

November 28, 2025

Alberta Transportation and Economic Corridors Main Floor, Provincial Building 9621 – 96th Avenue Peace River, Alberta T8S 1T4

Robert Senior Construction Technologist

Dear Mr. Senior:

CON0022166 Peace Region (Grande Prairie District – South) GRMP Instrumentation Monitoring Site GP028; H43:12, km 34.473 Two Creeks Section C – 2025 Fall Readings

1 GENERAL

Six vibrating wire piezometers (VWPs) (VWP15-13U/L, MW14-6, MW15-12, PW14-2, and PW15-3), seven standpipe piezometers (SPs) (SP02-05, SP02-07, SP14-2, MW14-3, MW14-8, MW14-10, and MW14-11), two monitoring wells (MW14-7 and MW14-9), one pumping well (PW14-1) were read at the GP028 site in the Peace Region (Grande Prairie District – South) (GP South Region) on September 3, 2025 by Evan Hergott, E.I.T. and Katrina Cereno, E.I.T. of KCB. Four VWPs (MW14-6, PW14-2, PW15-3 and MW15-12) were reread by Evan Hergott on September 24, 2025. These instruments were read as part of the GP South Region Geohazard Risk Management Program (GRMP). The site is located on Hwy 43:12, km 34.473. The approximate site coordinates are 6017213 N, 544193 E (UTM Zone 11, NAD 83). A site plan is presented on Figure 1.

The geohazard at the GP028 site consists of a landslide with a backscarp that extends through the south (eastbound) lanes of Hwy 43:12 and toes out in Two Creeks. High groundwater levels are also impacting the pavement subgrade/surface. The site is located north (upslope) of Two Creeks.

Previous remedial actions completed at the GP028 site include the installation of 1-m-deep pavement drains below the eastbound lane and a 315-m-long subdrain in the median in 2003. The subdrain is approximately 2.5 m deep, 400 mm in diameter, and outlets via a culvert, beneath the south lane of Hwy 43:12, that eventually drains into Two Creeks. In 2015, two pumps were installed in pumping wells that discharge water into the same subdrain outlet, a remote monitoring station was installed, and Class 2 riprap was keyed-in along a 100 m length of the creekbank to protect it from erosion.

Between 2002 and 2015, several geotechnical site investigations, which included installing instruments, were conducted at the site by the previous consultants. The encountered stratigraphy has not been provided to KCB.



1.1 Instrumentation

KCB has been reading the instruments at this site since the spring of 2021. Instrumentation installation details are tabulated in Table 1.1. Instrument locations are shown on Figure 1. Any instruments not included in Table 1.1 or shown on Figure 1 are assumed to be inoperable and are not presented or discussed herein.

Between 2002 and 2015, several slope inclinometers (SIs), piezometers, and wells were installed at the site by the previous consultants to monitor movement and groundwater conditions, respectively. A barologger was also installed in 2014. Some of these instruments are now inoperable (e.g., sheared or damaged), as detailed in Table 1.1 (see table notes). Recommendations for maintenance or replacement are made in Section 3.

During the fall 2025 readings, the data logger connected to VW15-13U (VWP) and the Levelogger installed in MW14-11 (SP) were both found to be inoperable. KCB was able to repair the data logger and reconnect it to VW15-13U, but not the Levelogger installed in MW14-11. A replacement Levelogger is not currently recommended for MW14-11 because the instrument is located approximately 150 m east of the site and MW14-10 (SP) installed at the same location is still operable.

The operable instruments are protected by above-ground casing protectors.

The operable VWPs were read using RST Instruments DT Logger Host software and Campbell Scientific Device Configuration software. It is noted that the remotely-monitored VWPs cannot be accessed remotely right now, likely due to a change in service provider. Until this issue is resolved, KCB will continue to manually download the data from these instruments. The operable SPs with Solinst Leveloggers installed in them were read using a Solinst PC Interface Cable and Solinst Levelogger software. The remaining operable SPs were read using a Heron Water Level Meter.

