Town of Penhold, Red Deer County, and Lacombe County.

The Red Deer River Hazard Study includes multiple components and deliverables. This report documents the methodology and results of the survey and base data collection component, which will support hydraulic modelling, flood mapping, flood risk assessment, and channel stability investigation components as part of this study. Tasks associated with this study component include cross section surveys on the Red Deer River, Waskasoo Creek, and Piper Creek as well as hydraulic and flood control structure data collection along the study reaches. Additional base data collected by Golder in support of the study includes administrative data, cadastral data, infrastructure data (bridges, roads, and culverts), benchmark surveys, and other relevant information.

Topographic, control point, and shallow-water surveys were performed using Real-time Kinematic (RTK) GPS units or a total station. Bathymetric surveys were conducted on the Red Deer River using an Acoustic Doppler Profiler (ADP) in combination with a boat-mounted RTK unit where flow depths were too deep to wade. Bridge survey data were collected using RTK or total station. A reflectorless total station was used to survey bridges that were unsafe to access due to traffic volumes.

The study area covers approximately 51 km reach of the Red Deer River, 33 km reach of Waskasoo Creek, and 18 km reach of Piper Creek through the City of Red Deer, Town of Penhold, Lacombe County, and Red Deer County. The features surveyed as a part of this study are summarized in Table i.

Table i: Summary of Survey Features in the Study Area

Feature	Number of Surveyed Cross Sections or Locations			
	Red Deer River	Waskasoo Creek	Piper Creek	Totals
Cross Sections	153	304	131	**588**
Bridges	9	35	8	**52**
Culverts	None	12	7	**19**
Flood Control Structures	2	4	None	**6**

Water levels were measured at each cross section, and discharge measurements were made at select locations along the study reaches. These hydraulic data will be used in this study to calibrate the hydraulic model for low-flow conditions.

Acknowledgements

This component of the Red Deer River Hazard Study was managed by Dr. Dejiang Long and Mr. Gaven Tang, both of Golder Associates Ltd. (Golder). Mr. Darren Shepherd of SG1 Water Consulting Ltd. (SG1) provided technical review to Golder during this study component. The field survey was conducted by Mr. Gaven Tang, Mr. Carmen Orosz, Ms. Anna-Maria Viaud, Mr. Hossein Kheirkhah Gildeh, Mr. Kyle Nontell, Mr. Mesgana Gizaw, and Mr. Michael De Coste, all of Golder.

The authors thank Trevor Poth and Andria Klatt from the City of Red Deer, Nancy McAteer from the Town of Penhold, and Eric Sanford from Tagish Engineering Ltd. for their involvement and input during the site reconnaissance on August 28, 2017 and for providing relevant project information.

The authors express their special thanks to Abdullah Mamun, project manager for Alberta Environment and Parks (AEP), who provided overall study management, background data, and technical guidance to Golder's team throughout the field program. The authors also express their gratitude to Peter Onyshko of AEP for his additional support and for providing background information and survey-related data.

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1.0 INTRODUCTION

1.1 Study Background

Alberta Environment and Parks (AEP) commissioned Golder Associates Ltd. (Golder) in August 2017 to conduct the Red Deer River Hazard Study. The study is being conducted under the provincial Flood Hazard Identification Program (FHIP), the goals of which include the enhancement of public safety and the reduction of future flood damages through the identification of river and flood hazards. Project stakeholders include the provincial government, local authorities, and the public. Key municipal stakeholders are the City of Red Deer, the Town of Penhold, Red Deer County, and Lacombe County.

This report documents the methodology and results of the survey and base data collection component, which will support hydraulic modelling, open water flood mapping, flood risk assessment, and channel stability investigation components as part of this study. Tasks associated with this component include cross section surveys, and hydraulic and flood control structure data collection on the Red Deer River, Waskasoo Creek, and Piper Creek. Additional base data collected by Golder in support of the study includes cadastral data, infrastructure data (bridges, roads, and culverts), benchmark surveys, and other relevant project information.

1.2 Study Objectives

The primary purpose of the study is to assess and identify river and flood hazards along the Red Deer River reach from Township Road 380 to the Highway 11 Bridge, the Waskasoo Creek reach from the Highway 2A Bridge to its confluence with the Red Deer River, and the Piper Creek reach from Township Road 374 to its confluence with Waskasoo Creek.

1.3 Study Area and Reaches

The study area covers approximately 51 km reach of the Red Deer River, 33 km reach of Waskasoo Creek, and 18 km reach of Piper Creek through the City of Red Deer, the Town of Penhold, Lacombe County, and Red Deer County. The study area is shown in Figure 1.

1.4 Scope of Work

The field program included the survey of river cross sections, hydraulic structures, flood control structures and other features. Base data collected for the study included infrastructure data (bridges, roads, and culverts), cadastral data, benchmark surveys and other relevant data.

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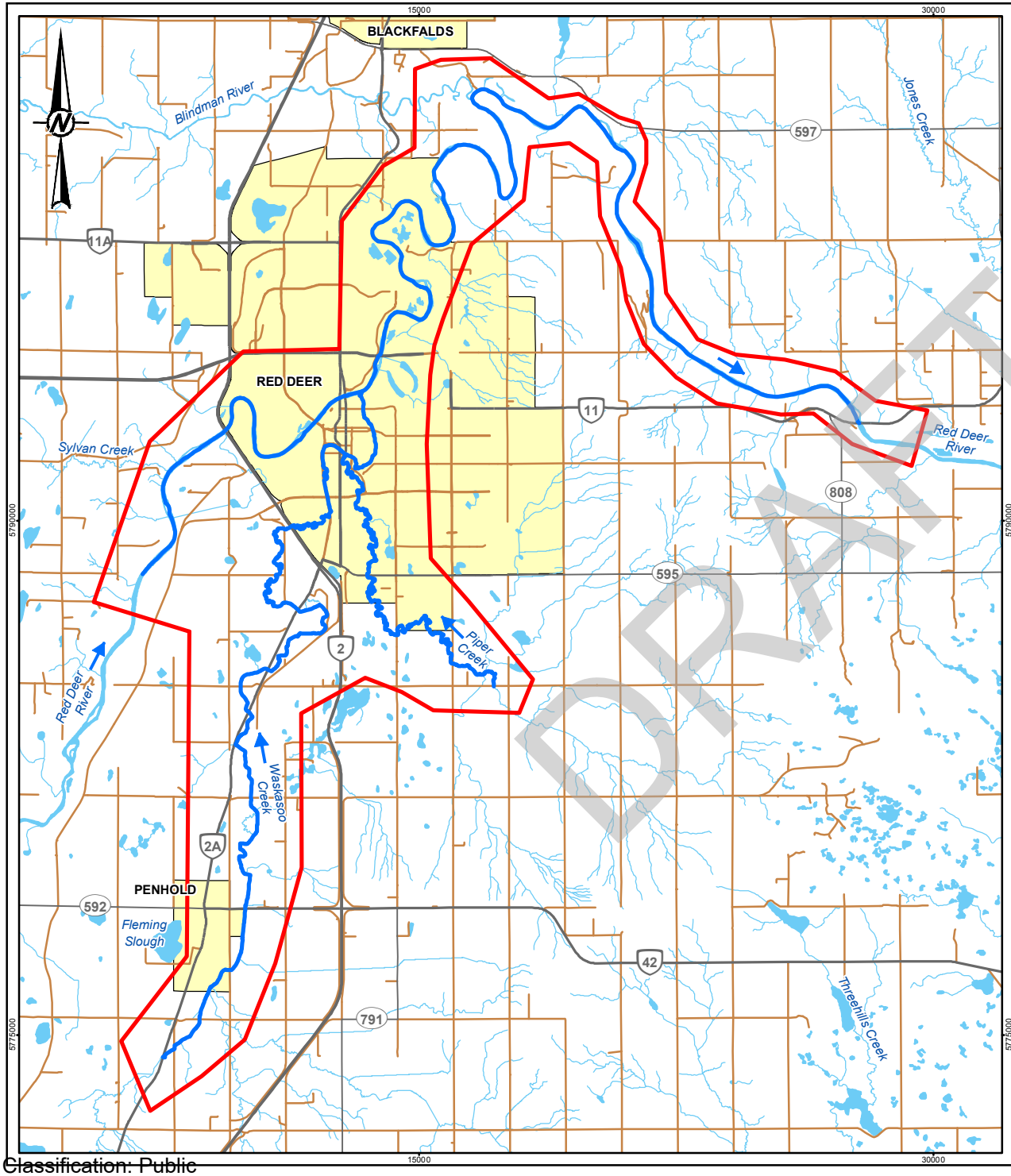

LEGEND

- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- LOCAL ROAD
- FLOW DIRECTION
- WATERCOURSE
- WATERBODY
- POPULATED PLACE
- SURVEY REACH
- RIVER HAZARD STUDY AREA

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REFERENCE(S)

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ROADS OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED. SPOT 6 IMAGERY PROVIDED BY CLIENT, CAPTURED 02/04/2016 & 15/08/2016.
DATUM: NAD 83 CSRS PROJECTION: 3TM 114

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

TITLE
LOCATION MAP OF STUDY AREA

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-11
DESIGNED	G.TANG
PREPARED	B.PENDERGAST
REVIEWED	D.SHEPHERD
APPROVED	D.LONG

PROJECT NO.	CONTROL	REV.	FIGURE
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2.0 SURVEY PROGRAM AND DATA

2.1 General

The survey of cross sections, hydraulic structures and flood control structures within the study area was conducted between August 29 and November 4, 2017. In addition, some temporary benchmarks associated with AEP's 2013 Red Deer River highwater mark surveys were surveyed. Water levels were measured at each cross section. Discharge measurements were made at suitable, selected locations during the field program to assist with calibration of the hydraulic model that will be created later in this study.

2.2 Procedures and Methodology

2.2.1 Topographic, Bathymetric and Structure Surveys

The following survey equipment was used to collect the topographic, bathymetric, and structure data for this study:

- **Real-time Kinematic (RTK) GPS** – Trimble R8® and R10® RTK units were used to survey ground features and river bed levels in areas where hydraulic conditions allowed the surveyors to wade the channel. The RTK units were also used to survey the control points and benchmarks found within the study area and to survey the flood control structures and portions of the bridge structures.
- **Acoustic Doppler Profiler (ADP)** – A SonTek RiverSurveyor M9® was used in combination with a boat-mounted RTK unit to survey deep sections of the Red Deer River.
- **Total Station** – A Nikon Nivo 5M® total station was used to collect cross section data in some of the study areas (primarily on Waskasoo Creek and Piper Creek) where vegetation was too dense to receive sufficient satellite reception by the RTK GPS. This total station was also used in reflectorless mode to survey inaccessible bridges (i.e., railway and highway bridges).

All of the survey data collected for this study was referenced to the Alberta Survey Control Network using Alberta Survey Control Markers (ASCMs). The entire study area is covered by the Can-Net Virtual Reference System (VRS) (2016) Network, which was used to provide network-corrected data via a cellular network to define horizontal and vertical positions to within ±0.02 m. When Can-Net was used, each RTK rover was calibrated daily to an ASCM or a Golder-established temporary benchmark that had been tied to an ASCM.

Most of the survey data was acquired by RTK rover units with pre-loaded geoid files. The RTK data output for this study provides an orthometric elevation with correct northing and easting coordinates. All survey data was collected in the 3TM coordinate system with the Meridian at 114° W and referenced to NAD83 (CSRS) horizontal and CGVD28 vertical datum. Ellipsoidal heights are transformed to CGVD28 orthometric heights using the HTv2.0 geoid model. Survey data collected on Gleniffer Lake using the ADP/RTK combination was collected in UTM coordinates and projected into the 3TM 114° W coordinate system.

The total station was used in two ways: (i) with a prism mounted on a survey rod, and (ii) in reflectorless mode (without a prism). Method (i) was used to collect survey points for cross sections with obstructed views of the sky. Method (ii) was used to collect survey points of hydraulic structures where it is impractical or unsafe for a rod person to walk.

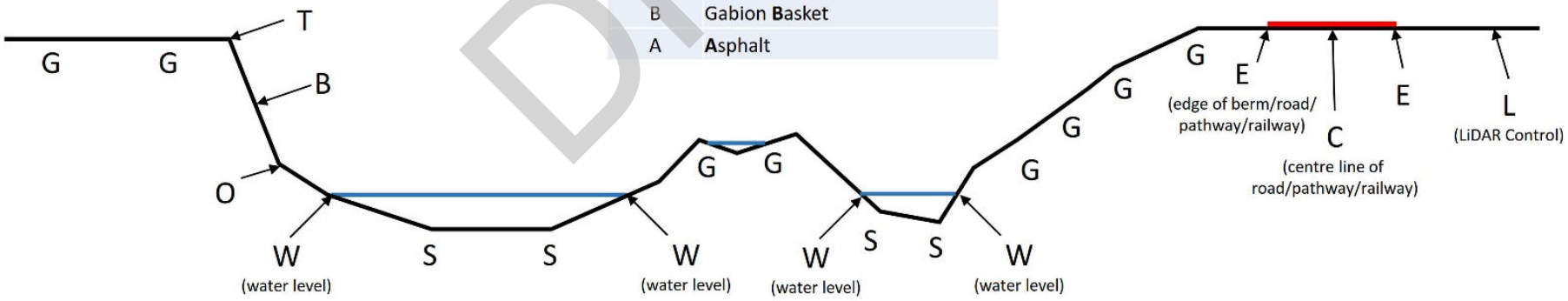
Survey Codes for RTK GPS River Surveys (No Structures)

Purpose: - Create common definitions for survey points collected in the field for easier data processing in the office
- Reduce confusion or uncertainty for field staff regarding coding of points

Location Code	
G	**G**round
T	**T**op of Bank
B	**B**ank
O	T**o**e of Bank
W	**W**ater Level
S	**S**tream Bottom (under water)
E	**E**dge of Road/Berm/Pathway/Railway
C	**C**entre Line of Road/Berm/Pathway/Railway
L	**L**iDAR control point

Material Code	
1	Mud/Silt (<0.063 mm)
2	Sand (0.063 mm - 2 mm)
3	Gravel (2 mm - 6.4 cm)
4	Cobble (6.4 cm - 25 cm)
5	Boulder (> 25 cm)
6	Bedrock
C	**C**oncrete
G	**G**rass
R	**R**iprap
T	**T**rees (large, trunk > 10 cm)
W	**W**illows and Shrubs
B	Gabion **B**asket
A	**A**sphalt

Examples	
G2	Ground, Sand
G4	Ground, Cobble
W3	Water Level, Gravel
GG	Ground, Grass
GT	Ground, Trees
CA	Centre Line, Asphalt
BR	Bank, Riprap
LC	LiDAR control, Concrete



Version 0, August 25, 2017 Golder Associates Ltd. Wolf Ploeger

Figure 2: Schematic of Survey Point Locations and Code Descriptions

Use of a total station requires that a minimum of two temporary benchmarks be established in the vicinity via RTK. The steps used to set up the total station are critical to ensure quality data from the instrument. The total station is set up over one of the temporary benchmarks. Then the other temporary benchmark is sighted and used as a backsight. The coordinates are then checked for errors by comparing the coordinates established by RTK and the coordinates output by the total station. During the total station survey, checks are performed to ensure proper prism heights and offsets. The survey is closed by sighting the temporary benchmark backsight. Where possible, points recorded from different setups of the total station and points from RTK are compared to confirm that the two survey methods agree with each other.

Each survey point collected using either the RTK or total station was attributed a specific code. A schematic of survey point codes and corresponding locations is shown in Figure 2, which includes a complete list of survey codes for the RTK and total station.

The quality and accuracy of all survey data was checked using a Trimble data extraction and processing tool. All survey data was imported into Global Mapper to allow for validation and further processing. Data with horizontal or vertical accuracies of less than ±0.05 m was rejected. Daily quality and accuracy checks were completed in the office.

In addition to the quality assurance and quality control (QA/QC) procedures for field data collection, the survey data was checked in Esri ArcGIS® for outliers and through visual inspection of triangulated irregular network (TIN) surfaces developed from the survey data. Similar procedures were applied to ensure concurrence among all datasets collected on different dates and using different types of survey equipment.

Channel Cross Section Surveys

The channel data were collected by surveying cross sections approximately perpendicular to the direction of the flow. The majority of the cross sections on the Red Deer River were surveyed by boat. All of the cross sections along Waskasoo Creek and Piper Creek were surveyed by wading.

The following procedures were applied when carrying out a bathymetric survey by wading:

- Set up the RTK-GPS base station if Can-net coverage was not available or did not provide sufficient accuracy.
- RTK rover units were used to collect cross-sectional information from a location approximately 2 to 5 m beyond the top of bank on one side of the channel to a location approximately 2 to 5 m beyond the top of bank on the other side. A minimum of 20 points were established across the channel and care was taken to reference points where the transverse bed slope changed significantly.
- In areas with dense vegetation, a total station was used to collect the cross section information.
- Special attention was paid to surveying topographic slope breaks along the banks.
- Each of the surveyed data points was attributed with field codes that described substrate and vegetation types.
- The water surface elevation was surveyed where the water made contact with both banks. In case of the braided channels, water surface points were surveyed for each channel.

The boat survey method for most of the Red Deer River reach involved the following:

- The ADP was mounted onto a frame, which was fastened to the side of the river boat. Once the ADP was securely mounted on the boat, it was deployed in the water and the distance from the middle sensor to the water surface was measured using a standard tape measure.
- The RTK unit was attached to the top of the ADP mount at a measured offset from the water surface. This offset was measured and recorded on a daily basis.
- The ADP and RTK units were connected to a laptop data acquisition system that provided data storage and a real-time display of the position and data being collected. The RiverSurveyor Live® system was checked to make sure that both units were communicating properly and data was being stored.
- A short calibration profile was run at the beginning of each day to verify that both the ADP offset and the level of the sounding head below the water surface remained consistent while the boat was in motion. Furthermore, the sounding depths were verified by direct measurements during the calibration process.
- The bathymetric data were collected using the ADP and RTK units at a frequency of one Hertz along each cross section (i.e., a data point was collected every second). At a nominal boat speed of 0.75 m/s, this would correspond to a measured depth at intervals of approximately 0.75 m.
- Bank topographic data were obtained using RTK rover units, as described above.
- Water surface elevations were surveyed at all points where the water made contact with the bank.

Processing of the data collected using ADP and RTK included the following steps:

- Data were sorted using the 3TM (or UTM) easting values and any points with 3TM (or UTM) coordinates of zero were removed.
- Data were sorted by altitude, which corresponds to the elevation value supplied to the ADP from the RTK unit (instrument offsets were applied to the data during post-processing).
- Data were sorted by combined depth and anomalous depths were discarded.
- Data were sorted by difference between the vertical beam (VB) depth and the averaged bottom track (BT) depth. The BT depth was used in cases where the VB returned an inaccurate value (i.e., shallow areas).
- Data were sorted by mean velocity. The ADP returns a value of zero when it cannot compute a flow velocity and vector. These values were removed, and the rest of the values within the data set were retained.

In total, less than five percent of the collected survey data points were removed during the above-mentioned process.

Hydraulic Structures

Hydraulic structures within the study area that could affect channel conveyance and water levels include bridges and culverts. The features of each bridge that were surveyed include the following:

- length of span (corner points, abutment-to-abutment)
- width of bridge (corner points, outside-to-outside)
- top of curb or solid guard rail elevations
- low chord elevations
- number and width of piers
- location of piers and the distance of each pier relative to the abutment
- type of piers (e.g., concrete, pile bent)
- shape of pier (e.g., square nose, round nose, sharp nose, cylindrical)
- top of roadway (or path) profile

The features of each culvert that were surveyed include the following:

- culvert type
- culvert shape
- entrance conditions
- culvert dimensions
- upstream and downstream invert elevations

The hydraulic structures were surveyed using RTK-GPS and measuring tape. Geo-located photos of each structure were taken during the survey.

Flood Control Structures

Flood control structures located along the Red Deer River and Waskasoo Creek were surveyed using an RTK-GPS to verify as-built elevations and to characterize their typical cross-sectional geometry. Survey data were collected along the crest(s) of each flood control structure at regular intervals of approximately 20 m to 30 m. In addition, a number of cross sections were surveyed along the structure lengths. Geo-located photos of all flood control structures were taken by the surveyor.

2.2.2 Discharge and Water Level Measurements

River flows and corresponding water levels along the various study reaches were measured to provide additional data to support the low-flow hydraulic model calibration. The flow data also provides a check on the provisional data obtained from the online database provided by Water Survey of Canada (WSC).

The figures of Appendix A show the locations where flows were measured on the Red Deer River, Waskasoo Creek, and Piper Creek. The Red Deer River was relatively shallow near its banks and was deeper near the thalweg, requiring a boat to cross. Flow measurements were taken at opportunistic locations. Waskasoo Creek and Piper Creek had no flow within the upper reaches of the study area. Flow measurements on these creeks were only performed at a limited number of locations within the lower reaches.

All flow measurements on the Red Deer River were performed using a SonTek M9® Acoustic Doppler Profiler (ADP) in combination with an RTK mounted on a boat. A minimum of four discharge measurements across the channel were taken, with a maximum variation of five percent between each measurement. The measurements were further processed in the office to obtain an average flow value.

All flow measurements along Waskasoo Creek and Piper Creek were performed by wading the channel with a handheld SonTek FlowTracker2® ADV and top-set wading rod in accordance with standard WSC protocols, including: (i) selecting a suitable measurement location; (ii) choosing an even number of transects with equal left bank to right transects and right bank to left transects; and (iii) ensuring that the data set of each transect was within a maximum standard deviation of five percent. The measurement procedure involved the following:

- Survey points were selected to result in a minimum of 20 panels (flow segments across the stream thus requiring a minimum of 21 velocity measurement points).
- Velocity readings were taken at 0.6 of the total depth at measurement locations since flow depth was less than 1.0 m in all cases.
- Survey points were selected such that no panel discharge exceeded 10 percent of the total discharge (six panels were within the 5 to 10 percent range; the remaining 17 panels were all less than five percent).

A summary of collected discharge measurements is in Section 2.7.

2.3 Cross Sections

The study area covered a 51 km long reach of the Red Deer River (from Township Road 380 to the Highway 11 Bridge), a 33 km long reach of Waskasoo Creek (from the Highway 2A Bridge to its confluence with the Red Deer River), and an 18 km long reach of Piper Creek (from Township Road 374 to its confluence with Waskasoo Creek). A total of 588 cross sections were surveyed as part of the field program. A summary of the surveyed river cross sections in the study area is provided in Table 1. An overview of the surveyed cross section locations is provided in Appendix B.

Table 1: Surveyed Cross Sections within the Study Area

Waterbody	Reach Description	Cross Section ID	Number of Cross Sections[(1)]	Average Cross Section Spacing (m)
Red Deer River	Above Discovery Canyon Pedestrian Bridge	R1 to R68	68	275
	Below Discovery Canyon Pedestrian Bridge	R69 to R153	85	384
Waskasoo Creek	Above Confluence with Piper Creek	W1 to W252	254	121
	Below Confluence with Piper Creek	W253 to W300	50	70
Piper Creek	Piper Creek	P1 to P126	131	145

Notes: [(1)]The number of cross sections includes those surveyed immediately upstream and downstream of each bridge.

2.4 Longitudinal Profiles

Appendix A contains plots of the surveyed main channel thalweg of each river reach and the water levels measured during the cross section survey within the study area.

2.5 Hydraulic Structures

2.5.1 Bridges

There are a total of 52 bridge crossings within the study area, including 9 bridges on the Red Deer River, 35 bridges on Waskasoo Creek, and 8 bridges on Piper Creek. A summary of the bridges within the study area is provided in Table 2.

Bridge locations are shown in the map sheets provided in Appendix B. Summary datasheets that include site photos, survey data point locations, and detailed information with regard to the bridge deck and piers are provided in Appendix C.

The bridge data (i.e., detailed design and/or as-built survey drawings) were obtained from AEP through Alberta Transportation and the City of Red Deer, but are not included in this report.

Table 2: Bridges within Study Area

Waterbody	Location	Name / Identifier	Preliminary River Station (m)	Bridge Type	Number of Spans	Corresponding Figure No.
Red Deer River	R16-R17	CP Rail Bridge	45304.6	Railway	3	C-1
	R18-R19	Red Deer Bypass (Queen Elizabeth II Highway) Northbound and Southbound Bridges	45226	Traffic	4	C-2
	R28-R29	Heritage Ranch Pedestrian Bridge	42405.7	Pedestrian	4	C-3
	R37-R38	Taylor Drive Northbound and Southbound Bridges	40110.1	Traffic	5	C-4
	R41-R42	CP Rail (58 Street) Pedestrian Bridge	39335.7	Pedestrian	4	C-5
	R44-R45	50 Avenue (Gaetz Avenue) Bridge	39104.7	Traffic	6	C-6
	R47-R48	49 Avenue Bridge	38935.2	Traffic	5	C-7
	R54-R55	67 Street (David Thompson Highway) Bridge	37212.2	Traffic	5	C-8
	R68-R69	Riverbend (Discovery Canyon) Pedestrian Bridge	32344.3	Pedestrian	3	C-9
Waskasoo Creek	W13-W14	Township Road 364 Bridge	32520.2	Traffic	1	C-11
	W29-W30	Range Road 280 Bridge	30692.9	Traffic	1	C-14
	W44-W45	Highway 42 Bridge	28772.8	Traffic	2	C-15
	W61-W62	Private Bridge	26363.2	Traffic	1	C-16
	W73-W74	Township Road 372 Bridge	24744.3	Traffic	1	C-17
	W75-W76	Private Bridge	24672.3	Traffic	1	C-18
	W98-W99	Highway 2A Bridge	21753.5	Traffic	1	C-20
	W100-W101	CP Rail Bridge	21687.2	Railway	1	C-21
	W106-W107	Township Road 374 Bridge	20903.8	Traffic	1	C-22
	W114-W115	CP Rail Bridge	19859.6	Railway	1	C-23
	W115-W116	Highway 2A Bridge	19824.5	Traffic	1	C-24
	W118-W119	Private Bridge	19574.1	Traffic	1	C-25

Table 2: Bridges within Study Area

Waterbody	Location	Name / Identifier	Preliminary River Station (m)	Bridge Type	Number of Spans	Corresponding Figure No.
Waskasoo Creek	W123-W124	Private Bridge	19060.4	Traffic	1	C-26
	W130-W131	Lantern Street Bridge	18265.4	Traffic	1	C-27
	W137-W138	Township Road 375 Bridge	17263.4	Traffic	2	C-28
	W149-W150	Highway 2A Bridge	15582.3	Traffic	1	C-29
	W150-W151	CP Rail Bridge	15548	Railway	1	C-30
	W154-W155	Range Road 275 Bridge	15128.2	Traffic	2	C-31
	W173-W174	Township Road 380 Bridge	12441.3	Traffic	1	C-33
	W180-W181	Private Bridge	11276.6	Traffic	1	C-34
	W192-W193	Range Road 275 Bridge	9467.7	Traffic	1	C-35
	W196-W197	Highway 2 Bridge	9248.2	Traffic	1	C-37
	W201-W202	Private Bridge	8592.4	Traffic	1	C-38
	W230-W231	ACR Trail South Pedestrian Bridge	5116.7	Pedestrian	1	C-42
	W233-W234	ACR Trail North Pedestrian Bridge	4919.6	Pedestrian	1	C-43
	W247-W248	50 Avenue (Gaetz Avenue) Bridge[1]	3738	Traffic	1	C-46
	W250-W251	49 Avenue Bridge	3547.6	Traffic	1	C-47
	W265-W266	Barrett Park South Pedestrian Bridge	2440.7	Pedestrian	1	C-49
	W270-W271	Barrett Park North Pedestrian Bridge	1983.4	Pedestrian	1	C-50
	W279-W280	Ross Street Eastbound and Westbound Bridges	1310.4	Traffic	1	C-51
	W281-W282	Coronation Park South Pedestrian Bridge	1242.7	Pedestrian	1	C-52
	W285-W286	Coronation Park North Pedestrian Bridge	968.7	Pedestrian	4	C-53
	W288-W289	53 Street Bridge	820.9	Traffic	3	C-54
	W291-W292	55 Street Bridge	588.2	Traffic	1	C-55
	W298-W299	Gaetz Park Pedestrian Bridge	147.2	Pedestrian	1	C-56
Piper Creek	P14-P15	Range Road 272 Bridge	16807.2	Traffic	1	C-58
	P81-P82	Bannerman Close Pedestrian Bridge	6095.3	Pedestrian	1	C-63
	P99-P100	Bower Woods East-West Pedestrian Bridge	3351.8	Pedestrian	1	C-64
	P103-P104	Bower Woods North-South Pedestrian Bridge	2870.2	Pedestrian	1	C-65
	P112-P113	Kin Canyon South Pedestrian Bridge	1634.1	Pedestrian	1	C-67
	P116-P117	Kin Canyon North Pedestrian Bridge	1173.7	Pedestrian	1	C-68
	P121A-P121B	Rotary Picnic Park South Pedestrian Bridge	555.1	Pedestrian	1	C-69
	P122A-P122B	Rotary Picnic Park North Pedestrian Bridge	362.6	Pedestrian	1	C-70

Note: The River Station is described as preliminary because it is subject to change during the Hydraulic Modelling component, as more detailed river centerlines are digitized.

[1] The 50 Avenue (Gaetz Avenue) Bridge on the Waskasoo Creek was surveyed and modelled as a bridge in the Study. It is acknowledged that the City of Red Deer recognizes this structure as a culvert.

2.5.2 Culverts

There are a total of 19 culvert crossings within the study area, including 12 culverts on Waskasoo Creek and 7 culverts on Piper Creek. A summary of the culverts within the study area is provided in Table 3.

Culvert locations are shown in the map sheets provided in Appendix B. The summary datasheets of Appendix C include site photos, survey data point locations, and detailed information with regard to the culvert configurations.

Table 3: Culverts within the Study Area

Waterbody	Location	Name / Identifier	Preliminary River Station (m)	Number of Culverts	Inside Diameter (m)	Culvert Type	Culvert Shape	Corresponding Figure No.
Waskasoo Creek	W4-W5	Range Road 281 Culvert	33745.1	1	0.9	Pipe	Circular	C-10
	W19-W20	Private Culvert	31730.2	1	2.5	Pipe	Circular	C-12
	W26-W27	Private Culvert	30951.4	4	0.5	Pipe	Circular	C-13
					0.7	Pipe	Circular	
					0.7	Pipe	Circular	
					0.5	Pipe	Circular	
	W92-W93	Private Culvert	22452.4	1	1.5	Pipe	Circular	C-19
	W161-W162	Private Culvert	14239.5	2	1.6	Pipe	Circular	C-32
					2.1	Pipe	Circular	
	W194-W195	CP Rail Culvert	9346.9	2	3.0	Pipe	Circular	C-36
					3.0	Pipe	Circular	
	W214-W215	Taylor Drive Culvert	6698.0	1	4.5 (W) x 2.8 (H)	Pipe	Ellipse	C-39
	W220-W221	32 Street Culvert	6198.6	1	3.4	Pipe	Circular	C-40
	W224-W225	34 Street Culvert	5790.5	1	3.2	Pipe	Circular	C-41
	W237-W238	43 Street Culvert	4423.2	1	3.7 (W) x 2.4 (H)	Pipe	Ellipse	C-44
	W243-W244	52 Avenue & 45 Street Loop Culvert	4072.5	2	3.0 (W) x 2.0 (H)	Box	Box	C-45
					3.0 (W) x 2.0 (H)	Box	Box	
	W255-W256	48 Avenue Culvert	3322.2	3	3.6 (W) x 2.8 (H)	Box	Box	C-48
					3.6 (W) x 2.8 (H)	Box	Box	
					3.6 (W) x 2.8 (H)	Box	Box	
Piper Creek	P6-P7	Private Culvert	17126.4	1	1.4	Pipe	Circular	C-57
	P45-P46	40 Avenue Culvert	11783.7	2	2.2	Pipe	Circular	C-59
					2.2	Pipe	Circular	
	P48-P49	Private Culvert	11506.9	2	1.8	Pipe	Circular	C-60
					1.8	Pipe	Circular	
	P52-P53	Private Culvert	10977.4	1	2.2	Pipe	Circular	C-61
	P73-P74	Delburne Road (19 Street) Culvert	7201.1	2	2.2	Pipe	Circular	C-62
					2.2	Pipe	Circular	
	P109-P110	32 Street Culvert	2172.3	3	3.0 (W) x 2.5 (H)	Box	Box	C-66
					3.1 (W) x 2.8 (H)	Box	Box	
					3.1 (W) x 2.8 (H)	Box	Box	
	P125-P126	43 Street Culvert	46.7	2	3.0 (W) x 2.0 (H)	Pipe	Ellipse	C-71
					3.0 (W) x 2.0 (H)	Pipe	Ellipse	

2.6 Flood Control Structures

A summary of flood control structures within the study area is provided in Table 4. The locations of the flood control structures are shown in Appendix B. The summary datasheets for the various flood control structures are provided in Appendix D.

Table 4: Flood Control Structures within Study Area

Waterbody	Name	Approximate Length (m)	Side of River[(1)]	Type	Corresponding Figure No.
Red Deer River	McKenzie Trails Berm	280	Right	Retaining Structure	D-1
	City of Red Deer Wastewater Treatment Plant Dike	1514	Left	Access Road	D-2
Waskasoo Creek	Penhold Dike #1	998	Left	Road	D-3
	Penhold Dike #2	868	Left	Retaining Structure	D-4
	Safeway Dike	160	Left	Retaining Structure	D-5
	Baymont Dike	80	Left	Retaining Structure	D-6

Note: [(1)]Left or right refers to the direction as seen by an observer looking downstream.

2.7 Discharge Measurements

River discharges were measured (as described in Section 2.2.2) to provide additional data to support the low-flow hydraulic model calibration. The flow data were also used as a check on the provisional data obtained from the online database provided by Water Survey of Canada (WSC) for the following gauges:

- Red Deer River at Red Deer (WSC 05CC002)
- Waskasoo Creek at Red Deer (WSC 05CC011)
- Blindman River Near Blackfalds (WSC 05CC001)

A total of 13 flow measurements were performed throughout the survey, including 7 on the Red Deer River, 4 on Waskasoo Creek, and 2 on Piper Creek. The measured flows were compared to the preliminary flow data from WSC (Table 5).

Table 5: Comparison between Measured and WSC Flow Data

Stream	Date	Location	Discharge (m^3/s)		Difference between WSC and Measured Flows		Corresponding WSC Gauges
			Measured during Survey	WSC Gauge	(m^3/s)	(%)	
Red Deer River	Sep. 24, 2017	R12	20.76	21.1	0.34	1.6%	05CC002
	Sep. 27, 2017	R50	21.37	22.12	0.76	3.5%	05CC002, 05CC011
	Sep. 25, 2017	R94	23.27	22.13	-1.14	-4.9%	05CC002, 05CC011
	Sep. 17, 2017	R103	24.05	22.72	-1.33	-5.5%	05CC002, 05CC011
	Sep. 18, 2017	R121-R122	24.32	23.74	-0.58	-2.4%	05CC002, 05CC011, 05CC001
	Sep. 19, 2017	R128	21.87	21.52	-0.36	-1.6%	05CC002, 05CC011, 05CC001
	Sep. 16, 2017	R143	22.65	22.83	0.18	0.8%	05CC002, 05CC011, 05CC001
Waskasoo Creek	Sep. 14, 2017	W219	0.02	N/A	N/A	N/A	N/A
	Sep. 15, 2017	W243	0.02	N/A	N/A	N/A	N/A
	Sep. 16, 2017	W264	0.038	0.034	-0.004	-10.5%	05CC011
	Sep. 13, 2017	W295	1.37	0.74	-0.63	-46.1%	05CC011
Piper Creek	Sep. 20, 2017	P99	0.11	N/A	N/A	N/A	N/A
	Sep. 21, 2017	P125	0.27	N/A	N/A	N/A	N/A

Note: WSC gauge discharge values are preliminary and are subject to change. These values are calculated as the sum of preliminary mean daily discharge values from relevant contributing WSC gauges.

The sum of flows reported by WSC for the contributing streams on the Red Deer River are 5.5% lower to 3.5% higher than the flow measurements made by Golder during the survey period. Sources of the differences may include the following:

- There were few locations that were considered suitable for flow measurements, particularly on Waskasoo Creek. Even at the locations where the flow measurement were made, there were still relatively large portions of the channel cross sections that were too shallow to measure any flow.
- The preliminary flows posted by WSC are provisional at this time and may be subject to change when manually reviewed and corrected by WSC.
- There are storm outfalls that feed into the Red Deer River and Waskasoo Creek. During the discharge measurement, these outfalls might have been discharging and contributing to a slightly elevated flow in the Red Deer River or Waskasoo Creek. This particularly affects flow measurements downstream of the Red Deer River gauging station. This might also affect flow measurement downstream of the Waskasoo Creek confluence if stormwater had been discharged downstream of the gauge on Waskasoo Creek (WSC 05CC011).

The sum of flows reported by WSC on Waskasoo Creek downstream of its confluence with Piper Creek (WSC 05CC011) are 10.5 to 46.1 percent lower than the flows measured by Golder over the survey period. These relatively large differences between the WSC and Golder's values may be attributed to the following:

- The preliminary flows posted by WSC are provisional at this time and may be subject to change when manually reviewed and corrected by WSC.

- The flow values reported by WSC may not be directly measured but estimated using the flow rating curve. Such estimation may introduce large error particularly during low flow conditions.

WSC flow data were not available for comparison with the flow measurements on Piper Creek and on Waskasoo Creek upstream of its confluence with Piper Creek.

2.8 Survey Standards and Accuracy

The accuracy of the points collected using the RTK system in conjunction with Can-Net's VRS network is considered to be within ±0.02 m in both horizontal and vertical directions. The spatial position and elevation of each RTK rover unit was calibrated daily to an Alberta Survey Control Marker (ASCM) benchmark or a temporary benchmark tied to an ASCM. Furthermore, the daily survey protocol required that the field crews calibrate to and then open and close at an ASCM benchmark or a temporary benchmark to maintain a ±0.02 m level of accuracy.

The RTK data collectors were set to provide a warning when calculated maximum error exceeded 0.05 m for a manually-recorded point. When notified, the survey technician would attempt collecting the point again at the same location or adjust their location slightly with the goal of decreasing the calculated error to below 0.05 m. All RTK collected survey data was analyzed in the office using a Trimble tool to check the accuracy of each point. The relatively small number of points with less than 0.05 m horizontal or vertical accuracy were deleted.

Some of the cross sections were surveyed using a total station that was set up over temporary benchmarks established using the RTK. The temporary benchmark setup and total station accuracy are considered to have a combined accuracy level of ±0.05 m or less. The exact accuracy for each point varied in proportion to the distance between the target and the survey instrument.

The bathymetric surveys conducted from the river boat using the RTK-ADP combination have a slightly reduced accuracy relative to the ground-based surveys, because the constant movement of the boat on the water surface creates pitch, roll, and yaw that influence the angle of the ADP beams. Depending on the water depth and the angle of deviation from vertical, the ±0.02 m accuracy from the RTK can be reduced by a few centimetres. Overall, the bathymetric surveys conducted using the RTK-ADP combination are considered to have an accuracy of ±0.10 m in both the horizontal and vertical directions.

3.0 ADDITIONAL BASE DATA

Additional base data collected for this study included:

- Highwater marks for the Red Deer River (AENV 1990, AENV 2005, and AESRD 2014) and Waskasoo Creek (AENV 1982 and AENV 2007);
- As-built and design drawings of the culverts and bridges located within the study area as provided by Alberta Transportation and the City of Red Deer;
- Engineering design drawings for the Red Deer Safeway and Baymont flood control dike;
- GIS and CAD base map data provided by the City of Red Deer, the Town of Penhold, and Red Deer County;
- Provisional streamflow data from the following WSC gauging stations:
  - Red Deer River at Red Deer (WSC 05CC002)

- Waskasoo Creek at Red Deer (WSC 05CC011)
- Blindman River Near Blackfalds (WSC 05CC001); and

- Previous flood risk maps for the Red Deer River and Waskasoo Creek.

4.0 CONCLUSIONS

Topographic, bathymetric, and supporting base data required to support other components of the Red Deer River Hazard Study were collected in accordance with AEP's requirements. The following conclusions are made:

- *Channel Cross Section Surveys* – Cross section survey data collected for this study between August and October 2017 meet the current study requirements with regard to cross section spacing and alignment, extents of cross sections on the floodplains, labeling of survey points, and data accuracy.
- *Hydraulic and Flood Control Structure Surveys* – Hydraulic and flood control structure survey data collected between August and October 2017 meet the study requirements and include the necessary details for the hydraulic modelling to be performed in this study.
- The survey was conducted according to the Red Deer River Survey Plan, dated August 22, 2017. No substantial deviations with potential to impact the project deliverables occurred.

