



PEMBINA RIVER: HIGH LEVEL BANK STABILITY REVIEW

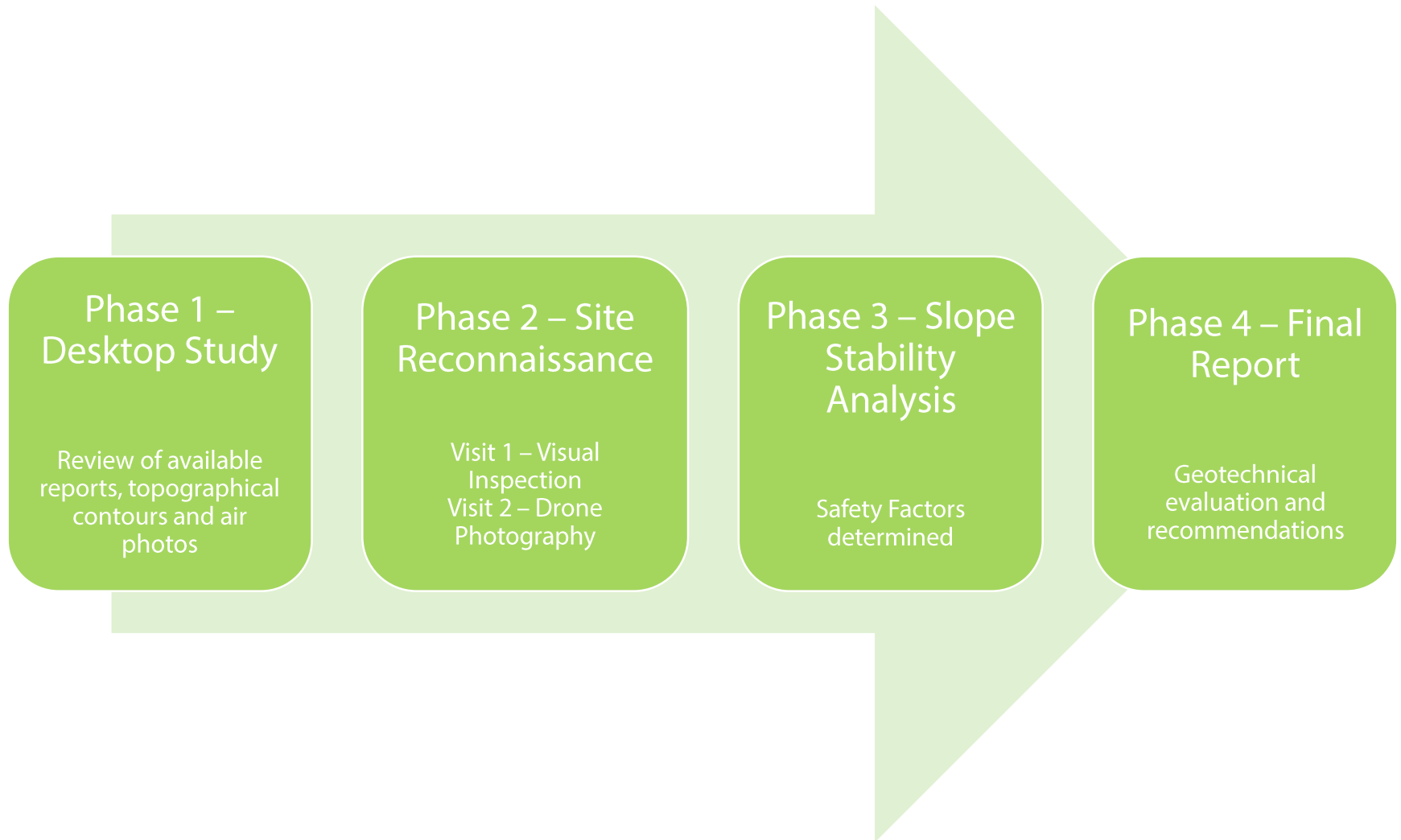
PEMBINA RIVER VALLEY, ENTWISTLE, ALBERTA

JANUARY 9, 2018

BACKGROUND

- The High Level Bank Stability Review was undertaken to:
 - Address concerns from area residents adjacent to the Pembina River regarding slope stability and the detrimental effect failure could have.
 - Exercise due-diligence through assessment, evaluation and prioritization of potential slope stability concerns in Entwistle.
- On February 28, 2017 council approved administration to proceed with the High Level Bank Stability Review from Township Road 532 to Township Road 534 in Entwistle, along the east bank of the Pembina River.
- Thurber Engineering Ltd. was retained to complete the High Level Bank Stability Review.

