
REFERENCE: EPCOR WTP DRAWINGS



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EPCOR

OKOTOKS WATER TREATMENT PLANT UPGRADE

MARCH 18, 2013

Client Number: 996738

Project No: 110773184

ISSUED FOR RECORD

DRAWING LIST

<u>DRAWING NO</u>	<u>DESCRIPTION</u>	
<u>GENERAL</u>		
73184G-000	COVER SHEET	
73184G-001	DRAWING LIST AND LOCATION PLAN	
73184G-002	CONTRACT LIMITS	
<u>CIVIL</u>		
73184C-100	EXISTING UNDERGROUND UTILITIES PLAN	
73184C-101	HYDROVAC LOCATE POINTS	
73184C-102	EXISTING SITE CONDITIONS	
73184C-103	UNDERGROUND UTILITIES RELOCATION	
73184C-104	ACCESS ROAD AND FENCING RELOCATION	
73184C-301	SECTIONS	SHEET 1
73184C-302	SECTIONS	SHEET 2
73184C-501	DETAILS	
73184C-502	CHAINLINK FENCING DETAILS	
<u>STRUCTURAL</u>		
73184S-001	WTP	GENERAL NOTES
73184S-002	WTP	STANDARD DETAILS - SHEET 1
73184S-003	WTP	STANDARD DETAILS - SHEET 2
73184S-004	WTP	STANDARD DETAILS - SHEET 3
73184S-005	WTP	STANDARD DETAILS - SHEET 4
73184S-006	WTP	STANDARD DETAILS - SHEET 5
73184S-101	WTP	FOUNDATION PLAN
73184S-102	WTP	MAIN FLOOR PLAN
73184S-103	WTP	ROOF PLAN
73184S-301	WTP	SECTIONS - SHEET 1
73184S-302	WTP	SECTIONS - SHEET 2
73184S-303	WTP	DETAILS & SECTIONS - SHEET 3
73184S-304	WTP	DETAILS & SECTIONS - SHEET 4
73184S-305	WTP	DETAILS & SECTIONS - SHEET 5
<u>ARCHITECTURAL</u>		
73184A-001	WTP	LEGENDS AND SYMBOLS, CODE REVIEW
73184A-101	SITE PLAN	
73184A-102	WTP	MAIN FLOOR PLAN; SCHEDULES
73154A-103	WTP	ROOF PLAN
73184A-201	WTP	BUILDING ELEVATIONS
73184A-301	WTP	BUILDING SECTIONS
73184A-302	WTP	WALL SECTIONS
73184A-303	WTP	WALL SECTIONS
73184A-401	WTP	DETAILS
<u>PROCESS</u>		
73184DI-001	ABBREVIATIONS, LEGENDS AND SYMBOLS	SHEET 1
73184DI-002	ABBREVIATIONS, LEGENDS AND SYMBOLS	SHEET 2
73184DI-003	INSTRUMENTATION SYMBOLS	
73184DI-601	WATER TREATMENT PLANT	PROCESS FLOW DIAGRAM
73184DI-602	WATER TREATMENT PLANT	HYDRAULIC PROFILE
73184DI-603	PRETREATMENT 1	PROCESS & INSTRUMENTATION DIAGRAM
73184DI-604	PRETREATMENT 2	PROCESS & INSTRUMENTATION DIAGRAM
73184DI-605	FILTER 1	PROCESS & INSTRUMENTATION DIAGRAM
73184DI-606	FILTER 2	PROCESS & INSTRUMENTATION DIAGRAM
73184DI-607	FILTER 3	PROCESS & INSTRUMENTATION DIAGRAM
73184DI-608	UV AND CLEARWELL	PROCESS & INSTRUMENTATION DIAGRAM
73184DI-609	RESERVOIR AND DISTRIBUTION	PROCESS & INSTRUMENTATION DIAGRAM
73184DI-610	RESIDUALS HANDLING	PROCESS & INSTRUMENTATION DIAGRAM
73184DI-611	COAGULANT DOSING SYSTEM	PROCESS & INSTRUMENTATION DIAGRAM
73184DI-612	POLYMER DOSING SYSTEM	PROCESS & INSTRUMENTATION DIAGRAM
73184DI-613	HYPOCHLORITE DOSING SYSTEM	PROCESS & INSTRUMENTATION DIAGRAM
73184DI-614	FLUORIDE DOSING SYSTEM	PROCESS & INSTRUMENTATION DIAGRAM
73184DI-615	RAW WATER PIPING	PROCESS & INSTRUMENTATION DIAGRAM
73184DI-616	RAW WATER PIPING	PROCESS & INSTRUMENTATION DIAGRAM
73184D-001	STANDARD DETAILS	SHEET 1
73184D-002	STANDARD DETAILS	SHEET 2
73184D-003	STANDARD DETAILS	SHEET 3
73184D-004	STANDARD DETAILS	SHEET 4
73184D-005	STANDARD DETAILS	SHEET 5
73184D-100	WTP	KEY PLAN
73184D-101	WTP	DEMOLITION AND RELOCATION PLAN
73184D-102	PRETREATMENT SYSTEM	LOWER LEVEL PLAN
73184D-103	PRETREATMENT SYSTEM	UPPER LEVEL PLAN
73184D-104	FILTER 1/2 AND UV	LOWER LEVEL PLAN
73184D-105	FILTER 1/2 AND UV	UPPER LEVEL PLAN
73184D-106	FILTER 3 AND UV	LOWER LEVEL PLAN
73184D-107	FILTER 3 AND UV	UPPER LEVEL PLAN
73184D-108	NORTH DISTRIBUTION AND ANCILLARIES	PLAN
73184D-109	SOUTH DISTRIBUTION AND STANDBY POWER	PLAN
73184D-301	PRETREATMENT	SECTIONS - SHEET 1
73184D-302	PRETREATMENT	SECTIONS - SHEET 2

<u>DRAWING NO</u>	<u>DESCRIPTION</u>
73184D-303	FILTER 3
73184D-304	FILTERS
73184D-305	BACKWASH PUMPS AND UV 3
73184D-306	FILTERS AND SOUTH DISTRIBUTION
73184D-901	WTP
73184D-902	PRETREATMENT
73184D-903	PRETREATMENT
73184D-904	FILTER 3
73184D-905	UV DISINFECTION AND BACKWASH
<u>MECHANICAL</u>	
73184M-001	WTP
73184M-050	WTP
73184M-101	WTP
73184M-102	WTP
73184M-103	WTP
73184M-201	WTP
73184M-202	WTP
<u>ELECTRICAL</u>	
73184E-001	SYMBOLS AND GENERAL NOTES
73184E-002	STANDARD DETAILS
73184E-003	STANDARD DETAILS
73184E-010	PLANT SINGLE LINE DIAGRAM
73184E-011	PLANT SINGLE LINE DIAGRAM (ADDITIONS)
73184E-012	HVAC, PANELBOARDS & CABLE SCHEDULES
73184E-100	SITE PLAN
73184E-101	SITE PLAN
73184E-102	WTP KEY PLAN
73184E-103	WTP - PRETREATMENT AREA
73184E-104	WTP - PRETREATMENT AREA
73184E-105	WTP - FILTERS AREA
73184E-106	WTP - FILTERS AREA
73184E-107	WTP - NORTH DISTRIBUTION AREA
73184E-108	WTP - SOUTH DISTRIBUTION AREA
73184E-601	WTP - ELECTRICAL ROOM
73184E-603	WTP - MOTOR STARTER SCHEMATICS
73184E-604	WTP - MOTOR STARTER SCHEMATICS
73184E-605	WTP - MOTOR STARTER SCHEMATICS
73184E-606	WTP - PRETREATMENT EQUIPMENT
73184E-607	WTP - FILTER SYSTEM
73184E-608	WTP - SECURITY, FIRE ALARM AND
73184EI-002	WTP - INSTRUMENT
73184EI-003	WTP - INSTRUMENT
73184EI-004	WTP - INSTRUMENT
73184EI-005	WTP - INSTRUMENT LOOP DIAGRAM
73184EI-006	WTP - INSTRUMENT LOOP DIAGRAM
73184EI-007	WTP - INSTRUMENT LOOP DIAGRAM
73184EI-008	WTP - INSTRUMENT LOOP DIAGRAM
73184EI-009	WTP - CONTROL SYSTEM
73184EI-010	WTP
73184EI-011	WTP - JUNCTION BOX DETAIL
73184EI-012	WTP - CONTROL PANEL
73184EI-013	WTP - FILTER PANEL INTERCONNECTION
73184EI-014	WTP - LCP-6.900 MAIN PLC
73184EI-015	WTP - LCP-6.900 MAIN PLC
73184EI-016	WTP - LCP-6.900 MAIN PLC
73184EI-017	WTP - LCP-6.900 MAIN PLC
73184EI-018	WTP - LCP-6.900 MAIN PLC
73184EI-019	WTP - LCP-6.900 MAIN PLC
73184EI-020	WTP - LCP-6.900 MAIN PLC
73184EI-021	WTP - LCP-6.900 MAIN PLC
73184EI-030	WTP - LCP-3.110 FILTER #1 RIO
73184EI-031	WTP - LCP-3.110 FILTER #1 RIO
73184EI-033	WTP - LCP-3.110 FILTER #1 RIO
73184EI-034	WTP - LCP-3.110 FILTER #1 RIO
73184EI-035	WTP - LCP-3.150 FILTER #2 RIO
73184EI-036	WTP - LCP-3.150 FILTER #2 RIO
73184EI-038	WTP - LCP-3.150 FILTER #2 RIO
73184EI-039	WTP - LCP-3.150 FILTER #2 RIO
73184EI-100	WTP
73184EI-101	WTP - PRETREATMENT AREA
73184EI-102	WTP - FILTER AREA

DISCIPLINE CODE & DRAWING ORDER

G	GENERAL DRAWINGS
C	CIVIL DRAWINGS
S	STRUCTURAL DRAWINGS
A	ARCHITECTURAL DRAWINGS
DI	PROCESS & INSTRUMENTATION DIAGRAMS
D	PROCESS DRAWINGS
M	MECHANICAL DRAWINGS
E	ELECTRICAL DRAWINGS
EI	INSTRUMENTATION DRAWINGS

DRAWING TYPE

0	GENERAL (SYMBOLS, LEGENDS, NOTES ETC.)
1	PLANS (HORIZONTAL VIEWS)
2	ELEVATIONS (VERTICAL VIEWS)
3	SECTIONS (SECTIONAL VIEWS, WALL SECTIONS)
4	LARGE SCALE (PLANS, ELEVATIONS OR SECTIONS THAT ARE NOT DETAILS)
5	DETAILS
6	SCHEMATICS AND DIAGRAMS
7	USER DEFINED (FOR TYPES WHICH DO NOT FALL IN OTHER CATEGORIES)
8	USER DEFINED (FOR TYPES WHICH DO NOT FALL IN OTHER CATEGORIES)
9	3D VIEWS (ISOMETRIC, PERSPECTIVES, PHOTOGRAPHS)

SECTIONS
SECTIONS
SECTIONS
SECTIONS

OVERALL PLANT ISOMETRIC
SOUTHEAST ISOMETRIC VIEW
SOUTHWEST ISOMETRIC VIEW
SOUTHWEST ISOMETRIC VIEW
SOUTHWEST ISOMETRIC VIEW

DRAWING LIST & LEGEND
FOUNDATION PLAN

MAIN FLOOR DEMOLITION PLAN
MAIN FLOOR PLAN
ROOF PLAN

DETAILS
SCHEDULES

SHEET 1
SHEET 2
SHEET 1
SHEET 2

SECURITY
FIRE AND SECURITY PLAN
EQUIPMENT PLAN
POWER AND LIGHTING PLAN
EQUIPMENT PLAN
POWER AND LIGHTING PLAN
EQUIPMENT PLAN
EQUIPMENT PLAN

EQUIPMENT PLAN
SHEET 1
SHEET 2
SHEET 3
WIRING BLOCK DIAGRAM
WIRING CONTROL BLOCK DIAGRAM
FIBRE OPTIC SCHEMATIC DIAGRAM

INSTALLATION DETAIL - SHEET 1
INSTALLATION DETAIL - SHEET 2
INSTALLATION DETAIL - SHEET 3

SHEET 1
SHEET 2
SHEET 3
SHEET 4
ARCHITECTURE BLOCK DIAGRAM
CONTROL PANEL LAYOUT
TERMINATIONS
TERMINAL BLOCKS (POWER)

ANALOG INPUTS WIRING DIAGRAM
ANALOG INPUTS WIRING DIAGRAM
ANALOG INPUTS WIRING DIAGRAM
ANALOG INPUTS WIRING DIAGRAM
ANALOG OUTPUTS WIRING DIAGRAM
DISCRETE INPUTS WIRING DIAGRAM
DISCRETE OUTPUTS WIRING DIAGRAM
ANALOG INPUTS WIRING DIAGRAM
ANALOG OUTPUTS WIRING DIAGRAM
DISCRETE INPUTS WIRING DIAGRAM
DISCRETE OUTPUTS WIRING DIAGRAM

KEY PLAN
INSTRUMENT PLAN
INSTRUMENT PLAN



LOCATION PLAN
N.T.S.
OKOTOKS, ALBERTA



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Legend

Notes

Revision	By	Appd.	YY.MM.DD
E			
D			
C FOR RECORD	JX	RR	13.03.18
B FOR CONSTRUCTION	JX	RR	09.08.25
A FOR QUOTATION	JX	RR	09.06.30
Issued		By Appd.	YY.MM.DD
Client Number 996738	SJ	RR	10.12.15
	Dwn.	Chk-d	09.09.15

Permit-Seal

ORIGINAL STAMPED & SIGNED
FOR IFC - 2009 AUG 25
IFR - 2013 MAR 18

Client/Project



OKOTOKS WATER TREATMENT PLANT UPGRADE
Okotoks, AB, Canada

Title

GENERAL DRAWING LIST AND LOCATION PLAN

Project No.	Scale
110773184	NONE
Drawing No.	Issue/Revision

73184G-001

C / 0

DRAWING NUMBER

73184X-001

— DRAWING NUMBER
— DRAWING TYPE
— DISCIPLINE CODE
— PROJECT NUMBER

NOTE:
DRAWINGS NOT IN THIS CONTRACT
~~XXXXXX XXXXXX XXXXXX~~



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Legend

- CONTRACT LIMITS
- CONTRACT LAYDOWN AREA

Notes

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	Desn.	Chkd.	Drsgn.

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 FOR IFC - 2009 AUG 25
 IFR - 2013 MAR 18**

Client/Project

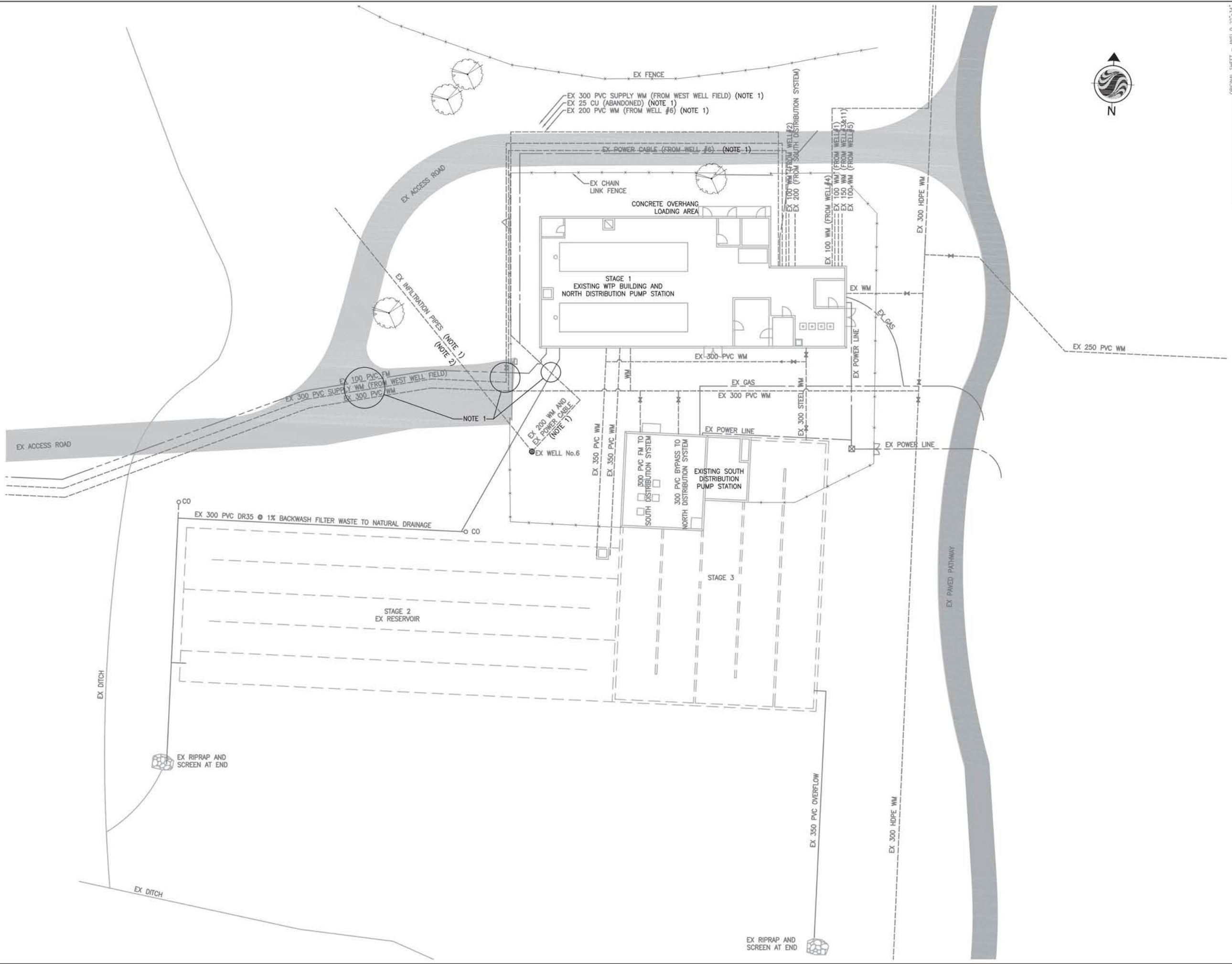


OKOTOKS WATER TREATMENT PLANT UPGRADE
 Okotoks, AB, Canada

Title

**GENERAL
 CONTRACT LIMITS**

Project No. 110773184	Scale 1:150	0 1.5 4.5 7.5m
Drawing No. 73184G-002	Issue/Revision C / 0	



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Legend

- TREE
- CHAINLIKE FENCE
- WATER LINE
- POWER LINE
- GAS LINE
- BACKWASH OVERFLOW LINE
- GRAVELED ROAD
- PAVED PATHWAY

Notes

1. CONTRACTOR TO FIELD LOCATE ALL PIPES PRIOR TO CONSTRUCTION. SEE DWG 73184C-101 FOR PROPOSED HYDROVAC LOCATIONS.
2. LOCATION OF LINE HAS NOT BEEN VERIFIED, IF ADDITIONAL LINES ARE FOUND NOTIFY THE OWNER'S REPRESENTATIVE FOR INSTRUCTION ON HOW TO PROCEED.

Revision	By	Appd.	YY.MM.DD
E			
D			
C FOR RECORD	JM	RR	10.12.15
B FOR CONSTRUCTION	JM	RR	09.08.25
A FOR QUOTATION	JM	DL	09.06.30
Issued	By	Appd.	YY.MM.DD
Client Number 996738	SJ	FR	JM 1012.15
	Desn.	Chkd.	Dsgn.

Permit-Seal

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 FOR IFC - 2009 AUG 25
 IFR - 2013 MAR 18**

Client/Project

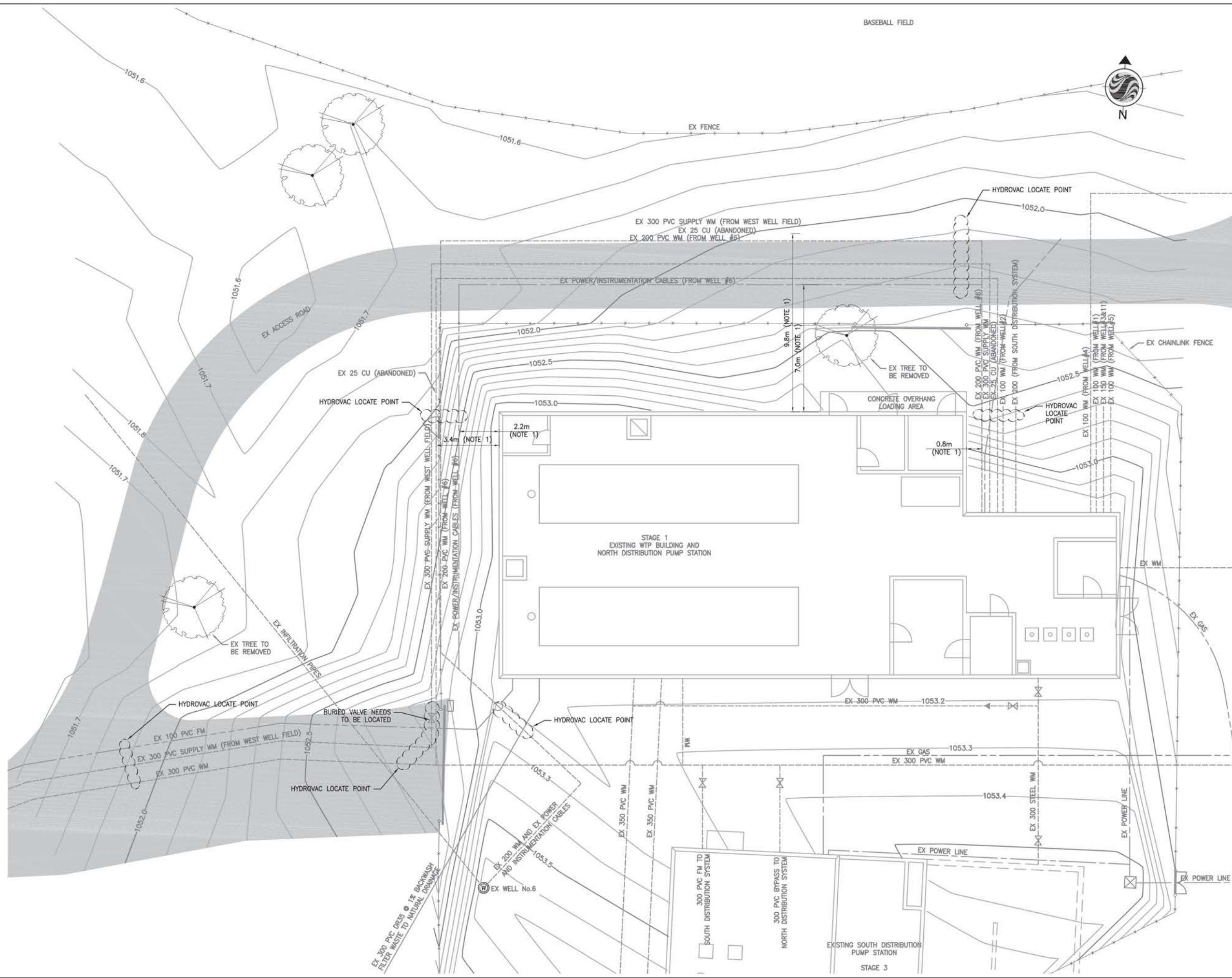


OKOTOKS WATER TREATMENT PLANT UPGRADE
 Okotoks, AB, Canada

Title

**CIVIL
 EXISTING UNDERGROUND
 UTILITIES PLAN**

Project No. 110773184	Scale 1:200	Issue/Revision C / 0
Drawing No. 73184C-100		



BASEBALL FIELD



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Legend

	TREE
	CHAINLIKE FENCE
	WATER LINE
	POWER LINE
	GAS LINE
	BACKWASH OVERFLOW LINE
	GRAVELED ROAD
	HYDROVAC LOCATE POINT

Notes

1. OFFSET DIMENSIONS SHOWN WERE TAKEN FROM RECORD INFORMATION. CONTRACTOR TO CONFIRM.
2. LOCATION + QUANTITY OF HYDROVAC LOCATIONS ARE A GUIDELINE. CONTRACTOR SHALL ADJUST AS REQUIRED TO LOCATE ALL PIPES SHOWN.
3. CONTRACTOR TO SUBMIT A HYDROVAC PLAN FOR APPROVAL FROM THE OWNER'S REPRESENTATIVE.
4. DEPTH OF PIPELINES HAVE NOT BEEN VERIFIED CONTRACTOR TO VERIFY.
5. CONTRACTOR TO NOTIFY OWNER'S REPRESENTATIVE PRIOR BACKFILL OF HYDROVAC TRENCHES CONTRACTOR TO ENSURE THAT THE CLOUDED PIPELINES SHOWN ON THE DRAWINGS HAVE BEEN EXPOSED.

Revision	By	Appd.	YY.MM.DD
E			
D			
C FOR RECORD	JM	RR	10.12.15
B FOR CONSTRUCTION	JM	RR	09.08.25
A FOR QUOTATION	JM	DL	09.06.30
Issued	By	Appd.	YY.MM.DD
Client Number 996738	SJ	FR	JM 1012.15
	Desn.	Chkd.	Dsgn YY.MM.DD

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FOR IFC - 2009 AUG 25
IFR - 2013 MAR 18

Client/Project



OKOTOKS WATER TREATMENT PLANT UPGRADE
Okotoks, AB, Canada

Title

CIVIL
HYDROVAC LOCATE POINTS

Project No.
110773184

Scale
1:100

Drawing No.

73184C-101

Issue/Revision

C / 0



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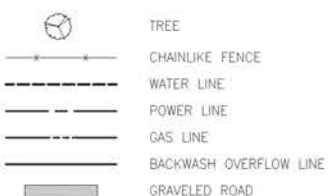
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Legend



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E			
D			
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B FOR CONSTRUCTION	JM	RR	09.08.25
A FOR QUOTATION	JM	DL	09.06.30
Issued	By	Appd.	YY.MM.DD
Client Number 996738	SJ	FR	09.02.25
	Drawn	Checked	Revised

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FOR IFC - 2009 AUG 25
IFR - 2013 MAR 18

Client/Project



OKOTOKS WATER TREATMENT PLANT UPGRADE
Okotoks, AB, Canada

Title
CIVIL
EXISTING SITE CONDITIONS

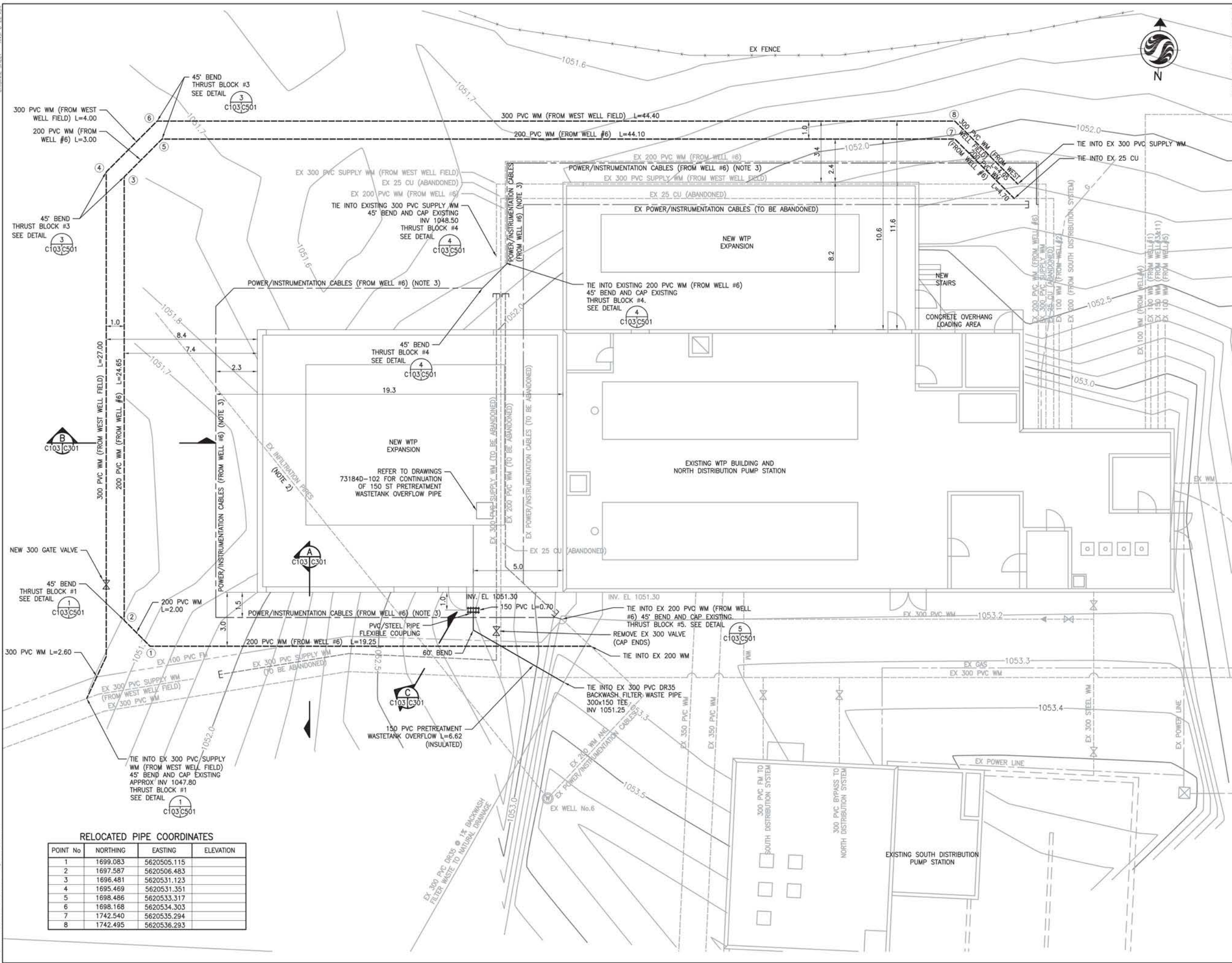
Project No.
110773184

Scale 0 1 3 5m
1:100

Drawing No.

73184C-102

C / 0



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Legend

----- WATER LINE
----- POWER LINE
----- BACKWASH OVERFLOW LINE

----- EX WATER LINE
----- EX POWER LINE
----- EX BACKWASH OVERFLOW LINE
----- EX GAS LINE

Notes

1. SEE DWG. 73184C-301 FOR POWER/INSTRUMENTATION CABLES AND WATER LINES TRENCH DETAILS.
2. LOCATION OF LINE HAS NOT BEEN VERIFIED, IF ADDITIONAL LINES ARE FOUND NOTIFY THE OWNER'S REPRESENTATIVE FOR INSTRUCTION ON HOW TO PROCEED.
3. FOR ELECTRICAL AND INSTRUMENTATION CABLES, REFER TO DWG. 73184E-004
4. TOPSOIL TO BE STOCKPILED AT THE SOUTH SIDE OF THE ACCESS ROAD TO THE WTP, ABOUT 130m WEST OF THE WTP BUILDING.

