REPORT

Town of Fort Smith

Slope Monitoring Report 2025

Slave River Adjacent to Fort Smith, NT

March 2026

CA0058096.7320

Distribution List

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1.0 INTRODUCTION

WSP Canada Inc. (WSP) was retained by the Town of Fort Smith to provide geotechnical input in regard to the slope assessment along the Slave River, adjacent to the Town of Fort Smith, NT. This report, prepared by WSP provides a summary of the activities in 2025 which included a slope field inspection, survey of installed pins and a remotely piloted aircraft system (RPAS) for orthophoto imagery collection and a LiDAR digital elevation model (DEM) survey. Figure 1 provides an overview of the study area in relation to the community.

This work was completed based on WSP's Proposal number 2025CA437320, submitted to the Town of Fort Smith on July 31, 2025. The proposal included effort for slope stability monitoring and reporting in the fiscal years of 2025/26, 2026/27 and 2027/28. The scope of work included the following tasks, broken down by fiscal year.

Table 1: Proposed Scope of Work

Task	Approximate Timing
Visual Slope Inspection	Annually in 2025, 2026 and 2027 during snow-free months.
Survey of Steel Monitoring Pins	Annually in 2025, 2026 and 2027 during snow-free months.
LiDAR Data Collection	In 2025 during snow-free months.
Reporting	Annually in 2025/26, 2026/27 and 2027/28 in fall/winter.

1.1 Scope of Work in 2025/26

The following items were planned and completed in the 2025/26 fiscal year:

- Visual slope inspection and comparison to previous inspections (2021 and 2022). Field work completed in September 2025.
- Survey of steel monitoring pins and comparison to 2022 installation coordinates. Field work completed in September 2025.
- LiDAR data collection, including orthophoto and comparison to historical data (2009, 2021, and 2022). Field work completed in September 2025.
- Presentation of data, discussion and recommendations. Completed via this report.

2.0 BACKGROUND

The slopes above the banks of the Slave River have a long history of instability posing a threat to some of the infrastructure in the Town of Fort Smith including the water intake pipeline, roads, walking trails, sewage lagoon and developed residential properties along the crest of the Slave River valley slope. Several previous geotechnical studies have identified possible causes of the previous slope instability as including the presence of weak clayey material at depth, shallow and deep aquifers, thawing icy permafrost, steep slope angles, and natural river erosion processes.

WSP (formerly Wood Environment & Infrastructure Solutions) provided a memorandum, titled Slope Remediation Design and Construction Plan, Fort Smith, NT, to the Town on 10 October 2019. The memo summarized the history of the valley slope instability, previous geotechnical causes reported to the Town of Fort Smith, as well as an assessment of the ongoing geotechnical issues surrounding the valley slope instability. The memo also recommended path forward – which included a site visit, reconstructing the history of landsliding, and a geotechnical investigation program with the installation of slope monitoring equipment.

After presenting the town with the recommendations outlined in the memorandum, the town elected to proceed with the proposed monitoring plan for a section of 4.5 km long slope along the Slave River. The monitoring plan focuses on key infrastructure and priority areas, with the purpose of measuring the magnitude and location of slope movements. This information will aid in informing residents and the Town of the risks the slope instability poses to existing infrastructure and also help with future municipal planning. It is understood that the Town of Fort Smith has applied for Federal Grants to support the proposed monitoring plan.

For completeness and ongoing knowledge retention, Table 2 lists the reports and memos which WSP (and its predecessor companies) have submitted for this site since 2019.

Table 2: Existing WSP (and predecessor companies) Reports and Memos for this Site since 2019

#	Date	Title
1	October 10, 2019	Memo: Slope Remediation Design and Construction Plan, Fort Smith, NT
2	December 21, 2021	Memo: 2021 Data Review and Slope Monitoring Instrumentation (Draft)
3	February 8, 2022	Presentation: Fort Smith Slope Stability, Presentation to Council
4	May 26, 2022	Memo: Fort Smith Monitoring Plan
5	March 31, 2023	Memo: Fort Smith – 2022 Field Inspection and Monitoring

WSP notes that in the summer of 2023 there were some management changes in the Town of Fort Smith, followed by a full Town evacuation due to wildfire threat. This resulted in a reporting and data gap for 2023 and 2024.

3.0 VISUAL SLOPE INSPECTION

The 2025 visual slope inspection was completed by WSP's Brian Wells on September 16 and 17, 2025. As planned and to avoid safety considerations of working alone on a remote slope, Mr. Wells was accompanied by the Town of Fort Smith's Adam McNab, or at times his delegate.

The focus of the 2025 inspection was to visit areas of the river valley slope which had historically experienced the greatest slope movement, as well as priority areas previously identified by the Town, such as the clean water intake pipeline, water outfall pipeline and cemetery area. A plan view showing the site topography via the 2025 LiDAR data, key features and the visual slope inspection traverses as recorded by handheld GPS are shown on Figure 2. The visual slope inspection traverses covered approximately 12 km over the course of the two days.

A plan view of select photograph locations taken during the slope inspection are shown on Figure 3, with the corresponding photographs shown on Figure 4 through Figure 8.

In general, the area with the most active landslide activity was observed between the boat launch access road and the cemetery, near the toe of the slope. These movements were not observed to be directly impacting known infrastructure, however the possibility of ongoing and future movements in these areas negatively impacting slope stability by extending further laterally or upslope cannot be ruled out.

3.1 Historical Instruments

During the September 2025 visual slope inspection, historical geotechnical instruments were visited. The intent was to measure the depth at which the instrument was open to (i.e., not blocked), whether there was static water inside, and if so what depth.

Table 3: Historical Geotechnical Instruments

Borehole/ Instrument ID	September 2025 Observation and Comments
79-3	75 mm aluminum casing observed with minor damage at surface. This instrument is blocked or pinched at approximately 3 m depth (possibly due to landslide movement) and was dry.
87-3	25 mm PVC standpipe piezometer, paired with 87-4. This instrument was noted to be damaged by heavy equipment and no longer unreadable.
87-4	25 mm PVC standpipe piezometer, paired with 87-3. This instrument was noted to be damaged by heavy equipment and no longer unreadable.
87-7	25 mm PVC standpipe piezometer. This instrument was noted to be damaged by heavy equipment and no longer unreadable.
87-8	25 mm PVC standpipe piezometer. This instrument was blocked at 2.1 m depth (possibly due to landslide movement) and was dry.

4.0 MONITORING PIN SURVEY

In June 2022 a total of 37 steel pins were installed along three (3) profiles approximately parallel to the slope fall line as shown in Figure 9. The purpose of the installed survey pins was to monitor changes in the ground surface across the survey pin array, in both the horizontal and vertical direction.

Maskwa Engineering Ltd, was responsible for the provision of the pins, installation and baseline survey work. Each of the installed pins was approximately 1.5 m long and 127 mm (0.5 inch) in diameter. The pins were driven into the ground approximately flush (to prevent subsequent tripping hazard and vandalism) using a manual post pounder and sledgehammer. Following installation, the pins were surveyed using Real-Time Kinetic (RTK) survey techniques to determine its location in x, y and z coordinates. The initial RTK survey used a tripod that was left on each pin for a continuous 60 second observation. The pin was then re-observed for 30 seconds to determine if there was any change. If the first and second locations were within 0.01 m horizontal and 0.01 m vertical of each other, then the coordinate was accepted. If not, then the process was repeated. The purpose of this baseline work was to allow for a repeatable ground survey of set locations along the Water Outfall Pipeline, near the cemetery and along the Water Intake Pipeline. Resurveying the installed pins on an annual, semi-annual or as needed basis would help to quantify slope movement in these key areas.

In addition to the installed survey pins, additional coordinates were collected along the crown of the water intake and outfall pipelines. All survey work was baselined to the GWNT’s Control Monument 100021, based on their Legal Land Survey and three additional control points were installed near each survey pin profile for future accuracy checks.

The 2025 survey was the first time these pins were re-surveyed since installation in 2022. The survey was completed by Global Raymac Surveys, on behalf of Osprey Integrity. All 37 survey pins, except one which was observed to be destroyed, were surveyed. Additionally, all seven top of water outfall pipe locations were surveyed. Of the collective 43 survey locations (36 pins and 7 top of water outfall pipeline), 36 locations were surveyed via total station and 7 via RTK, where line-of-sight total station shots were not practical.

Of the 43 surveyed points, 14 were found to have changed by 50 mm or more in either the horizontal or vertical plane, which is approximately 33% of points. The maximum change was 396 mm. A summary of the movement data is presented in Table 4 and the maximum displacement as an absolute value in either the horizontal or vertical plane is shown on Figure 10. Changes of 50 mm or more are highlighted in Table 4, and the corresponding pins are labelled on Figure 10.