Report Signature Page

This report was prepared and reviewed by the undersigned:

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President, Technical Reviewer

GT/DL/DS/WP/rd

PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD

RM SIGNATURE: _____

RM APEGA ID #: _____

DATE: _____

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The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

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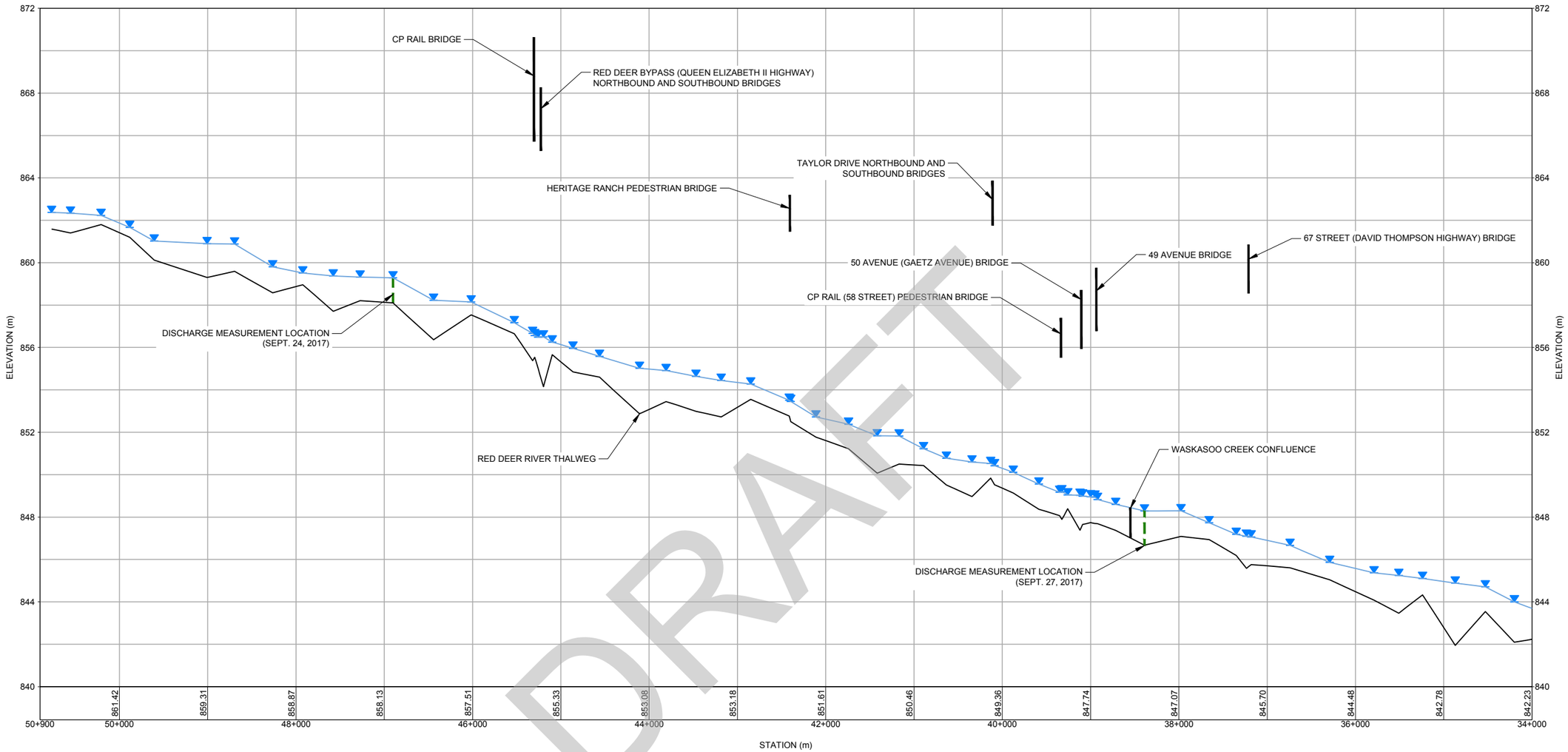
APPENDIX A

Surveyed Thalweg and Water Surface Profiles



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▼ MEASURED WATER LEVELS DURING CROSS SECTION SURVEY

NOTES

SEE REPORT SECTION 2.4 FOR MORE INFORMATION.

REFERENCE

SURVEY DATA COLLECTED BY GOLDER FROM AUGUST 29 TO NOVEMBER 4, 2017 (RED DEER RIVER, WASKASOO CREEK AND PIPER CREEK).

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HORIZONTAL SCALE 1:50,000
VERTICAL EXAGGERATION = 240X

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

TITLE
SURVEYED THALWEG AND WATER SURFACE PROFILE - RED DEER RIVER *(UPPER REACH)*

CONSULTANT
GOLDER

YYYY-MM-DD	2019-01-04
PREPARED	J. SIKORSKY
DESIGN	G. TANG
REVIEW	G. TANG
APPROVED	D. LONG

PROJECT No.	CONTROL	Rev.	FIGURE
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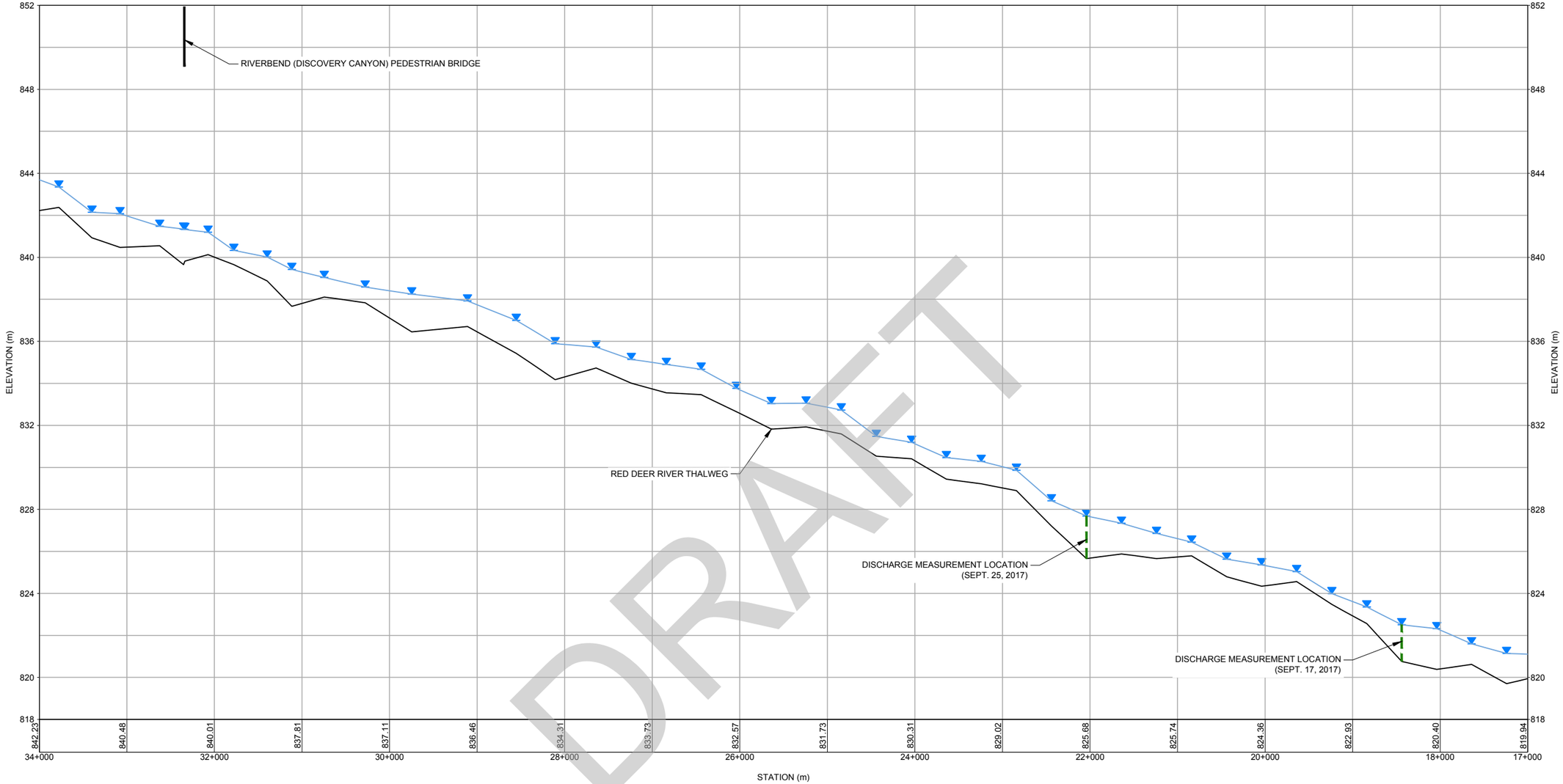

LEGEND

▼ MEASURED WATER LEVELS DURING CROSS SECTION SURVEY

NOTES

SEE REPORT SECTION 2.4 FOR MORE INFORMATION.

REFERENCE

SURVEY DATA COLLECTED BY GOLDER FROM AUGUST 29 TO NOVEMBER 4, 2017 (RED DEER RIVER, WASKASOO CREEK AND PIPER CREEK).

0 1,000 2,000 METRES

HORIZONTAL SCALE 1:50,000
VERTICAL EXAGGERATION = 240X

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

TITLE
SURVEYED THALWEG AND WATER SURFACE PROFILE - RED DEER RIVER *(MIDDLE REACH)*

CONSULTANT
GOLDER

YYYY-MM-DD	2019-01-04
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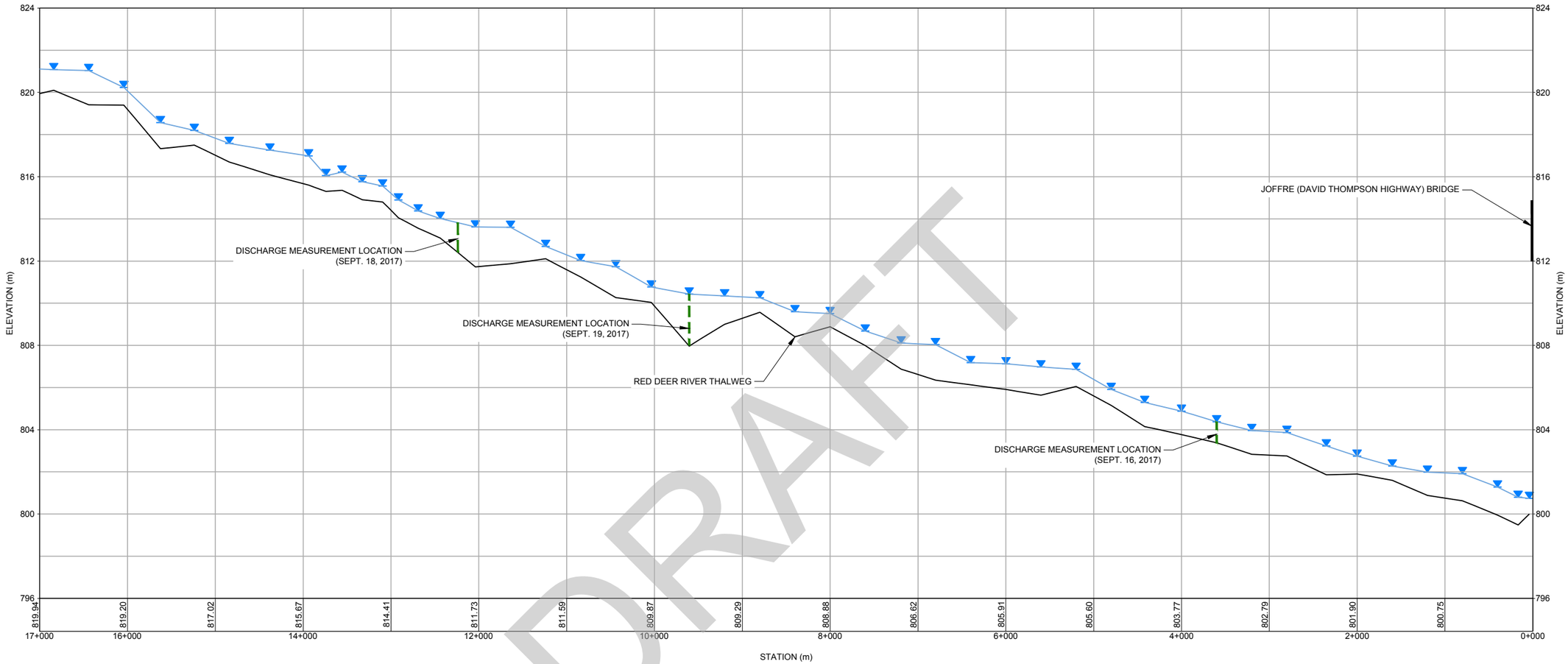

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▼ MEASURED WATER LEVELS DURING CROSS SECTION SURVEY

NOTES

SEE REPORT SECTION 2.4 FOR MORE INFORMATION.

REFERENCE

SURVEY DATA COLLECTED BY GOLDER FROM AUGUST 29 TO NOVEMBER 4, 2017 (RED DEER RIVER, WASKASOO CREEK AND PIPER CREEK).

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HORIZONTAL SCALE 1:50,000
VERTICAL EXAGGERATION = 240X

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

TITLE
SURVEYED THALWEG AND WATER SURFACE PROFILE - RED DEER RIVER *(LOWER REACH)*

CONSULTANT
GOLDER

YYYY-MM-DD	2019-01-04
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PROJECT No.	CONTROL	Rev.	FIGURE
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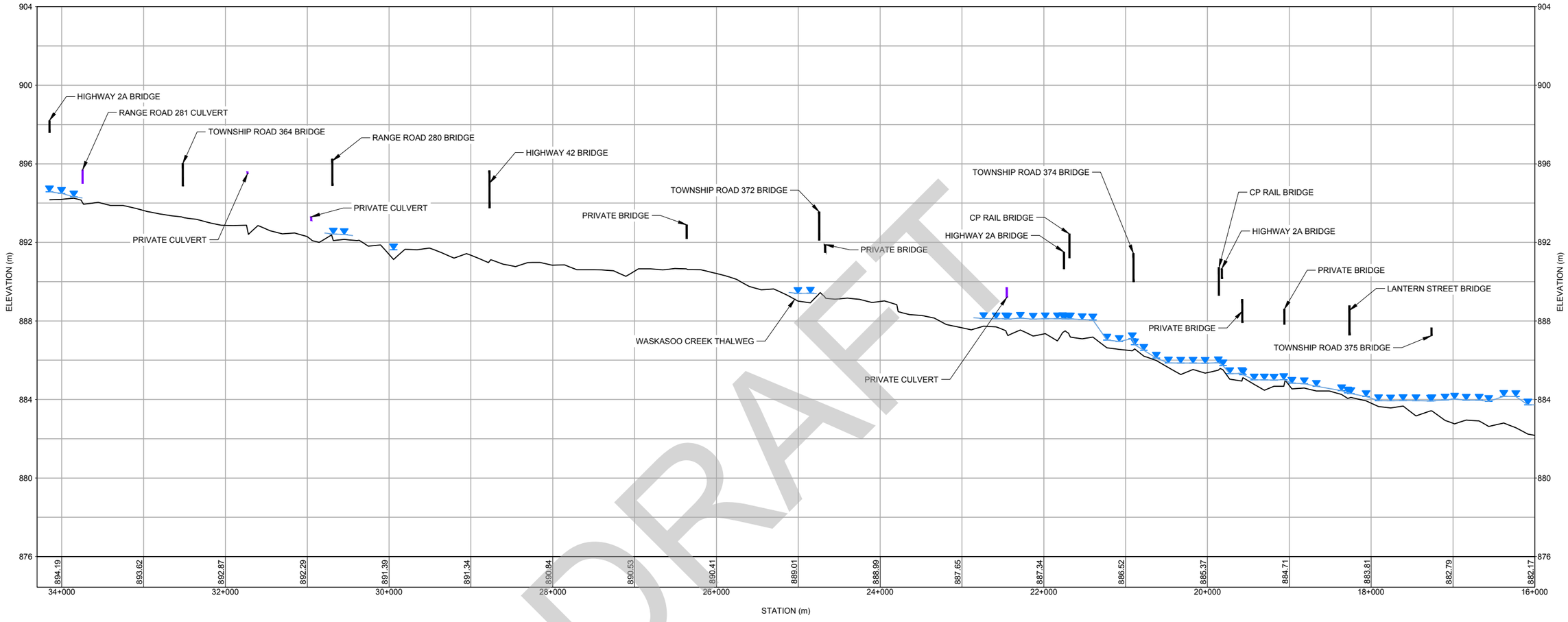

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▼ MEASURED WATER LEVELS DURING CROSS SECTION SURVEY

NOTES

SEE REPORT SECTION 2.4 FOR MORE INFORMATION.

REFERENCE

SURVEY DATA COLLECTED BY GOLDER FROM AUGUST 29 TO NOVEMBER 4, 2017 (RED DEER RIVER, WASKASOO CREEK AND PIPER CREEK).

0 1,000 2,000 METRES

HORIZONTAL SCALE 1:50,000
VERTICAL EXAGGERATION = 240X

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

TITLE
SURVEYED THALWEG AND WATER SURFACE PROFILE - WASKASOO CREEK *(UPPER REACH)*

CONSULTANT
GOLDER

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PREPARED	J. SIKORSKY
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REVIEW	G. TANG
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PROJECT No.	CONTROL	Rev.	FIGURE
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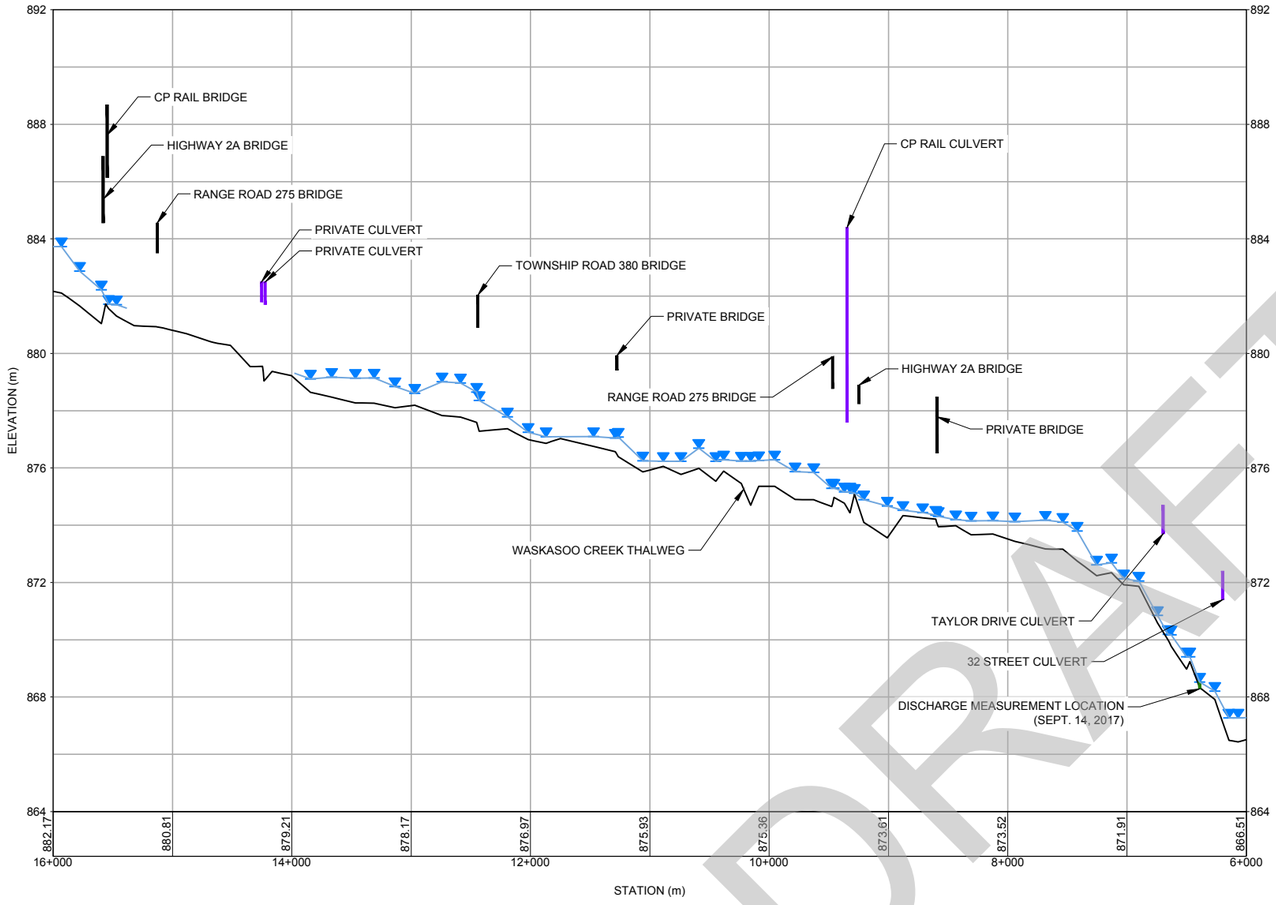

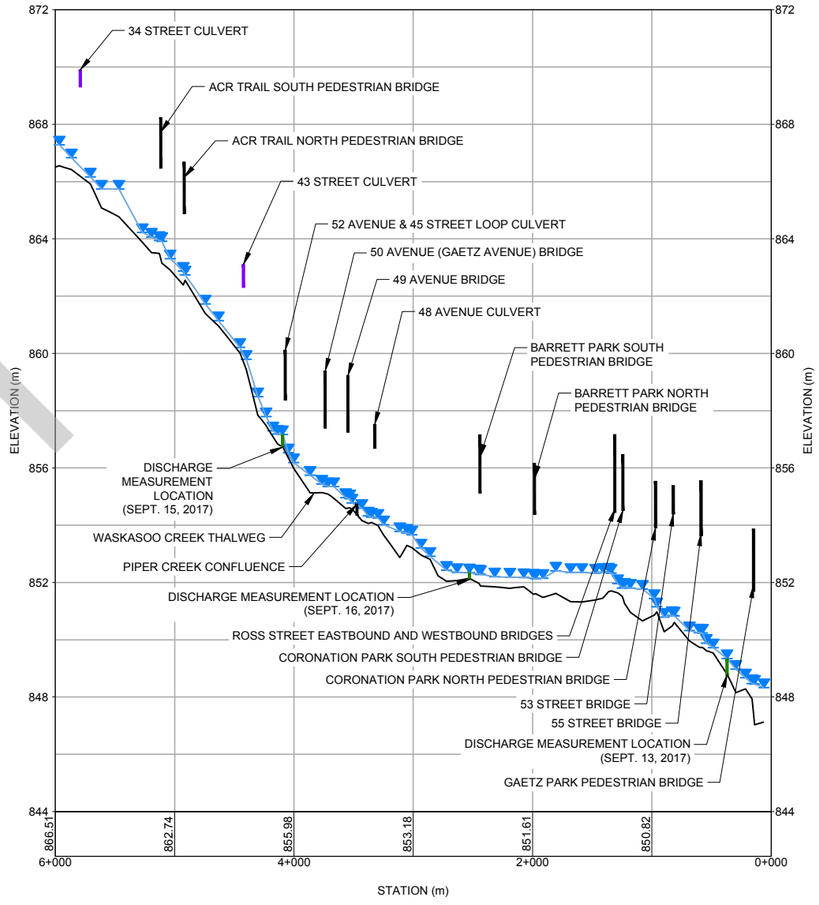

LEGEND

▼ MEASURED WATER LEVELS DURING CROSS SECTION SURVEY

NOTES

SEE REPORT SECTION 2.4 FOR MORE INFORMATION.

REFERENCE

SURVEY DATA COLLECTED BY GOLDER FROM AUGUST 29 TO NOVEMBER 4, 2017 (RED DEER RIVER, WASKASOO CREEK AND PIPER CREEK).

0 1,000 2,000 METRES

HORIZONTAL SCALE 1:50,000
VERTICAL EXAGGERATION = 240X

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

TITLE
SURVEYED THALWEG AND WATER SURFACE PROFILE - WASKASOO CREEK *(LOWER REACH)*

CONSULTANT
GOLDER

YYYY-MM-DD	2019-01-04
PREPARED	J. SIKORSKY
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PROJECT No.	CONTROL	Rev.	FIGURE
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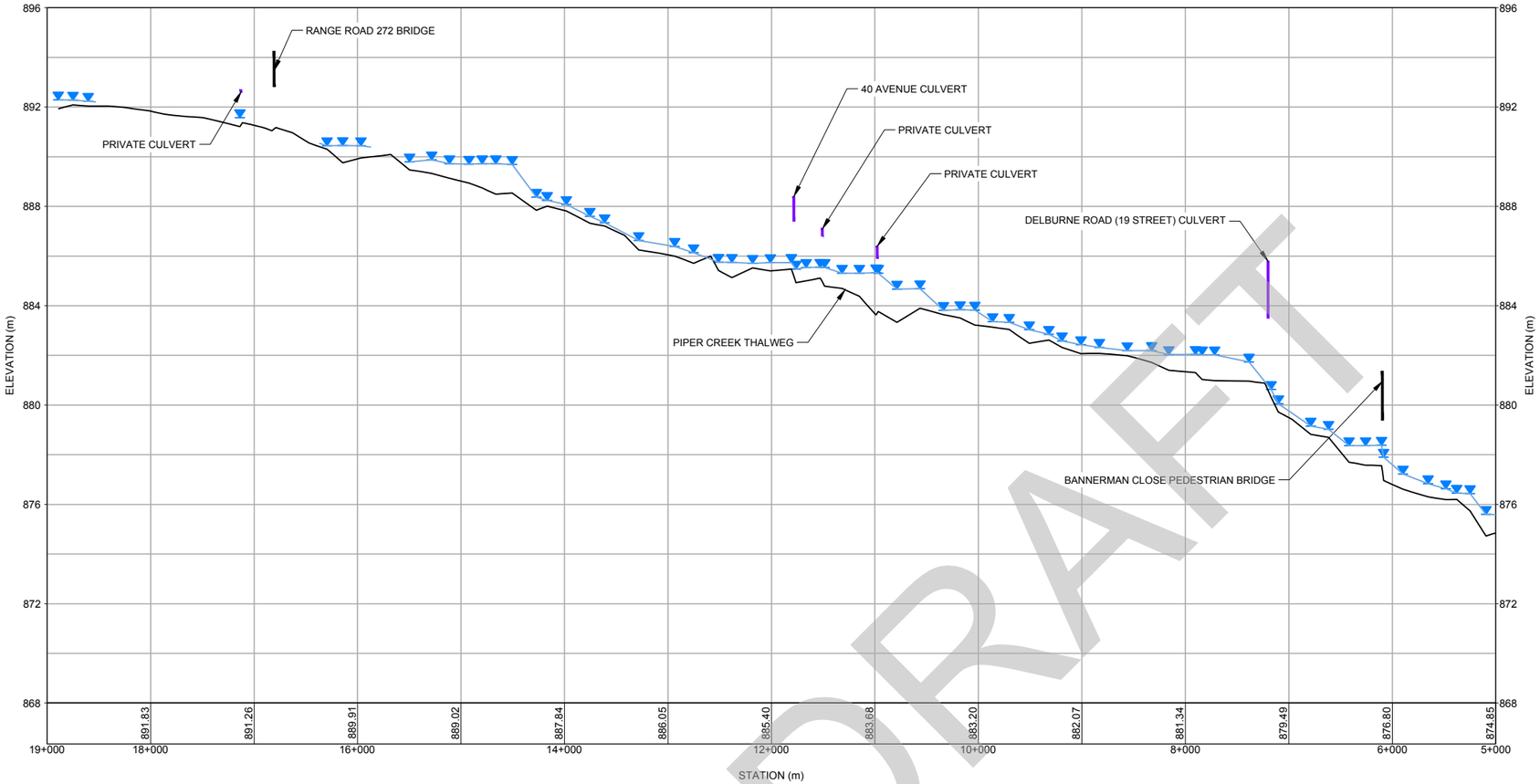

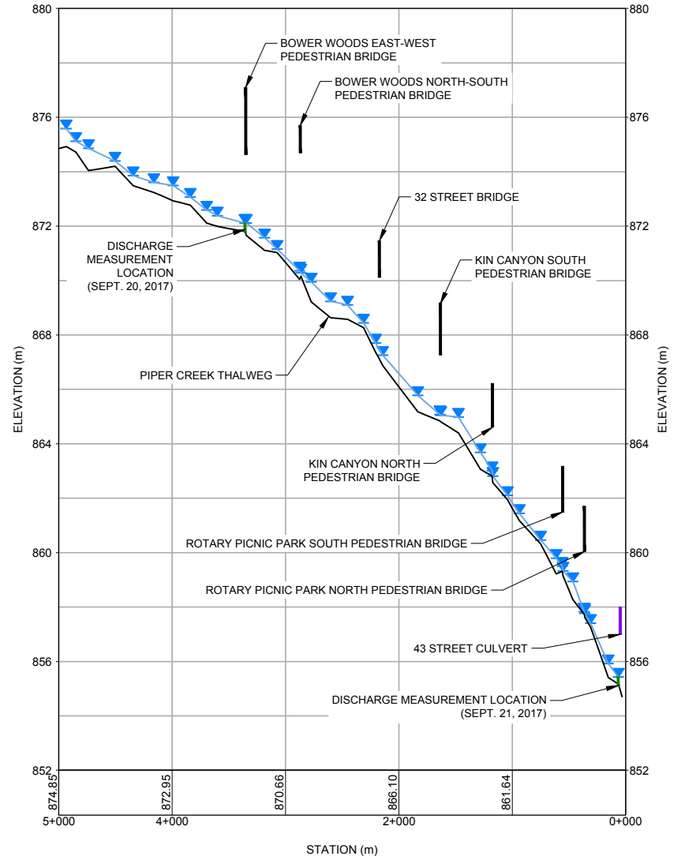

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▼ MEASURED WATER LEVELS DURING CROSS SECTION SURVEY

NOTES

SEE REPORT SECTION 2.4 FOR MORE INFORMATION.

REFERENCE

SURVEY DATA COLLECTED BY GOLDER FROM AUGUST 29 TO NOVEMBER 4, 2017 (RED DEER RIVER, WASKASOO CREEK AND PIPER CREEK).

0 1,000 2,000 METRES

HORIZONTAL SCALE 1:50,000
VERTICAL EXAGGERATION = 240X

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

TITLE
SURVEYED THALWEG AND WATER SURFACE PROFILE - PIPER CREEK

CONSULTANT
GOLDER

YYYY-MM-DD	2019-01-04
PREPARED	J. SIKORSKY
DESIGN	G. TANG
REVIEW	G. TANG
APPROVED	D. LONG

PROJECT No.	CONTROL	Rev.	FIGURE
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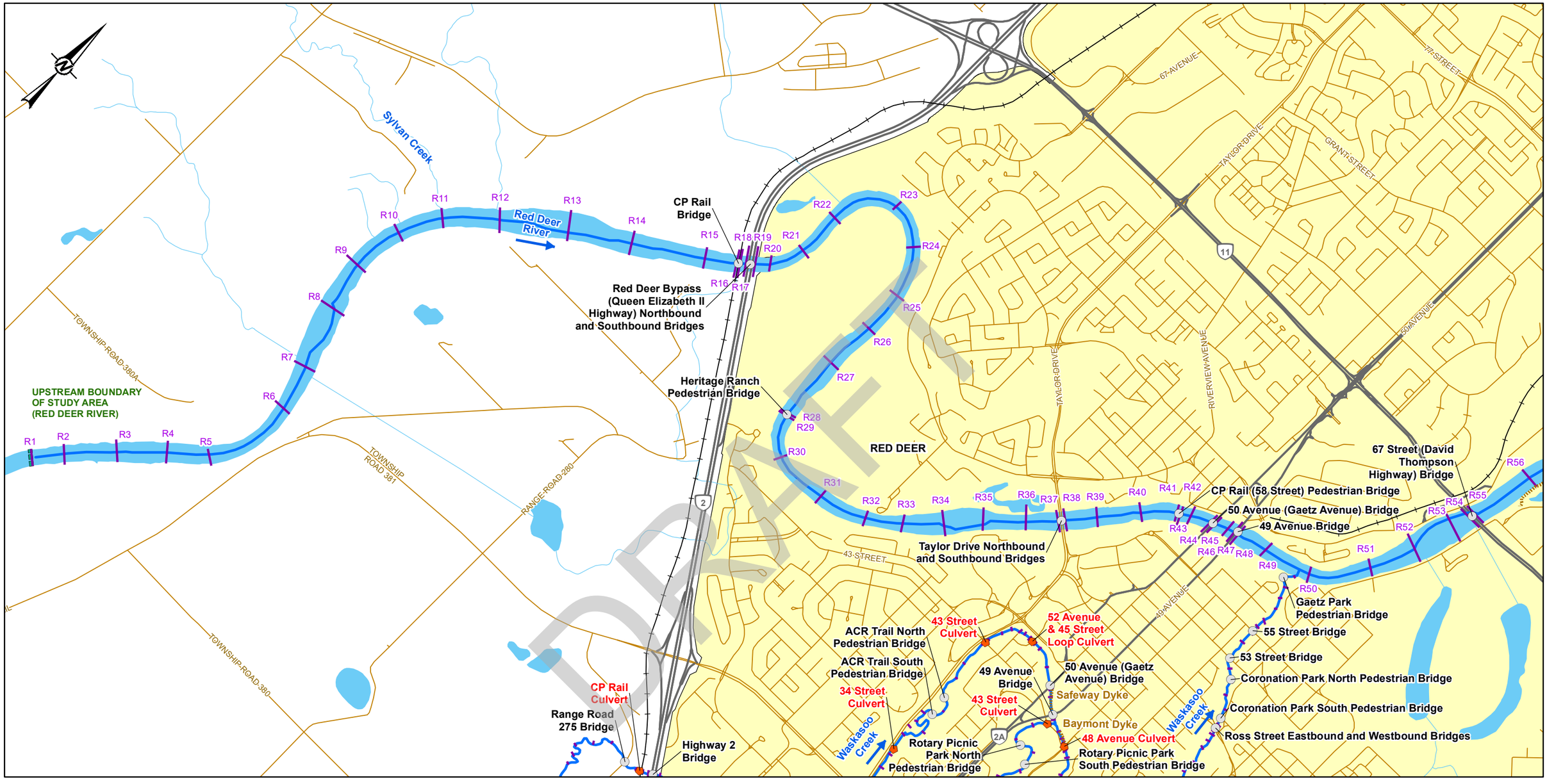
APPENDIX B

Cross Section, Hydraulic Structure, and Flood Control Structure Locations



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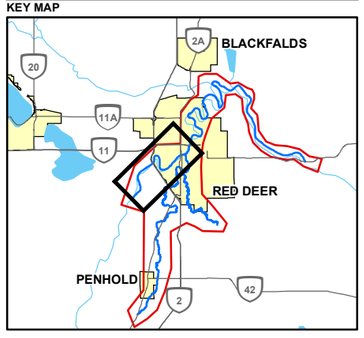
- FLOW DIRECTION
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- LOCAL ROAD
- RAILWAY
- WATERCOURSE
- WATERBODY
- POPULATED PLACE
- CULVERT
- HYDRAULIC STRUCTURE
- FLOOD CONTROL STRUCTURE
- SURVEY REACH
- SURVEYED CROSS SECTION
- STUDY BOUNDARY

KEY MAP



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ALBERTA ENVIRONMENT AND PARKS

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	GT
PREPARED	NB
REVIEWED	DS
APPROVED	DL

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NOTE(S)
SEE REPORT SECTION 2.3 FOR MORE INFORMATION.

PROJECT
RED DEER RIVER HAZARD STUDY

TITLE
CROSS SECTIONS, HYDRAULIC STRUCTURES AND FLOOD CONTROL STRUCTURES ON THE RED DEER RIVER, WASKASOO CREEK AND PIPER CREEK.

PROJECT NO.	CONTROL	REV.	FIGURE
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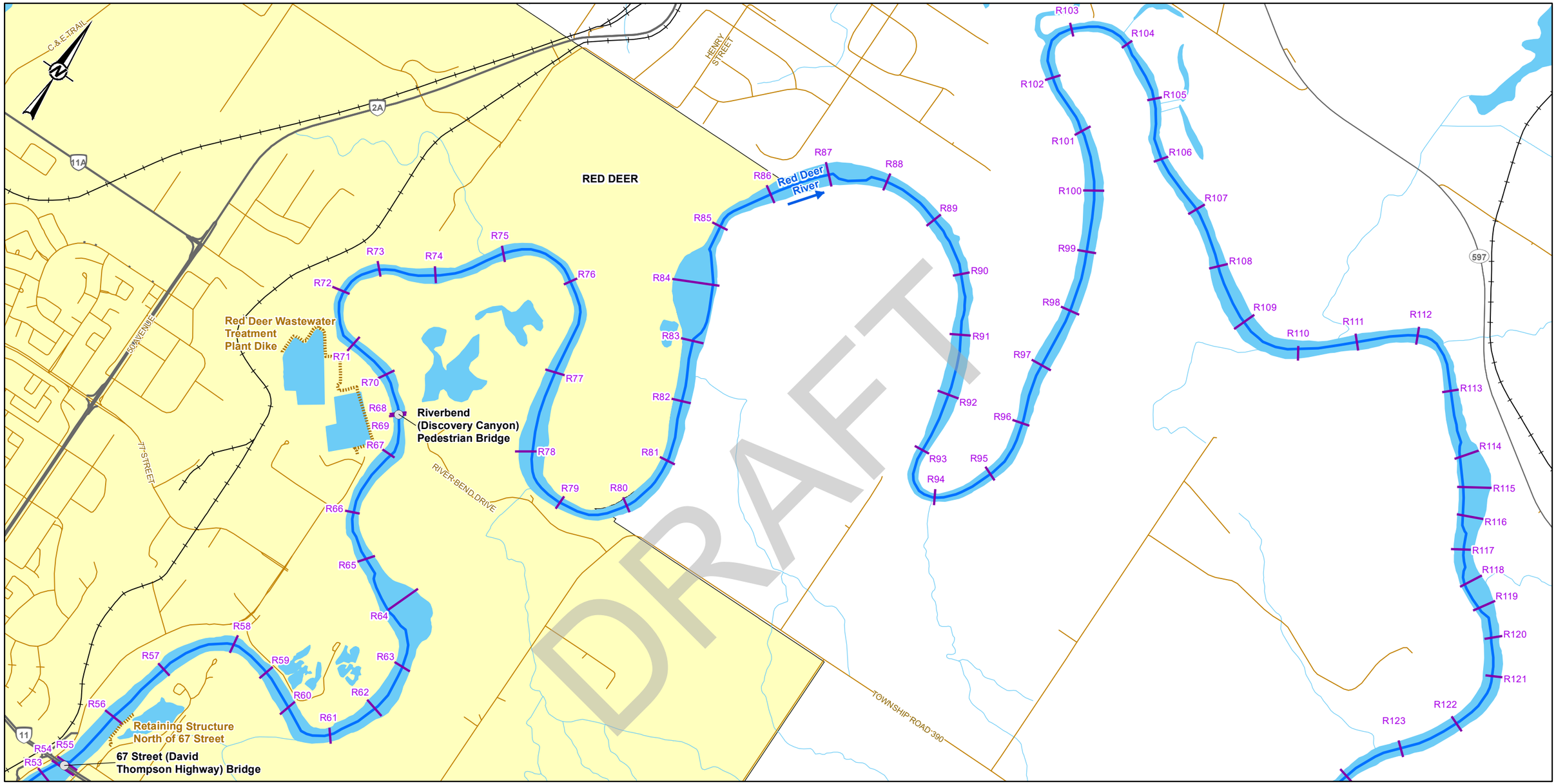

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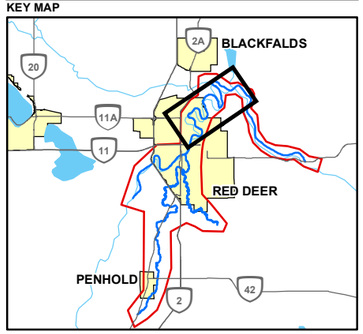
- FLOW DIRECTION
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- LOCAL ROAD
- RAILWAY
- WATERCOURSE
- WATERBODY
- POPULATED PLACE
- CULVERT
- HYDRAULIC STRUCTURE
- FLOOD CONTROL STRUCTURE
- SURVEY REACH
- SURVEYED CROSS SECTION
- STUDY BOUNDARY

KEY MAP



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1:25,000 KILOMETERS

CLIENT
ALBERTA ENVIRONMENT AND PARKS

Alberta Government

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	GT
PREPARED	NB
REVIEWED	DS
APPROVED	DL

REFERENCE(S)
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DATUM: NAD 83 CSRS PROJECTION: 3TM 114

NOTE(S)
SEE REPORT SECTION 2.3 FOR MORE INFORMATION.

