Alberta Transportation
Bi-Annual GRMP
Meeting

North Central Region – NC76, NC82, and NC57 Overview

Stantec

Agenda

1. Overview
2. NC76 – Blue Ridge Slide
3. NC82 – Morinville Slide
4. NC57 – HWY 624 Embankment Failure
5. Questions

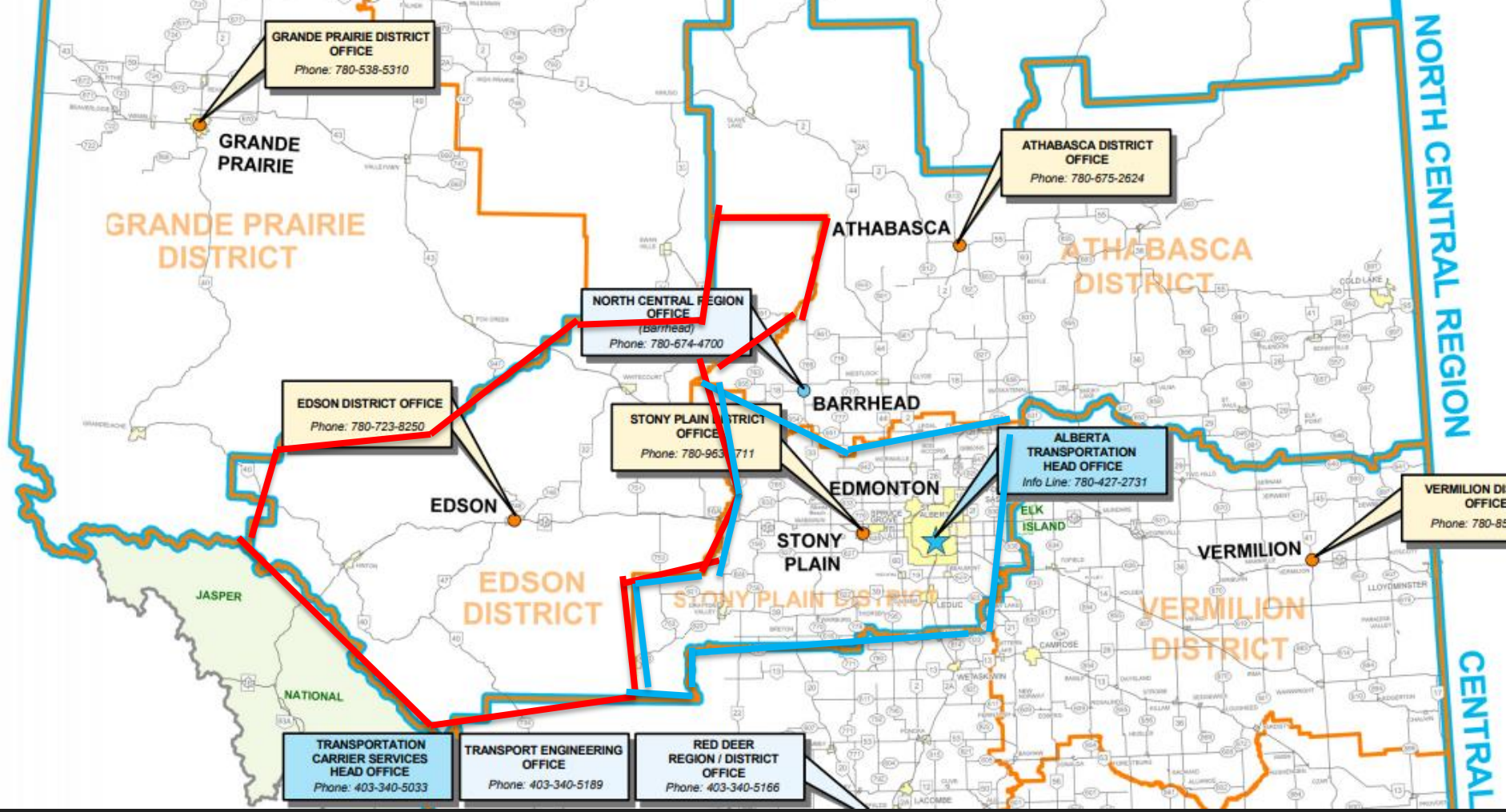
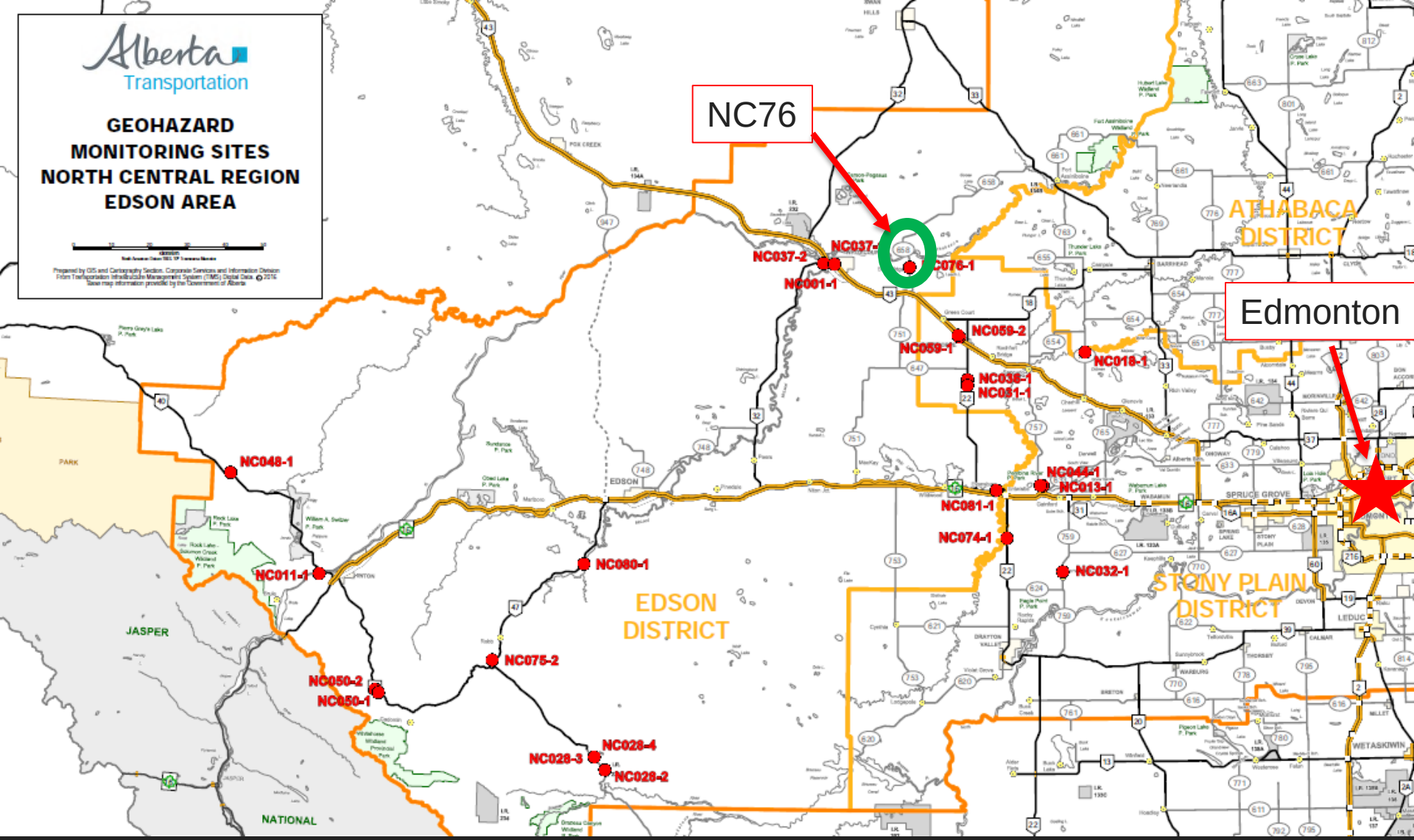