Table 4: Survey Pin Summary

Transect Line	ID Number	Horizontal Magnitude Change	Azimuth Movement Direction	Elevation Change
Water Outfall Pipeline Transect #1 - West	4000	0.038	256	-0.035
	4001	0.028	219	-0.021
	4002	0.026	231	-0.014
	4003	0.020	354	-0.010
	4004	0.033	339	-0.021
	4005	0.044	278	-0.057
	4006	0.030	310	0.015
	4007	0.035	333	-0.025
	4008	0.027	347	0.020
	4009	0.028	249	0.005
	4010	0.059	253	-0.054
	4011	0.035	257	-0.041
	4012	0.062	288	-0.078
	4013	0.142	70	-0.158
	4014	0.018	19	-0.121
	4015	0.024	298	-0.045
	4016	0.006	309	-0.021
	4017	0.009	342	-0.027
	4018	0.016	320	-0.024
	4019	0.008	40	-0.020
	4020	0.010	29	-0.015
Cemetery Area Transect #2 - Central	8000	0.012	0	0.027
	8001	0.033	198	0.021
	8002	0.019	198	0.010
	8003	0.025	198	0.014
	8004	0.035	68	-0.396
	8005	0.042	121	0.024
	8006	0.029	158	-0.026
	8007	0.060	96	-0.002
	8008	0.032	167	0.052
	8009	0.028	203	0.001
	8010	0.257	78	-0.173
Water Intake Pipeline Transect #3 - East	6000	0.022	30	-0.036
	6001	0.015	20	-0.010
	6002	0.027	13	-0.049
	6003	0.039	48	-0.100
	6005	0.097	42	-0.016
	6006	0.132	17	-0.151
	6007	0.026	351	-0.024
	6008	0.027	255	-0.044
	6009	0.043	5	-0.030
	6010	0.078	350	0.003
	6011	0.059	358	0.001

From the 2025 survey data, the greatest movement in these three key areas is as follows:

- Water Outfall Pipeline, Transect #1 – West: on this transect, the most measured vertical displacement was -158 mm and the most measured horizontal displacement was 142 mm, both for pin ID#4013. The horizontal displacement was in the downslope direction. This pin is near the toe of the slope, in the area where a large crack can be seen on the LiDAR (Figure 10) and is shown on Figure 4, Photo 3. All three pins in this area (ID#4012, 4013, 4014) indicate elevation displacement (drop) since the 2022 survey.
- Cemetery Area, Transect #2 – Central: on this transect, the most vertical displacement is noted in pin ID#8004 (-396 mm), which is on the downslope side of the main headscarp (Figure 10 and Figure 6, Photo 15). There was also a minor horizontal component to movement, which was toward the toe of the slope. Elevation loss in this location makes sense with landslide mechanics for large deep seated movement. Pin ID#8010, near the toe of the slope, indicates the greatest elevation displacement (drop) of -396 mm, as well as lateral movement, approximately toward the river downslope. This area (Figure 10 and Figure 6, Photo 16) appears to be experiencing erosion near the edge of the river, and localized landsliding.
- Water Intake Pipeline, Transect #3 – East: on this transect, the most measured vertical displacement was -151 mm and the most measured horizontal displacement was 132 mm, both for pin ID#6006. The horizontal displacement was in the downslope direction. This location is also on the downslope side of the main headscarp, although this area has been regraded for the waterline. Elevation loss and the movement direction in this location makes sense with landslide mechanics for large deep seated movement. Pin ID#6005 and Pin ID#6003 are also in this headscarp area, abet upslope and also indicate similar direction and elevation loss displacements. Pin ID#6004 was reported as “disturbed” by the survey contractor, additional information on this pin in 2026 may provide more context. Most pins along this transect indicate movement in the downslope direction, toward the river. No significant field observations were noted along this transect.

5.0 LIDAR AND ORTHOPHOTO DATA

LiDAR (Light Detection and Ranging) is a spatial data collection method, which consists of a device mounted on either an airplane or a Remotely Piloted Aircraft System (RPAS). The system works by transmitting low intensity laser pulses, which hit the ground, trees, buildings, etc. and are reflected to the transmitter. The time for the laser pulse to hit a target and return is used to calculate the distance the target is from the sensor. Knowing the position of the transmitter at the time it sent each laser pulse allows for a 3D image to be constructed. The LiDAR data can be subsequently filtered to remove trees and other obstructions, leaving just a Bare Earth digital elevation model (DEM) of the surveyed area. A DEM can be used to understand the slope geometry, visualize slope features (e.g., cracks, slumps, head scarps), and perform comparisons of temporal datasets to better understand how the slope ground surface is changing over time. The quality of the LiDAR DEM is based on many things, three of which are: sensor quality, flight height and obstructions (e.g., vegetation). LiDAR data can range in quality from <1 point per square meter to >100 points per square meter.

LiDAR data, along with orthophotos, were collected for the project area by Osprey Integrity Limited of Cochrane, AB from September 8 to 10, 2025. The data was collected by multi-rotor drone with LiDAR providing more than 100 points per square meter and orthophotos of 25 mm resolution. Deliverables included point classified LiDAR in .las format and orthophotos in .tif format. The 2025 bare earth LiDAR data is presented in Figure 2 and 3.

WSP compared the 2025 LiDAR DEM to previous years of LiDAR data to spot check elevation surfaces in areas which should not be experiencing any displacement, such as roads well back from the crest of the slope. WSP did an elevation correction to more closely align these features and to facilitate comparison between data sets. Despite this, there may be some year-to-year comparison discrepancies, particularly in areas with dense vegetation, where there were fewer LiDAR ground returns.

A LiDAR derivative map was generated by comparing the 2020 and 2025 LiDAR data, producing a visualization of the areas of change in ground surface elevation. This is often referred to as LiDAR Change Detection (LCD). Areas where elevation loss was detected are shown as blue and areas where elevation gain was detected are shown as red. White or light areas represent areas with little to no elevation change. An overview of the 2020-2025 LCD, overlain on the 2025 bare earth LiDAR is shown on Figure 11.

WSP does not rely on the magnitudes calculated from the LCD work due to uncertainties as discussed above. Instead, we use this as an indicative tool to be used for high-level screening and confirmed/correlated with the visual inspection work and ideally with geotechnical instrumentation in the future. In most cases, based on the LCD there is elevation loss indicated along the toe of the slope, in areas which might be expected to be zones of accumulation if the entire slope were moving. WSP interprets this as localized slumping of the toe only into the river.

WSP also has 2022 LiDAR data, however there were some elevation issues during acquisition, which impacted the final DEM, making site-wide LCD more challenging. Localized LCD is still possible and was considered in this 2025 assessment.

The most significant apparent changes within the 2020 to 2025 time period are generally near to toe of the slope and correspond with elevation loss (i.e., blue), adjacent to the river. Likely much of this movement relates to river erosion, removing slope toe support. The possibility of ongoing and future movements in these areas negatively impacting slope stability by extending further laterally or upslope cannot be ruled out. Several of the locations are shown in greater detail on the following Figures 12 to 15 and are discussed below:

- Figure 12 – this shows the water outfall pipeline corridor from the crest of the slope down to the river. There are some sporadic areas of elevation loss and gain, including an area of ponded water on the south side of the corridor, mid-slope. The greatest changes in this area are down at the river edge, including a scarp that extended northwest, away from the pipeline between 2020 and 2025. This extended scarp was also observed in the 2022 LiDAR. This scarp under the pipeline was first observed in 2020 and is shown in 2025 on Figure 4, Photo 3, with little observable change.
- Figure 13 – this shows the area south of the boat launch and below the cemetery. There are some sporadic areas of elevation loss and gain, including a few areas of ponded water in mid-slope. On the left side of the figure nearest to the boat launch access road, there is a new scarp that has developed since 2020 (also not visible on the 2022 LiDAR). This represents an area of retrogression of active slope area within the landslide complex. Photographs of this area are presented on Figure 4 and 5. Similarly, on the east side of the figure, there is a new scarp that has developed since 2020 (also not visible on the 2022 LiDAR). There is also ground loss in this area immediately adjacent to the river since 2022. Photographs of this area from the visual slope inspection are presented on Figure 6. Near the crest of the slope there are some areas of apparent elevation gain, which appear to generally correspond to erosion of the headscarp and or anomalies in the DEM surface due to vegetation cover.
- Figure 14 – this shows several areas of apparent creep toward the river as evidenced by areas of broad elevation loss (i.e., blue) and indicated on the figure. In many cases these areas are in close proximity to drainage features and/or seepage areas. Creep-type movement may be deep seated or relatively shallow and related to seasonal freeze-thaw cycles. The upper extent of this apparent creep in many cases is around elevation 190 m, which is about 1/3 up the slope. It is possible this corresponds with a stratigraphic feature or melting permafrost. Two areas of more active movement as indicated by the LCD are immediately upstream and downstream of the water intake structure. Photographs of these areas from the visual slope inspection are presented on Figure 7. The area of more active movement on the upstream side of the water intake location also shows change in the 2022 to 2025 LCD.
- Figure 15 – in this area there is no Town infrastructure on or near the slope or crest of slope. This area has historically been part of the study area as it was considered a potential area for future development. Along this part of the slope, there are a few locations as shown on the figure where there may be minor or creep-type movement occurring.
- Figure 16 – this figure revisits the data from the pin survey work and combines it with the LCD work, to visually indicate where the data may show correlations. This is especially evident on Transect #1 and #2, near the toe of the slope, where the LCD indicates elevation loss. The most significant elevation loss was on Transect #2, just downslope of the headscarp. The LCD does suggest some potential changes in this area, but not exactly at this pin location. The survey data from Transect #3 appears to show most horizontal movement in the downslope direction, with most significant movement on the lower 2/3 portion of the slope, which may show some correlation with the LCD, especially given the creep-type movement on the east side of the pipeline clearing. The correlation and non-correlation further underlies the importance of not relying on a single tool, but rather a suite of data sources, including visual observations and engineering judgement.

