ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION (PEACE RIVER DISTRICT)
2024 INSPECTION

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
PH043	Daishowa East Hill	Diashowa Retaining Wall – Site A / Site B	986:01	33.45 – 33.74
Legal Description		**UTM Co-ordinates (NAD 83)**		
NE7/NW8-85-20 W5M		11V E 491380 N 6246075		

	Date	PF	CF	Total
Previous Inspection:	May 18, 2023 Site A – Pile Wall	6	4	24 (Slide Risk Rating)
	Site B	11	5	55 (Slide Risk Rating)
Current Inspection:	May 29, 2024 Site A – Pile Wall	8	3	24 (Slide Risk Rating)
	Site B	11	5	55 (Slide Risk Rating)
Road WAADT:	870		**Year:**	2023
Inspected By:	Don Proudfoot, Tyler Clay, Cole Szakacs (Thurber). Rocky Wang, Robert Senior (TEC)			
Report Attachments:	☒ Photographs ☒ Plans ☐ Maintenance			

Primary Site Issue:	Site A – Pile Wall Roadway constructed across major landslide. Embankment originally stabilized by diverting unnamed creek on north side of roadway through a culvert within toe berm constructed across valley bottom. Embankment failed up to roadway requiring installation of a cantilever pile wall in 2004. Shallow slumping has been ongoing below the wall subsequently. Culvert outlet also became unstable and was eroding/ 'head cutting' through toe berm. Site B An unnamed creek was diverted through a culvert located under a toe berm downslope of the roadway embankment. The culvert was undersized to handle the spring runoff, which overflowed and eroded the west sideslope of the toe berm. Landslide movement in the natural creek valley severed the CPP downpipe near 33+850 which has since caused an erosion gully to form upslope of the culvert inlet area.
Dimensions:	Site A - Unstable roadway embankment was approximately 225 m in length. Distance from roadway to toe of slope approximately 110 m. Site B - Embankment is about 175 m long and extends 150 m below roadway to toe of slope
Date of any remediation:	2017-2019 - Mitigation measures involved construction of gabion drop structures and overflow channels at both sites to reduce rates of the creek erosion. At Site A the work also included the installation of a driven steel pile retaining wall to allow the construction of the drop structure; further regrading work across the embankment slope that slid during

	construction; and the construction of an armored swale to repair an erosion gully down the east edge (crotch) of the embankment fill sideslope. At Site B the work also included construction of a swale to repair an erosion gully down the east edge (crotch) of the highway embankment sideslope and lining the highway ditch further east with gabion mattress and ECM.		
Maintenance:			
Observations:	**Description:**	**Worsened?**	
		Yes	**No**
☐ Pavement		☐	☐
☒ Slope Movement	**Site A** During mitigation work in 2017/2018 a slide was initiated within the lower slope near the new drop structure that was mitigated via a driven steel pile wall. There is shallow slide activity with ongoing movement within the disturbed slide mass and minor retrogression and expansion downslope of the west end of the older buried tangent pile wall. (Photo 43-02) Previous cracking further east from this area have been graded during the mitigation work and appeared in good condition. No evidence of slope movement was observed upslope of the buried pile wall. (Photo 43-04) Tension cracks potentially related to sliding downslope and towards the east crotch riprap swale (near damaged section) had no change in offset between the installed lath stakes from the 2022 condition, measuring 1.16 m offset to the outside bottom of the stakes. This feature may be a result of erosion instead of slope movement. (Photo 43-08) **Site B** Sliding is ongoing within the erosion gully at the broken CPP down pipe near 33+850. (Photo 43-16) A new surficial slide developed near the upper slope adjacent to the swale (33+825) that was identified during the July 2024 callout.	☒	☐
☒ Erosion	**Site A** Rill erosion upslope from the steel pile wall was slightly deeper relative to the 2023 condition. (Photo 43-01) At the culvert inlet (33+500) the south channel bank erosion was slightly worse with expansion of the erosion and additional riprap fallen away. (Photo 43-06) The swale riprap at the east end of Site A with erosion damage from a 2019/2020 high flow event	☒	☐