Image from http://www.transportation.alberta.ca/Content/docType329/Production/2015_TRANSPORTATION_REGIONS_DISTRICTS.pdf

Edson and Stony Plain Districts

Overview

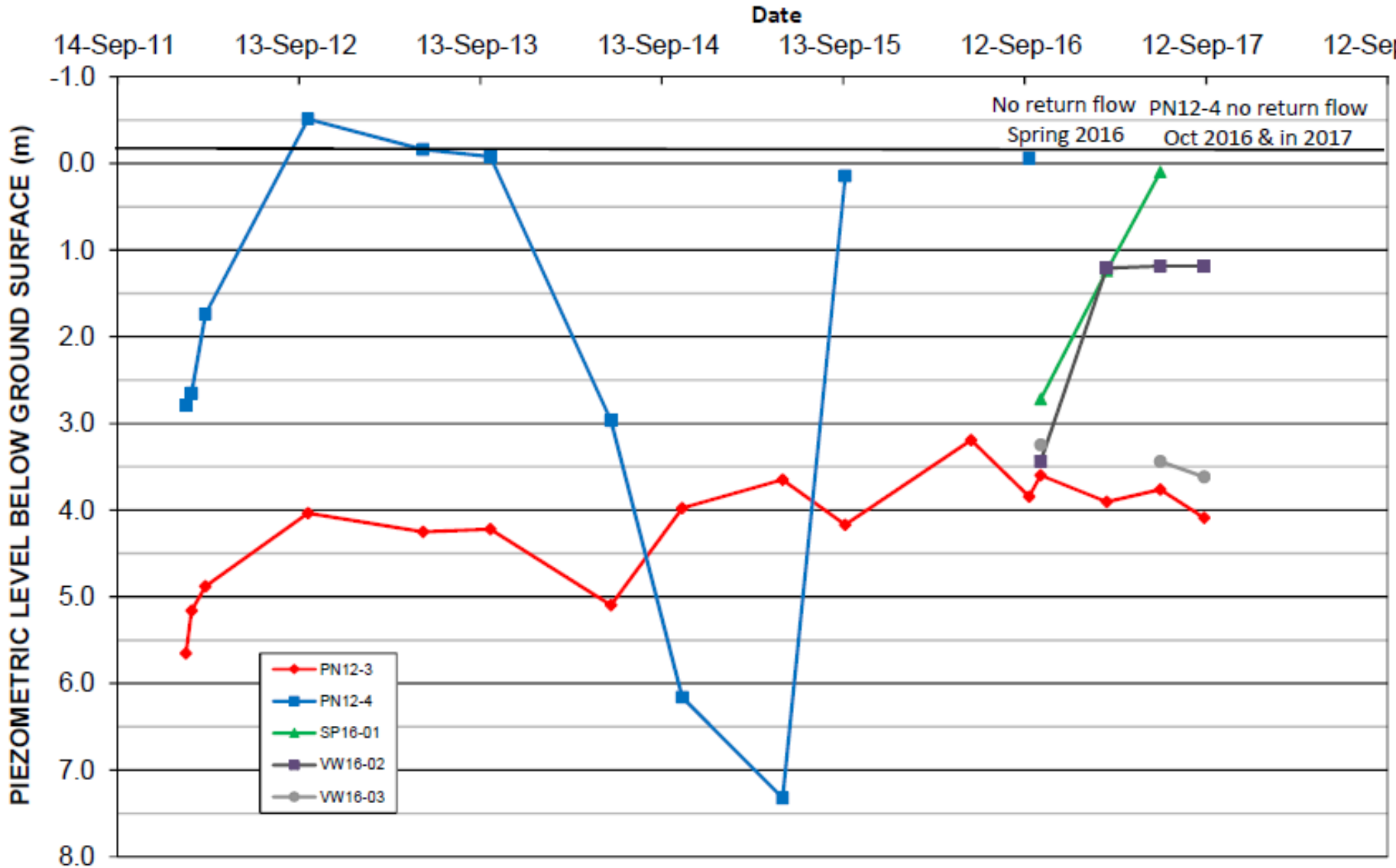


NC76 – Blue Ridge Slide

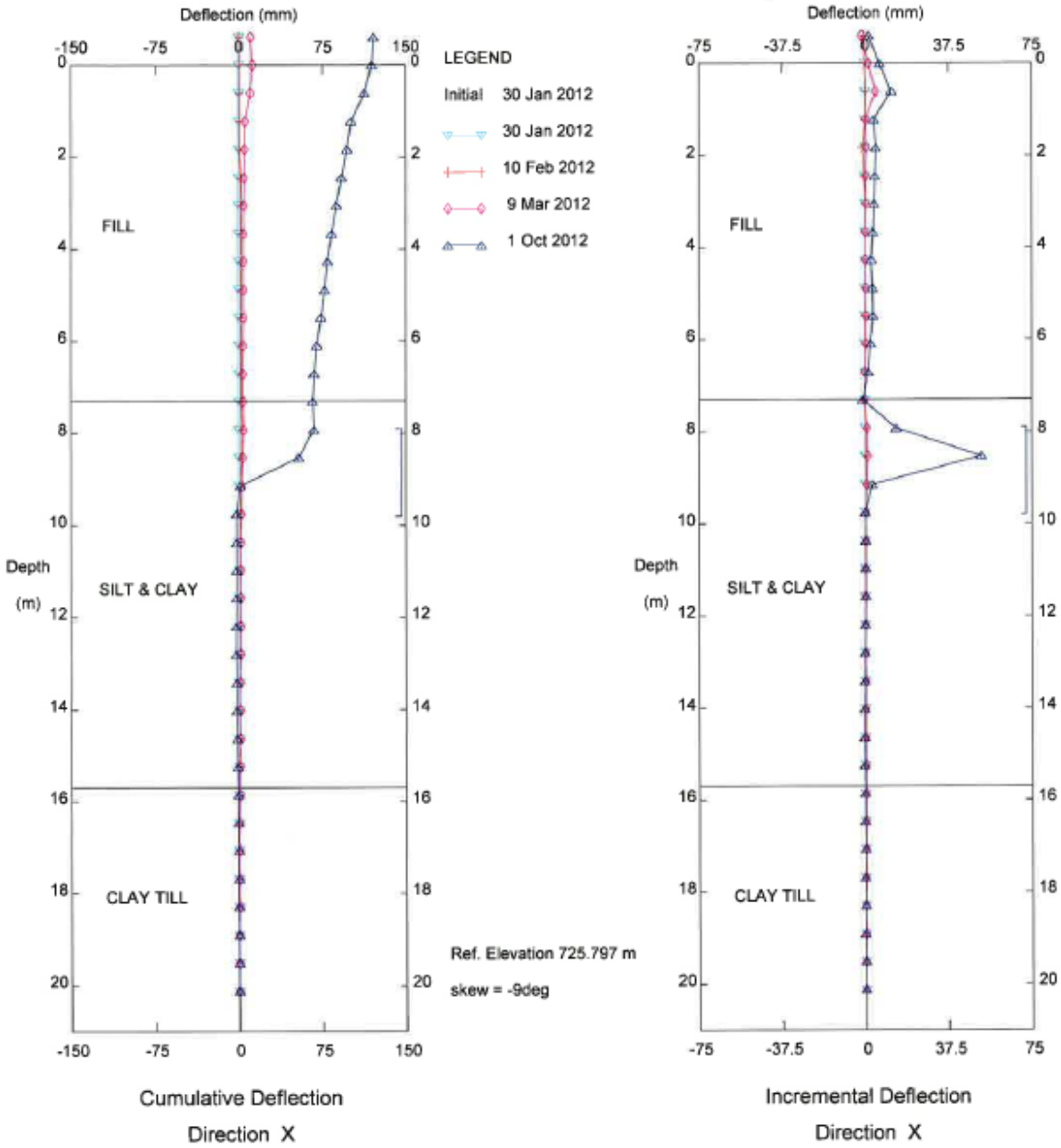
Background

- Fill embankment through valley of Bull Creek (12 m to 15 m high)
- Side slopes at 3.5H:1V
- Slope failures during culvert replacement in 2009
- Call-out in October 2011 and subsequently included in inspection list
- Instruments installed in 2012