6.0 DISCUSSION AND PATH FORWARD

The following recommendations are presented based on the analysis of the 2025 data:

- This large landslide complex continues to move in various areas and at various rates. In 2025, the movement was noted to continue in similar areas as noted in previous assessments, most significantly upstream of the boat launch and below the cemetery, as well as near the water intake pipeline. These two areas appear to not be directly impacting Town infrastructure at present, but may at some point in the future as natural slope retrogression and movement is expected to continue. These areas should be closely monitored for retrogression, and accelerations that could pose a risk to Town infrastructure.
- Survey pin data generally agrees with the LCD work, as well as observations in the field. Consideration could be given to adding more survey pins on the slope to enhance the coverage of this relatively, low-cost monitoring system. The survey data when compared to the LCD work indicates some correlation and non-correlation. This underlies the importance of not relying on a single tool for slope assessment, but rather a suite of data sources, including visual observations and engineering judgement.
- Geotechnical slope monitoring instruments, such as slope inclinometers or ShapeArrays, are recommended to be installed in key areas of the slope (i.e., water intake pipeline cemetery and water outfall pipeline areas) to better monitor the slope movement at this site. Deep landslide complexes like this one, often have movements at depth which are partially or fully masked at surface. Surficial LiDAR and visual observations may not provide sufficient monitoring or warning in the event of a larger, or more rapid landslide event. Additional geotechnical instruments, such as vibrating wire piezometers and thermistors would augment existing subsurface stratigraphical information during their installation, and also allow for long-term geotechnical measurements below the ground surface. Understanding the geotechnical slope conditions at depth will better aid in understanding the mechanisms involved with the slope movement and assessing the hazard. Automation of slope monitoring instruments has the capability to include near-real-time monitoring of the slope, including alarm based movement thresholds. WSP understands that Government Grant funding applications have been submitted in the past and would be pleased to assist again, as needed.
- A geotechnical visual inspection of the slope should be completed annually, or if significant movement is noted by the Town.
- Undertake a survey of the geotechnical monitoring pins annually, or if significant movement is noted by the Town.
- Collect LiDAR data on a 3-year basis (i.e., next in 2028), or if significant movement is noted by the Town or during the annual visual inspection or annual survey work.
- Contingency planning should take place, as appropriate, for key infrastructure on or near the river slopes (i.e., water intake pipeline, cemetery area, water outfall pipeline) should these areas be rapidly impacted by slope movement.

7.0 CLOSURE

This memorandum has been prepared for the exclusive use of the Town of Fort Smith. This memorandum is based on, and limited by, the interpretation of data, circumstances, and conditions available at the time of completion of the work as referenced throughout the memorandum. It has been prepared in accordance with generally accepted engineering practices. No other warranty, express or implied, is made.

WSP Canada Inc.

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B.H.L. BRODLAND
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2026-03-20

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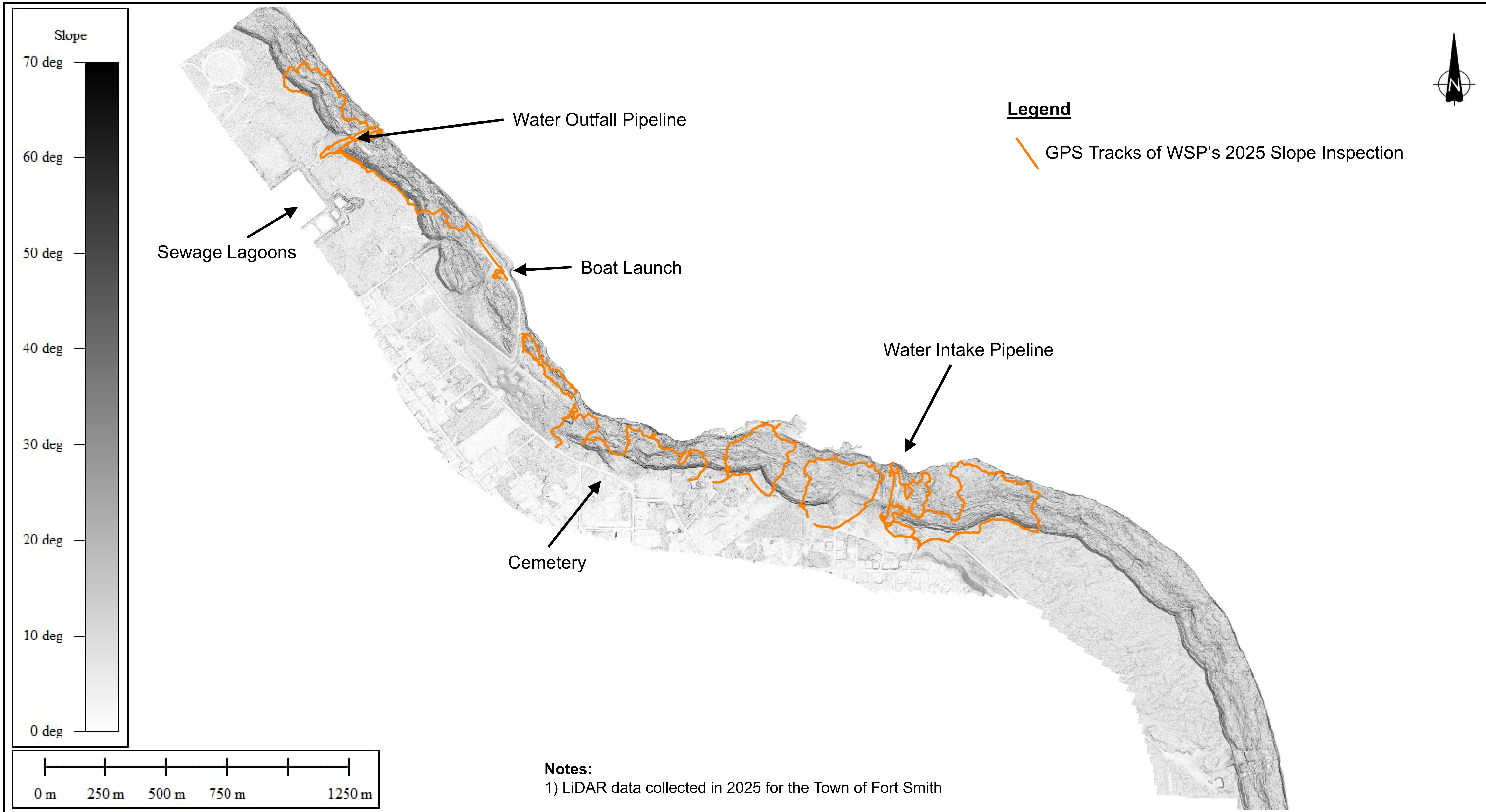
PERMIT TO PRACTICE
WSP Canada, Inc.
Signature Karen Hancks
Date 2026-03-20
PERMIT NUMBER: P407
NT/NU Association of Professional Engineers and Geoscientists

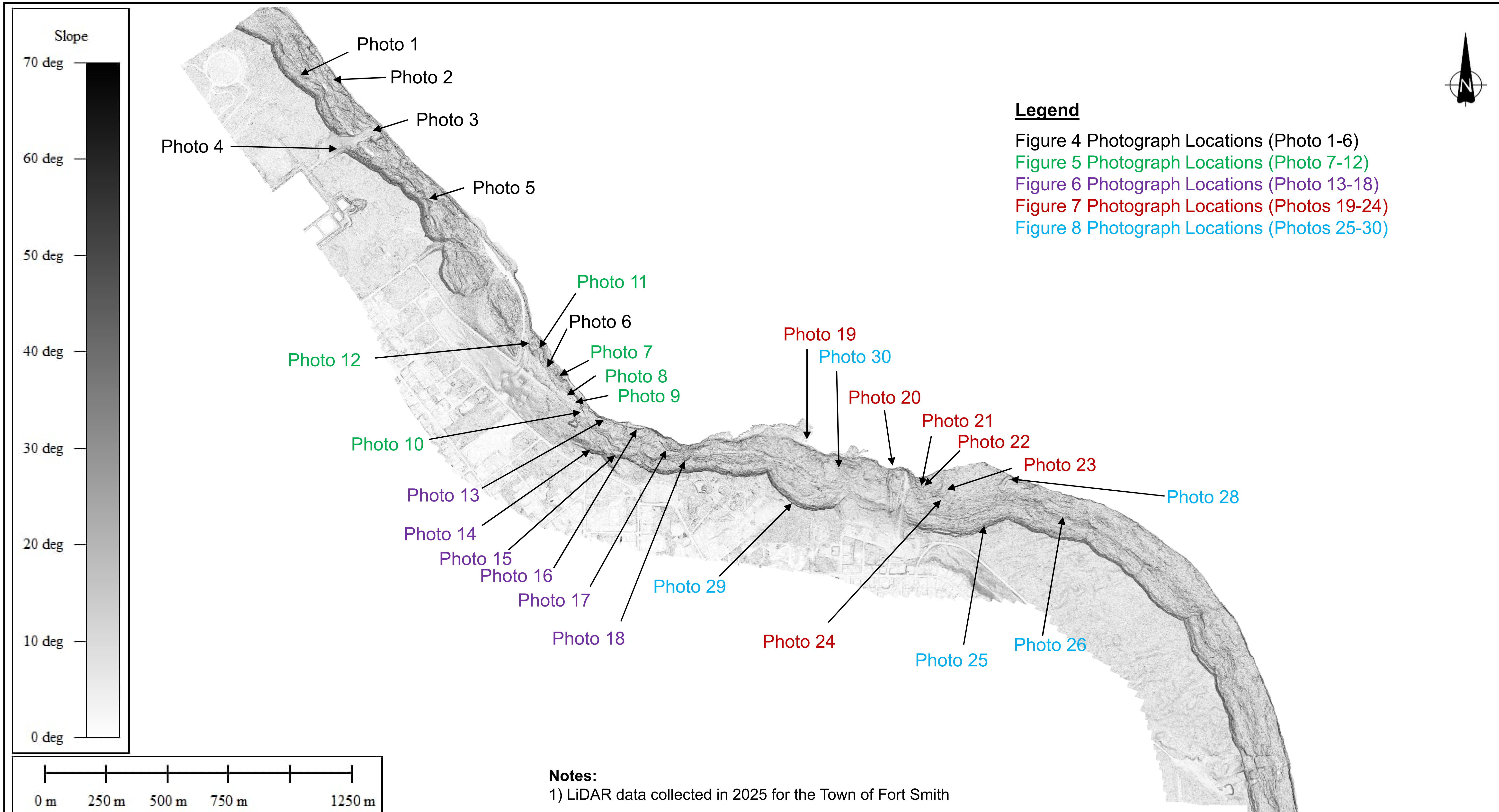
Figures

Client:	*Project Name:* **Slope Monitoring Report 2025, Slave River Adjacent to Forth Smith NT**	*Project Number:* CA0058096.7320
	Figure Title: **Site Overview**	*Figure Number:* 1
		Date: March 2026