Revision	By	Appd.	YY.MM
E			
D			
C FOR RECORD	JM	RR	10.12
B FOR CONSTRUCTION	JM	RR	09.08
A FOR QUOTATION	JM	DL	09.06
Issued	By	Appd.	YY.MM
Client Number 996738	SJ	JM	1012
	Dean	Dean	YY.MM

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FOR IFC - 2009 AUG 25
IFR - 2013 MAR 18

Client/Project



OKOTOKS WATER TREATMENT PLANT UPGRADE
Okotoks, AB, Canada

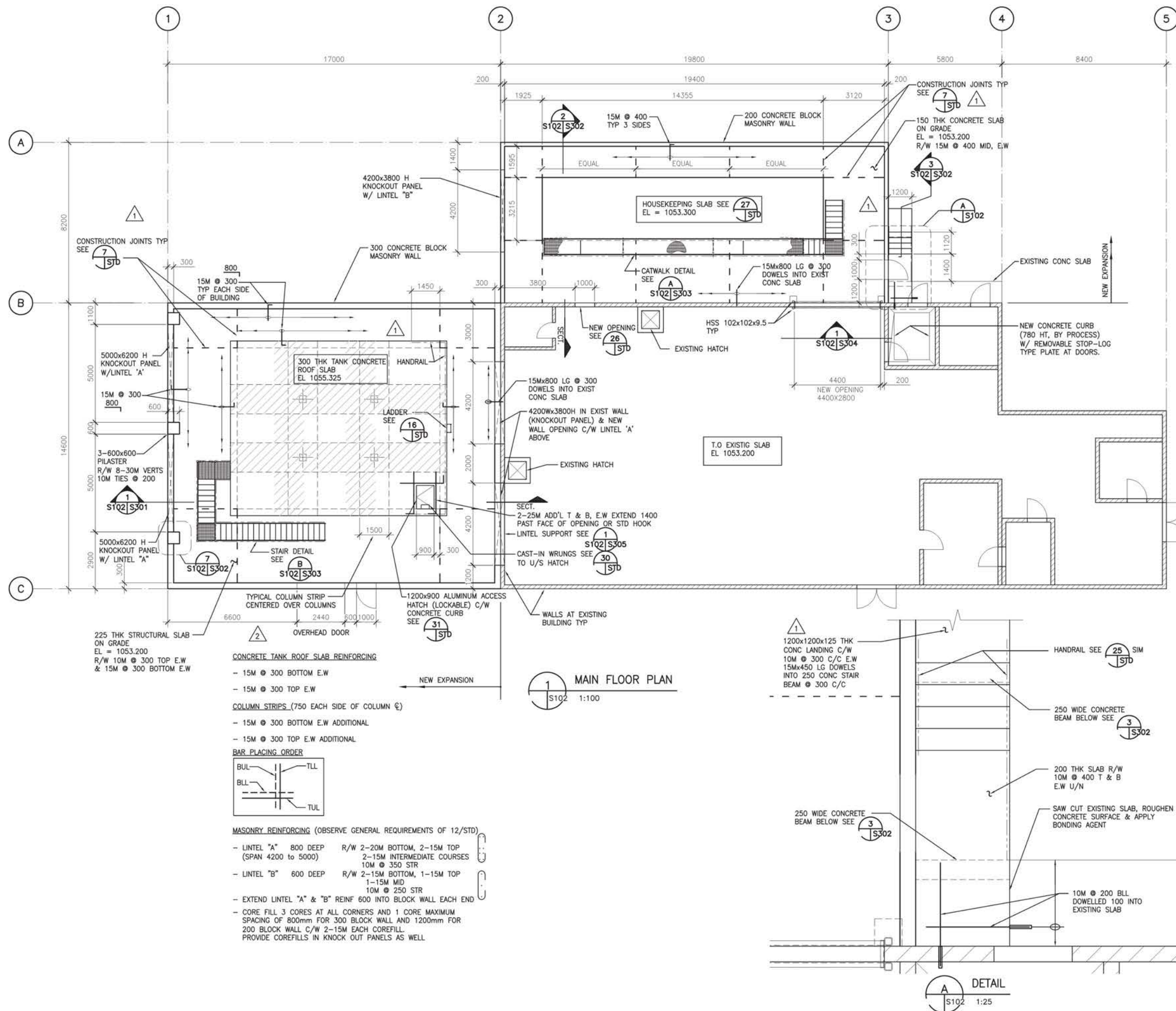
Title
CIVIL
UNDERGROUND UTILITIES RELOCATION

Project No. 110773184 Scale 0 1 3 5
1:100

Drawing No.	Issue/Revision
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73184C-103

C / 0



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Legend

Notes

2 PER ADDENDUM No. 4	DC	PCW	09.08.01
1 PER ADDENDUM No. 1	DC	PCW	09.07.30
Revision	By	Appd.	YY.MM.DD
E			
D			
C FOR RECORD	DC	RR	13.03.11
B FOR CONSTRUCTION	DC	RR	09.08.21
A FOR QUOTATION	DC	PCW	09.06.21
Issued	By	Appd.	YY.MM.DD
Client Number 996738	SKB	PCW	DC 10.12.11
	Deno	Chkd	Deno YY.MM.DD

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FOR IFC - 2009 AUG 25
IFR - 2013 MAR 18

Client/Project

OKOTOKS WATER TREATMENT PLANT UPGRADE
Okotoks, AB, Canada

Title

STRUCTURAL
WTP
MAIN FLOOR PLAN

Project No. _____

110773184

Scale

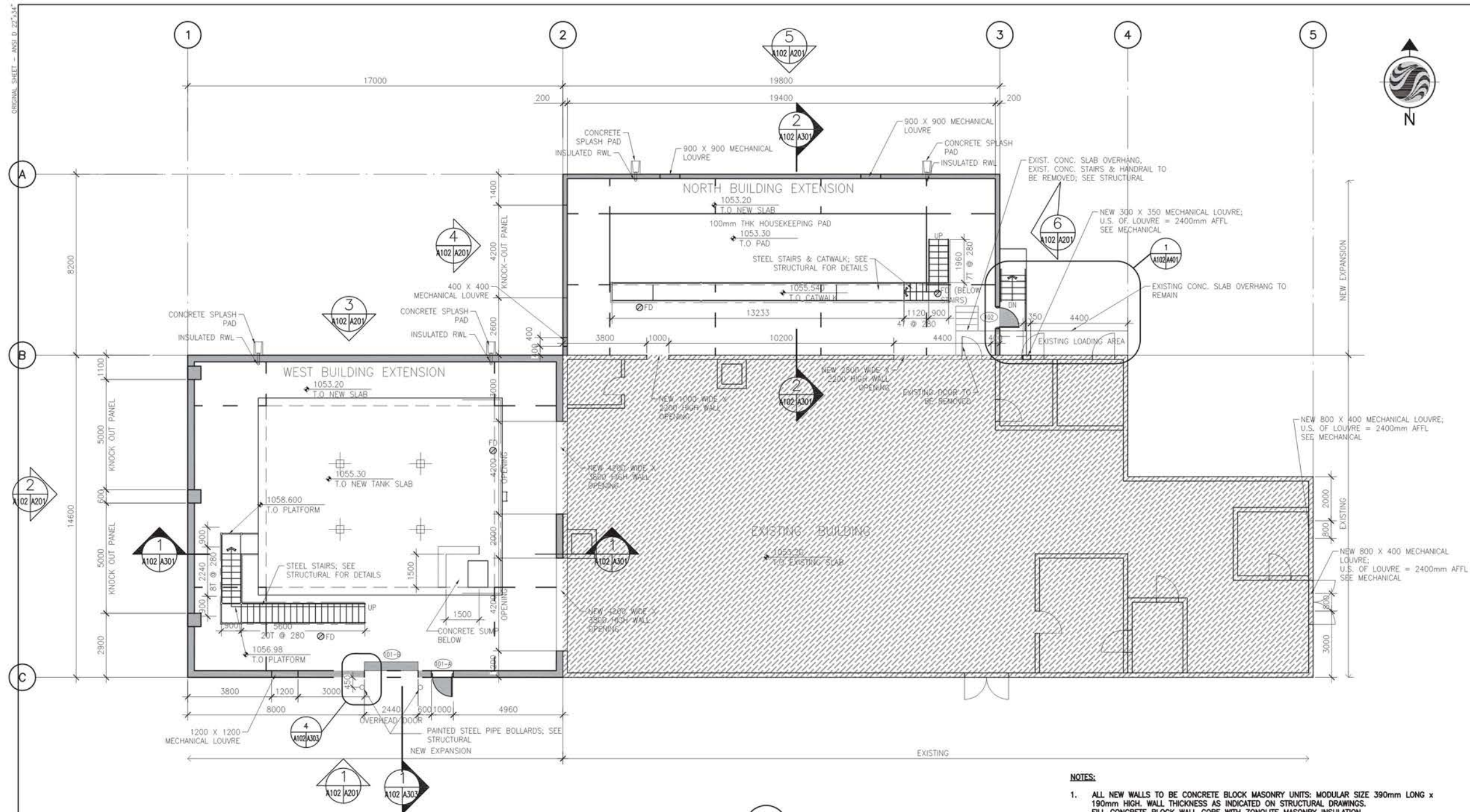
AS NOTED

Drawing No. _____

Issue/Revision

73184S-102

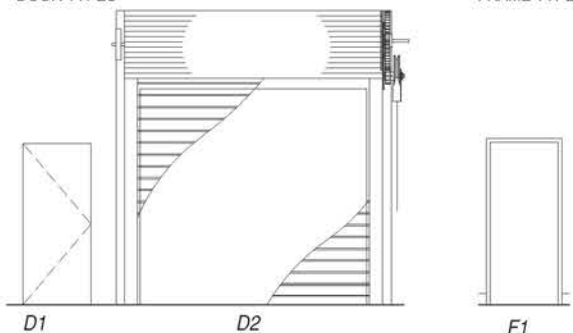
C / 2



DOOR SCHEDULE												
LOCATION	DESCRIPTION	DOOR	FRAME	GLAZING	HAND	HARDWARE	REMARKS					
DOOR NO.	WIDTH	HEIGHT	THICK	TYPE	MAT'L	CORE	FINISH	TYPE	MAT'L	FINISH	DOOR TRANS.	SIDE-LITE
101-A (WEST BUILDING EXTENSION)	0	900	2150	45	D1	HM	INSUL	PAINT	F1	P.ST.	PAINT	-
101-B (WEST BUILDING EXTENSION)	0	2440	3050	-	D2	-	INSUL	PAINT	-	-	-	-
102 (NORTH BUILDING EXTENSION)	0	900	2150	45	D1	HM	INSUL	PAINT	F1	P.ST.	PAINT	-

DOOR TYPES

FRAME TYPE



SCHEDULE LEGEND

HM	HOLLOW METAL
INSUL	INSULATED
RH	RIGHT HAND
RHR	RIGHT HAND REVERSE
LH	LEFT HAND
LHR	LEFT HAND REVERSE
PAINT	REFER TO FINISH SCHEDULE, SPECIFICATIONS SECTION 09999
SPEC	SPECIFIED
P.ST.	PRESSED STEEL

INTERIOR FINISH SCHEDULE

NORTH & WEST BUILDING EXTENSIONS

FLOOR: CONCRETE HARDENER & SEALER
MANUFACTURER: REFER TO SPECIFICATIONS
COLOR: CLEAR COAT

WALLS: CONCRETE BLOCK - PAINTED
MANUFACTURER: REFER TO SPECIFICATIONS
COLOR: TO MATCH EXISTING

CEILING: EXPOSED

NOTES:

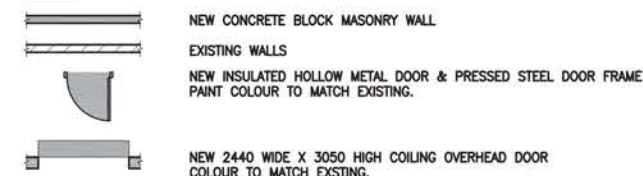
1. PAINT ALL METAL DOOR FRAMES & DOORS TO MATCH EXISTING.
2. CONTRACTOR TO VERIFY AVAILABILITY OF ALL PRODUCTS UPON RECEIVING TENDER DOCUMENTS. IF THERE ARE DELIVERY ISSUES, CONTRACTOR TO NOTIFY ARCHITECT IMMEDIATELY.

1 MAIN FLOOR PLAN
1:100

NOTES:

1. ALL NEW WALLS TO BE CONCRETE BLOCK MASONRY UNITS: MODULAR SIZE 390mm LONG x 190mm HIGH. WALL THICKNESS AS INDICATED ON STRUCTURAL DRAWINGS. FILL CONCRETE BLOCK WALL CORE WITH ZONOLITE MASONRY INSULATION. COURSEWORK FOR CONCRETE UNIT MASONRY SHALL BE RUNNING BOND TO MATCH EXISTING.
2. PRE-FINISHED STEEL SIDING TO MATCH EXISTING.
3. PAINT EXTERIOR & INTERIOR BLOCK WALLS TO MATCH EXISTING. PAINT ALL COLUMNS TO MATCH CONCRETE BLOCK WALL.
3. NEW FLOOR CONSTRUCTION:
CONCRETE HARDENER & SEALER
CONCRETE FLOOR SLAB (SEE STRUCTURAL)
UNDER SLAB SHEET VAPOUR RETARDER
CRUSHED GRAVEL
4. ROOF CONSTRUCTION:
2 PLY SBS ROOFING MEMBRANE
INSULATION OVERLAY BOARD
100mm RIGID INSULATION
AIR/ VAPOUR BARRIER MEMBRANE
13mm EXTERIOR GWB SHEATHING
SLOPED METAL ROOF DECK (SEE STRUC'L)
5. ALL EXTERIOR DOORS & FRAMES TO BE INSULATED.
6. PROVIDE TEMPORARY STAIRS FOR THE EXISTING LOADING AREA DURING CONSTRUCTION.

LEGEND:



Stantec Consulting Ltd.
200, 325-25 Street S.E.
Calgary AB Canada
T2A 7H8
Tel. 403.716.8000
Fax. 403.716.8049
www.stantec.com

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Record Drawing

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Legend

ROOF TRUSSES PAINT:
ICI - DEVCO COATINGS
DEVGUARD 4160-1000
WHITE
BLOCK FILLER:
ICI - X-PERT WATER BASE ACRYLIC
INTERIOR/ EXTERIOR PRIMER/ SEALER

BLOCK PAINT:
GLIDDEN ULTRA INTERIOR
ALKYD LOW ORDER
SEMI GLOSS WHITE
#9441-O WHITE

Notes

Revision	By	Appd.	YY.MM.DD
E			
D			
C FOR RECORD	KC	TH	13.03.18
B FOR CONSTRUCTION	JB	RR	09.08.25
A FOR QUOTATION	JB	TH	09.06.30
Issued	By	Appd.	YY.MM.DD
Client Number 996738	JB	FK	09.04.29
	Dem.	Chkd.	Desgn.

Permit-Seal

ORIGINAL STAMPED & SIGNED
FOR IFC - 2009 AUG 25
IFR - 2013 MAR 18

Client/Project



OKOTOKS WATER TREATMENT PLANT UPGRADE
Okotoks, AB, Canada

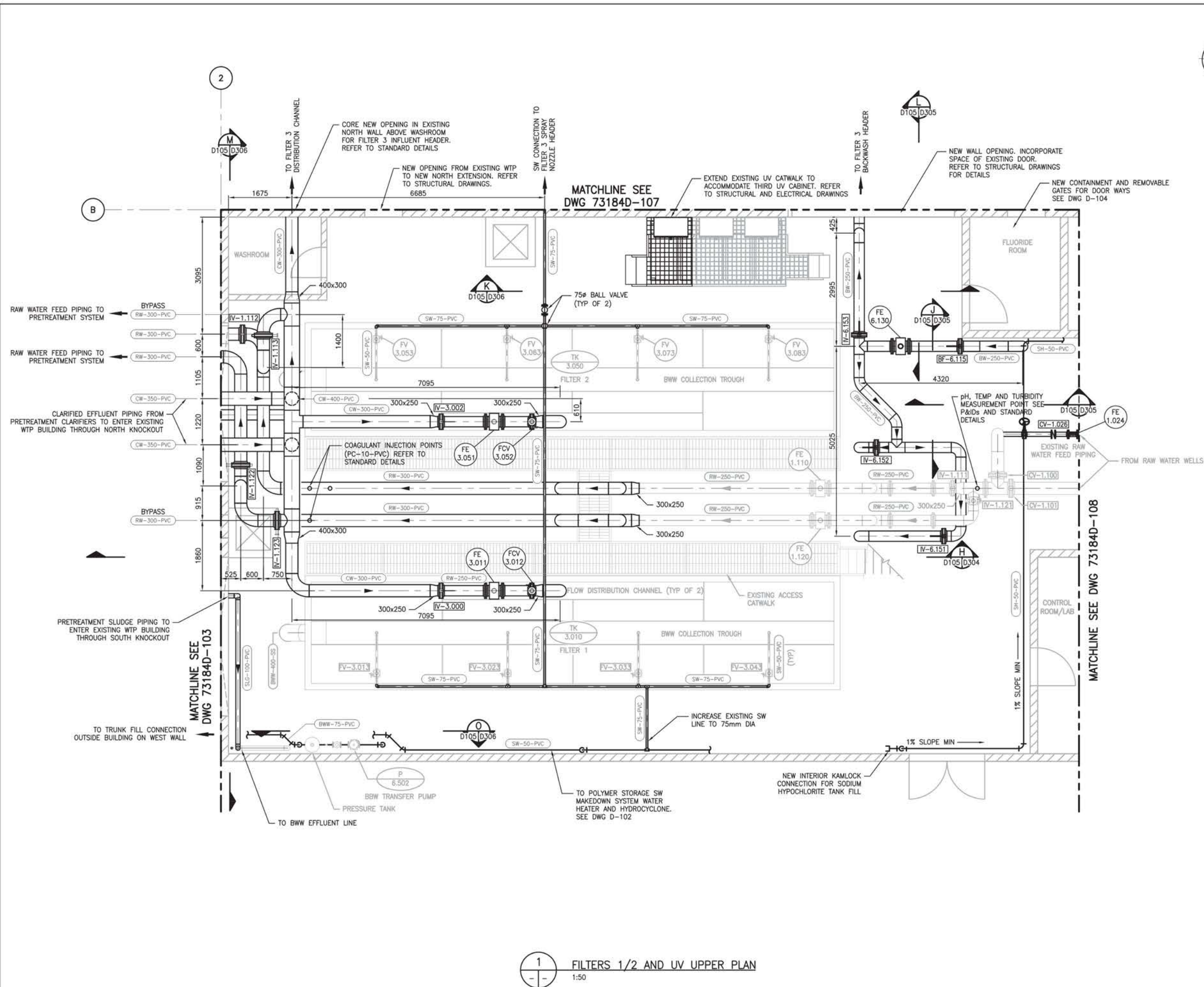
Title

ARCHITECTURAL
WTP
MAIN FLOOR PLAN; SCHEDULES

Project No.	Scale	0 1000 3000 5000
110773184	1:100	
Drawing No.	Issue/Revision	

73184A-102

C / 0



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Legend

Notes

Revision	By	Appd.	YY.MM.DD
E			
D			
C FOR RECORD	JX	RR	13.03.1
B FOR CONSTRUCTION	JX	RR	09.08.2
A FOR QUOTATION	JX	RR	09.06.3
Issued	By	Appd.	YY.MM.DD
Client Number 996738	TR	RR	JX 10.12.1
	Drawn	Checked	Desig. YY.MM.DD

Permit-Seal

ORIGINAL STAMPED & SIGNED
FOR IFC - 2009 AUG 25
IFR - 2013 MAR 18

Client/Project



OKOTOKS WATER TREATMENT PLANT UPGRADE
Okotoks, AB, Canada

Title

PROCESS
FILTER 1/2 AND UV
UPPER LEVEL PLAN

Project No. _____

110773184

Scale	0	500	1500	2500
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Drawing No. _____

73184D-105

C / 0

**REFERENCE: GEOTECHNICAL REPORTS FOR
OKOTOKS WTP TIE INS**



October 14, 2022

Town of Okotoks

PO Box 20 200, 524 17th Avenue S.W.
Calgary, AB T2S 0B2
Attention: Pierce Mimura

Subject: Soil and Groundwater Site Conditions - Summary Letter
Water Treatment Collection & Sump
Englobe Ref: 02208358.000

Englobe Corp. (Englobe) has undertaken a geotechnical investigation at a property located in Okotoks, Alberta to support the design and construction of a sump and collection piping at an existing water treatment plant. The piping is proposed to be installed via directional drilling and will not be placed in the bedrock formation. Pursuant to your request, this letter is a summary of soil and groundwater conditions on site. A detailed geotechnical evaluation report will be sent at a later date.

1.0 Soil Investigation

The subsurface investigation was conducted on September 29, 2022 using a truck-mounted Becker hammer rig contracted from Earth Drilling Co. Ltd. of Calgary, Alberta. Drilling included:

- Four (4) boreholes (numbered 1-4) targeted to reach bedrock advanced along the proposed location of where the directional drilling will take place. All boreholes reached bedrock and were terminated at depths of 8.8 to 11.9 metres below existing grade.
- One (1) borehole (numbered 5) advanced on the east end of the site in case the directional drilling alignment is flipped if site conditions are better. This borehole was advanced to 8.8 metres below existing grade.

It should be understood that the nature of the subsurface investigation is approximate, particularly when using a Becker Hammer drill rig. The Becker Hammer drives a double walled steel casing with a diesel pile hammer. The casing is open-ended with a hardened drive bit and compressed air is forced down the annulus of the casing to flush cuttings up the centre of the inner pipe to the surface. Open-ended Becker Hammer blow counts were utilized to aid in determining in-situ soil densities & strengths.

A location of the project site area and the boreholes advanced across site are attached to this letter in Appendix A. The borehole logs are attached to this letter in Appendix B.

1.1 Groundwater Monitoring

Upon completion of the boreholes, the depth of the borehole was measured, including any slough, and the presence or absence of free water within the borehole was noted. A 25 mm diameter slotted PVC standpipe well was installed in all five (5) boreholes to allow future measurement of groundwater level within the depth of the investigation. This type of installation assumes a simple groundwater regimen. The

annulus around the standpipe was backfilled with drill cuttings from drilling operation. Specifics of each well installation are illustrated on the borehole logs.

1.2 Laboratory Testing

All laboratory testing is carried out in accordance with the applicable ASTM International test methods in our fully certified soils testing laboratory. Select samples were subjected to determination of natural moisture content, Atterberg limits and soluble sulphate content. The results, along with any subsequent recommendations, will be forwarded once complete.

2.0 Subsurface conditions

At the time this letter was prepared, information on subsurface stratigraphy was available only at discrete borehole locations. Conditions were extrapolated and interpolated from the borehole locations to develop recommendations. Adequate monitoring should be provided during construction to check that these assumptions are reasonable.

The below summarizes the subgrade conditions encountered in the drilling program. A more detailed soil description is contained in the borehole logs which are attached to this letter.

2.1 Soils

In general, the observed subsurface stratigraphy of the subject site consisted of surficial fills overlying sandy gravels overlying a layer of lacustrine clay and glacial till overlying sedimentary bedrock.

The following is the detailed stratigraphy of the soils encountered in the boreholes.

2.1.1 Fills

Fill consisting of silt was encountered at surface of all five (5) boreholes drilled across the project site.

The silt fill was found to be compact in consistency, damp and medium brown with trace black in colour. In addition, trace amounts of sand and organics were encountered within the silt fill. The silt fill extended to depths of 1.1 to 1.8 metres below grade across the site.

2.1.2 Gravels

Sandy gravel dominated the soil profile and was encountered below the surficial fill in all boreholes drilled and extended to depths of 6.4 to 9.9 metres below existing grade. The deposit was observed to be compact in consistency, dry to damp and light brown in colour. Trace clay and silt was encountered throughout the gravel deposit. Furthermore, trace amounts of cobbles were observed within the sandy gravel deposit. Cobbles and boulder sized rocks are typically present in this soil formation.

2.1.3 Lacustrine Clays/Tills

A glacial till and lacustrine clay deposit was encountered below the sandy gravel in three (3) of the five (5) boreholes advanced on the project site.

Glacial till soils consisting of silt till and silty clay till was encountered below the sandy gravel in borehole 1 at a depth of 6.4 metres below grade and extended to bedrock. The silt till was compact in consistency, damp and medium brown in colour. In addition, the silty clay till was found to be stiff in consistency, low in plasticity, moist and medium brown in colour.

A lacustrine silty clay deposit was encountered below the sandy gravels in boreholes 2 and 5 and extended to sedimentary bedrock. The lacustrine deposit was found to be moist, firm to stiff in consistency, low in plasticity and medium grey in colour.

2.1.4 Sedimentary Bedrock

Bedrock was encountered in all boreholes at depths ranging from 7.8 to 11.6 metres below the existing grade and extended at least to the ends of all boreholes. The bedrock was sedimentary and composed mainly of siltstone. The bedrock was generally damp and medium brown in colour.

With the directional drilling of the collection pipes proposed to not be placed in bedrock, the geotechnical drilling operation consisted of advancing roughly 1 metre into the bedrock when reached. As such, the bedrock encountered on site was the upper weak zone of bedrock.

2.2 Groundwater

During drilling, groundwater seepage was encountered between 4.0 and 4.5 metres below grade and within the sandy gravel deposit. Furthermore, all boreholes were noted to be wet upon completion. Stabilized groundwater levels were measured after the drilling operation on October 7, 2022 and groundwater levels were found to be 3.69 to 3.98 metres below existing grades. Groundwater levels fluctuate seasonally and as a result of climatic influences.

The groundwater levels are presented on the borehole logs which are attached to this letter.

3.0 Closure

We trust the information presented meets with your present requirements. Should you have questions please contact our office.

Respectfully Submitted,

Englobe Corp.



Mohamed Hussein, Engineer-in-Training

Tyler Windsor, P.Eng.
Senior Geotechnical Engineer

Appendix A

Drawings



eNGLOBE



Client:	Town of Okotoks		
Project:	Water Treatment Collection & Sump	Scale:	N.T.S.
Title:		Date:	October 14, 2022
Job Number:	Drawing Number:		
02208358.000	02208358.000.G01		



Client: Town of Okotoks			
Project: Water Treatment Collection & Sump		Scale: N.T.S.	
Title: Borehole Plan		Date: October 14, 2022	
Job Number: 02208358.000	Drawing Number: 02208358.000.G02		

Appendix B

Borehole Logs



eNGLOBE

Project: Water Treatment Sump & Collection					Drilling Information:					Borehole No.:1				
Client: Town of Okotoks					Earth Drilling Co. Ltd.					Project No.:02208358.000				
					Beckerhammer					Elevation:				
SAMPLE TYPE		☒ SHELBY TUBE	☒ CORE SAMPLE	☒ SPT SAMPLE	☒ GRAB SAMPLE	NO RECOVERY								
BACKFILL TYPE		☒ BENTONITE	☒ PEA GRAVEL	☒ SLOUGH	☒ GROUT	☒ DRILL CUTTINGS				☒ SAND				
Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	USCS	BLOWS	PLASTIC M.C. LIQUID 10203040		BECKERHAMMER		OTHER DATA	Well 1" SLOTTED PIEZOMETER	Elevation (m)	
									BLOW COUNT					
0		Silt FILL - trace sand, gravel and organics, compact, damp, medium brown with trace black.		1-1	FILL	18			60					
1		Sandy GRAVEL - trace silt, compact, dry, medium brown and grey.		1-2	GPS	18			60					
			1-3	11				60						
			1-4	13				60						
			1-5	22				60						
2		- damp.		1-6		21			60					
			1-7	23				60						
			1-8	24				60						
			1-9	18				60						
3		- trace free water.		1-10	ML	17			60					
			1-11	23				60						
			1-12	36				60						
			1-13	67				60						
4		SILT (Till) - trace gravel, compact, damp, medium brown.		1-14		CL-ML	69			60				
			1-15	20					60					
			1-16	20					60					
			1-17	32					60					
5	Silty CLAY (Till) - trace sand and gravel, stiff, moist, low plastic, medium brown.		1-18	BE	20			60						
		1-19	20				60							
		1-20	80				60							
		1-21	82				60							
6	BEDROCK (Siltstone) - weak, damp, medium grey.		1-22		86			60						
		1-23	86				60							
		1-24	89				60							
		1-25					60							
7		END OF BOREHOLE at a depth of 8.8 metres (Targeted Depth). Wet upon completion. 25 mm PVC installed to a depth of 8.8 m with 4.6 m slotted.		1-26					60					
			1-27					60						
			1-28					60						
			1-29					60						
8		Water Levels: October 7, 2022 - 3.83 m		1-30					60					
			1-31					60						
			1-32					60						
			1-33					60						
9				1-34					60					
			1-35					60						
			1-36					60						
			1-37					60						
10				1-38					60					
			1-39					60						
			1-40					60						
			1-41					60						
11				1-42					60					
			1-43					60						
			1-44					60						
			1-45					60						
12				1-46					60					
			1-47					60						
			1-48					60						
			1-49					60						
13				1-50					60					
			1-51					60						
			1-52					60						
			1-53					60						

Englobe Corp.

Logged By: Scott Bryan

Reviewed By: Tyler Windsor

Groundwater Depth: m

Completion Depth: 29 ft

Drilled on: 9/29/2022

Page 1 of 1



Englobe Corp.

Logged By: Scott Bryan

Reviewed By: Tyler Windsor

Groundwater Depth: m

Completion Depth: 29 ft

Drilled on: 9/29/2022

Project: Water Treatment Sump & Collection					Drilling Information:					Borehole No.:2				
Client: Town of Okotoks					Earth Drilling Co. Ltd.					Project No.:02208358.000				
					Beckerhammer					Elevation:				
SAMPLE TYPE		☒ SHELBY TUBE	☒ CORE SAMPLE	☒ SPT SAMPLE	☒ GRAB SAMPLE	NO RECOVERY								
BACKFILL TYPE		☒ BENTONITE	☒ PEA GRAVEL	☒ SLOUGH	☒ GROUT	☒ DRILL CUTTINGS ☒ SAND								
Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	USCS	BLOWS	PLASTIC 10 M.C. 20 LIQUID 30 40	BECKERHAMMER BLOW COUNT				OTHER DATA	Well 1" SLOTTED PIEZOMETER	Elevation (m)
								60 120 180 240						
0		Silt FILL - trace sand, gravel and organics, compact, damp, medium brown with trace black.		2-1	FILL	16								
				2-2		38								
1				2-2		22								
			Sandy GRAVEL - compact, dry, light brown.		2-3	GPS	16							
					2-3		30							
2					2-3		41							
					2-4		32							
					2-4		46							
3					2-4		40							
					2-5		42							
					2-5		50							
4			- trace free water.		2-6		70							
					2-6		37							
					2-6	32								
5					2-7	39								
					2-7	30								
				2-7	54									
				2-8	52									
6		- sandy layer approximately 250 mm thick.		2-8	50									
				2-8	37									
				2-9	40									
7				2-9	32									
				2-10	40									
				2-10	36									
8				2-11	25									
				2-11	14									
				2-11	24									
				2-11	23									
9				2-12	16									
				2-12	8									
				2-12	6									
				2-12	7									
10		Silty CLAY (Lacustrine) - trace gravel, firm, moist, low plastic, medium grey.		2-13	CL-ML	5								
				2-14		5								
				2-14		6								
				2-14		5								
11		- wet, medium grey sand lenses throughout.		2-15	BE	4								
				2-15		5								
				2-15		5								
				2-15		6								
12		BEDROCK (Siltstone) - weak, damp, weathered, medium grey.		2-16	BE	6								
		END OF BOREHOLE at a depth of 3.6 metres (Targeted Depth). Wet upon completion. 25 mm PVC installed to a depth of 11.9 m with 4.6 m slotted.				96								
13		Water Levels: October 7, 2022 - 3.80 m												

Englobe Corp.

Logged By: Scott Bryan

Reviewed By: Tyler Windsor

Groundwater Depth: m

Completion Depth: 11.8 ft

Drilled on: 9/29/2022

Page 1 of 1



Englobe Corp.

Logged By: Scott Bryan

Reviewed By: Tyler Windsor

Groundwater Depth: m

Completion Depth: 11.8 ft

Drilled on: 9/29/2022

Project: Water Treatment Sump & Collection					Drilling Information:					Borehole No.:3						
Client: Town of Okotoks					Earth Drilling Co. Ltd.					Project No.:02208358.000						
					Beckerhammer					Elevation:						
SAMPLE TYPE		☒ SHELBY TUBE	☒ CORE SAMPLE	☒ SPT SAMPLE	☒ GRAB SAMPLE	NO RECOVERY										
BACKFILL TYPE		☒ BENTONITE	☒ PEA GRAVEL	☒ SLOUGH	☒ GROUT	☒ DRILL CUTTINGS				☒ SAND						
Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	USCS	BLOWS	PLASTIC M.C. LIQUID 10 20 30 40			BECKERHAMMER ☒ BLOW COUNT ☒ 60 120 180 240				OTHER DATA	Well 1" SLOTTED PIEZOMETER	Elevation (m)
0		Silt FILL - trace sand, gravel and organics, compact, damp, medium brown with trace black.		3-1	FILL	40										
				3-2		49										
1		Sandy GRAVEL - compact, dry, light brown.		3-3		33										
				3-4		29										
2				3-5	24											
				3-6	26											
3		- trace free water.		3-7	GPS	23										
				3-8		30										
4				3-9		26										
				3-10		5										
5				3-11	GPS	6										
				3-12		4										
6			3-13	25												
			3-14	34												
7			3-15	GPS	28											
			3-16		23											
8			3-17		24											
			3-18		22											
9			3-19	GPS	22											
			3-20		24											
10			3-21		16											
			3-22		9											
11			3-23	GPS	11											
			3-24		5											
12			3-25		4											
			3-26		6											
13			3-27	GPS	28											
			3-28		80											
14			3-29		64											
			3-30		62											
15			3-31	GPS	68											
			3-32													
16			3-33													
			3-34													
17			3-35	GPS												
			3-36													
18			3-37													
			3-38													
19			3-39	GPS												
			3-40													
20			3-41													
			3-42													
21			3-43	GPS												
			3-44													
22			3-45													
			3-46													
23			3-47	GPS												
			3-48													
24			3-49													
			3-50													
25			3-51	GPS												
			3-52													
26			3-53													
			3-54													
27			3-55	GPS												
			3-56													
28			3-57													
			3-58													
29			3-59	GPS												
			3-60													
30			3-61													
			3-62													
31			3-63	GPS												
			3-64													
32			3-65													
			3-66													
33			3-67	GPS												
			3-68													
34			3-69													
			3-70													
35			3-71	GPS												
			3-72													
36			3-73													
			3-74													
37			3-75	GPS												
			3-76													
38			3-77													
			3-78													
39			3-79	GPS												
			3-80													
40			3-81													
			3-82													
41			3-83	GPS												
			3-84													
42			3-85													
			3-86													
43			3-87	GPS												
			3-88													
44			3-89													
			3-90													
45			3-91	GPS												
			3-92													
46			3-93													
			3-94													
47			3-95	GPS												
			3-96													
48			3-97													
			3-98													
49			3-99	GPS												
			3-100													
50			3-101													
			3-102													
51			3-103	GPS												
			3-104													
52			3-105													
			3-106													
53			3-107	GPS												
			3-108													
54			3-109													
			3-110													
55			3-111	GPS												
			3-112													
56			3-113													
			3-114													
57			3-115	GPS												
			3-116													
58			3-117													
			3-118													
59			3-119	GPS												
			3-120													
60			3-121													
			3-122													
61			3-123	GPS												
			3-124													
62			3-125													
			3-126													
63			3-127	GPS												
			3-128													
64			3-129													
			3-130													
65			3-131	GPS												
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66			3-133													
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77			3-155	GPS												
			3-156													
78			3-157													
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79			3-159	GPS												
			3-160													
80			3-161													
			3-162													
81			3-163	GPS												
			3-164													
82			3-165													
			3-166													
83			3-167	GPS												
			3-168													
84			3-169													
			3-170													
85			3-171	GPS												
			3-172													
86			3-173													
			3-174													
87			3-175	GPS												
			3-176													
88			3-177													
			3-178													
89			3-179	GPS												
			3-180													
90			3-181													
			3-182													
91			3-183	GPS												
			3-184													
92			3-185													
			3-186													
93			3-187	GPS												
			3-188													
94			3-189													
			3-190													
95			3-191	GPS												
			3-192													
96			3-193													
			3-194													
97			3-195	GPS												
			3-196													
98			3-197													



Englobe Corp.

Logged By: Scott Bryan

Reviewed By: Tyler Windsor

Groundwater Depth: m

Completion Depth: 36 ft

Drilled on: 9/29/2022

Project: Water Treatment Sump & Collection					Drilling Information:					Borehole No.:4				
Client: Town of Okotoks					Earth Drilling Co. Ltd.					Project No.:02208358.000				
					Beckerhammer					Elevation:				
SAMPLE TYPE		☒ SHELBY TUBE	☒ CORE SAMPLE	☒ SPT SAMPLE	☒ GRAB SAMPLE	NO RECOVERY								
BACKFILL TYPE		☒ BENTONITE	☒ PEA GRAVEL	☒ SLOUGH	☒ GROUT	☒ DRILL CUTTINGS ☒ SAND								
Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	USCS	BLOWS	PLASTIC M.C. LIQUID 10 20 30 40		BECKERHAMMER		OTHER DATA	Well 1" SLOTTED PIEZOMETER	Elevation (m)	
									☒ BLOW COUNT ☒ 60 120 180 240					
0		Silt FILL - trace sand, gravel and organics, compact, damp, dark brown with trace black		4-1	FILL	19								
				4-2		29								
1				4-2		16								
			Sandy Gravel - trace silt and cobbles, compact, damp, medium brown and grey.		4-3	GPS	22							
2					4-3		31							
					4-4		30							
					4-4		32							
3					4-4		24							
					4-5		28							
					4-5		25							
4					4-6		35							
				4-6	29									
		4-6	35											
5				4-7	GPS	36								
				4-7		38								
				4-7		32								
6				4-8		34								
				4-8	31									
				4-8	37									
7		- trace free water.		4-9	GPS	28								
				4-9		28								
				4-9		20								
				4-10	GPS	11								
				4-10		6								
8		Bedrock (Siltstone) - weak, damp, medium grey.		4-11		BE	55							
					79									
9		END OF BOREHOLE at a depth of 8.2 metres (Targeted Depth). Wet upon completion. 25 mm PVC installed to a depth of 8.2 m with 4.6 m slotted.												
10		Water Levels: October 7, 2022 - 3.7 m												
11														
12														
13														

Englobe Corp.

Logged By: Scott Bryan

Reviewed By: Tyler Windsor

Groundwater Depth: m

Completion Depth: 27 ft

Drilled on: 9/29/2022

Page 1 of 1



Englobe Corp.

Logged By: Scott Bryan

Reviewed By: Tyler Windsor

Groundwater Depth: m

Completion Depth: 27 ft

Drilled on: 9/29/2022

Project: Water Treatment Sump & Collection					Drilling Information:					Borehole No.:5				
Client: Town of Okotoks					Earth Drilling Co. Ltd.					Project No.:02208358.000				
					Beckerhammer					Elevation:				
SAMPLE TYPE		☒ SHELBY TUBE	☒ CORE SAMPLE	☒ SPT SAMPLE	☒ GRAB SAMPLE	NO RECOVERY								
BACKFILL TYPE		☒ BENTONITE	☒ PEA GRAVEL	☒ SLOUGH	☒ GROUT	☒ DRILL CUTTINGS ☒ SAND								
Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	USCS	BLOWS	PLASTIC M.C. LIQUID 10 20 30 40	BECKERHAMMER		OTHER DATA	Well 1" SLOTTED PIEZOMETER	Elevation (m)		
								☒ BLOW COUNT	☒					
0		Silt FILL - trace sand, gravel and organics, compact, damp, medium brown with trace black.		5-1	FILL	31								
1				5-2		28								
2		Sandy GRAVEL - compact, dry, light brown.		5-3		24								
3				5-4		18								
4				5-5	GPS	19								
5				5-6		23								
6				5-7		23								
7				5-8		22								
8		Silty CLAY (Lacustrine) - trace sand, stiff, moist, low plastic, medium grey.		5-9	CL-ML	29								
9		BEDROCK (Sandstone) - weak, damp, medium brown.		5-10		32								
10				5-11		32								
11				5-12		32								
12		END OF BOREHOLE at a depth of 8.8 metres (Targeted Depth). Wet upon completion. 25 mm PVC installed to a depth of 8.8 m with 4.6 m slotted.			BE	18								
13						11								
14						5								
15						4								
16		Water Levels: October 7, 2022 - 3.69 m				110								
17						86								
18						91								

Englobe Corp.