	had increased damage, gullying was deeper and wider. (Photo 43-07) **Site B** Rills were slightly worse between the road and north ditch gabion armour at km 34+000 (Photo 43-20). South ditch erosion has an expanded gully (1.2 m wide, 0.7 m deep) in area with previous erosion that vegetated between approximately 34+150 and 33+900. (Photo 43-19) Previous area of erosion rills at top of embankment at the east end of the site has been graded and TRM installed. TRM appears effective in reducing rill erosion development. Limited vegetation growth within the upper road embankment likely due to sand and salt runoff from winter road maintenance. At end of TRM section at west end of site rill erosion looked similar to the 2023 condition. (Photos 43-09 and 43-14) Increased gully erosion was noted near the outlet of the CPP down pipe (33+800) due to a leaking joint caused by a local landslide movement. Further upslope from the CPP down pipe outlet is an additional break in the pipe that has resulted in large erosion gully developing (2 m wide, 1.4 m deep) offset approximately 200 m from the highway. (Photo 43-16)		
☐Seepage		☐	☐
☒ Bridge/Culvert	**Site A** Gabion drop structure had minor increase in silt buildup at the base within the dissipation bowl (Photo 43-03). Culvert inlet is damaged and eroded causing water to flow under the base and come in at a joint (Photo 43-06). **Site B** Culvert inlet at 33+800 is still damaged from high flow event and has severely reduced flow capacity. Additional riprap above the inlet had collapsed above it and slid down burying it (Photos 43-15). Piping erosion has formed a void in the previously damaged area and location where culvert joint and grouting repairs were made, at the gabion drop structure. The gabion baskets and mattresses in the bottom part of the drop structure have settled and tilted around the area of damage. There was an expansion of the erosion damage around the north	☒	☐

	side of the drop structure and baskets were slightly more deformed (Photos 43-10 and 43-11).		
☒ Other	No significant beaver activity noted at the creek between Sites A and B. Additional woody debris buildup upslope of the Site B culvert inlet, indicative of flooding during high flow conditions. (Photo 43-15)	☐	☒

Instrumentation:

Site A Spring 2024 measurements:

- Slope inclinometers SI-4, SI-5 and SI-6 are located east of the wall and the main slide block. All three SI's have shown a consistent rate of movement trend, however the shallow movement zones in SI-5 and SI-6 show some acceleration in movement since the spring of 2023 readings. Current movement rates are between 5 to 10 mm/yr in the upper 6 m. Cumulative resultant movements range between approximately 30 mm and 200 mm.

Buried Tangent Pile Wall

- SI04-1 – 7.0 mm/yr between 0.1 m to 2.6 m (136 mm cumulative above wall), 3.1 mm/yr over the length of pile (66 mm cumulative within wall).
- SI04-3 – showed a rate of movement of 16.1 mm/yr over 0.1 to 1.4 m depth since the spring of 2023 readings and a rate of movement of 4.1 mm/yr over the length of the pile (110 mm cumulative within wall).
- There has been an increased movement rate trend within the upper 2 m of the wall since a landslide occurred downslope of the wall during erosion mitigation construction in 2017/2018.

Upslope of roadway

- SI03-6 – Creep (< 1.0 mm/yr) over 4.7 m to 6.0 m depth.

Groundwater

- Groundwater elevation trend has been consistent since 2008 between 4 m and 7 m depth.

Site B Spring 2024 measurements:

- SI-7 – No discernible movement measured.
- SI-8 –5.7 mm/yr over 0.3 m to 1.5 m depth (approximately 80 mm of cumulative moment since 1996), creep (< 1.0 mm/yr) over 1.5 m to 4.0 m depth.
- SI-9 –10.9 mm/yr over 0.3 m to 2.7 m depth (approximately 130 mm of cumulative moment since 1996).
- An accelerating movement trend has been observed in the last 3 reading sets for SI's 8 and 9.

Assessment (Refer to Drawings PH043-1 to PH043-3)**:**

Note that following the May 29, 2024 site inspection a high-flow event occurred in July 2024 that resulted in significant erosion damage within the valley bottom (primarily at the Site B drop structure). Thurber performed a callout inspection on July 18, 2024 to document the damage from the high flow event that was submitted to TEC on September 30, 2024. The callout report should be referenced for updated site conditions and, maintenance and repair recommendations.

Site A – Pile Wall:

Pile wall appears to be limiting sliding of area upslope of the wall and is protecting the west portion of Site A embankment. The erosion repair work has reinforced the embankment toe and is expected to reduce the rate of soil loss from this area and the potential of destabilizing the upper embankment slope.

