# ALBERTA TRANSPORTATION
# GEOHAZARD ASSESSMENT
# PEACE REGION (SWAN HILLS)
# SITE SH 27: JUDY CREEK, HWY 32:12

## SECTION A – GEOTECHNICAL FILE REVIEW

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# 1.0 PROJECT SETTING

## 1.1 LOCATION

Site SH27 (Judy Creek) is located on Highway 32:12 approximately 20.4 km south of the Town of Swan Hills. The legal land description of site SH27 is LSD 11 – Sec 15 – Twp 64 – Rge 10 – W5M. The site is located approximately 130 m north of the Judy Creek Culvert (BF 75478) which carries the flow of the creek (from west to east) beneath Highway 32.

At the site, the west creek bank adjacent to the highway is located on the outside of a bend in the creek channel. In the area of the site, Judy Creek generally flows from south to north along the east side of Highway 32. Approximately 70 m upstream of the site, a bend in the creek has historically directed the creek flow to the west and immediately upstream, the creek flow approaches nearly perpendicular to the west bank where it is directed downstream to the north. Historically, toe erosion and bank slumping on the west creek bank has been on-going and the top of the bank has been gradually encroaching on Highway 32 to the west.

## 1.2 SITE GEOLOGY, HYDROGEOLOGIC AND GEOMORPHOLOGIC SETTING

**Physiographic Region:** The site is situated in the Swan Hills Upland Region of Alberta

**Bedrock Geology:** The site is likely underlain by the Tertiary Scollard Formation or Cretaceous Wapiti Formation. Both Formations contain sandstone, siltstone, and minor shale. The Scollard contains coal beds and local tuffaceous beds. The Tertiary Paskapoo Formation occurs to the west of the site, but may be locally present.

**Surficial Geology:** Drift thickness 0 to 5 m. No detailed published surficial geology information available. At the site, there is likely a thin cover of surficial materials consisting of alluvial or fluvial deposits associated with the Judy Creek meander plain over top of bedrock.

**Hydrogeology:** Aquifers generally limited to sandstone and coal beds in the Paskapoo, Scollard, and Wapiti Formations. Groundwater also occurs in surficial sands and gravels in the region. Wells in the Paskapoo Formation and surficial sands and gravels have the potential to produce groundwater flows up to 8 L/s.

**Stratigraphy:** No subsurface investigation has been completed to investigate the stratigraphy at the site. Observation of the exposed soils on the creek bank have indicated that the stratigraphy in the area of the erosion and bank slumping consists of alluvial (or possibly colluvial) deposits consisting of a mixture of clay, clay shale, glacial clay till, and sand, with organic strata interbedded within the mixture.

## 2.0 HISTORICAL INFORMATION

The history of this site is based on a review of Thurber Engineering Ltd. (2007), Karl Engineering Consultants Ltd. (2008 to 2010), AMEC Environment & Infrastructure (2012), and Alberta Transportation files. Historical plans and photos of the site are found in Section F.

### 2007

The erosion/slumping of the west creek bank was first documented in a call out inspection report completed by Thurber Engineering Ltd. (Thurber) in summer 2007 following an inspection in the spring of 2007. At this time, it was reported that "the erosion along the west creek bank has been observed to be enlarging and steadily approaching closer to the highway each year." The bank erosion was reported to be 12 m from the highway at its closest point. A near vertical, 3.4 m high, section of the west bank was observed. This near vertical section of creek bank began where the channel approached the highway from the east and extended downstream for a distance of about 15 m. Further downstream, past erosion had created some associated slumping along the west bank. The reported soils exposed on the vertical bank face consisted of a mixture of clay, clay shale, some glacial clay till, and some sand, with two horizontal organic strata interbedded within the mixture.

The creek bank at the site was assessed by Thurber as highly erodible and it was stated that with high flow, the creek would continue to erode the toe of the west bank, cause the slumps in the west bank to retrogress closer to the edge of the highway, and eventually approach within the clear zone. The length of channel that was deemed to require protection was estimated to be about 60 m. Possible remedial options presented by Thurber included three options: form a new channel; divert flow away from the west creek bank; and/or, armour the west creek bank.

### 2008

The steep bank section was reported over a length of 25 m. The inspection report indicates that vegetation had begun to re-establish on the west bank of the creek. In 2008, the top of the bank was reported to be 7 m from the highway.

### 2009/2010

The steep bank section was reported over a length of 30 m. In both the 2009 and 2010 inspection reports, the top of the bank was reported to be 7 to 11 m from the highway.

### 2012

Active erosion and slumping was observed along a 35 m stretch of the west creek bank with an additional 25 m stretch downstream of this active zone with less active erosion. Along the active erosion zone, the near vertical bank was 3 to 3.5 m high. At the closest point, the top of the bank within the active erosion zone was measured to be 10 m from the highway edge. The exposed soils on the bank face consisted of sand/silt/clay with intermittent organic beds. These soils overlay possible sandstone found within the bottom 1 m of the exposed bank face.

The soils on the exposed bank face were reported as highly erodible and it was assessed that erosion and slumping could accelerate during high flow or flooding of Judy Creek. Stabilization of the creek bank was assessed as being required to preserve the R/W and to mitigate further bank retrogression and encroachment toward the highway. It was also noted that a guard rail would be required along the highway if the top of the bank retrogressed into the Clear Zone of the highway. Possible bank stabilization measures presented by AMEC Environment & Infrastructure included: bank flattening and armouring, installation of in-channel rock vanes, root rot, and bio engineering. Recommended investigation for the design of remedial measures for the bank erosion included: a detailed site survey and detailed streambed profile, a hydro technical assessment, and a fisheries assessment.

## REFERENCES

1. Research Council of Alberta, 1962. Preliminary Report 62-5 "Reconnaissance Groundwater Study Swan Hills and Adjacent Areas, Alberta."

2. Thurber Engineering Ltd., July 12, 2007. "Peace Region - Swan Hills Area - Geohazard Assessment (CE047/2004), Call-Out for Stream Bank Erosion/Slumping (SH 27) on Hwy 32:12 ~km 48.4 Judy Creek, ~20 km South of Swan Hills, Alberta."

3. Karl Engineering Consultants Ltd., December 31, 2008. "Peace Region (Swan Hills) GeoHazard Assessment, (SH27) Hwy 32:12 Judy Creek."

4. Karl Engineering Consultants Ltd., December, 2009. "Peace Region - Swan Hills GeoHazard Risk Assessment, Site Inspection Form, SH 27, Judy Creek, Hwy 32:12."

5. Karl Engineering Consultants Ltd., November, 2010. "Peace Region - Swan Hills GeoHazard Risk Assessment, Site Inspection Form, SH 27, Judy Creek, Hwy 32:12."

6. Amec Environment & Infrastructure, July 4, 2012. "Peace Region - Swan Hills GeoHazard Risk Assessment, Site Inspection Form, SH 27, Judy Creek, Hwy 32:12, km 48.4."