Table 1.1 Instrumentation Installation Details¹

Instrument	Instrument	Date Installed	UTM Coord	dinates (m)	Ground Surface	Stick Up	Depth	Constitution
Туре	ID		Northing	Easting	Elevation (m)	(m)	(mbgs ²)	Condition
	SI02-01	Sep. 11, 2002	Unknown					Inoperable ⁶
SI	SI02-02	Sep. 12, 2002	6017223	544356	851.9	0.7	14.6 6	Inoperable ⁷
	SI02-03	Sep. 12, 2002			Unknown	Inoperable 6		
	SI15-13	Oct. 15, 2015	6017220	544327	850.2	Unkr	Inoperable ⁶	
VWP ³	VW15-13U	0-1-45-2045	6017220	544327	850.2	N/A	13.7	Operable
	VW15-13L	Oct. 15, 2015				N/A	18.3	Operable
	MW14-6	2014		544435 ⁴	856.0	N/A	15.3	Operable
VWP ⁴	MW15-12	2015	60473504		858.2	N/A	27.1	Operable
VWP*	PW14-2	2014	6017259 ⁴		856.3	N/A	18.0	Operable
	PW15-3	2015			857.0	N/A	26.9	Operable
	SP02-01	Sep. 13, 2002		Inoperable ⁷				
	SP02-02	Sep. 11, 2002		Inoperable ²				
	SP02-03	Sep. 11, 2002		Inoperable⁷				
	SP02-04	Sep. 12, 2002		Inoperable ⁷				
SP	SP02-05	Sep. 11, 2002	6017232	544367	854.0	0.8	12.4	Operable
	SP02-06	Sep. 11, 2002		Inoperable ⁷				
	SP02-07	Sep. 12, 2002	6017214	544358	851.2	0.7	6.6	Operable
	SP02-08	Sep. 12, 2002	6017195	544351	849.8	0.8	6.9	Inperable¹⁰
	SP14-2	2014	6017298	544055	839.3	1.0	8.8	Operable
	MW14-3	2014	6017279	544221	845.0	-	7.0	Operable
	MW14-4	2014	6017264	544350	851.7	-	10.1	Inoperable⁸
SP ⁵	MW14-5	2014	6017264	544354	851.7	-	6.9	Inoperable⁸
SPS	MW14-8	2014	6017247	544513	861.2	-	12.1	Operable
	MW14-10	2014	6017231	544671	870.7	-	12.8	Operable
	MW14-11	2014	6017232	544668	870.7	-	27.1	Inoperable ¹²
Barologger	BW14-10	2014	6017231	544671	870.7	N/A	N/A	Inoperable⁹
Pumping Well	PW14-1	2014	6017250	544423	855.5	0.6	17.5	Operable
Monitoring	MW14-7	2014	6017258	544431	856.0	1.1	11.9	Operable
Well	MW14-9	2014	6017247	544521	861.2	1.0	6.1	Operable

Notes

¹ Instrument installation details were taken from reports and data files prepared or provided by the previous consultant(s) or TEC. Instrument coordinates and stick ups (where applicable) were confirmed by KCB using a handheld GPS (accuracy of ± 5 m) and tape measure, respectively.

² Meters below ground surface (mbgs). Bottom reading depth for SIs, and tip or screen depth for piezometers.

³ VW15-13U/L are connected to single-channel data loggers (Model No. DT2011B from RST Instruments Ltd.), which are programmed to record a reading of the instruments every two hours.

⁴ MW14-6, PW14-2, PW15-3, MW15-12 are connected to a multi-channel data logger (Model CR6 from Campbell Scientific), which is programmed to record a reading of the instruments every two hours. The data logger is installed at the central monitoring station located in the highway median. The coordinates given for the instruments are for the location of the central monitoring station.

⁵ Solinst Leveloggers are installed in MW14-3/4/5/8/10/11. The loggers are programmed to record a reading of the instruments every two hours.

⁶ SI02-1, SI02-2, SI02-3, and SI15-13 have sheared at an approximate depth of 13.0 m, 15.7 m, 14.0 m, and 14.6 m below ground surface, respectively.

⁷ SP-01 through SP-04, and SP-06 were reported as inoperable by a previous consultant.

⁸ On March 24, 2021, the protective head boxes for MW14-4 and MW14-5 were struck by a vehicle, leaving MW14-4 inoperable. MW14-5 was inoperable during the spring 2024 readings.

⁹ BW14-10 could not be read in 2022 or 2023 and was removed from site. Previously, BW14-10 was in the head box for MW14-10. The instrument is being temporarily stored at the KCB Edmonton Office.

¹⁰ SP02-08 is pinched at an approximate depth of 2.0 m below ground surface. Camera inspection completed during the spring 2025 readings. Instrument last read in May 2024.

¹² Levelogger in MW14-11 was inoperable during the fall 2025 readings.

2 INTERPRETATION

2.1 General

For the operable PNs and VWPs, the recorded porewater pressures were converted to an equivalent water/piezometric elevation and plotted relative to ground surface elevation and the tip elevation for each instrument.

For the operable SPs and monitoring/pumping wells, the water level data was plotted relative to ground surface elevation and the screen elevation for each instrument.