Logged By: Scott Bryan

Reviewed By: Tyler Windsor

Groundwater Depth: m

Completion Depth: 29 ft

Drilled on: 9/29/2022

Page 1 of 1



Englobe Corp.

Logged By: Scott Bryan

Reviewed By: Tyler Windsor

Groundwater Depth: m

Completion Depth: 29 ft

Drilled on: 9/29/2022

**REFERENCE: ENGLOBE HAZARDOUS MATERIALS
STUDY**

Pre-Renovation Hazardous Materials Report - Select Area

Okotoks Water Treatment Plant
101 Woodhaven Drive, Okotoks, AB

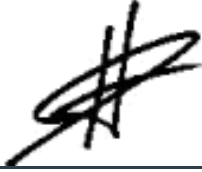
Town of Okotoks

November 6, 2024
Englobe Project Number: 2410626



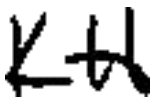
ENGLOBE

Prepared by:



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Okotoks Water Treatment Plant

101 Woodhaven Drive, Okotoks, AB



Executive Summary

This report details the results/findings of the pre-renovation hazardous materials survey that was completed on October 24, 2024, at the water treatment plant building located at 101 Woodhaven Drive in Okotoks, AB (herein referred to as the Subject Building). The hazardous materials survey was completed by James Heron, Alberta OH&S certified asbestos worker and WorkSafeBC Level S certified building inspector of Englobe Corp's (Englobe's) Calgary Office. This investigation was conducted on behalf of the Town of Okotoks (the Client) in preparation for upcoming renovation work within the Subject Building and to ensure compliance with the applicable provincial regulations.

Project Area

The areas/rooms of the Subject Building surveyed were limited to the interiors and exterior of the west wall of the existing structure (herein referred to as the Project Area).

Findings and Recommendations

A summary of the applicable assessment criteria and the methodology used to define the current condition, access and current action required, is provided in Appendix C of this document.

These findings must be read in conjunction with the observations section associated with each hazardous material or substance.

The site investigation revealed the following hazardous materials:

Silica

Potential sources of silica were observed in the Project Area in the form of concrete, concrete block, and concrete block mortar. These materials appeared to be in a non-respirable form, Access A, requiring Action Level 7.

Property and Confidentiality

“This report can only be used for the purposes stated therein. Any use of the report must take into consideration the object and scope of the mandate by virtue of which the report was prepared, as well as the limitations and conditions specified therein and the state of scientific knowledge at the time the report was prepared. Englobe Corp. provides no warranty and makes no representations other than those expressly contained in the report.

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If tests have been carried out, the results of these tests are valid only for the sample described in this report.

Englobe Corp.’s subcontractors who have carried out on-site or laboratory work are duly assessed according to the purchase procedure of our quality system. For further information, please contact your project manager.”

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Appendix B - Sampling Site Map

Appendix C - Assessment Methodology

Appendix D - Regulatory Framework and Guidelines

1 Abbreviations/Acronyms

ACM - Asbestos-Containing Material
ACT - Acoustic Ceiling Tile
AT - Acoustic Tile
ALARA - As Low As Reasonably Achievable
As - Arsenic (chemical formula)
DJC - Drywall Joint Compound
DS - Designated Substances
DSS - Designated Substances Survey
ESA - Environmental Site Assessment (example: Phase 1 ESA)
Hg - Mercury (chemical formula)
HMR - Hazardous Materials Report
HVAC - Heating, Ventilation, and Air Conditioning
ICP - Inductively Coupled Plasma
LCM - Lead-Containing Material
NIOSH - National Institute of Occupational Safety and Health
ODS - Ozone-Depleting Substance
OHS (or OH&S) - Occupational Health and Safety
Pb - Lead (chemical formula)
PCB - Polychlorinated Biphenyl
PCM - Phase Contrast Microscopy
PLM - Polarized Light Microscopy
PPM - Parts Per Million
TDG - Transportation of Dangerous Goods
TEM - Transmission Electron Microscopy
TMI - Thermal Mechanical Insulation
TSI - Thermal Systems Insulation
UFFI - Urea Formaldehyde Foam Insulation
US EPA - United States Environmental Protection Agency
US HUD - US Housing and Urban Development
VSF - Vinyl Sheet Flooring
VFT - Vinyl Floor Tile
VCT - Vinyl Composite Tile

2 Introduction

This report details the results/findings of the pre-renovation hazardous materials survey that was completed on October 24, 2024, at the water treatment plant building located at 101 Woodhaven Drive in Okotoks, AB (herein referred to as the Subject Building). The hazardous materials survey was completed by James Heron, Alberta OH&S certified asbestos worker and WorkSafeBC Level S certified building inspector of Englobe Corp's (Englobe's) Calgary Office. This investigation was conducted on behalf of the Town of Okotoks (the Client) in preparation for upcoming renovation work within the Subject Building and to ensure compliance with the applicable provincial regulations.

2.1 Subject Building Overview

According to the Client, the base structure of Subject Building was constructed in the 1980's and multiple additions and upgrades have been made since that time. The structure is a concrete block structure with poured in place concrete floor slab.

2.2 Project Area and Materials

The areas/rooms of the Subject Building surveyed were limited to the interiors and exterior of the west wall of the existing structure (herein referred to as the Project Area). Sampling of the roof of the Subject Building was not included in the Scope of Work. Architectural materials within the Project Area consisted of concrete block walls and columns and concrete floors.

The Client reported to Englobe that the Project Area is an addition to the Subject Building completed in 2009/2010.

2.3 Englobe Scope of Work Overview

Englobe's scope of work included the visual identification of hazardous building materials based on the surveyor's knowledge of the historic composition of building products. Visual identification of materials suspected to contain asbestos, or lead (in coatings) was supported by the analysis of representative samples and the preparation of a hazardous materials report based on the above noted findings (this document).

2.4 Proposed Contractor Scope of Work

Contractor scope of work includes:

- Removal and disposal of concrete block wall from the west wall of the Project Area.
- Exterior tie-in of a building addition on the west wall of the Project Area.

3 Purpose

The survey was completed at the request of the Client to identify the presence of hazardous materials in preparation for renovation work and to ensure compliance with the applicable provincial regulations.

4 Previous Renovations

Previous renovations were not identified within the Project Area.

5 Previous Reports

No previous hazardous materials reports are available for Project Area.

6 Survey Methodology

The survey was completed by Englobe following sampling protocols and procedures in compliance with provincial regulations and guidelines, and the surveyor's previous experience. As part of the survey Englobe evaluated the current condition and accessibility and action recommendations for the noted hazardous materials based on methods used by the United States Environmental Protection Agency (USEPA), which complies with federal and provincial jurisdictional requirements.

Identified suspect ACMs were sampled and analyzed using Environmental Protection Agency (EPA) analytical method 600/R-93/116 - Polarized Light Microscopy (PLM).

For vermiculite block fill insulation, samples were analyzed via PLM and if no asbestos was detected, the samples were analyzed via EPA analytical method 600/R-93/116 with milling prep - Transmission Electron Microscopy (TEM).

Identified suspected LCMs were sampled and analyzed using Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B).

During the assessment, accessible areas of the Project Area were assessed, by visual inspection, for the presence of ODS sources, silica, mercury, and PCBs-containing electrical equipment, toxic materials, flammable materials, explosive materials, and biological hazards.

A summary of the applicable assessment criteria and the methodology used to define the current condition, access and current action required, is provided in Appendix C of this document.

The survey excluded the following:

- Underground materials or equipment (e.g., vessels, drums, underground stage tanks, pipes, etc.);
- Roofing, structural components, inaccessible or concealed materials or other items where sampling may cause consequential damage to the property;

- Energized systems (e.g., internal boiler components, elevators, mechanical or electrical components) due to the occupational risk and where sampling may cause consequential damage to the property; and,
- Materials not typically associated with construction (e.g., settled dust, spills, residual contamination from prior spills, etc.).

7 Regulatory Framework and Applicable Guidelines

The applicable provincial regulatory framework and guidelines referenced in this document can be located in Appendix D. It should be noted that with regards to the referenced regulations and guidelines, the most current version or amendment applies.

8 Summary of Findings

The following sections outline the findings of the hazardous building material survey.

Bulk asbestos and lead results are included in Appendix A.

Site drawings, with sample locations are included in Appendix B.

Assessment and risk methodology are included in Appendix C.

Regulatory framework and guidelines are included in Appendix D.

8.1 Asbestos-Containing Materials (ACMs)

Suspect ACMs were identified within the accessible areas of the Project Area. Representative samples of suspect ACMs were collected and analyzed for asbestos content. Sample descriptions and analytical results for each of the sampled suspect ACMs are summarized in Table 1, below.

8.1.1 Observations

- If applicable, Englobe has utilized a “Positive Stop” analytical methodology with this sample set. This methodology dictates that the first sample in a sample set found to contain asbestos negates the need to analyze subsequent samples as they are deemed to be homogenous (asbestos containing). In addition, samples within the sample set that were analyzed and found to not contain asbestos, will be treated as asbestos-containing due in part to the inconsistent nature of asbestos in some materials.
- Beige Caulking was collected from an electrical penetration on the west wall. Material was only identified in one location and collected as a limited sample set due to the volume of material observed within the Project Area.
- Sampling of the White Caulking associated with the roof drainage piping on the northside of the Subject Building (outside the Project Area) was not completed at the time of the hazardous material survey as these areas are not scheduled to be disturbed according to the scope of work current to

the time of the assessment. The white caulking was observed to be in Good condition, Access A, requiring Action Level 7.

- Sampling of the Grey Electrical Putty associated with the electrical conduit on the northside of the Subject Building (outside the Project Area) was not completed at the time of the hazardous material survey as these areas are not scheduled to be disturbed according to the scope of work current to the time of the assessment. The electrical putty was observed to be in Good condition, Access C - Exposed, requiring Action Level 7.

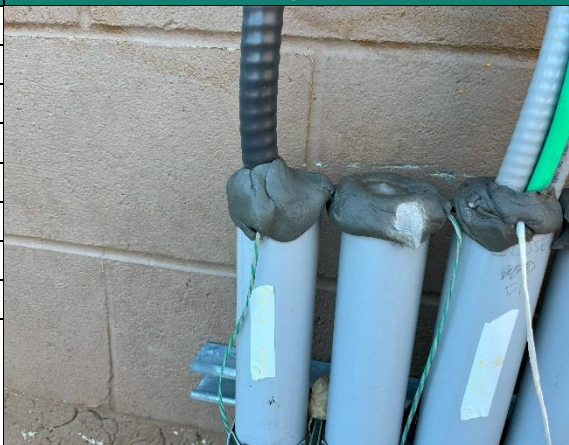
Table 1: Analysis of Suspect ACMs

Sample	Area or Room	Building Materials and Colour	Sampling Location	Asbestos Percentage & Type
2410626-1A	Interior	Cinder Block Mortar	Northwest Column	None Detected
2410626-1B	Interior	Cinder Block Mortar	Central Wall Column	None Detected
2410626-1C	Interior	Cinder Block Mortar	Southwest Column	None Detected
2410626-1D	Exterior	Cinder Block Mortar	Northwest Corner	None Detected
2410626-1E	Exterior	Cinder Block Mortar	Southwest Corner	None Detected
2410626-2A	Exterior	Beige Caulking	Southwest Wall Penetration	None Detected
2410626-3A	Exterior	Concrete	Northwest Corner	None Detected
2410626-3B	Exterior	Concrete	West Wall Section	None Detected
2410626-3C	Exterior	Concrete	Southwest Corner	None Detected
2410626-4A	West Wall - Block Fill	Vermiculite	Northwest Wall Section	None Detected
2410626-4B	West Wall - Block Fill	Vermiculite	Central West Wall Section	None Detected
2410626-4C	West Wall - Block Fill	Vermiculite	Southwest Wall Section	None Detected

*Highlighted and bold rows denote asbestos-containing samples.

Table 2: Summary of Presumed ACMs

Presumed Asbestos Containing Material		Photograph
White Caulking		
Sample Identification	N/A	
Asbestos Content	Presumed to Contain	
Friability	Non-Friable	
Substrate	Metal	
Location & Extent	North Room Drains, 2 Linear Feet	
Condition	Good	
Access	A	
Action	7	

Presumed Asbestos Containing Material		Photograph
Electrical Putty - Grey		
Sample Identification	N/A	
Asbestos Content	Presumed to Contain	
Friability	Non-Friable	
Substrate	PVC Conduit	
Location & Extent	North Wall, 0.5 m ²	
Condition	Good	
Access	A	
Action	7	

8.1.2 Vermiculite

Vermiculite was observed within the concrete block walls, within the Project Area. Samples of vermiculite were collected from the west wall according to the Alberta Asbestos Abatement Manual and other provincial guidelines and analysed for the presence of asbestos. No asbestos was identified within the samples.

8.2 Lead-Containing Materials (LCMs)

Suspect LCMs were identified in the Project Area. Representative samples of suspect LCMs were collected and analyzed for lead content. Sample descriptions and analytical results for each of the sampled suspect LCMs are summarized in Table 3, below.

Table 3: Analysis of Suspect LCMs

Sample #	Area or Room	Building Materials	Sampling Location	Concentration of Lead
2410626-L1	Interior	White Paint	Northwest Column	<80 ppm
2410626-L2	Exterior	Brown Paint	West Wall Section	<81 ppm

A "<" result indicates the analyte was not detected at or above the reporting limit.

*Highlighted and bold rows denote samples considered to contain lead.

8.3 Biological Hazards

Potential sources of biological hazards were not identified in the Project Area.

8.4 Silica

Potential sources of silica were observed in the Project Area in the form of concrete, concrete block, and concrete block mortar. These materials appeared to be in a non-respirable form, Access A, requiring Action Level 7.

8.5 Ozone-Depleting Substances (ODSs)

Potential sources of ODSs (refrigerant) were not observed in the Project Area.

8.6 Polychlorinated Biphenyls (PCBs)

Potential sources of PCBs were not observed in the Project Area.

8.7 Mercury

Potential sources of mercury were not observed in the Project Area. One thermostat was observed in the Project Area and was found to contain a bimetallic strip and no mercury ampules.

8.8 Radioactive, Toxic, Flammable, Explosive or Other Hazardous Materials

Potential sources of radioactive, toxic, flammable, explosive, or other hazardous materials were not observed in the Project Area.

9 Recommendations

Englobe provides recommendations for each identified hazardous material in the Project Area, which are based on both regulatory compliance and best practice guidelines, in the following sections.

Additionally, if applicable, due to Englobe's safety policy, confined spaces such as crawlspaces, attic spaces, etc. were not physically entered but were visually assessed to the best of the surveyor's ability. Restoration personnel must be aware that concealed, potentially hazardous materials may be present in these confined spaces and should ensure that persons familiar with the recognition and identification of these materials are present throughout the restoration. If materials are discovered that are deemed potentially hazardous, all work must cease, and further investigation must be preformed by a qualified person.

9.1 Silica

Silica-containing materials can be managed in place in accordance with acceptable standards of care. If silica-containing materials are to be removed or destructively altered (drilled, chipped, abraded, etc.), ensure dust control measures are employed such that airborne silica dust concentrations do not exceed the exposure limit as stipulated in the applicable provincial regulations as outlined in Appendix D.

In the event of conflict between silica precautionary measures and other precautionary measures (e.g., asbestos), the more stringent procedures shall apply.

9.2 Precautionary Recommendation

Due to the nature and variation of construction methods, materials, and the restrictions imposed by the Client, it is impractical to assume that all areas either concealed or otherwise, were, or can be tested to ensure with absolute certainty the presence or absence of all hazardous materials. With this in mind, if, after written confirmation is provided, a person discovers material that may be a hazardous material, all employers responsible for the workers, and the owner, must ensure that a qualified person or competent person repeats the inspection process outlines above. Should additional information become available, Englobe requests that this information be brought to our attention so that we may re-assess the findings, conclusions, and/or recommendations presented herein.

10 Limitations

The conclusions presented in this report represent the judgement of the assessor based on current environmental and health and safety standards, and on-site conditions on the date(s) cited in this report. Due to the nature of the investigation and the limited data available, the assessor cannot warrant against undiscovered environmental liabilities.

This report is intended for Client use only. Any use of this document by a third party, or any reliance on or decisions made based on the findings described in this report, are the sole responsibility of such third parties, and Englobe Corp. accepts no responsibility for damages, suffered by any third party as a result of decisions made or actions conducted based on this report. No other warranties are implied or expressed.

The data, conclusions and recommendations which are presented in this report, and the quality thereof are based on a scope of work authorized by the Client. The sampling program included asbestos bulk sampling and paint chip sampling in select representative areas for laboratory analysis. Note, however, that no scope of work, no matter how exhaustive, can guarantee to identify all contaminants. This report therefore cannot warranty that all building conditions are represented by those identified at specific locations.

Recommendations, when included, are made in good faith and are based on several successful experiences.

Note, also that standards, guidelines, and practices related to environmental investigations may change with time. Those which were applied at the time of this investigation may be obsolete or unacceptable at a later date.

Appendix A - Analytical Laboratory Reports



eNGLOBE



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<http://www.EMSL.com> / CalgaryLab@EMSL.com

EMSL Canada Order: 652411558

Customer ID: 55NGLB75

Customer PO:

Project ID:

Attention: Kevin Smith
Englobe Corp
10 Stonehill PL NE #110
Calgary, AB T3N 1T7

Phone:
Fax: (519) 741-5422

Received Date: 10/25/2024 12:05 PM

Analysis Date: 10/31/2024

Collected Date: 10/24/2024

Project: 2410626 / 101 WOODHAVEN DRIVE, OKOTOKS, AB

Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
2410626-1A - Mortar 1 652411558-0001	INTERIOR - NORTHWEST COLUMN - CINDER BLOCK MORTAR	Gray Non-Fibrous Homogeneous		15% Quartz 85% Non-fibrous (Other)	None Detected
2410626-1A - Mortar 2 652411558-0001A	INTERIOR - NORTHWEST COLUMN - CINDER BLOCK MORTAR	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2410626-1B - Mortar 1 652411558-0002	INTERIOR - CENTRAL WALL COLUMN - CINDER BLOCK MORTAR	Gray Non-Fibrous Homogeneous		15% Quartz 85% Non-fibrous (Other)	None Detected
2410626-1B - Mortar 2 652411558-0002A	INTERIOR - CENTRAL WALL COLUMN - CINDER BLOCK MORTAR	Gray Non-Fibrous Homogeneous		15% Quartz 85% Non-fibrous (Other)	None Detected
2410626-1C - Mortar 1 652411558-0003	INTERIOR - SOUTHWEST COLUMN - CINDER BLOCK MORTAR	Gray Non-Fibrous Homogeneous		5% Quartz 95% Non-fibrous (Other)	None Detected
2410626-1C - Mortar 2 652411558-0003A	INTERIOR - SOUTHWEST COLUMN - CINDER BLOCK MORTAR	Gray Non-Fibrous Homogeneous		15% Quartz 85% Non-fibrous (Other)	None Detected
2410626-1D - Mortar 1 652411558-0004	EXTERIOR - NORTHWEST CORNER - CINDER BLOCK MORTAR	Gray Non-Fibrous Homogeneous		5% Quartz 95% Non-fibrous (Other)	None Detected
2410626-1D - Mortar 2 652411558-0004A	EXTERIOR - NORTHWEST CORNER - CINDER BLOCK MORTAR	Gray Non-Fibrous Homogeneous		15% Quartz 85% Non-fibrous (Other)	None Detected
2410626-1E 652411558-0005	EXTERIOR - SOUTHWEST CORNER - CINDER BLOCK MORTAR	Gray Non-Fibrous Homogeneous		5% Quartz 95% Non-fibrous (Other)	None Detected
2410626-2A 652411558-0006	EXTERIOR - SOUTHWEST WALL PENETRATION - BEIGE CAULKING	Beige Non-Fibrous Homogeneous	5% Cellulose	95% Non-fibrous (Other)	None Detected
2410626-3A 652411558-0007	EXTERIOR - NORTHWEST CORNER - CONCRETE	Gray Non-Fibrous Homogeneous		15% Quartz 85% Non-fibrous (Other)	None Detected
2410626-3B 652411558-0008	EXTERIOR - WEST WALL SECTION - CONCRETE	Gray Non-Fibrous Homogeneous		15% Quartz 85% Non-fibrous (Other)	None Detected

Initial report from: 10/31/2024 13:21:57



EMSL Canada Inc.

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EMSL Canada Order: 652411558

Customer ID: 55NGLB75

Customer PO:

Project ID:

Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
2410626-3C 652411558-0009	EXTERIOR - SOUTHWEST CORNER - CONCRETE	Gray Non-Fibrous Homogeneous		15% Quartz 85% Non-fibrous (Other)	None Detected
2410626-4A 652411558-0010	WEST WALL - BLOCK FILL - NORTHWEST WALL SECTION - VERMICULITE	Silver/Gold Non-Fibrous Homogeneous		99% Vermiculite 1% Non-fibrous (Other)	None Detected
Vermiculite is a problem matrix. Other analytical options are recommended such as EPA 600 PLM/TEM with milling prep or TEM Qualitative.					
2410626-4B 652411558-0011	WEST WALL - BLOCK FILL - CENTRAL WEST WALL SECTION - VERMICULITE	Silver/Gold Non-Fibrous Homogeneous		99% Vermiculite 1% Non-fibrous (Other)	None Detected
Vermiculite is a problem matrix. Other analytical options are recommended such as EPA 600 PLM/TEM with milling prep or TEM Qualitative.					
2410626-4C 652411558-0012	WEST WALL - BLOCK FILL - SOUTHWEST WALL SECTION - VERMICULITE	Silver/Gold Non-Fibrous Homogeneous		99% Vermiculite 1% Non-fibrous (Other)	None Detected
Vermiculite is a problem matrix. Other analytical options are recommended such as EPA 600 PLM/TEM with milling prep or TEM Qualitative.					

Analyst(s)

Jeremy Mildenberger (5)

Pamela Padolina (11)

Jefferson Salvador, Laboratory Manager
or Other Approved Signatory

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Samples analyzed by EMSL Canada Inc. Calgary, AB NVLAP Lab Code 500100-0

Initial report from: 10/31/2024 13:21:57



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EMSL Order: 652411558
Customer ID: 55NGLB75
Customer PO: 2410626 / 101 WOODHAVEN DRIVE, OKOTOK
Project ID:

Attn: Kevin Smith
Englobe Corp
10 Stonehill PL NE #110
Calgary, AB, T3N 1T7

Phone: N/A
Fax: (519) 741-5422
Collected: 10/24/2024
Received: 10/25/24 12:05

Project: 2410626 / 101 WOODHAVEN DRIVE, OKOTOKS, AB

Analyzed: 11/06/24

SUMMARY REPORT : TEM EPA 600/R-93/116

Analysis of Bulk Material Utilizing Analytical Electron Microscopy (Section 2.5.5.2) with Milling Prep

Sample ID	Minerals Present	Results	Structures	Reporting Limit	Asbestos Weight	Comments
2410626-4A	No Structures Detected	Regulated Asbestos	0	0.1%	< 0.1%	
652411558-0010		Other Minerals	0		< 0.1%	
WEST WALL - BLOCK FILL - NORTHWEST WALL SECTION		Total	0		< 0.1%	
		Undetermined	0		-----	
2410626-4B	No Structures Detected	Regulated Asbestos	0	0.1%	< 0.1%	
652411558-0011		Other Minerals	0		< 0.1%	
WEST WALL - BLOCK FILL - CENTRAL WEST WALL SECTION		Total	0		< 0.1%	
		Undetermined	0		-----	
2410626-4C	No Structures Detected	Regulated Asbestos	0	0.1%	< 0.1%	
652411558-0012		Other Minerals	0		< 0.1%	
WEST WALL - BLOCK FILL - SOUTHWEST WALL SECTION		Total	0		< 0.1%	
		Undetermined	0		-----	

K. Nguyen

Analyst

Approved Signatory

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Phone: N/A WOODHAVEN

Fax: (519) 741-5422

Collected: 10/24/2024

Received: 10/25/24 12:05

Project: 2410626 / 101 WOODHAVEN DRIVE, OKOTOKS, AB

Analyzed: 11/06/2024

TEM EPA 600/R-93/116

Analysis of Bulk Material Utilizing Analytical Electron Microscopy (Section 2.5.5.2) with Milling Prep

Detailed Sample Report

Customer Sample Number: 2410626-4A		Reporting Limit : 0.1%	
Sample Description: WEST WALL - BLOCK FILL - NORTHWEST WALL SECTION			
EMSL Sample Number: 652411558-0010		Sample Matrix: Bulk	
Aspect ratio for fiber definition: 3:1		Area of collection filter (mm ²): 1320	
Minimum Length (µm): 0.5		Grid Opening Area (mm ²): 0.0127	
Gravimetric Reduction Ratio: 1.00		Grid Openings Analyzed: 10	
Mass contributed by Largest fiber: N/A		Analyst: K.Nguyen	
Mineral Type	Structures	Weight %	Average Aspect Ratio
Total Regulated Asbestos	None Detected	< 0.1%	
Chrysotile	None Detected	<0.1%	
Amosite	None Detected	<0.1%	
Crocidolite	None Detected	<0.1%	
Tremolite	None Detected	<0.1%	
Actinolite	None Detected	<0.1%	
Anthophyllite	None Detected	<0.1%	
Total Other Elongate Mineral Types	None Detected	< 0.1%	
Undetermined Elongate Mineral	None Detected	-	

Laboratory Manager or Other Approved Signatory

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Fax: (519) 741-5422
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Received: 10/25/24 12:05

Project: 2410626 / 101 WOODHAVEN DRIVE, OKOTOKS, AB

Analyzed: 11/06/2024

TEM EPA 600/R-93/116

Analysis of Bulk Material Utilizing Analytical Electron Microscopy (Section 2.5.5.2) with Milling Prep

Detailed Sample Report

Customer Sample Number: 2410626-4B		Reporting Limit : 0.1%	
Sample Description: WEST WALL - BLOCK FILL - CENTRAL WEST WALL SECTION			
EMSL Sample Number: 652411558-0011		Sample Matrix: Bulk	
Aspect ratio for fiber definition: 3:1		Area of collection filter (mm ²): 1320	
Minimum Length (µm): 0.5		Grid Opening Area (mm ²): 0.0127	
Gravimetric Reduction Ratio: 1.00		Grid Openings Analyzed: 10	
Mass contributed by Largest fiber: N/A		Analyst: K.Nguyen	
Mineral Type	Structures	Weight %	Average Aspect Ratio
Total Regulated Asbestos	None Detected	< 0.1%	
Chrysotile	None Detected	<0.1%	
Amosite	None Detected	<0.1%	
Crocidolite	None Detected	<0.1%	
Tremolite	None Detected	<0.1%	
Actinolite	None Detected	<0.1%	
Anthophyllite	None Detected	<0.1%	
Total Other Elongate Mineral Types	None Detected	< 0.1%	
Undetermined Elongate Mineral	None Detected	-	

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Fax: (519) 741-5422
Collected: 10/24/2024
Received: 10/25/24 12:05

Project: 2410626 / 101 WOODHAVEN DRIVE, OKOTOKS, AB

Analyzed: 11/06/2024

TEM EPA 600/R-93/116

Analysis of Bulk Material Utilizing Analytical Electron Microscopy (Section 2.5.5.2) with Milling Prep

Detailed Sample Report

Customer Sample Number: 2410626-4C		Reporting Limit : 0.1%	
Sample Description: WEST WALL - BLOCK FILL - SOUTHWEST WALL SECTION			
EMSL Sample Number: 652411558-0012		Sample Matrix: Bulk	
Aspect ratio for fiber definition: 3:1		Area of collection filter (mm ²): 1320	
Minimum Length (µm): 0.5		Grid Opening Area (mm ²): 0.0127	
Gravimetric Reduction Ratio: 1.00		Grid Openings Analyzed: 10	
Mass contributed by Largest fiber: N/A		Analyst: K.Nguyen	
Mineral Type	Structures	Weight %	Average Aspect Ratio
Total Regulated Asbestos	None Detected	< 0.1%	
Chrysotile	None Detected	<0.1%	
Amosite	None Detected	<0.1%	
Crocidolite	None Detected	<0.1%	
Tremolite	None Detected	<0.1%	
Actinolite	None Detected	<0.1%	
Anthophyllite	None Detected	<0.1%	
Total Other Elongate Mineral Types	None Detected	< 0.1%	
Undetermined Elongate Mineral	None Detected	-	

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Phone: (403) 255-3273
Fax: (519) 741-5422
Received: 10/28/2024 09:58 AM
Collected: 10/24/2024

Project: **Okotokd WTP Tie in / 2410626****Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)***

<i>Client Sample</i>	<i>Description</i>	<i>Collected</i>	<i>Analyzed</i>	<i>Weight</i>	<i>RDL</i>	<i>Lead Concentration</i>
2410626-L1		10/24/2024	10/30/2024	0.2540 g	80 ppm	<80 ppm
552417201-0001		Site: Interior / Northwest Column Desc: White Paint				
2410626-L2		10/24/2024	10/30/2024	0.2481 g	81 ppm	<81 ppm
552417201-0002		Site: Exterior / West Wall Section Desc: Brown Paint				

Rowena Fanto, Lead Supervisor
or other approved signatory

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* Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.008% wt based on the minimum sample weight per our SOP. "<" (less than) result signifies the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. Definitions of modifications are available upon request.

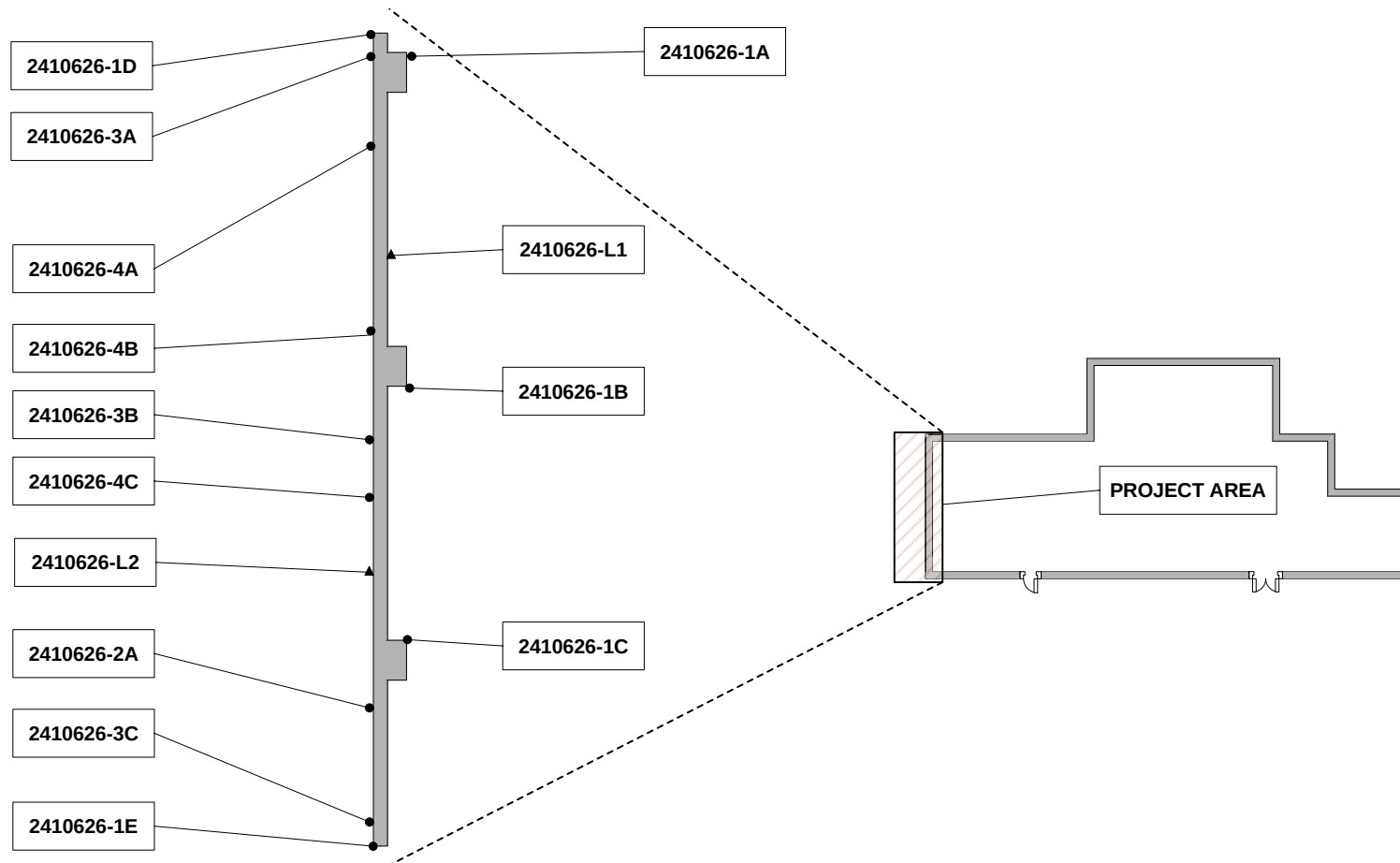
Samples analyzed by EMSL Canada Inc. Mississauga, ON AIHA LAP, LLC-ELLAP Accredited #196142

Report Amended: 11/04/2024 16:09:24 Replaces Report Amended: 11/04/2024 07:57:39. Reason Code: Data Entry-Change to Bill Address

Appendix B - Sampling Site Map



eNGLOBE



Note

1. This drawing shall be read in conjunction with the associated technical report.
2. Do not scale drawing.
3. Not all hazardous materials shown.
4. Yellow indicates positive sample result.
5. Asbestos Containing Material (ACM)
6. Lead Containing Material (LCM)

LEGEND

- APPROX. ACM SAMPLE LOCATION
- ▲ APPROX. LCM SAMPLE LOCATION

YELLOW INDICATES POSITIVE SAMPLE

CLIENT

TOWN OF OKOTOKS

SITE

101 WOODHAVEN DRIVE
OKOTOKS, AB

REPORT TITLE

PRE-RENOVATION HAZARDOUS
MATERIALS REPORT – SELECT
AREAS

DRAWING TITLE

BUILDING OVERVIEW AND PROJECT
AREA SAMPLING LOCATIONS

SCALE

NTS

DATE

06/11/2024

DRAWN BY

JGH

PROJECT NO.

2410626

NOTE: THIS MAP MAY NOT INDICATE ALL HAZARDOUS MATERIALS ASSOCIATED WITH THE SUBJECT BUILDING

Appendix C - Assessment Methodology



ENGLOBE

ASSESSMENT METHODOLOGY

1.0 ASSESSMENT METHODOLOGY

Englobe evaluated the condition and accessibility of Asbestos-containing and or contaminated materials (materials not originally intended to contain asbestos) based on methods used by the United States Environmental Protection Agency (USEPA), which complies with federal and provincial jurisdictional requirements. Similar methodology was used to evaluate other hazardous materials as deemed pertinent. A summary of the applicable criteria is provided in the following subsections.

It should be noted that the following criteria may be deviated from based upon the professional opinion of site assessors and the specific site conditions encountered.

2.0 Asbestos Condition

The criteria that applies in evaluating the condition of ACMs is outlined in the sub-sections below.

It should be noted that the evaluation of concealed ACMs (e.g., present above ceilings) may be limited by the number of access/assessment points and by building components such as ducts or full height walls that create visual obstructions. In these circumstances, it may not be possible to observe all ACM from all angles.