PIEZOMETER DATA
NC76: HWY 658:02 km 7.5 BLUE RIDGE SLIDE

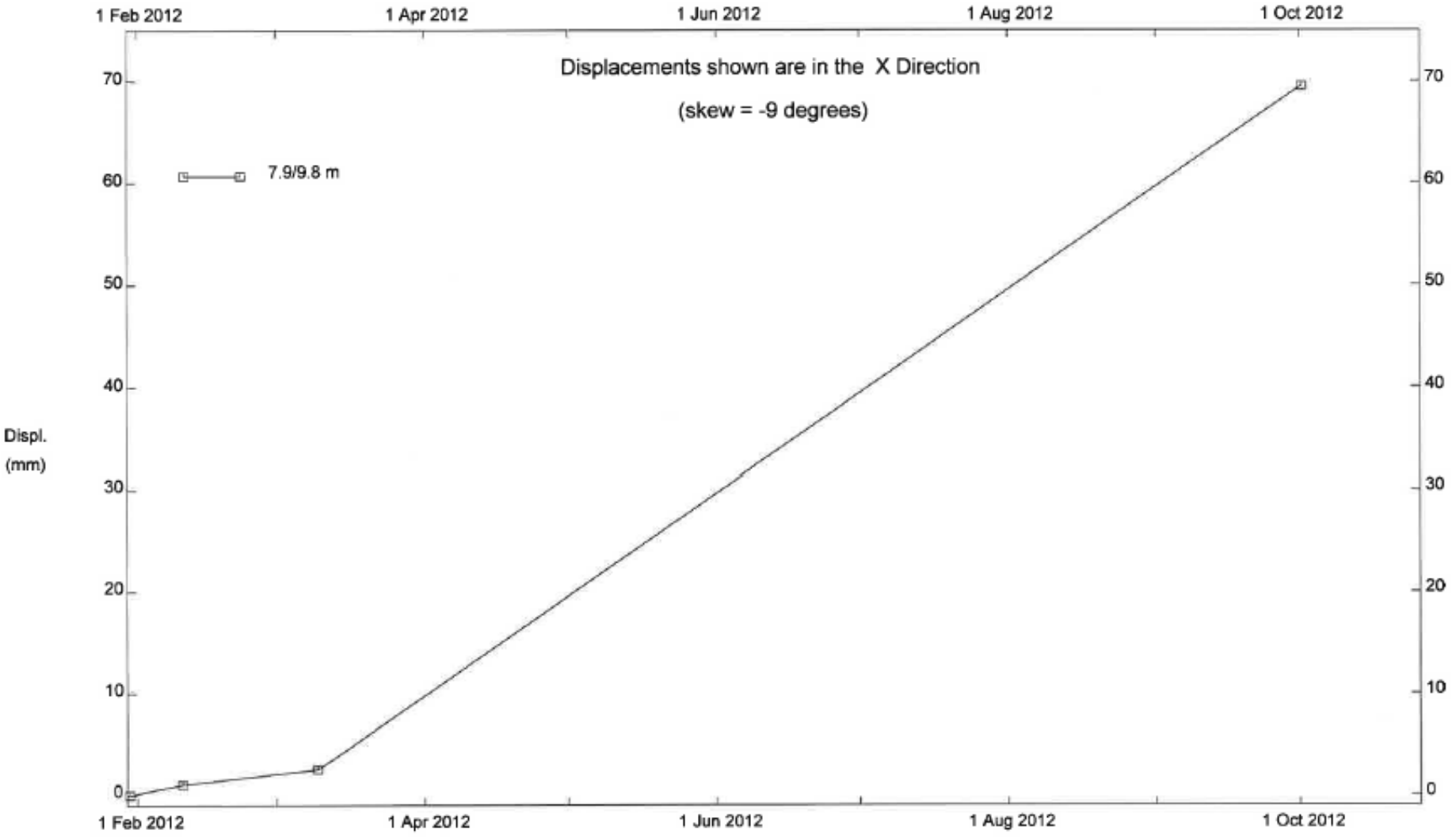


Golder Associates - Edmonton



HWY 658:02 km 7.5 Blue Ridge Slide, Inclinometer SI12-3

Alberta Transportation



HWY 658:02 km 7.5 Blue Ridge Slide, Inclinometer SI12-3

Alberta Transportation

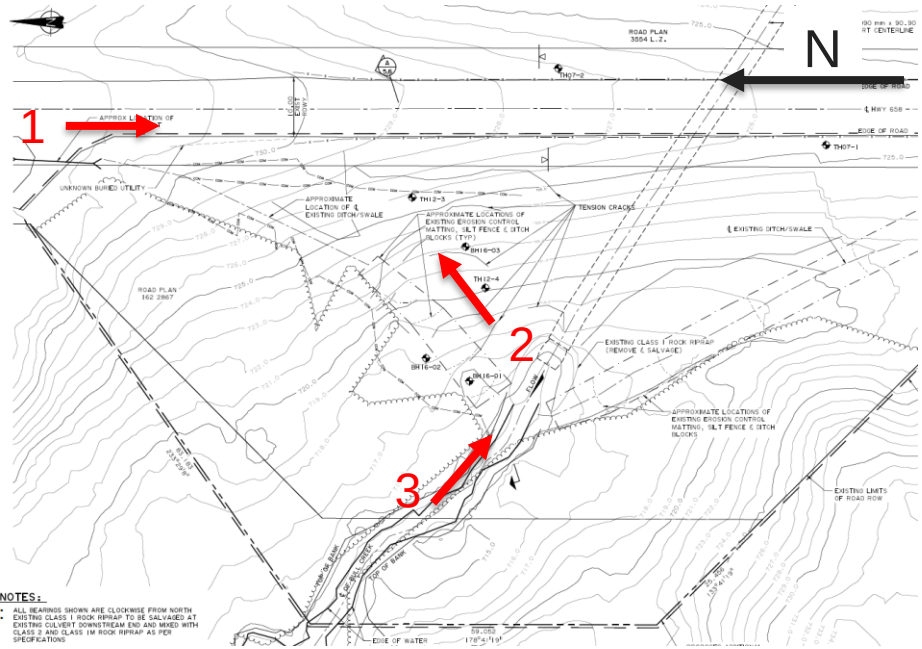


Photo 1 – Looking South at slide

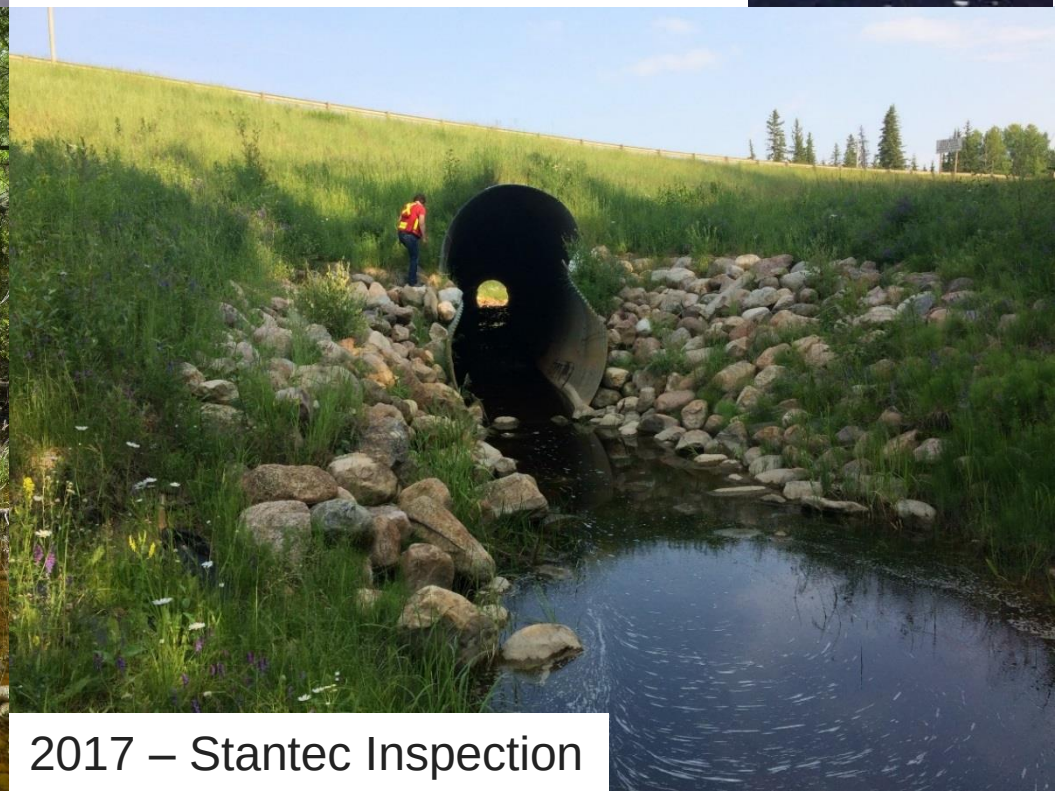