Slide activity in the lower part of the valley slope that was initiated during construction was mitigated via driven steel piles which appear effective in limiting new slide development. Instruments at the existing buried tangent pile wall indicated a trend of increased movement rates since construction. There is ongoing slide activity directly below the west end of the old wall, but it appears relatively shallow and not currently a direct threat to the highway. The embankment above the old pile wall has not exhibited signs of slide movement and slide related pavement damage has not been observed. The apparent tension slide crack adjacent to the swale should be monitored for movement; however, the feature may also be due to erosion.

Erosion and sedimentation buildup was observed around the new erosion mitigation structures. Maintenance work is required around the culvert inlet. The east crotch swale riprap is no longer effective and should be rebuilt to prevent expansion of the erosion damage. Due to the gradient in this area, either angular riprap or anchored gabion mattress will be required.

Site B:

The culvert and erosion control mitigation work should reinforce the embankment toe and reduce rates of soil loss from this area and the potential of destabilizing the upper embankment slope. Current erosion control measures appear mostly effective in controlling drainage at the site with the exception of the lower embankment culvert inlet (33+800) which has become damaged apparently during a high flow event. The culvert inlet requires repairs to restore full drain capacity. The end slope of the inlet should be cut steeper and shorter and lined with a stronger SWSP (with concrete collar) to resist hydraulic uplift forces. The riprap around the culvert needs to be reconfigured and should be “benched” into the slope as is practical to reduce displacement and sliding. The CPP downpipe requires replacement and realignment, which was caused by a local landslide in the lower valley slope. The gully erosion upslope occurring downslope from the break will continue to retrogress upslope towards the highway and could initiate deeper instabilities.

During the spring of 2018 a sinkhole developed beside the lower portion of the drop structure, caused by water flowing under pressure from a separated joint in the underlying C.S.P. culvert creating a subsurface void. The void was grouted, and the sinkhole backfilled, however distortions to the overlying gabion baskets/mattresses remain. It is believed the outlet of the C.S.P., which sits in the flow dissipation bowl, froze underwater and that the pressurized water eroded the sinkhole out the side of the pipe and drop structure. During the 2023 inspection further void formation as a result of piping erosion was observed to occur and cause displacement of the gabion drop structure and ongoing erosion damage. Repair of this area is required to prevent further damage to the drop structure and proper culvert function. The disturbed soils could be removed and then the sink hole and related erosion gully beside the gabion wall could be backfilled with Class 1M riprap over geotextile and armoured at the top with Class 1 riprap. The side of the gabion drop structure wall could be pushed back into vertical orientation as is practically possible during the riprap backfill activity. Maintenance and cleaning of the outlet to limit sediment and ice buildup prior to spring thaw will be critical to limit potential water backup and further damage. Consideration should be given to bypassing the compromised culvert joint by inserting a new internal reline pipe (e.g., expandable “slipline” or similar) and grouting the annulus between the pipes. Alternatively, an internal band could be applied across the damaged joint using a combination of gaskets and sealing materials. Further pressure grouting would also be beneficial to reinforce the void area around the joint and limit further disturbance to the drop structure.

The current instrumentation indicates shallow movement (less than 3 m depth) at slow and steady rates (<10 mm/yr). No visual indicators of landslide movement are apparent on the slope. The SI closest to the highway (SI-7) has not measured movement.

Recommendations:

Monitoring:
Annual inspections should continue with the next inspection occurring in the Spring of 2025.
Biannual instrument readings should continue.

Maintenance:

- Sediment buildup within the dissipation bowls of both drop structures should be cleaned out.
- The outlet of the Site B drop structure should be carefully cleared of excess ice and the outlet of the CSP steamed open in early Spring to limit further sinkhole expansion and damage.
- Remove sand accumulation from side of roadway which is causing channelization of surface runoff on embankments and highway ditch.

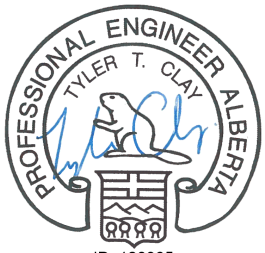
Short-term Measures (repair work is prioritized in terms of urgency with "1" being lowest priority and "5" as the highest priority):