PROJECT PROCESS



MAIN CONCLUSION

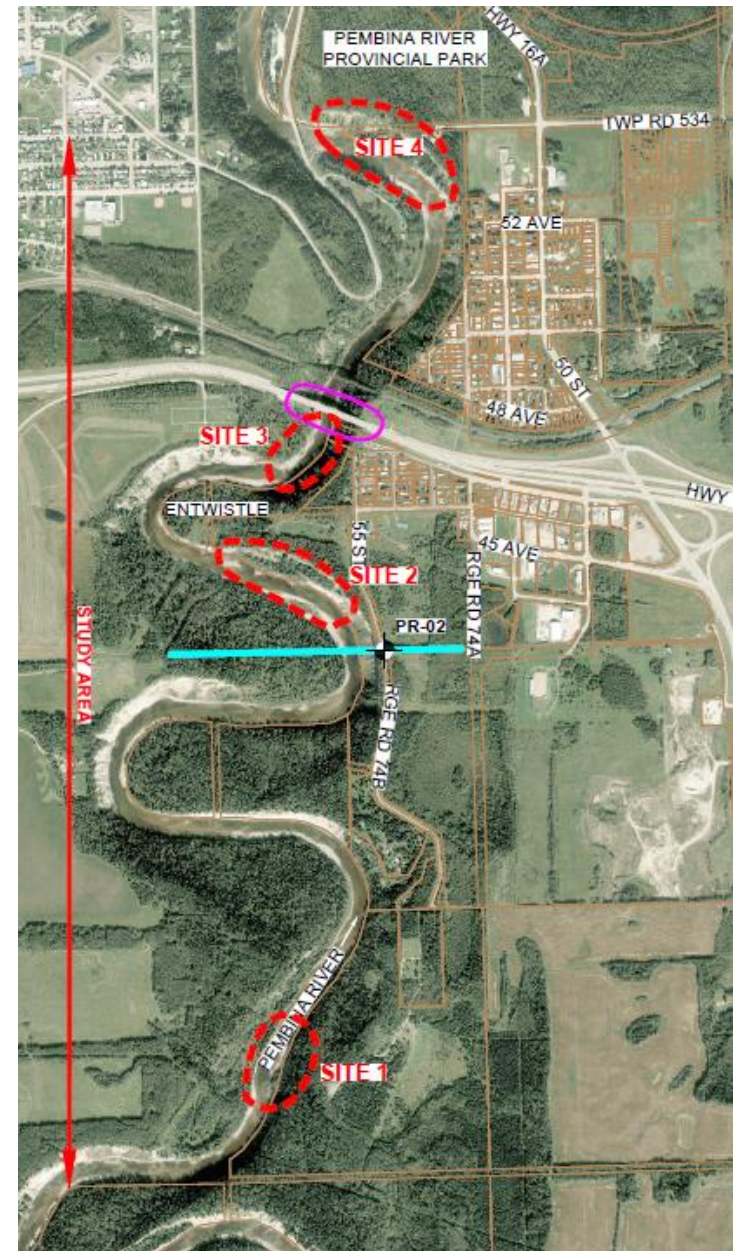
Visually there appears to be no immediate threat of imminent slope failure to any existing development within the Hamlet of Entwistle based on the observed conditions of the slopes and what is known about the shallow bedrock geology.

- In general, bedrock is found between 5 and 25 meters below the ground surface.
- The presence of competent bedrock in the lower and mid-slopes is a large contributing factor in the stability of the study area.



KEY FINDING 1

- Four historical landslides were identified through the desktop investigation. These locations were selected for site reconnaissance.
- None of the landslide locations appear to pose an imminent risk to existing development or infrastructure.



SITE 1 – WEST OF PEMBINA RIVER TUBING



Slopes appear to be relatively stable due to:

- The presence of heavy mature vegetation
- Little encroachment by human activities
- The presence of very shallow bedrock



SITE 2 – WEST OF 55 ST. AND SOUTH OF 46 AVE.



- This landslide occurred decades in the past.
- Lower slopes feature mature vertical vegetation with some bare areas that may be experiencing minor surface erosion.



SITE 3 – WEST OF 55 ST., NORTH OF 46 AVE. AND SOUTH OF HIGHWAY 16



- The southern end of site 3 is experiencing either fairly recent and/or continuing landslide activity.
- No habitable structures should be immediately effected.