PROJECT
RED DEER RIVER HAZARD STUDY

TITLE
CROSS SECTIONS, HYDRAULIC STRUCTURES AND FLOOD CONTROL STRUCTURES ON THE RED DEER RIVER, WASKASOO CREEK AND PIPER CREEK.

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	**B-2**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

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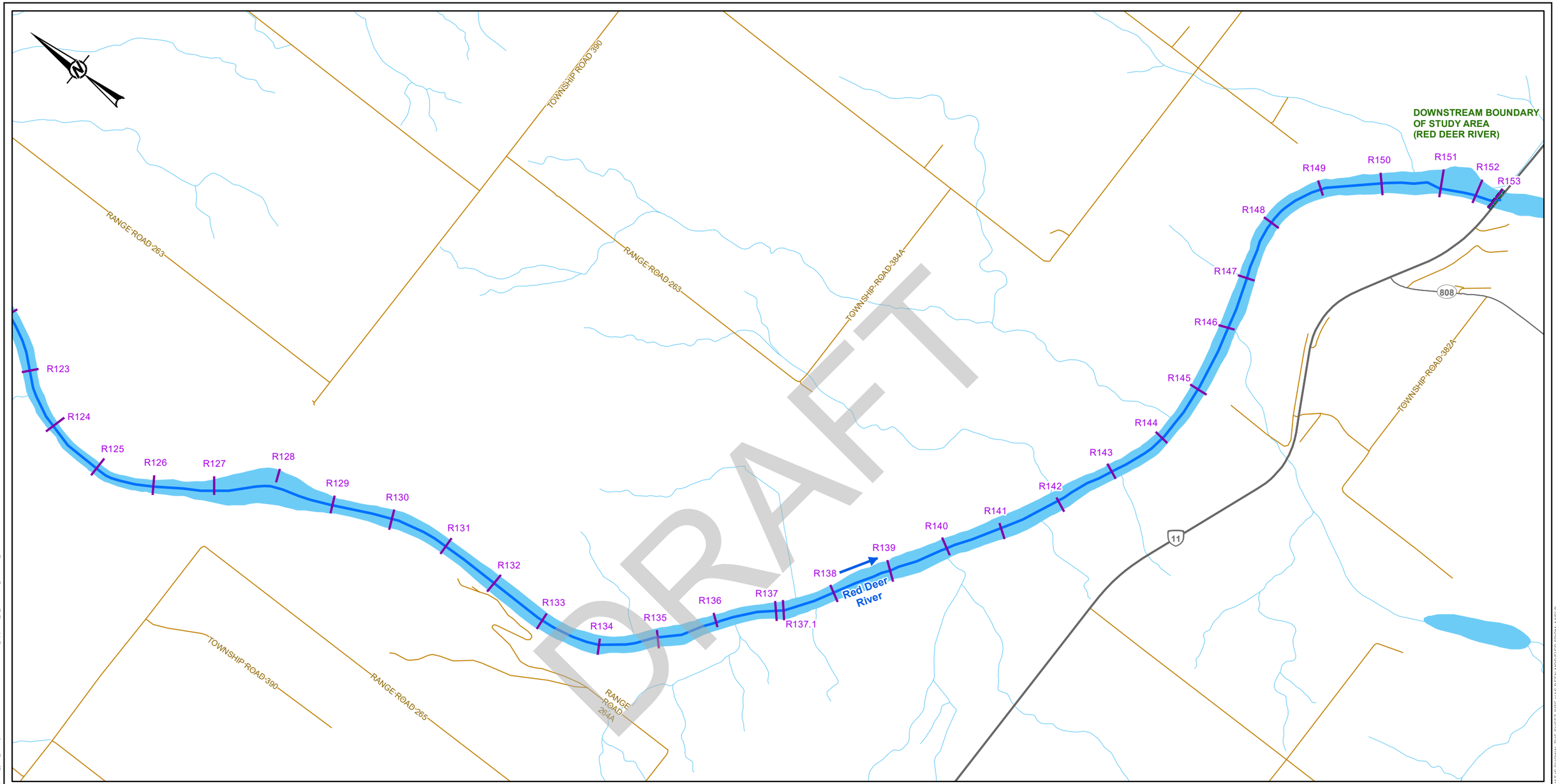
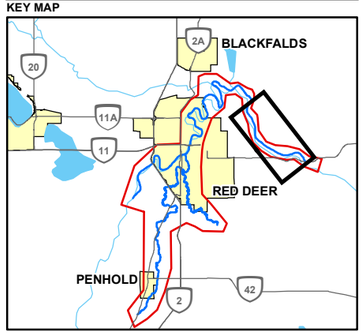
PATH: I:\CLIENTS\GOVERNMENT_OF_ALBERTA\21452576_Red_Deer\Mapping\Products\Hydrology\01_Survey & Base Data Collection\Rev2\1783039_Appendix_B_Structures_Red-Deer_Rev2.mxd PRINTED ON: 2022-12-12 AT 10:17:44 AM



LEGEND

- FLOW DIRECTION
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- LOCAL ROAD
- RAILWAY
- WATERCOURSE
- WATERBODY
- POPULATED PLACE
- CULVERT
- HYDRAULIC STRUCTURE
- FLOOD CONTROL STRUCTURE
- SURVEY REACH
- SURVEYED CROSS SECTION
- STUDY BOUNDARY

KEY MAP



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ALBERTA ENVIRONMENT AND PARKS

Alberta Government

CONSULTANT
GOLDER

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REVIEWED	DS
APPROVED	DL

REFERENCE(S)
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DATUM: NAD 83 CSRS PROJECTION: 3TM 114

NOTE(S)
SEE REPORT SECTION 2.3 FOR MORE INFORMATION.

PROJECT
RED DEER RIVER HAZARD STUDY

TITLE
CROSS SECTIONS, HYDRAULIC STRUCTURES AND FLOOD CONTROL STRUCTURES ON THE RED DEER RIVER, WASKASOO CREEK AND PIPER CREEK.

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	**B-3**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

25mm

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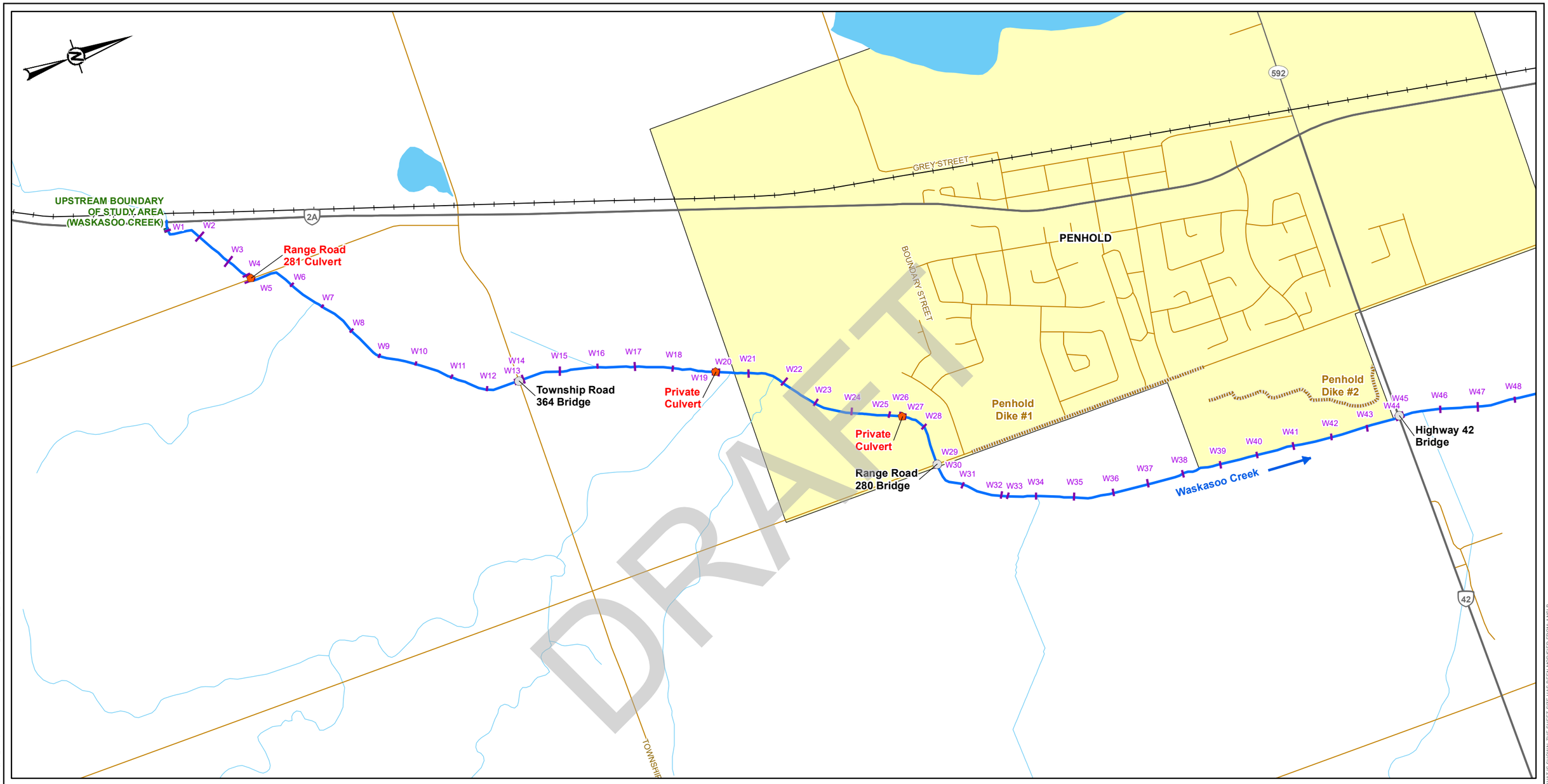
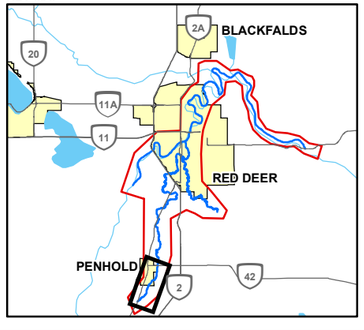


LEGEND

- FLOW DIRECTION
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- LOCAL ROAD
- RAILWAY
- WATERCOURSE
- WATERBODY
- POPULATED PLACE
- CULVERT
- HYDRAULIC STRUCTURE
- FLOOD CONTROL STRUCTURE
- SURVEY REACH
- SURVEYED CROSS SECTION
- STUDY BOUNDARY

KEY MAP



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NOTE(S)
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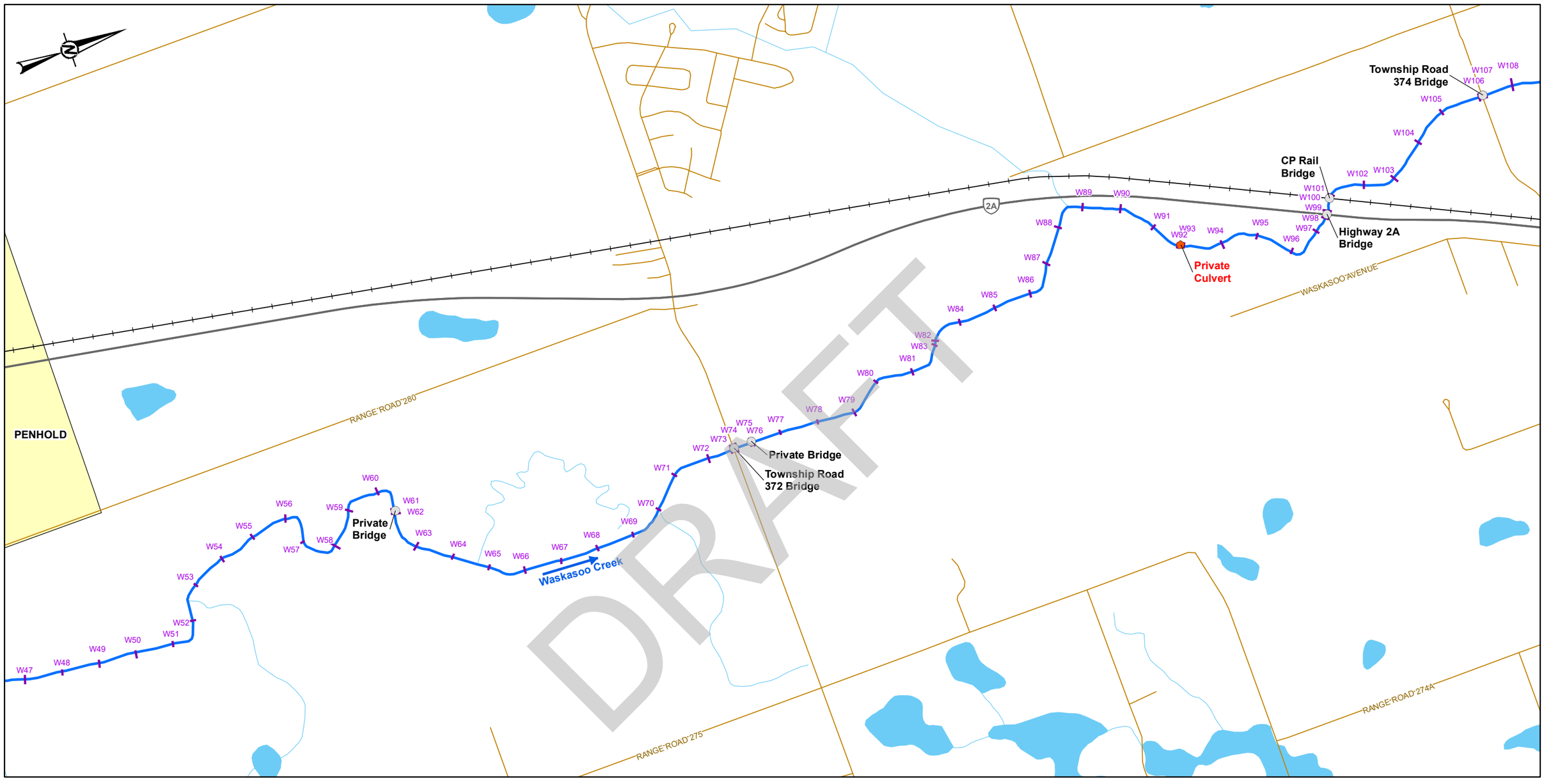
PROJECT
RED DEER RIVER HAZARD STUDY

TITLE
CROSS SECTIONS, HYDRAULIC STRUCTURES AND FLOOD CONTROL STRUCTURES ON THE RED DEER RIVER, WASKASOO CREEK AND PIPER CREEK.

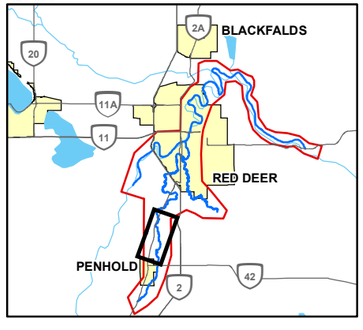
PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	**B-4**



LEGEND

- FLOW DIRECTION
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- LOCAL ROAD
- RAILWAY
- WATERCOURSE
- WATERBODY
- POPULATED PLACE
- CULVERT
- HYDRAULIC STRUCTURE
- FLOOD CONTROL STRUCTURE
- SURVEY REACH
- SURVEYED CROSS SECTION
- STUDY BOUNDARY

KEY MAP



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NOTE(S)
SEE REPORT SECTION 2.3 FOR MORE INFORMATION.

PROJECT
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TITLE
CROSS SECTIONS, HYDRAULIC STRUCTURES AND FLOOD CONTROL STRUCTURES ON THE RED DEER RIVER, WASKASOO CREEK AND PIPER CREEK.

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	**B-5**

PATH: I:\CLIENTS\GOVERNMENT_OF_ALBERTA\21452576_Red_DeerMapping\Products\Hydrology\01_Survey & Base Data Collection\Rev2\1783039_Appendix_B_Structures_Waskasoo_Piper_Rev2.mxd PRINTED ON: 2022-12-12 AT: 10:23:23 AM

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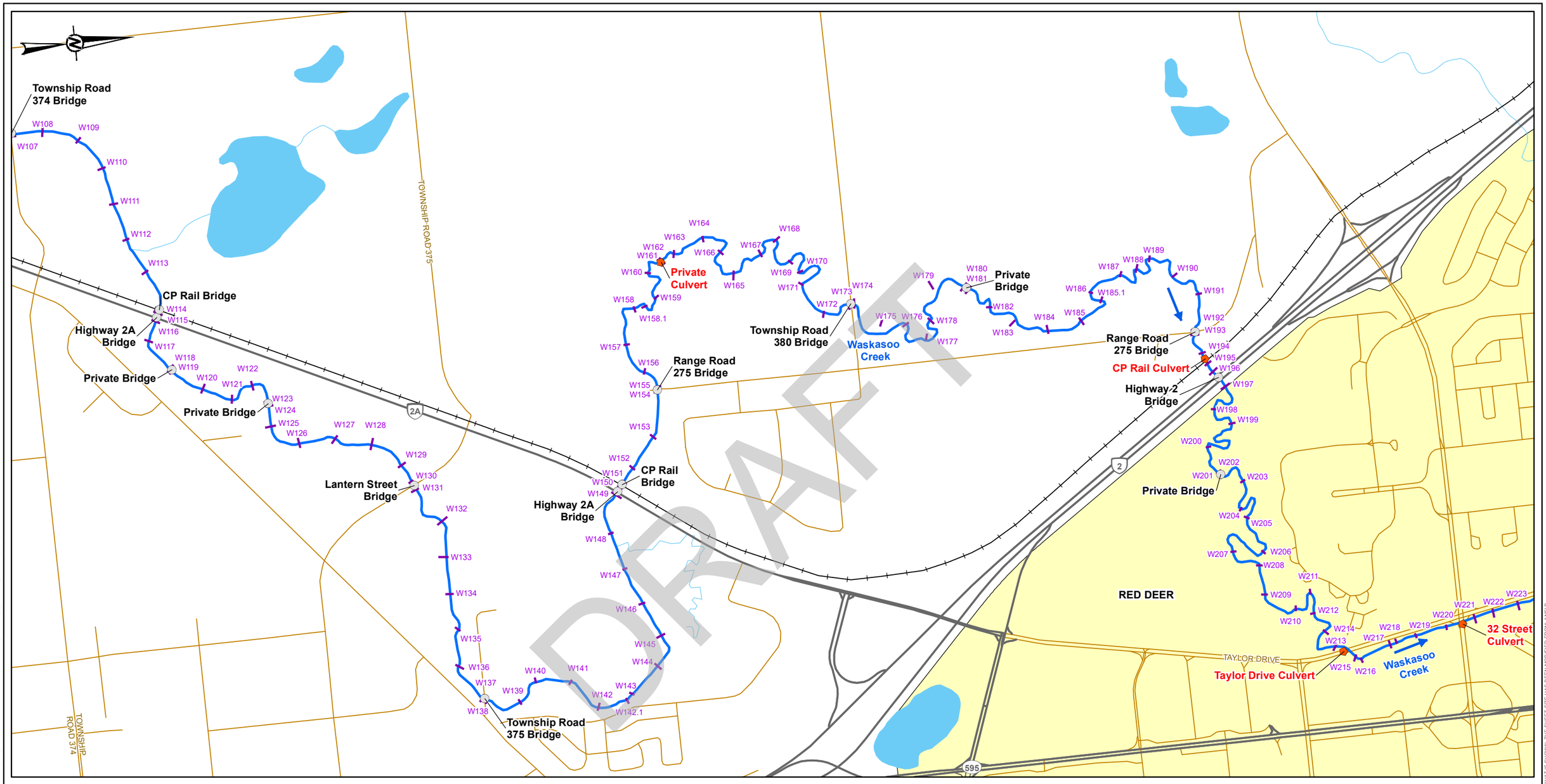
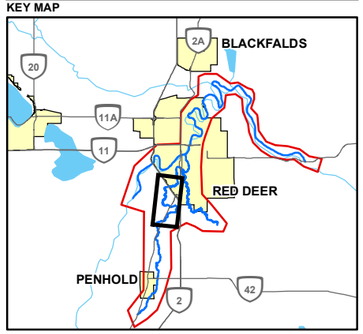


LEGEND

- FLOW DIRECTION
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- LOCAL ROAD
- RAILWAY
- WATERCOURSE
- WATERBODY
- POPULATED PLACE
- CULVERT
- HYDRAULIC STRUCTURE
- FLOOD CONTROL STRUCTURE
- SURVEY REACH
- SURVEYED CROSS SECTION
- STUDY BOUNDARY

KEY MAP



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NOTE(S)
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PROJECT
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TITLE
CROSS SECTIONS, HYDRAULIC STRUCTURES AND FLOOD CONTROL STRUCTURES ON THE RED DEER RIVER, WASKASOO CREEK AND PIPER CREEK.

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	**B-6**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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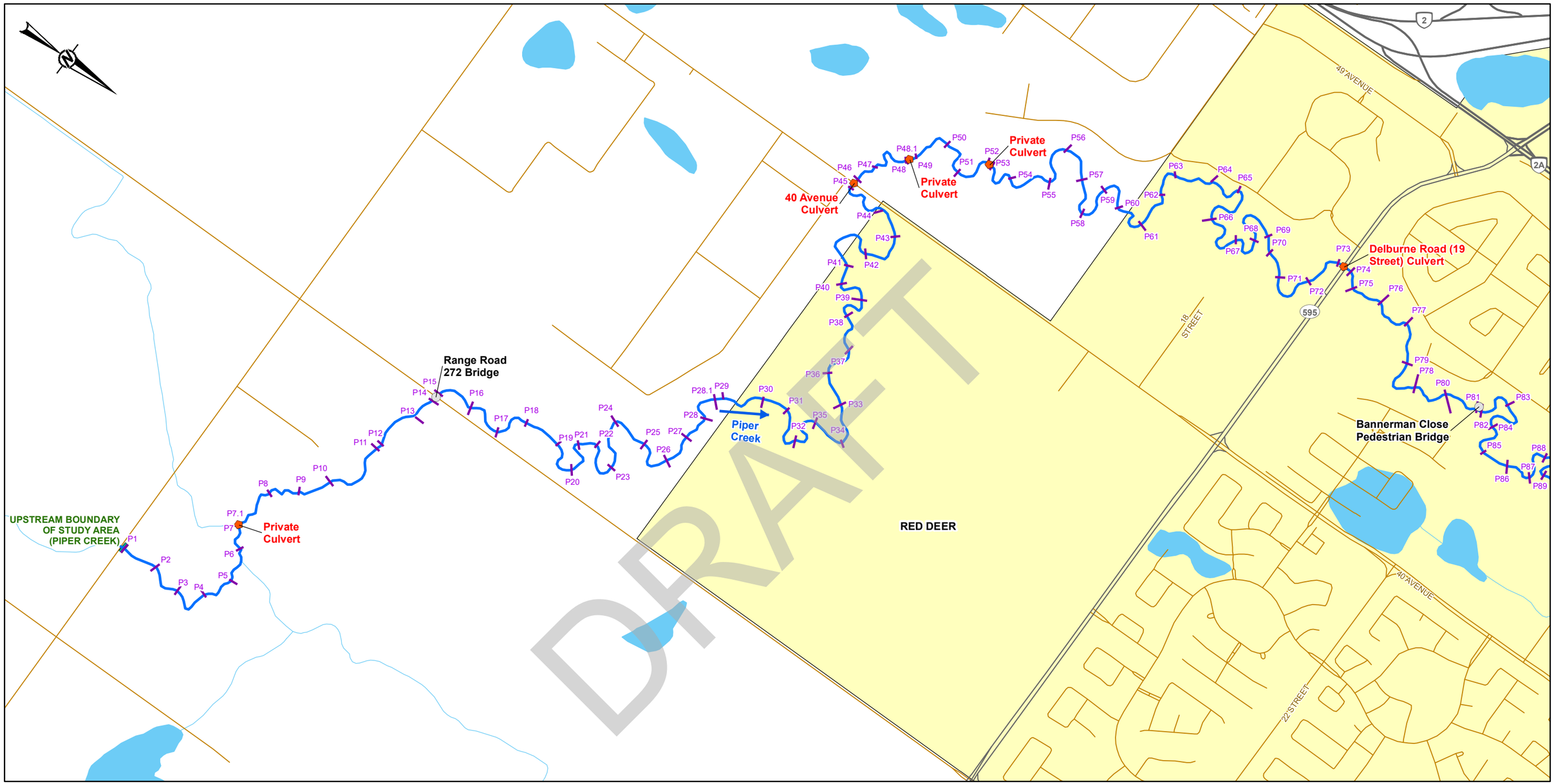
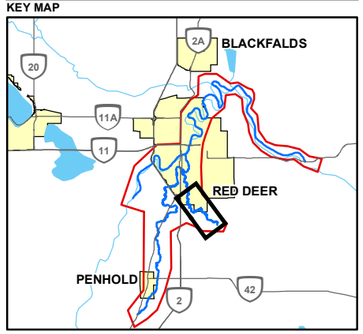


LEGEND

- FLOW DIRECTION
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- LOCAL ROAD
- RAILWAY
- WATERCOURSE
- WATERBODY
- POPULATED PLACE
- CULVERT
- HYDRAULIC STRUCTURE
- FLOOD CONTROL STRUCTURE
- SURVEY REACH
- SURVEYED CROSS SECTION
- STUDY BOUNDARY

KEY MAP



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NOTE(S)
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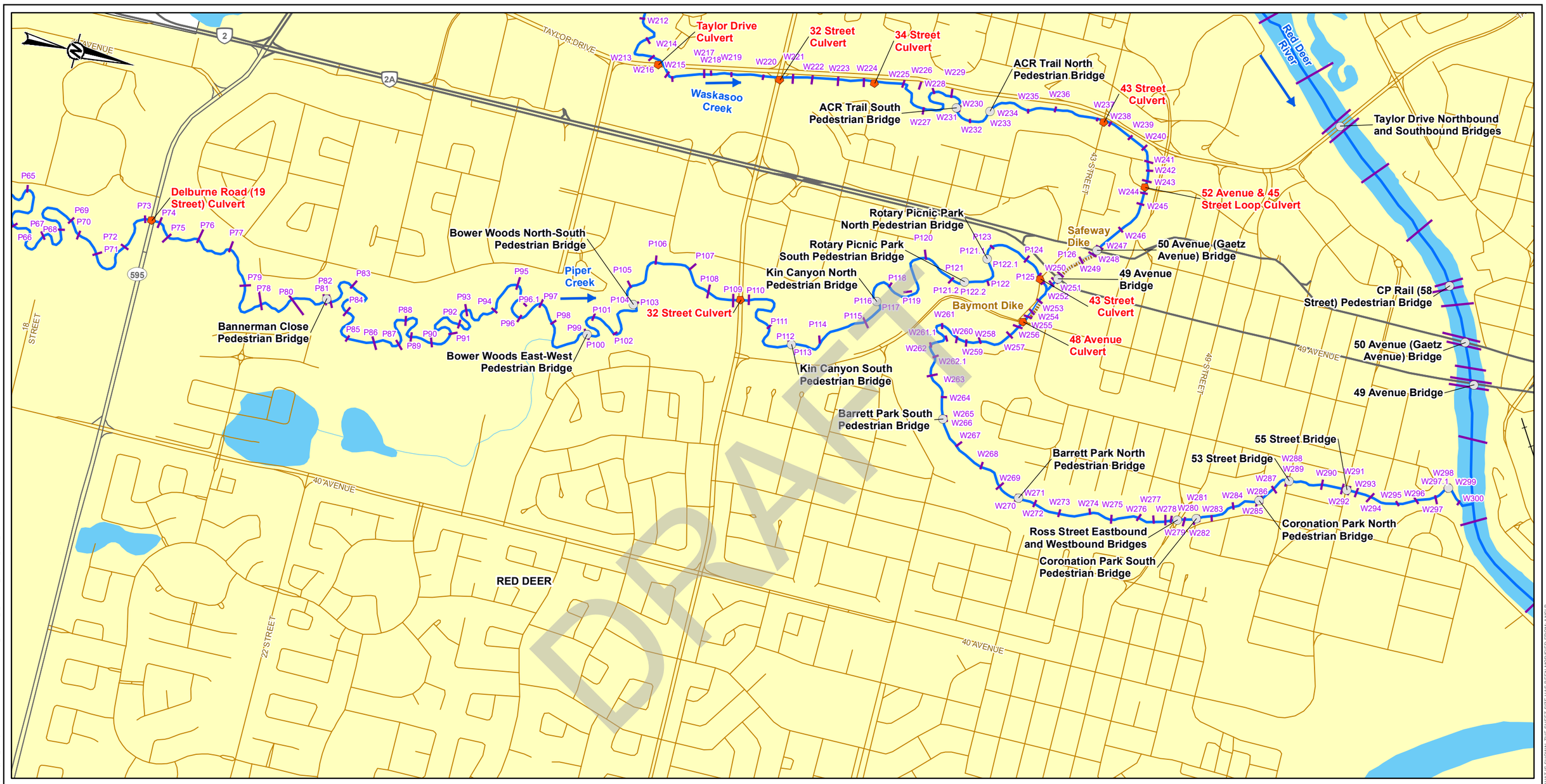
PROJECT
RED DEER RIVER HAZARD STUDY

TITLE
CROSS SECTIONS, HYDRAULIC STRUCTURES AND FLOOD CONTROL STRUCTURES ON THE RED DEER RIVER, WASKASOO CREEK AND PIPER CREEK.

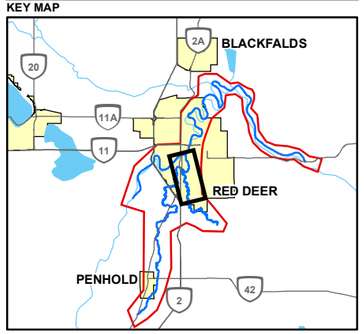
PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	**B-7**



LEGEND

- FLOW DIRECTION
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- LOCAL ROAD
- RAILWAY
- WATERCOURSE
- WATERBODY
- POPULATED PLACE
- CULVERT
- HYDRAULIC STRUCTURE
- FLOOD CONTROL STRUCTURE
- SURVEY REACH
- SURVEYED CROSS SECTION
- STUDY BOUNDARY

KEY MAP



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DATUM: NAD 83 CSRS PROJECTION: 3TM 114

NOTE(S)
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PROJECT
RED DEER RIVER HAZARD STUDY

TITLE
CROSS SECTIONS, HYDRAULIC STRUCTURES AND FLOOD CONTROL STRUCTURES ON THE RED DEER RIVER, WASKASOO CREEK AND PIPER CREEK.

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	**B-8**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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PATH: I:\CLIENTS\GOVERNMENT_OF_ALBERTA\21452576_Red_Deer\Mapping\Products\Hydrology\01_Survey & Base Data Collection\Rev2\1783039_Appendix_B_Structures_Waskasoo_Piper_Rev2.mxd PRINTED ON: 2022-12-12 AT: 10:23:40 AM

APPENDIX C

Hydraulic Structure Datasheets

0 50 100

1:2,500 METRES

PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

TITLE

CP RAIL BRIDGE

LOCATION	RED DEER RIVER
DESCRIPTION	RAILWAY
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	169.50
DECK WIDTH OF BRIDGE (m)	6.52
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	870.63
AVERAGE LOW CHORD ELEVATION (m)	865.72
BRIDGE OBSTRUCTION HEIGHT (m)	4.91
NUMBER OF PIERS	2

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	46.50	2.28	CONCRETE	SHARP NOSE
2	94.70	2.28	CONCRETE	SHARP NOSE
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- FLOW DIRECTION
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
SEE REPORT SECTION 2.5 AND HYDRAULIC MODEL FOR MORE INFORMATION.

REFERENCE(S)

BRIDGE SURVEY AND BRIDGE PHOTOS BY GOLDER ASSOCIATES LTD. AUG 2017 - NOV 2017. ROADS OBTAINED FROM ALTALIS, © GOVERNMENT OF ALBERTA 2017. ALL RIGHTS RESERVED. IMAGERY CAPTURED JULY 2018 BY ORTHOSHOP GEOMATICS LTD. FOR THE GOVERNMENT OF ALBERTA. DATUM: NAD 83 CSRS PROJECTION: 3TM 114

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PROJECT

RED DEER RIVER HAZARD STUDY

CONSULTANT

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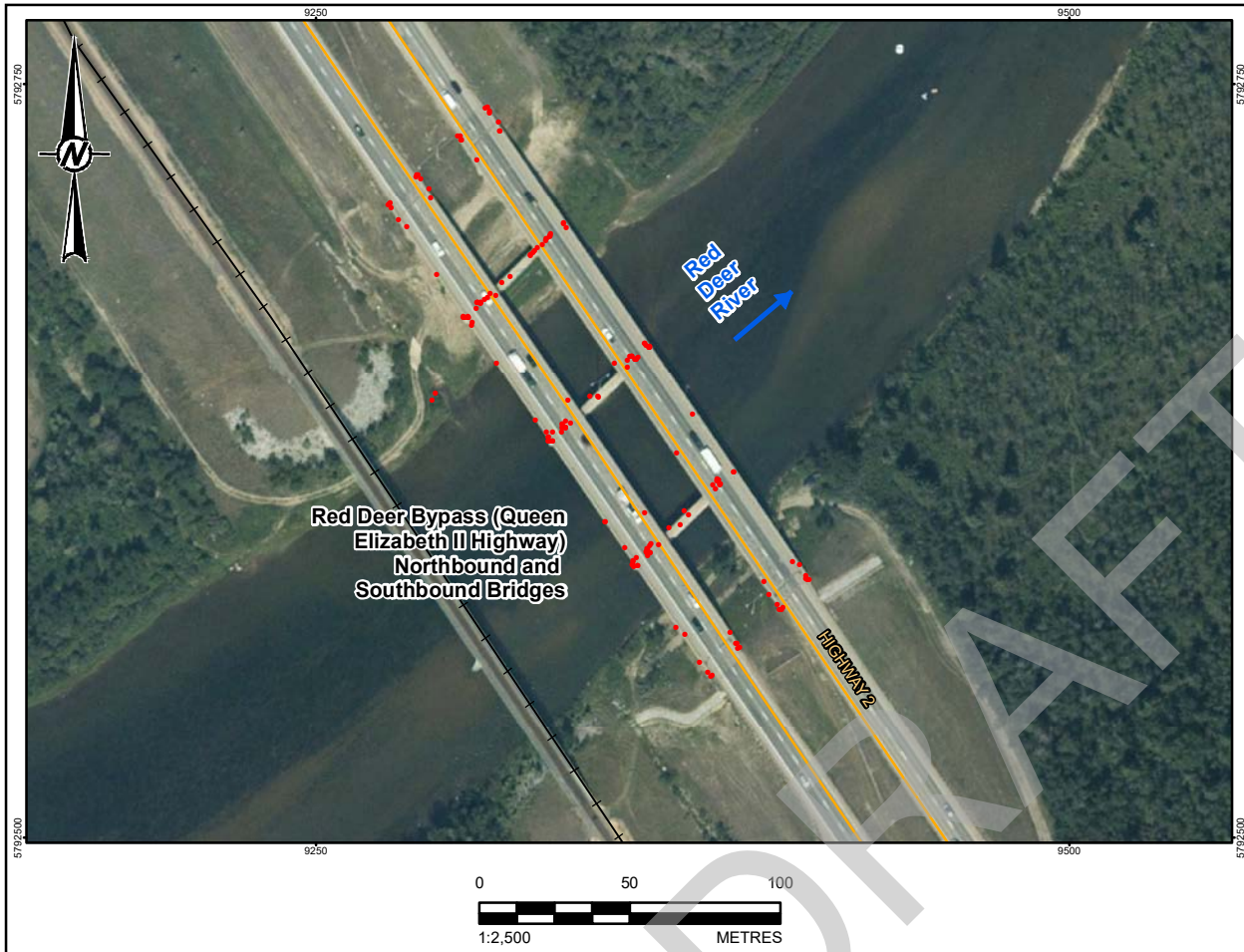
PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-1



TITLE

RED DEER BYPASS (QUEEN ELIZABETH II HIGHWAY) NORTHBOUND AND SOUTHBOUND BRIDGES

LOCATION	RED DEER RIVER
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	75335
YEAR BUILT	1963
TOTAL LENGTH OF SPAN (m)	177.63
DECK WIDTH OF BRIDGE (m)	44.50
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	868.26
AVERAGE LOW CHORD ELEVATION (m)	865.28
BRIDGE OBSTRUCTION HEIGHT (m)	2.98
NUMBER OF PIERS	3

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	39.40	1.83	CONCRETE	ROUND NOSE
2	89.20	1.83	CONCRETE	ROUND NOSE
3	138.40	1.83	CONCRETE	ROUND NOSE
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- FLOW DIRECTION
- ROADS
- RAILWAY

NOTE(S)

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REFERENCE(S)

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PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

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PROJECT
RED DEER RIVER HAZARD STUDY

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GOLDER

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REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-2

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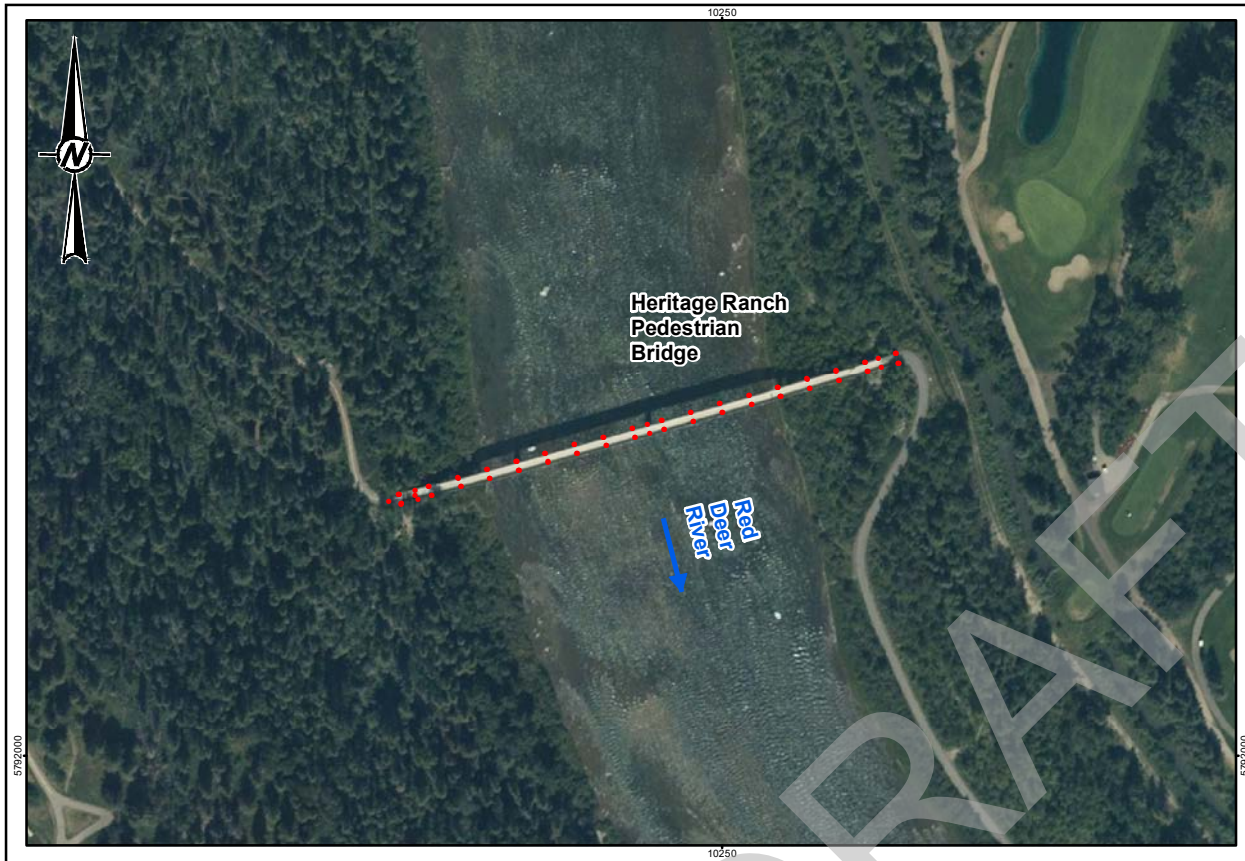

0 50 100

1:2,500 METRES

PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

TITLE

HERITAGE RANCH PEDESTRIAN BRIDGE

LOCATION	RED DEER RIVER
DESCRIPTION	PEDESTRIAN
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	1983
TOTAL LENGTH OF SPAN (m)	170.84
DECK WIDTH OF BRIDGE (m)	3.03
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	863.19
AVERAGE LOW CHORD ELEVATION (m)	862.10
BRIDGE OBSTRUCTION HEIGHT (m)	1.09
NUMBER OF PIERS	3

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	40.49	1.55	CONCRETE	SHARP NOSE
2	85.45	1.55	CONCRETE	SHARP NOSE
3	130.42	1.55	CONCRETE	SHARP NOSE
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- FLOW DIRECTION
- ROADS
- RAILWAY

NOTE(S)

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SEE REPORT SECTION 2.5 AND HYDRAULIC MODEL FOR MORE INFORMATION.