-
- (4) Site B- drop structure erosion repair. The disturbed soils outside the drop structure wall should be excavated and backfilled with Class 1M riprap placed over non-woven geotextile. Class 1 rock should be placed as armour cover and to reinforce the toe of the backfilled zone. ($150k)
- (4) Site A - repair of the armored swale. Existing rock should be salvaged and used with additional imported material to line the armored swale with gabion mattress anchored at intervals to the slope. Swale alignment improvements should also be made (reduction of super elevation in the upper curve) and a cross berm should be added near the top to divert highway runoff into the swale. ($45k)
- (4) Site B - replace culvert inlet at km 33+800 within valley bottom. Replace with concrete faced headwall and rebuild embankment slope. The new inlet should comprise a liner with SWSP. Additional rip should be added and shaped around the reinforced headwall. ($85k)
- (4) Site A - replacement of the damaged culvert inlet with a stronger SWSP with steeper end bevel. The new culvert should be grouted into the existing CSP. Additional Class 2 riprap should be added and shaped to better funnel water into the inlet. ($30k)
- (3) Site B - replace CPP down pipe severed by landslide. Replace with welded HDPE pipe seated below ground to new Big-O jointed pipe and regrade slope. Run a new Big-O pipe at surface to the creek along a shifted alignment outside of unstable slope area. ($125k)
- (3) Site A - repair south channel bank erosion near the culvert inlet and toe of the armored swale. The disturbed soils should be excavated and backfilled with gravel over non-woven geotextile. Additional Class 2 riprap should be added over the bank and blended into the toe of the armored drainage swale. ($25k)
- (2) Site B - repair erosion in south ditch and armor similar to north ditch with TRM and gabion mattress in section with gradient above 5%. Backslope could be used as borrow source to fill gullies. Estimate length of repair section is between 250 m to 300 m in order to extend the armoured section to the culvert inlet. ($85k)
- (1) Site B -repair erosion rills on north sideslopes above gabion mattress in ditch. Grade and line with TRM and composite rolls. ($15k)
- (1) Site A - fill erosion gully with rock above pile wall at outlet drop structure. ($5k)

CLOSURE

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

Don Proudfoot, P.Eng.
Principal | Senior Geotechnical Engineer



ID: 120965
October 15, 2024

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE: Don Proudfoot
RM APEGA ID #: 51674
DATE: October 15, 2024
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Tyler Clay, P.Eng.
Geological Engineer

THURBER

STATEMENT OF LIMITATIONS AND CONDITIONS

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This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

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3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

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5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

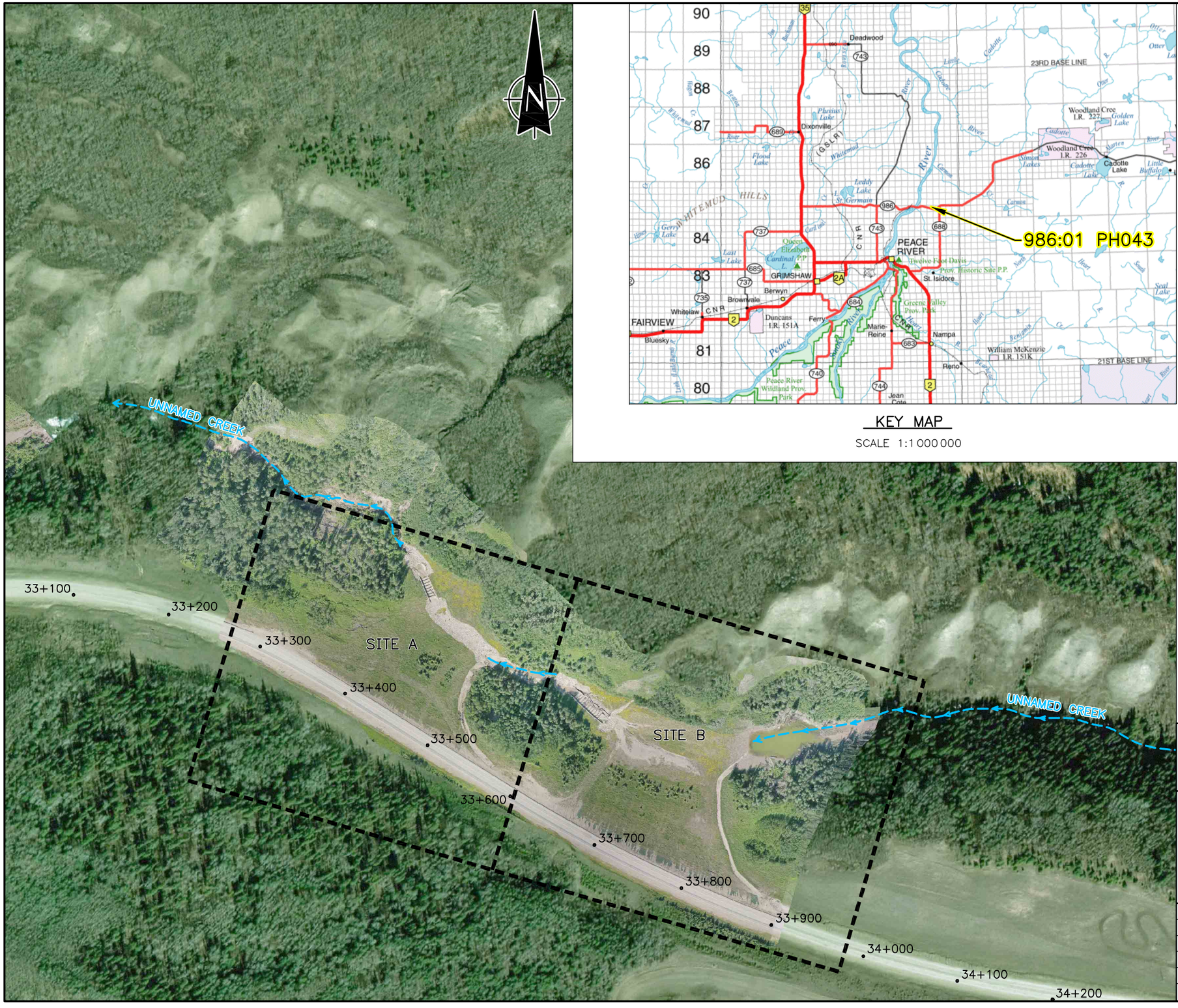
d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.