Notes:
1) LiDAR data collected in 2025 for the Town of Fort Smith

Client: Fort Smith NORTHWEST TERRITORIES	wsp	*Project Name:* **Slope Monitoring Report 2025, Slave River Adjacent to Forth Smith NT**	*Project Number:* CA0058096.7320
		Figure Title: **Site Topography, Key Features and 2025 GPS Tracks**	*Figure Number:* 2
			Date: March 2026



Client: Fort Smith NORTHWEST TERRITORIES	wsp	*Project Name:* **Slope Monitoring Report 2025, Slave River Adjacent to Forth Smith NT**	*Project Number:* CA0058096.7320
		Figure Title: **2025 Visual Slope Inspection, Select Photographs**	*Figure Number:* 3
			Date: March 2026

Photo 1 – area of ponded water

Photo 2 – erosion along toe of the slope

Photo 3 – scarp crossing under the water outfall line, and likely impacting support pad

Photo 4 – water outfall pipeline near crest of slope, showing exposed sandy soil

Photo 5 – lateral ground separation with legacy vegetation tears and younger trees regrowing


Photo 6 (cropped) – area of fresh ground movement, torn vegetation mat and tilting trees/brush

Client: Fort Smith NORTHWEST TERRITORIES		*Project Name:* **Slope Monitoring Report 2025, Slave River Adjacent to Forth Smith NT**	*Project Number:* CA0058096.7320
		Figure Title: **Site Photographs 2025 (1 of 5)**	*Figure Number:* 4
			Date: March 2026

Photo 7 – parallel cracks with area of fresh ground movement, torn vegetation mat and tilting trees/brush

Photo 8 – area of fresh ground movement, torn vegetation mat and tilting trees/brush

Photo 9 – area of fresh ground movement, torn vegetation mat and tilting trees/brush

Photo 10 – scarp with exposed soil, near to the river level

Photo 11 – water seepage from area of fresh ground cracking

Photo 12 – scarp with exposed soil and mature tilted trees

Client:		Project Name:	Project Number:
Fort Smith NORTHWEST TERRITORIES	WSP	**Slope Monitoring Report 2025, Slave River Adjacent to Forth Smith NT**	CA0058096.7320
		Figure Title: **Site Photographs 2025 (2 of 5)**	Figure Number: 5
			Date: March 2026

Photo 13 – scarps and benched topography along river showing erosion

Photo 14 – headscarp, with overhanging j-trunk and fallen trees, overhanding vegetation. Vandalized picnic table in foreground.

Photo 15 – headscarp with overhanging vegetation. Note the moist soil on the lower right and bedded sand structure at the crest and mid-photo banding.

Photo 16 – toe of slope adjacent to the river showing erodible soils, high water marks, as well as tilted trees and scarps in the distance

Photo 17 – scarp with mobilized vegetation mat, fore and back tilted trees

Photo 18 – scarp with exposed soil, exposed tree roots, split and damaged trees

Client:

Fort Smith
NORTHWEST TERRITORIES

Project Name:
Slope Monitoring Report 2025,
Slave River Adjacent to Forth Smith NT

Project Number: CA0058096.7320

Figure Title:
Site Photographs 2025 (3 of 5)

Figure Number: 6

Date: March 2026

Photo 19 – fallen and tilting trees near river. Note exposed granite bedrock surface exposed adjacent to flowing river

Photo 20 – water intake area. Note exposed suspected bedrock foundation and highwater mark


Photo 21 – vegetation mat tears, possibly indicative of ground movement.


Photo 22 (cropped) – consecutive vegetation mat tears aligned with split tree trunk


Photo 23 – area of ponded water on slope


Photo 24 (cropped) – continuous vegetation tear and open void beneath

Client: Fort Smith NORTHWEST TERRITORIES	WSP	*Project Name:* **Slope Monitoring Report 2025, Slave River Adjacent to Forth Smith NT**	*Project Number:* CA0058096.7320
		Figure Title: **Site Photographs 2025 (4 of 5)**	*Figure Number:* 7 *Date:* March 2026

Photo 25 – headscarp area, showing relatively straight trees below

Photo 26 – area of relative stability, with some tilted trees

Photo 27 – scrap with fore and back tilted trees, some exposed soil

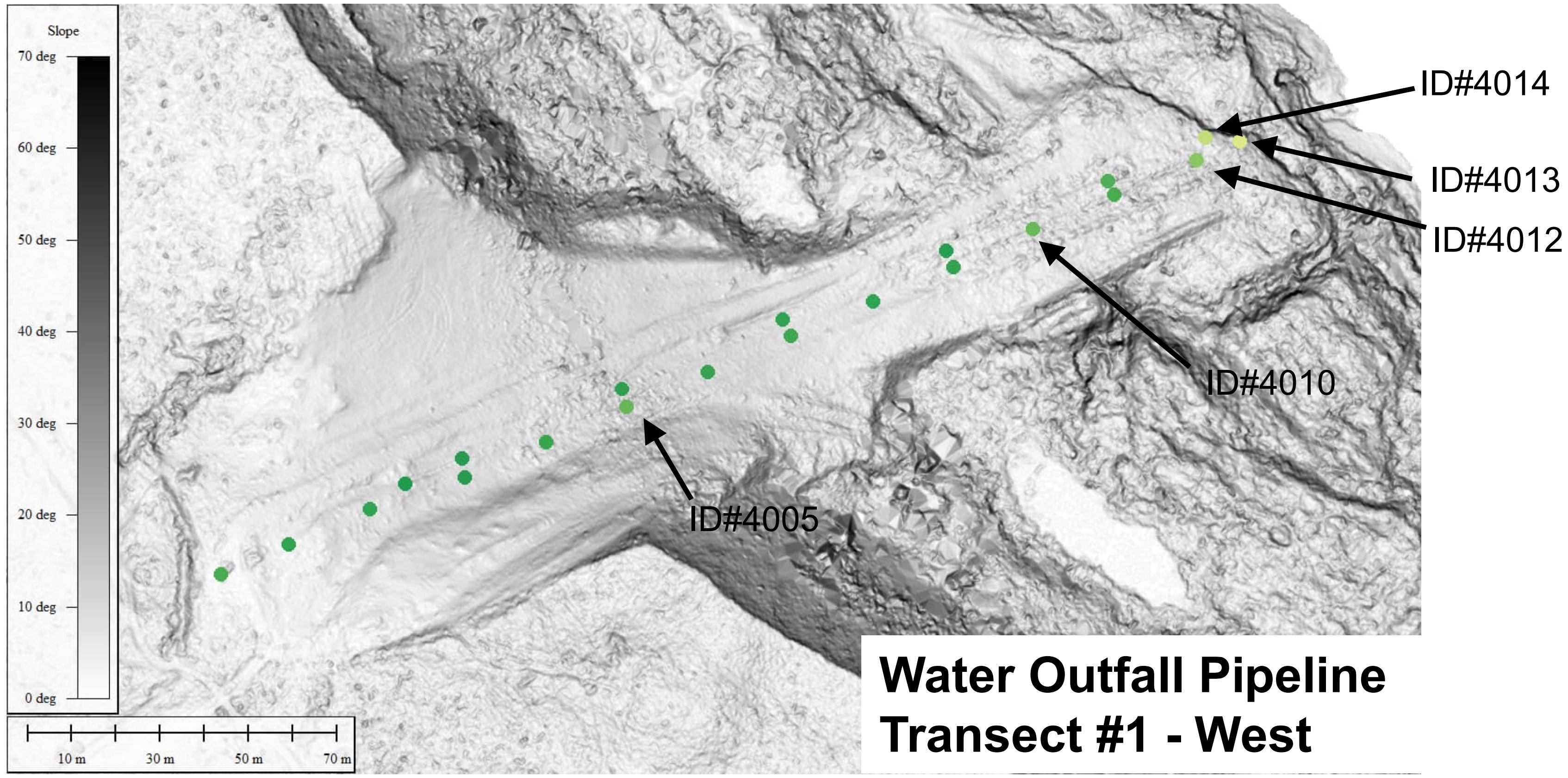
Photo 28 – toe of slope adjacent to the river showing eroding bank and flooded trees