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PROJECT

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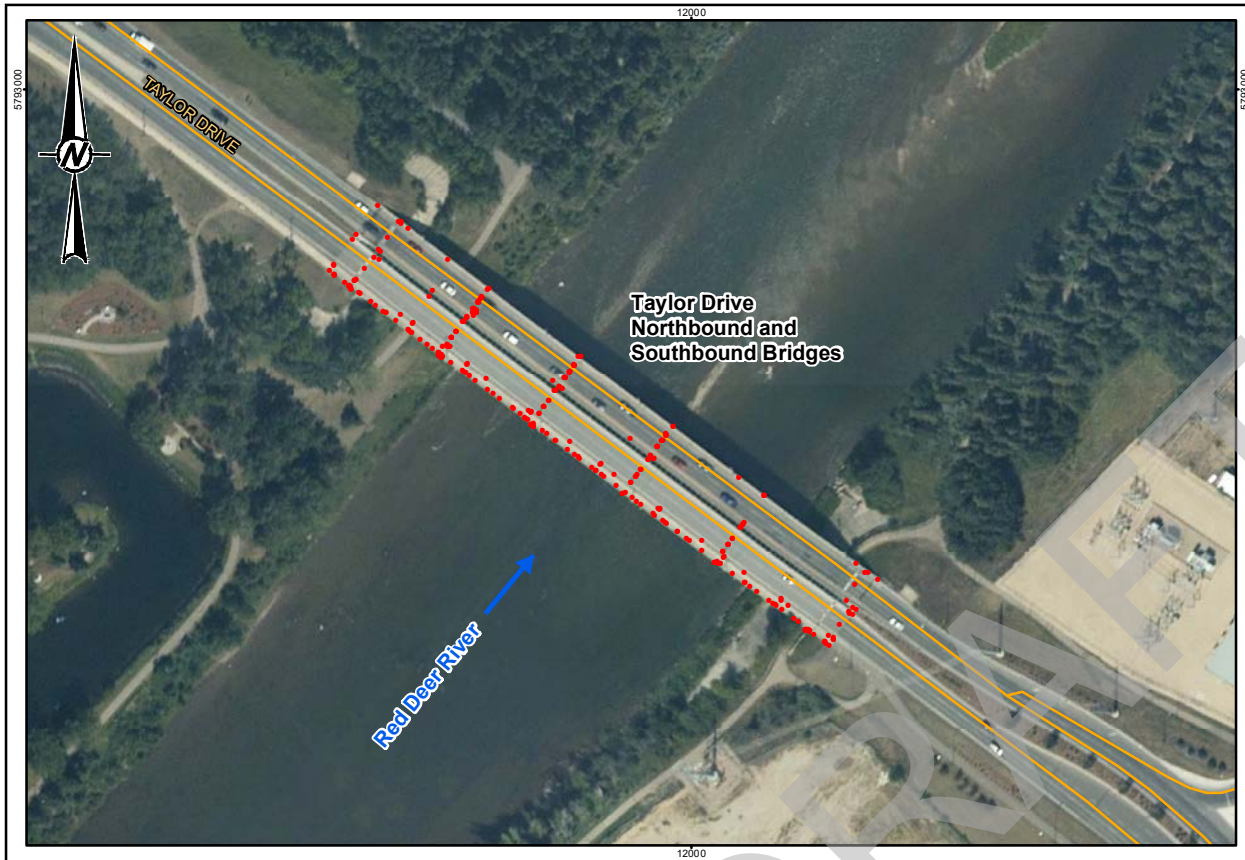
PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-3



0 50 100

1:2,500 METRES

TITLE

TAYLOR DRIVE NORTHBOUND AND SOUTHBOUND BRIDGES

LOCATION	RED DEER RIVER
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	79058
YEAR BUILT	1991
TOTAL LENGTH OF SPAN (m)	206.72
DECK WIDTH OF BRIDGE (m)	13.11
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	863.86
AVERAGE LOW CHORD ELEVATION (m)	861.76
BRIDGE OBSTRUCTION HEIGHT (m)	2.10
NUMBER OF PIERS	4

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	46.38	1.22	CONCRETE	SHARP NOSE
2	84.61	1.22	CONCRETE	SHARP NOSE
3	122.62	1.22	CONCRETE	SHARP NOSE
4	160.66	1.22	CONCRETE	SHARP NOSE
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- FLOW DIRECTION
- ROADS
- RAILWAY

NOTE(S)

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PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

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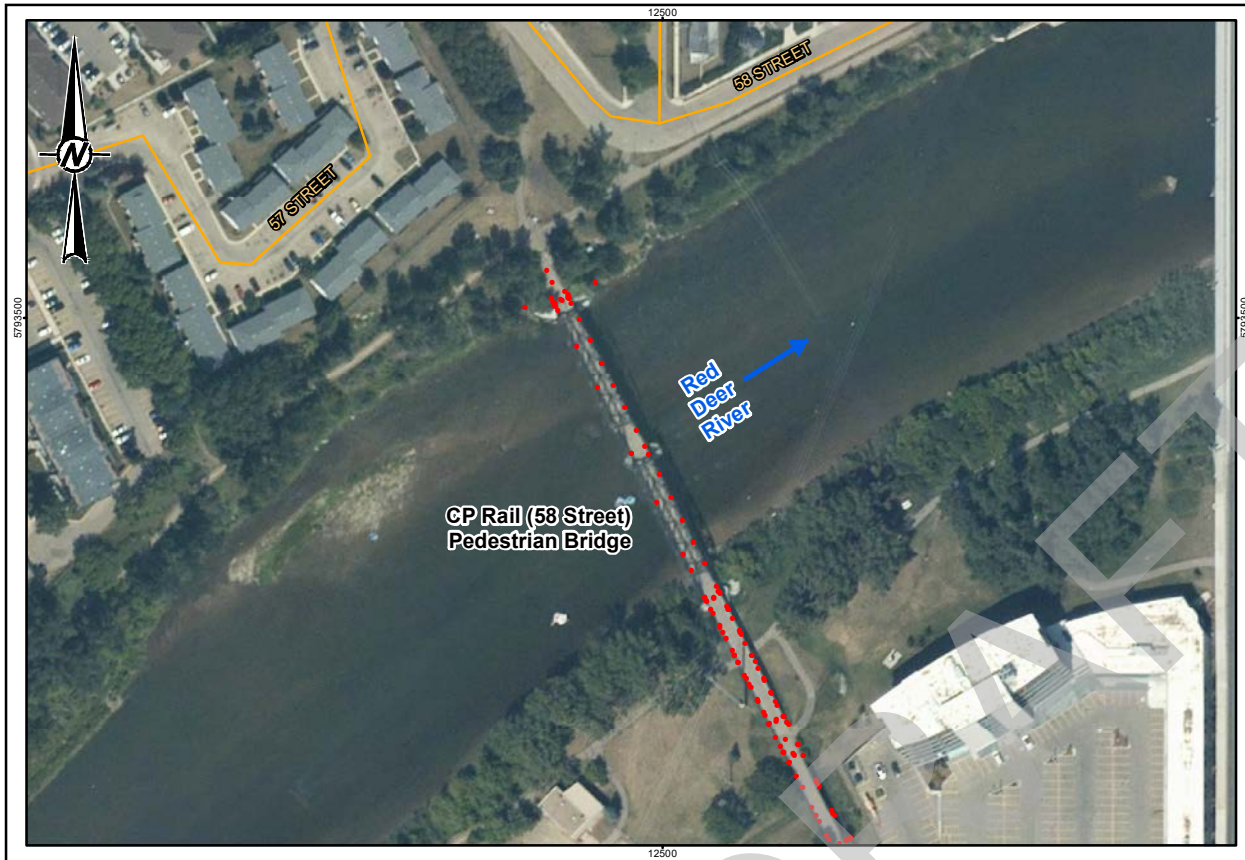
PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-4



CP RAIL (58 STREET) PEDESTRIAN BRIDGE

LOCATION	RED DEER RIVER
DESCRIPTION	PEDESTRIAN
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	1906
TOTAL LENGTH OF SPAN (m)	201.67
DECK WIDTH OF BRIDGE (m)	5.03
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	857.39
AVERAGE LOW CHORD ELEVATION (m)	856.50
BRIDGE OBSTRUCTION HEIGHT (m)	0.69
NUMBER OF PIERS	4

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	56.26	3.70	CONCRETE	SHARP NOSE
2	111.05	3.70	CONCRETE	SHARP NOSE
3	180.5	0.76	CONCRETE	CYLINDRICAL
4	192.72	0.76	CONCRETE	CYLINDRICAL
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- FLOW DIRECTION
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
SEE REPORT SECTION 2.5 AND HYDRAULIC MODEL FOR MORE INFORMATION.

REFERENCE(S)

BRIDGE SURVEY AND BRIDGE PHOTOS BY GOLDER ASSOCIATES LTD. AUG 2017 - NOV 2017. ROADS OBTAINED FROM ALTALIS, © GOVERNMENT OF ALBERTA 2017. ALL RIGHTS RESERVED. IMAGERY CAPTURED JULY 2018 BY ORTHOSHOP GEOMATICS LTD. FOR THE GOVERNMENT OF ALBERTA. DATUM: NAD 83 CSRS PROJECTION: 3TM 114

PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A
0 25mm

0 50 100
1:2,500 METRES

PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

TITLE
50 AVENUE (GAETZ AVENUE) BRIDGE

LOCATION	RED DEER RIVER
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	1981
TOTAL LENGTH OF SPAN (m)	197.45
DECK WIDTH OF BRIDGE (m)	15.30
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	858.70
AVERAGE LOW CHORD ELEVATION (m)	855.94
BRIDGE OBSTRUCTION HEIGHT (m)	2.76
NUMBER OF PIERS	5

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	34.25	1.50	CONCRETE	SHARP NOSE
2	66.21	1.50	CONCRETE	SHARP NOSE
3	98.59	1.50	CONCRETE	SHARP NOSE
4	130.69	1.50	CONCRETE	SHARP NOSE
5	162.75	1.50	CONCRETE	SHARP NOSE
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- FLOW DIRECTION
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
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CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-6

TITLE

49 AVENUE BRIDGE

LOCATION	RED DEER RIVER
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	76179
YEAR BUILT	1981
TOTAL LENGTH OF SPAN (m)	181.89
DECK WIDTH OF BRIDGE (m)	15.86
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	859.75
AVERAGE LOW CHORD ELEVATION (m)	858.00
BRIDGE OBSTRUCTION HEIGHT (m)	1.75
NUMBER OF PIERS	4

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	32.3	1.80	CONCRETE	ROUND NOSE
2	70.5	1.80	CONCRETE	ROUND NOSE
3	108.60	1.80	CONCRETE	ROUND NOSE
4	146.80	1.80	CONCRETE	ROUND NOSE
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- FLOW DIRECTION
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
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REFERENCE(S)

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PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
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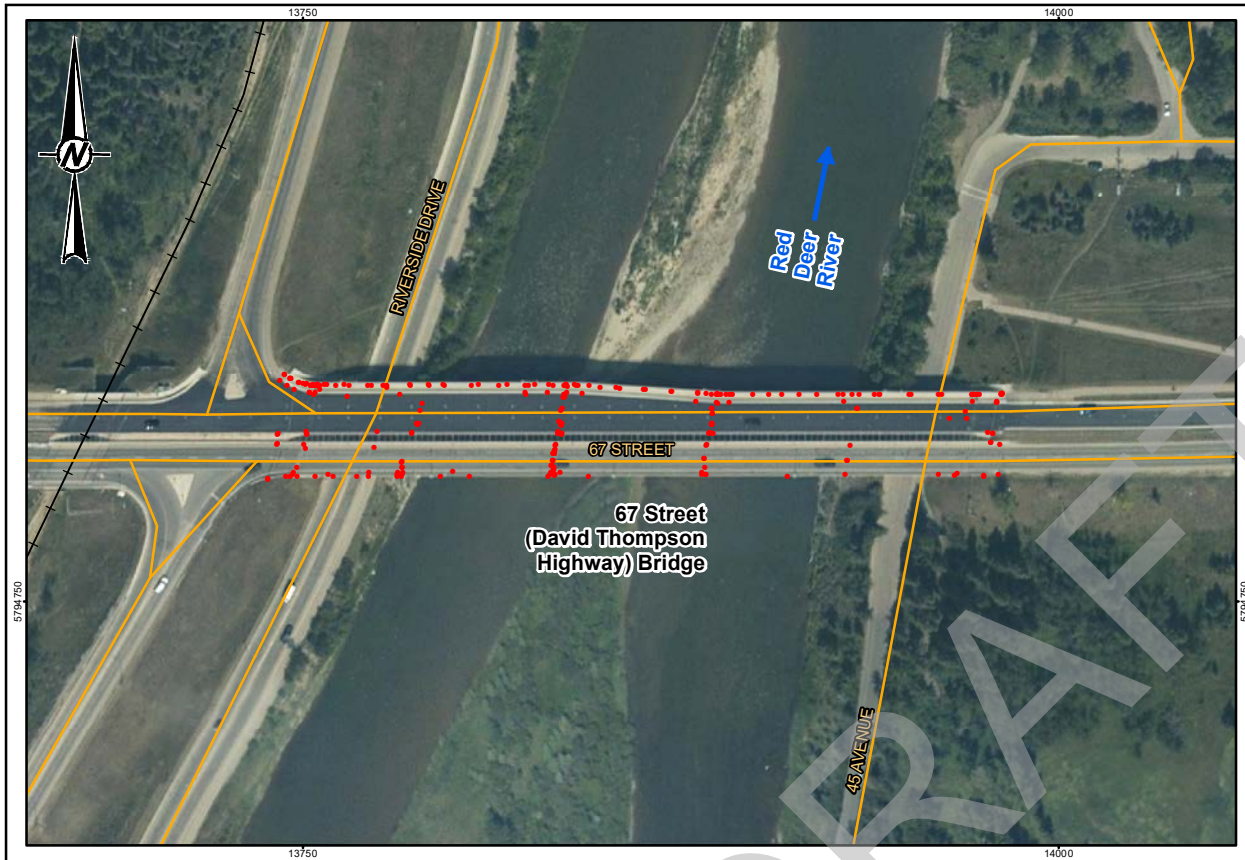
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A
0 25mm



0 50 100
1:2,500 METRES

PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

TITLE
67 STREET (DAVID THOMPSON HIGHWAY) BRIDGE

LOCATION	RED DEER RIVER
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	80872
YEAR BUILT	1999
TOTAL LENGTH OF SPAN (m)	219.33
DECK WIDTH OF BRIDGE (m)	30.60
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	860.85
AVERAGE LOW CHORD ELEVATION (m)	857.67
BRIDGE OBSTRUCTION HEIGHT (m)	3.18
NUMBER OF PIERS	4

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	38.41	1.24	CONCRETE	ROUND NOSE
2	83.16	1.24	CONCRETE	ROUND NOSE
3	135.0	1.24	CONCRETE	ROUND NOSE
4	185.78	1.24	CONCRETE	ROUND NOSE
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- FLOW DIRECTION
- ROADS
- RAILWAY

NOTE(S)

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CLIENT
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PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

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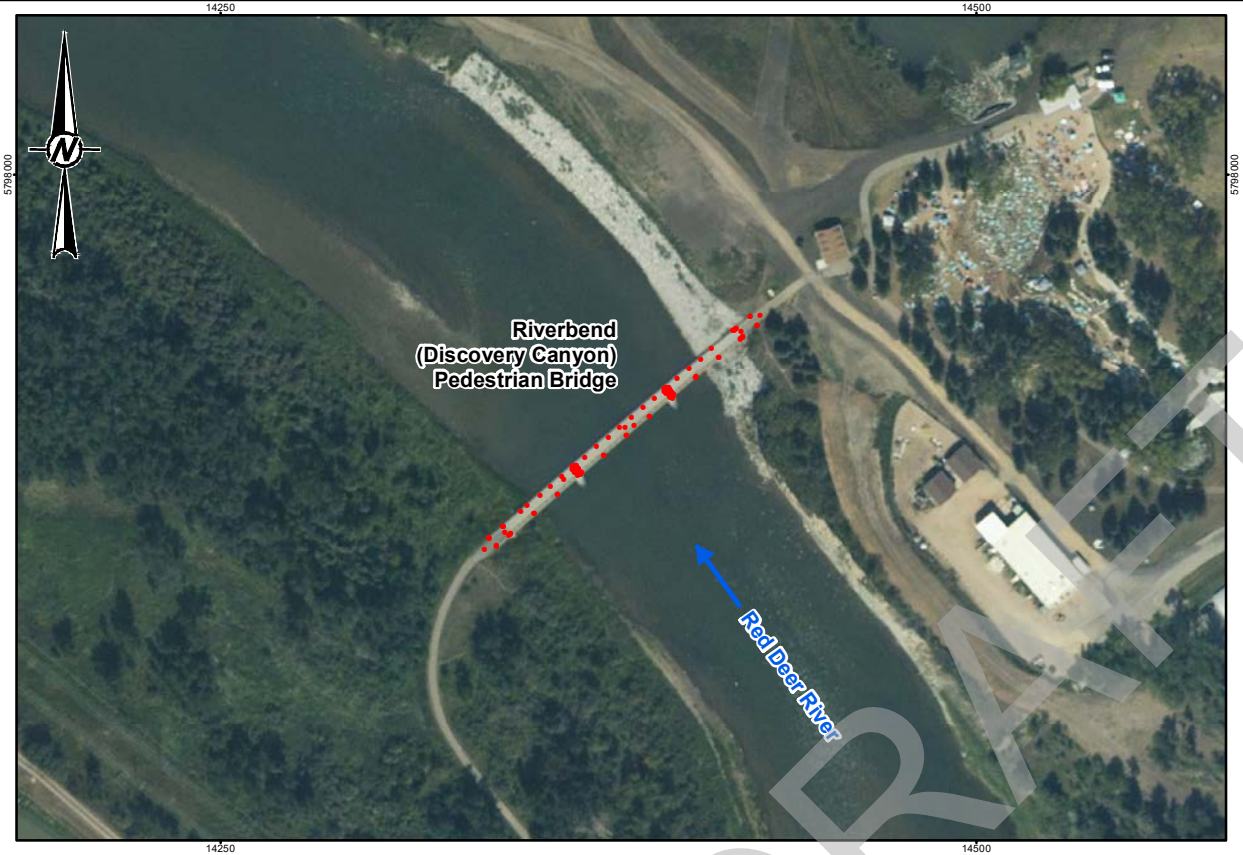
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-8



0 50 100

1:2,500 METRES

PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

TITLE

RIVERBEND (DISCOVERY CANYON) PEDESTRIAN BRIDGE

LOCATION	RED DEER RIVER
DESCRIPTION	PEDESTRIAN
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	1983
TOTAL LENGTH OF SPAN (m)	100.42
DECK WIDTH OF BRIDGE (m)	3.45
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	851.93
AVERAGE LOW CHORD ELEVATION (m)	849.09
BRIDGE OBSTRUCTION HEIGHT (m)	2.84
NUMBER OF PIERS	2

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	30.38	1.20	CONCRETE	SHARP NOSE
2	70.26	1.20	CONCRETE	SHARP NOSE
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- FLOW DIRECTION
- ROADS
- RAILWAY

NOTE(S)

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CLIENT

ALBERTA ENVIRONMENT AND PARKS

PROJECT

RED DEER RIVER HAZARD STUDY

CONSULTANT

GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-9

0 50 100

1:2,500 METRES

PHOTO 1 DOWNSTREAM END, LOOKING UPSTREAM

PHOTO 2 UPSTREAM END, LOOKING DOWNSTREAM

TITLE

RANGE ROAD 281 CULVERT

LOCATION	WASKASOO CREEK
NUMBER OF CULVERTS	1
TOTAL LENGTH OF CULVERT (m)	13.66
RISE OF CULVERT (m)	-
SPAN OF CULVERT (m)	-
DIAMETER OF CULVERT (m)	0.9
CULVERT TYPE	PIPE
CULVERT INVERT ELEVATION - UPSTREAM END (m)	894.07
CULVERT INVERT ELEVATION - DOWNSTREAM END (m)	894.09

LEGEND

- SURVEY POINT
- ROAD
- RAILWAY

NOTE(S)

SEE REPORT SECTION 2.3 FOR MORE INFORMATION.
WHERE THERE ARE MULTIPLE CULVERTS, SUBSEQUENT INFORMATION IS APPLICABLE FOR ALL CULVERTS.

REFERENCE(S)

CULVERT SURVEY AND CULVERT PHOTOS BY GOLDER ASSOCIATES LTD. AUG 2017 - NOV 2017.
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CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

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DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-10

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A
25mm
0

TITLE

TOWNSHIP ROAD 364 BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	8.79
DECK WIDTH OF BRIDGE (m)	7.28
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	896.01
AVERAGE LOW CHORD ELEVATION (m)	895.20
BRIDGE OBSTRUCTION HEIGHT (m)	0.81
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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REFERENCE(S)

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PHOTO 1 DOWNSTREAM END, LOOKING UPSTREAM

PHOTO 2 BRIDGE LEFT SIDE

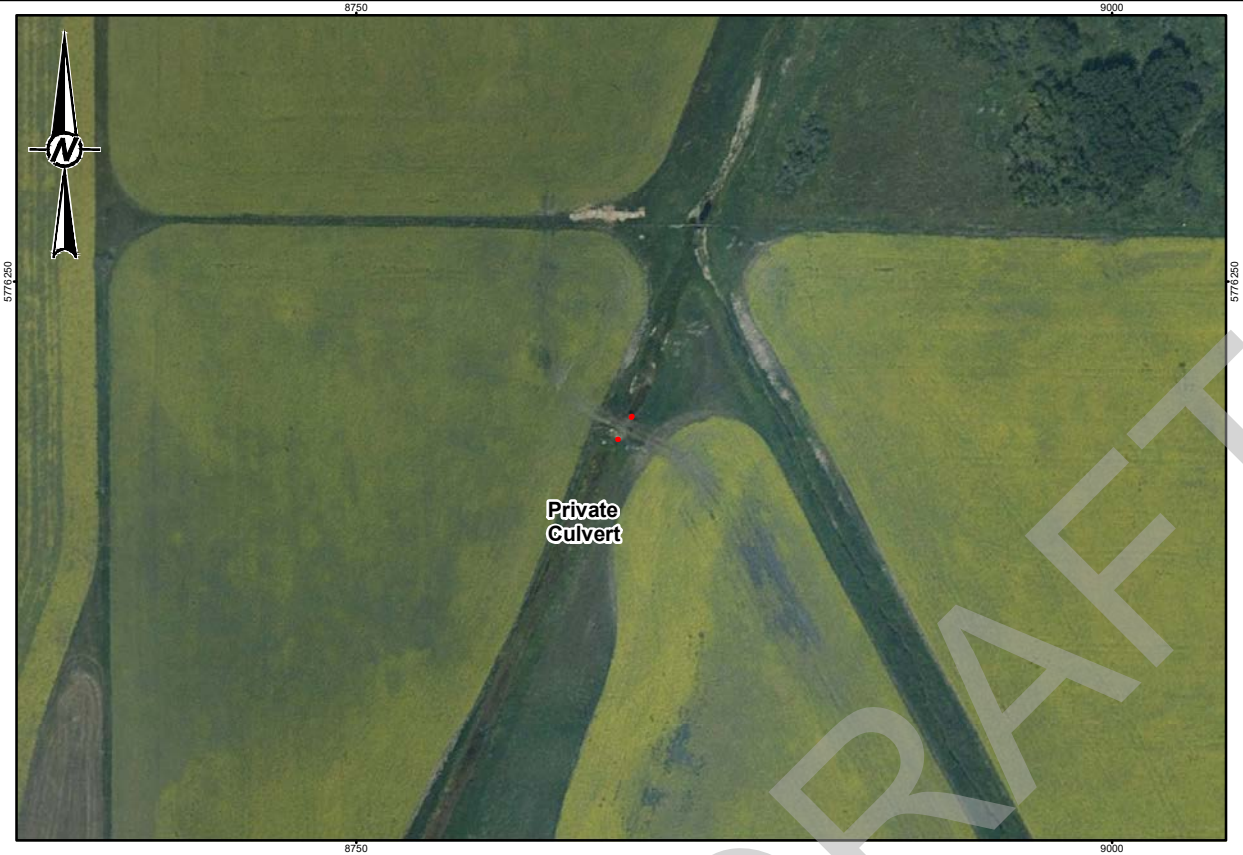
CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-11



TITLE

PRIVATE CULVERT

LOCATION	WASKASOO CREEK
NUMBER OF CULVERTS	1
TOTAL LENGTH OF CULVERT (m)	8.74
RISE OF CULVERT (m)	-
SPAN OF CULVERT (m)	-
DIAMETER OF CULVERT (m)	2.5
CULVERT TYPE	PIPE
CULVERT INVERT ELEVATION - UPSTREAM END (m)	892.92
CULVERT INVERT ELEVATION - DOWNSTREAM END (m)	893.17

LEGEND

- SURVEY POINT
- ROAD
- RAILWAY

NOTE(S)

SEE REPORT SECTION 2.3 FOR MORE INFORMATION.
WHERE THERE ARE MULTIPLE CULVERTS, SUBSEQUENT INFORMATION IS APPLICABLE FOR ALL CULVERTS.

REFERENCE(S)

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DATUM: NAD 83 CSRS PROJECTION: 3TM 114

PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 UPSTREAM END, LOOKING DOWNSTREAM

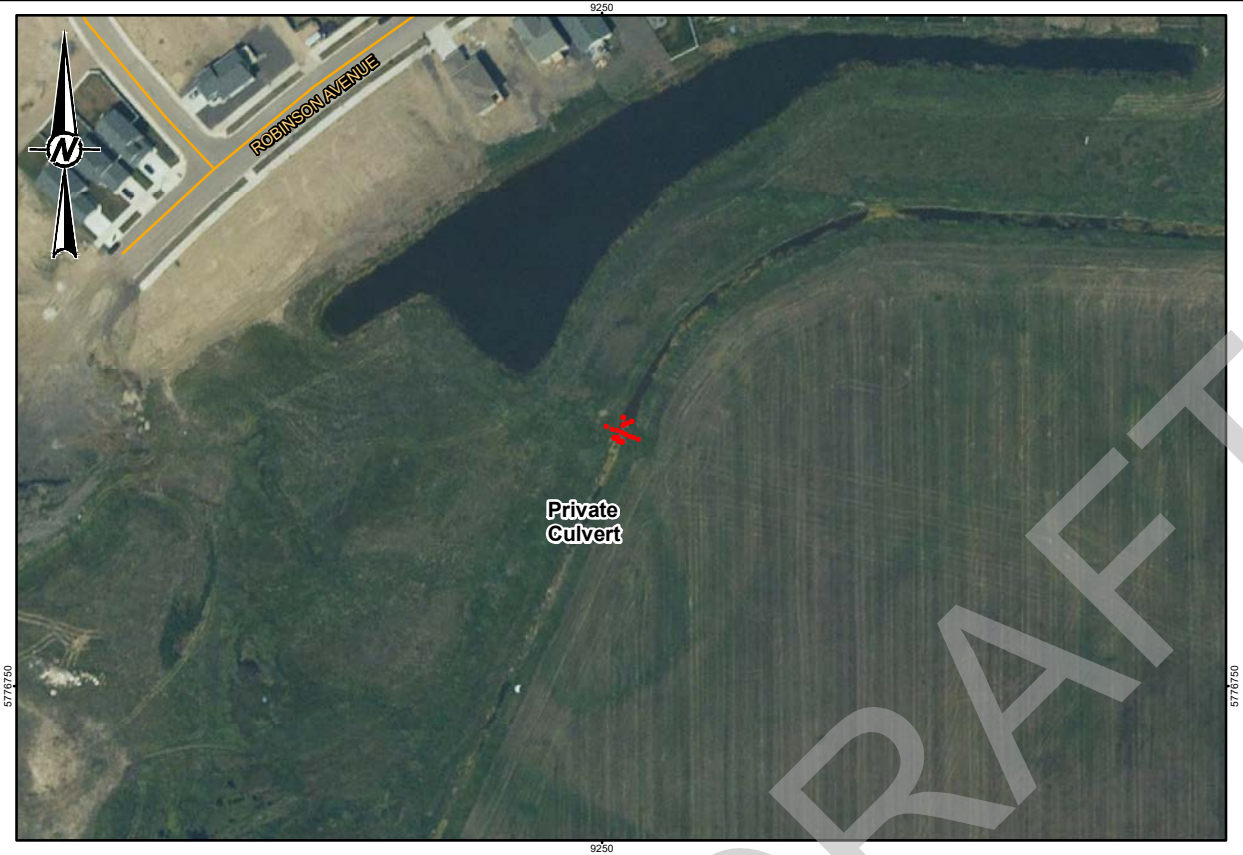
CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-12



0 50 100

1:2,500 METRES

PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

TITLE

PRIVATE CULVERT

LOCATION	WASKASOO CREEK
NUMBER OF CULVERTS	4
TOTAL LENGTH OF CULVERT (m)	7.73
RISE OF CULVERT (m)	-
SPAN OF CULVERT (m)	-
DIAMETER OF CULVERT (m)	0.5
CULVERT TYPE	PIPE
CULVERT INVERT ELEVATION - UPSTREAM END (m)	892.46
CULVERT INVERT ELEVATION - DOWNSTREAM END (m)	892.57

LEGEND

- SURVEY POINT
- ROAD
- RAILWAY

NOTE(S)

SEE REPORT SECTION 2.3 FOR MORE INFORMATION.
WHERE THERE ARE MULTIPLE CULVERTS, SUBSEQUENT INFORMATION IS APPLICABLE FOR ALL CULVERTS.

REFERENCE(S)

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GOLDER

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DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-13

0 50 100

1:2,500 METRES

PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

TITLE

RANGE ROAD 280 BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	26.55
DECK WIDTH OF BRIDGE (m)	10.38
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	896.25
AVERAGE LOW CHORD ELEVATION (m)	894.89
BRIDGE OBSTRUCTION HEIGHT (m)	1.36
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
SEE REPORT SECTION 2.5 AND HYDRAULIC MODEL FOR MORE INFORMATION.

REFERENCE(S)

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ALBERTA ENVIRONMENT AND PARKS

PROJECT

RED DEER RIVER HAZARD STUDY

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YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-14

0 50 100

1:2,500 METRES

PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

TITLE

HIGHWAY 42 BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	67.84
DECK WIDTH OF BRIDGE (m)	11.89
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	895.65
AVERAGE LOW CHORD ELEVATION (m)	893.75
BRIDGE OBSTRUCTION HEIGHT (m)	1.90
NUMBER OF PIERS	1

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	37.11	0.35	WOOD	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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CONSULTANT

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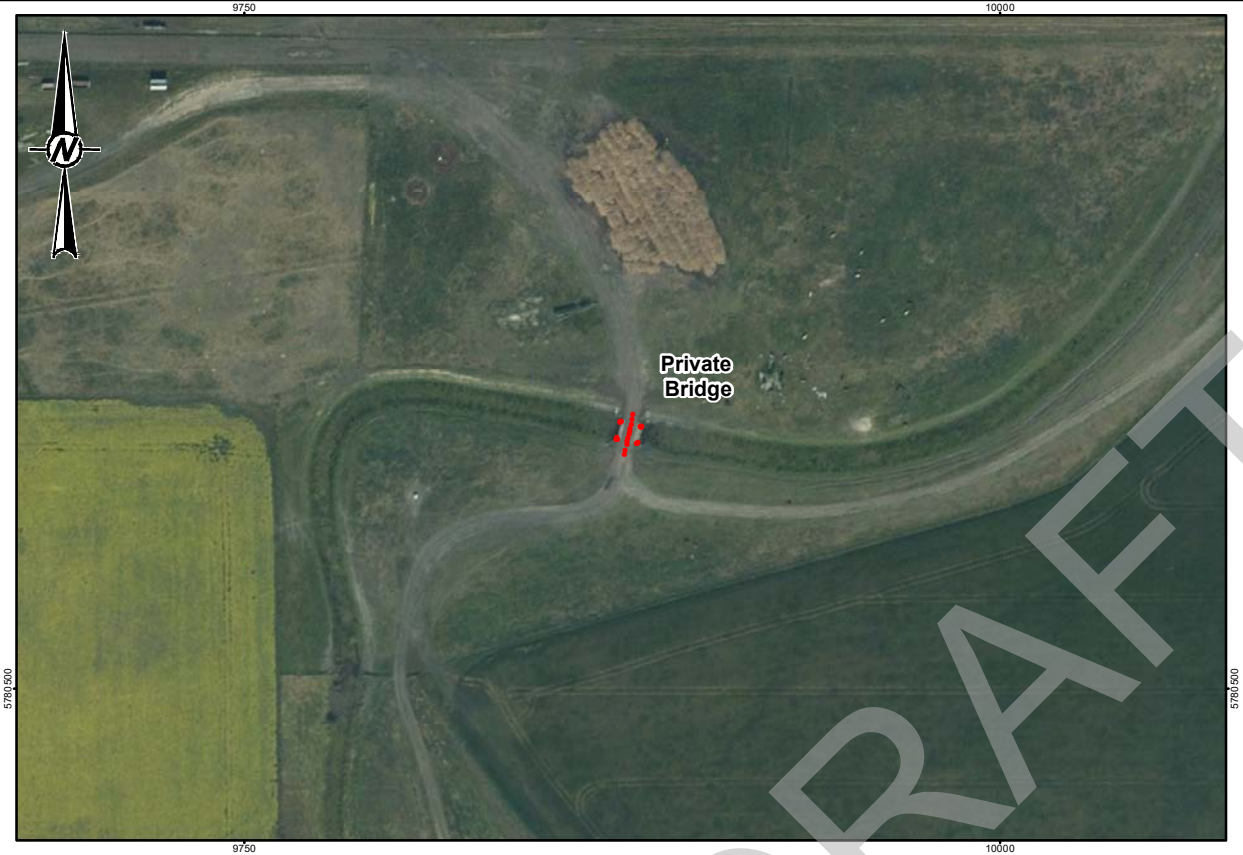
PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-15



TITLE

PRIVATE BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	5.95
DECK WIDTH OF BRIDGE (m)	7.31
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	892.89
AVERAGE LOW CHORD ELEVATION (m)	892.19
BRIDGE OBSTRUCTION HEIGHT (m)	0.70
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
SEE REPORT SECTION 2.5 AND HYDRAULIC MODEL FOR MORE INFORMATION.

REFERENCE(S)

BRIDGE SURVEY AND BRIDGE PHOTOS BY GOLDER ASSOCIATES LTD. AUG 2017 - NOV 2017. ROADS OBTAINED FROM ALTALIS, © GOVERNMENT OF ALBERTA 2017. ALL RIGHTS RESERVED. IMAGERY CAPTURED JULY 2018 BY ORTHOSHOP GEOMATICS LTD. FOR THE GOVERNMENT OF ALBERTA. DATUM: NAD 83 CSRS PROJECTION: 3TM 114

PHOTO 1 BRIDGE LEFT SIDE

PHOTO 2 UPSTREAM END, LOOKING DOWNSTREAM

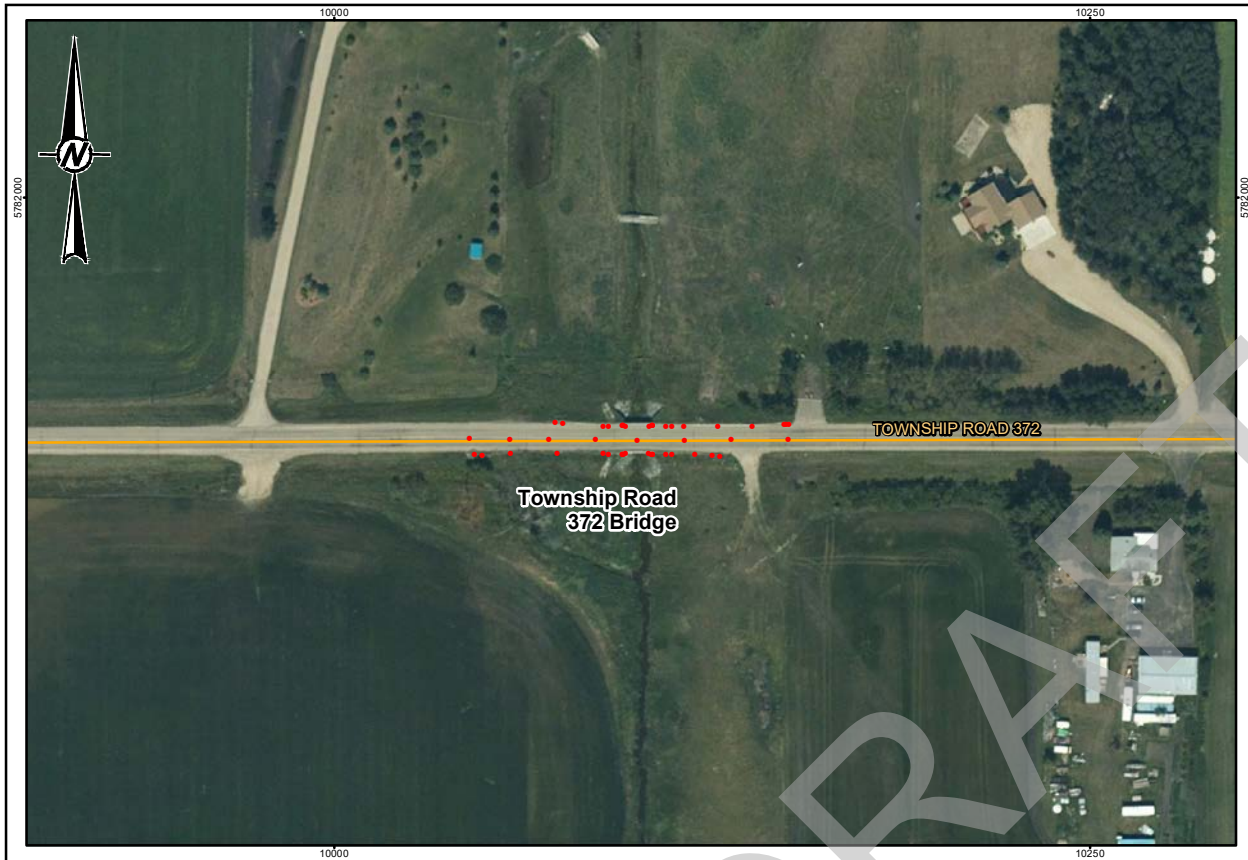
CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-16



0 50 100

1:2,500 METRES

TITLE

TOWNSHIP ROAD 372 BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	9.37
DECK WIDTH OF BRIDGE (m)	9.71
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	893.55
AVERAGE LOW CHORD ELEVATION (m)	892.11
BRIDGE OBSTRUCTION HEIGHT (m)	1.44
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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REFERENCE(S)

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PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-17

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A
25mm
0

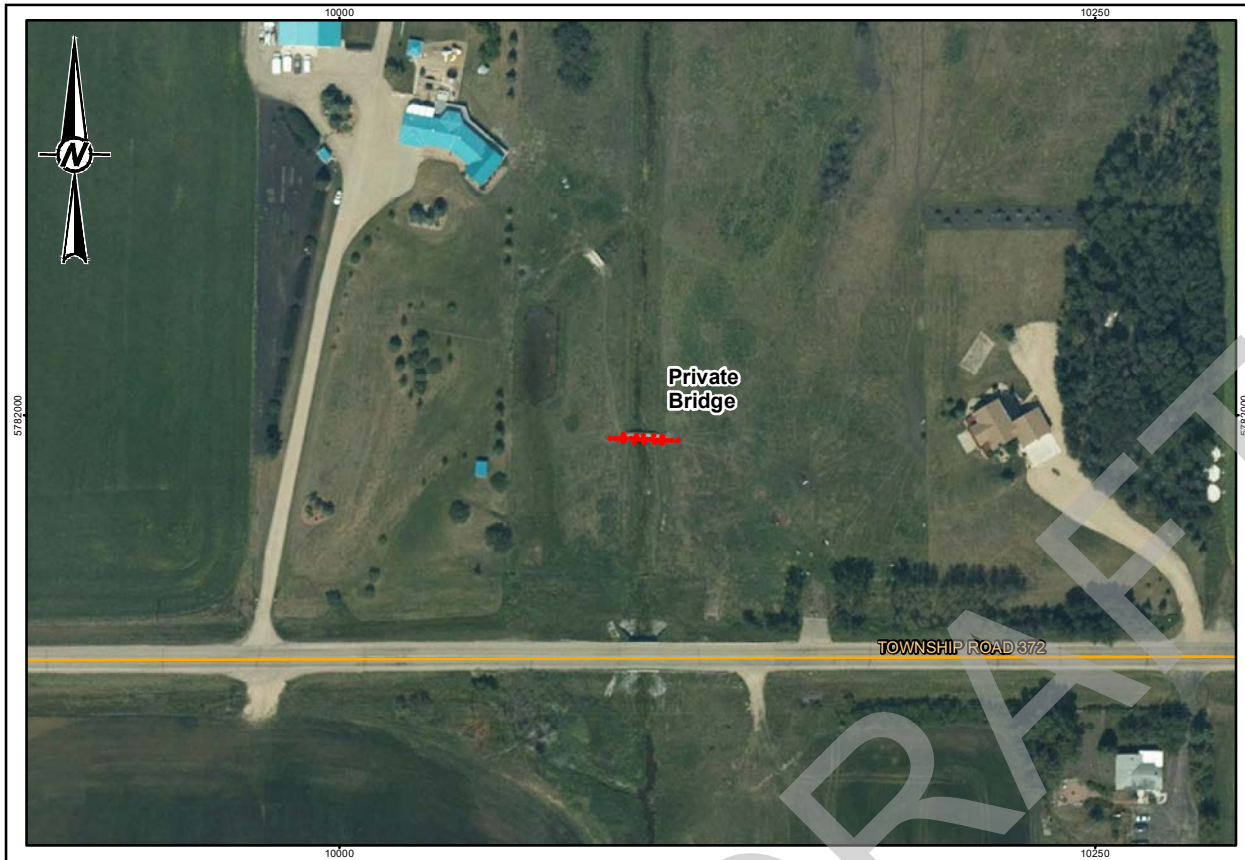

PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

TITLE
PRIVATE BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	13.06
DECK WIDTH OF BRIDGE (m)	2.02
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	891.89
AVERAGE LOW CHORD ELEVATION (m)	891.48
BRIDGE OBSTRUCTION HEIGHT (m)	0.41
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
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CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-18

0 50 100
1:2,500 METRES

PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

TITLE
PRIVATE CULVERT

LOCATION	WASKASOO CREEK
NUMBER OF CULVERTS	1
TOTAL LENGTH OF CULVERT (m)	8.17
RISE OF CULVERT (m)	-
SPAN OF CULVERT (m)	-
DIAMETER OF CULVERT (m)	1.5
CULVERT TYPE	PIPE
CULVERT INVERT ELEVATION - UPSTREAM END (m)	887.43
CULVERT INVERT ELEVATION - DOWNSTREAM END (m)	887.74

LEGEND

- SURVEY POINT
- ROAD
- RAILWAY

NOTE(S)

SEE REPORT SECTION 2.3 FOR MORE INFORMATION.
WHERE THERE ARE MULTIPLE CULVERTS, SUBSEQUENT INFORMATION IS APPLICABLE FOR ALL CULVERTS.