KEY MAP

SCALE 1:1 000 000

LEGEND:

HORIZONTAL CHAINAGE — 32+100

PHOTOGRAPH LOCATION — 43–01

SLOPE INCLINOMETER

- NO MOVEMENT — SI 64
- CREEP — SI 82
- MEASURABLE MOVEMENT (OR RECENTLY SHEARED) — SI 82

PIEZOMETER — PN 004

PH43 BOUNDARY

NOTES:

1 FIGURE MUST BE USED IN CONJUNCTION WITH THE ATTACHED REPORT REFERENCE 32121 DATED MAY 2024 AND IS SUBJECT TO ANY LIMITATIONS DESCRIBED THEREIN.

2 AIR PHOTO BASE FROM DRONE IMAGERY DATED JULY 18, 2024 AND ESRI (DIGITAL GLOBE, 2016).

0 50 100 200 300 m

UTM 11N NAD83

Alberta Transportation

PEACE REGION (PEACE RIVER DISTRICT)

DAISHOWA EAST HILL
HWY 986:01 (PH043)
LOCATION PLAN

FIGURE PH043-1

DRAWN BY	ICB
DESIGNED BY	TTC
APPROVED BY	DWP
SCALE	1:4 000
DATE	AUGUST 13, 2024
FILE No.	32121–A3F

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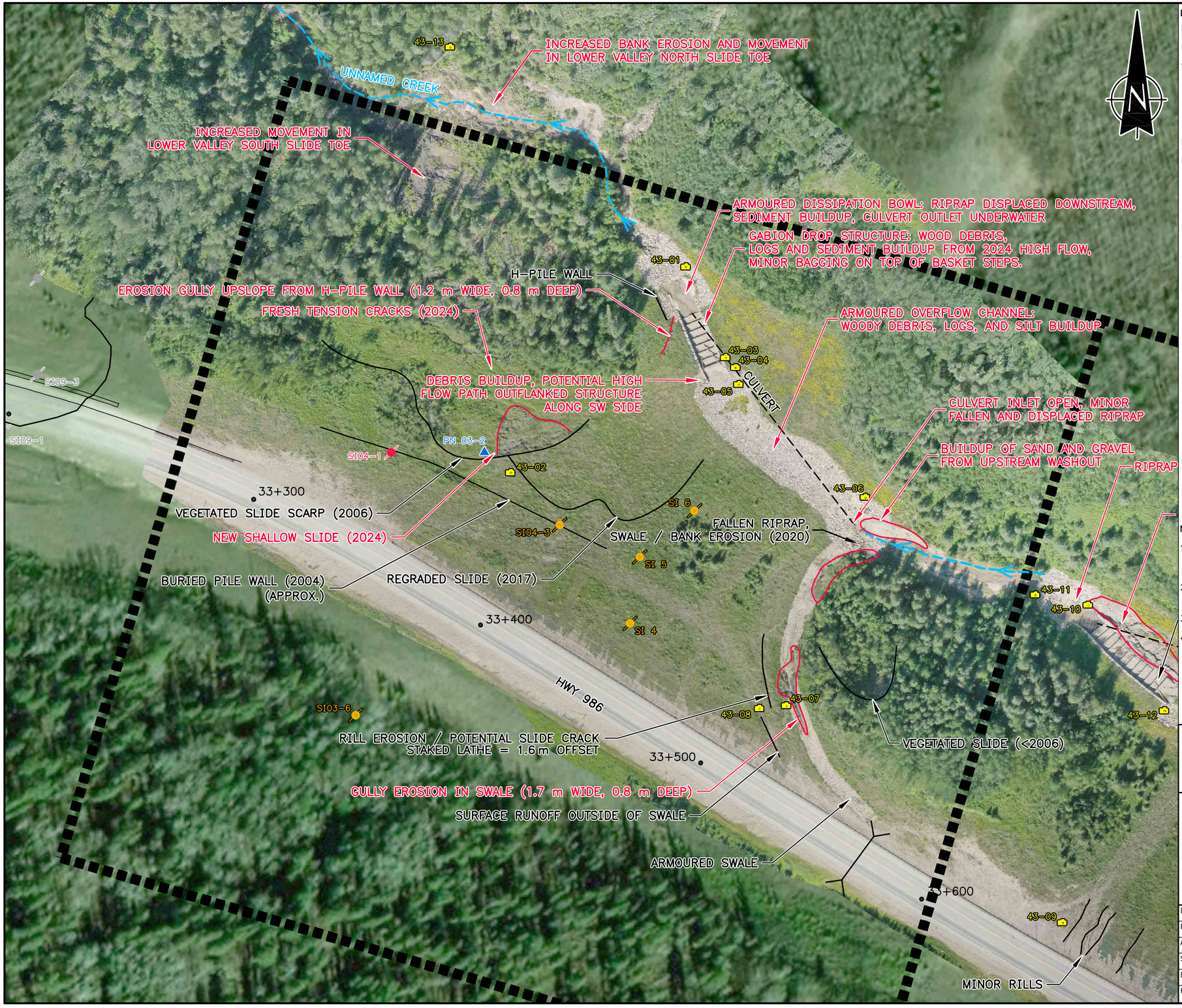