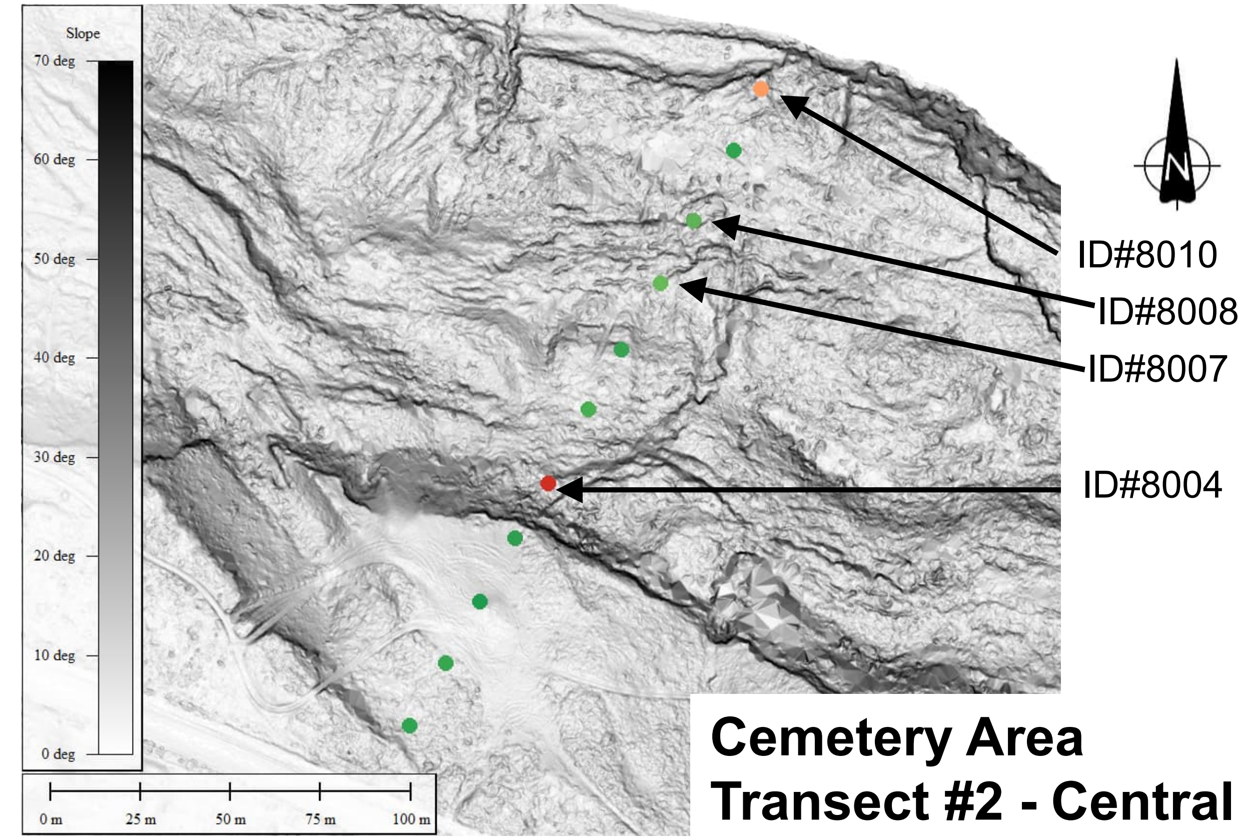
Photo 29 – headscarp with exposed soil

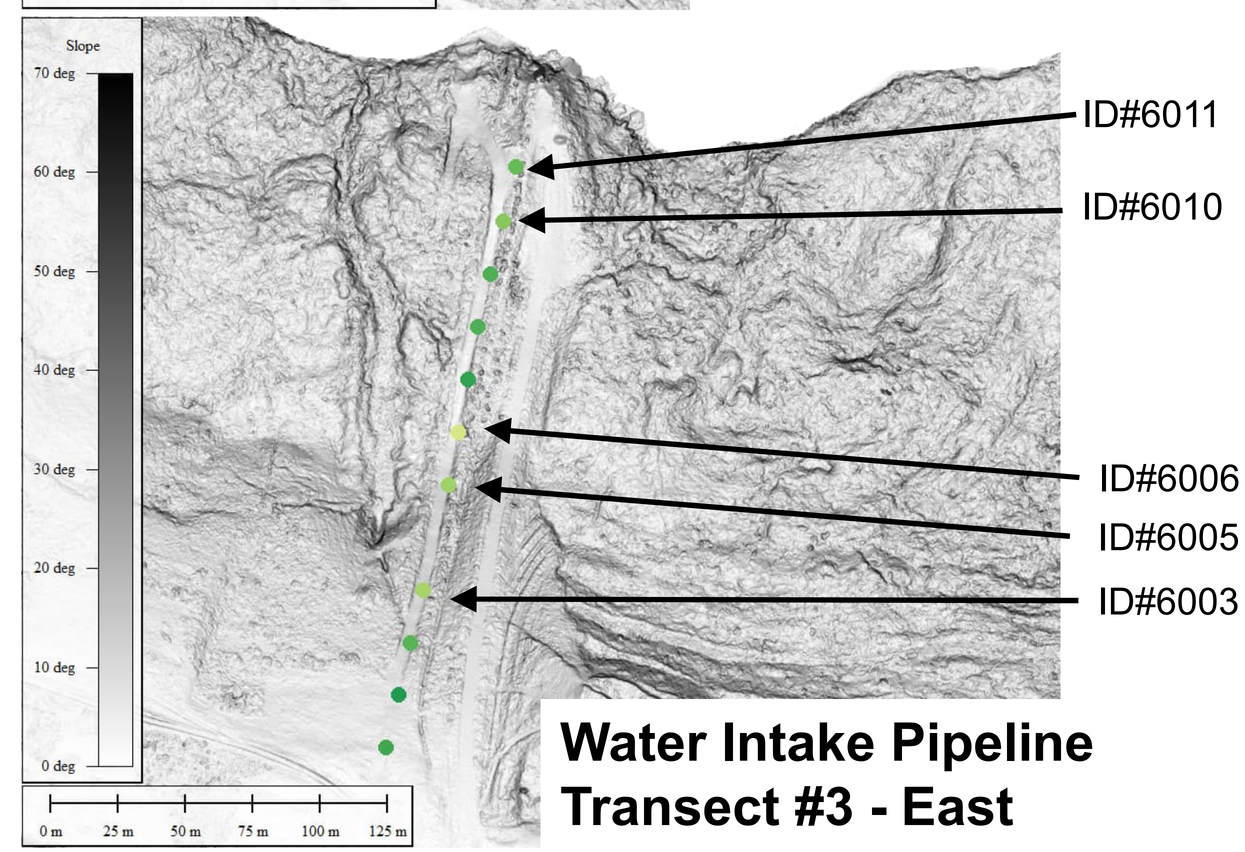
Photo 30 – scarp with exposed soil

Client: Fort Smith NORTHWEST TERRITORIES	wsp	*Project Name:* **Slope Monitoring Report 2025, Slave River Adjacent to Forth Smith NT**	*Project Number:* CA0058096.7320
		Figure Title: **Site Photographs 2025 (5 of 5)**	*Figure Number:* 8 *Date:* March 2026

Client: Fort Smith NORTHWEST TERRITORIES	wsp	Project Name: **Slope Monitoring Report 2025, Slave River Adjacent to Forth Smith NT**	Project Number: CA0058096.7320
		Figure Title: **2025 Survey Locations**	Figure Number: 9
			Date: March 2026







Legend

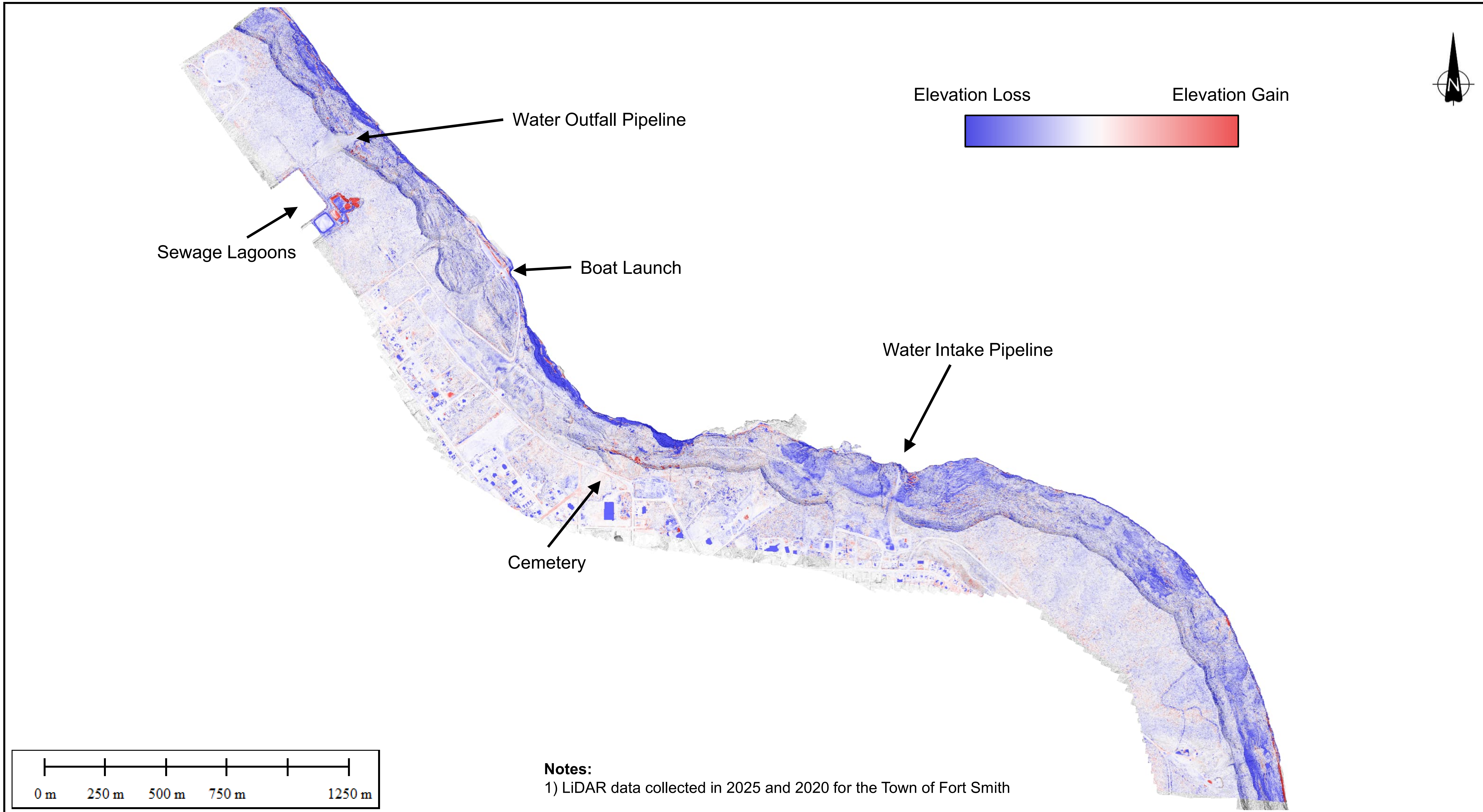
Survey Location Maximum Displacement (m)