Similarly, the evaluation of asbestos-containing flooring may be limited by the extent of visual obstructions and additional, obstructing layers of flooring installed. In these circumstances, it may not be possible to observe the entire flooring installation.

2.1 Spray-Applied Insulation

In evaluating the condition of friable, spray-applied ACMs (e.g., fireproofing, textured/decorative or acoustic finishes, etc.), the following criteria apply:

GOOD

Surface of material shows no significant signs of damage, deterioration, or delamination. Up to one percent visible damage to surface is allowed within range of GOOD. Evaluation of sprayed fireproofing requires the assessor to be familiar with the irregular surface texture typical of sprayed asbestos products. GOOD condition includes un-encapsulated or unpainted fireproofing or friable texture finishes, where no delamination or damage is observed, and encapsulated fireproofing or friable texture finishes where the encapsulation has been applied after the damage or fallout occurred.

FAIR

FAIR condition is not utilized or considered as a valid criterion in the evaluation of sprayed fireproofing, sprayed insulation, or friable texture coat finishes.

ASSESSMENT METHODOLOGY

POOR

Sprayed materials show signs of damage, delamination, or deterioration. More than one percent damage to surface of hazardous building material spray. In observation areas, where damage exists in isolated locations, both GOOD and POOR condition may be reported. The extent or percentage of each condition will be recorded on the assessor's reassessment form.

2.2 Mechanical Insulation

In evaluating the condition of ACM mechanical insulation (on boilers, breeching, ductwork, piping, tanks, equipment, etc.) the following criteria are used:

GOOD

Insulation is completely covered in jacketing and exhibits no evidence of damage or deterioration. No insulation is exposed. Includes conditions where the jacketing has minor surface damage (e.g., scuffs or stains), but the jacketing is not penetrated. Includes thermal mechanical insulation tape that is not encapsulated and shows no signs of disturbance.

FAIR

Minor penetration damage to jacketed insulation (cuts, tears, nicks, deterioration or delamination) or undamaged insulation that is unjacketed (exposed) but not showing surface disintegration/damage. The extent of missing insulation should range from minor to none.

POOR

Jacketing or Insulation is significantly dislodged, damaged, or deteriorated. Insulation is exposed and significant areas have been dislodged. Damage cannot be readily repaired.

2.3 Loose Fill (Vermiculite) Insulation

In evaluating the condition of Vermiculite insulation, the following criteria are used:

GOOD

Vermiculite that is enclosed or encapsulated (e.g., within the void space of block walls), not accessible without destructive means, will be considered in Good condition.

FAIR

FAIR condition is not utilized or considered as a valid criterion in the evaluation of Vermiculite insulation.

ASSESSMENT METHODOLOGY

POOR

All loose fill Vermiculite insulation that is visible, and accessible without destructive means, is to be considered in Poor condition.

Attic spaces containing Vermiculite insulation are considered accessible and the vermiculite should be treated as Poor condition.

2.4 Other Friable Materials

In evaluating the condition of other friable ACMs including but not limited to vinyl sheet floor backing, ceiling tiles/panels, or textiles, the following criteria are used:

GOOD

ACM exhibits no evidence of damage or deterioration and is fully covered by a non-asbestos material (e.g., vinyl surface for sheet flooring).

FAIR

Minor damage to ACM (e.g., cuts, tears, nicks, deterioration or delamination to ACM rather than any applicable covering material) or undamaged and fully exposed friable ACM (e.g., sheet flooring that is not installed).

POOR

ACM is significantly dislodged, damaged, or deteriorated.

2.5 Non-Friable Materials

Non-friable ACMs generally have little potential to release airborne fibres, even when damaged by mechanical breakage. However, some non-friable materials (e.g., exterior asbestos cement products) may have deteriorated so that the binder no longer effectively contains the asbestos fibres. In such cases of significantly deteriorated, non-friable material, the material will be treated as a friable product.

In evaluating the condition of non-friable ACMs such as vinyl floor tile, Transite, stucco, and drywall joint compound the following criteria are used.

GOOD

Material exhibits no evidence of damage or deterioration. No loose materials, significant cracking (more than one percent). Includes conditions where the materials have minor surface damage (i.e., scuffs or stains), but the surface is not penetrated, gouged or cracked.

ASSESSMENT METHODOLOGY

FAIR

Minor penetration damage to surface (cuts, tears, nicks, deterioration or delamination) or significant cracking without pieces being dislodged.

POOR

Material is significantly damaged, deteriorated, delaminated but not dislodged. Materials may have had significant exposure to water, which may have affected their friability or structural integrity. Damage cannot be readily repaired.

2.5.1 Debris from Friable ACM

The presence of fallen friable ACM is noted separately from the friable ACM source (e.g., sprayed fireproofing, thermal insulation, texture, decorative or acoustic finishes, or mechanical insulation) and is referred to as debris.

2.5.2 Debris from Damaged Non-Friable ACM

The presence of debris from damaged non-friable ACM, is reported separately from the non-friable ACM source. Only fallen non-friable ACM that has become friable, is reported as debris.

3.0 Biohazardous Materials (Mould/Fungi addressed in section 4.0 below)

Good

Good condition is only utilized for biohazardous materials appropriately packaged/containerized (i.e. not loose) and labeled for disposal or retained for future use.

Fair

FAIR condition is not utilized or considered as a valid criterion in the evaluation of Biohazardous Materials.

Poor

Poor condition represents any and all situations where the materials are identified and not classified as good condition in the above noted criteria.

4.0 Mould, Fungi and Moisture-Impacted Building Materials

Good

Good condition is not utilized or considered as a valid criterion in the evaluation of Mould, Fungi or moisture-impacted materials.

ASSESSMENT METHODOLOGY

Fair

Non-porous building materials (e.g., glass, metal) that can be cleaned and dried without losing function would be considered to be in “fair condition” if wet, and “poor condition” only if visible mould growth is present on surfaces (typically indicating the surfaces are covered with a layer of dirt, as mould will not typically grow on non-porous, inorganic materials).

The above is subject to change if the source of water impact has other hazardous of concern (e.g., bacteria, hydrocarbons, asbestos).

4.6 Poor

The condition of building materials impacted by moisture, resulting in physical damage to the material, or mould is typically considered “poor”, requiring action. Additional details are provided below:

- Semi-porous and porous materials (e.g., wood framing, gypsum board, carpets, furniture) that are impacted by moisture (without mould contamination) are considered to be in “fair” condition—representative of a situation that requires moisture intrusion correction and drying of affected surfaces only.
- Depending on the extent of impaction and/or building material, the mould/water impacts may have degraded the material itself to a point where replacement is required (e.g., gypsum, insulation).
- Semi-porous and porous materials that are impacted by moisture (current or previous) and have evidence of mould contamination are considered to be in “poor” condition.
- The evaluation of the structural integrity of impacted materials does not form part of this assessment.

5.0 Other Hazardous Materials – Silica, ODSs, PCBs and Metals

Good

Materials, or equipment containing these materials, exhibit no signs of damage and are not expected to release these materials to the environment. In the case of silica, these materials are not considered to be in a respirable form.

ASSESSMENT METHODOLOGY

Fair

FAIR condition is not utilized or considered as a valid criterion in the evaluation of Silica, ODSs, PCBs or metals.

Poor

Materials, or equipment containing these materials, exhibit signs of damage and are expected to release these materials to the environment. In the case of silica, these materials are considered to be in a respirable form.

6.0 Toxic, Flammable, Explosive or other Hazardous Materials.

Good

Materials in good condition are in their original packaging which exhibits no signs of damage or leakage and original labeling is appropriate, intact and legible.

Fair

Materials in Fair condition are in their original packaging but exhibit signs of damage or the original labeling is damaged, illegible, or missing, but signs of leakage or exposure is not evident.

Poor

Materials in poor condition are not in their original packaging or packaging exhibits damage likely to cause leakage or exposure or is actively leaking or has exposed materials.

7.0 Mercury-, Arsenic-, PCBs-, or Lead-Containing Paints

The criteria for condition evaluation pertaining to coatings described herein are generally based on the United States Housing and Urbana Development (HUD) 2012 *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*. This criterial will also be applied to other metals in paint as required.

“**Poor**” surfaces are considered to be a hazard and should be corrected. “**Fair**” surfaces should be repaired but are not yet considered to be a hazard; if not repaired, they should be monitored frequently. “**Good/intact**” surfaces should be monitored to ensure that they remain in a nonhazardous condition. Paint chip debris will be considered Poor condition and will require an action.

The condition evaluation criteria for metals in paint are summarized in Table 1, below.

ASSESSMENT METHODOLOGY

Table 1 Mercury-, Arsenic-, PCB- and/or Lead-Containing Coatings

Type of Building Component ¹	Total Area of Deteriorated Paint on Each Component		
	Good/Intact	Fair ²	Poor ³
Exterior components with large surface areas	Entire surface is intact	Less than or equal to 1 m ²	More than 1 m ²
Interior components with large surface areas (walls, ceilings, floors, doors)	Entire surface is intact	Less than or equal to 0.5 m ²	More than .5 m ²
Interior and exterior components with small surface areas (window sills, baseboards, soffits, trim)	Entire surface is intact	Less than 10% of the total surface area of the component.	More than 10% of the total surface area of the component
NOTES: ¹ Building components in this table refers to each individual components or side of building, not the combined surface area of all similar components in a room (e.g., a wall with .25 m² deteriorated paint is in “fair” condition, even if the other three walls in a room are intact). ² Surfaces in “fair” condition should be repaired and/or monitored. ³ Surfaces in “poor” condition a greater risk of exposure and should be addressed through abatement or interim controls.			

8.0 Accessibility

The accessibility of materials known or suspected of being hazardous is rated according to the following criteria:

Access (A)

Areas of the building within reach of all building users, regardless of frequency of access. Includes areas such as gymnasiums, workshops, and storage areas where activities of the building users may result in disturbance of hazardous material not normally within reach from floor level.

Access (B)

Frequently entered maintenance areas within reach of maintenance staff, without the need for a ladder. Includes: frequently entered pipe chases, tunnels, and service areas or areas within reach from a fixed ladder or catwalk (e.g., tops of equipment, mezzanines).

Access (C) Exposed

Areas of the building above 2.4 m where use of a ladder is required to access. Only refers to hazardous materials that are exposed to view, from the floor or ladder, without removing or opening other building components such

ASSESSMENT METHODOLOGY

as ceiling tiles, or service access doors or hatches. Does not include infrequently accessed service areas of the building.

Access (C) Concealed

Areas of the building which require the removal of a building component, including lay-in ceilings and access panels into solid ceiling systems. Includes rarely entered building areas such as crawl spaces, attic spaces, etc. Observations are limited to the extent visible from the access points.

Access (D)

Areas of the building behind inaccessible solid ceiling systems, walls, floors, or mechanical equipment, etc. where demolition of the ceiling, wall, floor or equipment, etc., is required to reach the hazardous material. Evaluation of the condition and extent of hazardous building material is limited or impossible, depending on the assessor's ability to visually examine the materials in Access D.

9.0 Action Matrix

The Action Matrix provided below establishes the recommended control action. The ACTIONS are described in full in the following matrix.

Table 2 Action Matrix

Access	Hazardous Building Material Condition			Debris
	Good	Fair	Poor	
A	ACTION 7 ¹	ACTION 6 ²	ACTION 4/6	ACTION 1
B	ACTION 7	ACTION 6/5 ³	ACTION 4/6	ACTION 1
C (exposed)	ACTION 7	ACTION 6	ACTION 4/6	ACTION 2
C (concealed)	ACTION 7	ACTION 7	ACTION 4/6	ACTION 2
D	ACTION 7	ACTION 7	ACTION 7	ACTION 7
NOTES: ¹ If material in ACCESS (A)/GOOD condition is not removed ACTION 7 is required. ² If material in ACCESS (A)/FAIR condition is not removed ACTION 6 is required. ³ Remove hazardous building material in ACCESS (B)/FAIR condition if hazardous building material is likely to be disturbed. Exposed friable asbestos is to be treated as Action level 3 in all circumstances				

9.1 Action Descriptions

ACTION 1 – Immediate Clean-up of Debris that is Likely to be Disturbed—Requires Exposure Control Plan

Restrict access that is likely to cause a disturbance of the hazardous material debris and contact an approved abatement contractor to clean up hazardous material debris immediately, utilizing correct abatement

ASSESSMENT METHODOLOGY

procedures. This action is required for compliance with regulatory requirements. The surveyor should immediately notify the appropriate parties of this condition.

ACTION 2 – Entry into Areas with Hazardous Material Debris— Requires Exposure Control Plan

At locations where hazardous material debris can be isolated in lieu of removal or cleaned up, use appropriate means to limit entry to the area. Restrict access to the area to approved abatement contractor personnel. The precautions will be required until the hazardous material debris has been cleaned up, and the source of the debris has been stabilized or removed.

ACTION 3 – Hazardous Material Removal, Enclosure or Encapsulation Required for Compliance

Contact an approved abatement contractor to remove, enclose or encapsulate the hazardous material for compliance with regulatory requirements, utilizing procedures appropriate to the scope of work.

ACTION 4 – Access into Areas Where a Hazardous Material is Present and Likely to be Disturbed by Access — Requires Exposure Control Plan

Assessment and/or contractor personnel will use appropriate abatement precautions when entry or access into an area is likely to disturb the hazardous material. ACTION 4 must be used until the hazardous material is removed (Use ACTION 1 or 2 if debris is present).

ACTION 5 – Proactive Hazardous Material Removal

Retain an approved abatement contractor to remove hazardous material in lieu of repair, or at locations where the presence of hazardous material in GOOD condition is not desirable.

ACTION 6 – Hazardous Material Repair

Retain an approved abatement contractor to repair hazardous material found in FAIR or Poor condition, and not likely to be damaged again or disturbed by normal use of the area or room. Upon completion of the repair work, treat hazardous material as material in GOOD condition and implement ACTION 7. If hazardous material is likely to be damaged or disturbed, during normal use of the area or room, implement ACTION 5.

ACTION 7 – Routine Surveillance

Institute routine surveillance of the hazardous material. Approved contractors must use appropriate abatement precautions during disturbance of the remaining hazardous materials.

Appendix D - Regulatory Framework and Guidelines



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PROVINCIAL REGULATORY FRAMEWORK & APPLICABLE GUIDELINES

1.0 Occupational Health and Safety - General

In Alberta, the management of hazardous building materials in the workplace is regulated under the Alberta Occupational Health and Safety (AB OH&S) Act¹, current to the time of this writing. Specific requirements of the AB OH&S Act are prescribed in the AB OH&S Regulation, Alberta Reg 184/2021² and the AB OH&S Code, Alberta Regulation 191/2021³.

1.1 Hazardous Materials & Demolition/Restorations

The AB OH&S Code, Part 4, Section 34 requires that “if a building is to be demolished, the employer must ensure that materials with the potential to release asbestos fibres are removed first.” Section 35 requires that “if a building is being altered or renovated, the employer must ensure that materials in the area of the alterations or renovations that could release asbestos fibres are encapsulated, enclosed or removed.” Part 30, Section 417 of the AB OH&S Code indicates the requirement for removal of all chemical and biological substances that may be hazardous to the workers during demolition from the structure or part of the structure to be demolished.

1.2 General Regulation on Exposure Controls

Part 4, Sections 16 to 25 of the AB OH&S Code details requirements regarding controlling worker exposures to substances on the worksite and provides details on exposure limits, exposure control plans, workplace monitoring and controls.

1.2.1 ALARA Principle

Many substances are governed by the ALARA principle, meaning all exposures must be kept as low as reasonably achievable. In effect, this means that although the AB OH&S Code provides explicit exposure limits, action levels and other significant criteria, employers must also demonstrate further efforts (beyond those prescribed in the Regulation) to reduce, or eliminate worker exposure to substances, when it is considered reasonable to do so.

2.0 Environment

2.1 Hazardous Wastes Legislation & Regulations

In Alberta, environmental matters pertaining to waste generally fall under the jurisdiction of Alberta Environment and Parks (AEP). AEP has published guidelines for the disposal of asbestos waste. In Alberta, management of hazardous waste is regulated by the Environmental Protection and

¹ Occupational Health and Safety Act, Statutes of Alberta, 2020, Chapter O-2.2, Province of Alberta

² Occupational Health and Safety Regulation, Alberta Regulation 184/2021, Province of Alberta

³ Occupational Health and Safety Code, Alberta Regulation 191/2021, Province of Alberta

PROVINCIAL REGULATORY FRAMEWORK & APPLICABLE GUIDELINES

Enhancement Act, RSA 2000, c E-12, specifically the Waste Control Regulation, AB Reg. 192/96⁴, which provides regulations for carriers, storage, handling and disposal of hazardous and non-hazardous wastes and recycling. Alberta's waste classification procedures, test methods, requirements and approval systems are covered in the Alberta User Guide for Waste Managers⁵.

3.0 Provincially Regulated Designated Substances

3.1 Asbestos-Containing Materials (ACMs)

Part 4 of the AB OHS Code details specific requirements for employers that includes a Code of Practice governing the storage, handling, use and disposal of asbestos, and various control measures, including procedures.

Government of Alberta Manual - "Alberta Asbestos Abatement Manual"⁶

The manual outlines basic information on asbestos and asbestos products, health hazard requirements for worker protection, Alberta Regulations, safe work procedures and principles that should be followed in selecting the most suitable technique for the safe abatement of ACMs. This document provides a guide to current practices that are to be followed in the Province of Alberta.

In the manual, an ACM is not defined as a percentage. An ACM is defined as a product or building material containing asbestos in **ANY** quantity or percentage.

The Alberta Asbestos Abatement Manual (2019) also provides the following acceptable methods for asbestos bulk sample analysis:

- i. NIOSH Method 9002, Asbestos (bulk) by PLM or Method 9000, Asbestos Chrysotile by XRD (if the material is chrysotile).
- ii. US EPA test method EPA/600/R-93/116, Method for the Determination of Asbestos in Bulk Building Materials.

Alberta Environment - "Guidelines for the Disposal of Asbestos Waste"⁷

The document provides the outline for the proper disposal practices and clarifies the regulatory requirement for asbestos waste management.

⁴ Waste Control Regulation, Environmental Protection and Enhancement Act, AB Reg. 192/96, Province of Alberta

⁵ Alberta User Guide for Waste Managers, Alberta Environmental Protection

⁶ Alberta Asbestos Abatement Manual, Government of Alberta

⁷ Guidelines for the Disposal of Asbestos Waste, Alberta Environment, Environmental Protection Services

PROVINCIAL REGULATORY FRAMEWORK & APPLICABLE GUIDELINES

3.2 Lead & Lead-Containing Materials (LCMs)

Current to the time of this writing, lead is regulated under the AB OH&S Code Part 4. Specifically, Sections 41 to 43 outlines the requirements for an exposure control plan, air monitoring and medical monitoring.

Government of Alberta, Occupational Health and Safety Bulletin - “Lead at the Work Site”⁸

This document outlines basic information on lead and lead-containing products, medical monitoring requirements, sampling procedures and principles that should be followed in selecting the most suitable technique for the safe handling of lead.

3.3 Silica

Exposure to silica dust is governed by the AB OH&S Code Part 4. Specifically, Section 28 requires that an employer must minimize the release of silica dust into the air as far as is reasonably practicable. According to the AB OH&S Code Table 2 occupational exposure limits for chemical substances, the 8-hour time-weighted average exposure limit for airborne silica dust is 0.025 milligram per cubic meter (mg/m³).

3.4 Ozone-Depleting Substances (ODSs)

Provincial regulatory framework providing the requirements for the safe management, storage and disposal of ozone-depleting substances are provided in the Alberta Ozone-Depleting Substances and Halocarbons Regulation (181/2000)⁹.

3.5 Mould

Best Practices Mould at the Work Site¹⁰ is an Alberta guideline when reviewing practices and describes the principles to be followed when selecting the most appropriate techniques for managing mould and mould-contaminated materials.

4.0 Federal Regulatory Framework & Applicable Guidelines

Where provincial regulations or guidelines are not available, federal regulations and guidelines will be referenced with respect to the storage, use, handling and disposal.

⁸ Lead at the Work Site, Occupational Health and Safety Bulletin, Work Safe Alberta, Alberta Government, Human Resources

⁹ Ozone Depleting Substances and Halocarbons Regulation, Environmental Protection and Enhancement Act, AB Reg.181/2000, Province of Alberta

¹⁰ Best Practices Mould at the Work Site, Government of Alberta, Employment and Immigration

PROVINCIAL REGULATORY FRAMEWORK & APPLICABLE GUIDELINES

4.1 Polychlorinated Biphenyls (PCBs)

The Canadian PCB Regulations¹¹ came into force on September 5, 2008 and has since had several amendments. The purpose of the regulations is to improve the protection of Canada's environment and the health of Canadians by minimizing the risks posed by the use, storage, and release of PCBs and by accelerating the elimination of these substances. The Regulations also set out end-of-use and end-of-storage dates for PCBs. These dates are listed in Environment Canada's fact sheet, "PCB Regulations: An Overview."

Additionally, Environment Canada has published a report entitled, "Identification of Lamp Ballasts Containing PCBs"¹², that can be referenced to determine the PCB-content in fluorescent lamp ballast.

1.2 Mercury

The Products Containing Mercury Regulations¹³ prohibit the manufacture and import of products containing mercury or any of its compounds, with some exemptions for essential products which have no technically or economically viable alternatives (e.g., certain medical and research applications, and dental amalgam). In the case of lamps, rather than introducing a prohibition, the Regulations limit the amount of mercury contained in fluorescent and other types of lamps.

1.3 Transportation of Dangerous Goods

The transportation of hazardous wastes is governed under the Transportation of Dangerous Goods (TDG) Act and Regulations¹⁴ which outline the requirements for storage, handling, and transportation of hazardous waste, amongst other products. Transportation of Dangerous Goods Regulations SOR/2008-34, Transportation of Dangerous Goods Act.

¹¹ PCB Regulations, SOR/2008-273, Canadian Environmental Protection Act

¹² Identification of Lamp Ballasts Containing PCBs, Report EPS 2/CC/2, Environment Canada, Commercial Chemicals Branch

¹³ Products Containing Mercury Regulations, SOR/2014-254, Canadian Environmental Protection Act

¹⁴ Transportation of Dangerous Goods Regulations, SOR/2001-286, including most recent consolidation and amendments, Transportation of Dangerous Goods Act, Government of Canada

REFERENCE: SHEEP RIVER FLOOD HAZARD STUDY

March 2023

Sheep River Flood Hazard Study

Design Flood Hazard Mapping



Submitted to:

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Sheep River Hazard Study Design Flood Hazard Mapping

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2023-03-31	1	Final	S. Zare/N. Langenberg	J. Groeneveld	J. Groeneveld
DATE	REV.	STATUS	PREPARED BY	CHECKED BY	APPROVED BY
				Discipline Director	Functional Director

Executive Summary

Alberta Environment and Parks retained Hatch to complete a flood hazard study for a reach of the Sheep River (the Study). The primary purpose of the Study is to assess and identify river and flood hazards along an approximately 60-kilometer-long reach of the Sheep River, and a 35-kilometer-long reach of Threepoint Creek in the Municipal District of Foothills No. 31. This includes the Towns of Black Diamond, Turner Valley, Okotoks and the Hamlet of Millarville.

The study is being completed 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 government of Alberta, the towns of Okotoks, Turner Valley, and Black Diamond, the Municipal District of Foothills No. 31, and the public.

The Sheep River Hazard Study includes multiple components and deliverables. This report summarizes the work of the design flood hazard mapping component of the study. A summary of the work related to the determination of the governing design flood and flood hazard mapping production is provided. Flood hazard areas are utilized for the open water design flood, composed of floodway and flood fringe zones.

The design flood event for the study area is a scenario involving passage of the 100-year open water flood, and this reflects the most severe flood hazard in each reach.

Impacts during this event would include:

- Inundation of 337 residential buildings, resulting in a population at risk of approximately 1029 residents.
- Inundation of 87 non-residential buildings, including flooding of the waste water treatment facility in Okotoks. Inundation will also isolate the water treatment facility in Okotoks, but actual flooding within the facility would be limited.
- Transportation infrastructure impacts would consist of:
 - Inundation of an 800 m stretch of Highway 2A adjacent to the Sheep River
 - Impacts to an approximately 25 km length of roadway in the study area.

The lower chords would be submerged on two bridges on the Sheep River – the Highway 2A crossing in Okotoks and the Highway 22 crossing in Black Diamond.

Acknowledgements

The authors express their special thanks to Kurt Morrison, Peter Bezeau, and Pat Stevenson of Alberta Environment and Parks (AEP), who provided overall study management, background data, and technical guidance for this study.

The following members of Hatch completed the hydraulic modelling component of this study:

- Joe Groeneveld, Project Manager and technical advisor
- Babak Alinejad, Project Engineer and flood risk assessment inventory
- Soheil Zare, Hydraulic modelling and mapping
- Mark Orton, Hydrology review
- Shayla Murphy, Mapping
- Nadia Langenberg, Mapping
- Rachel Groeneveld, Mapping and flood risk assessment inventory

The study team would also like to thank the following agencies, each of which provided valuable information and assistance in the completion of this portion of the study:

- Municipal District of Foothills No. 31;
- Town of Black Diamond;
- Town of Okotoks;
- Town of Turner Valley;
- Water Survey of Canada; and
- Informatics Branch of Alberta Environment and Parks
- Amec Foster Wheeler (initial investigator, who supplied the surveys and cross sectional data)

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1. Introduction

Alberta Environment and Parks retained Hatch to complete a flood hazard study for a reach of the Sheep River (the Study). The primary purpose of the Study is to assess and identify river and flood hazards along an approximately 60 kilometer long reach of the Sheep River, and a 35 kilometer long reach of Threepoint Creek in the Municipal District of Foothills No. 31. This includes the Towns of Black Diamond, Turner Valley, Okotoks and the Hamlet of Millarville.

The upstream limit of the study reach is located approximately 60 km upstream of the Highwood confluence, just to the west of section 20-19-3-W5M. This is approximately 8 km southwest of Turner Valley. The Threepoint Creek study reach extends from its confluence with the Sheep River, 35 km upstream, to its confluence with Ware Creek (just to the northwest quarter of 23-20-04-W5M).

1.1 Study Background

As described by AEP, “the study will be completed 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.”

This project was originally awarded to Amec Foster Wheeler (AFW) in 2015, and AFW completed a portion of the scope before their contract ended. Hatch was retained to complete the remainder of the study.

1.2 Study Objectives

Similar to other flood hazard studies undertaken by the Province, the Sheep River Study includes multiple components and deliverables:

- Survey and Base Data Collection Report (Previously completed by AFW)- Volume 1;
- Hydraulic Model Creation, Calibration, and Open Water Flood Inundation Map Production Report - Volume 2;
- Open Water Flood Hazard Identification Report – Volume 3;
- Governing Design Flood Hazard Mapping Report – Volume 4 (not required for this study, since open water flood conditions govern for this reach);
- Flood Risk Assessment and Inventory Report – Volume 5; and
- Channel Stability Investigation Report – Volume 6.

This document represents Volume 3 and provides details of the Design Flood Hazard mapping assessment.

1.3 Study Area & Reach

Figure 1-1 summarizes the study area. As shown, the downstream end of this study reach is the confluence of Highwood River and Sheep River downstream of the Town of Okotoks.

The upstream limit of the study reach is located approximately 60 km upstream of the Highwood confluence, just to the west of section 20-19-3-W5M. This is approximately 8 km southwest of Turner Valley. The Threepoint Creek study reach extends from its confluence with the Sheep River, 35 km upstream, to its confluence with Ware Creek (just to the northwest quarter of 23-20-04-W5M).

The 60 km Sheep River study reach includes the key points listed below. The stationing shown is listed in kilometers, as measured from the downstream end of the study reach and extending upstream.

- Confluence with the Highwood River - km 0.0
- Highway 2 Bridge - km 6.98
- Town of Okotoks – between km 11.25 and km 17.45
- Confluence with Threepoint Creek - km 34.52
- Town of Black Diamond - between km 39.9 and km 42.5
- Town of Turner Valley - between km 43.9 and km 48.2

The 35 km Threepoint Creek study reach includes the key points listed below.

- Confluence with the Sheep River - km 0.0
- 192 Street W Bridge Crossing (in the vicinity of the Millarville Race Track) - km 11.36
- Highway 22 Bridge Crossing (in the vicinity of the community of Millarville) - km 20.2
- Confluence with Fisher Creek - km 26.3
- Confluence with Ware Creek and upstream end of study area - km 34.79

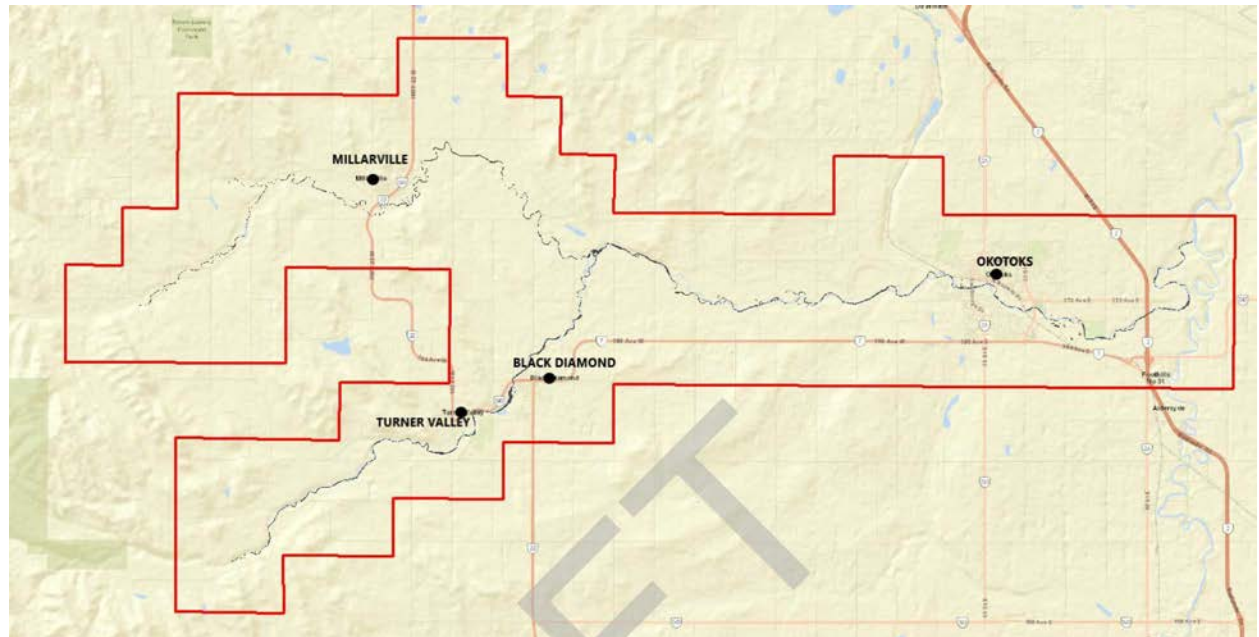


Figure 1-1: Study Reach

2. Available Data

As a first step in this assessment, it was necessary to compile all readily available spatial data representing development in the study area. This included the collection of available cadastral data, infrastructure data, and census data. Each data source is further described below.

2.1 Flood Hydrology

Table 2-1 shows the maximum annual instantaneous discharge adopted for different return periods for the project area. These flows were applied to the hydraulic model at the locations described in the hydraulic model report. The 100-yr flood was adopted as the open water design flood hazard flood.

Table 2-1 – Annual maximum instantaneous discharge values applied to the model

Estimated Average Recurrence Interval (Years)	Sheep River at Black Diamond (05BL014)	Sheep River at Okotoks (05BL012)	Sheep River at Mouth (Node 344)	Threepoint + Ware Creek (Nodes 338 and 339)	Threepoint Creek at Millarville (05BL013)	Threepoint Creek at Mouth (Node 341)	Okotoks North of CPR
2	61.5	158	166	26.8	39.8	48.7	0.1*
5	148	338	355	58.1	98.2	118	0.1*
10	240	504	530	88.2	158	192	0.1*
20	361	701	737	125.3	235	290	0.1*
35	484	886	931	161.2	312	387	0.1*
50	576	1020	1070	187.4	368	457	0.1*
75	693	1180	1240	221	439	545	4
100	787	1300	1370	246	495	616	14
200	1050	1640	1720	317	650	810	18
350	1310	1950	2050	386	803	1000	52
500	1500	2180	2290	436	914	1140	85
750	1720	2420	2540	496	1040	1300	112
1000	1900	2620	2750	543	1140	1430	139

* These values are placeholders, needed for the model to run - actual expected flows are zero.

The cadastral information required for the study includes recent data on building footprints and land parcels. This data has been provided by AEP.

Building footprint data were available for the town of Okotoks. This dataset covers potentially impacted areas in the community. Aerial photos have also been collected by AEP and were provided to complete this assessment. Google Earth aerial imagery and Bing Aerial Imagery (available through ARC-GIS) have been used to interpret building utilization where the AEP-supplied aerial photos were not clear or complete.

2.2 Survey and DTM Data

Digital Terrain Model (DTM) data was provided by AEP. LiDAR information was gathered in 2016 by AEP with a 0.5 m spacing. The horizontal accuracy of the LiDAR information at this resolution is generally within 20 cm and the vertical accuracy for bare earth information is about 10 to 20 cm.

All coordinate information and mapping is in three-degree Transverse Mercator (3TM) plane coordinates based on the Canadian Spatial Reference System 1983 North American Datum (NAD83 [CSRS]); vertical control is referenced to Canadian Geodetic Vertical Datum of 1928 (CGVD28).

Channel cross section survey data was collected and prepared by AFW and provided by AEP for use in this study. AFW's survey report has been finalized and is included in volume 1 of this study report. Both data sets were used to create the hydraulic model.

The aerial imagery has also been provided by AEP. There are two datasets available for the aerial imagery. The most recent dataset was gathered as a part of previous work completed by AFW and was finalized in 2016. AEP also provided an older dataset collected in the 1950's which was used to support other study components.

2.3 HEC-RAS Model

A one-dimensional model of the project reach was developed using the HEC-RAS program (Version 5.0.3) and current diking configurations in each community. The HEC-RAS model was set up to represent hydraulic conditions on an approximately 60 kilometer long reach of the Sheep River, and a 35 kilometer long reach of Threepoint Creek in the Municipal District of Foothills No. 31. This reach includes the Towns of Black Diamond, Turner Valley, Okotoks and the Hamlet of Millarville. The model was calibrated based on the available low flow, high flow, and rating curve data. Using the calibrated HEC-RAS model, surface water profiles were then simulated for the 2-, 5-, 10-, 20-, 35-, 50-, 75-, 100-, 200-, 350-, 500-, 750- and 1,000-year flood events. A detailed description of this work can be found in Volume 2 of the study.

3. Design Flood Hazard Determination

3.1 Design Flood

The 100-yr flood was selected as the open water design flood in accordance with the flood Hazard Identification Program (FHIP) Guidelines (AEP 2011).

3.2 Floodway and Flood Fringe Terminology

Flood Hazard Area

The flood hazard area is the area of land that would be flooded during the design flood. It is composed of the floodway and the flood fringe zones, which are defined below.

Flood Hazard Mapping

Flood hazard mapping identifies the area flooded for the design flood and is typically divided into floodway and flood fringe zones. Flood hazard maps can also show additional flood hazard information, including areas of high hazard within the flood fringe and incremental areas at risk for more severe floods, like the 200-year and 500-year floods. Flood hazard mapping is typically used for long-term flood hazard area management and land-use planning.

Floodway

When a floodway is first defined on a flood hazard map, it typically represents the area of highest flood hazard where flows are deepest, fastest, and most destructive during the 100-

year design flood . The floodway generally includes the main channel of a stream and a portion of the adjacent overbank area. Previously mapped floodways do not typically become larger when a flood hazard map is updated, even if the flood hazard area gets larger or design flood levels get higher, but there may be areas of high hazard outside of either an updated or newly-mapped floodway.