The SI and piezometer data plots are included in Appendix I, and a summary of the SI and piezometer data is provided in Table 2.1 through Table 2.3.

In 2021, KCB reviewed the instrumentation data provided by the previous consultant and removed corrections applied to the historical SI data based on our experience. The instrumentation data obtained by KCB is consistent with the data obtained by the previous consultant. No re-initialization of the SI is recommended. The SI data plots presented herein include data for readings taken with both the previous consultants' and KCB's SI reading equipment.

2.2 Zones of Movement

SI02-1, SI02-2, and SI02-3 have sheared at an approximate depth of 13.0 m, 15.7 m, and 14.0 m below ground surface, respectively.

Table 2.1 Vibrating Wire Piezometer Summary

Instrument	Serial No.	Date			Ground Surface	Tip Depth			
ID	Serial No.	Installed	Previous Reading	Most Recent Reading	Elevation (m)	(mbgs ¹)	Previous Reading (mbgs ¹)	Most Recent Reading (mbgs1)	Change from Previous Reading (m)
VW15-13U ²	34611	2015		Sep. 03, 2025	850.2	13.7	5.8	5.9	-0.1
VW15-13L ²	34612	2015				18.3	N/A – instrument is dry		
MW14-6 ³	34613	2014	lun 02 2025		856.0	15.3	7.5	3.5	4.0
MW15-12 ³	34616	2015	Jun. 02, 2025		858.2	27.1	19.9	17.2	2.7
PW14-2 ^{3,}	34615	2014			856.3	18.0	7.8	3.8	4.0
PW15-3 ³	34614	2015			857.0	26.9	18.7	3.7	15.0

Notes:

MW14-6, PW14-2, PW15-3, MW15-12 are connected to a multi-channel data logger, which is programmed to record a reading of the instruments every two hours.

Table 2.2 Standpipe Piezometer, Monitoring Well, and Pumping Well Reading Summary

Instrument	Instrument Type		Date		Ground Surface	Screen Depth	Water Level		
ID	Instrument Type	Installed	Previous Reading	Most Recent Reading	Elevation (m)	(mbgs ¹)	Previous Reading (mbgs¹)	Most Recent Reading (mbgs ¹)	Change from Previous Reading (m)
SP02-05	SP	2002	Jun. 02, 2025	Sep. 03, 2025	854.0	12.4	5.6	4.8	0.6
SP02-07	SP	2002			851.2	6.6	3.3	2.7	0.6
SP14-2	SP	2014			839.3	8.8	1.4	2.1	-0.7
MW14-7	Monitoring Well	2014			856.0	11.9	7.5	7.5	0.0
MW14-9	Monitoring Well	2014			861.2	6.1	1.7	1.9	-0.2
PW14-1	Pumping well	2014			855.5	17.5	7.3	7.0	0.3

Notes:

Table 2.3 Levelogger Reading Summary¹

Instrument Serial No.	Date			Ground Surface	Screen Depth	oth Water Level			
ID	Serial No.	Installed	Previous Reading	Most Recent Reading	Elevation (m)	(mbgs ²)	Previous Reading (mbgs ²)	Most Recent Reading (mbgs ²)	Change from Previous Reading (m)
MW14-3	62053343	2014	Jun. 02, 2025	Sep. 03, 2025	845.0	7.0	2.1	1.6	0.5
MW14-8	62053315	2014			861.2	12.1	3.3	3.8	-0.5
MW14-10	62053298	2014			870.7	12.8	9.3	9.5	-0.2

Notes

¹ Meters below ground surface (mbgs).

² VW15-13U and -13L are connected to single-channel data loggers, which are programmed to record a reading of the instruments every two hours.

¹ Meters below ground surface (mbgs).

¹Solinst Leveloggers are installed in MW14-3/8/10/11. The loggers are programmed to record a reading of the instruments every two hours.

² Meters below ground surface (mbgs).

2.3 Interpretation of Monitoring Results

Since mid-August 2025, an increase in porewater pressure/water level (up to approximately 15 m) was recorded in the VWPs connected to the central monitoring station (PW14-2, MW14-6, PW15-3, and MW15-12). This increase, similar to the increase recorded between fall 2017 and fall 2020, is believed to be caused by the pumping wells not being operational. The pumping wells should be inspected and repaired before the onset of winter, so water levels can decrease before the ground freezes. It is noted that last time high water levels were recorded in these instruments, an increase in water level was also recorded in MW14-7 (monitoring well) and PW14-1 (pumping well), but an increase has yet to be recorded in these instruments at this time.