- 0.01
- 0.08
- 0.14
- 0.21
- 0.27
- 0.33

Notes:

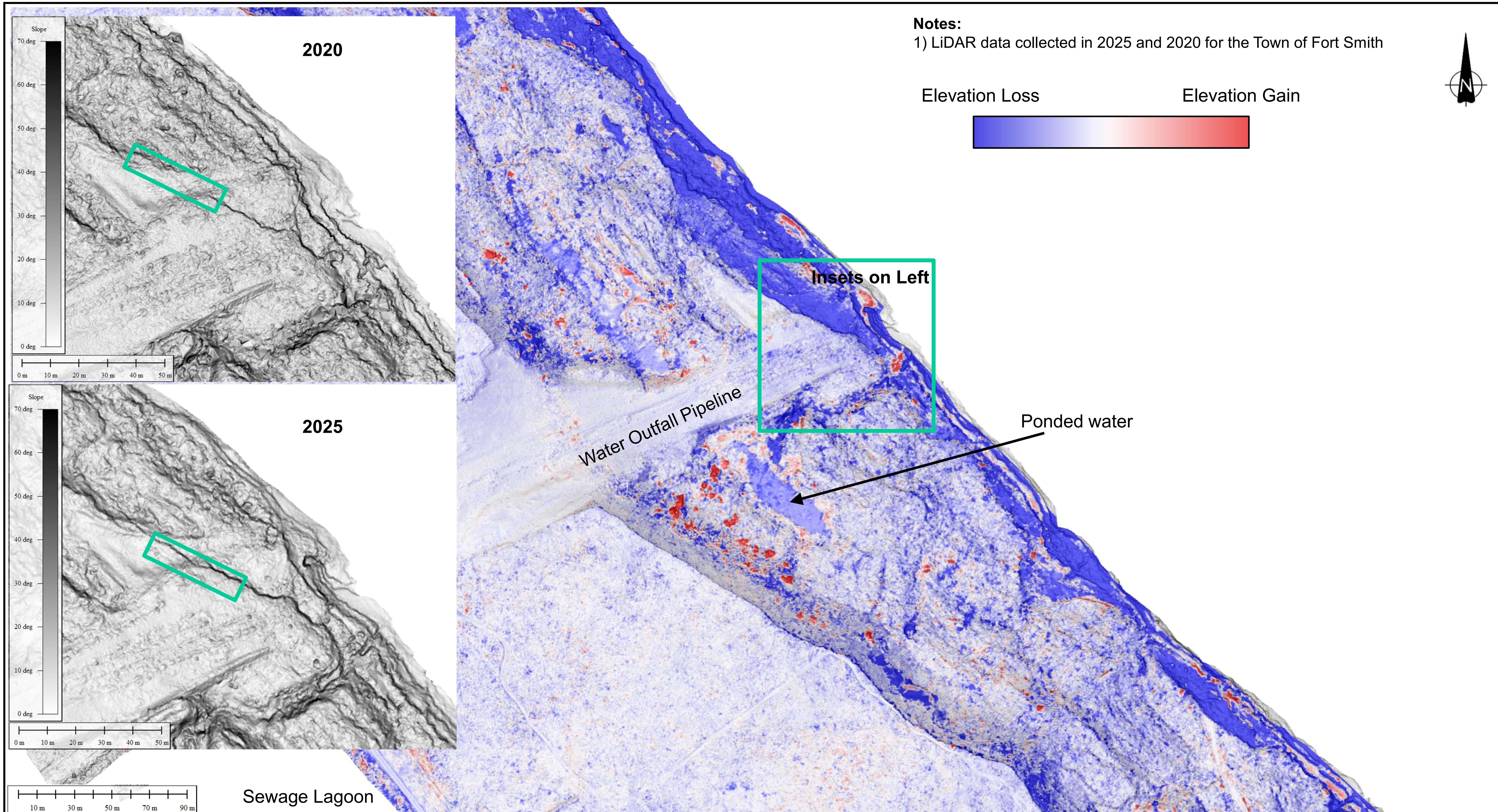
1) LiDAR data collected in 2025 for the Town of Fort Smith
2) Reported displacement is the greater absolute value in either the horizontal or vertical plane

Client: Fort Smith NORTHWEST TERRITORIES	wsp	*Project Name:* **Slope Monitoring Report 2025, Slave River Adjacent to Forth Smith NT**	*Project Number:* CA0058096.7320
		Figure Title: **2025 Survey Displacement Magnitudes**	*Figure Number:* 10 *Date:* March 2026

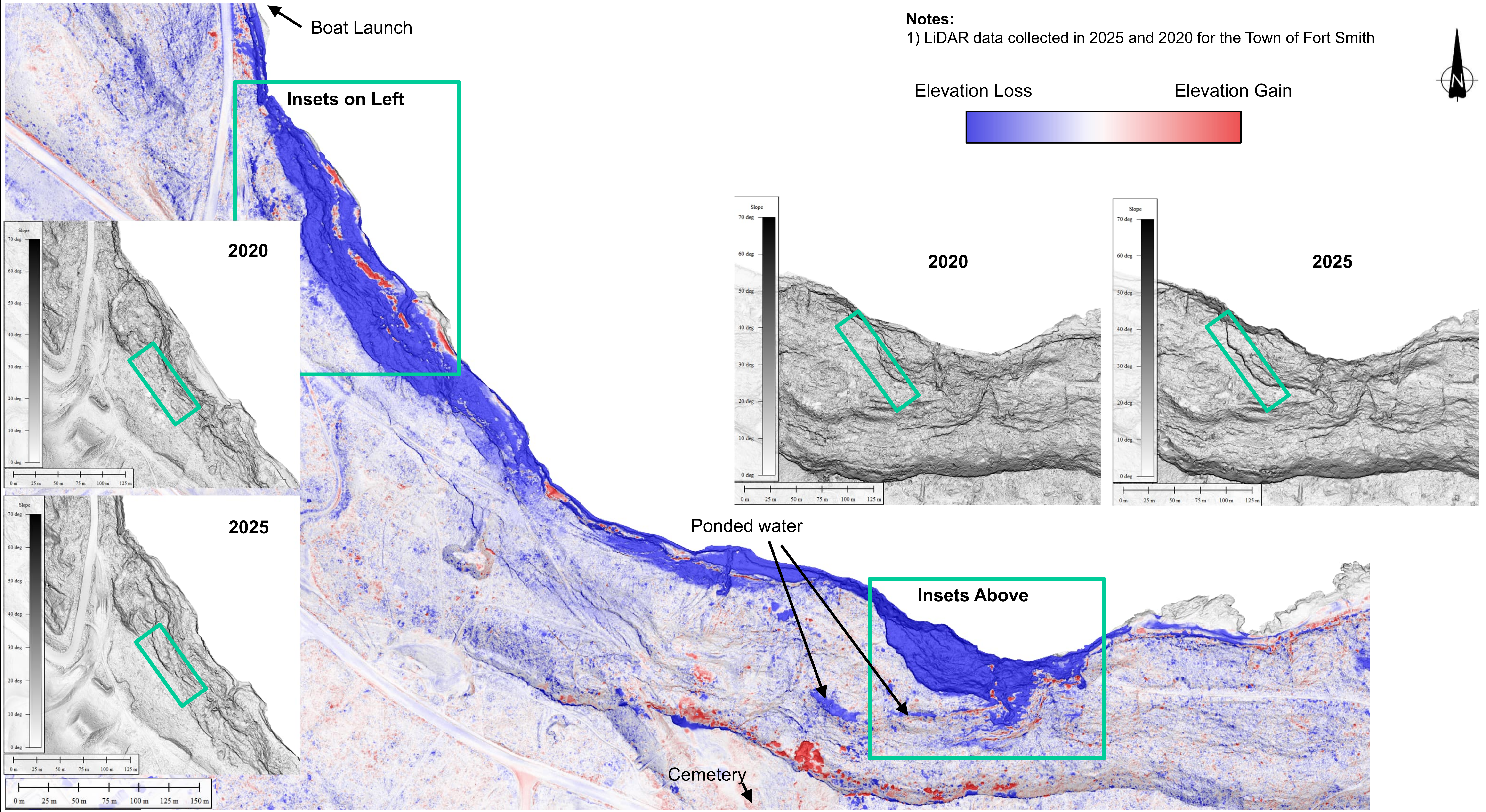


Notes:
1) LiDAR data collected in 2025 and 2020 for the Town of Fort Smith

Client: Fort Smith NORTHWEST TERRITORIES	wsp	*Project Name:* **Slope Monitoring Report 2025, Slave River Adjacent to Forth Smith NT**	*Project Number:* CA0058096.7320
		Figure Title: **LiDAR Change Detection Overview**	*Figure Number:* 11
			Date: March 2026



Client:		Project Name: Slope Monitoring Report 2025, Slave River Adjacent to Forth Smith NT	Project Number: CA0058096.7320
Fort Smith NORTHWEST TERRITORIES	wsp	Figure Title: LiDAR Change Detection – Water Outfall Pipeline	Figure Number: 12
			Date: March 2026



Client:

Fort Smith
NORTHWEST TERRITORIES

wsp

Project Name:

Slope Monitoring Report 2025, Slave River Adjacent to Forth Smith NT

Project Number:

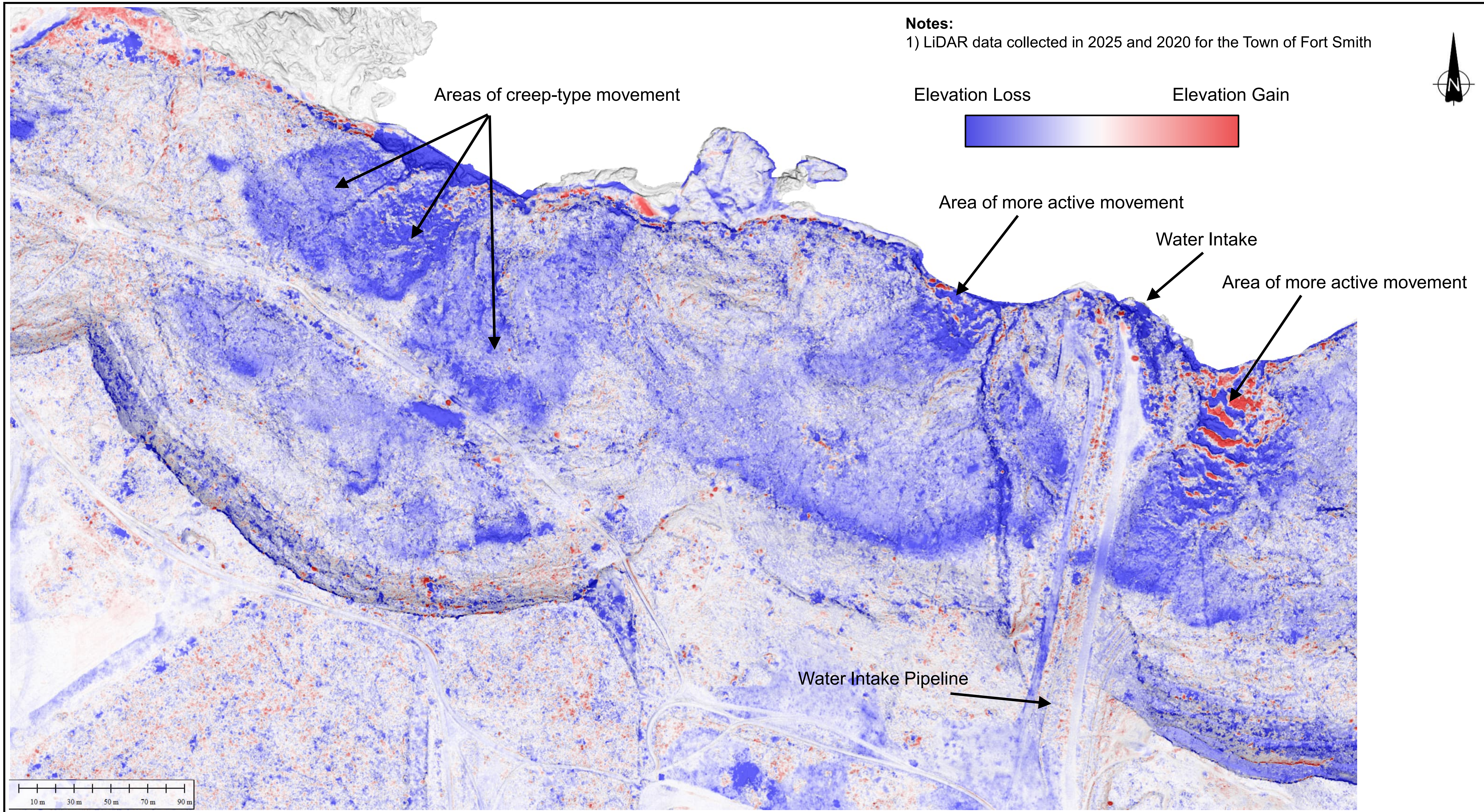
CA0058096.7320

Figure Title:

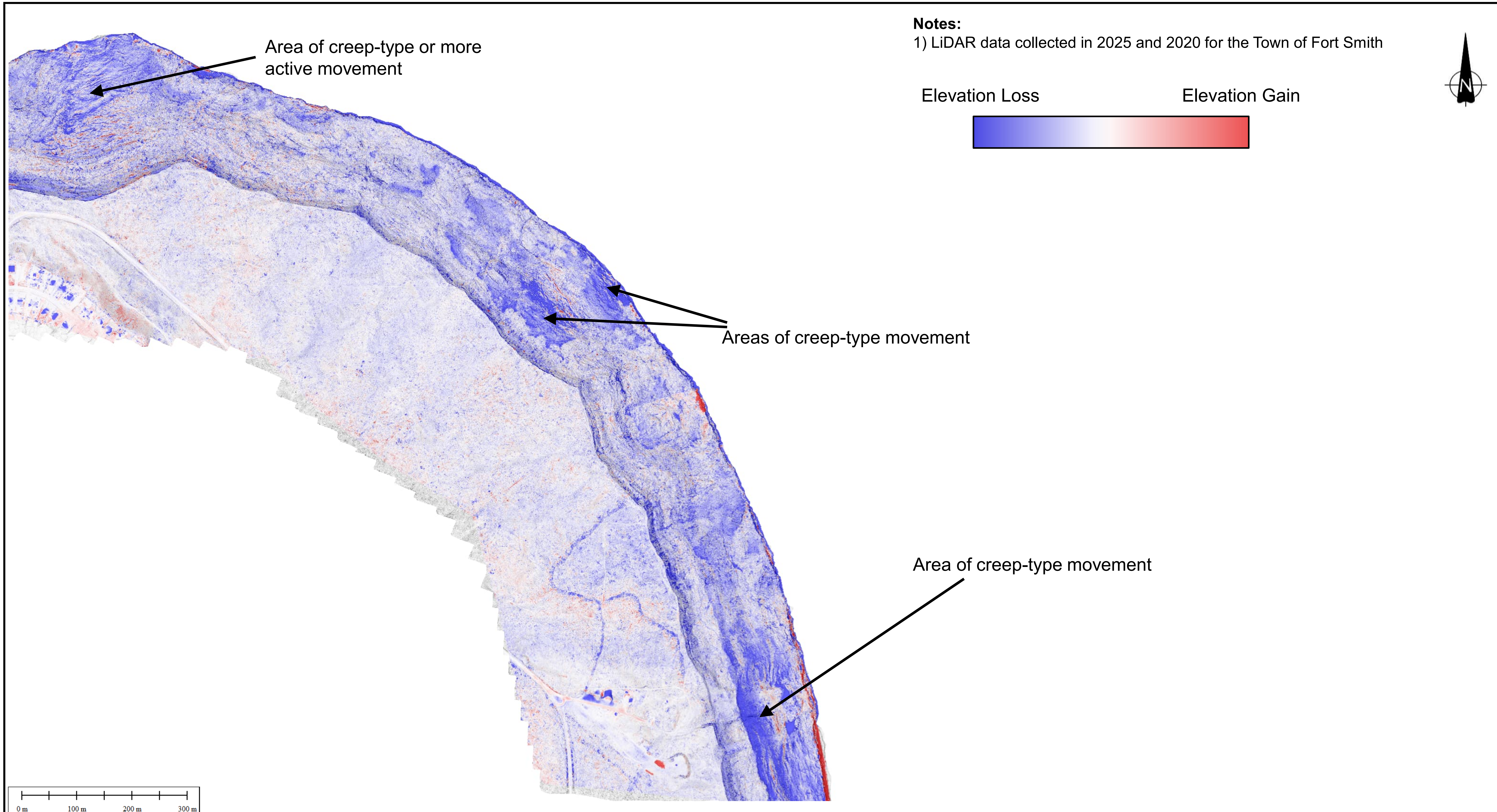
LiDAR Change Detection – Between Boat Launch and Cemetery