Flood Fringe

The flood fringe is the portion of the flood hazard area outside of the floodway. The flood fringe typically represents areas with shallower, slower, and less destructive flooding during the 100-year design flood. However, areas with deep or fast moving water may also be identified as high hazard flood fringe within the flood fringe. Areas at risk behind flood berms may also be mapped as protected flood fringe areas.

Design Flood Levels

Design flood levels are the computed water levels associated with the design flood.

3.3 Design Flood Profile

The final floodway stationing for each cross section on Threepoint Creek is summarized in **Table 3-1**. The final floodway stationing for each cross section on Sheep River is summarized in **Table 3-2**. **Table 3-3** and **Table 3-4** provide a summary of the design flood profiles for Threepoint Creek and Sheep River respectively.

Table 3-1 – Floodway Limit Stations and Governing Criteria – Threepoint Creek

Reach	River Station (km)	Left Floodway Station (m)	Criteria	Right Floodway Station (m)	Criteria
US Millarville	34.48	373.67	Depth	398.60	Depth
US Millarville	34.21	287.63	Velocity	361.57	Depth
US Millarville	34.11	291.46	Velocity	325.77	Velocity
US Millarville	33.621	159.99	Depth	242.23	Velocity
US Millarville	33.3	100.99	Depth	354.06	Depth
US Millarville	33.041	135.20	Depth	289.08	Depth
US Millarville	32.75	292.08	Depth	351.56	Depth
US Millarville	32.515	239.84	Depth	356.23	Depth
US Millarville	32.39	202.25	Depth	247.64	Depth
US Millarville	32.36	225.30	Depth	283.27	Velocity
US Millarville	32.16	206.50	Depth	229.68	Depth
US Millarville	31.95	29.41	Depth	61.42	Velocity
US Millarville	31.68	160.24	Velocity	209.89	Velocity
US Millarville	31.58	110.81	Depth	153.65	Velocity
US Millarville	31.454	108.65	Velocity	176.39	Velocity
US Millarville	31.3	24.30	Velocity	139.14	Velocity
US Millarville	31.03	19.53	Velocity	509.40	Depth
US Millarville	30.75	40.62	Depth	407.35	Depth
US Millarville	30.49	59.80	Depth	403.65	Depth
US Millarville	30.21	59.51	Velocity	324.83	Depth
US Millarville	30	18.71	Depth	197.04	Depth
US Millarville	29.85	25.65	Depth	390.60	Depth
US Millarville	29.61	28.64	Depth	427.95	Depth
US Millarville	29.31	270.61	Velocity	478.01	Depth
US Millarville	29.19	289.97	Velocity	381.51	Depth
US Millarville	29	261.37	Depth	353.47	Depth
US Millarville	28.77	259.35	Depth	296.91	Depth
US Millarville	28.36	291.24	Depth	517.24	Velocity
US Millarville	27.98	242.49	Depth	415.88	Depth
US Millarville	27.68	364.59	Depth	557.25	Depth
US Millarville	27.37	152.62	Depth	278.03	Depth
US Millarville	26.86	187.35	Depth	217.92	Depth
US Millarville	26.51	67.62	Velocity	92.78	Velocity
US Millarville	26.2	869.96	Depth	1502.17	Depth
US Millarville	25.93	195.51	Depth	819.59	Depth

Reach	River Station (km)	Left Floodway Station (m)	Criteria	Right Floodway Station (m)	Criteria
US Millarville	25.52	326.39	Depth	865.93	Depth
US Millarville	25.32	176.69	Depth	643.43	Depth
US Millarville	25.13	188.25	Depth	550.53	Depth
US Millarville	24.85	151.86	Depth	761.84	Depth
US Millarville	24.73	64.64	Depth	697.79	Depth
US Millarville	24.56	63.47	Depth	737.79	Velocity
US Millarville	24.33	31.57	Depth	759.64	Velocity
US Millarville	23.97	394.68	Depth	785.20	Velocity
US Millarville	23.72	348.28	Depth	830.11	Depth
US Millarville	23.37	276.36	Depth	883.25	Depth
US Millarville	23.02	305.70	Depth	844.71	Depth
US Millarville	22.71	437.07	Depth	916.56	Depth
US Millarville	22.41	463.04	Depth	933.88	Depth
US Millarville	22.07	335.63	Depth	1102.67	Depth
US Millarville	21.78	489.22	Depth	1365.51	Depth
US Millarville	21.51	710.29	Depth	1266.38	Depth
US Millarville	21.23	672.97	Depth	1117.39	Depth
US Millarville	20.95	743.32	Velocity	1039.60	Velocity
US Millarville	20.72	50.14	Depth	833.90	Depth
US Millarville	20.44	39.97	Depth	780.27	Depth
US Millarville	20.344	61.13	Depth	904.72	Depth
US Millarville	20.216	56.24	Depth	998.11	Depth
US Millarville	20.17	89.78	Depth	1033.48	Depth
US Millarville	19.98	176.95	Depth	1176.27	Depth
US Millarville	19.95	143.88	Depth	1237.81	Depth
US Millarville	19.73	137.85	Depth	998.69	Depth
US Millarville	19.49	132.12	Depth	971.44	Depth
US Millarville	19.35	114.35	Depth	937.35	Depth
US Millarville	18.43	68.98	Depth	730.07	Depth
US Millarville	18.229	30.52	Depth	649.46	Depth
US Millarville	18.071	21.38	Depth	682.57	Depth
US Millarville	17.8	24.65	Depth	605.87	Depth
US Millarville	17.68	100.66	Depth	609.05	Depth
US Millarville	17.54	92.76	Depth	681.85	Depth
US Millarville	17.31	109.99	Depth	723.75	Velocity
US Millarville	16.87	147.56	Depth	952.59	Depth
US Millarville	16.63	183.96	Depth	776.51	Velocity

Reach	River Station (km)	Left Floodway Station (m)	Criteria	Right Floodway Station (m)	Criteria
US Millarville	16.44	136.61	Depth	689.35	Depth
US Millarville	16.15	233.32	Depth	761.82	Depth
US Millarville	15.93	178.13	Depth	802.84	Depth
US Millarville	15.74	245.88	Depth	736.24	Depth
US Millarville	15.34	200.20	Depth	702.47	Depth
US Millarville	14.98	15.11	Depth	366.42	Depth
US Millarville	14.88	241.03	Depth	517.66	Depth
US Millarville	14.74	262.34	Depth	601.70	Depth
US Millarville	14.47	246.18	Depth	731.93	Depth
US Millarville	14.33	247.88	Depth	913.25	Depth
US Millarville	14.11	259.65	Depth	924.13	Depth
US Millarville	14.02	210.16	Depth	991.02	Depth
US Millarville	13.821	180.61	Depth	1099.38	Depth
US Millarville	13.6	15.28	Velocity	937.21	Depth
US Millarville	13.45	12.53	Depth	1005.25	Depth
US Millarville	13.3	10.17	Velocity	920.87	Depth
US Millarville	12.94	88.72	Depth	751.52	Depth
US Millarville	12.69	48.46	Depth	551.79	Depth
US Millarville	12.4	15.63	Velocity	604.78	Depth
US Millarville	12.12	72.95	Depth	335.91	Depth
US Millarville	11.91	25.89	Depth	214.03	Depth
US Millarville	11.72	112.90	Depth	384.37	Depth
US Millarville	11.42	43.42	Depth	245.76	Depth
US Millarville	11.13	232.63	Velocity	282.42	Velocity
US Millarville	11.09	206.98	Velocity	301.58	Velocity
US Millarville	10.79	1160.92	Depth	1220.12	Depth
US Millarville	10.36	712.03	Depth	759.77	Depth
US Millarville	10.01	811.54	Depth	1231.72	Depth
US Millarville	9.73	493.83	Depth	1098.38	Depth
US Millarville	9.44	346.14	Depth	965.82	Depth
US Millarville	9.11	588.35	Depth	1241.23	Depth
US Millarville	8.81	280.59	Depth	999.78	Depth
US Millarville	8.65	74.86	Depth	725.21	Depth
US Millarville	8.46	335.00	Depth	974.38	Depth
US Millarville	8.28	358.70	Depth	939.40	Depth
US Millarville	8.06	389.43	Depth	1068.19	Depth
US Millarville	7.89	370.63	Depth	1075.34	Depth

Reach	River Station (km)	Left Floodway Station (m)	Criteria	Right Floodway Station (m)	Criteria
US Millarville	7.65	330.33	Depth	1115.27	Depth
US Millarville	7.33	105.73	Depth	984.71	Depth
US Millarville	7.021	81.61	Depth	950.86	Depth
US Millarville	6.82	73.86	Depth	1069.03	Depth
US Millarville	6.44	111.16	Depth	876.69	Depth
US Millarville	6.14	222.65	Depth	872.16	Depth
US Millarville	5.85	66.95	Depth	619.05	Depth
US Millarville	5.55	72.53	Depth	718.17	Depth
US Millarville	5.25	93.81	Depth	747.34	Depth
US Millarville	4.9	129.29	Depth	454.36	Depth
US Millarville	4.66	90.25	Depth	266.42	Depth
US Millarville	4.33	238.43	Depth	374.13	Depth
US Millarville	4.29	300.22	Depth	425.89	Depth
US Millarville	4.05	257.68	Depth	812.47	Depth
US Millarville	3.932	285.42	Depth	930.62	Depth
US Millarville	3.79	213.41	Depth	877.66	Depth
US Millarville	3.67	202.76	Depth	875.39	Velocity
US Millarville	3.47	119.35	Depth	962.66	Depth
US Millarville	3.15	117.78	Depth	1112.67	Velocity
US Millarville	2.77	160.58	Depth	967.16	Depth
US Millarville	2.56	98.77	Depth	413.13	Depth
US Millarville	2.38	56.85	Velocity	326.80	Depth
US Millarville	2.17	76.16	Depth	373.72	Depth
US Millarville	1.98	155.42	Depth	321.49	Depth
US Millarville	1.715	202.74	Depth	289.51	Depth
US Millarville	1.42	252.85	Depth	379.21	Depth
US Millarville	1.22	70.42	Depth	166.69	Velocity
US Millarville	1.01	49.55	Depth	183.44	Depth
US Millarville	0.81	126.13	Depth	See Note 1	
US Millarville	0.63	173.43	Depth	See Note 1	
US Millarville	0.48	159.09	Depth	See Note 1	
US Millarville	0.2	81.58	Depth	See Note 1	

NOTE 1: This cross section only includes one side of the floodway. Please refer to the Floodway Criteria Maps Sheets 7 to 9 to identify opposite floodway station.

Table 3-2 – Floodway Limit Stations and Governing Criteria – Sheep River

Reach	River Station (km)	Left Floodway Station (m)	Criteria	Right Floodway Station (m)	Criteria
US Threepoint	59.66	22.2	Depth	63.9	Depth
US Threepoint	59.46	35.7	Depth	88.8	Depth
US Threepoint	59.23	6.2	Velocity	101.8	Depth
US Threepoint	59	58.5	Depth	126.7	Depth
US Threepoint	58.69	29.5	Depth	139.6	Depth
US Threepoint	58.33	37.0	Depth	191.6	Depth
US Threepoint	58.08	29.0	Depth	180.7	Velocity
US Threepoint	57.82	27.5	Velocity	173.5	Depth
US Threepoint	57.56	21.5	Depth	176.5	Depth
US Threepoint	57.32	11.6	Depth	59.9	Depth
US Threepoint	57.04	23.0	Depth	60.4	Velocity
US Threepoint	56.53	23.9	Depth	68.8	Depth
US Threepoint	56.353	20.1	Depth	158.1	Depth
US Threepoint	56.12	23.1	Depth	62.4	Depth
US Threepoint	55.74	59.6	Depth	100.2	Depth
US Threepoint	55.47	90.3	Velocity	145.0	Depth
US Threepoint	55.27	36.4	Depth	91.4	Velocity
US Threepoint	55.08	46.2	Velocity	136.4	Velocity
US Threepoint	54.55	70.0	Depth	129.1	Velocity
US Threepoint	54.33	18.8	Depth	175.2	Velocity
US Threepoint	54.1	50.0	Depth	145.6	Depth
US Threepoint	53.67	86.1	Depth	200.3	Depth
US Threepoint	53.35	101.1	Depth	175.8	Depth
US Threepoint	52.95	97.5	Depth	206.3	Depth
US Threepoint	52.7	139.9	Depth	328.6	Depth
US Threepoint	52.4	192.4	Depth	291.2	Depth
US Threepoint	52.1	145.8	Depth	351.4	Depth
US Threepoint	51.74	37.6	Depth	238.2	Depth
US Threepoint	51.44	235.4	Depth	387.1	Depth
US Threepoint	51.17	221.6	Depth	323.3	Depth
US Threepoint	50.96	31.8	Depth	181.9	Depth
US Threepoint	50.606	100.0	Depth	296.4	Depth
US Threepoint	50.51	62.0	Depth	153.2	Depth
US Threepoint	50.21	30.4	Velocity	102.2	Depth
US Threepoint	49.83	74.4	Depth	135.9	Velocity

Reach	River Station (km)	Left Floodway Station (m)	Criteria	Right Floodway Station (m)	Criteria
US Threepoint	49.54	46.8	Depth	187.9	Depth
US Threepoint	49.18	44.3	Depth	117.1	Depth
US Threepoint	48.94	41.6	Depth	96.1	Depth
US Threepoint	48.69	31.8	Depth	74.8	Depth
US Threepoint	48.44	118.2	Depth	182.2	Depth
US Threepoint	48.19	58.5	Velocity	111.3	Velocity
US Threepoint	48.15	103.1	Velocity	143.6	Depth
US Threepoint	48.08	54.5	Depth	110.3	Depth
US Threepoint	47.92	94.9	Orig Floodway	327.7	Depth
US Threepoint	47.88	25.8	Orig Floodway	168.4	Orig Floodway
US Threepoint	47.62	34.0	Depth	99.3	Orig Floodway
US Threepoint	47.35	20.9	Orig Floodway	137.9	Depth
US Threepoint	47.08	50.2	Depth	135.9	Orig Floodway
US Threepoint	46.78	130.6	Depth	244.7	Depth
US Threepoint	46.63	268.9	Orig Floodway	453.1	Depth
US Threepoint	46.46	355.3	Orig Floodway	565.3	Depth
US Threepoint	46.2	154.4	Orig Floodway	306.2	Orig Floodway
US Threepoint	46.1	142.8	Orig Floodway	262.5	Depth
US Threepoint	46.06	172.3	Flood Structure	225.7	Flood Structure
US Threepoint	46.01	133.2	Flood Structure	210.9	Depth
US Threepoint	45.97	92.9	Orig Floodway	144.6	Flood Structure
US Threepoint	45.94	119.6	Orig Floodway	177.8	Depth
US Threepoint	45.88	141.5	Flood Structure	229.2	Orig Floodway
US Threepoint	45.73	185.5	Orig Floodway	274.4	Orig Floodway
US Threepoint	45.53	290.4	Flood Structure	396.9	Depth
US Threepoint	45.29	341.8	Flood Structure	413.4	Depth
US Threepoint	45.05	331.8	Depth	519.0	Orig Floodway
US Threepoint	44.78	99.2	Orig Floodway	368.4	Orig Floodway
US Threepoint	44.41	154.2	Orig Floodway	265.3	Orig Floodway
US Threepoint	44.13	191.5	Orig Floodway	277.6	Orig Floodway
US Threepoint	44	103.9	Depth	191.3	Orig Floodway
US Threepoint	43.91	122.2	Orig Floodway	218.6	Orig Floodway
US Threepoint	43.47	218.2	Orig Floodway	545.1	Orig Floodway
US Threepoint	43.28	249.9	Depth	553.0	Depth
US Threepoint	43.04	198.9	Depth	696.1	Orig Floodway
US Threepoint	42.82	113.8	Depth	591.7	Orig Floodway
US Threepoint	42.62	133.1	Orig Floodway	490.2	Orig Floodway

Reach	River Station (km)	Left Floodway Station (m)	Criteria	Right Floodway Station (m)	Criteria
US Threepoint	42.45	51.6	Depth	291.6	Mixed
US Threepoint	42.29	54.5	Orig Floodway	209.5	Mixed
US Threepoint	42.24	82.2	Orig Floodway	145.4	Mixed
US Threepoint	42.21	207.7	Orig Floodway	258.2	Orig Floodway
US Threepoint	42.12	152.5	Orig Floodway	329.3	Orig Floodway
US Threepoint	41.94	290.1	Depth	405.7	Orig Floodway
US Threepoint	41.8	387.5	Orig Floodway	559.7	Orig Floodway
US Threepoint	41.63	540.0	Orig Floodway	673.8	Orig Floodway
US Threepoint	41.36	432.1	Orig Floodway	753.9	Orig Floodway
US Threepoint	41.13	317.0	Orig Floodway	672.1	Orig Floodway
US Threepoint	40.81	468.2	Depth	677.7	Depth
US Threepoint	40.51	618.0	Orig Floodway	895.6	Depth
US Threepoint	40.23	521.9	Depth	1169.3	Orig Floodway
US Threepoint	39.85	615.1	Depth	903.4	Depth
US Threepoint	39.5	187.6	Depth	995.8	Depth
US Threepoint	39.23	49.8	Depth	861.0	Depth
US Threepoint	39.12	43.8	Depth	776.8	Depth
US Threepoint	38.84	37.5	Depth	471.7	Depth
US Threepoint	38.65	12.2	Depth	397.7	Depth
US Threepoint	38.35	13.0	Depth	409.1	Depth
US Threepoint	38.17	58.8	Depth	567.3	Depth
US Threepoint	37.99	55.7	Depth	708.5	Depth
US Threepoint	37.74	40.0	Velocity	785.7	Depth
US Threepoint	37.58	53.0	Depth	579.5	Depth
US Threepoint	37.4	176.6	Depth	626.5	Depth
US Threepoint	37.25	72.7	Depth	See Note 1	
US Threepoint	36.93	105.3	Depth	See Note 1	
US Threepoint	36.64	268.5	Depth	See Note 1	
US Threepoint	36.534	266.2	Depth	See Note 1	
US Threepoint	36.31	282.9	Depth	See Note 1	
US Threepoint	35.91	185.0	Depth	See Note 1	
US Threepoint	35.61	115.0	Depth	See Note 1	
US Threepoint	35.37	See Note 2			
US Threepoint	35.27	See Note 2			
US Threepoint	35.02	See Note 2			
US Threepoint	34.89	See Note 2			
128 St Overflow	0.12	See Note 1		375.0	Velocity

Reach	River Station (km)	Left Floodway Station (m)	Criteria	Right Floodway Station (m)	Criteria
128 St Overflow	0.23		See Note 1	386.3	Velocity
128 St Overflow	0.28		See Note 1	480.5	Velocity
128 St Overflow	0.31		See Note 1	467.6	Velocity
128 St Overflow	0.43		See Note 1	409.7	Depth
128 St Overflow	0.53		See Note 1	289.7	Velocity
128 St Overflow	0.70		See Note 1	217.7	Depth
128 St Overflow	0.94		See Note 1	258.1	Velocity
128 St Overflow	1.21		See Note 1	181.0	Velocity
128 St Overflow	1.24		See Note 1	201.9	Depth
128 St Overflow	1.32		See Note 1	529.6	Depth
128 St Overflow	1.42		See Note 1	424.6	Depth
128 St Overflow	1.56		See Note 1	243.8	Depth
128 St Overflow	1.71		See Note 1	249.3	Depth
128 St Overflow	2.05		See Note 1	280.4	Depth
128 St Overflow	2.16		See Note 1	306.0	Depth
128 St Overflow	2.23		See Note 1	157.5	Velocity
128 St Overflow	2.33		See Note 1	155.0	Depth
128 St Overflow	2.39		See Note 1	136.5	Depth
128 St Overflow	2.46		See Note 1	97.8	Depth
128 St Overflow	2.53		See Note 1	118.6	Depth
128 St Overflow	2.57		See Note 1	124.4	Depth
128 St Overflow	2.67		See Note 1	171.8	Depth
128 St Overflow	2.72		See Note 1	214.5	Depth
128 St Overflow	2.78		See Note 1	228.9	Depth
DS Threepoint	34.28	48.9	Velocity	See Note 1	
DS Threepoint	34.12	30.3	Velocity	See Note 1	
DS Threepoint	33.83	23.5	Velocity	See Note 1	
DS Threepoint	33.62	22.5	Depth	See Note 1	
DS Threepoint	33.44	18.2	Depth	See Note 1	
DS Threepoint	33.23	44.1	Depth	See Note 1	
DS Threepoint	33.04	12.2	Depth	See Note 1	
DS Threepoint	32.89	11.0	Depth	See Note 1	
DS 128 Street	32.68	7.9	Velocity	373.8	Depth
DS 128 Street	32.51	32.9	Depth	503.7	Depth
DS 128 Street	32.32	84.7	Depth	594.9	Depth
DS 128 Street	32	68.2	Depth	570.4	Depth
DS 128 Street	31.63	51.3	Depth	698.5	Depth

Reach	River Station (km)	Left Floodway Station (m)	Criteria	Right Floodway Station (m)	Criteria
DS 128 Street	31.27	25.1	Depth	857.2	Depth
DS 128 Street	30.87	24.4	Depth	990.0	Depth
DS 128 Street	30.44	134.2	Depth	1010.0	Depth
DS 128 Street	30.09	258.1	Depth	1080.7	Depth
DS 128 Street	29.73	450.1	Depth	1166.9	Depth
DS 128 Street	29.463	736.3	Depth	1466.5	Depth
DS 128 Street	29.12	570.9	Depth	1414.0	Depth
DS 128 Street	28.89	404.3	Depth	1424.7	Depth
DS 128 Street	28.66	428.3	Depth	1374.2	Velocity
DS 128 Street	28.38	380.4	Depth	1334.4	Depth
DS 128 Street	28.02	279.5	Velocity	1276.2	Depth
DS 128 Street	27.79	128.4	Depth	1427.5	Depth
DS 128 Street	27.53	140.4	Depth	1204.4	Depth
DS 128 Street	27.25	126.6	Depth	1125.1	Depth
DS 128 Street	26.88	390.3	Depth	1056.7	Depth
DS 128 Street	26.47	484.8	Velocity	1176.1	Velocity
DS 128 Street	26.24	396.1	Depth	1107.5	Depth
DS 128 Street	25.82	543.2	Depth	1197.4	Depth
DS 128 Street	25.5	631.7	Depth	1326.3	Depth
DS 128 Street	25.21	675.6	Depth	1313.6	Depth
DS 128 Street	24.99	847.4	Depth	1718.2	Depth
DS 128 Street	24.78	846.6	Depth	1731.4	Depth
DS 128 Street	24.54	957.4	Depth	1696.5	Depth
DS 128 Street	24.4	877.8	Depth	1649.4	Depth
DS 128 Street	24.12	852.1	Depth	1613.4	Depth
DS 128 Street	23.85	874.9	Depth	1424.5	Depth
DS 128 Street	23.58	851.1	Depth	1267.2	Depth
DS 128 Street	23.27	838.2	Depth	1159.8	Depth
DS 128 Street	22.98	630.9	Depth	1007.6	Depth
DS 128 Street	22.77	487.9	Depth	864.4	Depth
DS 128 Street	22.46	309.7	Depth	701.7	Depth
DS 128 Street	22.17	35.1	Depth	352.6	Depth
DS 128 Street	21.85	92.9	Depth	386.7	Depth
DS 128 Street	21.8	108.2	Depth	362.6	Depth
DS 128 Street	21.49	587.2	Depth	733.2	Depth
DS 128 Street	21.06	856.1	Depth	1014.8	Depth
DS 128 Street	20.81	1108.0	Depth	1527.9	Depth

Reach	River Station (km)	Left Floodway Station (m)	Criteria	Right Floodway Station (m)	Criteria
DS 128 Street	20.69	815.2	Depth	1408.3	Depth
DS 128 Street	20.41	305.3	Velocity	1026.7	Depth
DS 128 Street	20.09	38.0	Depth	651.1	Depth
DS 128 Street	19.71	44.9	Velocity	332.7	Velocity
DS 128 Street	19.29	41.7	Depth	382.5	Depth
DS 128 Street	18.99	37.6	Depth	399.1	Depth
DS 128 Street	18.69	81.8	Depth	622.0	Depth
DS 128 Street	18.34	77.4	Depth	943.9	Mixed
DS 128 Street	18.206	480.9	Depth	1335.2	Mixed
DS 128 Street	18.15	791.4	Depth	1519.9	Mixed
DS 128 Street	18.07	324.0	Depth	1022.3	Depth
DS 128 Street	18.01	62.3	Depth	1038.6	Depth
DS 128 Street	17.65	414.0	Orig Floodway	836.5	Orig Floodway
DS 128 Street	17.45	354.9	Orig Floodway	705.5	Orig Floodway
DS 128 Street	17.22	240.7	Orig Floodway	569.9	Orig Floodway
DS 128 Street	17.04	56.0	Orig Floodway	414.9	Orig Floodway
DS 128 Street	16.77	20.3	Orig Floodway	513.8	Orig Floodway
DS 128 Street	16.45	59.9	Orig Floodway	466.3	Orig Floodway
DS 128 Street	16.22	174.0	Orig Floodway	455.7	Orig Floodway
DS 128 Street	16.07	243.5	Orig Floodway	461.2	Orig Floodway
DS 128 Street	15.95	283.1	Orig Floodway	621.3	Mixed
DS 128 Street	15.91	296.1	Orig Floodway	543.7	Mixed
DS 128 Street	15.883	299.0	Orig Floodway	407.8	Orig Floodway
DS 128 Street	15.86	284.0	Orig Floodway	391.5	Orig Floodway
DS 128 Street	15.73	207.0	Orig Floodway	426.0	Orig Floodway
DS 128 Street	15.56	120.8	Mixed	496.4	Orig Floodway
DS 128 Street	15.4	90.6	Mixed	497.7	Orig Floodway
DS 128 Street	15.36	109.7	Mixed	511.3	Orig Floodway
DS 128 Street	15.35	123.9	Mixed	525.3	Orig Floodway
DS 128 Street	15.24	87.3	Mixed	508.9	Orig Floodway
DS 128 Street	15.17	82.5	Mixed	503.1	Orig Floodway
DS 128 Street	15.06	101.9	Mixed	523.0	Orig Floodway
DS 128 Street	14.92	136.7	Mixed	608.2	Orig Floodway
DS 128 Street	14.78	98.8	Mixed	622.1	Orig Floodway
DS 128 Street	14.62	104.5	Mixed	578.3	Mixed
DS 128 Street	14.45	166.6	Mixed	596.3	Mixed
DS 128 Street	14.25	179.6	Mixed	636.7	Mixed

Reach	River Station (km)	Left Floodway Station (m)	Criteria	Right Floodway Station (m)	Criteria
DS 128 Street	14.04	2.7	Mixed	641.2	Mixed
DS 128 Street	13.82	7.3	Mixed	679.4	Mixed
DS 128 Street	13.65	3.4	Mixed	565.4	Mixed
DS 128 Street	13.48	8.8	Mixed	422.6	Mixed
DS 128 Street	13.25	11.6	Mixed	259.7	Mixed
DS 128 Street	13.13	70.5	Mixed	170.3	Mixed
DS 128 Street	13.12	78.8	Mixed	355.1	Mixed
DS 128 Street	13.01	366.9	Orig Floodway	641.6	Mixed
DS 128 Street	12.85	195.4	Orig Floodway	586.2	Mixed
DS 128 Street	12.75	200.4	Orig Floodway	619.4	Mixed
DS 128 Street	12.73	270.9	Orig Floodway	381.0	Orig Floodway
DS 128 Street	12.64	98.4	Orig Floodway	387.6	Orig Floodway
DS 128 Street	12.554	150.0	Orig Floodway	651.7	Orig Floodway
DS 128 Street	12.47	246.4	Orig Floodway	708.7	Orig Floodway
DS 128 Street	12.343	336.9	Orig Floodway	725.7	Orig Floodway
DS 128 Street	12.25	269.5	Orig Floodway	725.5	Orig Floodway
DS Okotoks	12.02	62.5	Depth	782.4	Depth
DS Okotoks	11.90	110.0	Depth	893.3	Depth
DS Okotoks	11.75	126.6	Depth	826.2	Depth
DS Okotoks	11.54	100.3	Depth	912.7	Depth
DS Okotoks	11.47	140.8	Depth	905.9	Depth
DS Okotoks	11.25	78.1	Depth	705.4	Depth
DS Okotoks	10.93	12.1	Depth	658.0	Depth
DS Okotoks	10.63	50.4	Depth	654.1	Depth
DS Okotoks	10.45	43.5	Velocity	561.8	Depth
DS Okotoks	10.15	28.3	Depth	410.4	Depth
DS Okotoks	9.87	87.8	Depth	364.9	Depth
DS Okotoks	9.58	271.7	Depth	635.2	Depth
DS Okotoks	9.31	359.9	Depth	538.6	Depth
DS Okotoks	9.09	124.2	Depth	446.6	Depth
DS Okotoks	8.79	96.2	Depth	484.1	Depth
DS Okotoks	8.44	60.1	Depth	535.4	Depth
DS Okotoks	8.20	47.8	Depth	497.8	Depth
DS Okotoks	7.94	182.0	Depth	433.8	Depth
DS Okotoks	7.71	53.2	Depth	321.1	Depth

Reach	River Station (km)	Left Floodway Station (m)	Criteria	Right Floodway Station (m)	Criteria
DS Okotoks	7.52	23.1	Depth	275.5	Depth
DS Okotoks	7.30	32.2	Velocity	253.0	Depth
DS Okotoks	7.13	42.9	Depth	225.7	Depth
DS Okotoks	7.02	271.7	Depth	546.9	Depth
DS Okotoks	6.98	227.0	Depth	329.3	Depth
DS Okotoks	6.94	241.7	Depth	358.5	Depth
DS Okotoks	6.85	188.5	Depth	465.5	Depth
DS Okotoks	6.60	256.9	Depth	549.1	Depth
DS Okotoks	6.32	329.3	Depth	632.7	Depth
DS Okotoks	6.01	276.1	Depth	636.2	Depth
DS Okotoks	5.77	291.0	Depth	593.2	Depth
DS Okotoks	5.59	330.8	Depth	593.5	Velocity
DS Okotoks	5.29	157.5	Depth	388.0	Depth
DS Okotoks	5.16	127.2	Depth	372.8	Depth
DS Okotoks	5.00	61.9	Depth	281.1	Velocity
DS Okotoks	4.83	22.8	Depth	245.2	Depth
DS Okotoks	4.64	131.7	Depth	358.0	Depth
DS Okotoks	4.40	182.8	Depth	380.2	Velocity
DS Okotoks	4.00	107.2	Depth	295.9	Depth
DS Okotoks	3.64	80.2	Depth	217.7	Depth
DS Okotoks	3.25	15.0	Velocity	137.4	Depth
DS Okotoks	2.98	22.3	Depth	160.0	Depth
DS Okotoks	2.74	42.6	Depth	178.2	Depth
DS Okotoks	2.55	78.6	Velocity	215.3	Depth
DS Okotoks	2.37	35.9	Depth	103.5	Depth
DS Okotoks	1.99	99.8	Depth	244.6	Depth
DS Okotoks	1.70	321.1	Depth	395.9	Velocity
DS Okotoks	1.40	409.7	Depth	507.3	Depth
DS Okotoks	1.12	427.0	Depth	548.1	Depth
DS Okotoks	0.87	266.5	Depth	413.0	Depth
DS Okotoks	0.65	21.4	Depth	165.3	Depth
DS Okotoks	0.53	21.9	Velocity	120.0	Velocity
DS Okotoks	0.24	186.1	Depth	264.6	Depth
DS Okotoks	0.01	475.8	Depth	545.1	Depth

NOTE 1: This cross section only includes one side of the floodway. Please refer to the Floodway Criteria Maps Sheets 7 to 9 to identify opposite floodway station.

NOTE 2: This cross section is entirely contained within the floodway. Please refer to the Floodway Criteria Maps Sheets 7 to 9 to identify opposite floodway station.