REFERENCE(S)

CULVERT SURVEY AND CULVERT PHOTOS BY GOLDER ASSOCIATES LTD. AUG 2017 - NOV 2017.
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DATUM: NAD 83 CSRS PROJECTION: 3TM 114

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-19

0 50 100

1:2,500 METRES

TITLE

HIGHWAY 2A BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	2001
TOTAL LENGTH OF SPAN (m)	14.00
DECK WIDTH OF BRIDGE (m)	13.45
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	891.51
AVERAGE LOW CHORD ELEVATION (m)	890.65
BRIDGE OBSTRUCTION HEIGHT (m)	0.86
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
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CLIENT

ALBERTA ENVIRONMENT AND PARKS

PROJECT

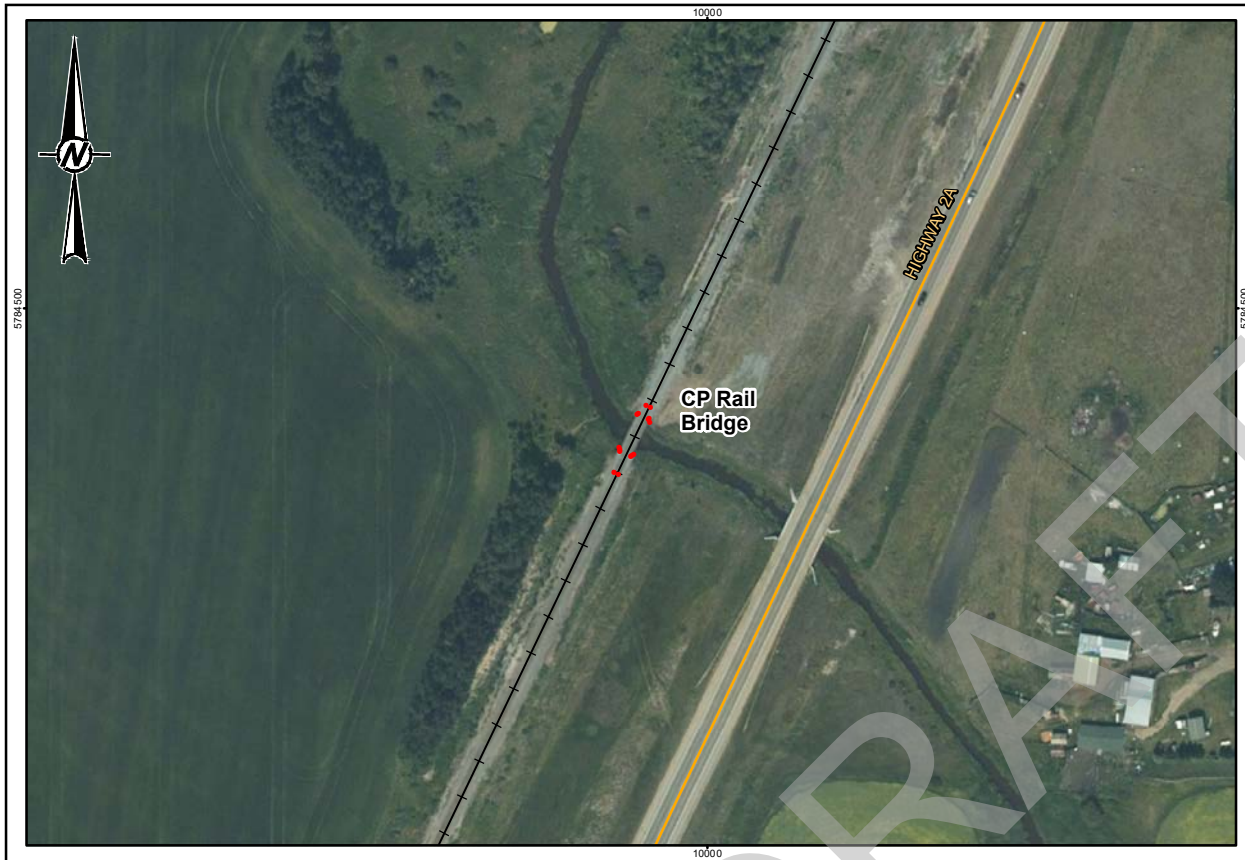
RED DEER RIVER HAZARD STUDY

CONSULTANT

GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-20



0 50 100

1:2,500 METRES

TITLE

CP RAIL BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	RAILWAY
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	13.03
DECK WIDTH OF BRIDGE (m)	4.32
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	892.43
AVERAGE LOW CHORD ELEVATION (m)	891.21
BRIDGE OBSTRUCTION HEIGHT (m)	1.21
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-21

0 50 100

1:2,500 METRES

TITLE

TOWNSHIP ROAD 374 BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	13.90
DECK WIDTH OF BRIDGE (m)	8.81
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	891.44
AVERAGE LOW CHORD ELEVATION (m)	889.99
BRIDGE OBSTRUCTION HEIGHT (m)	1.45
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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REFERENCE(S)

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PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-22

TITLE

CP RAIL BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	RAILWAY
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	11.63
DECK WIDTH OF BRIDGE (m)	5.29
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	890.72
AVERAGE LOW CHORD ELEVATION (m)	889.29
BRIDGE OBSTRUCTION HEIGHT (m)	1.43
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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REFERENCE(S)

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PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

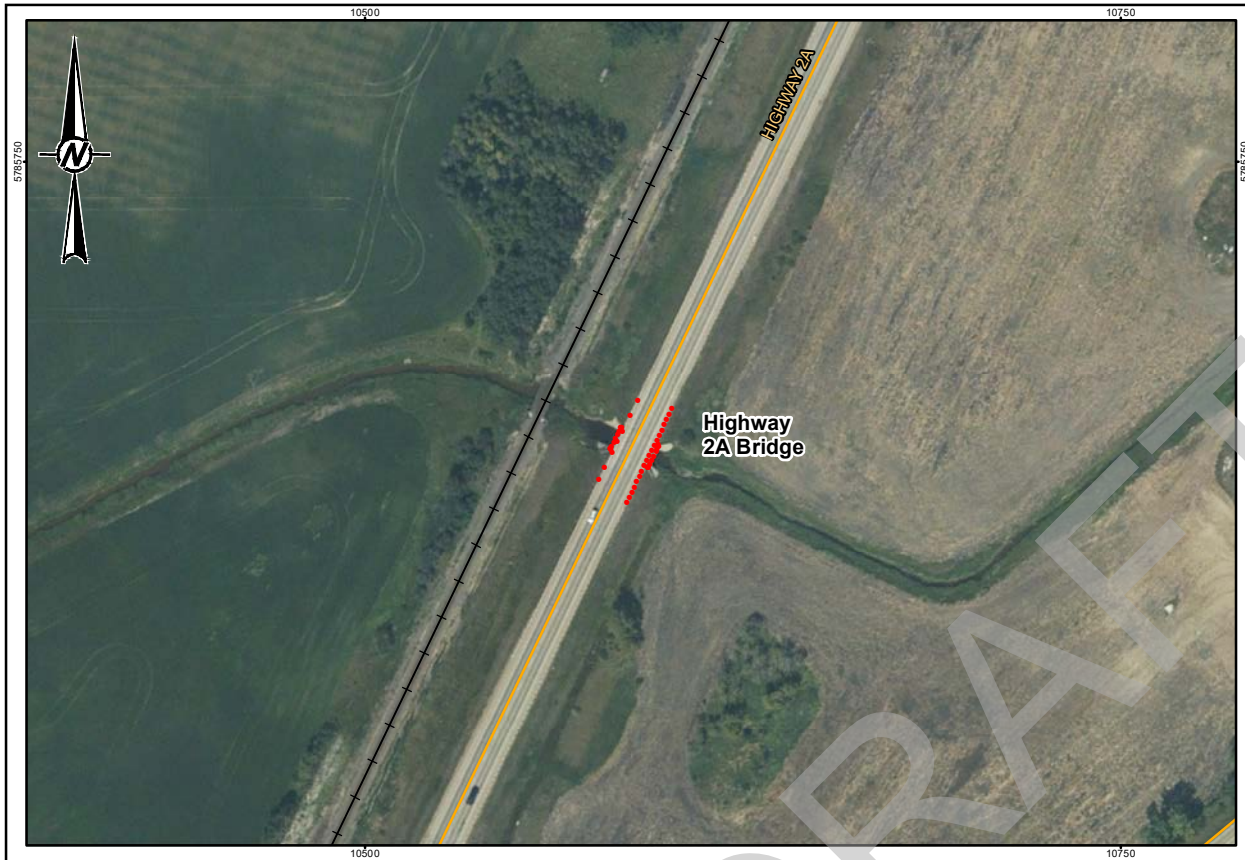
CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-23



TITLE
HIGHWAY 2A BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	80836
YEAR BUILT	1988
TOTAL LENGTH OF SPAN (m)	99.20
DECK WIDTH OF BRIDGE (m)	11.48
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	890.66
AVERAGE LOW CHORD ELEVATION (m)	890.15
BRIDGE OBSTRUCTION HEIGHT (m)	0.51
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-24

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A
25mm
0

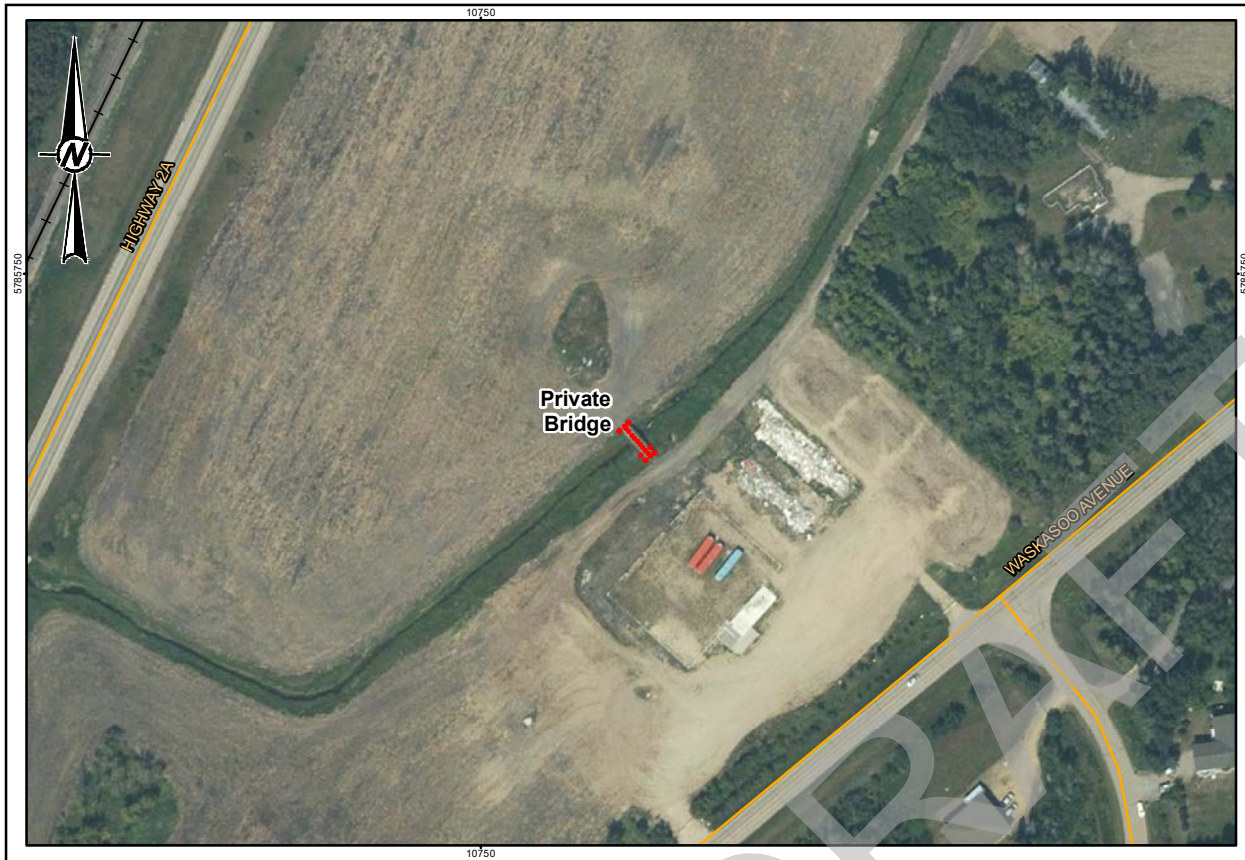

PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

TITLE
PRIVATE BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	12.98
DECK WIDTH OF BRIDGE (m)	3.41
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	889.10
AVERAGE LOW CHORD ELEVATION (m)	887.91
BRIDGE OBSTRUCTION HEIGHT (m)	1.18
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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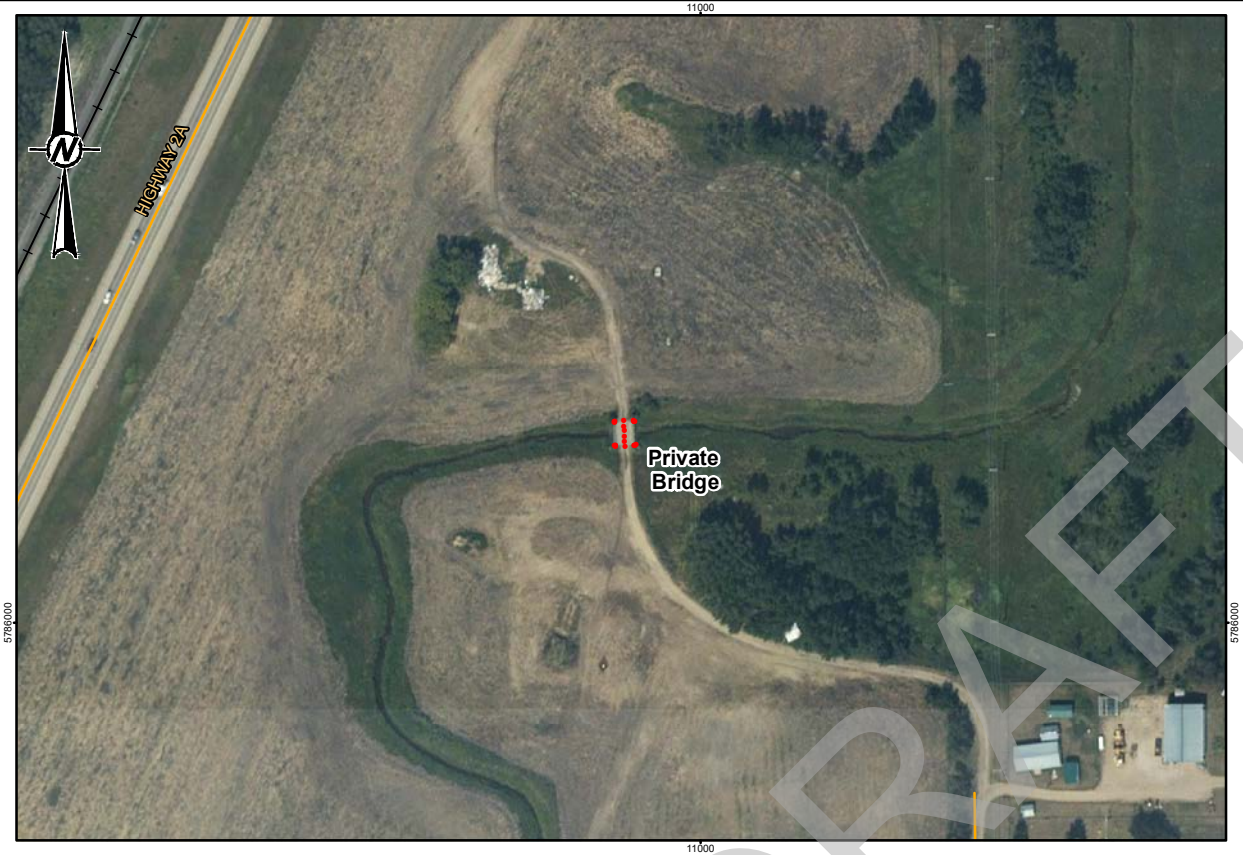
CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-25



0 50 100

1:2,500 METRES

TITLE

PRIVATE BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	8.16
DECK WIDTH OF BRIDGE (m)	6.11
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	888.60
AVERAGE LOW CHORD ELEVATION (m)	887.82
BRIDGE OBSTRUCTION HEIGHT (m)	0.79
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

PHOTO 1 DOWNSTREAM END, LOOKING UPSTREAM

PHOTO 2 UPSTREAM END, LOOKING DOWNSTREAM

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
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CLIENT
ALBERTA ENVIRONMENT AND PARKS

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CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
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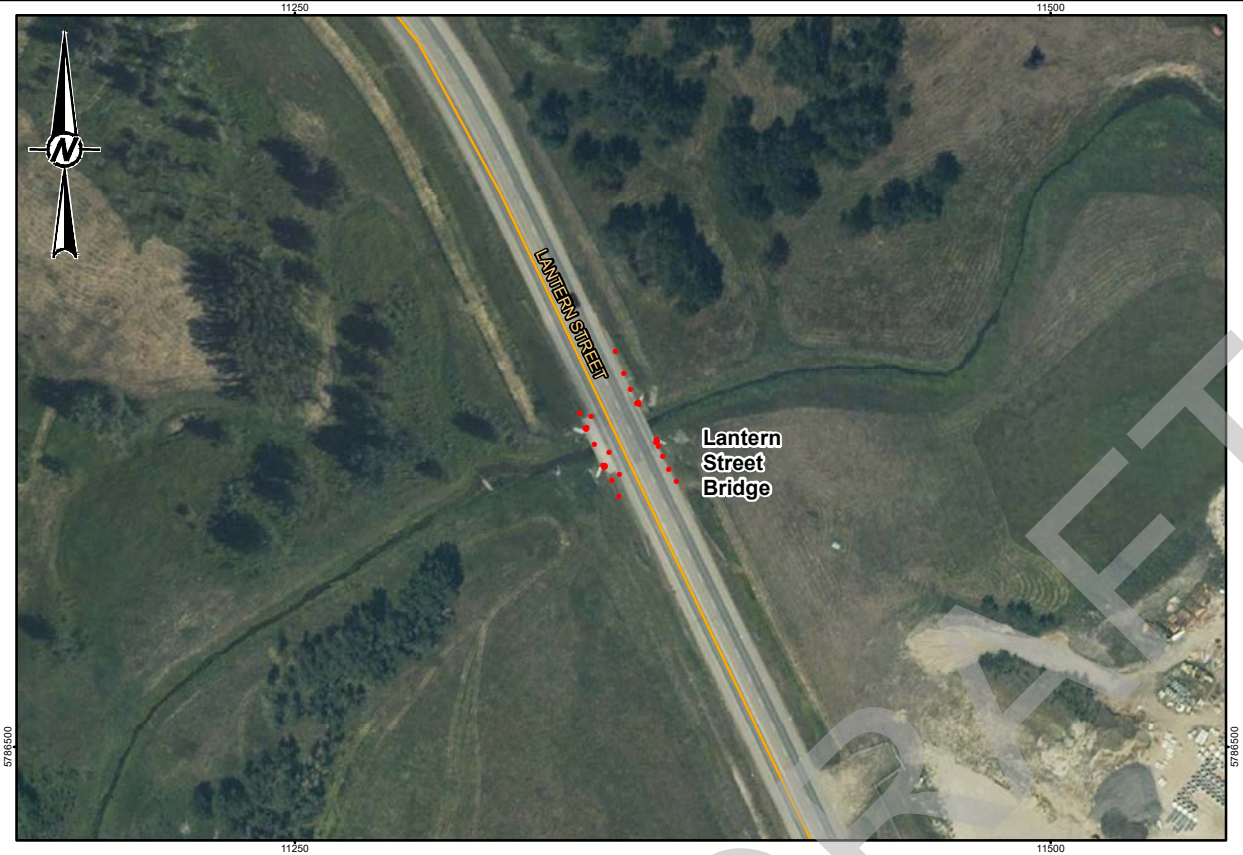
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-26

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A

25mm 0



0 50 100
1:2,500 METRES

PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK ABUTMENT

TITLE
LANTERN STREET BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	83095
YEAR BUILT	2007
TOTAL LENGTH OF SPAN (m)	14.38
DECK WIDTH OF BRIDGE (m)	18.48
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	888.78
AVERAGE LOW CHORD ELEVATION (m)	887.27
BRIDGE OBSTRUCTION HEIGHT (m)	1.51
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
SEE REPORT SECTION 2.5 AND HYDRAULIC MODEL FOR MORE INFORMATION.

REFERENCE(S)

BRIDGE SURVEY AND BRIDGE PHOTOS BY GOLDER ASSOCIATES LTD. AUG 2017 - NOV 2017. ROADS OBTAINED FROM ALTALIS, © GOVERNMENT OF ALBERTA 2017. ALL RIGHTS RESERVED. IMAGERY CAPTURED JULY 2018 BY ORTHOSHOP GEOMATICS LTD. FOR THE GOVERNMENT OF ALBERTA. DATUM: NAD 83 CSRS PROJECTION: 3TM 114

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-27

0 50 100

1:2,500 METRES

PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

TITLE

TOWNSHIP ROAD 375 BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	12.11
DECK WIDTH OF BRIDGE (m)	6.35
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	887.65
AVERAGE LOW CHORD ELEVATION (m)	887.25
BRIDGE OBSTRUCTION HEIGHT (m)	0.40
NUMBER OF PIERS	1

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	6.15	0.30	WOOD	CYLINDRICAL
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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CLIENT

ALBERTA ENVIRONMENT AND PARKS

PROJECT

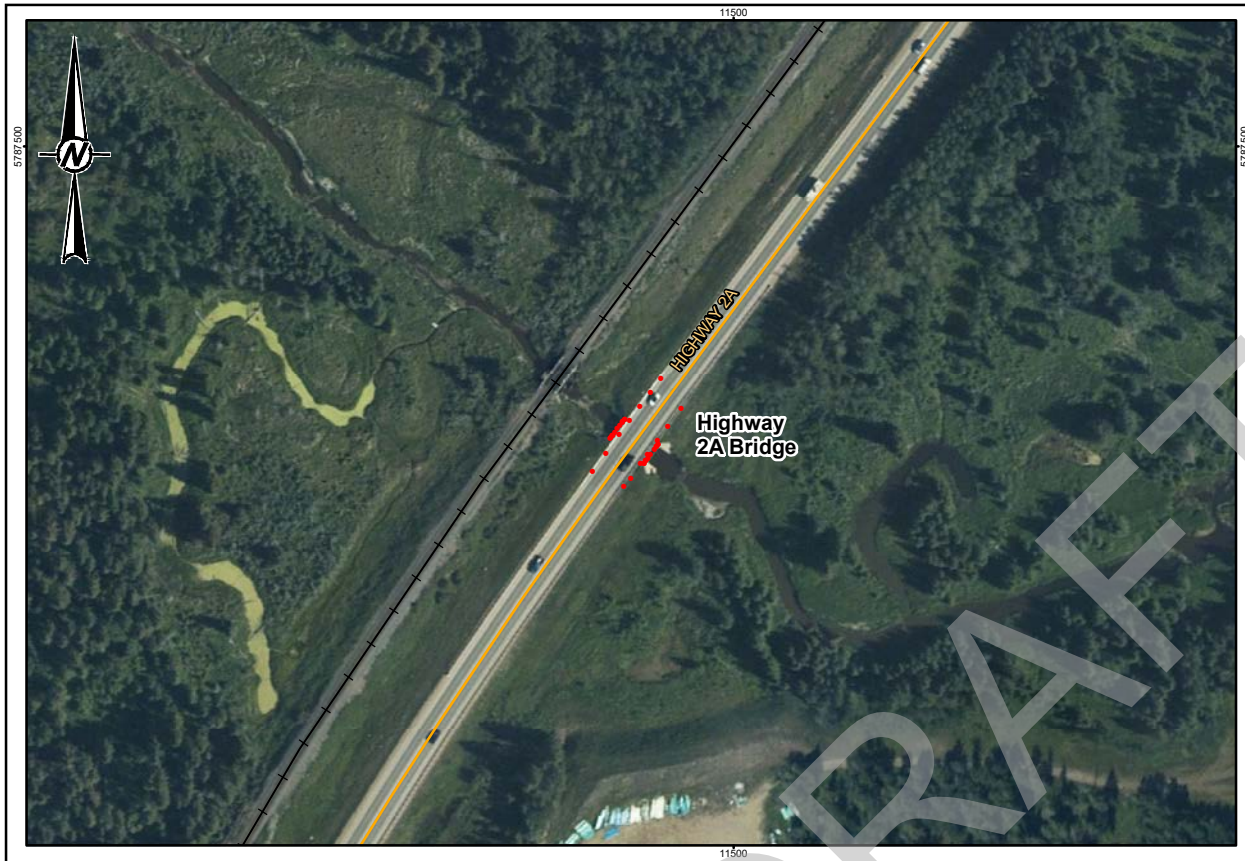
RED DEER RIVER HAZARD STUDY

CONSULTANT

GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-28



0 50 100

1:2,500 METRES

TITLE

HIGHWAY 2A BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	8.03
DECK WIDTH OF BRIDGE (m)	13.88
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	886.88
AVERAGE LOW CHORD ELEVATION (m)	885.70
BRIDGE OBSTRUCTION HEIGHT (m)	1.18
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
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PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

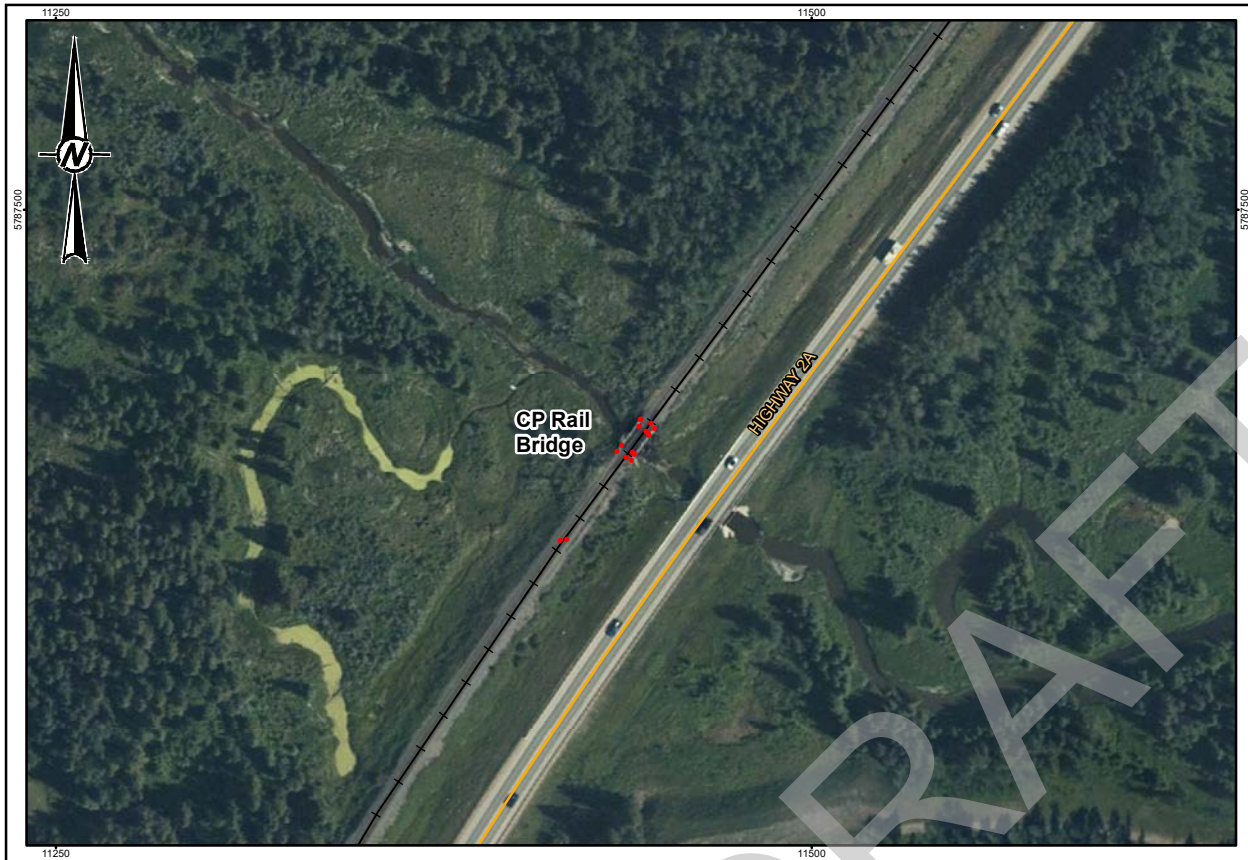
CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-29



TITLE

CP RAIL BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	RAILWAY
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	8.31
DECK WIDTH OF BRIDGE (m)	5.27
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	888.68
AVERAGE LOW CHORD ELEVATION (m)	886.15
BRIDGE OBSTRUCTION HEIGHT (m)	2.53
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-30

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A
0 25mm

0 50 100

1:2,500 METRES

TITLE

RANGE ROAD 275 BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	12.08
DECK WIDTH OF BRIDGE (m)	6.39
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	884.55
AVERAGE LOW CHORD ELEVATION (m)	883.51
BRIDGE OBSTRUCTION HEIGHT (m)	1.04
NUMBER OF PIERS	1

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	6.03	0.30	WOOD	CYLINDRICAL
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-31

TITLE
PRIVATE CULVERT

LOCATION	WASKASOO CREEK
NUMBER OF CULVERTS	2
TOTAL LENGTH OF CULVERT (m)	7.20
RISE OF CULVERT (m)	-
SPAN OF CULVERT (m)	-
DIAMETER OF CULVERT (m)	2.1
CULVERT TYPE	PIPE
CULVERT INVERT ELEVATION - UPSTREAM END (m)	879.55
CULVERT INVERT ELEVATION - DOWNSTREAM END (m)	879.64

LEGEND

- SURVEY POINT
- ROAD
- RAILWAY

NOTE(S)

SEE REPORT SECTION 2.3 FOR MORE INFORMATION.
WHERE THERE ARE MULTIPLE CULVERTS, SUBSEQUENT INFORMATION IS APPLICABLE FOR ALL CULVERTS.

REFERENCE(S)

CULVERT SURVEY AND CULVERT PHOTOS BY GOLDER ASSOCIATES LTD. AUG 2017 - NOV 2017.
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DATUM: NAD 83 CSRS PROJECTION: 3TM 114

PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

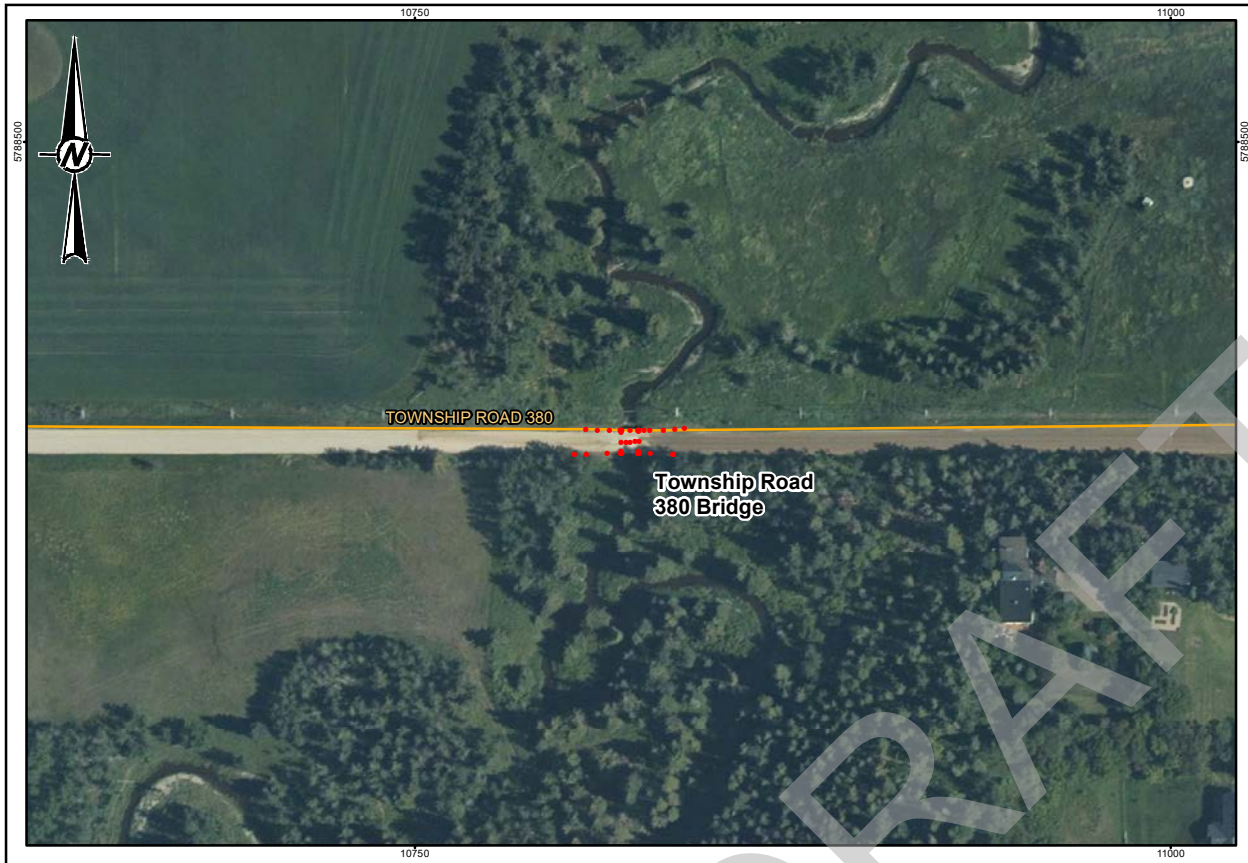
CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-32



0 50 100

1:2,500 METRES

TITLE

TOWNSHIP ROAD 380 BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	5.77
DECK WIDTH OF BRIDGE (m)	6.41
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	882.04
AVERAGE LOW CHORD ELEVATION (m)	880.91
BRIDGE OBSTRUCTION HEIGHT (m)	1.13
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-33

PHOTO 1 DOWNSTREAM END, LOOKING UPSTREAM

PHOTO 2 UPSTREAM END, LOOKING DOWNSTREAM

TITLE

PRIVATE BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	12.31
DECK WIDTH OF BRIDGE (m)	4.14
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	879.92
AVERAGE LOW CHORD ELEVATION (m)	879.42
BRIDGE OBSTRUCTION HEIGHT (m)	0.50
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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CLIENT

ALBERTA ENVIRONMENT AND PARKS

PROJECT

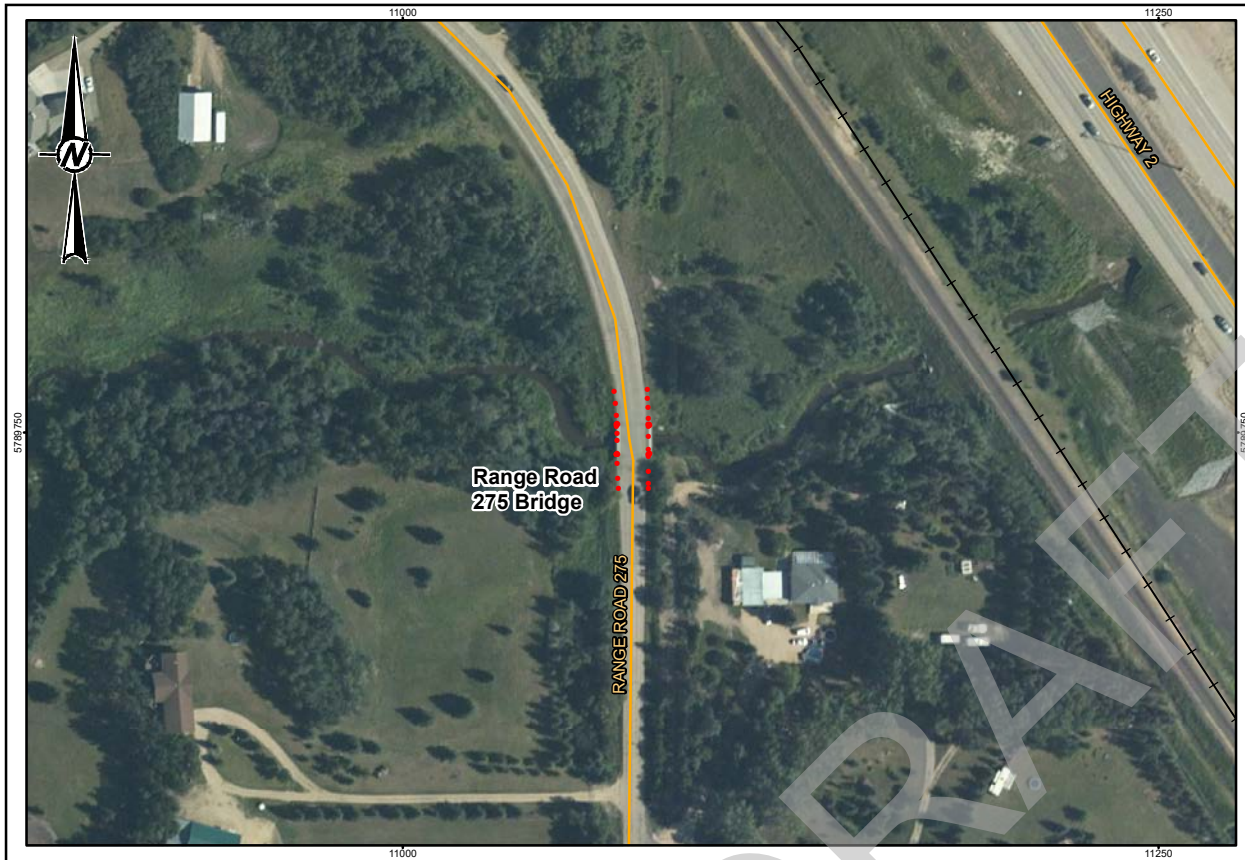
RED DEER RIVER HAZARD STUDY

CONSULTANT

GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-34



TITLE

RANGE ROAD 275 BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	9.98
DECK WIDTH OF BRIDGE (m)	10.01
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	879.88
AVERAGE LOW CHORD ELEVATION (m)	878.77
BRIDGE OBSTRUCTION HEIGHT (m)	1.11
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-35