The water level recorded in MW14-8 has been decreasing since the spring 2024 readings, which is inconsistent with water levels recorded in the other nearby instruments and could be an indication this instrument is failing. This instrument should continue to be monitored.

Overall, water levels recorded in the remaining instruments appear to be either relatively steady, fluctuating seasonally (with the spring/summer readings typically higher than the fall/winter readings), or dry (i.e., water level at or below instruments tip elevation). Occasionally "spikes" in water level of over 1 m are recorded in PW14-2, MW14-6, PW15-3, and MW15-12 for short periods of time (i.e., less than a day). These spikes have been removed from the data plots because KCB suspects these readings are due to connectivity issues between the data logger and instrument.

3 RECOMMENDATIONS

3.1 Future Work

All operable instruments should continue to be read twice per year (spring and fall). Spring readings should be completed after late-May or early-June, due to the risk of water inside the instrument casings being frozen earlier in the year.

The site should continue to be inspected by the Maintenance Contract Inspector (MCI) and as part of the GP South Region GRMP Section B inspections.

3.2 Instrument Installs, Repairs, and Maintenance

As discussed in Section 2.3, the pumping wells should be inspected and repaired before the onset of winter, so water levels can decrease before the ground freezes. A plan for routine inspections and maintenance of the pumps should be developed.

All the SIs installed at this site have sheared. Visual site observations made by KCB during inspections and instrument readings have not indicated any movement currently impacting the pavement surface. If site conditions were to deteriorate, replacement SIs could be considered but they are not recommended at this time.



The barologger (BW14-10) could not be read in 2022 or 2023 and was removed from site. The instrument is being temporarily stored at the KCB's Edmonton Office. It should be repaired or replaced.

MW14-5, which was previously struck by a vehicle in March 2021, could potentially be repaired by removing the headbox, cutting back the casing, installing a new Solinst Levelogger or removing and repairing the existing Solinst Levellogger, which is currently not working and stuck in the casing below where it is bent.

4 CLOSING

This report is an instrument of service of Klohn Crippen Berger (KCB). The report has been prepared for the exclusive use of Alberta Transportation and Economic Corridors (Client) for the specific application to the Peace Region (Grande Prairie District – South) Geohazard Risk Management Program (Contract No. CON0022166), and it may not be relied upon by any other party without KCB's written consent.

KCB has prepared this report in a manner consistent with the level of care, skill and diligence ordinarily provided by members of the same profession for projects of a similar nature at the time and place the services were rendered. KCB makes no warranty, express or implied.

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- 1. The report is to be read in full, with sections or parts of the report relied upon in the context of the whole report.
- 2. The observations, findings and conclusions in this report are based on observed factual data and conditions that existed at the time of the work and should not be relied upon to precisely represent conditions at any other time.
- 3. The report is based on information provided to KCB by the Client or by other parties on behalf of the client (Client-supplied information). KCB has not verified the correctness or accuracy of such information and makes no representations regarding its correctness or accuracy. KCB shall not be responsible to the Client for the consequences of any error or omission contained in Client-supplied information.
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- 5. This report is electronically signed and sealed and its electronic form is considered the original. A printed version of the original can be relied upon as a true copy when supplied by the author or when printed from its original electronic file.



Yours truly,

KLOHN CRIPPEN BERGER LTD.

Courtney Mulhall, M.Sc., P.Eng. Geotechnical Engineer

CM/EH:bb

Cc: Chris Gräpel, M.Eng., P.Eng.

Evan Hergott, E.I.T. Civil Engineer-in-Training

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ATTACHMENTS

Figure

Appendix I Instrumentation Plots

Site GP028; H43:12, km 34.473 Two Creeks Section C – 2025 Fall Readings

FIGURE



Legend

- Pneumatic Piezometer (PN)
- ✓ Slope Inclinometer (SI)
- Standpipe Piezometer (SP)
- Standpipe Piezometer (PW or MW)
- Levelogger (MW)
- Monitoring Well (MW)

- Pumping Well (PW)