Table 3-3 – Design Flood Profile for Threepoint Creek

River	Reach	River Station (km)	Min Channel El. (m)	WSE (m) for 100-year Flood
Threepoint Creek	US Millarville	34.48	1262.61	1265.47
Threepoint Creek	US Millarville	34.21	1261.47	1264.08
Threepoint Creek	US Millarville	34.11	1259.44	1263.42
Threepoint Creek	US Millarville	33.62	1258.73	1260.65
Threepoint Creek	US Millarville	33.30	1255.94	1258.84
Threepoint Creek	US Millarville	33.04	1254.46	1257.30
Threepoint Creek	US Millarville	32.75	1252.75	1255.01
Threepoint Creek	US Millarville	32.51	1250.37	1253.92
Threepoint Creek	US Millarville	32.39	1250.42	1253.57
Threepoint Creek	US Millarville	32.36	1250.18	1252.95
Threepoint Creek	US Millarville	32.16	1247.39	1250.87
Threepoint Creek	US Millarville	31.95	1246.32	1249.80
Threepoint Creek	US Millarville	31.68	1245.60	1248.32
Threepoint Creek	US Millarville	31.58	1245.09	1247.79
Threepoint Creek	US Millarville	31.45	1244.59	1247.01
Threepoint Creek	US Millarville	31.30	1243.81	1246.14
Threepoint Creek	US Millarville	31.03	1242.70	1244.71
Threepoint Creek	US Millarville	30.75	1241.11	1242.70
Threepoint Creek	US Millarville	30.49	1238.52	1240.82
Threepoint Creek	US Millarville	30.21	1237.09	1239.55
Threepoint Creek	US Millarville	30.00	1236.17	1238.41
Threepoint Creek	US Millarville	29.85	1235.56	1237.68
Threepoint Creek	US Millarville	29.61	1234.16	1235.48
Threepoint Creek	US Millarville	29.31	1231.30	1233.15
Threepoint Creek	US Millarville	29.19	1230.10	1232.38
Threepoint Creek	US Millarville	29.00	1228.70	1231.19
Threepoint Creek	US Millarville	28.77	1227.52	1229.98
Threepoint Creek	US Millarville	28.36	1225.14	1227.48
Threepoint Creek	US Millarville	27.98	1222.67	1224.47
Threepoint Creek	US Millarville	27.68	1219.62	1222.15
Threepoint Creek	US Millarville	27.37	1218.07	1220.33

River	Reach	River Station (km)	Min Channel El. (m)	WSE (m) for 100-year Flood
Threepoint Creek	US Millarville	26.86	1214.52	1216.78
Threepoint Creek	US Millarville	26.51	1212.71	1214.05
Threepoint Creek	US Millarville	26.20	1210.93	1211.99
Threepoint Creek	US Millarville	25.93	1209.44	1210.56
Threepoint Creek	US Millarville	25.52	1206.76	1209.03
Threepoint Creek	US Millarville	25.32	1205.39	1208.16
Threepoint Creek	US Millarville	25.13	1204.64	1207.41
Threepoint Creek	US Millarville	24.85	1203.53	1205.76
Threepoint Creek	US Millarville	24.73	1203.16	1205.45
Threepoint Creek	US Millarville	24.56	1201.71	1204.63
Threepoint Creek	US Millarville	24.33	1200.62	1203.94
Threepoint Creek	US Millarville	23.97	1199.59	1202.24
Threepoint Creek	US Millarville	23.72	1197.59	1201.17
Threepoint Creek	US Millarville	23.37	1195.92	1199.63
Threepoint Creek	US Millarville	23.02	1195.41	1198.64
Threepoint Creek	US Millarville	22.71	1194.04	1196.55
Threepoint Creek	US Millarville	22.41	1192.35	1195.33
Threepoint Creek	US Millarville	22.07	1191.27	1193.19
Threepoint Creek	US Millarville	21.78	1190.10	1191.63
Threepoint Creek	US Millarville	21.51	1188.74	1190.67
Threepoint Creek	US Millarville	21.23	1187.49	1189.43
Threepoint Creek	US Millarville	20.95	1186.27	1188.74
Threepoint Creek	US Millarville	20.72	1185.15	1188.24
Threepoint Creek	US Millarville	20.44	1184.53	1187.21
Threepoint Creek	US Millarville	20.34	1184.18	1186.98
Threepoint Creek	US Millarville	20.22	1183.57	1186.55
Threepoint Creek	US Millarville	20.17	1183.15	1186.58
Threepoint Creek	US Millarville	19.98	1182.35	1186.58
Threepoint Creek	US Millarville	19.95	1181.88	1185.92
Threepoint Creek	US Millarville	19.73	1182.52	1183.54
Threepoint Creek	US Millarville	19.49	1180.81	1183.19
Threepoint Creek	US Millarville	19.35	1181.31	1182.69
Threepoint Creek	US Millarville	18.43	1178.94	1181.97
Threepoint Creek	US Millarville	18.23	1178.14	1181.68
Threepoint Creek	US Millarville	18.07	1177.60	1180.79
Threepoint Creek	US Millarville	17.80	1177.34	1179.94
Threepoint Creek	US Millarville	17.68	1177.32	1179.56

River	Reach	River Station (km)	Min Channel El. (m)	WSE (m) for 100-year Flood
Threepoint Creek	US Millarville	17.54	1176.98	1179.33
Threepoint Creek	US Millarville	17.31	1175.89	1178.65
Threepoint Creek	US Millarville	16.87	1175.35	1178.39
Threepoint Creek	US Millarville	16.63	1173.80	1177.85
Threepoint Creek	US Millarville	16.44	1174.30	1177.56
Threepoint Creek	US Millarville	16.15	1174.41	1176.89
Threepoint Creek	US Millarville	15.93	1173.60	1176.15
Threepoint Creek	US Millarville	15.74	1172.42	1175.67
Threepoint Creek	US Millarville	15.34	1172.23	1175.10
Threepoint Creek	US Millarville	14.98	1170.52	1174.16
Threepoint Creek	US Millarville	14.88	1170.26	1174.07
Threepoint Creek	US Millarville	14.74	1169.53	1173.27
Threepoint Creek	US Millarville	14.47	1168.99	1172.26
Threepoint Creek	US Millarville	14.33	1168.12	1171.58
Threepoint Creek	US Millarville	14.11	1167.47	1170.43
Threepoint Creek	US Millarville	14.02	1167.43	1170.03
Threepoint Creek	US Millarville	13.82	1165.94	1169.92
Threepoint Creek	US Millarville	13.60	1165.08	1169.09
Threepoint Creek	US Millarville	13.45	1164.75	1169.03
Threepoint Creek	US Millarville	13.30	1164.30	1168.85
Threepoint Creek	US Millarville	12.94	1163.09	1166.87
Threepoint Creek	US Millarville	12.69	1162.40	1166.27
Threepoint Creek	US Millarville	12.40	1160.87	1165.99
Threepoint Creek	US Millarville	12.12	1160.88	1164.68
Threepoint Creek	US Millarville	11.91	1160.31	1164.56
Threepoint Creek	US Millarville	11.72	1159.34	1164.39
Threepoint Creek	US Millarville	11.42	1158.63	1163.72
Threepoint Creek	US Millarville	11.13	1156.91	1163.07
Threepoint Creek	US Millarville	11.09	1157.27	1162.58
Threepoint Creek	US Millarville	10.79	1156.66	1162.00
Threepoint Creek	US Millarville	10.36	1155.34	1159.82
Threepoint Creek	US Millarville	10.01	1154.32	1158.35
Threepoint Creek	US Millarville	9.73	1154.33	1157.68
Threepoint Creek	US Millarville	9.44	1152.97	1156.32
Threepoint Creek	US Millarville	9.11	1151.61	1154.90
Threepoint Creek	US Millarville	8.81	1151.38	1153.80
Threepoint Creek	US Millarville	8.65	1150.05	1152.82

River	Reach	River Station (km)	Min Channel El. (m)	WSE (m) for 100-year Flood
Threepoint Creek	US Millarville	8.46	1149.57	1152.32
Threepoint Creek	US Millarville	8.28	1149.67	1151.96
Threepoint Creek	US Millarville	8.06	1148.80	1151.41
Threepoint Creek	US Millarville	7.89	1147.57	1150.83
Threepoint Creek	US Millarville	7.65	1147.37	1150.29
Threepoint Creek	US Millarville	7.33	1146.24	1149.68
Threepoint Creek	US Millarville	7.02	1145.33	1148.60
Threepoint Creek	US Millarville	6.82	1145.23	1148.41
Threepoint Creek	US Millarville	6.44	1144.15	1147.85
Threepoint Creek	US Millarville	6.14	1143.80	1147.04
Threepoint Creek	US Millarville	5.85	1142.26	1146.09
Threepoint Creek	US Millarville	5.55	1141.98	1145.46
Threepoint Creek	US Millarville	5.25	1141.11	1145.15
Threepoint Creek	US Millarville	4.90	1140.09	1144.78
Threepoint Creek	US Millarville	4.66	1139.31	1144.02
Threepoint Creek	US Millarville	4.33	1138.83	1143.16
Threepoint Creek	US Millarville	4.29	1138.77	1142.95
Threepoint Creek	US Millarville	4.05	1138.37	1142.43
Threepoint Creek	US Millarville	3.93	1138.23	1142.06
Threepoint Creek	US Millarville	3.79	1137.94	1141.84
Threepoint Creek	US Millarville	3.67	1137.94	1140.64
Threepoint Creek	US Millarville	3.47	1137.48	1140.31
Threepoint Creek	US Millarville	3.15	1136.69	1140.02
Threepoint Creek	US Millarville	2.77	1134.83	1139.21
Threepoint Creek	US Millarville	2.56	1134.77	1138.65
Threepoint Creek	US Millarville	2.38	1134.38	1138.30
Threepoint Creek	US Millarville	2.17	1133.95	1138.09
Threepoint Creek	US Millarville	1.98	1133.14	1137.69
Threepoint Creek	US Millarville	1.71	1132.16	1136.67
Threepoint Creek	US Millarville	1.42	1131.79	1135.11
Threepoint Creek	US Millarville	1.22	1130.89	1134.31
Threepoint Creek	US Millarville	1.01	1130.10	1133.48
Threepoint Creek	US Millarville	0.81	1129.45	1132.91
Threepoint Creek	US Millarville	0.63	1128.33	1132.37
Threepoint Creek	US Millarville	0.48	1127.88	1131.36
Threepoint Creek	US Millarville	0.20	1126.88	1130.43

Table 3-4 – Design Flood Profile for Sheep River

River	Reach	River Station (km)	Min Channel El. (m)	WSE (m) for 100-year Flood
Sheep River	US Threepoint	59.66	1272.02	1277.16
Sheep River	US Threepoint	59.46	1271.27	1275.53
Sheep River	US Threepoint	59.23	1269.57	1274.28
Sheep River	US Threepoint	59.00	1268.94	1273.04
Sheep River	US Threepoint	58.69	1267.60	1271.61
Sheep River	US Threepoint	58.33	1265.73	1268.40
Sheep River	US Threepoint	58.08	1263.56	1267.08
Sheep River	US Threepoint	57.82	1262.40	1264.98
Sheep River	US Threepoint	57.56	1260.45	1264.15
Sheep River	US Threepoint	57.32	1257.53	1262.81
Sheep River	US Threepoint	57.04	1256.23	1260.83
Sheep River	US Threepoint	56.53	1253.98	1258.11
Sheep River	US Threepoint	56.35	1253.02	1258.48
Sheep River	US Threepoint	56.12	1251.50	1256.07
Sheep River	US Threepoint	55.74	1249.61	1253.71
Sheep River	US Threepoint	55.47	1248.06	1251.41
Sheep River	US Threepoint	55.27	1246.63	1250.33
Sheep River	US Threepoint	55.08	1245.66	1249.46
Sheep River	US Threepoint	54.55	1242.53	1245.95
Sheep River	US Threepoint	54.33	1239.90	1244.87
Sheep River	US Threepoint	54.10	1239.41	1243.24
Sheep River	US Threepoint	53.67	1236.66	1240.80
Sheep River	US Threepoint	53.35	1234.36	1238.46
Sheep River	US Threepoint	52.95	1232.82	1236.01
Sheep River	US Threepoint	52.70	1231.34	1234.95
Sheep River	US Threepoint	52.40	1229.51	1232.99
Sheep River	US Threepoint	52.10	1228.08	1231.67
Sheep River	US Threepoint	51.74	1226.19	1229.27
Sheep River	US Threepoint	51.44	1224.39	1228.60
Sheep River	US Threepoint	51.17	1223.15	1226.85
Sheep River	US Threepoint	50.96	1221.78	1225.57
Sheep River	US Threepoint	50.61	1219.23	1224.15

River	Reach	River Station (km)	Min Channel El. (m)	WSE (m) for 100-year Flood
Sheep River	US Threepoint	50.51	1218.53	1223.91
Sheep River	US Threepoint	50.21	1217.65	1222.83
Sheep River	US Threepoint	49.83	1215.71	1220.05
Sheep River	US Threepoint	49.54	1214.09	1218.97
Sheep River	US Threepoint	49.18	1211.47	1217.14
Sheep River	US Threepoint	48.94	1210.53	1215.91
Sheep River	US Threepoint	48.69	1208.88	1213.62
Sheep River	US Threepoint	48.44	1207.09	1212.78
Sheep River	US Threepoint	48.19	1205.74	1212.02
Sheep River	US Threepoint	48.15	1205.93	1211.06
Sheep River	US Threepoint	48.08	1205.62	1209.89
Sheep River	US Threepoint	47.92	1203.76	1208.74
Sheep River	US Threepoint	47.88	1203.23	1208.75
Sheep River	US Threepoint	47.62	1203.81	1206.75
Sheep River	US Threepoint	47.35	1201.82	1206.08
Sheep River	US Threepoint	47.08	1199.95	1204.38
Sheep River	US Threepoint	46.78	1198.84	1202.21
Sheep River	US Threepoint	46.63	1197.65	1201.83
Sheep River	US Threepoint	46.46	1197.09	1200.98
Sheep River	US Threepoint	46.20	1195.55	1200.31
Sheep River	US Threepoint	46.10	1194.45	1199.75
Sheep River	US Threepoint	46.06	1194.37	1198.35
Sheep River	US Threepoint	46.01	1194.33	1198.23
Sheep River	US Threepoint	45.97	1193.87	1197.21
Sheep River	US Threepoint	45.94	1193.51	1196.91
Sheep River	US Threepoint	45.88	1193.08	1196.90
Sheep River	US Threepoint	45.73	1191.92	1196.04
Sheep River	US Threepoint	45.53	1191.40	1195.53
Sheep River	US Threepoint	45.29	1190.01	1193.97
Sheep River	US Threepoint	45.05	1189.23	1192.71
Sheep River	US Threepoint	44.78	1187.21	1191.47
Sheep River	US Threepoint	44.41	1184.74	1189.52
Sheep River	US Threepoint	44.13	1184.28	1188.45
Sheep River	US Threepoint	44.00	1183.31	1187.25
Sheep River	US Threepoint	43.91	1182.47	1186.40
Sheep River	US Threepoint	43.47	1180.57	1183.36
Sheep River	US Threepoint	43.28	1179.42	1181.94

River	Reach	River Station (km)	Min Channel El. (m)	WSE (m) for 100-year Flood
Sheep River	US Threepoint	43.04	1178.15	1180.35
Sheep River	US Threepoint	42.82	1175.80	1178.56
Sheep River	US Threepoint	42.62	1174.68	1177.78
Sheep River	US Threepoint	42.45	1173.23	1177.26
Sheep River	US Threepoint	42.29	1172.09	1176.96
Sheep River	US Threepoint	42.24	1171.12	1176.72
Sheep River	US Threepoint	42.21	1171.16	1175.85
Sheep River	US Threepoint	42.12	1170.64	1174.73
Sheep River	US Threepoint	41.94	1170.11	1173.86
Sheep River	US Threepoint	41.80	1169.79	1173.43
Sheep River	US Threepoint	41.63	1168.99	1171.77
Sheep River	US Threepoint	41.36	1166.79	1169.67
Sheep River	US Threepoint	41.13	1165.31	1168.39
Sheep River	US Threepoint	40.81	1162.66	1165.99
Sheep River	US Threepoint	40.51	1160.71	1164.30
Sheep River	US Threepoint	40.23	1159.26	1162.39
Sheep River	US Threepoint	39.85	1157.02	1159.87
Sheep River	US Threepoint	39.50	1155.15	1157.03
Sheep River	US Threepoint	39.23	1152.76	1155.39
Sheep River	US Threepoint	39.12	1152.08	1154.84
Sheep River	US Threepoint	38.84	1149.74	1153.20
Sheep River	US Threepoint	38.65	1149.49	1152.38
Sheep River	US Threepoint	38.35	1147.39	1151.00
Sheep River	US Threepoint	38.17	1147.09	1149.79
Sheep River	US Threepoint	37.99	1145.72	1148.35
Sheep River	US Threepoint	37.74	1144.10	1147.02
Sheep River	US Threepoint	37.58	1143.55	1146.51
Sheep River	US Threepoint	37.40	1142.68	1146.01
Sheep River	US Threepoint	37.25	1141.57	1143.76
Sheep River	US Threepoint	36.93	1139.51	1142.03
Sheep River	US Threepoint	36.64	1138.80	1140.80
Sheep River	US Threepoint	36.53	1138.34	1140.27
Sheep River	US Threepoint	36.31	1136.56	1138.66
Sheep River	US Threepoint	35.91	1133.84	1136.41
Sheep River	US Threepoint	35.61	1132.24	1134.14
Sheep River	US Threepoint	35.37	1131.46	1133.45
Sheep River	US Threepoint	35.27	1130.87	1133.06

River	Reach	River Station (km)	Min Channel El. (m)	WSE (m) for 100-year Flood
Sheep River	US Threepoint	35.02	1129.22	1131.24
Sheep River	US Threepoint	34.89	1128.98	1130.76
Sheep River	DS Threepoint	34.28	1126.03	1129.22
Sheep River	DS Threepoint	34.12	1125.01	1128.74
Sheep River	DS Threepoint	33.83	1124.45	1127.60
Sheep River	DS Threepoint	33.62	1124.00	1126.93
Sheep River	DS Threepoint	33.44	1122.42	1126.53
Sheep River	DS Threepoint	33.23	1122.14	1125.96
Sheep River	DS Threepoint	33.04	1121.41	1125.15
Sheep River	DS Threepoint	32.89	1120.48	1124.53
Sheep River	128 St Overflow	2.78	1140.31	1142.86
Sheep River	128 St Overflow	2.72	1139.73	1142.45
Sheep River	128 St Overflow	2.67	1139.63	1141.77
Sheep River	128 St Overflow	2.57	1139.27	1141.5
Sheep River	128 St Overflow	2.53	1138.82	1141.39
Sheep River	128 St Overflow	2.46	1138.51	1140.52
Sheep River	128 St Overflow	2.39	1138.12	1139.65
Sheep River	128 St Overflow	2.33	1137.61	1139.63
Sheep River	128 St Overflow	2.23	1136.98	1138.48
Sheep River	128 St Overflow	2.16	1135.43	1137.68
Sheep River	128 St Overflow	2.05	1135.19	1136.59
Sheep River	128 St Overflow	1.71	1132.24	1133.72
Sheep River	128 St Overflow	1.56	1131.56	1133.52
Sheep River	128 St Overflow	1.42	1130.99	1133.49
Sheep River	128 St Overflow	1.32	1129.42	1133.47
Sheep River	128 St Overflow	1.24	1128.58	1133.45
Sheep River	128 St Overflow	1.21	1128.74	1131.26
Sheep River	128 St Overflow	0.94	1126.34	1130.13
Sheep River	128 St Overflow	0.70	1126.84	1128.72
Sheep River	128 St Overflow	0.53	1124.76	1126.92
Sheep River	128 St Overflow	0.43	1122.15	1127.03
Sheep River	128 St Overflow	0.31	1126.00	1126.89
Sheep River	128 St Overflow	0.28	1125.71	1126.65
Sheep River	128 St Overflow	0.23	1125.38	1126.42
Sheep River	128 St Overflow	0.12	1124.47	1125.94
Sheep River	DS 128 Street	32.68	1119.92	1124.02
Sheep River	DS 128 Street	32.51	1119.08	1123.65

River	Reach	River Station (km)	Min Channel El. (m)	WSE (m) for 100-year Flood
Sheep River	DS 128 Street	32.32	1118.41	1122.83
Sheep River	DS 128 Street	32.00	1117.55	1121.58
Sheep River	DS 128 Street	31.63	1115.99	1120.00
Sheep River	DS 128 Street	31.27	1115.19	1118.50
Sheep River	DS 128 Street	30.87	1114.01	1116.93
Sheep River	DS 128 Street	30.44	1112.43	1114.96
Sheep River	DS 128 Street	30.09	1110.34	1113.79
Sheep River	DS 128 Street	29.73	1109.08	1112.35
Sheep River	DS 128 Street	29.46	1107.80	1109.98
Sheep River	DS 128 Street	29.12	1105.65	1108.51
Sheep River	DS 128 Street	28.89	1104.27	1107.58
Sheep River	DS 128 Street	28.66	1103.25	1106.27
Sheep River	DS 128 Street	28.38	1102.37	1105.19
Sheep River	DS 128 Street	28.02	1099.38	1103.39
Sheep River	DS 128 Street	27.79	1099.01	1101.83
Sheep River	DS 128 Street	27.53	1097.72	1101.37
Sheep River	DS 128 Street	27.25	1094.84	1100.54
Sheep River	DS 128 Street	26.88	1094.03	1098.87
Sheep River	DS 128 Street	26.47	1093.01	1096.80
Sheep River	DS 128 Street	26.24	1091.71	1095.52
Sheep River	DS 128 Street	25.82	1090.61	1093.94
Sheep River	DS 128 Street	25.50	1088.13	1092.78
Sheep River	DS 128 Street	25.21	1087.57	1091.51
Sheep River	DS 128 Street	24.99	1086.24	1090.24
Sheep River	DS 128 Street	24.78	1085.32	1089.27
Sheep River	DS 128 Street	24.54	1085.20	1088.75
Sheep River	DS 128 Street	24.40	1084.68	1088.60
Sheep River	DS 128 Street	24.12	1083.50	1087.78
Sheep River	DS 128 Street	23.85	1082.67	1086.46
Sheep River	DS 128 Street	23.58	1080.78	1085.46
Sheep River	DS 128 Street	23.27	1080.11	1084.00
Sheep River	DS 128 Street	22.98	1078.69	1083.00
Sheep River	DS 128 Street	22.77	1078.06	1082.12
Sheep River	DS 128 Street	22.46	1076.93	1081.09
Sheep River	DS 128 Street	22.17	1075.89	1079.96
Sheep River	DS 128 Street	21.85	1074.81	1078.36
Sheep River	DS 128 Street	21.80	1072.52	1078.35

River	Reach	River Station (km)	Min Channel El. (m)	WSE (m) for 100-year Flood
Sheep River	DS 128 Street	21.49	1071.75	1077.14
Sheep River	DS 128 Street	21.06	1070.39	1075.19
Sheep River	DS 128 Street	20.81	1070.05	1073.96
Sheep River	DS 128 Street	20.69	1069.83	1073.08
Sheep River	DS 128 Street	20.41	1069.40	1072.01
Sheep River	DS 128 Street	20.09	1067.02	1071.10
Sheep River	DS 128 Street	19.71	1064.98	1069.98
Sheep River	DS 128 Street	19.29	1063.47	1068.59
Sheep River	DS 128 Street	18.99	1062.68	1067.62
Sheep River	DS 128 Street	18.69	1061.97	1065.66
Sheep River	DS 128 Street	18.34	1060.09	1063.87
Sheep River	DS 128 Street	18.21	1059.43	1063.55
Sheep River	DS 128 Street	18.15	1059.20	1063.14
Sheep River	DS 128 Street	18.07	1058.49	1062.77
Sheep River	DS 128 Street	18.01	1058.19	1062.59
Sheep River	DS 128 Street	17.65	1056.47	1061.01
Sheep River	DS 128 Street	17.45	1056.42	1060.97
Sheep River	DS 128 Street	17.22	1054.82	1060.03
Sheep River	DS 128 Street	17.04	1055.24	1058.73
Sheep River	DS 128 Street	16.77	1053.81	1057.90
Sheep River	DS 128 Street	16.45	1052.57	1057.39
Sheep River	DS 128 Street	16.22	1051.81	1056.40
Sheep River	DS 128 Street	16.07	1051.12	1056.30
Sheep River	DS 128 Street	15.95	1050.80	1056.22
Sheep River	DS 128 Street	15.91	1051.09	1055.90
Sheep River	DS 128 Street	15.88	1050.91	1055.52
Sheep River	DS 128 Street	15.86	1050.68	1054.44
Sheep River	DS 128 Street	15.73	1050.03	1054.09
Sheep River	DS 128 Street	15.56	1049.37	1053.30
Sheep River	DS 128 Street	15.40	1049.23	1052.94
Sheep River	DS 128 Street	15.36	1048.39	1052.81
Sheep River	DS 128 Street	15.35	1048.29	1052.71
Sheep River	DS 128 Street	15.24	1047.97	1052.18
Sheep River	DS 128 Street	15.17	1047.58	1051.66
Sheep River	DS 128 Street	15.06	1048.02	1051.37
Sheep River	DS 128 Street	14.92	1046.92	1050.37
Sheep River	DS 128 Street	14.78	1046.43	1050.21

River	Reach	River Station (km)	Min Channel El. (m)	WSE (m) for 100-year Flood
Sheep River	DS 128 Street	14.62	1044.77	1049.83
Sheep River	DS 128 Street	14.45	1045.00	1049.00
Sheep River	DS 128 Street	14.25	1043.50	1048.09
Sheep River	DS 128 Street	14.04	1042.91	1047.44
Sheep River	DS 128 Street	13.82	1042.17	1046.45
Sheep River	DS 128 Street	13.65	1041.71	1045.76
Sheep River	DS 128 Street	13.48	1041.02	1045.67
Sheep River	DS 128 Street	13.25	1040.03	1045.43
Sheep River	DS 128 Street	13.13	1038.93	1044.75
Sheep River	DS 128 Street	13.12	1039.27	1044.52
Sheep River	DS 128 Street	13.01	1039.34	1044.59
Sheep River	DS 128 Street	12.85	1038.42	1044.58
Sheep River	DS 128 Street	12.75	1037.61	1044.26
Sheep River	DS 128 Street	12.73	1037.28	1042.44
Sheep River	DS 128 Street	12.64	1037.53	1041.56
Sheep River	DS 128 Street	12.55	1037.50	1041.35
Sheep River	DS 128 Street	12.47	1037.30	1040.62
Sheep River	DS 128 Street	12.34	1036.69	1040.25
Sheep River	DS 128 Street	12.25	1035.85	1039.82
Sheep River	DS Okotoks	12.02	1033.51	1038.05
Sheep River	DS Okotoks	11.90	1033.66	1037.72
Sheep River	DS Okotoks	11.75	1032.12	1036.74
Sheep River	DS Okotoks	11.54	1031.95	1036.63
Sheep River	DS Okotoks	11.47	1031.81	1035.41
Sheep River	DS Okotoks	11.25	1030.10	1034.07
Sheep River	DS Okotoks	10.93	1029.44	1033.16
Sheep River	DS Okotoks	10.63	1027.53	1032.31
Sheep River	DS Okotoks	10.45	1027.98	1031.83
Sheep River	DS Okotoks	10.15	1026.10	1031.09
Sheep River	DS Okotoks	9.87	1024.20	1028.92
Sheep River	DS Okotoks	9.58	1023.59	1028.59
Sheep River	DS Okotoks	9.31	1022.73	1026.81
Sheep River	DS Okotoks	9.09	1021.23	1025.74
Sheep River	DS Okotoks	8.79	1018.83	1025.41
Sheep River	DS Okotoks	8.44	1017.78	1024.01
Sheep River	DS Okotoks	8.2	1017.84	1022.40
Sheep River	DS Okotoks	7.94	1016.12	1021.39

River	Reach	River Station (km)	Min Channel El. (m)	WSE (m) for 100-year Flood
Sheep River	DS Okotoks	7.71	1014.85	1021.27
Sheep River	DS Okotoks	7.52	1013.47	1019.99
Sheep River	DS Okotoks	7.3	1013.29	1019.45
Sheep River	DS Okotoks	7.13	1013.06	1019.31
Sheep River	DS Okotoks	7.02	1011.83	1019.39
Sheep River	DS Okotoks	6.9789	1011.58	1018.25
Sheep River	DS Okotoks	6.94	1012.22	1017.37
Sheep River	DS Okotoks	6.85	1011.82	1016.79
Sheep River	DS Okotoks	6.6	1010.33	1015.54
Sheep River	DS Okotoks	6.32	1009.22	1014.07
Sheep River	DS Okotoks	6.01	1008.85	1013.58
Sheep River	DS Okotoks	5.77	1007.23	1012.98
Sheep River	DS Okotoks	5.59	1006.32	1012.15
Sheep River	DS Okotoks	5.29	1006.27	1010.04
Sheep River	DS Okotoks	5.16	1005.09	1009.87
Sheep River	DS Okotoks	5	1003.74	1009.12
Sheep River	DS Okotoks	4.83	1003.61	1007.92
Sheep River	DS Okotoks	4.64	1002.87	1007.38
Sheep River	DS Okotoks	4.4	1001.59	1006.85
Sheep River	DS Okotoks	4	1000.54	1005.32
Sheep River	DS Okotoks	3.64	998.64	1003.69
Sheep River	DS Okotoks	3.25	996.67	1002.48
Sheep River	DS Okotoks	2.98	995.93	1001.12
Sheep River	DS Okotoks	2.74	995.19	999.51
Sheep River	DS Okotoks	2.55	994.30	999.67
Sheep River	DS Okotoks	2.37	993.17	997.83
Sheep River	DS Okotoks	1.99	991.28	997.45
Sheep River	DS Okotoks	1.7	990.74	995.60
Sheep River	DS Okotoks	1.4	988.88	994.32
Sheep River	DS Okotoks	1.12	986.96	993.45
Sheep River	DS Okotoks	0.87	986.95	992.99
Sheep River	DS Okotoks	0.65	985.71	993.03
Sheep River	DS Okotoks	0.53	985.52	991.31
Sheep River	DS Okotoks	0.24	984.57	989.67
Sheep River	DS Okotoks	0	982.85	988.07

4. Design Flood Hazard Map Production

4.1 Floodway Mapping Methodology

The following procedure was used in ArcGIS to develop inundation extents for the design flood:

1. Assigned design flood water levels at each cross section
2. Created a continuous water surface elevation Triangulated Irregular Network (TIN) between cross sections
3. Manually adjusted the water surface elevation TIN in special areas.
4. Converted the adjusted TIN into a water surface elevation raster
5. The DTM raster was subtracted from water surface elevation raster to define wet areas
6. A code of "NoData" was assigned to all dry raster cells
7. Conversion of wet areas into a flood inundation polygon dataset and deletion of all features not related to main river channels
8. Overall cleanup and simplification of polygons
9. Smoothing of polygon outlines using the PAEK algorithm

In addition to the above procedure, backwater inundation for any large tributary areas was included based on the design water levels at the main channel at the confluences of these tributaries.

4.2 Floodway Criteria Maps

Floodway criteria maps show the basis for determining the floodway and flood fringe extents for the design flood, and document the results of the model simulations of water level, depths, and flow velocities in a reach. The open water floodway criteria maps included the following:

- The extent of the open water design flood
- Areas meeting or exceeding the 1 m depth floodway criterion for the design flood
- The locations along each model cross section where flow velocities estimated to meet the 1 m/s velocity criterion
- The locations of the main channel top of bank
- The floodway boundary for the open water design flood

- The location and extent of all cross sections used in the HEC-RAS models with appropriate labels
- Background aerial imagery
- Roads, bridges, and flood control structures.

The governing floodway criteria maps were prepared in a scale of 1:7,500 in the study datum and coordinate system (CSRS NAD83, 111° 3TM). The maps are provided in Appendix A.

4.3 Flood Hazard Maps

4.3.1 Overview

The flood hazard maps provide a display of the areas along each river reach that are either in the floodway and/or the flood fringe. The floodway was determined in accordance with the criteria listed above, and the flood fringe includes all other directly inundated areas that lie outside of the floodway. The maps are provided in Appendix B.

4.3.2 Areas in the Floodway

The key development areas and structures that lie within the Floodway are briefly summarized below.

Sheep River

- The west end of 2430 Drive West (map sheet 3).
- Low lying areas of the floodplain at Calkins Place South East near Turner Valley (map sheet 5).
- Low lying areas of the floodplain at North Royalite Way North East near Turner Valley (map sheet 5).
- Flood control dike at km 41.95 just downstream of Black Diamond (map sheet 6).
- The lower chords would be submerged on two bridges on the Sheep River – the Highway 2A crossing in Okotoks (map sheet 14) and the Highway 22 crossing in Black Diamond (map sheet 6).
- Flood control dike at km 37.25 (map sheet 7).
- Large floodplain area and a number of low lying residences and roads at the Threepoint Creek and Sheep River confluence (map sheet 8).
- Large areas of the floodplain, and a rural residence at km 32 (map sheet 9).
- Meridian Street and sections low lying floodplain areas to the west of Meridian Street (map sheet 13).
- Various residences and infrastructure between km 11.89 and km 10.93 downstream of Okotoks (map sheet 15).

- Access road to Okotoks water treatment facility (map sheet 15).
- Northern sections of the Country Lanes Estates RV park just upstream of Highway 2 (map sheet 16).

Threepoint Creek

- Residences located at km 31.9 (map sheets 19-20).
- Sections of the 2338 Drive West roadway (map sheets 19-20).
- Sections of the 256 Street West roadway (map sheet 21-22).
- Low lying floodplain areas around Millarville Landing, and overtopping of both highways 22 and 549 (map sheet 23).
- Flooding of low lying areas of the Millerville Racing and Agricultural society grounds at km 11.72 (map sheet 25).

4.3.3 *Areas in the Flood Fringe*

The key development areas and structures that lie within the Flood Fringe are briefly summarized below.

Sheep River

- Low lying areas of the floodplain at Calkins Place South East near Turner Valley (map sheet 5).
- Low lying areas of the floodplain at North Royalite Way North East near Turner Valley (map sheet 5).
- Areas of Black Diamond to the south of the 22 Highway bridge crossing (high hazard) up to 1 St Northwest (map sheet 6).
- Low lying areas and roads at the Threepoint Creek and Sheep River confluence (map sheet 8).
- The Okotoks waste water treatment facility and Eco Center, located just upstream of the 32nd St E bridge crossing (map sheets 14-15).
- Okotoks Lions Campground (high hazard flood fringe) (map sheet 14).
- Numerous areas within Okotoks, particularly along the north bank of the river, where the river overflows through a section of the downtown area (map sheets 13-15).
- Southern sections of the Country Lanes Estates RV park just upstream of Highway 2 (map sheet 16).

Threepoint Creek

- Sections of the 2338 Drive West roadway (map sheets 19-20)

- Low lying floodplain areas and residences to the south of Highway 529, south of Millarville Landing (map sheet 23)
- Flooding of low lying areas of the Millarville Racing and Agricultural society grounds at km 11.72 (map sheet 25)

5. Design Flood Grids

Flood risk inventory studies have been completed to define and quantify flood risks in the Sheep River study.

5.1 Water Surface Elevation Grids

A water surface elevation grid was created by converting the water surface elevation TIN into a raster file with the same resolution as the DTM.

5.2 Flood Depth Grids

A flood depth grid was created by subtracting the water surface elevation grid from the DTM. The flood depth grid has the same resolution and alignment as the DTM, and includes all inundated areas.

6. Conclusions

The boundary between the floodway and flood fringe was determined using the calibrated HEC-RAS model and in consideration of the criteria for floodway determination. The floodway typically includes areas where water depths are greater than 1 m or where flow velocities are greater than 1 m/s. Exceptions may be made for ineffective flow areas, backwater areas or to accommodate a hydraulically smooth floodway line.

The governing floodway and flood fringe areas were then delineated for the Sheep River and Threepoint Creek, and are summarized in the mapping series included in Appendix B of this report.

7. References

- AEP (Alberta Environment and Parks). 2011. *Flood Hazard Identification Program Guidelines*. July 2011
- AFW (WOOD), 2017. *Sheep River Hazard Study Survey and Base Data Collection Report*
- Hatch. 2019a. *Sheep River Hazard Study – Hydraulic Model Creation, Calibration and Inundation Mapping Report*, July 2019.
- Hatch. 2019b. *Sheep River Hazard Study – Open Water Flood Hazard Identification Report*, July 2019.

DRAFT

Appendix A

Flood Criteria Mapping

DRAFT

March, 2023

SHEEP RIVER FLOOD HAZARD STUDY

FLOODWAY CRITERIA MAP LIBRARY

Definitions

Flood Hazard Map - A flood hazard map is a specific type of flood map that identifies the area flooded for the 1:100 design flood, and divides that flood hazard area into floodway and flood fringe zones. Flood hazard maps can also show additional flood hazard information, including the incremental areas at risk for more severe floods like the 1:200 and 1:500 floods. Flood hazard maps are typically used for long-term flood hazard area management and land-use planning.

Design Flood - The design flood standard in Alberta is the 1:100 flood, which is a flood that has a 1% chance of being equaled or exceeded in any given year. The design flood is typically based on the 1:100 open water flood, but it can also reflect 1:100 ice jam flood levels or be based on a historical flood event. Different sized floods have different chances of occurring – for example, a 1:200 flood has a 0.5% chance of occurring in any given year and a 1:500 flood has a 0.2% chance of occurring in any given year – but only the 1:100 design flood is used to define the floodway and flood fringe zones on flood hazard maps.

Floodway - When a floodway is first defined on a flood hazard map, it typically represents the area of highest flood hazard where flows are deepest, fastest, and most destructive during the 1:100 design flood. When a flood hazard map is updated, the floodway will not get larger in most circumstances to maintain long-term regulatory certainty, even if the flood hazard area gets larger or design flood levels get higher.

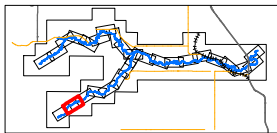
Flood Fringe - The flood fringe is the area outside of the floodway that is flooded or could be flooded during the 1:100 design flood. The flood fringe typically represents areas with shallower, slower, and less destructive flooding, but it may also include "high hazard flood fringe" areas. Areas at risk of flooding behind flood berms may also be mapped as "protected flood fringe" areas.

High Hazard Flood Fringe - The high hazard flood fringe identifies areas within the flood fringe with deeper or faster moving water than the rest of the flood fringe. High hazard flood fringe areas are likely to be most significant for flood maps that are being updated, but they may also be included in new flood maps.

Protected Flood Fringe - The protected flood fringe identifies areas that could be flooded if dedicated flood berms fail or do not work as designed during the 1:100 design flood, even if they are not overtopped. Protected flood fringe areas are part of the flood fringe and do not differentiate between areas with deeper or faster moving water and shallower or slower moving water.