Photo 2 – Looking northeast at slide

Photo 3 – Looking southeast at culvert

2011 – Thurber Inspection Report

2014 – Golder Inspection Report

2016 – Stantec Inspection



2017 – Stantec Inspection

NC76 – Blue Ridge Slide

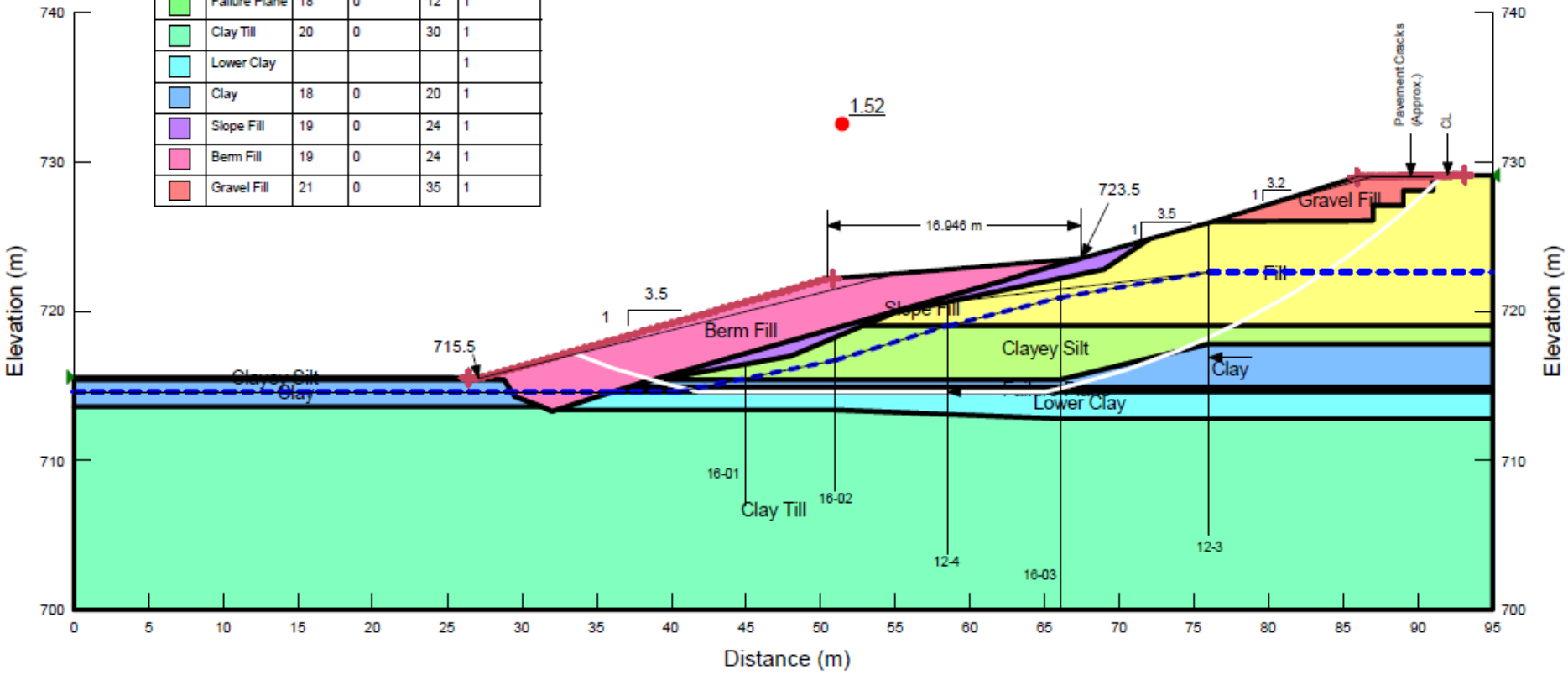
Challenges

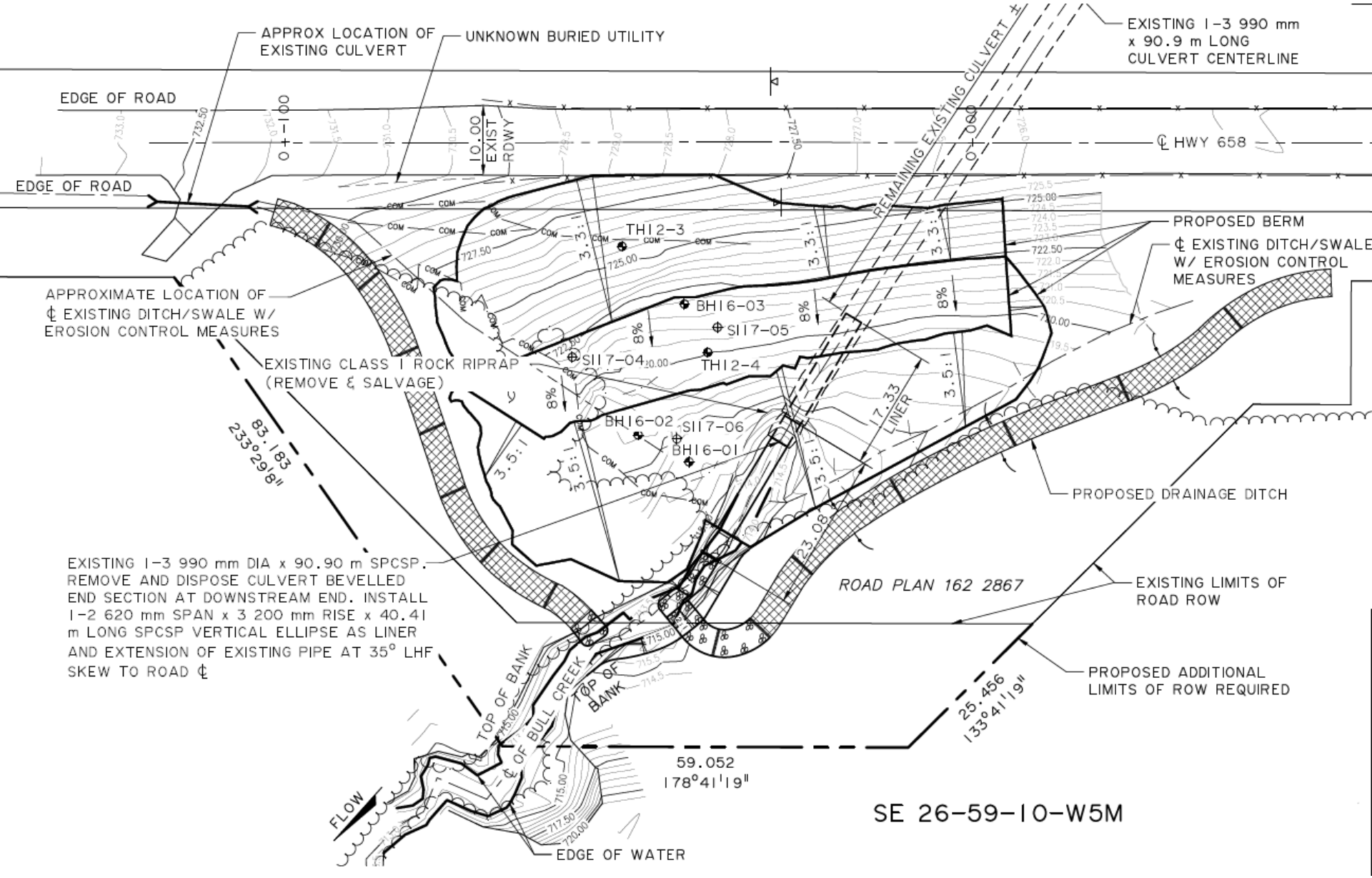
- Limited space due to creek
  - Pile wall – Cantilevered pile alone inadequate for support. Needed anchors.
  - Large number of anchors required became costly – went with berm solution (additional ROW needed for construction access)
- Relatively weak clay till
  - Concerns with constructability of a shear key due to poor soil and groundwater conditions – built a larger berm instead
- High groundwater table and springs
  - Drainage blanket with interceptor drains

