Stantec Consulting Ltd.
400-10220 103 Avenue NW, Edmonton AB T5J 0K4

August 16, 2019
File: 123312435

Attention: Brennan Evans, EIT
2nd Floor, Provincial Building
4709 – 44th Avenue
Stony Plain, AB T7N 1N4

Dear Mr. Evans,

Reference: Call Out Site – Highway 825 at Sturgeon River Crossing
Task D – Call Out Report

This letter documents the findings of a call out inspection of an erosion disturbance adjacent to Highway 825 at the Sturgeon River crossing approximately 200 m south of Township Road 555. The legal land description of the site is NW-28-55-22-W4M. The location of the site is shown on **Figure 1** in **Attachment B**.

Inspection of the site took place on July 15, 2019 in response to a request from Alberta Transportation (AT). Mr. Eric Leishman of Stantec Consulting Ltd. (Stantec), and Ms. Kristen Tappenden, Mr. Brennan Evans, Mr. Rishi Adhikari, and Mr. Ryan Luider were present during the inspection.

SITE BACKGROUND

The above-referenced site is located at the northeast quadrant of the crossing of Highway 825 over the Sturgeon River approximately 35 km northeast of Edmonton and 10 km north of Fort Saskatchewan. North Bank Potato Farm is located directly to the east of the site.

The topography in the surrounding area is generally hummocky to gently rolling. The grade of highway 825 gently rises to the north and south, with the Sturgeon River being a regional low spot. The river valley walls are approximately 7 to 8 m high at the site.

The original bridge drawings were provided to Stantec by AT for review. The existing bridge is a three-span structure with a 1% grade to the north. The abutments are founded on driven steel H piles, and the piers are on concrete footings founded in bedrock. Construction of the bridge was completed in 1964.

The eroded area was first observed by the AT staff on June 27, 2019, after a series of rainfall events. At that time, it was noted that sediment had eroded into the Sturgeon River and Alberta Environment was notified. Short term remediation measures were put in place by the maintenance contractor which included placing straw bales at strategic locations to minimize further erosion.

REGIONAL GEOLOGY AND SUBSURFACE CONDITIONS

Surficial geology at the site is expected to consist primarily of ground moraine comprising glacial till with mixed clay, silt, and sand. A thin layer of colluvium may be present along the valley walls of the Sturgeon

River. Localized zones of medium- to coarse-grained outwash sand are present near the site to the north, with a larger deposit on the south side of the river. The outwash sand contains cobbles and small gravel lenses. Alluvial soils consisting of clay, silt, and sand are also common along the Sturgeon River channel.

The bedrock geology consists of fine to medium grained sandstone and carbonaceous siltstone of the Belly River Formation. This formation may contain minor bentonite, coal and clay shale inclusions. The depth to the bedrock is expected to be at approximately 10 to 20 m below the ground surface.

The as-constructed bridge drawings provided to Stantec by AT show borehole information at the abutments. At the north abutment, it is noted that 3 m of “black organic fill - old grade” overlay 1.5 m of “grey fine wet sand.” Clay shale and sandstone were noted below the sand approximately 10 m below road grade. No soil strength information was indicated for the surficial soil. The as-constructed drawings also indicate an estimated high-water level approximately 3.5 m below the road grade.

ANTECEDENT PRECIPITATION CONDITIONS

Precipitation data obtained from the Government of Canada for the Fort Saskatchewan weather station approximately 10 km south of the site is shown below in **Chart 1**. This plot shows a number of relatively significant rainfall events in the weeks leading up to the erosion event. Most notably, a nearly 30 mm rainfall event occurred on May 24, followed by several events in the range of 15 to 20 mm of precipitation in June, with 17 and 19 mm observed on June 19 and 20, respectively.