TITLE

CP RAIL CULVERT

LOCATION	WASKASOO CREEK
NUMBER OF CULVERTS	2
TOTAL LENGTH OF CULVERT (m)	31.05
RISE OF CULVERT (m)	-
SPAN OF CULVERT (m)	-
DIAMETER OF CULVERT (m)	3.0
CULVERT TYPE	PIPE
CULVERT INVERT ELEVATION - UPSTREAM END (m)	874.54
CULVERT INVERT ELEVATION - DOWNSTREAM END (m)	874.56

LEGEND

- SURVEY POINT
- ROAD
- RAILWAY

NOTE(S)

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REFERENCE(S)

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PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

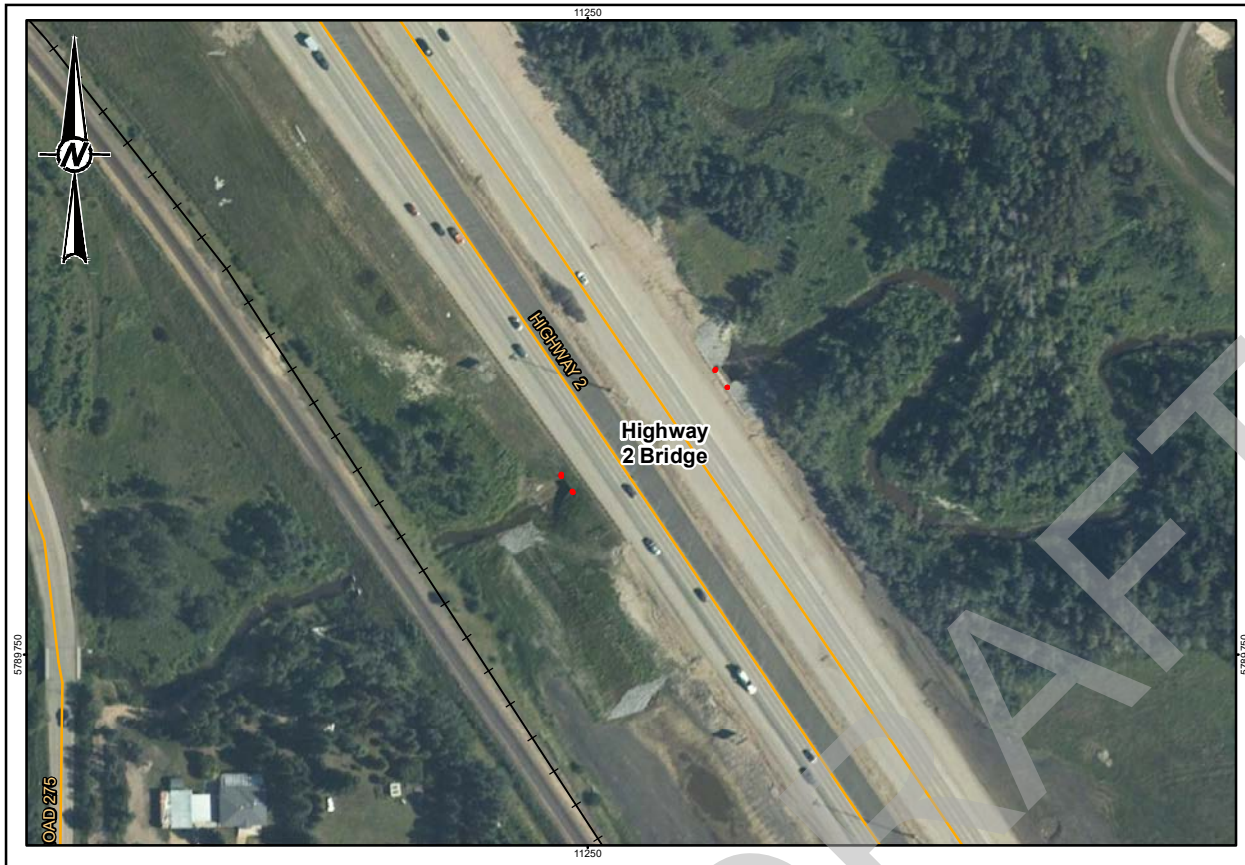
CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-36



0 50 100

1:2,500 METRES

PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 UPSTREAM END, LOOKING DOWNSTREAM

TITLE

HIGHWAY 2 BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	75333
YEAR BUILT	1963
TOTAL LENGTH OF SPAN (m)	6.95
DECK WIDTH OF BRIDGE (m)	61.45
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	878.89
AVERAGE LOW CHORD ELEVATION (m)	878.24
BRIDGE OBSTRUCTION HEIGHT (m)	0.65
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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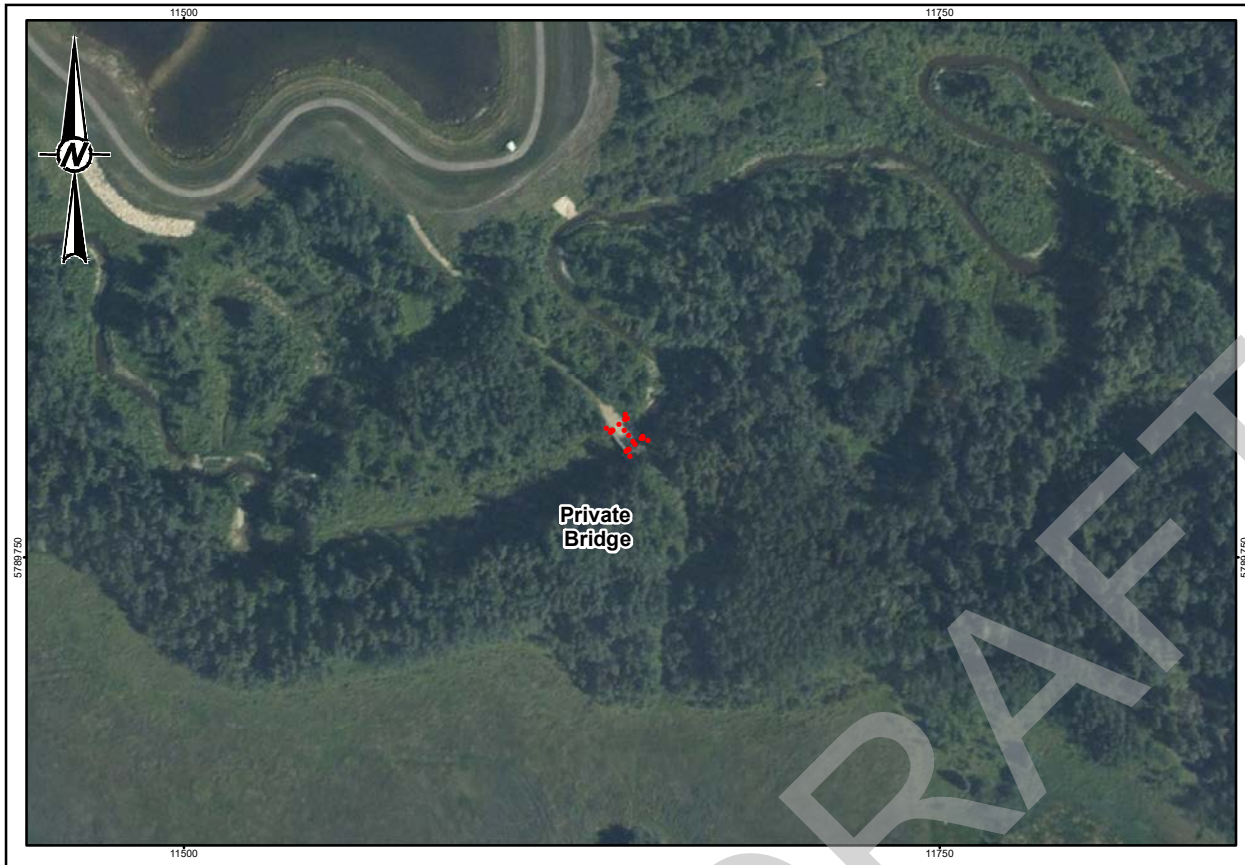
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-37

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A
0 25mm



0 50 100
1:2,500 METRES

TITLE
PRIVATE BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	8.36
DECK WIDTH OF BRIDGE (m)	6.57
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	878.47
AVERAGE LOW CHORD ELEVATION (m)	876.52
BRIDGE OBSTRUCTION HEIGHT (m)	1.95
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
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CLIENT
ALBERTA ENVIRONMENT AND PARKS

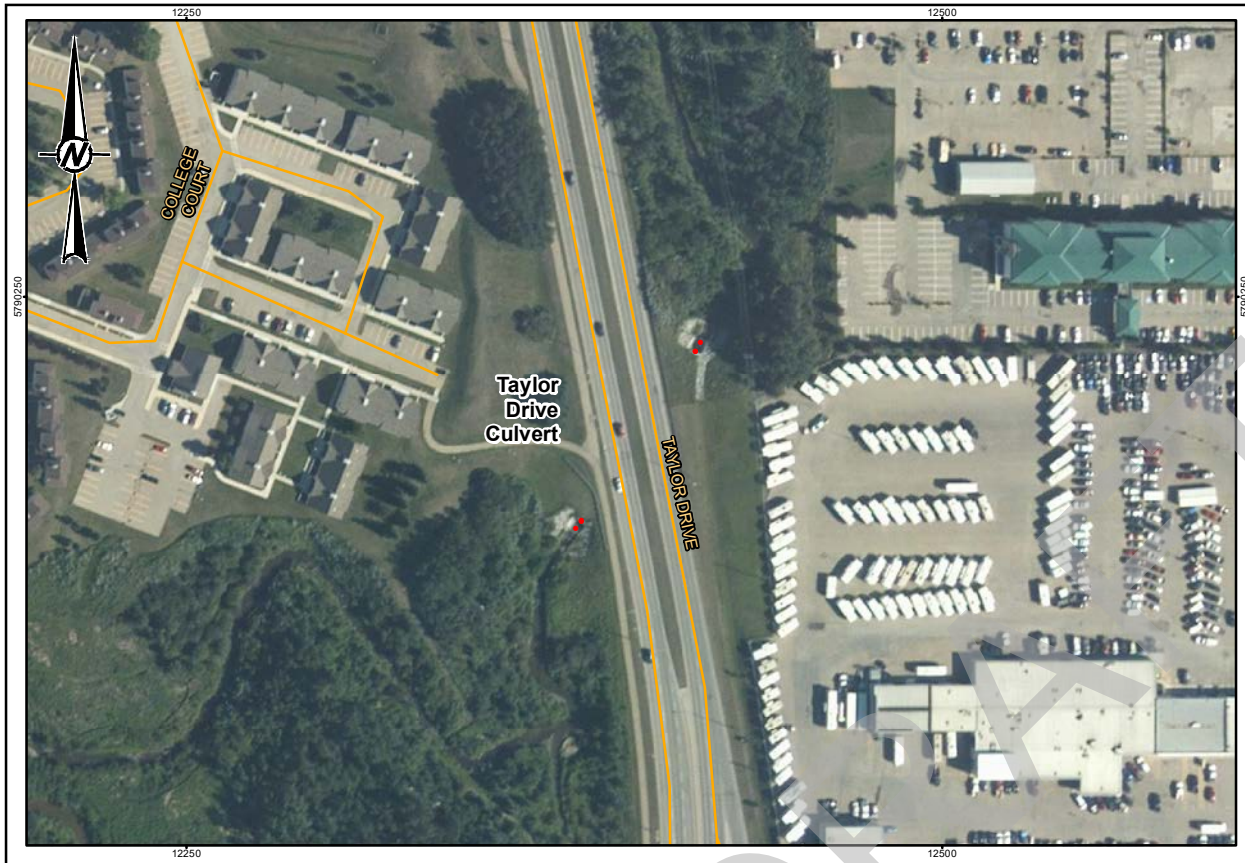
PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-38

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A
0 25mm



TITLE

TAYLOR DRIVE CULVERT

LOCATION	WASKASOO CREEK
NUMBER OF CULVERTS	1
TOTAL LENGTH OF CULVERT (m)	74.08
RISE OF CULVERT (m)	2.8
SPAN OF CULVERT (m)	4.5
DIAMETER OF CULVERT (m)	-
CULVERT TYPE	PIPE
CULVERT INVERT ELEVATION - UPSTREAM END (m)	870.59
CULVERT INVERT ELEVATION - DOWNSTREAM END (m)	870.03

LEGEND

- SURVEY POINT
- ROAD
- RAILWAY

NOTE(S)

SEE REPORT SECTION 2.3 FOR MORE INFORMATION.
WHERE THERE ARE MULTIPLE CULVERTS, SUBSEQUENT INFORMATION IS APPLICABLE FOR ALL CULVERTS.

REFERENCE(S)

CULVERT SURVEY AND CULVERT PHOTOS BY GOLDER ASSOCIATES LTD. AUG 2017 - NOV 2017.
ROADS OBTAINED FROM ALTALIS, © GOVERNMENT OF ALBERTA 2017. ALL RIGHTS RESERVED.
IMAGERY CAPTURED JULY 2018 BY ORTHOSHOP GEOMATICS LTD. FOR THE GOVERNMENT OF ALBERTA.
DATUM: NAD 83 CSRS PROJECTION: 3TM 114

PHOTO 1 DOWNSTREAM END, LOOKING UPSTREAM

PHOTO 2 UPSTREAM END, LOOKING DOWNSTREAM

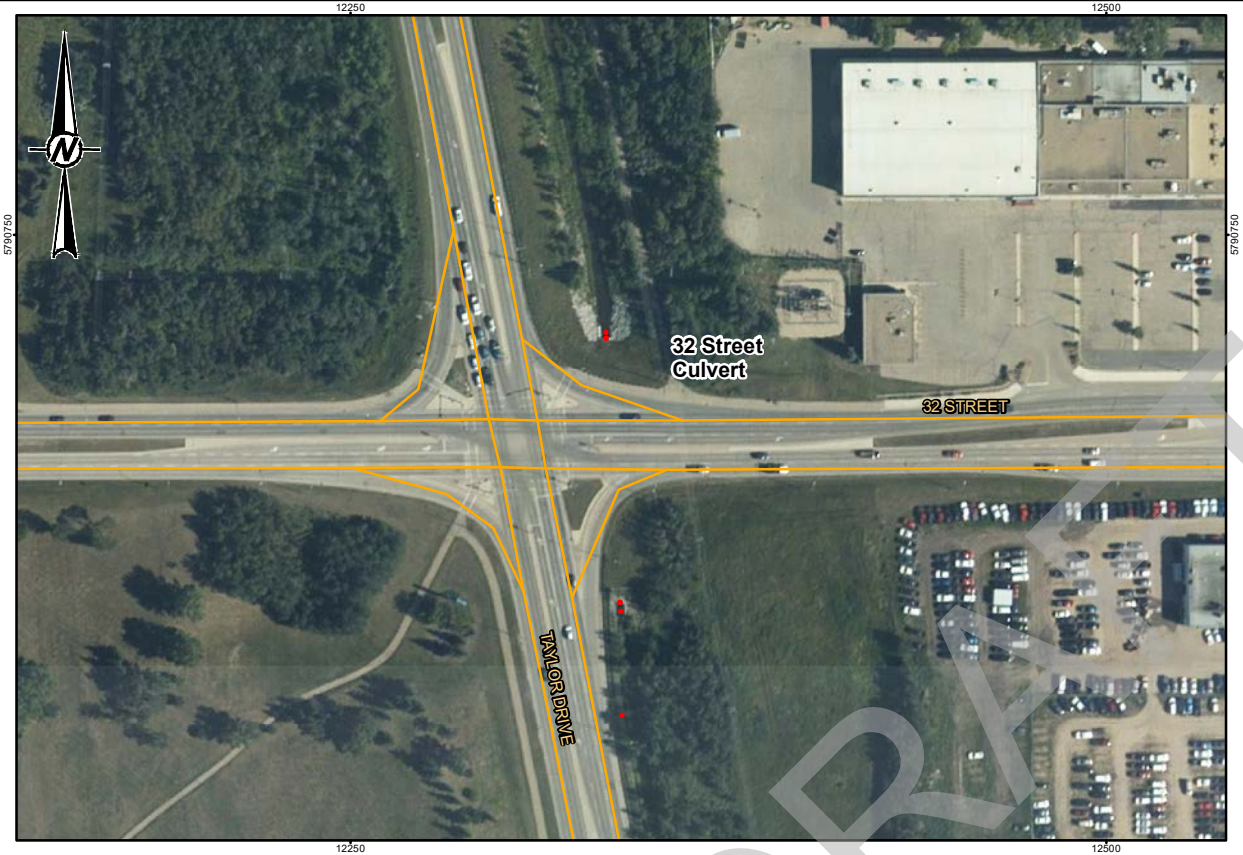
CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-39



0 50 100
1:2,500 METRES

TITLE
32 STREET CULVERT

LOCATION	WASKASOO CREEK
NUMBER OF CULVERTS	1
TOTAL LENGTH OF CULVERT (m)	92.72
RISE OF CULVERT (m)	-
SPAN OF CULVERT (m)	-
DIAMETER OF CULVERT (m)	3.4
CULVERT TYPE	PIPE
CULVERT INVERT ELEVATION - UPSTREAM END (m)	867.64
CULVERT INVERT ELEVATION - DOWNSTREAM END (m)	866.55

LEGEND
- SURVEY POINT
- ROAD
- RAILWAY

NOTE(S)
SEE REPORT SECTION 2.3 FOR MORE INFORMATION.
WHERE THERE ARE MULTIPLE CULVERTS, SUBSEQUENT INFORMATION IS APPLICABLE FOR ALL CULVERTS.

REFERENCE(S)
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DATUM: NAD 83 CSRS PROJECTION: 3TM 114

PHOTO 1 -

PHOTO 2 UPSTREAM END, LOOKING DOWNSTREAM

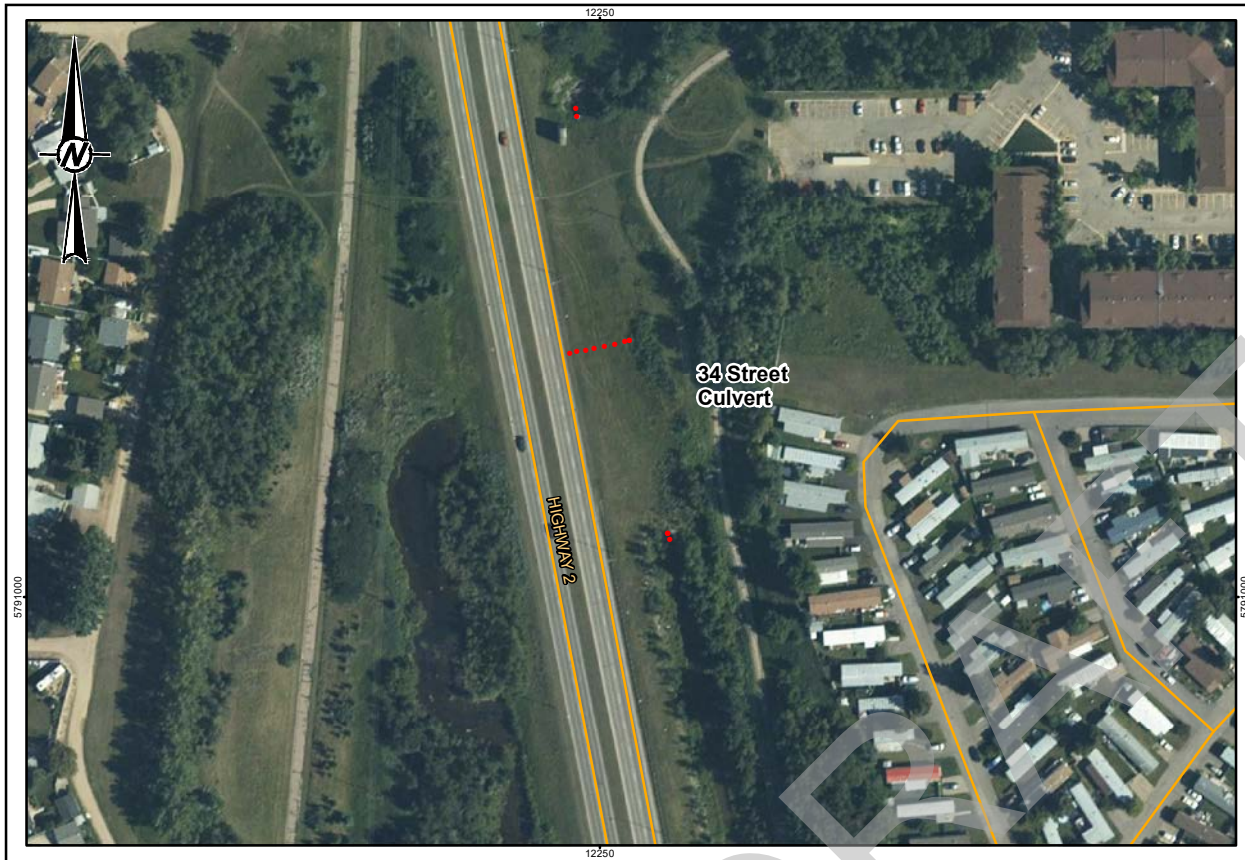
CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-40



0 50 100

1:2,500 METRES

PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

TITLE

34 STREET CULVERT

LOCATION	WASKASOO CREEK
NUMBER OF CULVERTS	1
TOTAL LENGTH OF CULVERT (m)	145.90
RISE OF CULVERT (m)	-
SPAN OF CULVERT (m)	-
DIAMETER OF CULVERT (m)	3.2
CULVERT TYPE	PIPE
CULVERT INVERT ELEVATION - UPSTREAM END (m)	866.27
CULVERT INVERT ELEVATION - DOWNSTREAM END (m)	865.45

LEGEND

- SURVEY POINT
- ROAD
- RAILWAY

NOTE(S)

SEE REPORT SECTION 2.3 FOR MORE INFORMATION.
WHERE THERE ARE MULTIPLE CULVERTS, SUBSEQUENT INFORMATION IS APPLICABLE FOR ALL CULVERTS.

REFERENCE(S)

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DATUM: NAD 83 CSRS PROJECTION: 3TM 114

CLIENT

ALBERTA ENVIRONMENT AND PARKS

PROJECT

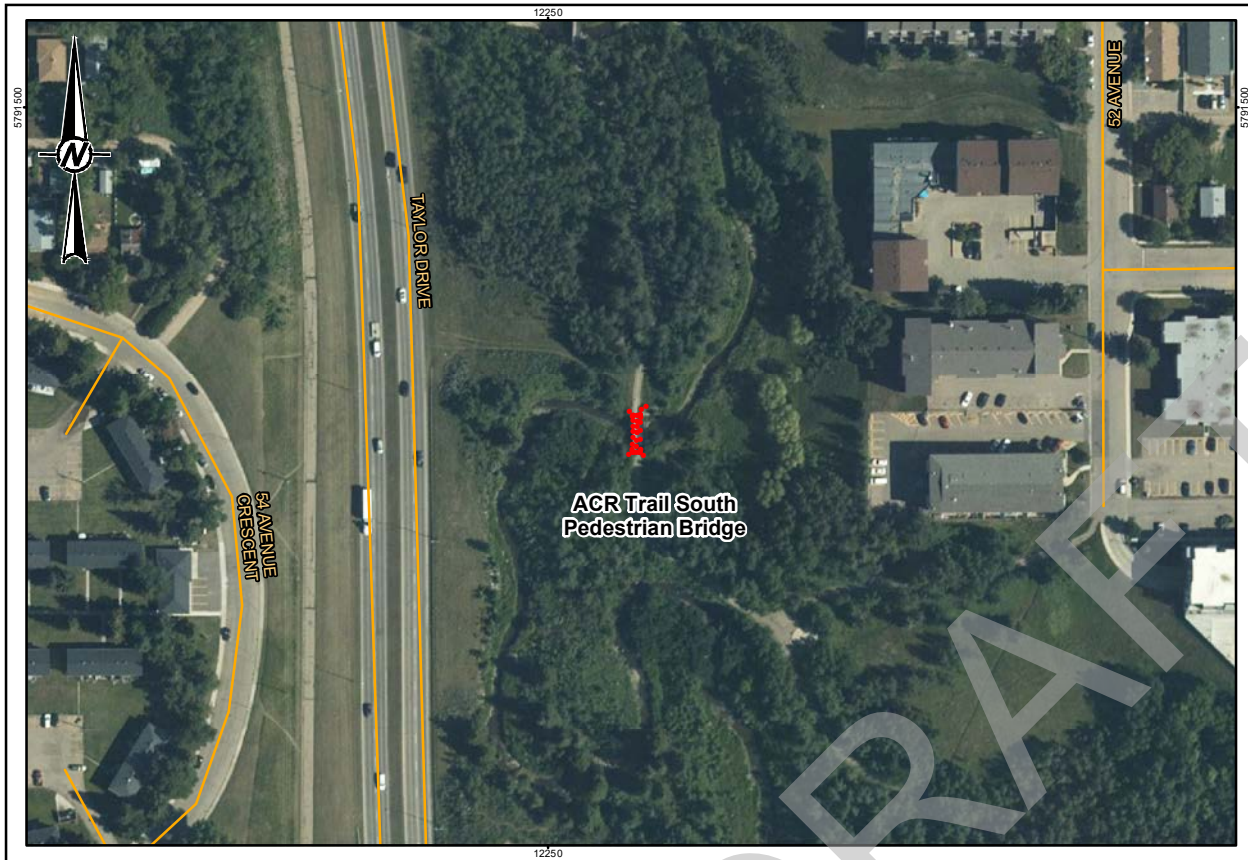
RED DEER RIVER HAZARD STUDY

CONSULTANT

GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-41



0 50 100

1:2,500 METRES

TITLE
ACR TRAIL SOUTH PEDESTRIAN BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	PEDESTRIAN
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	12.21
DECK WIDTH OF BRIDGE (m)	2.31
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	868.24
AVERAGE LOW CHORD ELEVATION (m)	866.46
BRIDGE OBSTRUCTION HEIGHT (m)	1.78
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
SEE REPORT SECTION 2.5 AND HYDRAULIC MODEL FOR MORE INFORMATION.

REFERENCE(S)

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PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

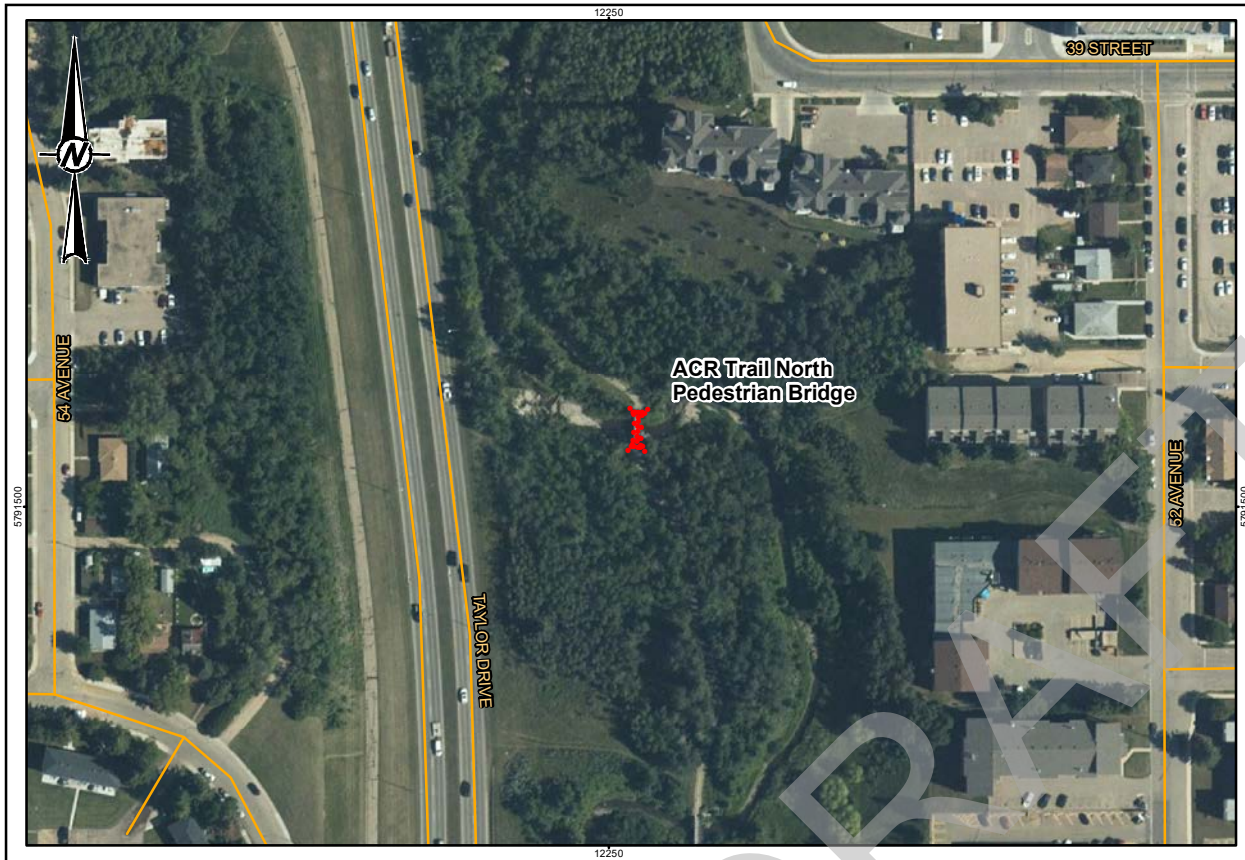
CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-42



0 50 100

1:2,500 METRES

TITLE

ACR TRAIL NORTH PEDESTRIAN BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	PEDESTRIAN
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	11.46
DECK WIDTH OF BRIDGE (m)	2.22
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	866.68
AVERAGE LOW CHORD ELEVATION (m)	864.88
BRIDGE OBSTRUCTION HEIGHT (m)	1.80
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
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PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-43

0 50 100
1:2,500 METRES

TITLE
43 STREET CULVERT

LOCATION	WASKASOO CREEK
NUMBER OF CULVERTS	1
TOTAL LENGTH OF CULVERT (m)	38.88
RISE OF CULVERT (m)	2.4
SPAN OF CULVERT (m)	3.7
DIAMETER OF CULVERT (m)	-
CULVERT TYPE	PIPE
CULVERT INVERT ELEVATION - UPSTREAM END (m)	859.91
CULVERT INVERT ELEVATION - DOWNSTREAM END (m)	859.77

LEGEND

- SURVEY POINT
- ROAD
- RAILWAY

NOTE(S)

SEE REPORT SECTION 2.3 FOR MORE INFORMATION.
WHERE THERE ARE MULTIPLE CULVERTS, SUBSEQUENT INFORMATION IS APPLICABLE FOR ALL CULVERTS.

REFERENCE(S)

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DATUM: NAD 83 CSRS PROJECTION: 3TM 114

PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-44

0 50 100
1:2,500 METRES

PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

TITLE
52 AVENUE & 45 STREET LOOP CULVERT

LOCATION	WASKASOO CREEK
NUMBER OF CULVERTS	2
TOTAL LENGTH OF CULVERT (m)	30.89
RISE OF CULVERT (m)	2.0
SPAN OF CULVERT (m)	3.0
DIAMETER OF CULVERT (m)	-
CULVERT TYPE	BOX
CULVERT INVERT ELEVATION - UPSTREAM END (m)	856.38
CULVERT INVERT ELEVATION - DOWNSTREAM END (m)	856.29

LEGEND

- SURVEY POINT
- ROAD
- RAILWAY

NOTE(S)

SEE REPORT SECTION 2.3 FOR MORE INFORMATION.
WHERE THERE ARE MULTIPLE CULVERTS, SUBSEQUENT INFORMATION IS APPLICABLE FOR ALL CULVERTS.

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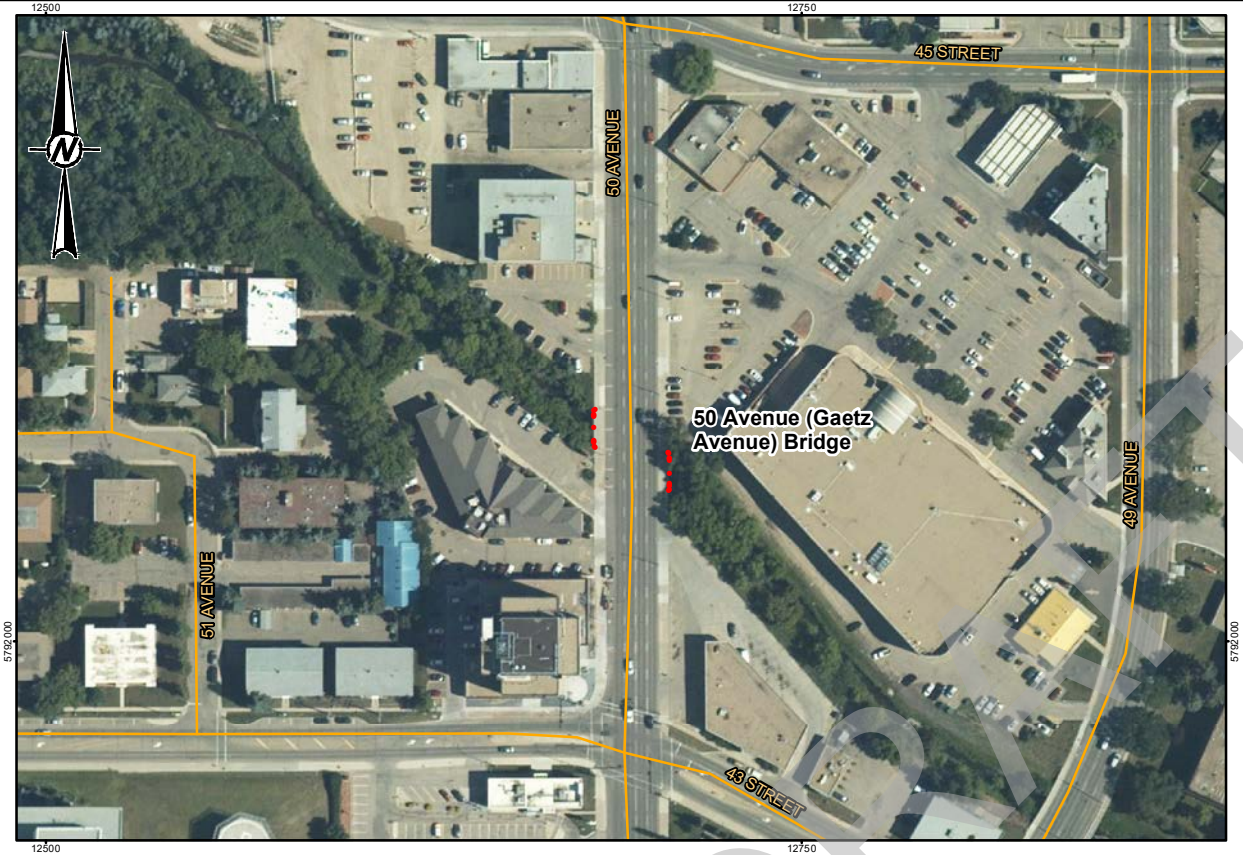
CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-45



TITLE

50 AVENUE (GAETZ AVENUE) BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	12.45
DECK WIDTH OF BRIDGE (m)	28.18
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	859.39
AVERAGE LOW CHORD ELEVATION (m)	857.39
BRIDGE OBSTRUCTION HEIGHT (m)	2.01
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
SEE REPORT SECTION 2.5 AND HYDRAULIC MODEL FOR MORE INFORMATION.

REFERENCE(S)

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PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-46

0 50 100
1:2,500 METRES

TITLE
49 AVENUE BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	1967
TOTAL LENGTH OF SPAN (m)	26.15
DECK WIDTH OF BRIDGE (m)	18.48
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	859.23
AVERAGE LOW CHORD ELEVATION (m)	857.25
BRIDGE OBSTRUCTION HEIGHT (m)	1.98
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
SEE REPORT SECTION 2.5 AND HYDRAULIC MODEL FOR MORE INFORMATION.

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PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-47

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A
0 25mm

0 50 100

1:2,500 METRES

PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

TITLE

48 AVENUE CULVERT

LOCATION	WASKASOO CREEK
NUMBER OF CULVERTS	3
TOTAL LENGTH OF CULVERT (m)	32.48
RISE OF CULVERT (m)	2.8
SPAN OF CULVERT (m)	3.6
DIAMETER OF CULVERT (m)	-
CULVERT TYPE	BOX
CULVERT INVERT ELEVATION - UPSTREAM END (m)	853.93
CULVERT INVERT ELEVATION - DOWNSTREAM END (m)	853.93

LEGEND

- SURVEY POINT
- ROAD
- RAILWAY

NOTE(S)

SEE REPORT SECTION 2.3 FOR MORE INFORMATION.
WHERE THERE ARE MULTIPLE CULVERTS, SUBSEQUENT INFORMATION IS APPLICABLE FOR ALL CULVERTS.

REFERENCE(S)

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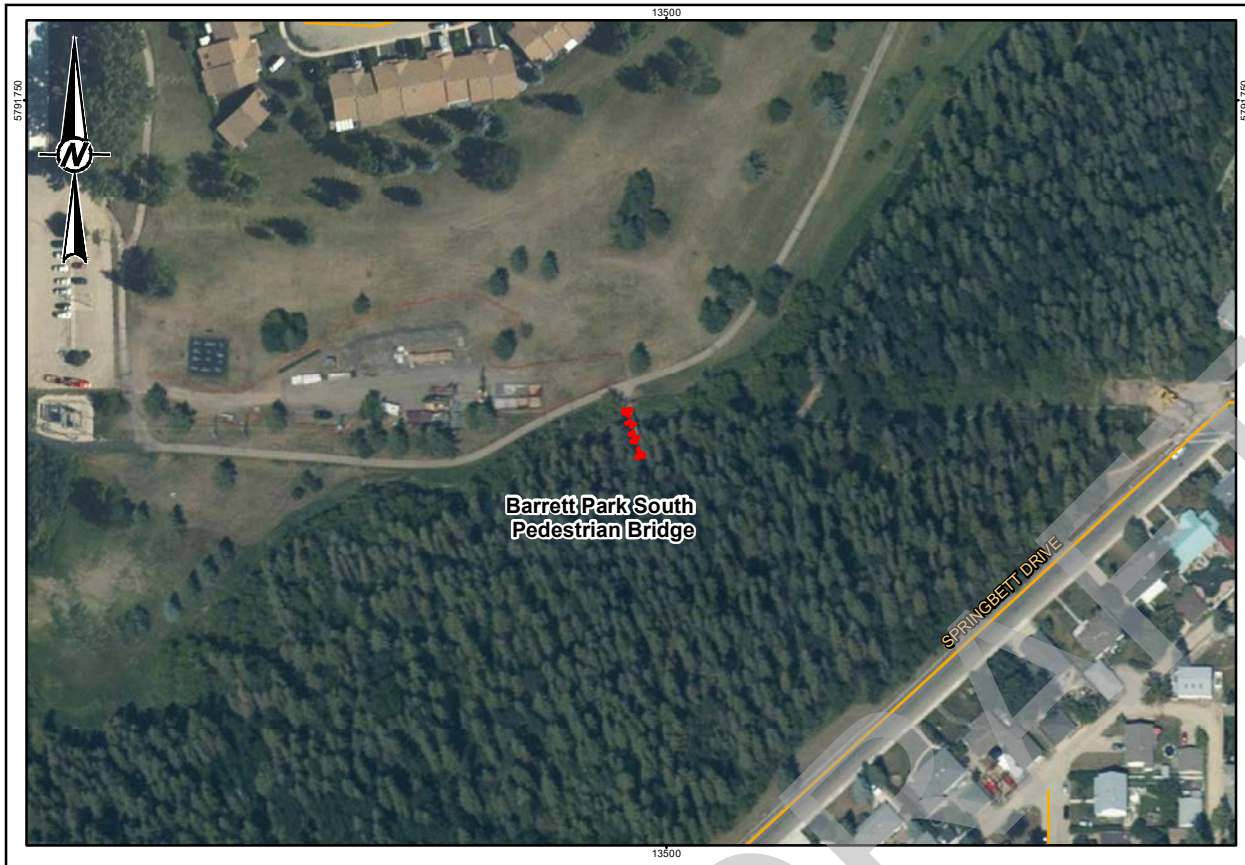
CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-48



0 50 100

1:2,500 METRES

TITLE
BARRETT PARK SOUTH PEDESTRIAN BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	PEDESTRIAN
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	16.09
DECK WIDTH OF BRIDGE (m)	2.16
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	857.16
AVERAGE LOW CHORD ELEVATION (m)	855.12
BRIDGE OBSTRUCTION HEIGHT (m)	2.04
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
SEE REPORT SECTION 2.5 AND HYDRAULIC MODEL FOR MORE INFORMATION.