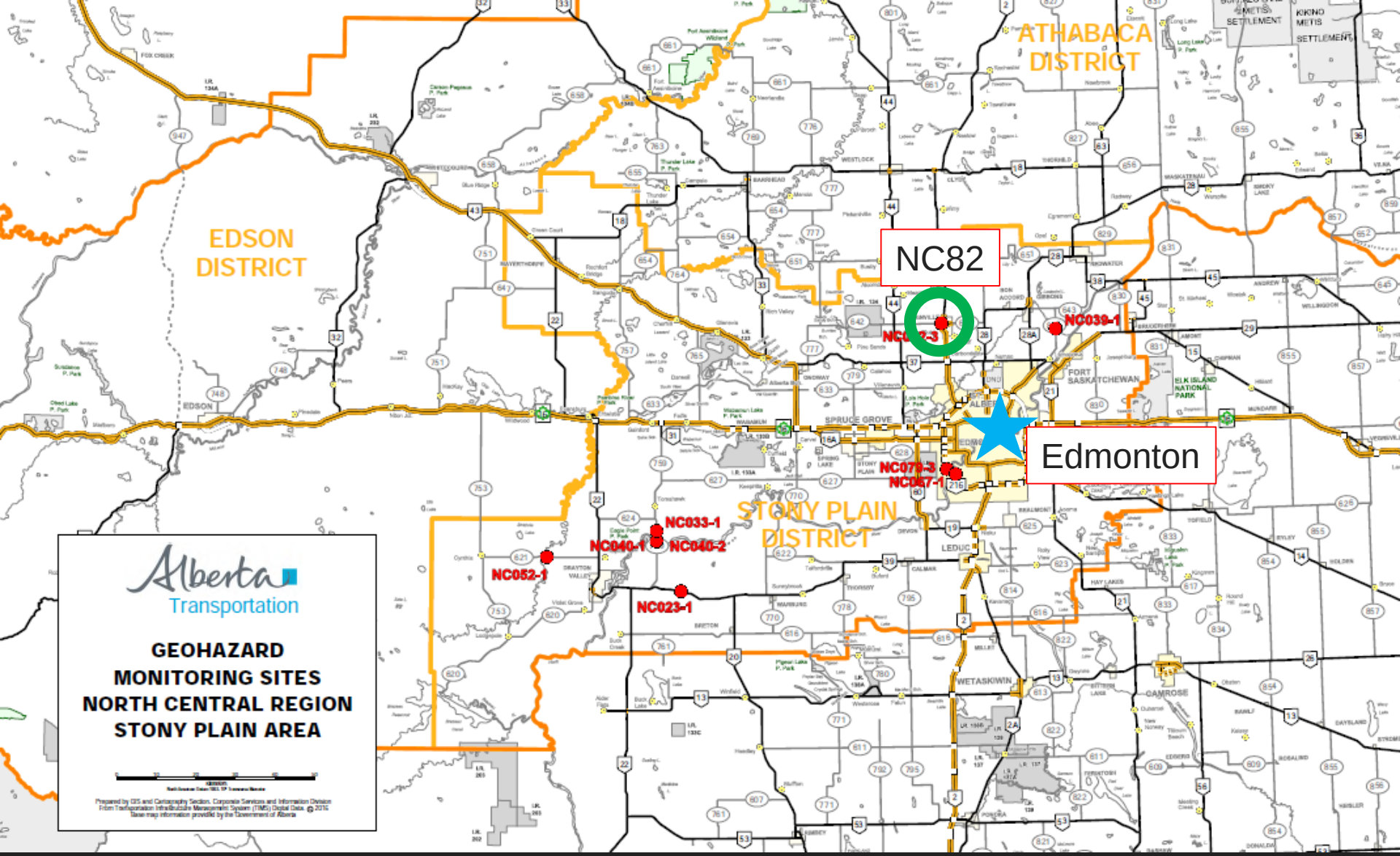
Figure E4

Overall slope of ~4.5H:1V

Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Piezometric Line
	Fill	19	5	26	
	Clayey Silt	19	0	24	1
	Failure Plane	18	0	12	1
	Clay Till	20	0	30	1
	Lower Clay				1
	Clay	18	0	20	1
	Slope Fill	19	0	24	1
	Berm Fill	19	0	24	1
	Gravel Fill	21	0	35	1




APPROX LOCATION OF EXISTING CULVERT
UNKNOWN BURIED UTILITY
EXISTING 1-3 990 mm x 90.9 m LONG CULVERT CENTERLINE
EDGE OF ROAD
0+100
10.00 EXIST RDWY
℄ HWY 658
0+000
REMAINING EXISTING CULVERT ±
EDGE OF ROAD
PROPOSED BERM
℄ EXISTING DITCH/SWALE W/ EROSION CONTROL MEASURES
APPROXIMATE LOCATION OF ℄ EXISTING DITCH/SWALE W/ EROSION CONTROL MEASURES
EXISTING CLASS I ROCK RIPRAP (REMOVE & SALVAGE)
TH12-3
BH16-03
SI17-05
SI17-04
TH12-4
BH16-02
SI17-06
BH16-01
3.5:1
8%
3.3:1
17.33 LINER
23.08
83.183
233°29'8"
PROPOSED DRAINAGE DITCH
EXISTING 1-3 990 mm DIA x 90.90 m SPCSP. REMOVE AND DISPOSE CULVERT BEVELLED END SECTION AT DOWNSTREAM END. INSTALL 1-2 620 mm SPAN x 3 200 mm RISE x 40.41 m LONG SPCSP VERTICAL ELLIPSE AS LINER AND EXTENSION OF EXISTING PIPE AT 35° LHF SKEW TO ROAD ℄
ROAD PLAN 162 2867
EXISTING LIMITS OF ROAD ROW
TOP OF BANK
℄ OF BULL CREEK
TOP OF BANK
PROPOSED ADDITIONAL LIMITS OF ROW REQUIRED
25.456
133°41'19"
59.052
178°41'19"
FLOW
EDGE OF WATER
SE 26-59-10-W5M



NC82 Morinville Slide

NC82 –
Morinville Slide

Background

- Two slides
  - North 55 m x 20 m
  - South 30 m x 15 m
- 4 m to 5 m high embankment, 3H:1V
- Standing water in east ditch – No grade
- Test pits showed soft soils, possible high water table, and uncontrolled fill
- No instrumentation