- -> Flow Direction
- Watercourse



Klohn Crippen Berger

PEACE REGION (GRANDE PRAIRIE DISTRICT-SOUTH)
GEOHAZARD RISK MANAGEMENT PROGRAM

Site Plan GP028 - Two Creeks Hwy 43:12, km 34.473

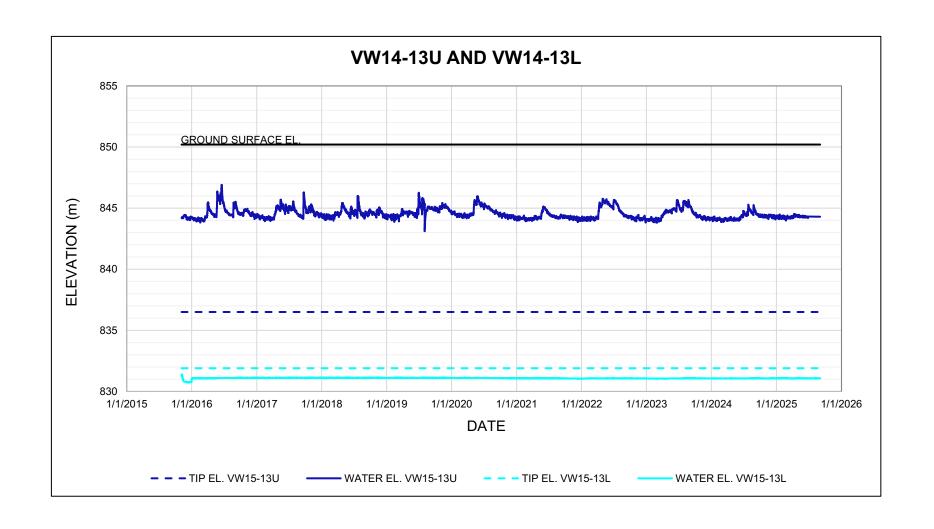
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Site GP028; H43:12, km 34.473 Two Creeks Section C – 2025 Fall Readings

APPENDIX I

Instrumentation Plots



1. PIEZOMETER DATA OBTAINED BEFORE JUNE 29, 2021, PROVIDED TO KLOHN CRIPPEN BERGER LTD. (KCB) BY ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS (TEC) ON JUNE 25, 2021.

2. INSTRUMENTS CONNECTED TO SINGLE-CHANNEL DATA LOGGERS.





PROJECT

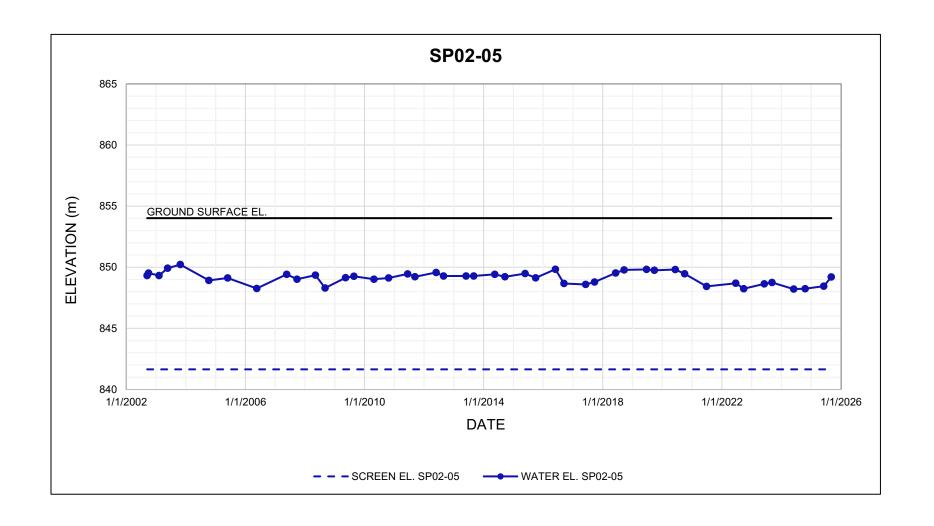
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GEOHAZARD RISK MANAGEMENT PROGRAM