LEGEND:

- HORIZONTAL CHAINAGE — 32+100
- PHOTOGRAPH LOCATION — 43-01
- SLOPE INCLINOMETER
  - NO MOVEMENT — SI 64
  - CREEP — SI 62
  - MEASURABLE MOVEMENT (OR RECENTLY SHEARED) — SI 82
- PIEZOMETER — PN 004
- PH43 BOUNDARY

NOTES:

1. FIGURE MUST BE USED IN CONJUNCTION WITH THE ATTACHED REPORT REFERENCE 32121 DATED MAY 2024 AND IS SUBJECT TO ANY LIMITATIONS DESCRIBED THEREIN.
2. AIR PHOTO BASE FROM DRONE IMAGERY DATED JULY 18, 2024 AND ESRI (DIGITAL GLOBE, 2016).
3. FEATURES/PHOTOGRAPH LOCATIONS SHOWN APPROXIMATE ONLY.
4. NOTE BASE PLAN IMAGERY AND DETAILS SHOWING CONDITIONS UPDATED FROM JULY 18, 2024 CALLOUT INSPECTION. PHOTO LOCATIONS SHOWN FROM MAY 29, 2024 SITE INSPECTION.

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UTM 11N NAD83

Alberta Transportation

PEACE REGION (PEACE RIVER DISTRICT)