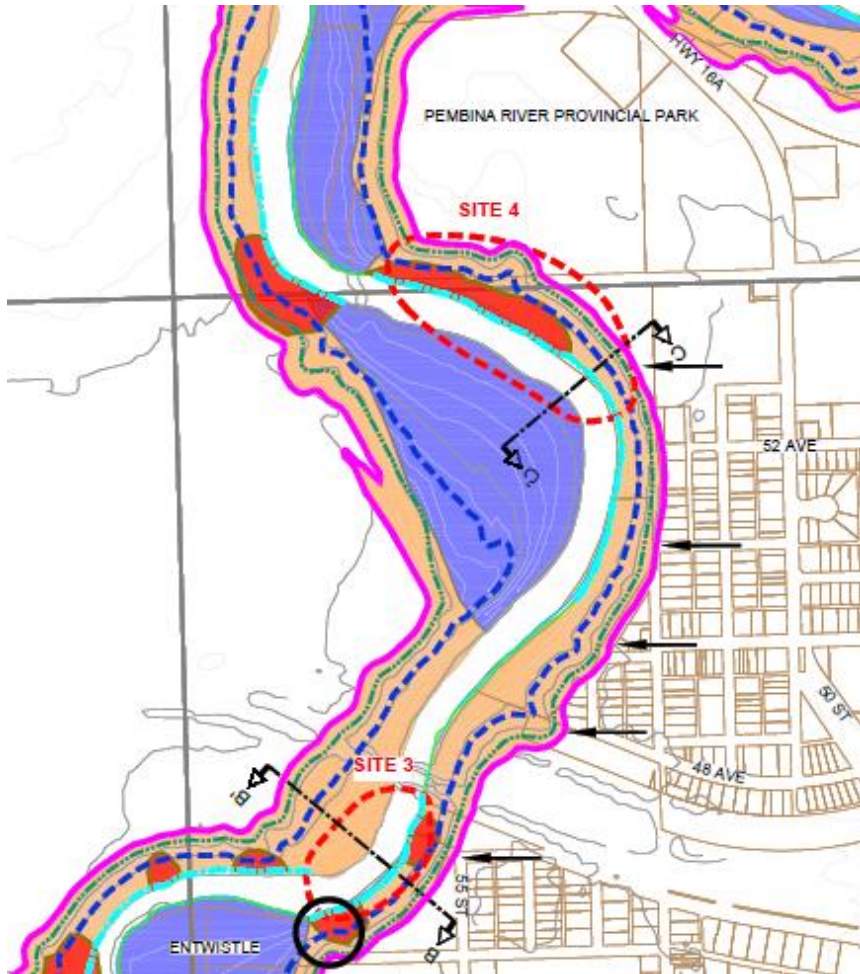
SITE 4 – WEST END OF TWP 534



- Heavily forested with mature vegetation.
- Exposed sandstone vertical faces appear to be stable.



KEY FINDING 2



- There are five locations where concentrated overland flow is occurring over the Pembina River banks causing erosion.
- If left unabated, this erosion will continue during surface runoff events and over time will remove overburden soils down to exposed bedrock.
- It is not expected that that the erosion down to bedrock will cause overall instability to the valley slope. However, it is possible that the erosion of the overburden soils in these areas could progress eastward from the crest of the slope, destabilizing some of the near crest areas.