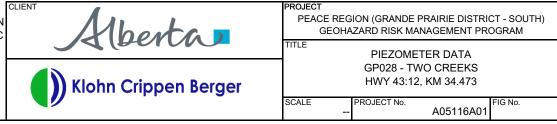
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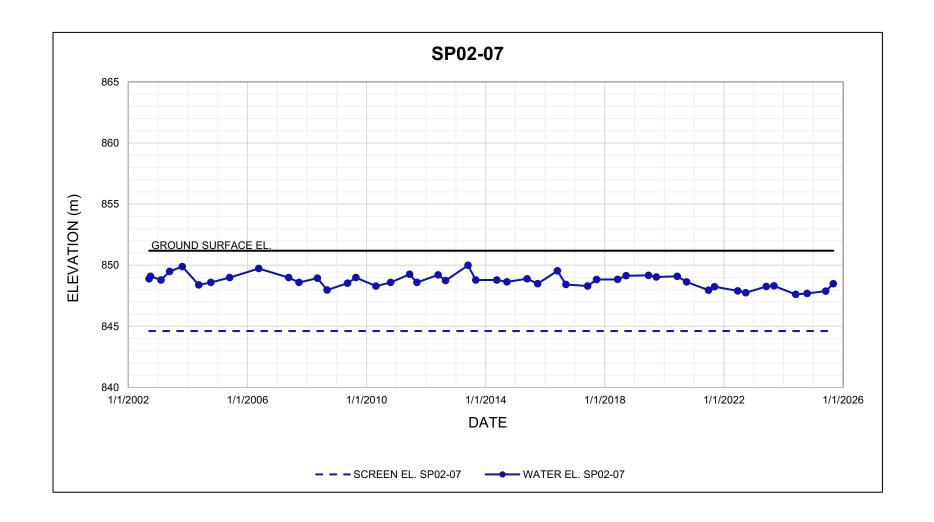
PIEZOMETER DATA GP028 - TWO CREEKS HWY 43:12, KM 34.473

SCALE PROJECT No.

A05116A01 FIG No.







1. PIEZOMETER DATA OBTAINED BEFORE JUNE 29, 2021, PROVIDED TO KLOHN CRIPPEN BERGER LTD. (KCB) BY ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS (TEC) ON JUNE 25, 2021.



PROJECT

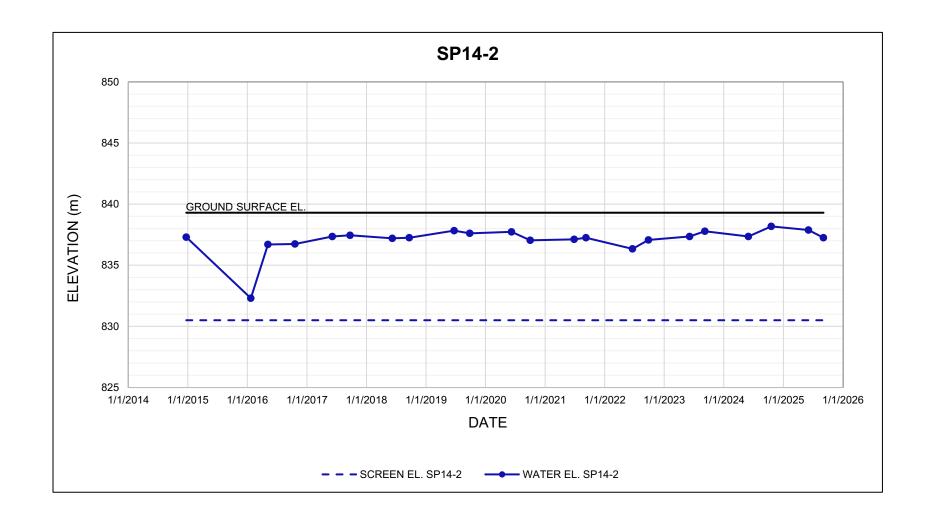
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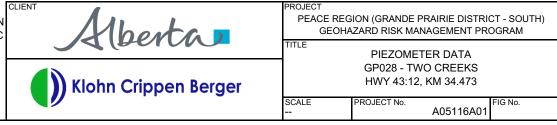
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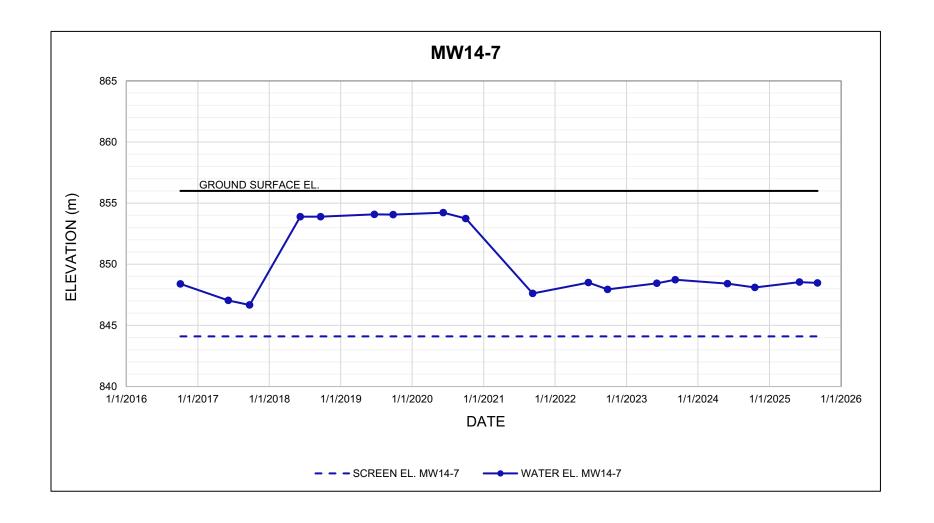
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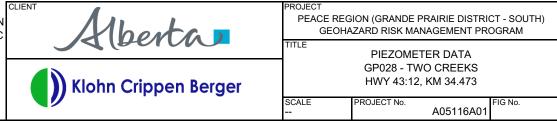
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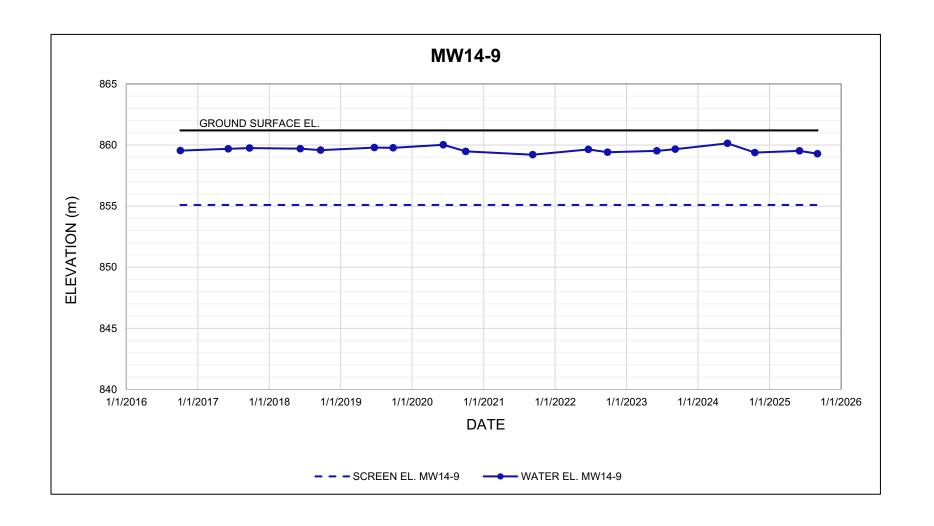
FIG No. A05116A01