DAISHOWA EAST HILL
HWY 986:01 (PH043)
SITE A PILE WALL - 2024 SITE INSPECTION PLAN

FIGURE PH043-2

DRAWN BY	ICB
DESIGNED BY	TTC
APPROVED BY	DWP
SCALE	1:1 500
DATE	AUGUST 13, 2024
FILE No.	32121-A3F

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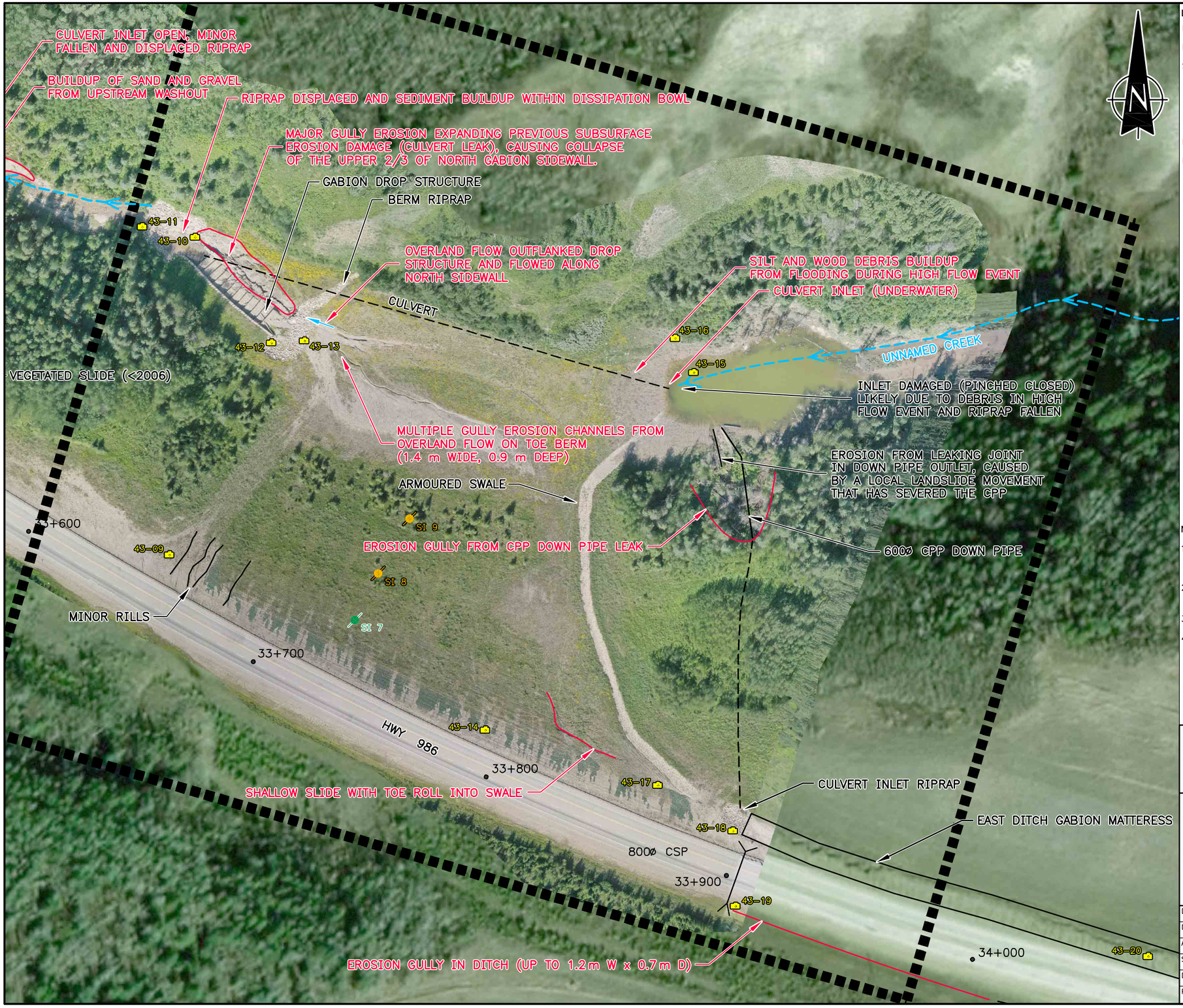

LEGEND:

- HORIZONTAL CHAINAGE — 32+100
- PHOTOGRAPH LOCATION — 43-01
- SLOPE INCLINOMETER
  - NO MOVEMENT — SI 64
  - CREEP — SI 82
  - MEASURABLE MOVEMENT (OR RECENTLY SHEARED) — SI 82
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- PH43 BOUNDARY

NOTES:

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UTM 11N NAD83

Alberta Transportation

PEACE REGION (PEACE RIVER DISTRICT)

DAISHOWA (EAST HILL)
HWY 986:01 (PH043)
SITE B - 2024 SITE INSPECTION PLAN

FIGURE PH043-3

DRAWN BY	ICB
DESIGNED BY	TTC
APPROVED BY	DWP
SCALE	1:1 500
DATE	AUGUST 13, 2024
FILE No.	32121-A3F

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	**Photo 43-01.** Looking towards the southeast (upstream) at the Site A gabion drop structure. No major change from 2023 condition. Rill erosion on the right side of the photo above the steel pile wall was slightly worse.
	**Photo 43-02.** Main slide scarp of active shallow failure downslope of the buried pile wall (33+325) first observed in 2017. Area is vegetated but appears there is active movement within the disturbed slide mass. No scarp retrogression since 2023.