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PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 BRIDGE RIGHT BANK

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-49

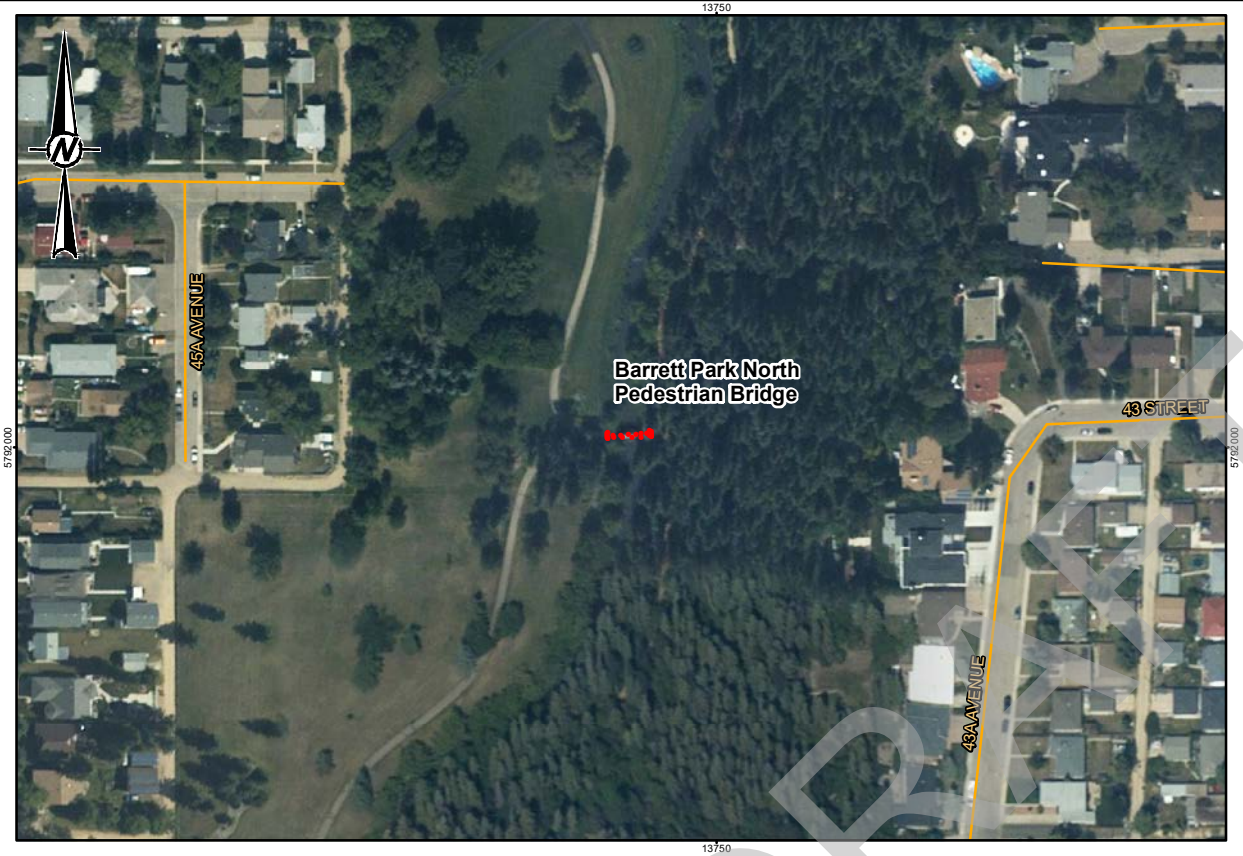

PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

TITLE

BARRETT PARK NORTH PEDESTRIAN BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	PEDESTRIAN
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	14.67
DECK WIDTH OF BRIDGE (m)	1.62
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	856.16
AVERAGE LOW CHORD ELEVATION (m)	854.37
BRIDGE OBSTRUCTION HEIGHT (m)	1.79
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

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YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-50

0 50 100

1:2,500 METRES

PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

TITLE

ROSS STREET EASTBOUND AND WESTBOUND BRIDGES

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	1980
TOTAL LENGTH OF SPAN (m)	30.15
DECK WIDTH OF BRIDGE (m)	35.58
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	857.17
AVERAGE LOW CHORD ELEVATION (m)	854.44
BRIDGE OBSTRUCTION HEIGHT (m)	2.72
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
SEE REPORT SECTION 2.5 AND HYDRAULIC MODEL FOR MORE INFORMATION.

REFERENCE(S)

BRIDGE SURVEY AND BRIDGE PHOTOS BY GOLDER ASSOCIATES LTD. AUG 2017 - NOV 2017. ROADS OBTAINED FROM ALTALIS, © GOVERNMENT OF ALBERTA 2017. ALL RIGHTS RESERVED. IMAGERY CAPTURED JULY 2018 BY ORTHOSHOP GEOMATICS LTD. FOR THE GOVERNMENT OF ALBERTA. DATUM: NAD 83 CSRS PROJECTION: 3TM 114

CLIENT

ALBERTA ENVIRONMENT AND PARKS

PROJECT

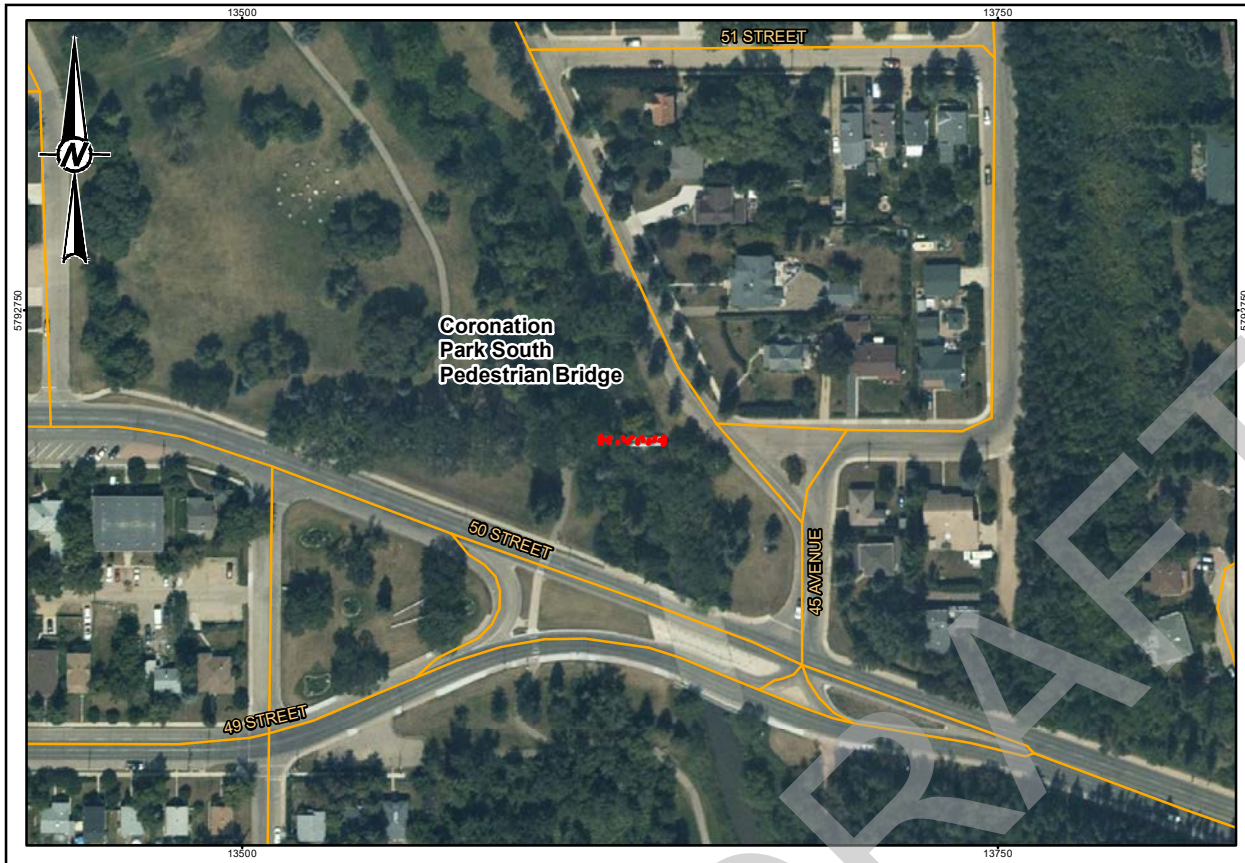
RED DEER RIVER HAZARD STUDY

CONSULTANT

GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-51



0 50 100
1:2,500 METRES

TITLE
CORONATION PARK SOUTH PEDESTRIAN BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	PEDESTRIAN
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	21.33
DECK WIDTH OF BRIDGE (m)	1.68
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	856.47
AVERAGE LOW CHORD ELEVATION (m)	854.51
BRIDGE OBSTRUCTION HEIGHT (m)	1.96
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
SEE REPORT SECTION 2.5 AND HYDRAULIC MODEL FOR MORE INFORMATION.

REFERENCE(S)

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PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-52

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A
0 25mm

0 50 100

1:2,500 METRES

TITLE

CORONATION PARK NORTH PEDESTRIAN BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	PEDESTRIAN
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	24.37
DECK WIDTH OF BRIDGE (m)	1.81
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	855.54
AVERAGE LOW CHORD ELEVATION (m)	853.91
BRIDGE OBSTRUCTION HEIGHT (m)	1.64
NUMBER OF PIERS	3

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	4.54	0.25	CONCRETE	CYLINDRICAL
2	12.12	0.25	CONCRETE	CYLINDRICAL
3	19.69	0.25	CONCRETE	CYLINDRICAL
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
SEE REPORT SECTION 2.5 AND HYDRAULIC MODEL FOR MORE INFORMATION.

REFERENCE(S)

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PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

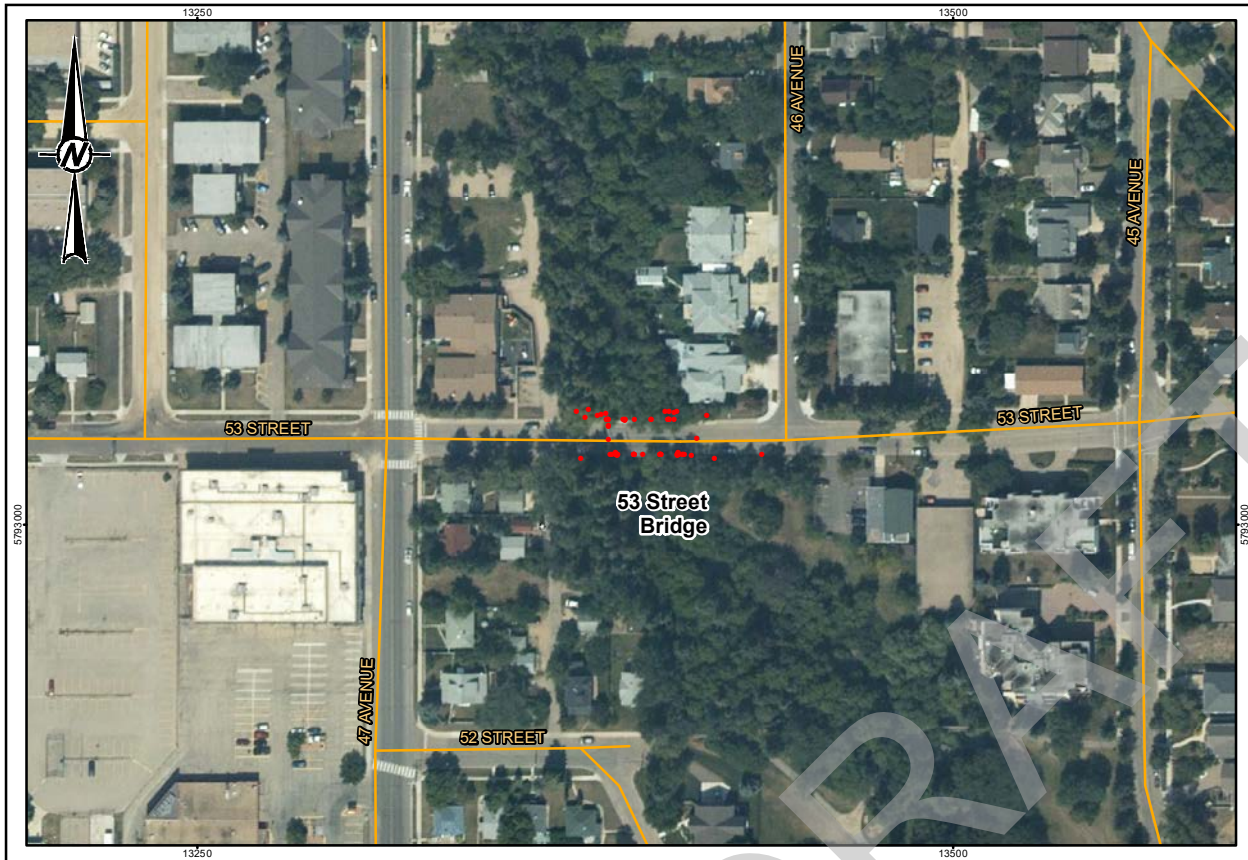
PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-53

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A
25mm
0



TITLE

53 STREET BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	20.59
DECK WIDTH OF BRIDGE (m)	12.13
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	855.39
AVERAGE LOW CHORD ELEVATION (m)	854.39
BRIDGE OBSTRUCTION HEIGHT (m)	1.00
NUMBER OF PIERS	2

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	5.93	0.40	CONCRETE	CYLINDRICAL
2	14.46	0.40	CONCRETE	CYLINDRICAL
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-54

0 50 100
1:2,500 METRES

TITLE
55 STREET BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	1956
TOTAL LENGTH OF SPAN (m)	24.11
DECK WIDTH OF BRIDGE (m)	18.06
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	855.55
AVERAGE LOW CHORD ELEVATION (m)	853.63
BRIDGE OBSTRUCTION HEIGHT (m)	1.92
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
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PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-55

0 50 100

1:2,500 METRES

TITLE

GAETZ PARK PEDESTRIAN BRIDGE

LOCATION	WASKASOO CREEK
DESCRIPTION	PEDESTRIAN
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	22.06
DECK WIDTH OF BRIDGE (m)	2.92
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	853.87
AVERAGE LOW CHORD ELEVATION (m)	851.69
BRIDGE OBSTRUCTION HEIGHT (m)	2.18
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	CYLINDRICAL
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
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PHOTO 1 BRIDGE RIGHT BANK

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

CLIENT

ALBERTA ENVIRONMENT AND PARKS

PROJECT

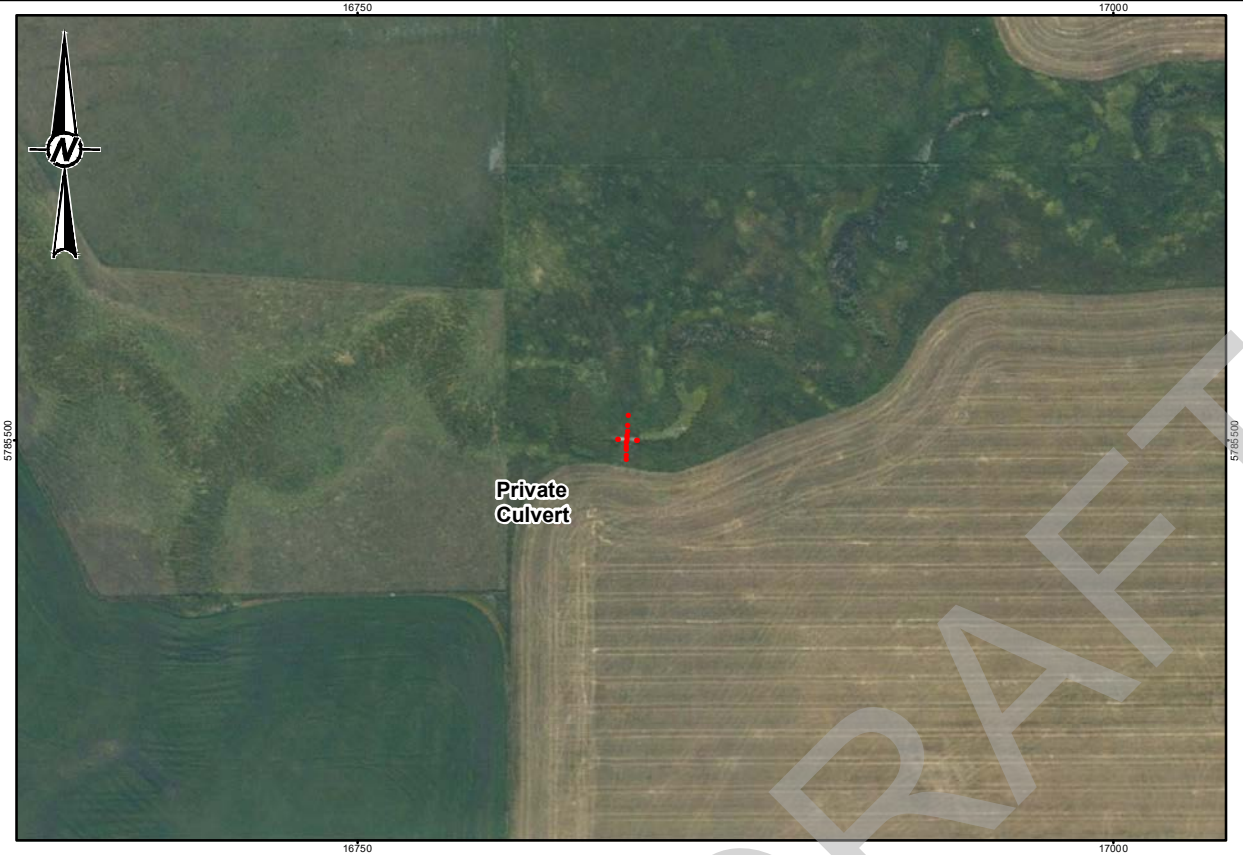
RED DEER RIVER HAZARD STUDY

CONSULTANT

GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-56



0 50 100

1:2,500 METRES

TITLE

PRIVATE CULVERT

LOCATION	PIPER CREEK
NUMBER OF CULVERTS	1
TOTAL LENGTH OF CULVERT (m)	6.34
RISE OF CULVERT (m)	-
SPAN OF CULVERT (m)	-
DIAMETER OF CULVERT (m)	1.4
CULVERT TYPE	PIPE
CULVERT INVERT ELEVATION - UPSTREAM END (m)	891.75
CULVERT INVERT ELEVATION - DOWNSTREAM END (m)	891.73

LEGEND

- SURVEY POINT
- ROAD
- RAILWAY

NOTE(S)

SEE REPORT SECTION 2.3 FOR MORE INFORMATION.
WHERE THERE ARE MULTIPLE CULVERTS, SUBSEQUENT INFORMATION IS APPLICABLE FOR ALL CULVERTS.

REFERENCE(S)

CULVERT SURVEY AND CULVERT PHOTOS BY GOLDER ASSOCIATES LTD. AUG 2017 - NOV 2017.
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DATUM: NAD 83 CSRS PROJECTION: 3TM 114

PHOTO 1 DOWNSTREAM END

PHOTO 2 UPSTREAM END, LOOKING DOWNSTREAM

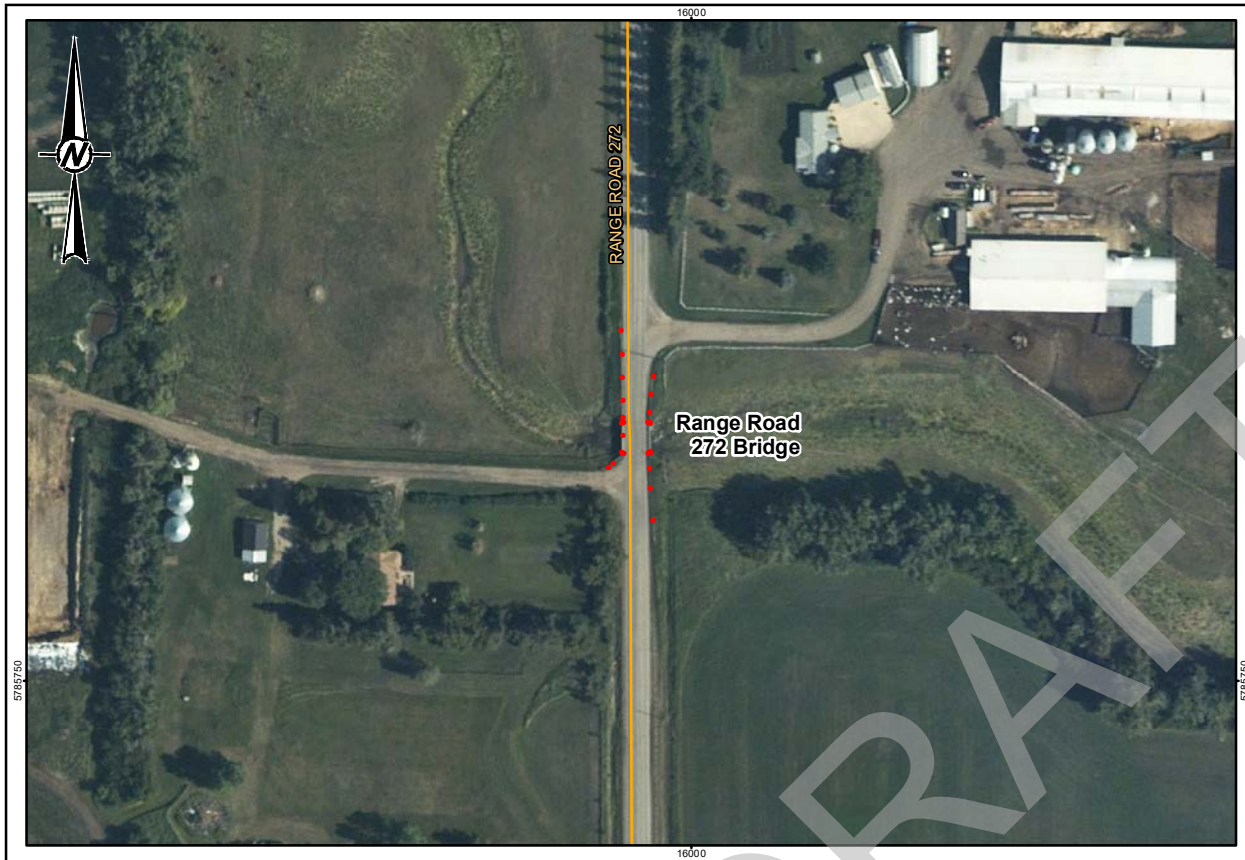
CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-57



0 50 100

1:2,500 METRES

PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

TITLE

RANGE ROAD 272 BRIDGE

LOCATION	PIPER CREEK
DESCRIPTION	TRAFFIC
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	9.97
DECK WIDTH OF BRIDGE (m)	8.27
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	894.25
AVERAGE LOW CHORD ELEVATION (m)	892.82
BRIDGE OBSTRUCTION HEIGHT (m)	1.43
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
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REFERENCE(S)

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CLIENT

ALBERTA ENVIRONMENT AND PARKS

PROJECT

RED DEER RIVER HAZARD STUDY

CONSULTANT

GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-58

0 50 100
1:2,500 METRES

TITLE
40 AVENUE CULVERT

LOCATION	PIPER CREEK
NUMBER OF CULVERTS	2
TOTAL LENGTH OF CULVERT (m)	32.38
RISE OF CULVERT (m)	-
SPAN OF CULVERT (m)	-
DIAMETER OF CULVERT (m)	2.2
CULVERT TYPE	PIPE
CULVERT INVERT ELEVATION - UPSTREAM END (m)	885.21
CULVERT INVERT ELEVATION - DOWNSTREAM END (m)	885.08

LEGEND

- SURVEY POINT
- ROAD
- RAILWAY

NOTE(S)

SEE REPORT SECTION 2.3 FOR MORE INFORMATION.
WHERE THERE ARE MULTIPLE CULVERTS, SUBSEQUENT INFORMATION IS APPLICABLE FOR ALL CULVERTS.

REFERENCE(S)

CULVERT SURVEY AND CULVERT PHOTOS BY GOLDER ASSOCIATES LTD. AUG 2017 - NOV 2017.
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DATUM: NAD 83 CSRS PROJECTION: 3TM 114

PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 UPSTREAM END

CLIENT
ALBERTA ENVIRONMENT AND PARKS

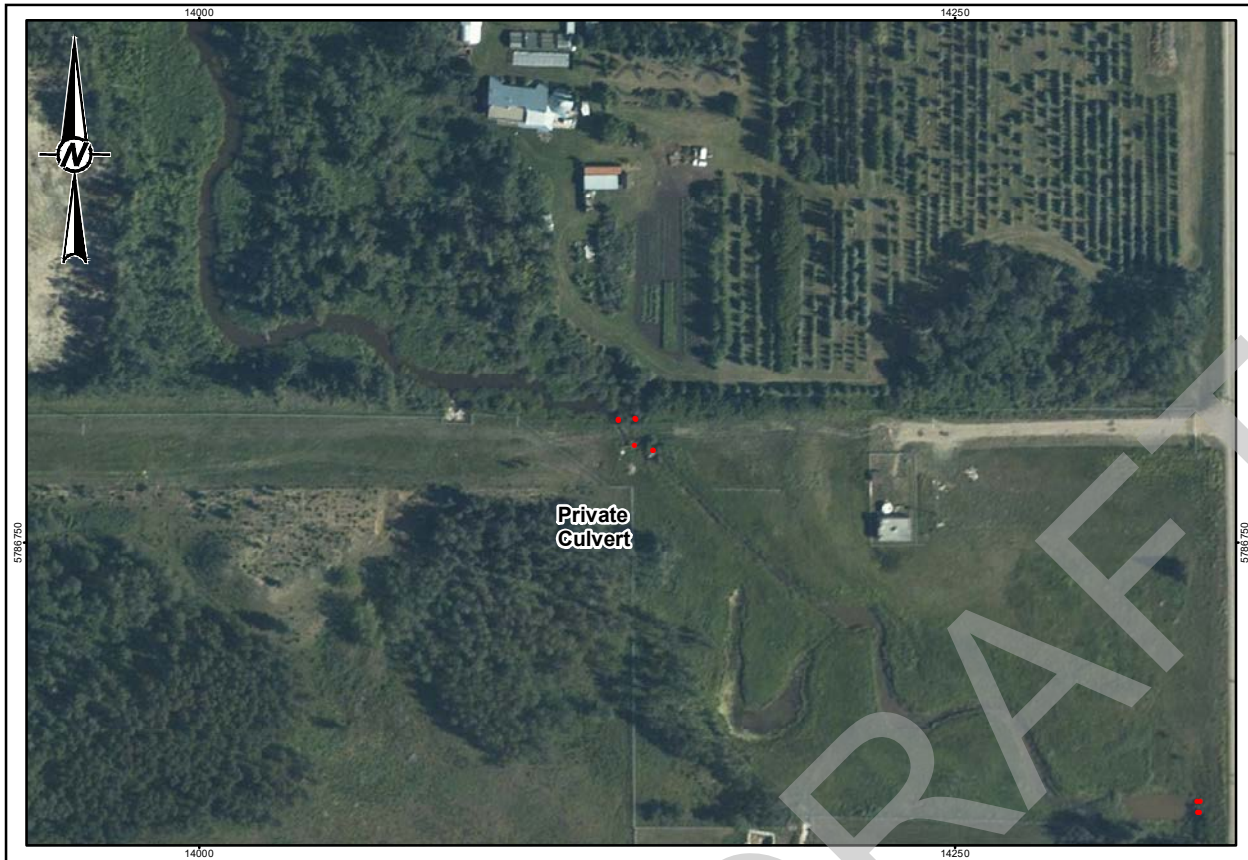
PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-59

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A
0 25mm



TITLE
PRIVATE CULVERT

LOCATION	PIPER CREEK
NUMBER OF CULVERTS	2
TOTAL LENGTH OF CULVERT (m)	12.25
RISE OF CULVERT (m)	-
SPAN OF CULVERT (m)	-
DIAMETER OF CULVERT (m)	1.8
CULVERT TYPE	PIPE
CULVERT INVERT ELEVATION - UPSTREAM END (m)	884.96
CULVERT INVERT ELEVATION - DOWNSTREAM END (m)	884.91

LEGEND

- SURVEY POINT
- ROAD
- RAILWAY

NOTE(S)

SEE REPORT SECTION 2.3 FOR MORE INFORMATION.
WHERE THERE ARE MULTIPLE CULVERTS, SUBSEQUENT INFORMATION IS APPLICABLE FOR ALL CULVERTS.

REFERENCE(S)

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DATUM: NAD 83 CSRS PROJECTION: 3TM 114

PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 UPSTREAM END

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-60

TITLE

PRIVATE CULVERT

LOCATION	PIPER CREEK
NUMBER OF CULVERTS	1
TOTAL LENGTH OF CULVERT (m)	11.52
RISE OF CULVERT (m)	-
SPAN OF CULVERT (m)	-
DIAMETER OF CULVERT (m)	2.2
CULVERT TYPE	PIPE
CULVERT INVERT ELEVATION - UPSTREAM END (m)	883.67
CULVERT INVERT ELEVATION - DOWNSTREAM END (m)	883.92

LEGEND

- SURVEY POINT
- ROAD
- RAILWAY

NOTE(S)

SEE REPORT SECTION 2.3 FOR MORE INFORMATION.
WHERE THERE ARE MULTIPLE CULVERTS, SUBSEQUENT INFORMATION IS APPLICABLE FOR ALL CULVERTS.

REFERENCE(S)

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DATUM: NAD 83 CSRS PROJECTION: 3TM 114

PHOTO 1 DOWNSTREAM END

PHOTO 2 -

CLIENT
ALBERTA ENVIRONMENT AND PARKS

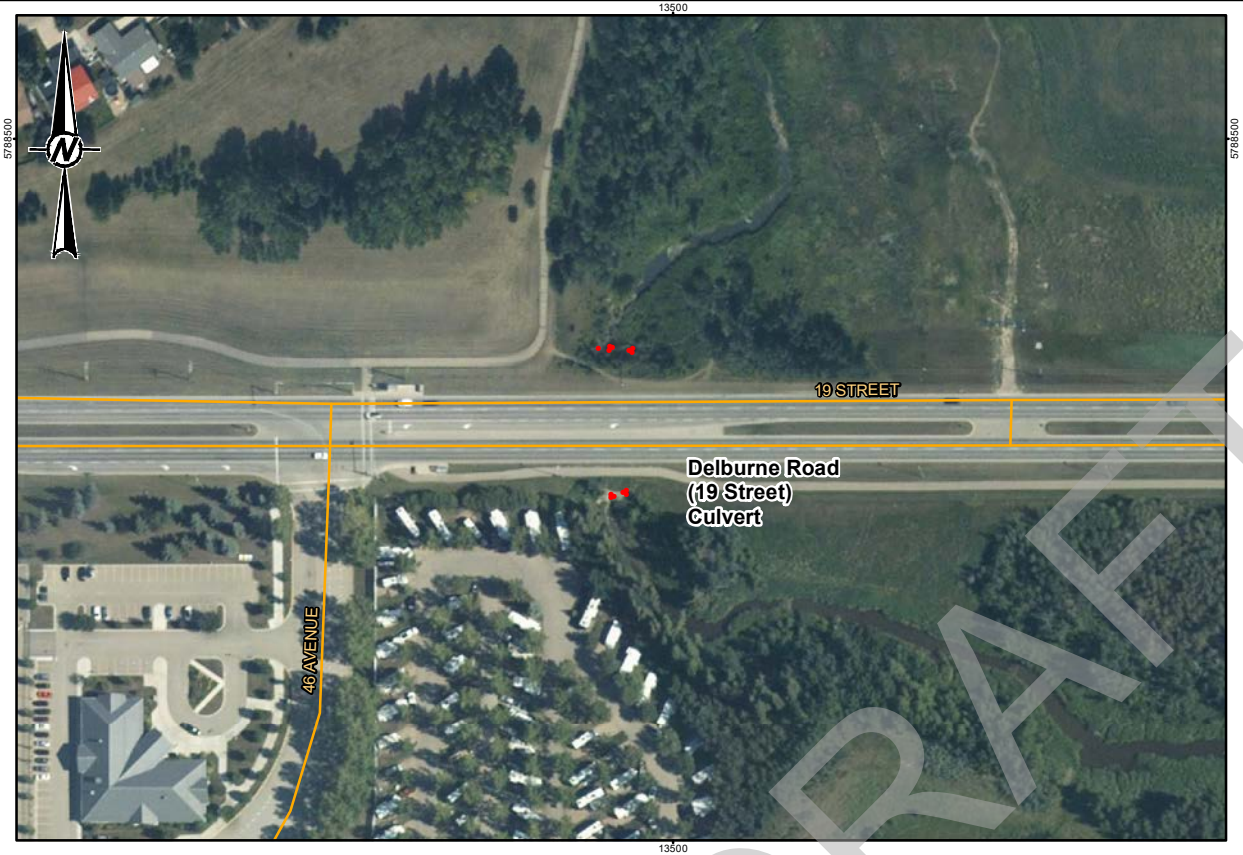
PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-61

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A
25mm
0



0 50 100
1:2,500 METRES

PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 UPSTREAM END

TITLE

DELBURNE ROAD (19 STREET) CULVERT

LOCATION	PIPER CREEK
NUMBER OF CULVERTS	2
TOTAL LENGTH OF CULVERT (m)	50.02
RISE OF CULVERT (m)	-
SPAN OF CULVERT (m)	-
DIAMETER OF CULVERT (m)	2.2
CULVERT TYPE	PIPE
CULVERT INVERT ELEVATION - UPSTREAM END (m)	880.82
CULVERT INVERT ELEVATION - DOWNSTREAM END (m)	880.53

LEGEND

- SURVEY POINT
- ROAD
- RAILWAY

NOTE(S)

SEE REPORT SECTION 2.3 FOR MORE INFORMATION.
WHERE THERE ARE MULTIPLE CULVERTS, SUBSEQUENT INFORMATION IS APPLICABLE FOR ALL CULVERTS.

REFERENCE(S)

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CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-62

BANNERMAN CLOSE PEDESTRIAN BRIDGE

LOCATION	PIPER CREEK
DESCRIPTION	PEDESTRIAN
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	11.91
DECK WIDTH OF BRIDGE (m)	3.07
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	881.36
AVERAGE LOW CHORD ELEVATION (m)	879.39
BRIDGE OBSTRUCTION HEIGHT (m)	1.97
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
SEE REPORT SECTION 2.5 AND HYDRAULIC MODEL FOR MORE INFORMATION.

REFERENCE(S)

BRIDGE SURVEY AND BRIDGE PHOTOS BY GOLDER ASSOCIATES LTD. AUG 2017 - NOV 2017. ROADS OBTAINED FROM ALTALIS, © GOVERNMENT OF ALBERTA 2017. ALL RIGHTS RESERVED. IMAGERY CAPTURED JULY 2018 BY ORTHOSHOP GEOMATICS LTD. FOR THE GOVERNMENT OF ALBERTA. DATUM: NAD 83 CSRS PROJECTION: 3TM 114

PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-63

0 50 100

1:2,500 METRES

TITLE

BOWER WOODS EAST-WEST PEDESTRIAN BRIDGE

LOCATION	PIPER CREEK
DESCRIPTION	PEDESTRIAN
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	19.98
DECK WIDTH OF BRIDGE (m)	2.38
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	877.10
AVERAGE LOW CHORD ELEVATION (m)	874.63
BRIDGE OBSTRUCTION HEIGHT (m)	2.47
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
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REFERENCE(S)

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PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

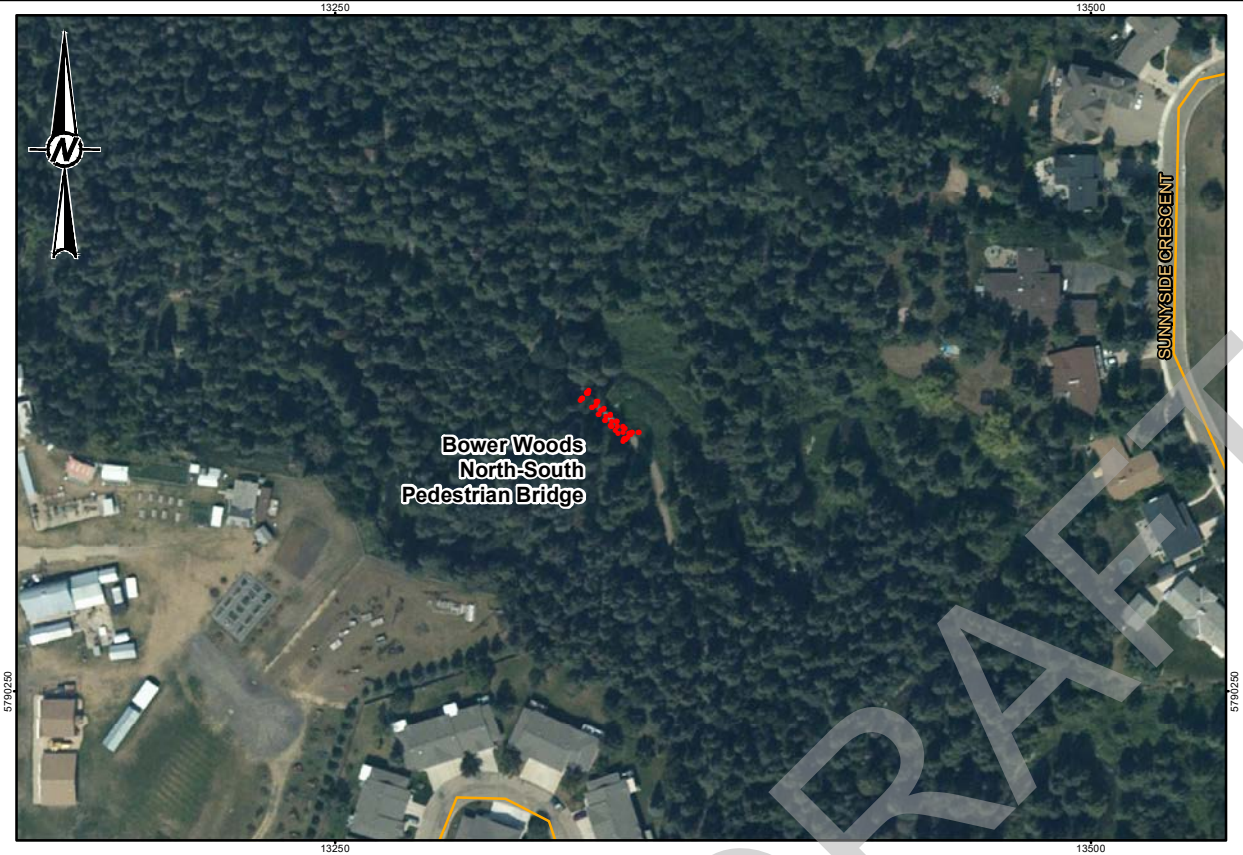
CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-64



0 50 100
1:2,500 METRES

PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

TITLE
BOWER WOODS NORTH-SOUTH PEDESTRIAN BRIDGE

LOCATION	PIPER CREEK
DESCRIPTION	PEDESTRIAN
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	19.65
DECK WIDTH OF BRIDGE (m)	2.68
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	875.70
AVERAGE LOW CHORD ELEVATION (m)	874.69
BRIDGE OBSTRUCTION HEIGHT (m)	1.01
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
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REFERENCE(S)

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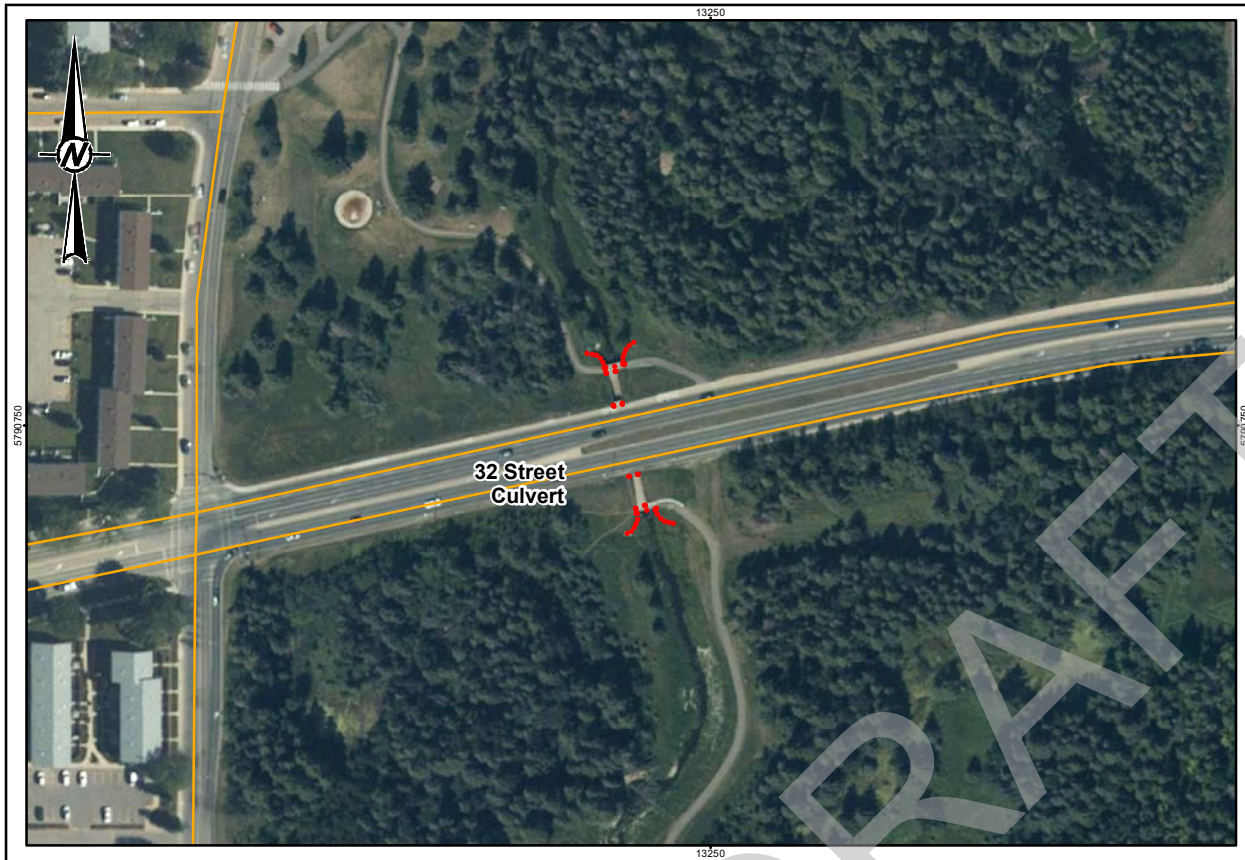
CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-65



TITLE

32 STREET CULVERT

LOCATION	PIPER CREEK
NUMBER OF CULVERTS	3
TOTAL LENGTH OF CULVERT (m)	49.00
RISE OF CULVERT (m)	2.5 (TOP), 2.8 (BOTTOM)
SPAN OF CULVERT (m)	3.0 (TOP), 3.1 (BOTTOM)
DIAMETER OF CULVERT (m)	-
CULVERT TYPE	BOX
CULVERT INVERT ELEVATION - UPSTREAM END (m)	867.40
CULVERT INVERT ELEVATION - DOWNSTREAM END (m)	867.25

LEGEND

- SURVEY POINT
- ROAD
- RAILWAY

NOTE(S)

SEE REPORT SECTION 2.3 FOR MORE INFORMATION.
WHERE THERE ARE MULTIPLE CULVERTS, SUBSEQUENT INFORMATION IS APPLICABLE FOR ALL CULVERTS.