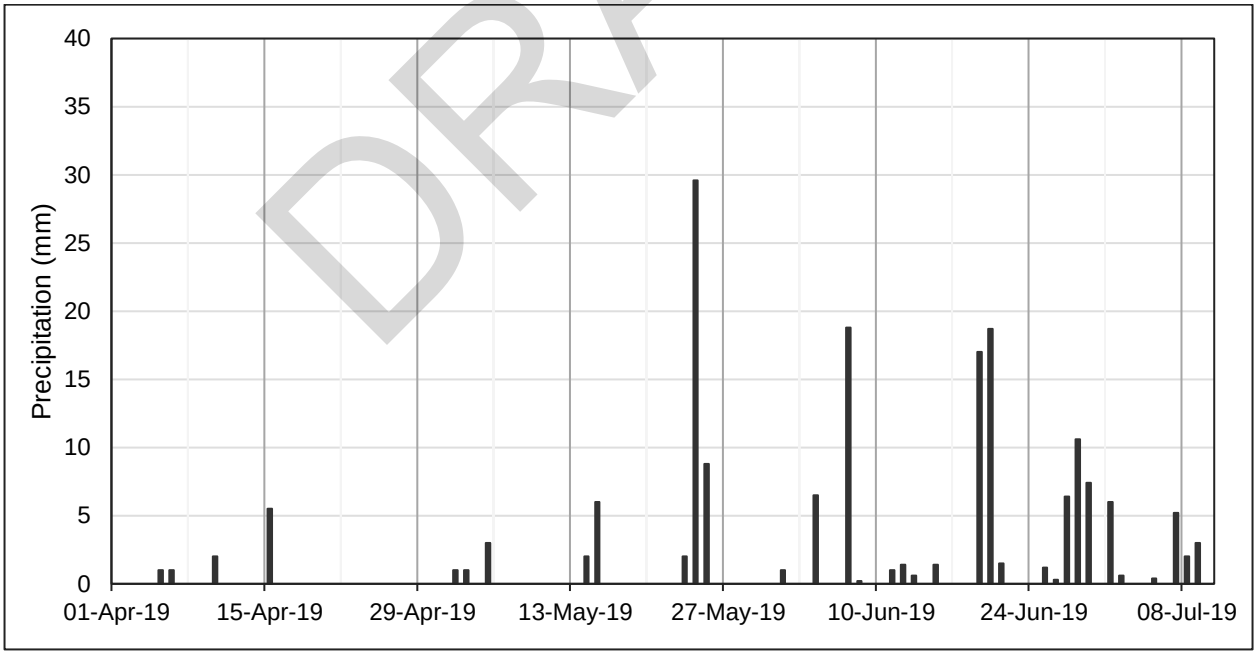

Chart 1: Daily total precipitation prior to call-out inspection (obtained from Government of Canada website for Fort Saskatchewan weather station)

Reference: **Call Out Site – Highway 825 at Sturgeon River Crossing Task D – Call Out Report**

SITE OBSERVATIONS

Visual observations were made of the east ditch of Highway 825 from the access to North Bank Potato Farm to the Sturgeon River, and the north river valley wall. Details are provided on **Figures 1 and 2** in **Attachment B**. Select site photographs are included in **Attachment C**.

At the time of the site inspection, standing water was observed at the culvert outlet at the access to the North Bank Potato Farm (**Photo 1**). There was some erosion noted at the outlet, as well as riprap that appeared to have been displaced downstream. The culvert had recently been replaced by installing a smooth-walled steel pipe adjacent to the existing corrugated steel pipe (CSP) culvert. Water was observed flowing in both culverts. The invert of the original CSP was above the water level at the inlet (**Photo 2**), indicating some amount of groundwater seepage along the length of this culvert.

The ground surface in the east ditch was saturated. Standing water was observed throughout the ditch in what appeared to be off-highway vehicle ruts (**Photo 3**). The ditch was heavily vegetated along its entire length from the farm access to the river. The maintenance contractor had placed hay bales within the ditch to reduce the velocity of surface water flow in advance of the eroded area.

The eroded area was between approximately 7 and 8 m wide at the north limit, with a depth of 2 to 3 m. (**Photos 4 through 6**). The west extent of the eroded area was about 4 m from the edge of the pavement. An existing standpipe piezometer was located between the west edge of the eroded area and the edge of pavement, as seen in **Photo 5** and **Figure 3**. The operational status of this instrument is currently unknown. Damaged geotextile was observed beneath what was assumed to be fill along the east face of the eroded area. The soil along the eroded face consisted of sandy clay with trace to some gravel. Riprap erosion protection was observed in the base of the eroded area.

Groundwater seepage was not visually observed. However, surface water was observed at the bottom of the eroded area (**Photo 7**) that was slowly flowing towards the river. The maintenance contractor had placed several rows of hay bales within the eroded area.