Figure Number: 13

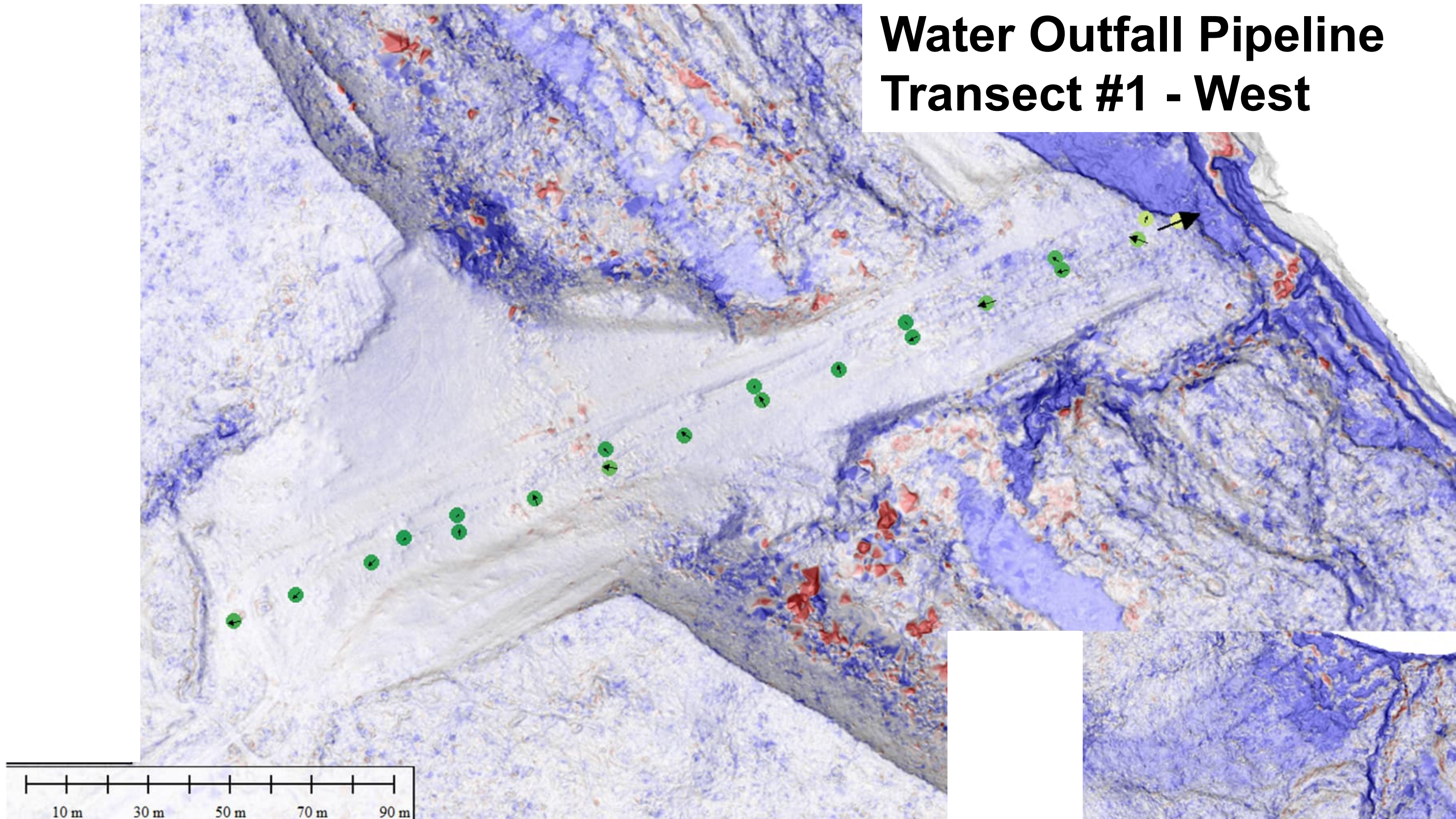
Date: March 2026

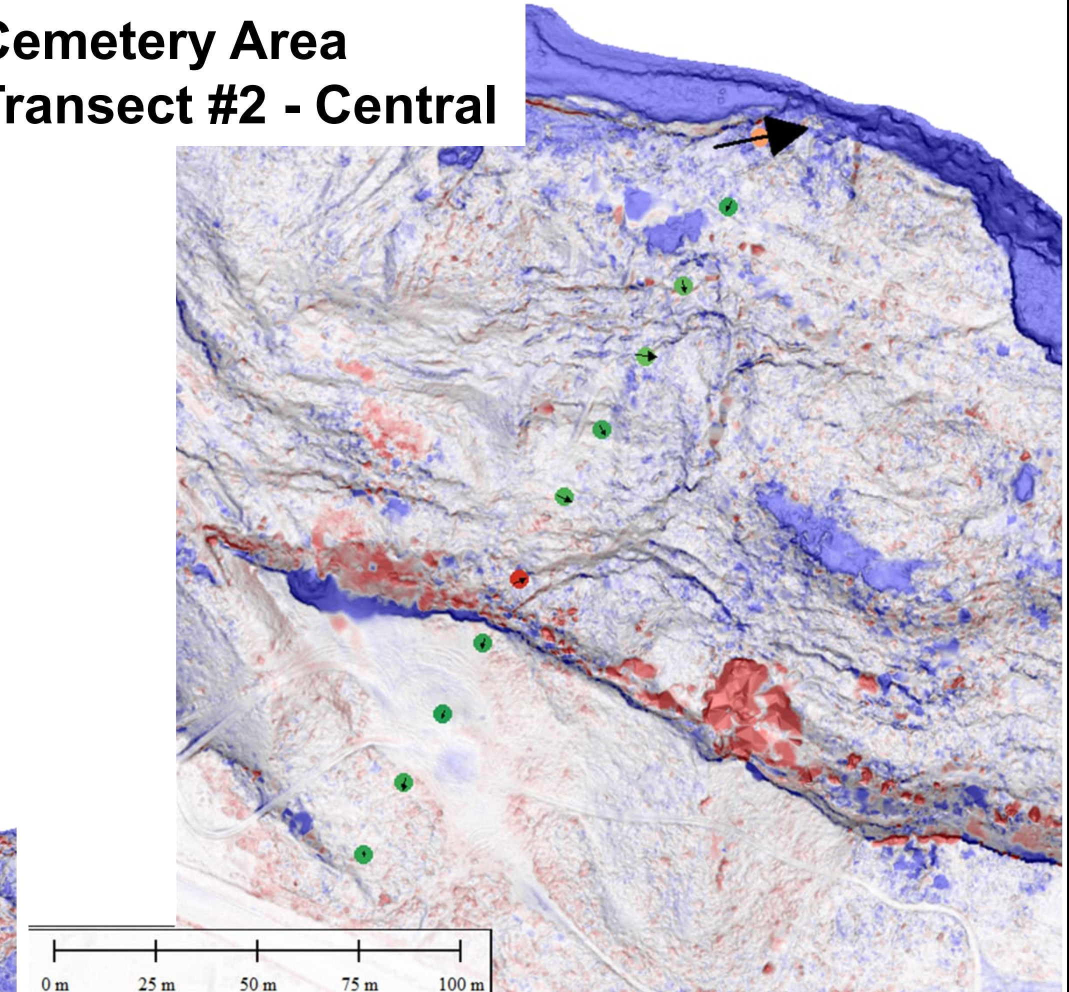


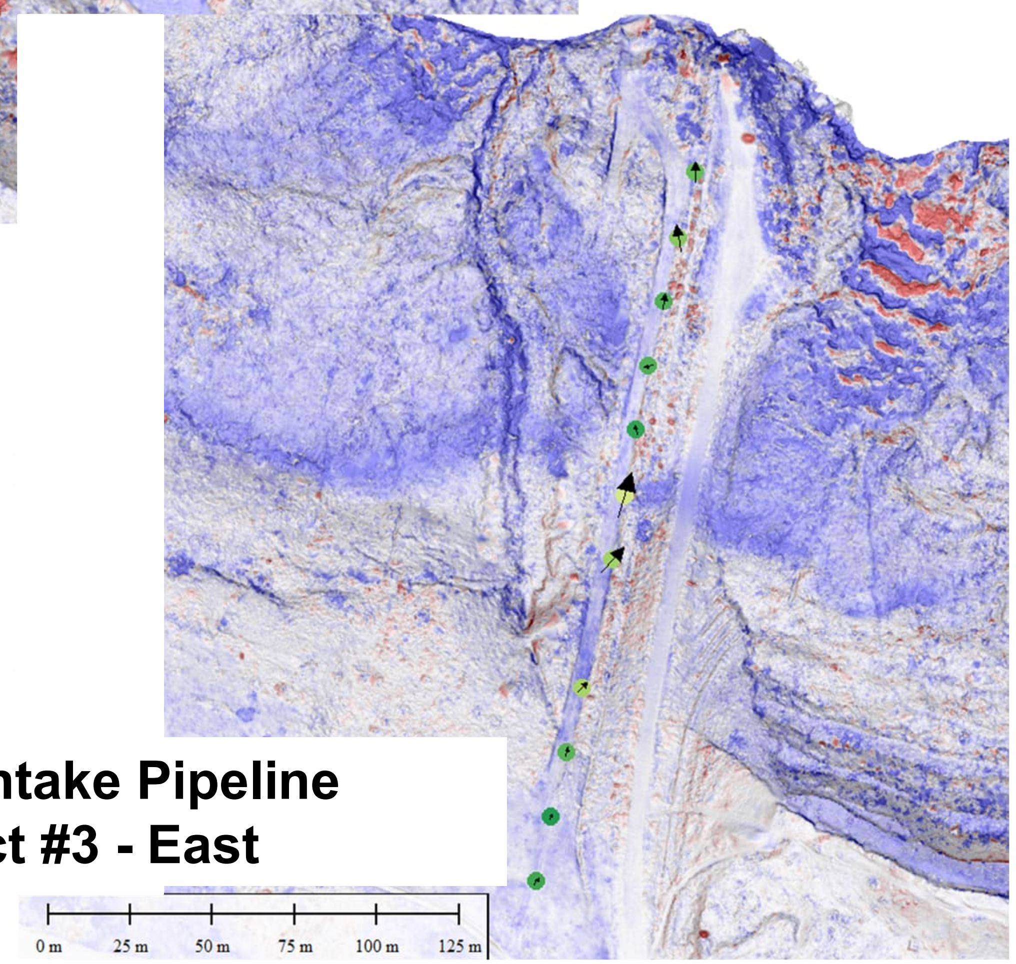
Client:		Project Name:	Project Number:
Fort Smith NORTHWEST TERRITORIES	wsp	**Slope Monitoring Report 2025, Slave River Adjacent to Forth Smith NT**	CA0058096.7320
		Figure Title: **LiDAR Change Detection – Near Water Intake Pipeline**	Figure Number: 14
			Date: March 2026



Client:		Project Name:	Project Number:
Fort Smith NORTHWEST TERRITORIES	wsp	**Slope Monitoring Report 2025, Slave River Adjacent to Forth Smith NT**	CA0058096.7320
		Figure Title:	Figure Number: 15
		LiDAR Change Detection – East End of Site	Date: March 2026







N

Notes:

1) LiDAR data collected in 2025 for the Town of Fort Smith
2) Reported displacement is the greater absolute value in either the horizontal or vertical plane
3) Arrows indicate to scale, the magnitude and direction of measured movement in the survey pin work

Legend

Survey Location Maximum Displacement (m)

- 0.01
- 0.08
- 0.14
- 0.21
- 0.27
- 0.33

Elevation Loss — Elevation Gain

Client:		Project Name:	Project Number:
Fort Smith NORTHWEST TERRITORIES	wsp	**Slope Monitoring Report 2025, Slave River Adjacent to Forth Smith NT**	CA0058096.7320
		Figure Title: **LiDAR Change Detection vs. Survey Pin Data**	Figure Number: 16
			Date: March 2026

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