	**Photo 43-03.** Overflow gabion drop structure and dissipation bowl at the previous culvert outlet that had extensive erosion and gullying below Site A (33+430). Some rill erosion was noted within the fill areas that were still vegetating. Dissipation bowl at base of drop structure had a large amount of silt buildup. Minor change from 2023 condition.
	**Photo 43-04.** Looking south at the area of previous slumping associated with culvert erosion below pile wall and regraded slide during construction in 2017 (33+430). Area has since revegetated following grading of the construction access. No change from 2023 condition.

	**Photo 43-05.** Site A - Standing at the top of the gabion drop structure looking southeast towards the rock washout and gully erosion in the armoured swale near 33+525. Erosion was worse from 2023. Armoured overflow channel in the valley bottom was in good condition.
	**Photo 43-06.** Site A - Looking south towards the culvert inlet riprap, riprap swale, and debris deflector (33+500). Note south channel bank erosion and fallen riprap. Slightly worse from the 2023 condition. Culvert inlet was damaged and eroded, causing water to flow under the base and come in at a joint.

Photo 43-07.
Site A - looking north, downslope towards washed out riprap and extensive erosion damage within the riprap swale at the east side of Site A (33+500), likely the result of a high-flow event in 2019/2020. Deeper and expanded erosion damage since 2023.

Photo 43-08. Looking towards the north at survey lath stakes installed in 2023 to monitor a potential tension crack related to potential downslope movement towards the swale washout and erosion area (km 33+500). The offset between the outside base of the stakes measured 1.16 m and did not increase relative to the previous measurement. Feature could be result of erosion.

	**Photo 43-09.** Looking east from the top of the Site B highway embankment. Minor rill erosion within top of embankment where TRM ends. No significant change from the 2023 condition.
	**Photo 43-10.** Site B- view east from the base of the gabion drop structure and riprap dissipation bowl at the culvert outlet (33+600). Additional erosion expansion and gabion deformation due to piping erosion from leak in the culvert joint (left side).

	**Photo 43-11.** Site B- view of the gabion drop structure and riprap dissipation bowl at the culvert outlet (33+600). Additional sediment buildup in dissipation bowl.
	**Photo 43-12.** Site B- view northeast from the top of the gabion drop structure the culvert outlet in the valley bottom (33+600). Top of structure appeared in good condition with no major change from the 2023 condition.

	**Photo 43-13.** Site B- view east at upstream of the gabion drop structure with riprap berm at west end of overland flow toe berm (33+625). No change from 2023 condition.
	**Photo 43-14.** Looking east towards the TRM installation on the upper portion of the slope north of the road (33+800). Limited vegetation growth within the upper road embankment likely due to sand and salt runoff from winter road maintenance.

	**Photo 43-15.** Damage around culvert inlet due to a high flow event in 2021/2022. Culvert pipe at the inlet was effectively pinched and twisted shut and was filled with woody debris. Additional riprap above the inlet has collapsed and buried it. Additional woody debris buildup. Repairs required in this area (33+800).
	**Photo 43-16.** Looking south towards the outlet of the CPP down pipe near the culvert inlet (33+850). Gully erosion was noted to be occurring upslope from the pipe outlet due to a leaking joint that requires repair. Increased gully erosion was noted on the right side of the pipe. Large gully erosion headwall developing upslope in the trees and sliding of gully sidewalls. Expanded erosion since 2023.

	**Photo 43-17.** Looking northwest from the top of Site B towards the armored swale and overland flow area (33+875). No changes from the 2023 condition.
	**Photo 43-18.** View of culvert inlet and riprap protection near 33+900 on north side of road. No visible changes from the 2023 condition.

	**Photo 43-19.** Looking upslope (east) at the south ditch erosion where a gully has developed (up to 1.2 m wide, 0.7 m deep) between approximately 33+900 and 34+150. Erosion has become deeper and wider since 2023.
	**Photo 43-20.** Rill erosion between the road and north ditch gabion armour (km 34+000) was slightly worse compared to the 2023 condition. TRM should be added to reduce rates of erosion.