1. PIEZOMETER DATA OBTAINED BEFORE JUNE 29, 2021, PROVIDED TO KLOHN CRIPPEN BERGER LTD. (KCB) BY ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS (TEC) ON JUNE 25, 2021.





PROJECT

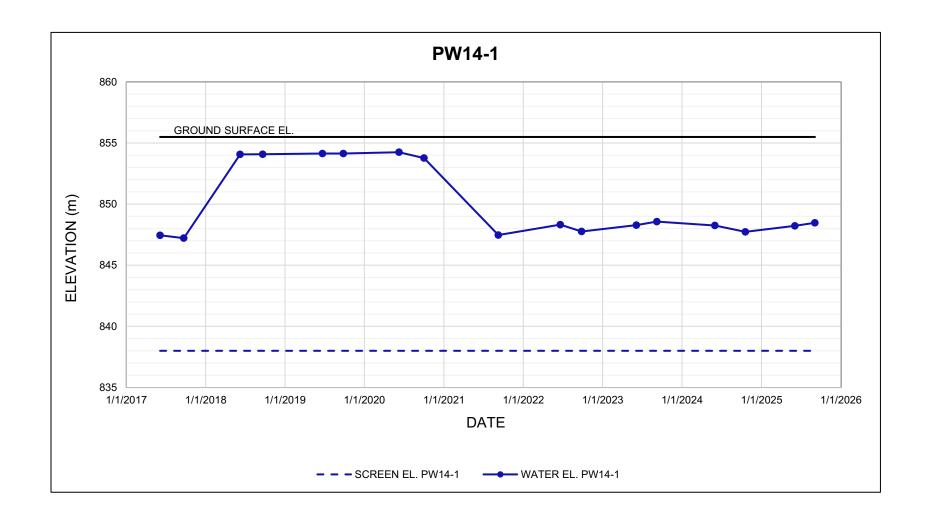
PEACE REGION (GRANDE PRAIRIE DISTRICT - SOUTH) GEOHAZARD RISK MANAGEMENT PROGRAM