A concrete apron was observed at the toe of the erosion (**Photo 6**). The apron was cracked in several places and is believed to have been part of the erosion protection installed during bridge construction. An above-ground water pipe was located at the toe bank and had been undermined by the erosion (**Photo 8**). This pipe is likely used for irrigation at the North Bank Potato Farm. It is unknown if the pipe was buried or placed on the ground surface prior to the erosion taking place.

ASSESSMENT AND DISCUSSION

The visual observations made during the call out inspection are indicative of erosion likely due to the amount of rainfall leading up to the event. The 3 m of “black organic fill - old grade” noted on the as-built drawings would have become saturated and soft after prolonged rainfall. The soil is very prone to erosion from surface run off based on site observations of the exposed soil with high sand/silt content. The high volume of rainfall would have resulted in high velocity concentrated flow in the ditch, increasing the rate of erosion. The concentrated water flow will down-cut the soil and cause soil to collapse at a small local scale. The local collapses would then propagate until a mass wash out occurs by surface water flow.

In addition, the relatively flat section of the ditch above the failure zone increases the potential of ground softening, which may also contribute to the failure.

RISK RATING

The risk rating based on the observations made during this call-out inspection is as follows:

- Probability Factor (PF) = 9
- Consequence Factor (CF) = 8
- **Risk Level (RL) = 72**

A probability factor of 9 is considered applicable since the erosion was observed to be active following a series of rainfall events, with steep side slopes and the erodible nature of the soil observed on site. The eroded area is likely to increase with significant rainfall events.

A consequence factor of 8 is considered applicable since a loss of a portion of the roadway is possible following one or a series of extreme rainfall events. Furthermore, the site is located within 500 m of a fish-bearing river. There has already been a deposition of silt into the river, and further deposition is possible. Partial closure of the highway may be required, but the edge of the eroded area is still a relatively safe distance from the edge of the pavement.

RECOMMENDATIONS

SHORT TERM RECOMMENDATIONS

Some short term measures have already been implemented by the maintenance contractor, such as the hay bales placed for erosion protection.

The site should be monitored by the maintenance contractor on a regular basis until the remediation can be undertaken. In particular, the site should be inspected after extreme rainfall events. If the west edge of the eroded area begins to encroach on the highway, the long term recommendations outlined below should be implemented immediately.

LONG TERM RECOMMENDATIONS

Currently the erosion at this site is not impacting the roadway. However, continued erosion may have detrimental effects on the stability of the embankment. Furthermore, sediment has washed into the river and may continue to be an environmental hazard. Stantec understands that AT wishes to implement a remediation measure at this site in 2019. The recommended measure involves:

- Removing loose soil, riprap, organics, and other debris from the eroded area;
- Backfilling the eroded area with imported medium plastic clay fill;

Reference: **Call Out Site – Highway 825 at Sturgeon River Crossing Task D – Call Out Report**

- Re-instating the ditch and valley wall grades and re-armouring the valley wall (e.g. rip rap) to match previous conditions. Consideration could be given to filling in low spots where water is ponding in the ditch;
- Installing erosion protection (ditch blocks, Turf reinforced mat or similar) within the ditch near the valley wall; and
- Seeding the ditch to promote vegetation growth.

Consideration should be given to including subsurface drainage. A French drain should be sub-excavated along the longitudinal axis of the eroded area and filled with clean drainage rock wrapped in non-woven geotextile prior to backfilling. A perforated pipe should be installed within the drainage rock to carry groundwater flow towards the river. The French drain should daylight within the valley wall and riprap erosion protection should be placed at the outlet. The riprap that is existing on site could be salvaged and re-used for this purpose. The outlet should be placed at an elevation greater than the high-water level to avoid increasing the porewater pressure in the slope due to a rise in river level. The high-water level based on the as-constructed drawings was estimated to be approximately 3.5 m below the road grade at the north abutment. This may require the French drain to be partially or completely installed in the fill material depending on current elevations.

Reference: **Call Out Site – Highway 825 at Sturgeon River Crossing Task D – Call Out Report**

CLOSURE

We trust that the information contained in this report meets your current needs. Should you require additional information or have any questions or comments regarding the information contained herein, please feel free to contact the undersigned. This report was prepared by Eric Leishman, M.Sc., P.Eng., and reviewed by Xiteng Liu, M.Sc., P.Eng. This report should be read in conjunction with Stantec's Statement of General Conditions provided in Attachment A.