CONCENTRATED OVERLAND FLOW

Near Site 3

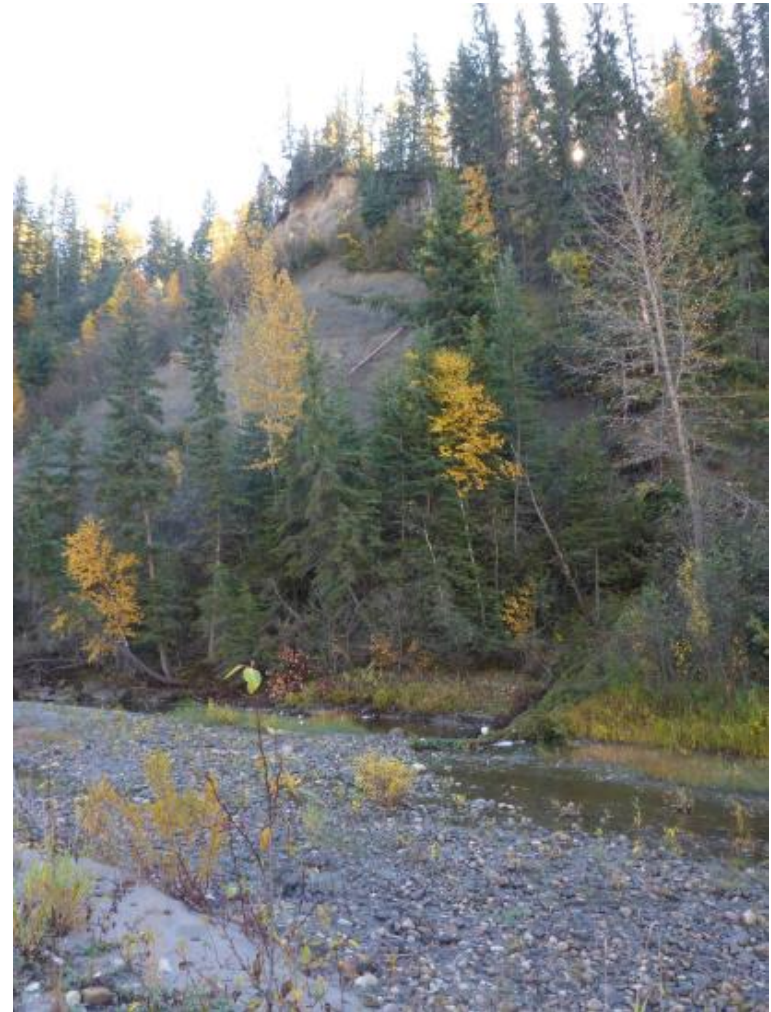


Near Site 4 - Entwistle School



RECOMMENDATION 1

- The location of the recent and/or continuing landslide activity at the southern end of Site 3 should be periodically monitored through visual inspection.
- Inspection should be undertaken at semi-annual intervals, in the early summer following spring run-off and again prior to winter.
- If the failure is observed to be ongoing, remedial measures may be required.

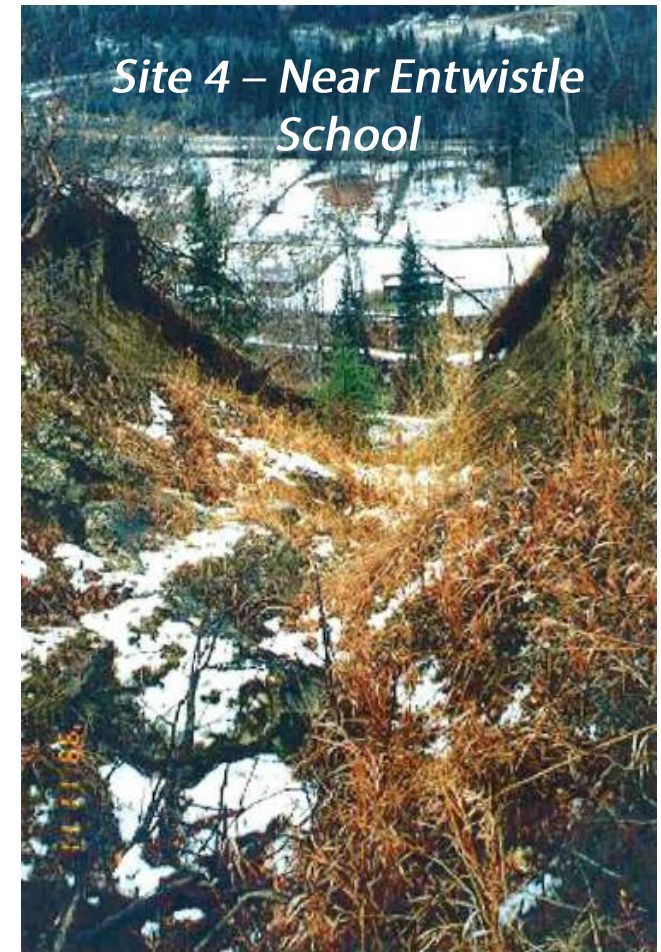


Site 3 – Toe of Landslide Zone

RECOMMENDATION 2

- Erosion control measures should be employed at the five locations where concentrated overland flow is occurring over the Pembina River banks.
- Repair could require regrading, armoring the crest and upper banks with rip-rap, erosion control blankets, or a similar engineered method.

*Site 4
Near
Entwistle
School*



RECOMMENDATION 3

Develop a periodic visual monitoring program every five years.

- To ensure ongoing movement and/or erosion are not at a degree of concern.
- Would consist of site visits in conjunction with topographical contour information and photographic review.

RECOMMENDATION 4

Future site specific geotechnical investigations should be undertaken for any future development within 100m of the crest of the valley

- The investigation should include test hole drilling to obtain soil and rock strength properties in order to determine an adequate development set back distance.
- In accordance with Parkland County's Land Use Bylaw 2017-18, a development permit application may be subject to a Slope Stability Assessment. Parkland County currently implements this practice and requires geotechnical investigations for development along the Pembina River.

Questions?