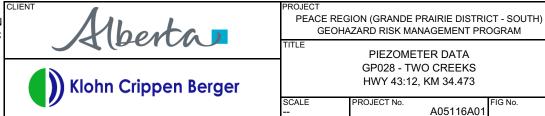
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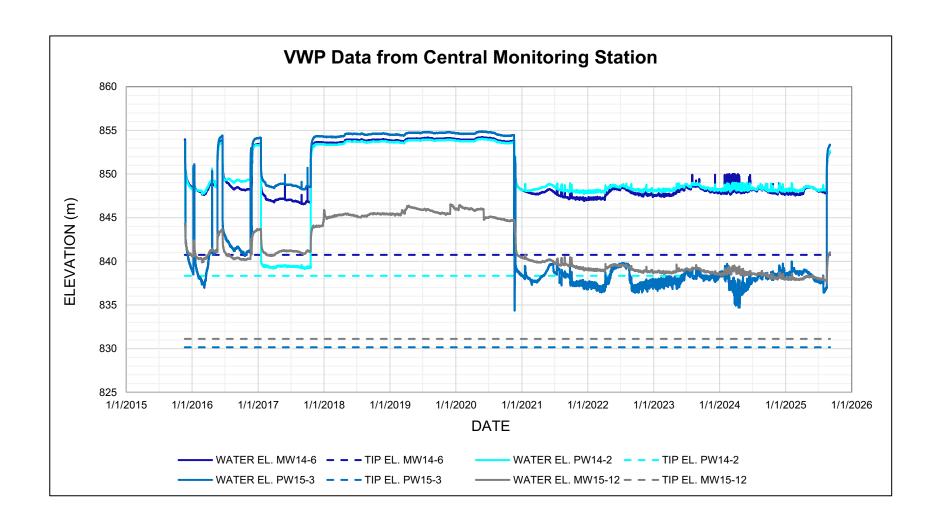
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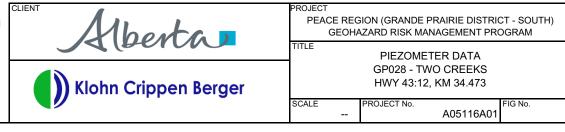
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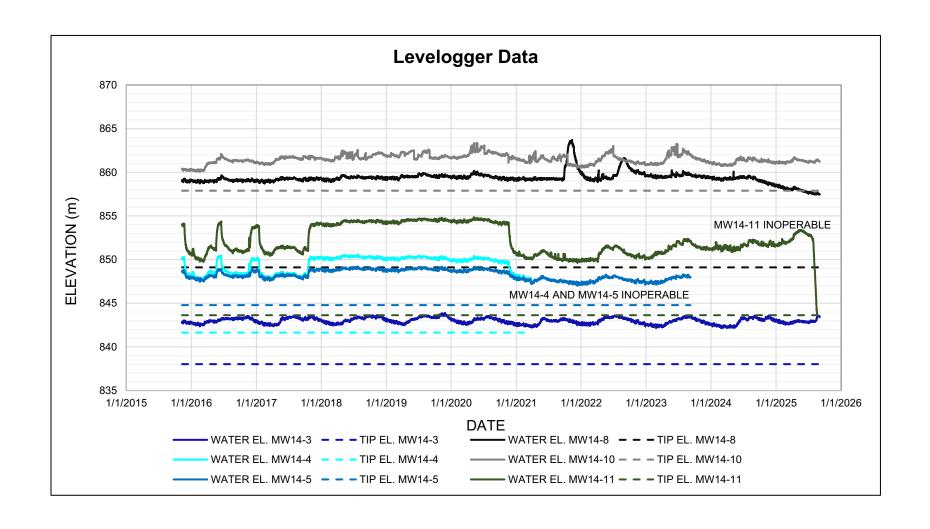






- 1. PIEZOMETER DATA OBTAINED BEFORE JUNE 28, 2021, PROVIDED TO KLOHN CRIPPEN BERGER LTD. BY ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS ON JUNE 25, 2021.
- 2. INSTRUMENTS CONNECTED TO MULTIPLE-CHANNEL DATA LOGGER INSTALLED AT CENTRAL MONITORING STATION.





- 1. PIEZOMETER DATA OBTAINED BEFORE JUNE 28, 2021, PROVIDED TO KLOHN CRIPPEN BERGER LTD. BY ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS ON JUNE 25, 2021.2.
- 2. PROTECTIVE HEADBOXES FOR MW14-4 AND MW14-5 DESTROYED BETWEEN FALL 2020 AND SPRING 2021 READINGS.
- SOLINST LEVELOGGERS INSTALLED IN THESE INSTRUMENTS.





PEACE REGION (GRANDE PRAIRIE DISTRICT - SOUTH) GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE

PIEZOMETER DATA GP028 - TWO CREEKS HWY 43:12, KM 34.473

SCALE PROJECT No. FIG No. A05116A01