Regards,

Stantec Consulting Ltd.

Prepared by:

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Attachment: Attachment A: Statement of General Conditions
Attachment B: Figures
Attachment C: Site Inspection Photos

c. Kristen Tappenden
Rishi Adhikari

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ATTACHMENT A

Statement of General Conditions

Stantec

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec and the Client. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Stantec's present understanding of the site-specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Stantec is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

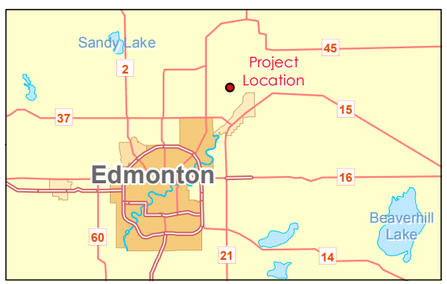
INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behaviour. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Stantec must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Stantec will not be responsible to any party for damages incurred as a result of failing to notify Stantec that differing site or sub-surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Stantec cannot be responsible for site work carried out without being present.

ATTACHMENT B

Figures



★ Approximate Site Location

Quarter Section

0 200 400 metres

(At original document size of 11x17)
1:10,000

N

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Project Location NW-28-055-22W4, Alberta	Prepared by DJ on 2019-08-07 TR by EL on 2019-08-15 IR Review by XL on 2019-08-16
Client/Project Alberta Transportation Task D: Call-Out Inspection Hwy 825 at Sturgeon River	123312435
Figure No. **1**	**DRAFT**
Title **Site Location Plan**	

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Data Sources: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Background: © 2019 Microsoft Corporation © 2019 DigitalGlobe ©CNES (2019) Distribution Airbus DS

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5961900 5961950 5962000 5962050 5962100 5962150

51150 51200 51250

Standing Water

Straw Bale

HWY 825

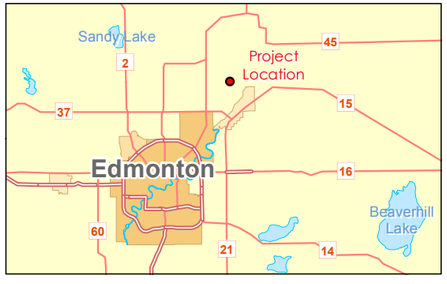
Saturated Ground Surface in Ditch

Standing Water at Culvert Outlet

Sturgeon River

Erosion Extent, See Figure 3 For More Details

Township Road 555



Site Detail

Erosion Extent

0 10 20 metres

(At original document size of 11x17)
1:750

N

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Project Location
NW-28-055-22W4, Alberta

Prepared by DJ on 2019-08-07
TR by EL on 2019-08-15
IR Review by ABC on 2019-08-16

Client/Project 123312435
Alberta Transportation
Task D: Call-Out Inspection
Hwy 825 at Sturgeon River

Figure No.
2

DRAFT

Title
Site Plan

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Data Sources: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Background: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Revised: 2019-08-07 By: djenkins