- LEGEND**
- CROSS SECTION
 - SECTION CROSS SECTION NUMBER
 - FLOW DIRECTION
 - STUDY BOUNDARY
 - FLOOD CONTROL STRUCTURES
 - BRIDGES
 - PRIMARY HIGHWAY
 - LOCAL ROAD/LOCAL STREET
 - RAILWAY
 - WATER BARRIER
 - FLOODWAY DIVERSION
 - PREVIOUS FLOODWAY
 - VELOCITY'S DATA
 - PROPOSED FLOODWAY
 - FLOOD EXTENT > 100 YEAR
 - DEPTH DATA
 - WATER BARRIER
 - WATER BARRIER



REFERENCES

1. ALBERTA ENVIRONMENT AND PARKS, "SHEEP RIVER FLOOD HAZARD STUDY", 2011. ALL RIGHTS RESERVED.

2. BROWN, CAPTAIN P.B., 2011. BY GEOSY GROUP INC., FOR THE GOVERNMENT OF ALBERTA.

3. DATA AND GIS COORDINATE SYSTEM 114

SHEEP RIVER FLOOD HAZARD STUDY

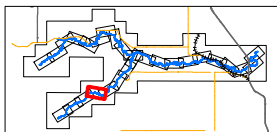
DESIGN FLOODWAY CRITERIA MAP

REVISIONS

NO.	DESCRIPTION	DATE
1	DESIGNED BY: J. L. LAMONTAGNE	2011/01/11
2	DESIGNED BY: J. L. LAMONTAGNE	2011/01/11
3	DESIGNED BY: J. L. LAMONTAGNE	2011/01/11
4	DESIGNED BY: J. L. LAMONTAGNE	2011/01/11

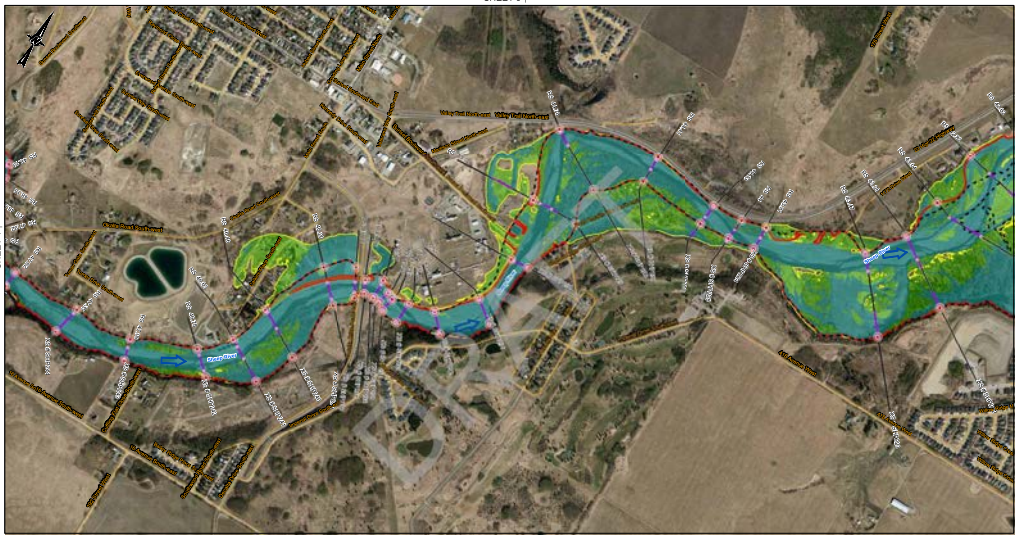
PROJECT DATA

PROJECT NO.	CONTRACT NO.	SCALE	DATE
H055730	228-272-0008-3321	0	Sheet 2 of 28

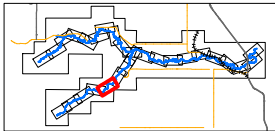
PROJECT
SHEEP RIVER FLOOD HAZARD STUDY

DESIGN FLOODWAY CRITERIA MAP

PROJECT NO.	CONTROL	REV.	FIGURE
H/355730	228-273-0008-3321	0	Sheet 4 of 28



- | LEGEND | | | |
|--------|--------------------------|--|-------------------------|
| | CROSS SECTION | | BANK STATION |
| | CROSS SECTION NUMBER | | FLOWWAY STATION |
| | FLOW DIRECTION | | PREVIOUS FLOWWAY |
| | STUDY BOUNDARY | | VELOCITY > 3 m/s |
| | FLOOD CONTROL STRUCTURES | | PROPOSED FLOWWAY |
| | BRIDGES | | FLOOD EXTENT - 100 YEAR |
| | PRIMARY HIGHWAY | | DEPTH > 1m |
| | LOCAL ROAD, LOCAL STREET | | SHEEP HEADS = 700 m |
| | RAILWAY | | |



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DATUM: NAD 83 CSRS PROJECT 10M3TM 114

PROJECT
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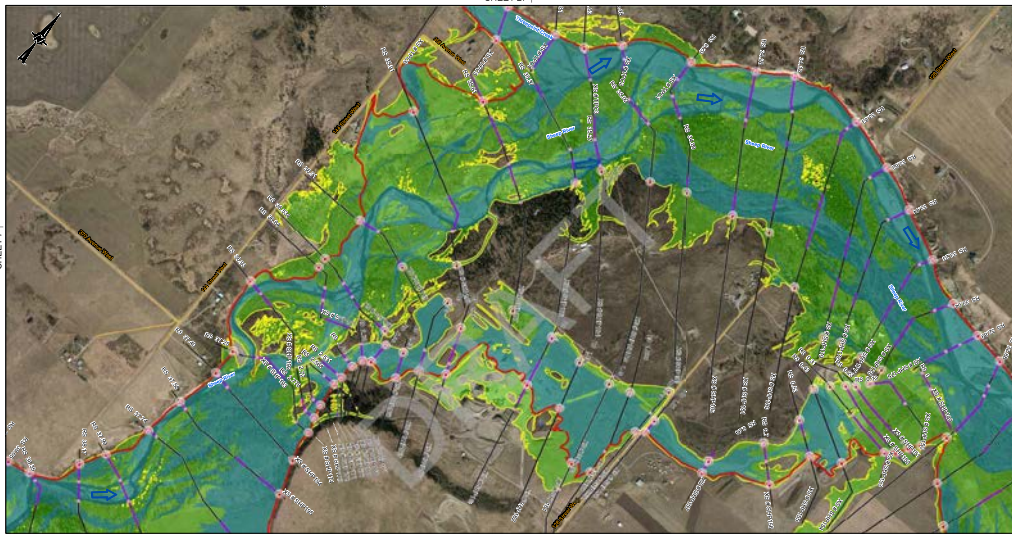
ALBERTA ENVIRONMENT
AND PARKS

HATCH

DESIGNED	N. LANGENBERG	2023-03-31
PREPARED	R. GROENEVELD	2023-03-31
REVIEWED	N. LANGENBERG	2023-03-31
APPROVED	A. GROENEVELD	2023-03-31

TITLE
DESIGN FLOODWAY CRITERIA MAP

PROJECT NO.	CONTROL	REV.	SHEET
H/355730	228-272-0008-3321	0	Sheet 5 of 28

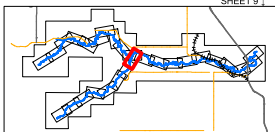


LEGEND

CROSS SECTION
 CROSS SECTION NUMBER
 FLOOD DIRECTION
 STUDY BOUNDARY
 FLOOD CONTROL STRUCTURES
 BRIDGES
 PRIMARY HIGHWAY
 LOCAL ROAD/LOCAL STREET
 HIGHWAY

WAKE SIGN
 FLOODWAY SIGN
 PREVIOUS FLOODWAY
 VELOCITY SIGN
 PROPOSED FLOODWAY
 FLOOD EXTENT 100 YEAR
 DEPTH SIGN

ABBREVIATIONS
 FLOODWAY CRITERIA 100 YRS
 SHEEP RIVER 100 YRS
 SHEEP RIVER 100 YRS 100 YRS 100 YRS



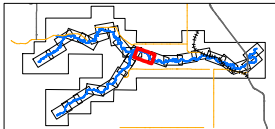
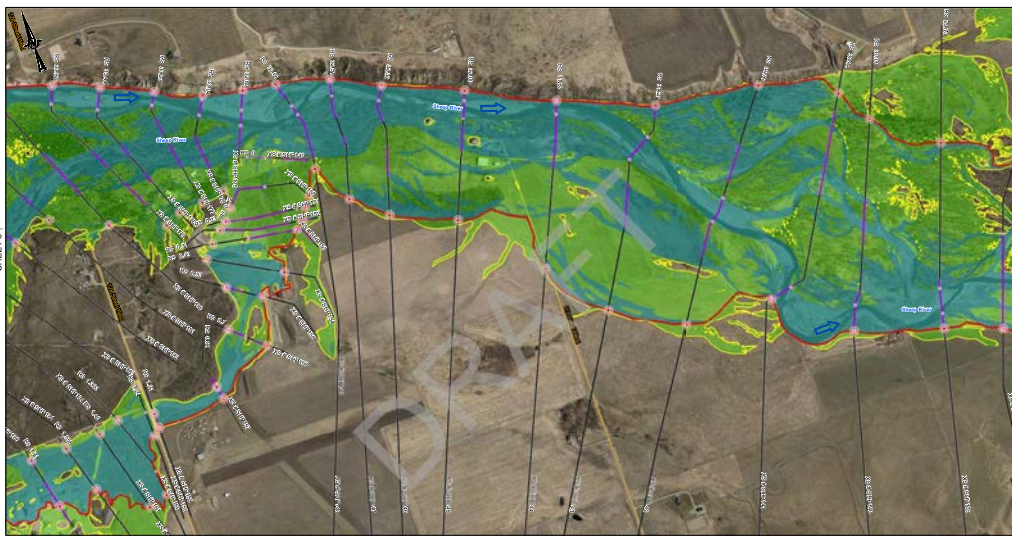
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 DATUM AND 83 COORDINATE SYSTEM 114

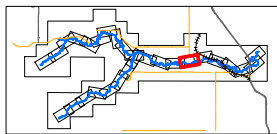
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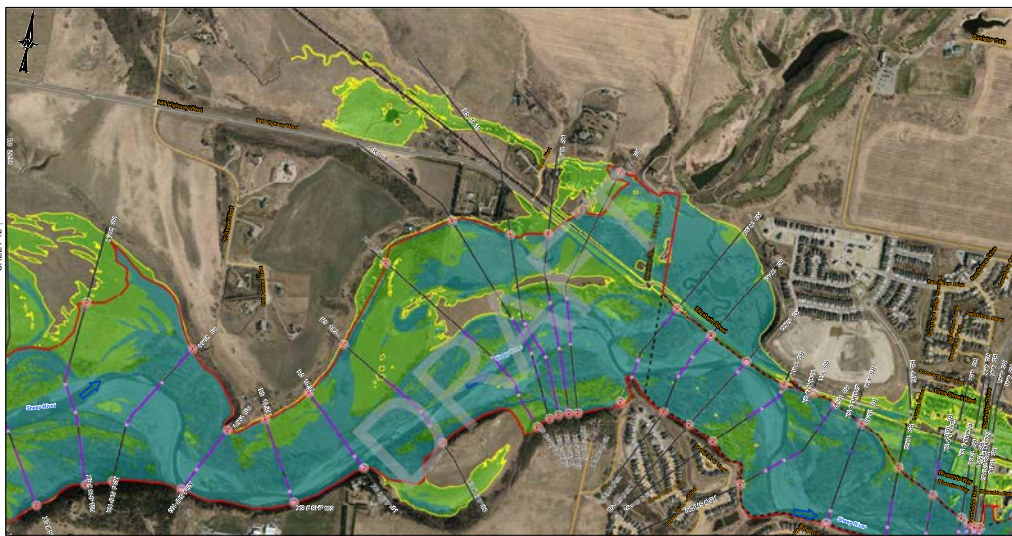
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 PROJECT NO. 228-272-0008-3321
 SHEET 8 OF 28

ALBERTA ENVIRONMENT AND PARKS
Alberta Government
HATCH

DESIGNED M. L. LEBLANC
PREPARED M. L. LEBLANC
REVIEWED M. L. LEBLANC
APPROVED M. L. LEBLANC



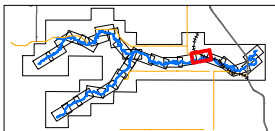




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 — FLOOD SECTION
 — STUDY BOUNDARY
 — FLOOD CONTROL STRUCTURES
 — BRIDGES
 — PRIMARY HIGHWAY
 — LOCAL ROAD/LOCAL STREET
 — HIGHWAY

— BANK ELEVATION
 — FLOODWAY ELEVATION
 — PREVIOUS FLOODWAY
 — VELOCITY'S DATA
 — PROPOSED FLOODWAY
 — FLOOD EXTENT-100 YEAR
 — DEPTH DATA
 — FLOOD EXTENT-1000 YRS



ALBERTA ENVIRONMENT AND PARKS
 Alberta Government
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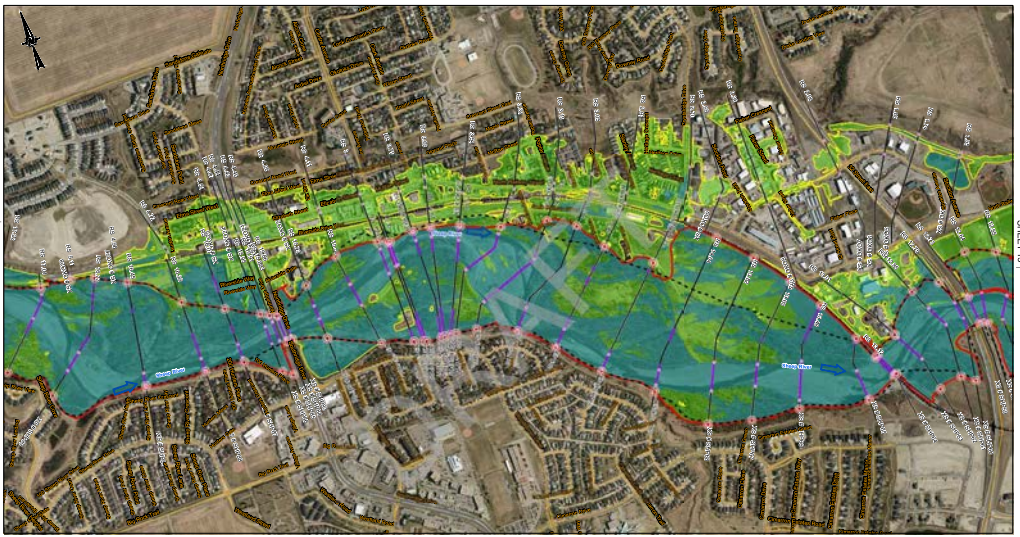
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 PREPARED: M. LINDENBERG 00342621
 REVIEWED: M. LINDENBERG 00342621
 APPROVED: M. LINDENBERG 00342621

REFERENCES:
 NOTES: THE DATA AND POPULATED AREAS ARE FROM ALBERTA GOVERNMENT OF ALBERTA 2011. ALL RIGHTS RESERVED.
 BASED ON: CAPRI, 2011 BY GEODESY GROUP INC., FOR THE GOVERNMENT OF ALBERTA.
 DATA AND GIS COORDINATE SYSTEM: NAD 83

SHEEP RIVER FLOOD HAZARD STUDY

DESIGN FLOODWAY CRITERIA MAP

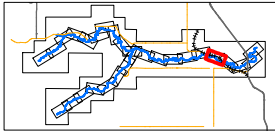
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 SHEET: 0
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 STUDY BOUNDARY
 FLOOD CONTROL STRUCTURES
 BRIDGE
 PRIMARY HIGHWAY
 LOCAL ROAD/LOCAL STREET
 HIGHWAY

WATER ELEVATION
 FLOODWAY ELEVATION
 PREVIOUS FLOODWAY
 VELOCITY'S DATA
 PROPOSED FLOODWAY
 FLOOD EXTENT 100 YEAR
 DEPTH 100 YEAR
 FLOODWAY ELEVATION 1000 m²/s

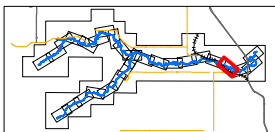
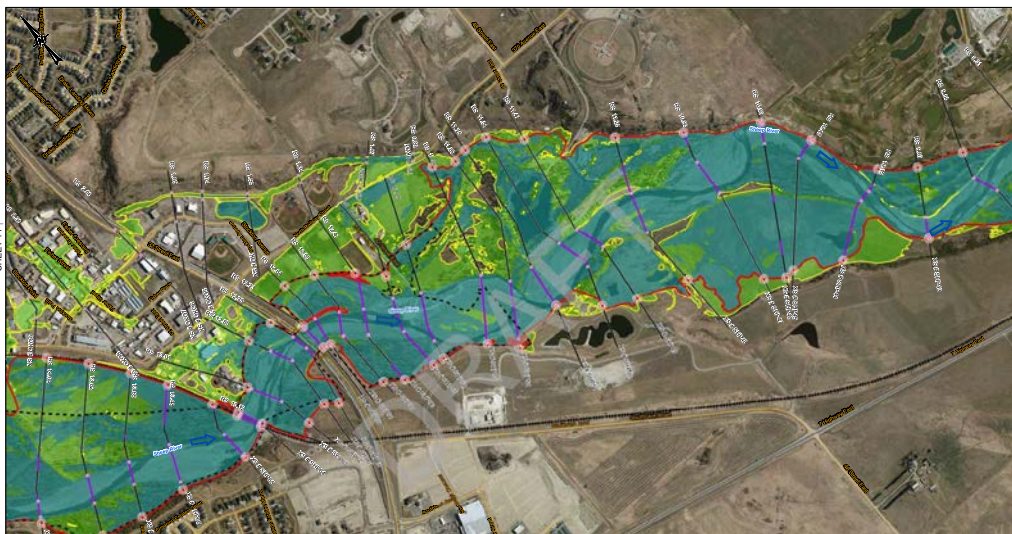


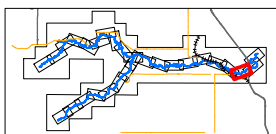
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 NOTES: THE DATA AND POPULATED AREAS ARE PROXIMALS. © GOVERNMENT OF ALBERTA 2017. ALL RIGHTS RESERVED.
 BASEMAP CAPTURED IN 2016 BY GEODESY GROUP INC., FOR THE GOVERNMENT OF ALBERTA.
 DATUM AND 83 CORDINATE SYSTEM 114

ALBERTA ENVIRONMENT AND PARKS
 Alberta Government
 HATCH

DESIGNED: M. LAMBERG (00040421)
 PREPARED: M. LAMBERG (00040421)
 REVIEWED: M. LAMBERG (00040421)
 APPROVED: M. LAMBERG (00040421)

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 PROJECT NO.: H055730
 CONTROL: 228-272-0008-3321
 SHEET: 0
 SHEET 14 OF 28

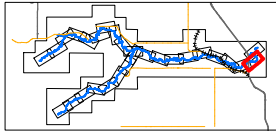
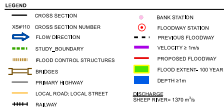




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IMAGERY CAPTURED APRIL 2017 BY ODYSSEY GROUP INC. FOR THE GOVERNMENT OF ALBERTA.
DATUM: NAD 83 CRS80PROJECTION: NTFM 114

TITLE
DESIGN FLOODWAY CRITERIA MAP

PROJECT NO.	CONTROL	REV.	FIGURE
H/355730	228-272-0008-3321	0	Sheet 16 of 28



0 100 200 300 400
1:10,000 METRES

ALBERTA ENVIRONMENT
AND PARKS

Alberta Government

HATCH

DESIGNED	N. LANGENBERG	2004/04/01
PREPARED	N. GROENEVELD	2004/04/01
REVIEWED	N. LANGENBERG	2004/04/01
APPROVED	N. GROENEVELD	2004/04/01

REFERENCE(S)
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BAGGERY CAPTURED APRIL 2017 BY OGDDEY GROUP INC. FOR THE GOVERNMENT OF
ALBERTA.
DRAWING NO. &33-DR-SPR-FLOOD-ITM 114

PROJECT
SHEEP RIVER FLOOD HAZARD STUDY

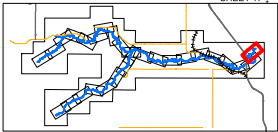
TITLE
DESIGN FLOODWAY CRITERIA MAP

PROJECT NO.	CONTROL	REV.	DATE
H355730	228-72-0008-3321	0	

Sheet 17 of 21



- LEGEND**
- CROSS SECTION
 - SECTION CROSS SECTION NUMBER
 - FLOW DIRECTION
 - STUDY BOUNDARY
 - FLOOD CONTROL STRUCTURES
 - BRIDGES
 - PRIMARY HIGHWAY
 - LOCAL ROAD/LOCAL STREET
 - RAILWAY
 - WATER BARRIER
 - WATER BARRIER 1:200-1:500



REFERENCES

NOTES: THE DATA AND POPULATED AREAS ARE FROM ALBERTA GOVERNMENT OF ALBERTA 2017. ALL RIGHTS RESERVED.

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DATA: AND BY GEODESY GROUP INC. 2017.

DESIGN RIVER FLOOD HAZARD STUDY

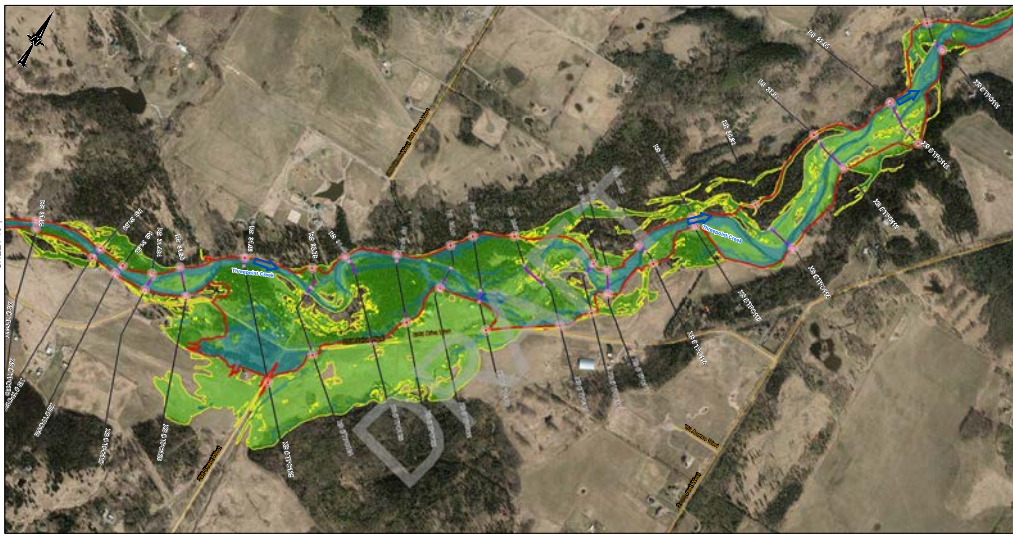
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REVISIONS

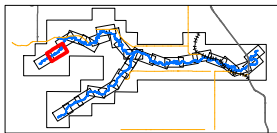
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PROJECT DATA

PROJECT NO.	CONTROL	SCALE	SHEET
H355730	228-272-0008-3321	0	Sheet 18 of 28



- LEGEND**
- CROSS SECTION
 - CROSS SECTION NUMBER
 - FLOOD SECTION
 - STUDY BOUNDARY
 - FLOOD CONTROL STRUCTURES
 - BRIDGES
 - PRIMARY HIGHWAY
 - LOCAL ROAD/LOCAL STREET
 - HIGHWAY
 - BANK ELEVATION
 - FLOODWAY ELEVATION
 - PROPOSED FLOODWAY
 - VELOCITY'S DATA
 - FLOOD EXTENT-100 YEAR
 - DEPTH DATA



REFERENCES

NOTES: THE DATA AND POPULATED AREAS ARE FROM ALBERTA GOVERNMENT OF ALBERTA 2011. ALL RIGHTS RESERVED.
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 DATA AND 83 CORRECTIONS/REVISIONS 114

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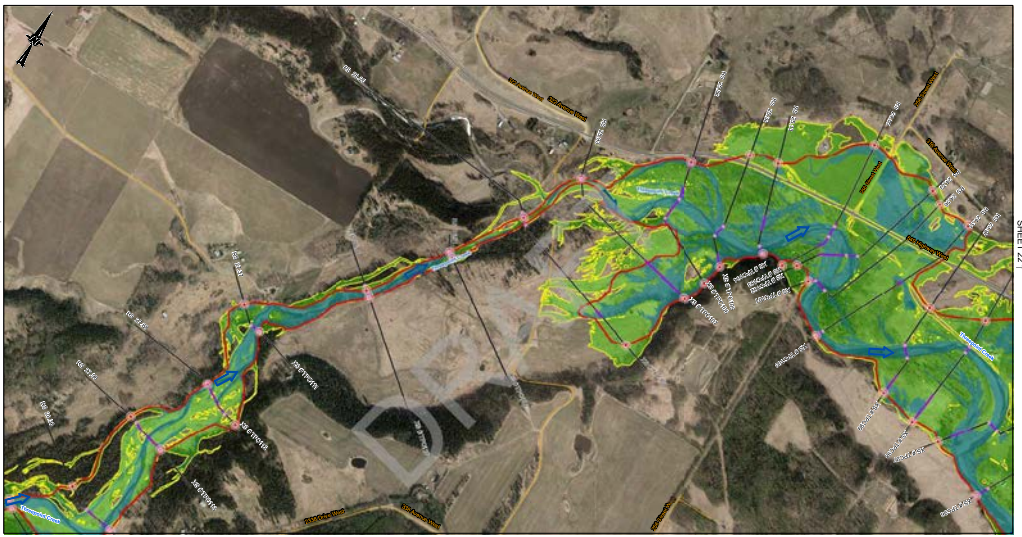
ALBERTA ENVIRONMENT AND PARKS

Alberta Government

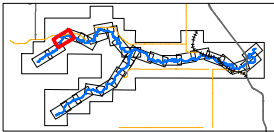
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PROJECT NO. 228-272-0008-3321
 SHEET 20 OF 28



- LEGEND**
- CROSS SECTION
 - SECTION CROSS SECTION NUMBER
 - FLOW DIRECTION
 - STUDY BOUNDARY
 - FLOOD CONTROL STRUCTURES
 - BRIDGE
 - PRIMARY HIGHWAY
 - LOCAL ROAD/LOCAL STREET
 - RAILWAY
 - WATER BARRIER
 - FLOODWAY DIVERSION
 - PREVIOUS FLOODWAY
 - VELOCITY ZONE
 - PROPOSED FLOODWAY
 - FLOOD EXTENT 100 YEAR
 - DEPTH ZONE
- ABBREVIATIONS**
THRESHOLD CRITERIA 146 (N/A)
THRESHOLD CRITERIA 285 (N/A) (UNAD 2015)



REFERENCES
LOCAL, REGIONAL AND POPULATED AREAS ARE FROM ALTA. © GOVERNMENT OF ALBERTA 2017. ALL RIGHTS RESERVED.
BASE MAP CAPTURED FROM CITY OF CALGARY GROUPING, FOR THE GOVERNMENT OF ALBERTA.
DATA HAND BY CIPROJECT/REINSTEIN 114

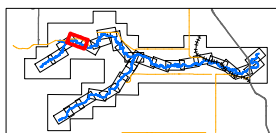
ALBERTA ENVIRONMENT AND PARKS *Alberta Government*

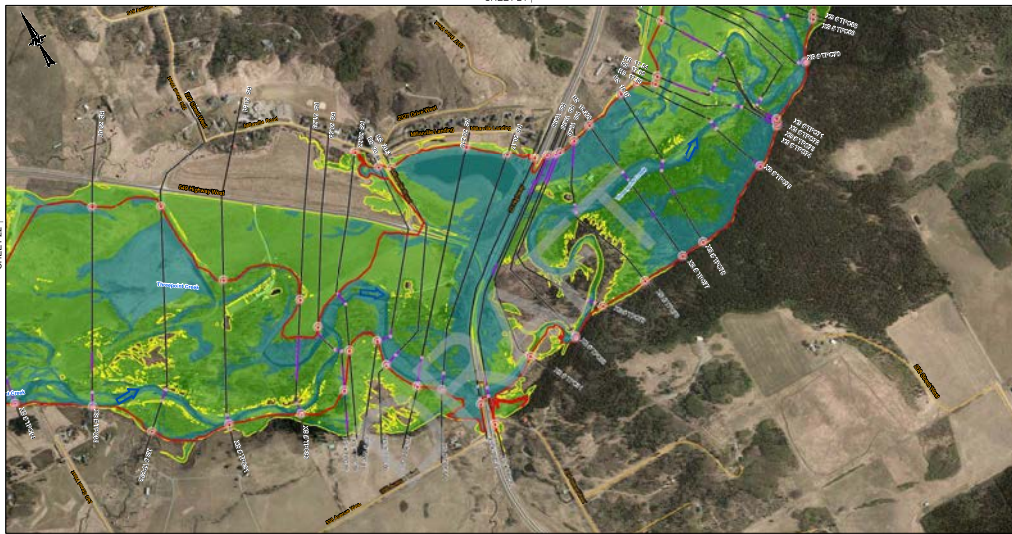
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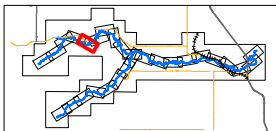
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PROJECT NO.	CONTROL	SCALE	DATE
H055730	228-272-0008-3321	0	Sheet 21 of 28





- LEGEND**
- CROSS SECTION
 - XXXX CROSS SECTION NUMBER
 - FLOOD SECTION
 - STUDY BOUNDARY
 - FLOOD CONTROL STRUCTURES
 - BRIDGE
 - PRIMARY HIGHWAY
 - LOCAL ROAD/LOCAL STREET
 - HIGHWAY
 - BANK ELEVATION
 - FLOODWAY ELEVATION
 - PROPOSED FLOODWAY
 - VELOCITY'S DATA
 - FLOOD EXTEND 100 YEAR
 - DEPTH DATA
 - FLOODWAY CRITERIA 400 kPa



ALBERTA ENVIRONMENT
AND PARKS

Alberta Government

HATCH

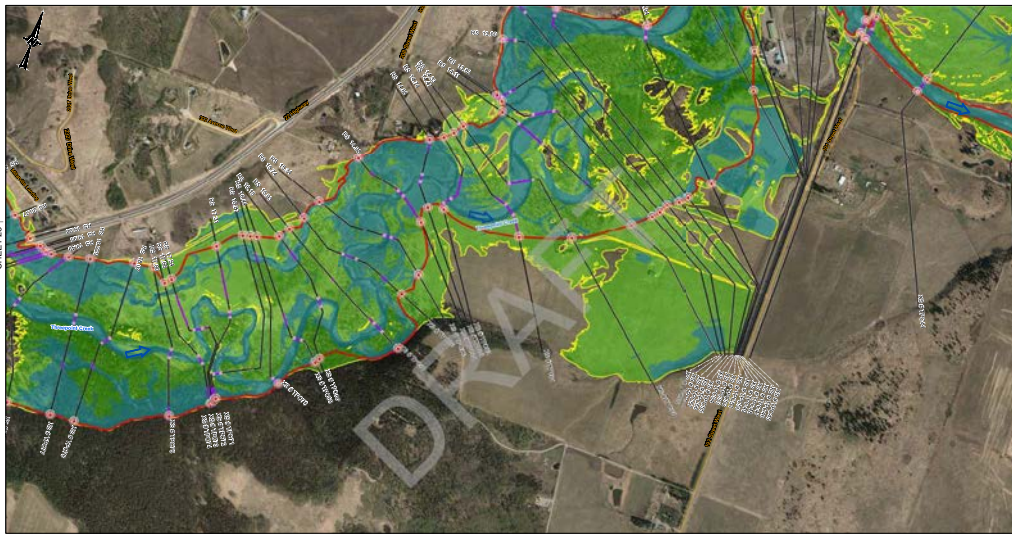
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BANK ELEVATION DATA, 2011 BY GEODESY GROUP INC., FOR THE GOVERNMENT OF ALBERTA.
DATA AND GIS CORRESPONDENCE ITEM 114

SHEEP RIVER FLOOD HAZARD STUDY

DESIGN FLOODWAY CRITERIA MAP

DESIGNED BY: N. LAMBERG (00342621)
PREPARED BY: N. LAMBERG (00342621)
REVIEWED BY: N. LAMBERG (00342621)
APPROVED BY: A. GROENEVELD (00342621)

PROJECT NO.: 228-272-2008-3321
SHEET: 0
DATE: Sheet 23 of 28

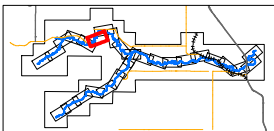


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CROSS SECTION
 CROSS SECTION NUMBER
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 STUDY BOUNDARY
 FLOOD CONTROL STRUCTURES
 BRIDGE
 HIGHWAY
 LOCAL ROAD/LOCAL STREET
 RAILWAY

WATER BOUNDARY
 FLOODWAY DIVISION
 PREVIOUS FLOODWAY
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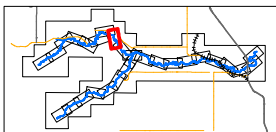
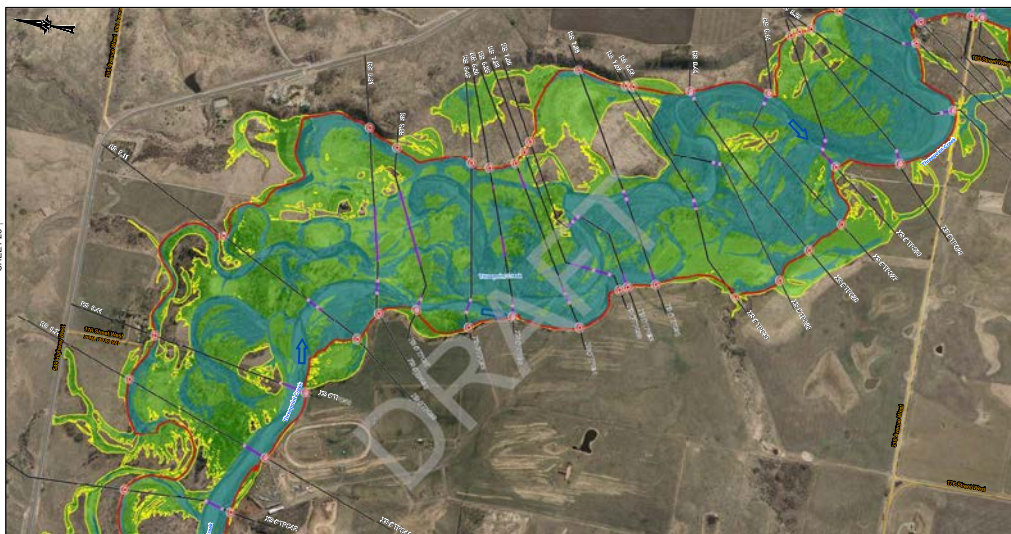
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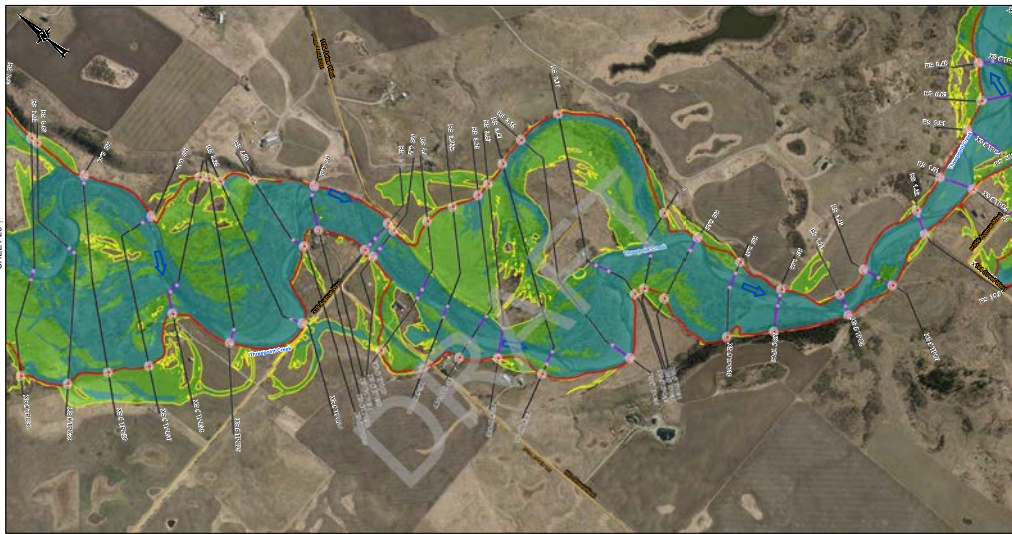


REFERENCES
 ALBERTA ENVIRONMENT AND PARKS
 ALBERTA GOVERNMENT
 HATCH

DESIGN FLOODWAY CRITERIA MAP

PROJECT NO. 228-272-0008-3321
 CONTROL 0
 SHEET 24 OF 28





LEGEND

CROSS SECTION

CROSS SECTION NUMBER

FLOW DIRECTION

STUDY BOUNDARY

FLOOD CONTROL STRUCTURES

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LOCAL ROAD/LOCAL STREET

RAILWAY

WATER BARRIER

FLOODWAY DIVERSION

PREVIOUS FLOODWAY

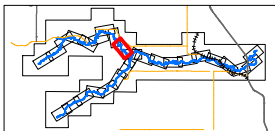
VELOCITY ZONE

PROPOSED FLOODWAY

FLOOD EXTEND 100 YEAR

DEPTH ZONE

ALBERTA ENVIRONMENT AND PARKS



REFERENCES

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BASE MAP CAPTURED FROM: CITY OF CALGARY GROUPING, FOR THE GOVERNMENT OF ALBERTA.