REFERENCE(S)

CULVERT SURVEY AND CULVERT PHOTOS BY GOLDER ASSOCIATES LTD. AUG 2017 - NOV 2017.
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DATUM: NAD 83 CSRS PROJECTION: 3TM 114

PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-66

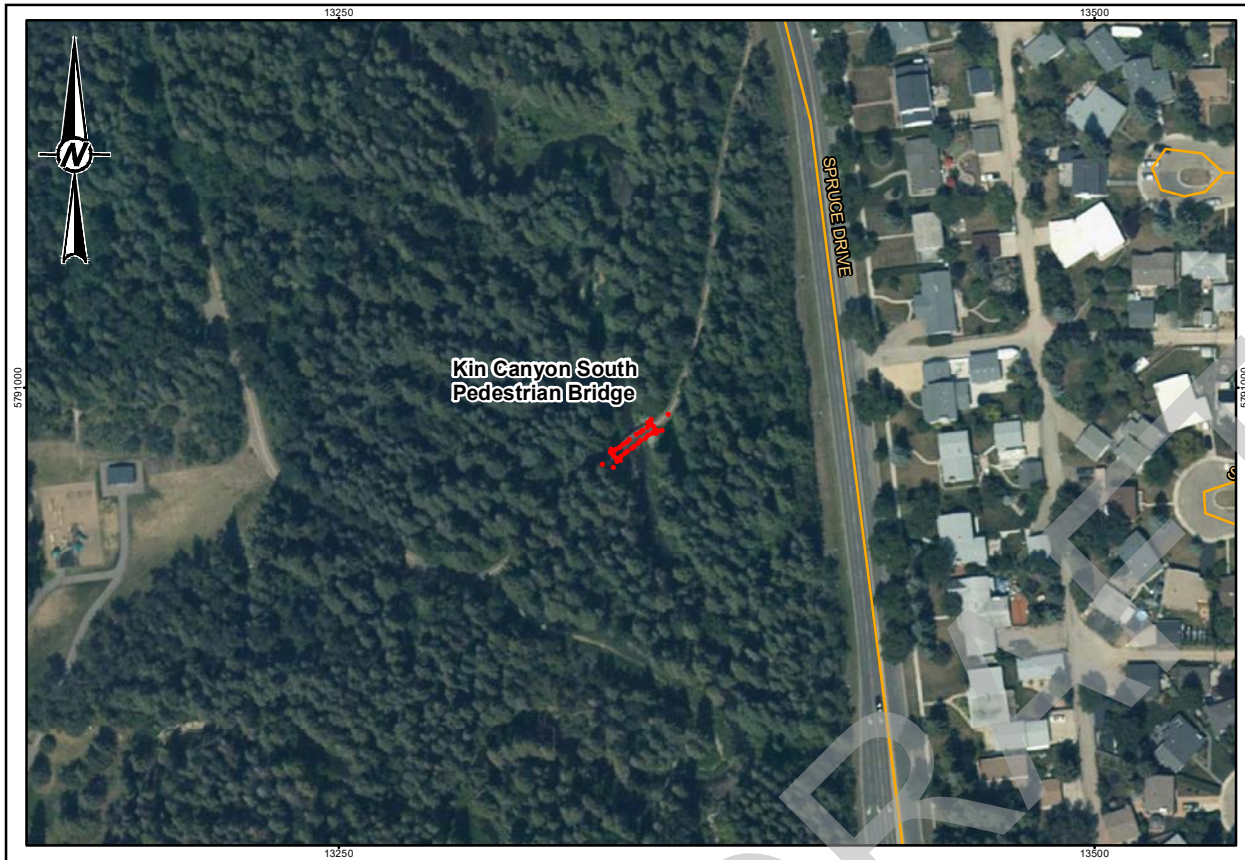

PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 RIGHT BANK ABUTMENT

TITLE

KIN CANYON SOUTH PEDESTRIAN BRIDGE

LOCATION	PIPER CREEK
DESCRIPTION	PEDESTRIAN
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	15.75
DECK WIDTH OF BRIDGE (m)	2.68
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	869.18
AVERAGE LOW CHORD ELEVATION (m)	867.27
BRIDGE OBSTRUCTION HEIGHT (m)	1.91
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

ALL DETAILS OF BRIDGE SURVEY WILL BE USED FOR HYDRAULIC MODELLING. PIERS HAVE VARIED WIDTH, ONLY LARGEST WIDTH IS SHOWN IN TABLE. PIER CENTRE STATION REFERS TO STATION IN THE HYDRAULIC MODEL.
SEE REPORT SECTION 2.5 AND HYDRAULIC MODEL FOR MORE INFORMATION.

REFERENCE(S)

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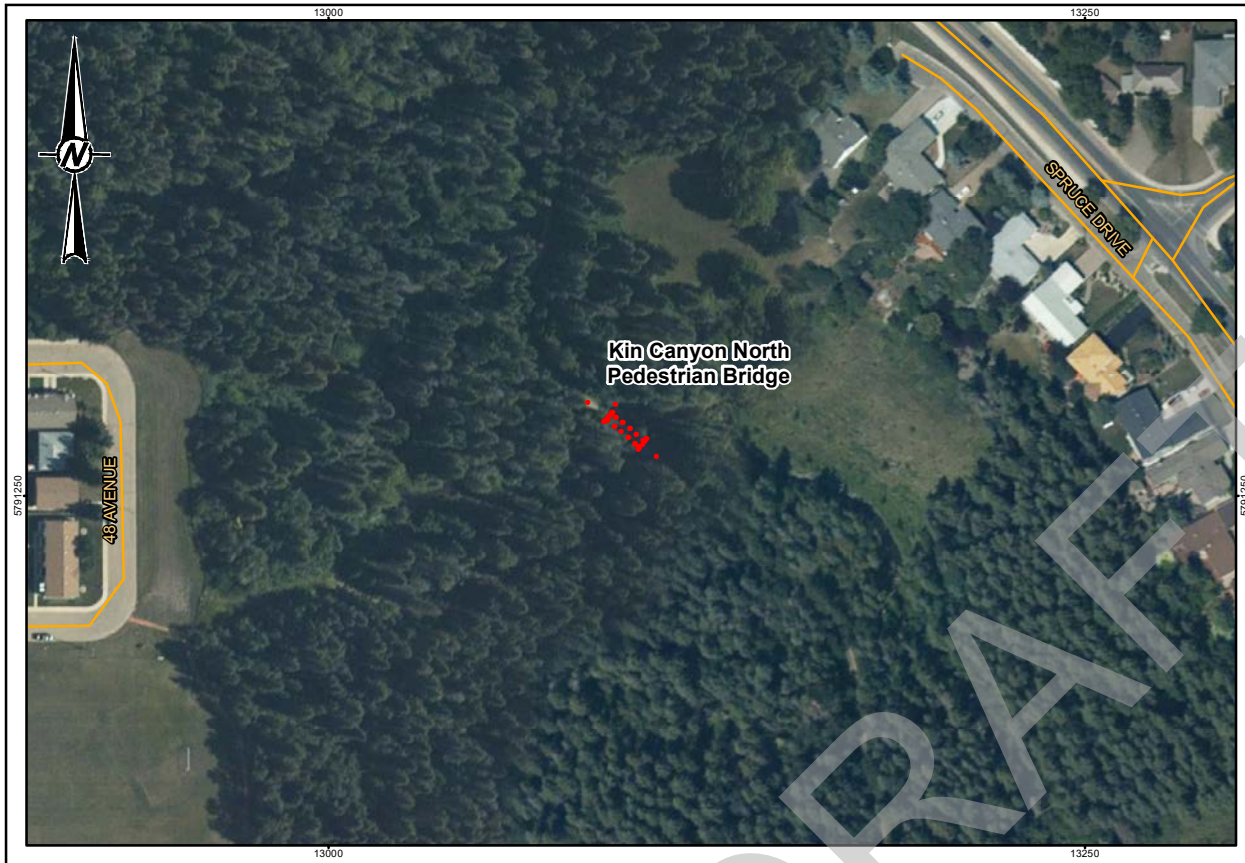
CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-67



TITLE

KIN CANYON NORTH PEDESTRIAN BRIDGE

LOCATION	PIPER CREEK
DESCRIPTION	PEDESTRIAN
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	13.71
DECK WIDTH OF BRIDGE (m)	2.69
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	866.22
AVERAGE LOW CHORD ELEVATION (m)	864.61
BRIDGE OBSTRUCTION HEIGHT (m)	1.61
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-68

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A
0 25mm

0 50 100

1:2,500 METRES

PHOTO 1 RIGHT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

TITLE

ROTARY PICNIC PARK SOUTH PEDESTRIAN BRIDGE

LOCATION	PIPER CREEK
DESCRIPTION	PEDESTRIAN
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	10.46
DECK WIDTH OF BRIDGE (m)	2.08
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	863.17
AVERAGE LOW CHORD ELEVATION (m)	861.49
BRIDGE OBSTRUCTION HEIGHT (m)	1.69
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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CLIENT

ALBERTA ENVIRONMENT AND PARKS

PROJECT

RED DEER RIVER HAZARD STUDY

CONSULTANT

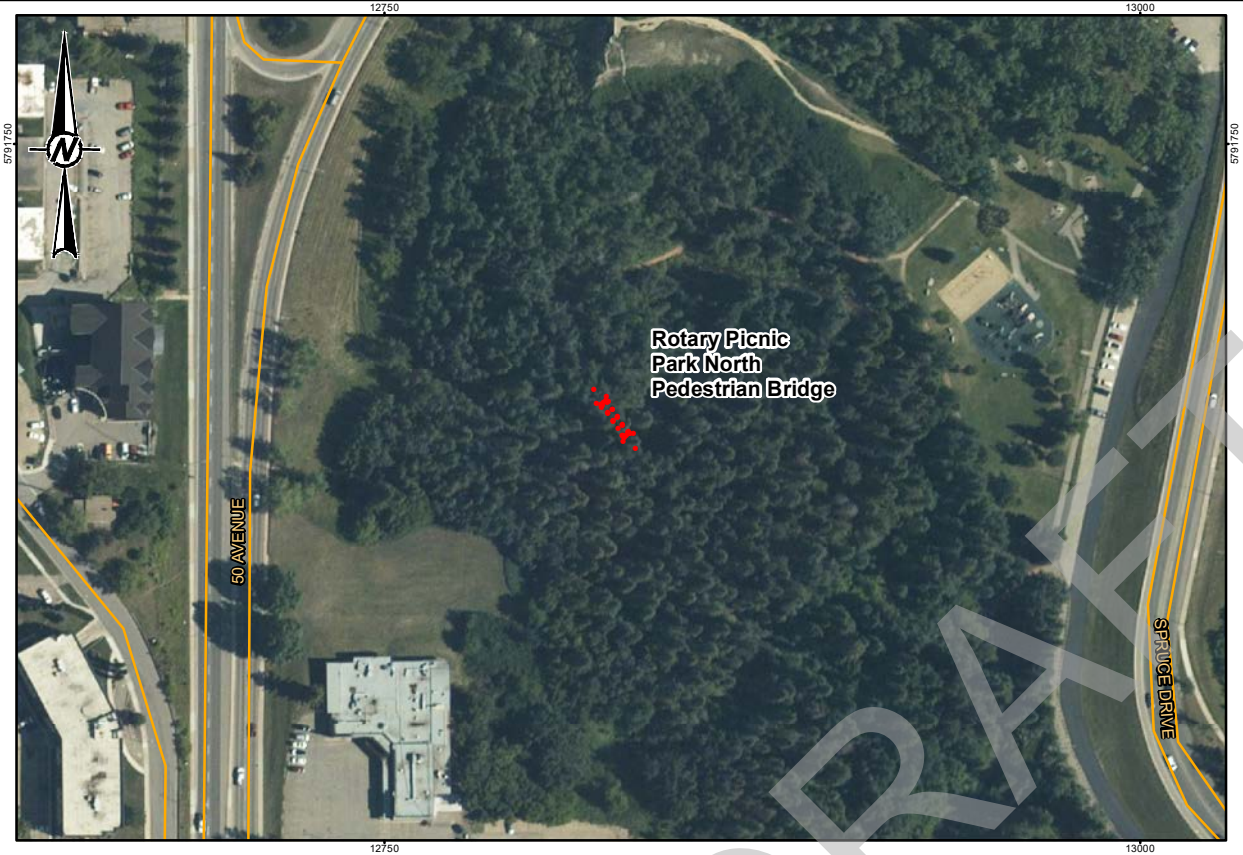
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-69

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A

0 25mm



TITLE

ROTARY PICNIC PARK NORTH PEDESTRIAN BRIDGE

LOCATION	PIPER CREEK
DESCRIPTION	PEDESTRIAN
ALBERTA TRANSPORTATION BRIDGE FILE NUMBER	-
YEAR BUILT	-
TOTAL LENGTH OF SPAN (m)	13.22
DECK WIDTH OF BRIDGE (m)	2.02
AVERAGE TOP OF CURB OR SOLID GUARD RAIL ELEVATION (m)	861.71
AVERAGE LOW CHORD ELEVATION (m)	860.04
BRIDGE OBSTRUCTION HEIGHT (m)	1.67
NUMBER OF PIERS	0

PIER	CENTRE STATION (m)	WIDTH (m)	TYPE	SHAPE
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-

LEGEND

- BRIDGE SURVEY POINT
- ROADS
- RAILWAY

NOTE(S)

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PHOTO 1 -

PHOTO 2 RIGHT BANK, LOOKING DOWNSTREAM

CLIENT

ALBERTA ENVIRONMENT AND PARKS

PROJECT

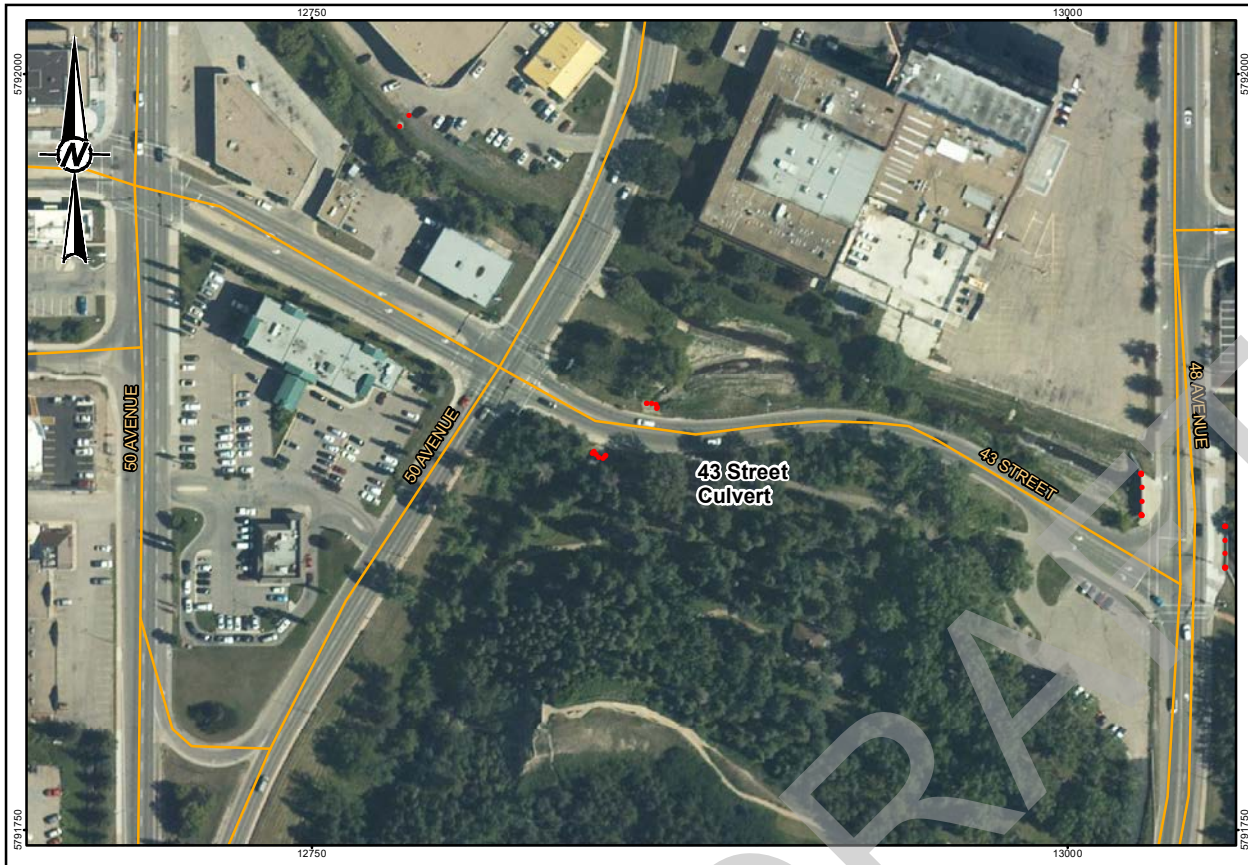
RED DEER RIVER HAZARD STUDY

CONSULTANT

GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-70



TITLE

43 STREET CULVERT

LOCATION	PIPER CREEK
NUMBER OF CULVERTS	2
TOTAL LENGTH OF CULVERT (m)	25.70
RISE OF CULVERT (m)	2.0
SPAN OF CULVERT (m)	3.0
DIAMETER OF CULVERT (m)	-
CULVERT TYPE	PIPE
CULVERT INVERT ELEVATION - UPSTREAM END (m)	855.17
CULVERT INVERT ELEVATION - DOWNSTREAM END (m)	855.09

LEGEND

- SURVEY POINT
- ROAD
- RAILWAY

NOTE(S)

SEE REPORT SECTION 2.3 FOR MORE INFORMATION.
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REFERENCE(S)

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DATUM: NAD 83 CSRS PROJECTION: 3TM 114

PHOTO 1 LEFT BANK, LOOKING UPSTREAM

PHOTO 2 LEFT BANK, LOOKING DOWNSTREAM

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

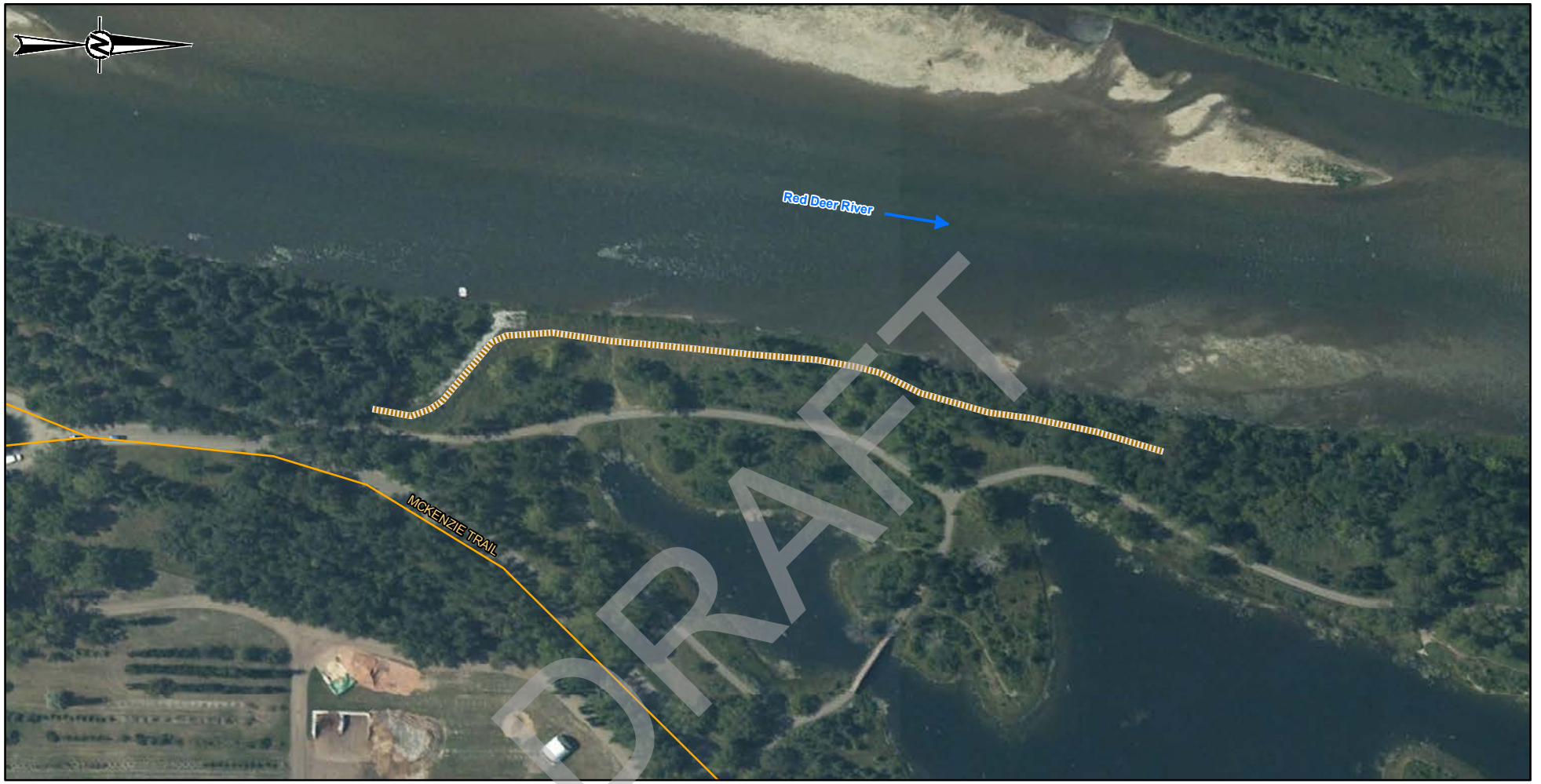
CONSULTANT
GOLDER

YYYY-MM-DD	2022-12-12
DESIGNED	WP
PREPARED	NB
REVIEWED	DS
APPROVED	DL

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1000	2	C-71

APPENDIX D

Flood Control Structure Datasheets



LEGEND

- ROAD
- FLOW DIRECTION
- FLOOD CONTROL STRUCTURE

LOCATION	RED DEER RIVER
APPROX. LENGTH OF STRUCTURE (m)	280
TYPE OF STRUCTURE	RETAINING STRUCTURE

NOTE(S)

FLOOD CONTROL STRUCTURE SURVEY COMPLETED TO SUPPORT HYDRAULIC MODELLING AND FLOOD MAPPING.

SEE REPORT SECTION 2.6 FOR MORE INFORMATION.

REFERENCE(S)

FLOOD CONTROL STRUCTURE SURVEY BY GOLDER ASSOCIATES LTD. NOVEMBER 2017. ROADS OBTAINED FROM ALTALIS, © GOVERNMENT OF ALBERTA 2017. ALL RIGHTS RESERVED. IMAGERY CAPTURED JULY 2018 BY ORTHOSHOP GEOMATICS LTD. FOR THE GOVERNMENT OF ALBERTA. DATUM: NAD 83 CSRS PROJECTION: 3TM 114

0 75 150

1:2,000 METRES

TITLE
MCKENZIE TRAILS BERM

DESCRIPTION
RETAINING STRUCTURE NORTH OF 67 ST

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT

GOLDER

YYYY-MM-DD	2018-03-22
DESIGNED	G.TANG
PREPARED	P.THIEDE
REVIEWED	D.SHEPHERD
APPROVED	D.LONG

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1783039-043-R-Rev0	0	D-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A

25mm

0

LEGEND

- ROAD
- FLOW DIRECTION
- FLOOD CONTROL STRUCTURE

LOCATION	RED DEER RIVER
APPROX. LENGTH OF STRUCTURE (m)	1514
TYPE OF STRUCTURE	ACCESS ROAD

NOTE(S)

FLOOD CONTROL STRUCTURE SURVEY COMPLETED TO SUPPORT HYDRAULIC MODELLING AND FLOOD MAPPING.

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REFERENCE(S)

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0 75 150

1:6,000 METRES

TITLE

RED DEER WASTEWATER TREATMENT PLANT DYKE

DESCRIPTION

ACCESS ROAD AROUND WASTEWATER TREATMENT CELLS

CLIENT

ALBERTA ENVIRONMENT AND PARKS

PROJECT

RED DEER RIVER HAZARD STUDY

CONSULTANT

GOLDER

YYYY-MM-DD	2018-03-22
DESIGNED	G.TANG
PREPARED	P.THIEDE
REVIEWED	D.SHEPHERD
APPROVED	D.LONG

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1783039-043-R-Rev0	0	D-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A

25mm

0

PATH: I:\CLIENTS\AEP\1783039\Mapping\MXD\Hydrology\01_Survey & Base Data Collection\Rev0\1783039_Appendix_D_FloodControl-Datasheets_Rev0.mxd PRINTED ON: 2019-03-12 AT: 9:19:27 AM

LEGEND

- ROAD
- FLOW DIRECTION
- FLOOD CONTROL STRUCTURE

LOCATION	WASKASOO CREEK
APPROX. LENGTH OF STRUCTURE (m)	998
TYPE OF STRUCTURE	ROAD

NOTE(S)

FLOOD CONTROL STRUCTURE SURVEY COMPLETED TO SUPPORT HYDRAULIC MODELLING AND FLOOD MAPPING.

SEE REPORT SECTION 2.6 FOR MORE INFORMATION.

REFERENCE(S)

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0 75 150

1:6,000 METRES

TITLE
PENHOLD DYKE #1

DESCRIPTION
WASKASOO AVE BETWEEN LUCINA ST AND ROBINSON AVE

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT

GOLDER

YYYY-MM-DD	2018-03-22
DESIGNED	G.TANG
PREPARED	P.THIEDE
REVIEWED	D.SHEPHERD
APPROVED	D.LONG

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1783039-043-R-Rev0	0	D-3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A

25mm

0

LEGEND

- ROAD
- FLOW DIRECTION
- FLOOD CONTROL STRUCTURE

LOCATION	WASKASOO CREEK
APPROX. LENGTH OF STRUCTURE (m)	868
TYPE OF STRUCTURE	RETAINING STRUCTURE

NOTE(S)

FLOOD CONTROL STRUCTURE SURVEY COMPLETED TO SUPPORT HYDRAULIC MODELLING AND FLOOD MAPPING.

SEE REPORT SECTION 2.6 FOR MORE INFORMATION.

REFERENCE(S)

FLOOD CONTROL STRUCTURE SURVEY BY GOLDER ASSOCIATES LTD. NOVEMBER 2017. ROADS OBTAINED FROM ALTALIS, © GOVERNMENT OF ALBERTA 2017. ALL RIGHTS RESERVED. IMAGERY CAPTURED JULY 2018 BY ORTHOSHOP GEOMATICS LTD. FOR THE GOVERNMENT OF ALBERTA. DATUM: NAD 83 CSRS PROJECTION: 3TM 114

0 75 150

1:6,000 METRES

TITLE
PENHOLD DYKE #2

DESCRIPTION
EAST OF WASKASOO AVE BETWEEN LUCINA ST AND HAWKRIDGE BLVD

CLIENT
ALBERTA ENVIRONMENT AND PARKS

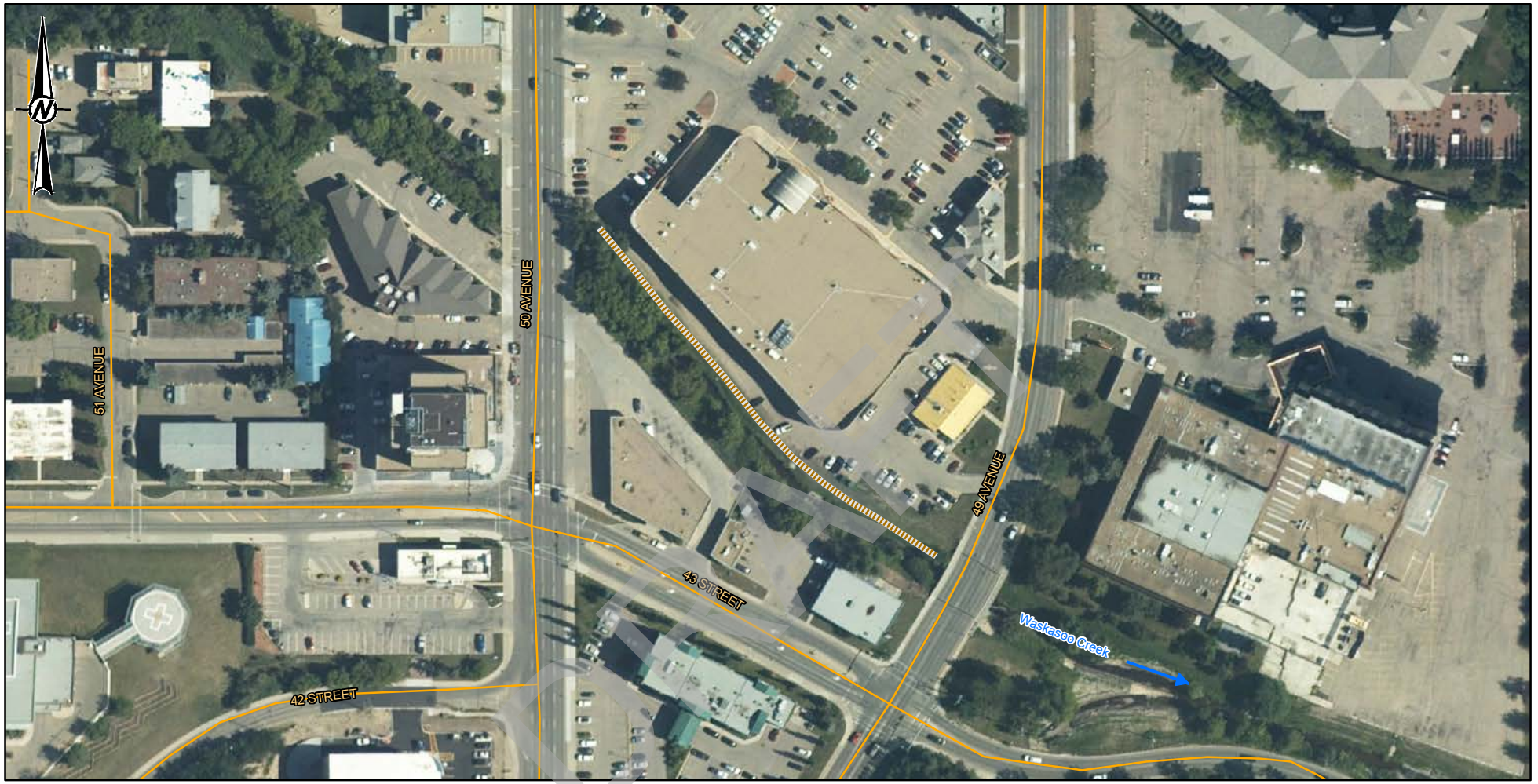
PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT

GOLDER

YYYY-MM-DD	2018-03-22
DESIGNED	G.TANG
PREPARED	P.THIEDE
REVIEWED	D.SHEPHERD
APPROVED	D.LONG

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1783039-043-R-Rev0	0	D-4



LEGEND

- ROAD
- FLOW DIRECTION
- FLOOD CONTROL STRUCTURE

LOCATION	WASKASOO CREEK
APPROX. LENGTH OF STRUCTURE (m)	160
TYPE OF STRUCTURE	RETAINING STRUCTURE

NOTE(S)

FLOOD CONTROL STRUCTURE SURVEY COMPLETED TO SUPPORT HYDRAULIC MODELLING AND FLOOD MAPPING.

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REFERENCE(S)

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0 75 150

1:2,000 METRES

TITLE
SAFEWAY DYKE

DESCRIPTION
SOUTH OF SAFEWAY BETWEEN 49 AVE AND 50 AVE

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT

GOLDER

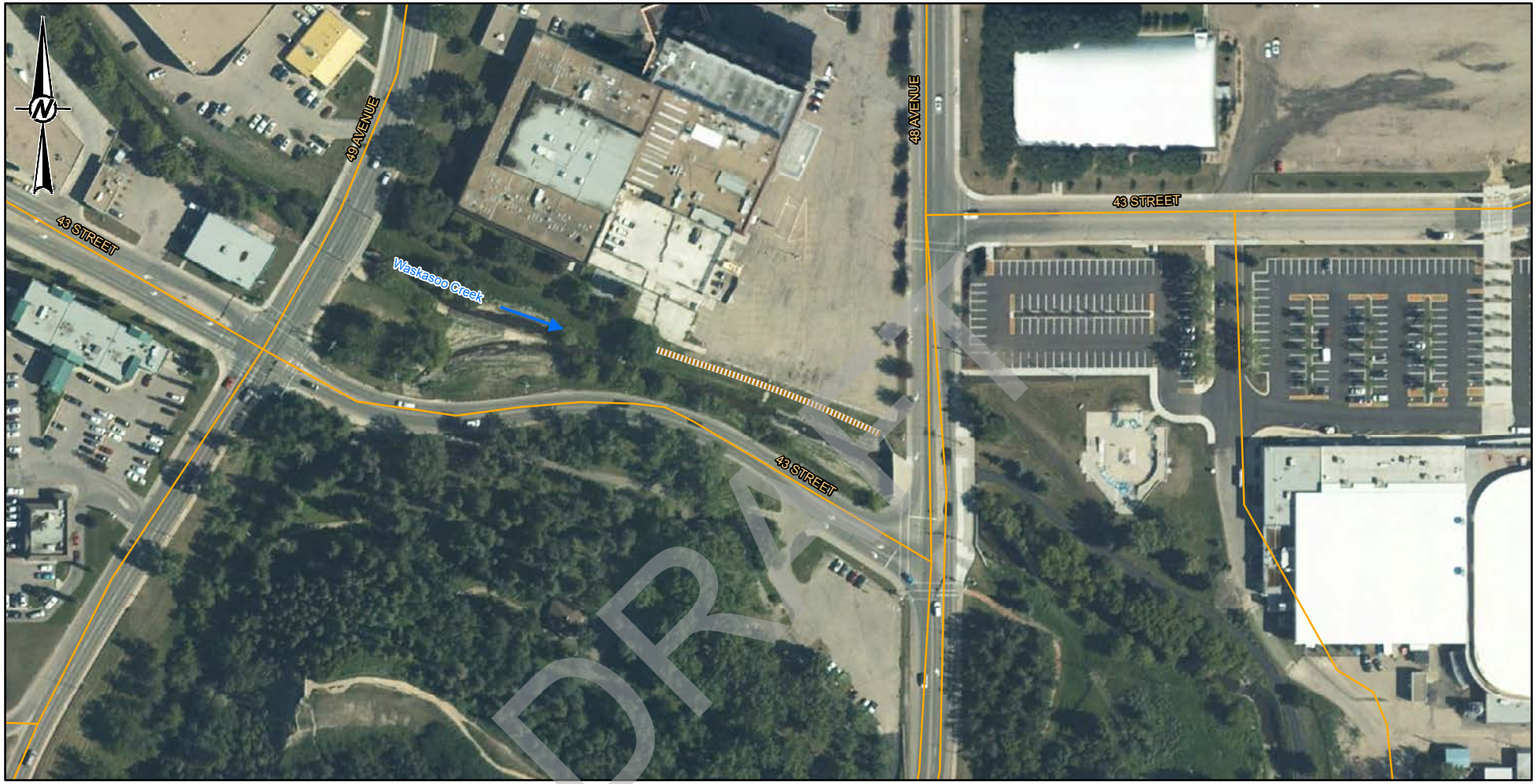
YYYY-MM-DD	2018-03-22
DESIGNED	G.TANG
PREPARED	P.THIEDE
REVIEWED	D.SHEPHERD
APPROVED	D.LONG

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1783039-043-R-Rev0	0	D-5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ANSI A

25mm

0



LEGEND

- ROAD
- FLOW DIRECTION
- FLOOD CONTROL STRUCTURE

LOCATION	WASKASOO CREEK
APPROX. LENGTH OF STRUCTURE (m)	80
TYPE OF STRUCTURE	RETAINING STRUCTURE

NOTE(S)

FLOOD CONTROL STRUCTURE SURVEY COMPLETED TO SUPPORT HYDRAULIC MODELLING AND FLOOD MAPPING.

SEE REPORT SECTION 2.6 FOR MORE INFORMATION.

REFERENCE(S)

FLOOD CONTROL STRUCTURE SURVEY BY GOLDER ASSOCIATES LTD. NOVEMBER 2017. ROADS OBTAINED FROM ALTALIS, © GOVERNMENT OF ALBERTA 2017. ALL RIGHTS RESERVED. IMAGERY CAPTURED JULY 2018 BY ORTHOSHOP GEOMATICS LTD. FOR THE GOVERNMENT OF ALBERTA. DATUM: NAD 83 CSRS PROJECTION: 3TM 114

0 75 150

1:2,000 METRES

TITLE
BAYMONT DYKE

DESCRIPTION
SOUTH OF BAYMONT INN & SUITES BETWEEN 48 AVE AND 49 AVE

CLIENT
ALBERTA ENVIRONMENT AND PARKS

PROJECT
RED DEER RIVER HAZARD STUDY

CONSULTANT

GOLDER

YYYY-MM-DD	2018-03-22
DESIGNED	G.TANG
PREPARED	P.THIEDE
REVIEWED	D.SHEPHERD
APPROVED	D.LONG

PROJECT NO.	CONTROL	REV.	FIGURE
1783039	1783039-043-R-Rev0	0	D-6

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25mm

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As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

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