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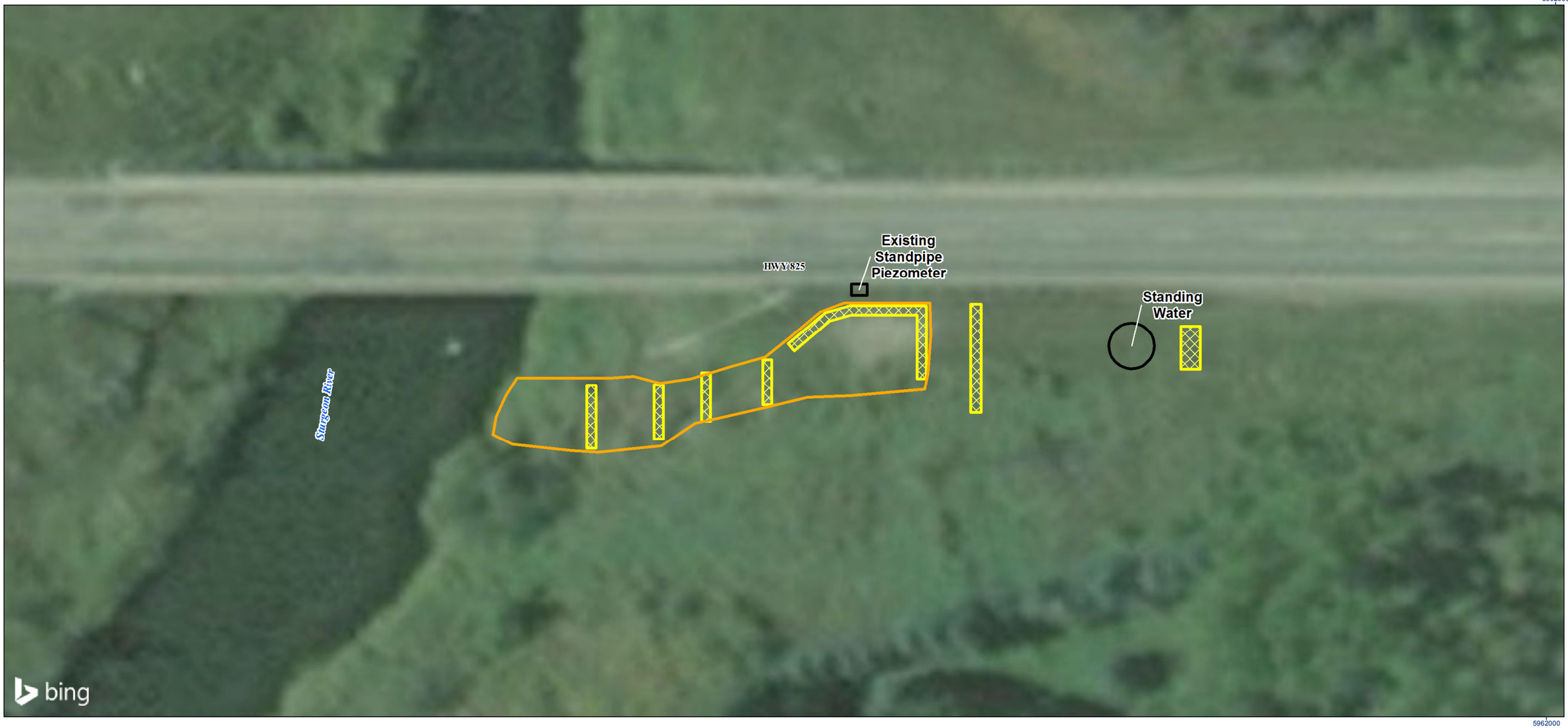

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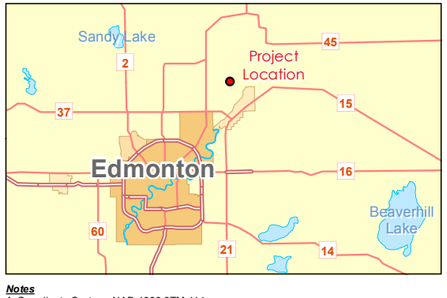

Eroded Area (Approximate)
Site Detail
Straw Bale

0 6.5 13 metres
(At original document size of 11x17)
1:325

N

Stantec

Project Location
NW-28-055-22W4, Alberta

Prepared by DJ on 2019-08-07
TR by EL on 2019-08-15
IR Review by XL on 2019-08-16

Client/Project 123312435
Alberta Transportation
Task D: Call-Out Inspection
Hwy 825 at Sturgeon River

Figure No.
3

DRAFT

Title
Site Plan

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Data Sources: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Background: © 2019 Microsoft Corporation © 2019 DigitalGlobe ©CNES (2019)
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ATTACHMENT C

Site Inspection Photos

Reference: Task D Site Inspection Photographs at HWY 825 at Sturgeon River Crossing
Photos Taken on July 15, 2019 File Number: 123312435

Photo 1: Standing water at culvert outlet at North Bank Potato Farm access, facing north.

Photo 2: Inlet of culverts at North Bank Potato Farm access, facing south. Note that invert of CSP is above water level.

Photo 3: Standing water in ditch, facing south.

Photo 4: Upper section of eroded area, facing south.

Photo 5: Upper section of eroded area, facing west.

Photo 6: Upper section of eroded area, facing north.

Photo 7: Water at base of eroded area, facing west.

Photo 8: Undermined water pipe at lower section of eroded area, facing south.