DATA: AND 83 CENSUS/POC/REG/ST/114

DESIGN FLOODWAY CRITERIA MAP

ALBERTA ENVIRONMENT AND PARKS

Alberta Government

HATCH

DESIGNED: A. LAMARCA (20140401)

DRAWN: A. LAMARCA (20140401)

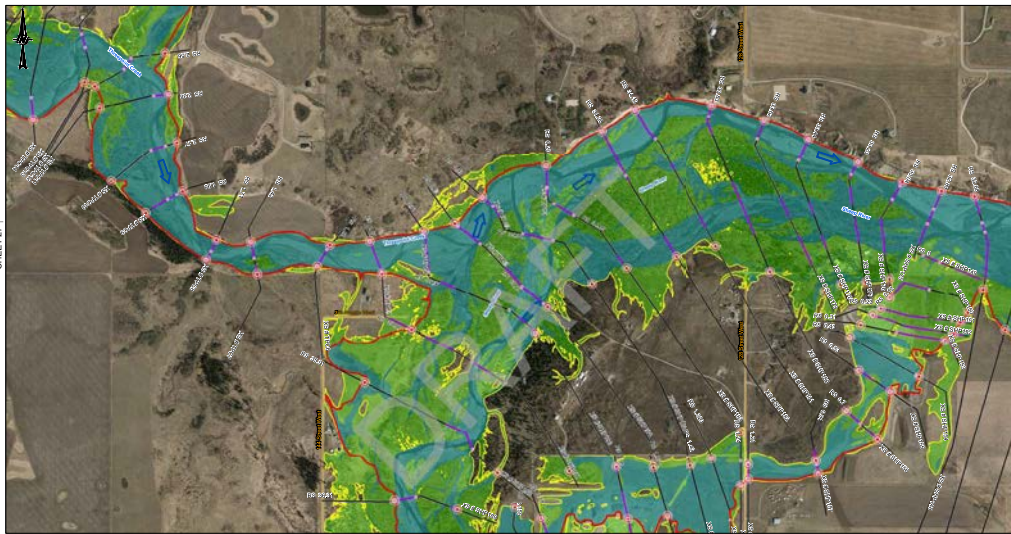
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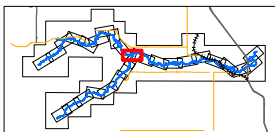
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SHEET 27 OF 28



- LEGEND**
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 - CROSS SECTION NUMBER
 - FLOOD SECTION
 - STUDY BOUNDARY
 - FLOOD CONTROL STRUCTURES
 - IMPERV
 - PRIMARY HIGHWAY
 - LOCAL ROAD/LOCAL STREET
 - RAILWAY
 - BANK ELEVATION
 - FLOODWAY DIVISION
 - PREVIOUS FLOODWAY
 - VELOCITY'S DATA
 - PROPOSED FLOODWAY
 - FLOOD EXTENT-100 YEAR
 - DEPTH DATA
- NOTES**
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REFERENCES

ALBERTA ENVIRONMENT AND PARKS
ALBERTA GOVERNMENT
HATCH

DESIGN FLOODWAY CRITERIA MAP

PROJECT NO. 228-272-0008-3321
SHEET 28 OF 28

DATE: 2018-01-15
BY: J. L. LAMONTAGNE
CHECKED: J. L. LAMONTAGNE
APPROVED: J. L. LAMONTAGNE

DESIGN FLOODWAY CRITERIA MAP

PROJECT NO. 228-272-0008-3321
SHEET 28 OF 28

Appendix B

Flood Hazard Mapping

DRAFT

March, 2023

SHEEP RIVER FLOOD HAZARD STUDY

DESIGN FLOOD HAZARD MAP LIBRARY

Definitions

Flood Hazard Map - A flood hazard map is a specific type of flood map that identifies the area flooded for the 1:100 design flood, and divides that flood hazard area into floodway and flood fringe zones. Flood hazard maps can also show additional flood hazard information, including the incremental areas at risk for more severe floods like the 1:200 and 1:500 floods. Flood hazard maps are typically used for long-term flood hazard area management and land-use planning.

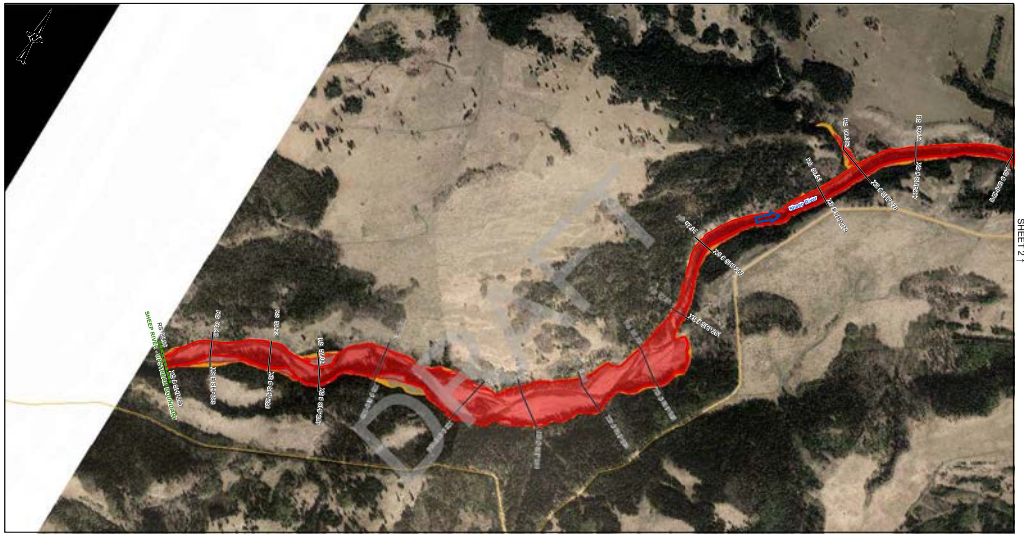
Design Flood - The design flood standard in Alberta is the 1:100 flood, which is a flood that has a 1% chance of being equaled or exceeded in any given year. The design flood is typically based on the 1:100 open water flood, but it can also reflect 1:100 ice jam flood levels or be based on a historical flood event. Different sized floods have different chances of occurring – for example, a 1:200 flood has a 0.5% chance of occurring in any given year and a 1:500 flood has a 0.2% chance of occurring in any given year – but only the 1:100 design flood is used to define the floodway and flood fringe zones on flood hazard maps.

Floodway - When a floodway is first defined on a flood hazard map, it typically represents the area of highest flood hazard where flows are deepest, fastest, and most destructive during the 1:100 design flood. When a flood hazard map is updated, the floodway will not get larger in most circumstances to maintain long-term regulatory certainty, even if the flood hazard area gets larger or design flood levels get higher.

Flood Fringe - The flood fringe is the area outside of the floodway that is flooded or could be flooded during the 1:100 design flood. The flood fringe typically represents areas with shallower, slower, and less destructive flooding, but it may also include "high hazard flood fringe" areas. Areas at risk of flooding behind flood berms may also be mapped as "protected flood fringe" areas.

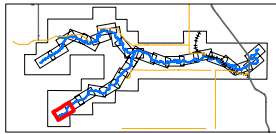
High Hazard Flood Fringe - The high hazard flood fringe identifies areas within the flood fringe with deeper or faster moving water than the rest of the flood fringe. High hazard flood fringe areas are likely to be most significant for flood maps that are being updated, but they may also be included in new flood maps.

Protected Flood Fringe - The protected flood fringe identifies areas that could be flooded if dedicated flood berms fail or do not work as designed during the 1:100 design flood, even if they are not overtopped. Protected flood fringe areas are part of the flood fringe and do not differentiate between areas with deeper or faster moving water and shallower or slower moving water.



SHEET 1

- LEGEND**
- CROSS SECTION NUMBER
 - FLOOD RANGE
 - FLOOD RANGE
 - STUDY BOUNDARY
 - FLOOD CONTROL STRUCTURES
 - HIGHWAY
 - LOCAL ROAD/LOCAL STREET
 - TOWNSHIP
 - FLOOD EXTENT-100 YEAR
 - FLOOD EXTENT-100 YEAR
 - FLOOD EXTENT-100 YEAR



REFERENCES

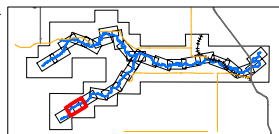
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ALBERTA GOVERNMENT

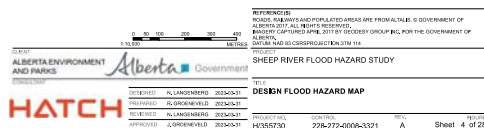
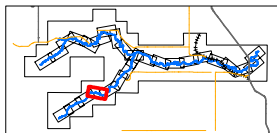
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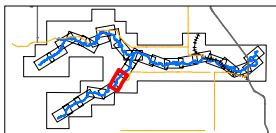
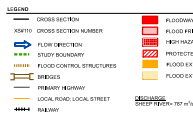
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PROJECTED: J. LANGRISH 2024/03/21
REVIEWED: J. LANGRISH 2024/03/21
APPROVED: J. LANGRISH 2024/03/21

PROJECT NO. 22B-272-2008-3321
DATE 2024/03/21
SHEET 1 OF 28

Classification: Public







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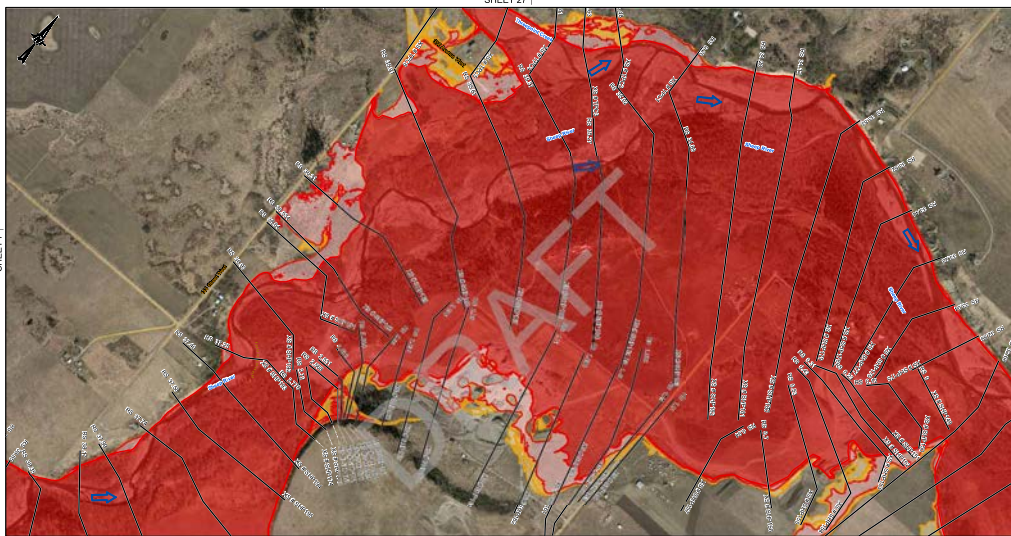
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 2018-01-01

REFERENCES:
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 DATUM AND NAD 83 CROSS-SECTION TO THE 2014 IGA
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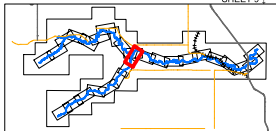
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 DEEP FLOOD HAZARD STUDY

HATCH

DESIGNED: N. LANGRISH 2018-04-01
 PREPARED: N. LANGRISH 2018-04-01
 APPROVED: N. LANGRISH 2018-04-01
 HATCH PROJECT NO. H356730 226-272-0008-3321 70% Sheet 6 of 6



SHEET 9



DISCHARGE
THREEPPOINT CREEK= 830 m³/s
SHEEP RIVER= 767 m³/s
SHEEP RIVER= 1403 m³/s JDS, RS 34-201

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PROJECT
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ALBERTA ENVIRONMENT
AND PARKS
CONSULTANT

HATCH

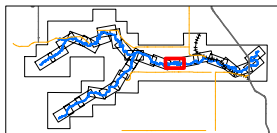
Alberta Government

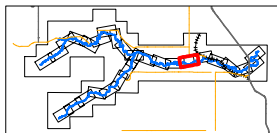
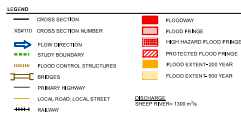
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PREPARED	R. GROENVELD	2023/05/31
REVIEWED	N. LANGENBERG	2023/05/31
APPROVED	J. GROENVELD	2023/05/31

PROJECT NO.	CONTRACT	REV.	SHEET
H/355730	228-272-0008-3321	A	Sheet 8 of 28









PROJECT: ALBERTA ENVIRONMENT AND PARKS
 (202000000)



APPROVED: 04 JANUARY 2020 (202000000)
 PREPARED: 04 JANUARY 2020 (202000000)



APPROVED: 04 JANUARY 2020 (202000000)
 PREPARED: 04 JANUARY 2020 (202000000)

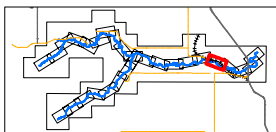
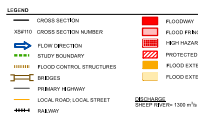
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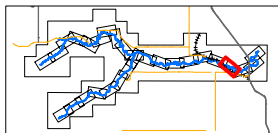
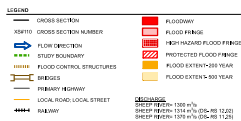
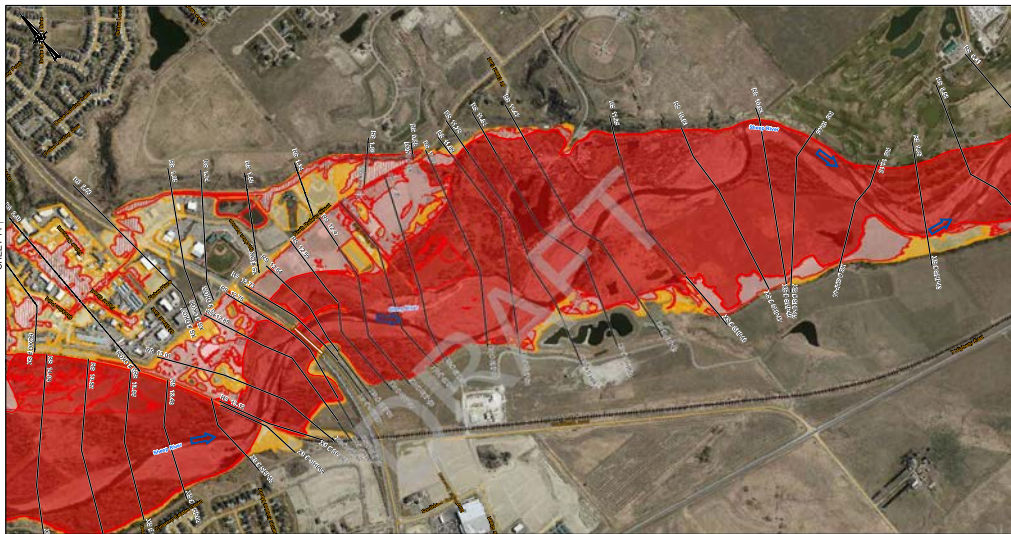
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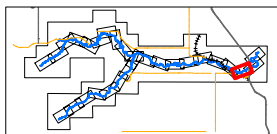
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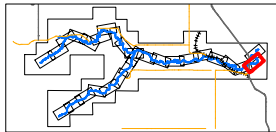
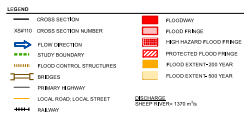
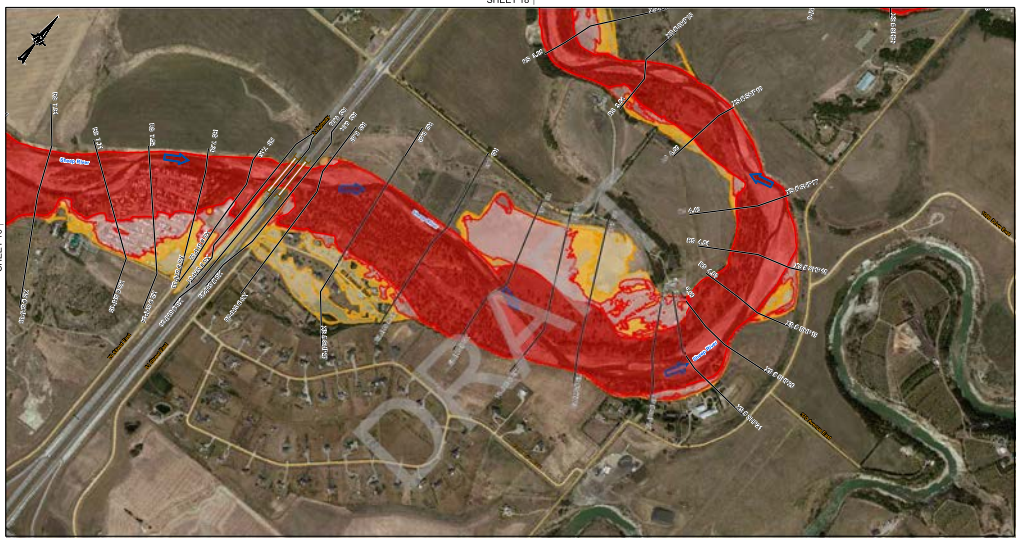
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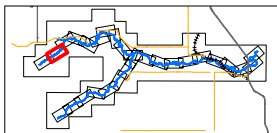
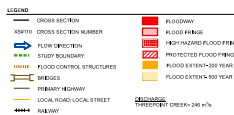
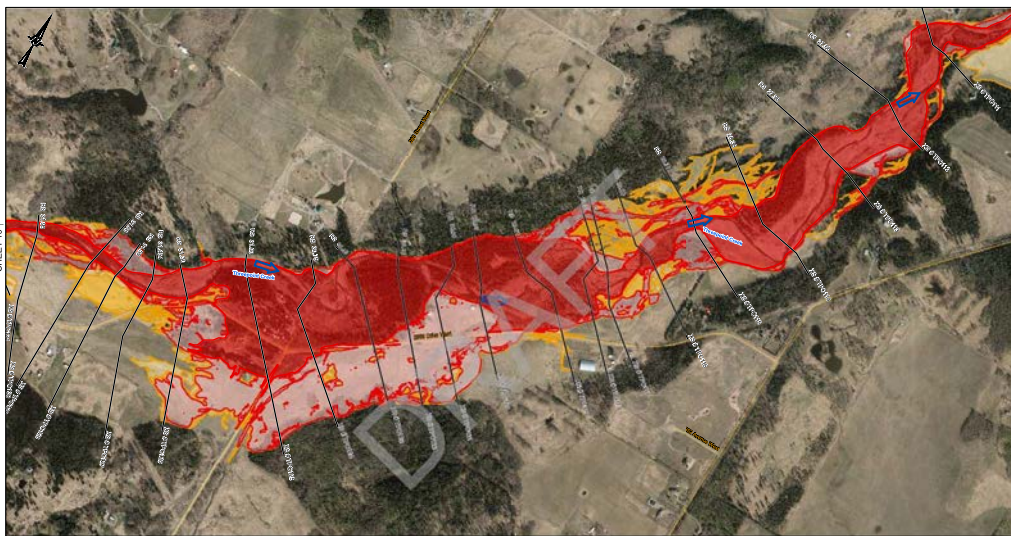


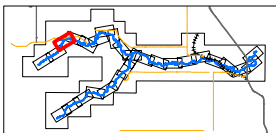
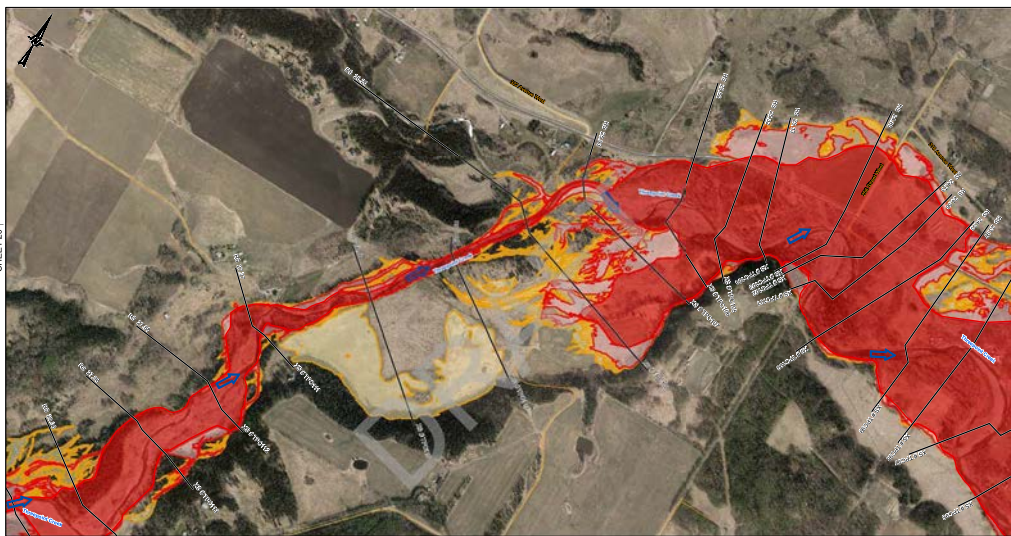








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ALBERTA ENVIRONMENT AND PARKS

Alberta Government

DESIGNED BY: K. LANGRISH 2024/01/01

DRAWN BY: K. LANGRISH 2024/01/01

CHECKED BY: K. LANGRISH 2024/01/01

APPROVED BY: J. GORDON 2024/01/01

REFERENCE:
ROAD, RAILWAYS AND POPULATED AREAS ARE FROM ALTA. GOVERNMENT OF ALBERTA 2011. ALL RIGHTS RESERVED.
RAILWAY CAPTURED APRIL 2017 BY GEORGE BROWN INC. FOR THE GOVERNMENT OF ALBERTA.
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SHEEP RIVER FLOOD HAZARD STUDY

DESIGN FLOOD HAZARD MAP

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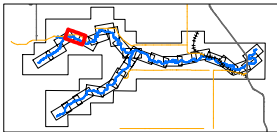
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SCALE

SHEET 21 OF 21



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 - FLOODS
 - PRIMARY HIGHWAY
 - LOCAL ROAD/LOCAL STREET
 - RAILWAY
 - FLOODWAY
 - FLOOD FRINGE
 - PROTECTED FLOOD FRINGE
 - FLOOD EXTENT-100 YEAR
 - FLOOD EXTENT-500 YEAR



REFERENCES

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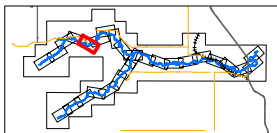
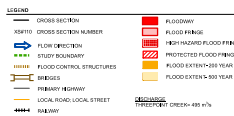
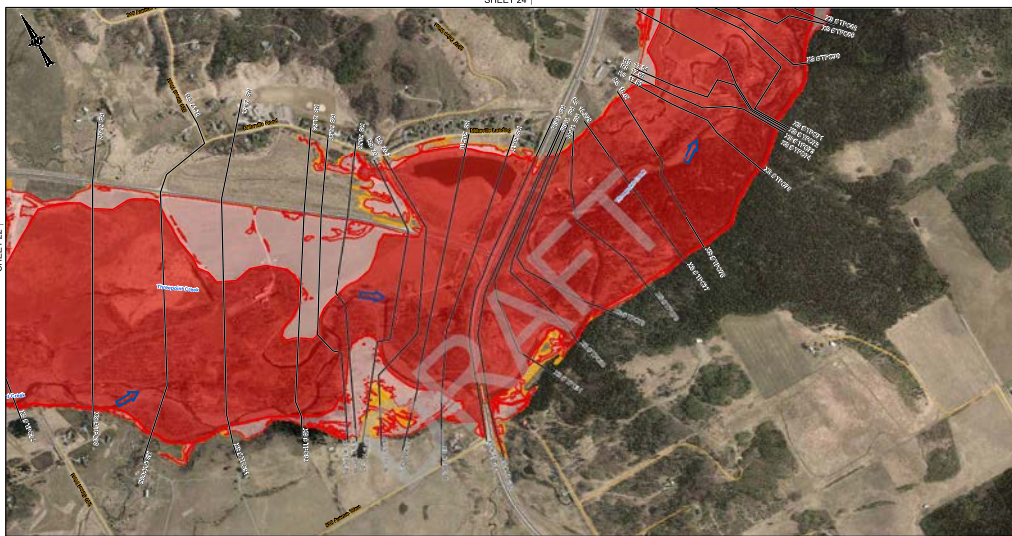
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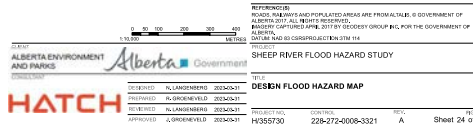
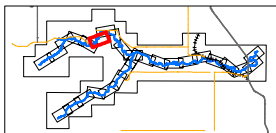
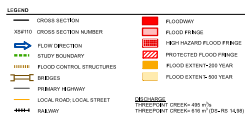
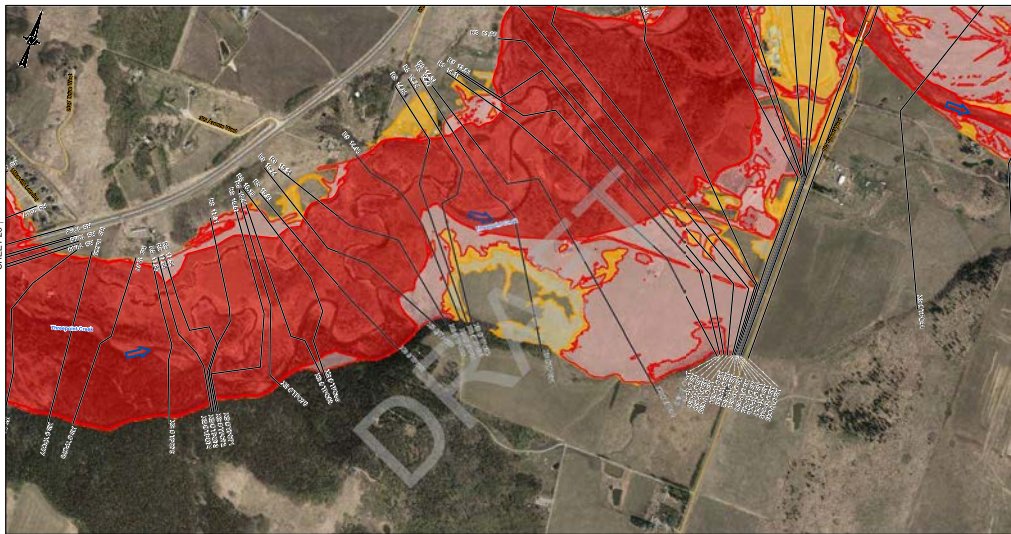
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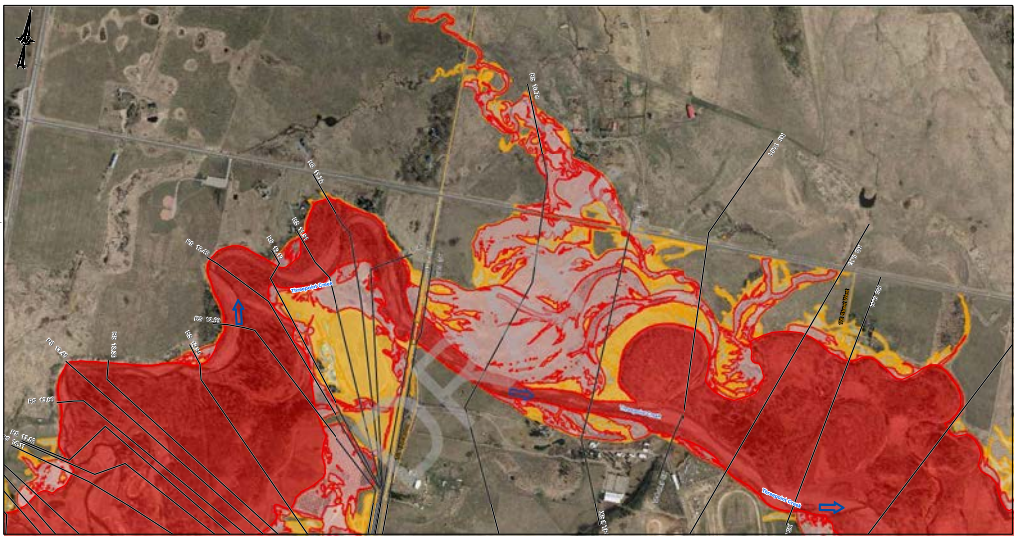
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REVIEWED: S. LANGRISH 00342631
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PROJECT NO. H355730
CONTRACT 228-272-2008-3321
SHEET A
Sheet 22 of 28

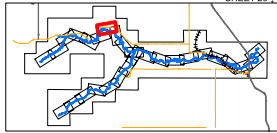






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 - PRIMARY HIGHWAY
 - LOCAL ROAD/LOCAL STREET
 - RAILWAY
 - FLOODWAY
 - FLOOD FRINGE
 - HIGH HAZARD FLOOD FRINGE
 - PROTECTED FLOOD FRINGE
 - FLOOD EXTENT-100 YEAR
 - FLOOD EXTENT-500 YEAR



ALBERTA ENVIRONMENT AND PARKS

Alberta Government

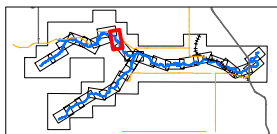
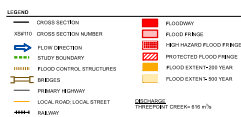
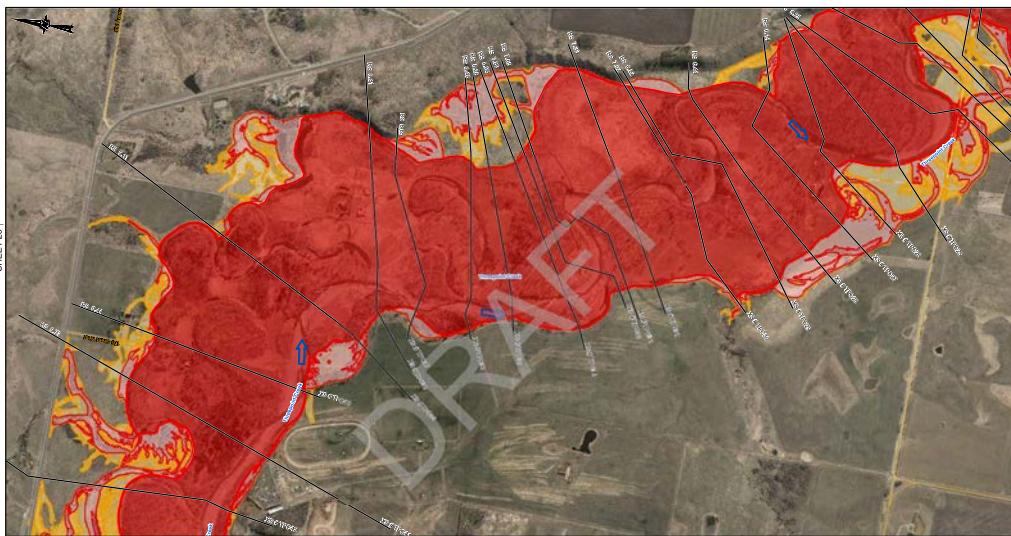
HATCH

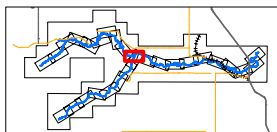
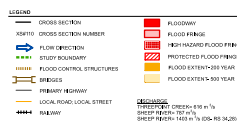
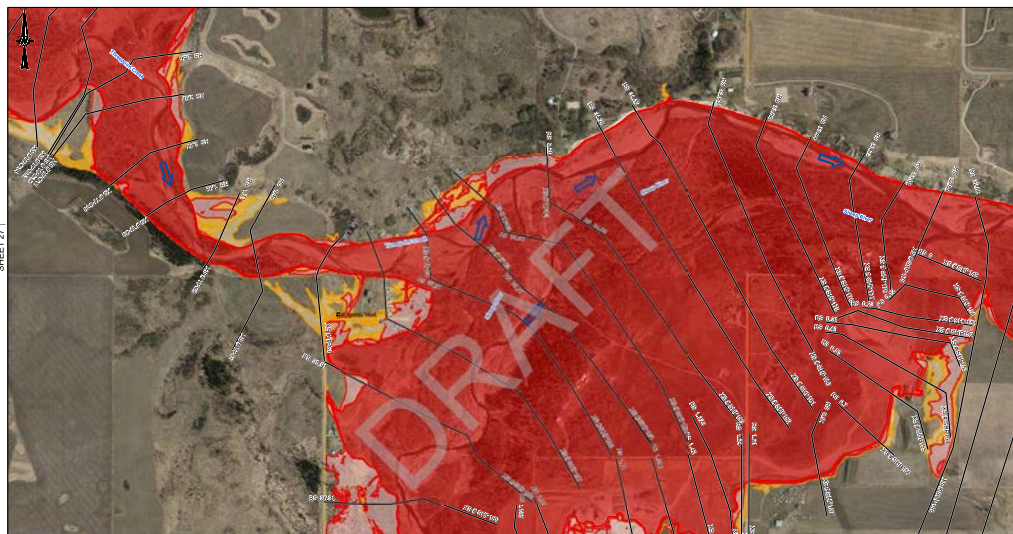
DESIGN FLOOD HAZARD MAP

PROJECT NO. 22B-272-2008-3321

DATE 2010-08-11

SHEET 25 OF 28





Alberta Environment and Parks
Alberta Government

HATCH

DESIGNED	N. LANGERMAN	2023-06-31
PREPARED	N. GROENEVELD	2023-06-31
REVIEWED	N. LANGERMAN	2023-06-31

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DATUM: NAD 83 GCS: PROJECTION: N 31M 114

PROJECT
SHEEP RIVER FLOOD HAZARD STUDY

DESIGN FLOOD HAZARD MAP

PROJECT NO.	CONTROL	REV.	FIGURE
W196730	238 272 0008 2324	A	Sheet 28 of 28