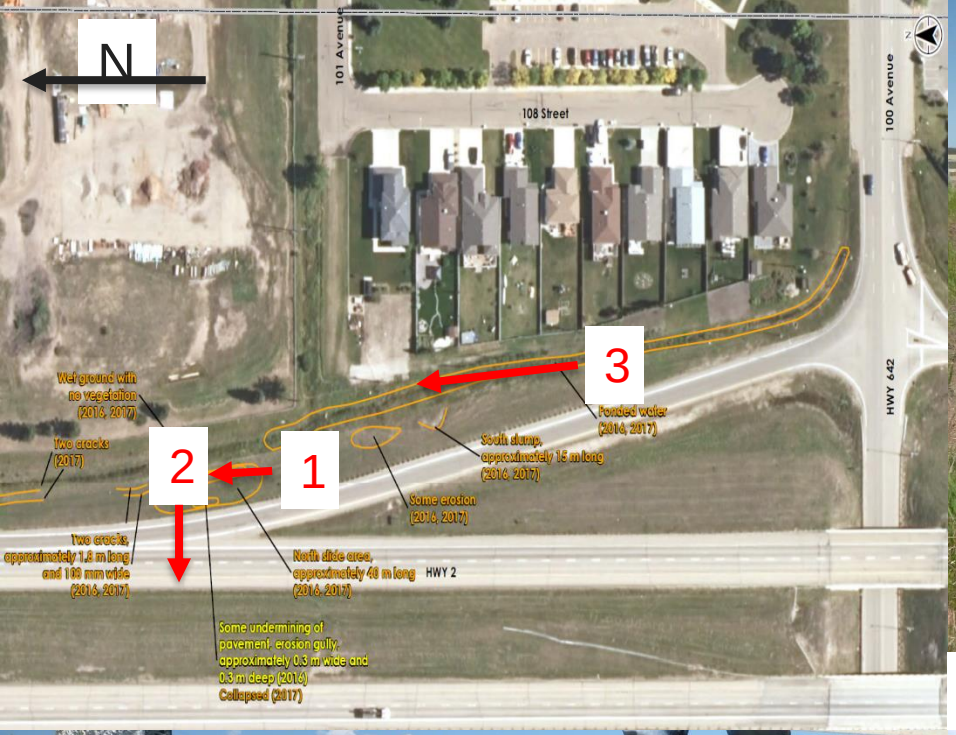


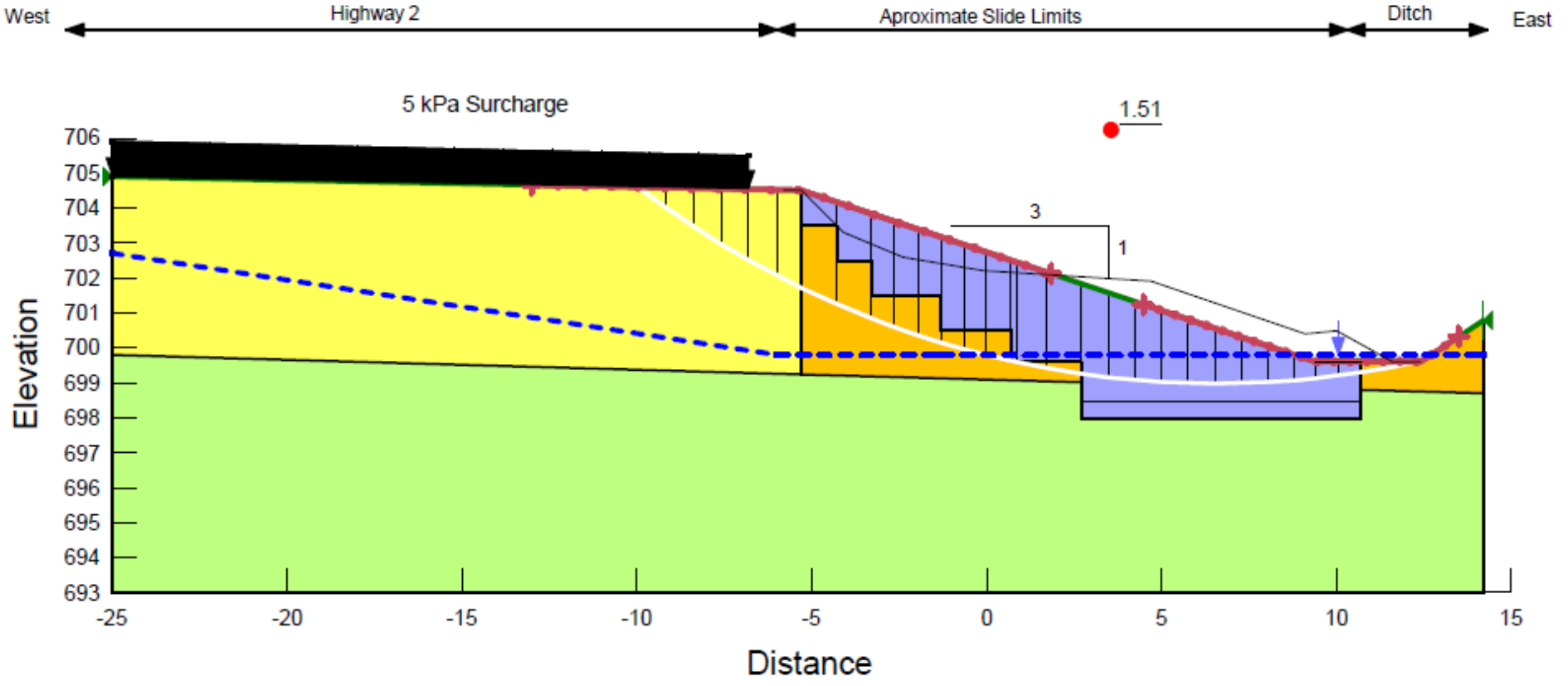
Photo 1 – Looking north at north slide

Photo 2 – Looking west from north slide

Photo 3 – Looking north at drainage ditch

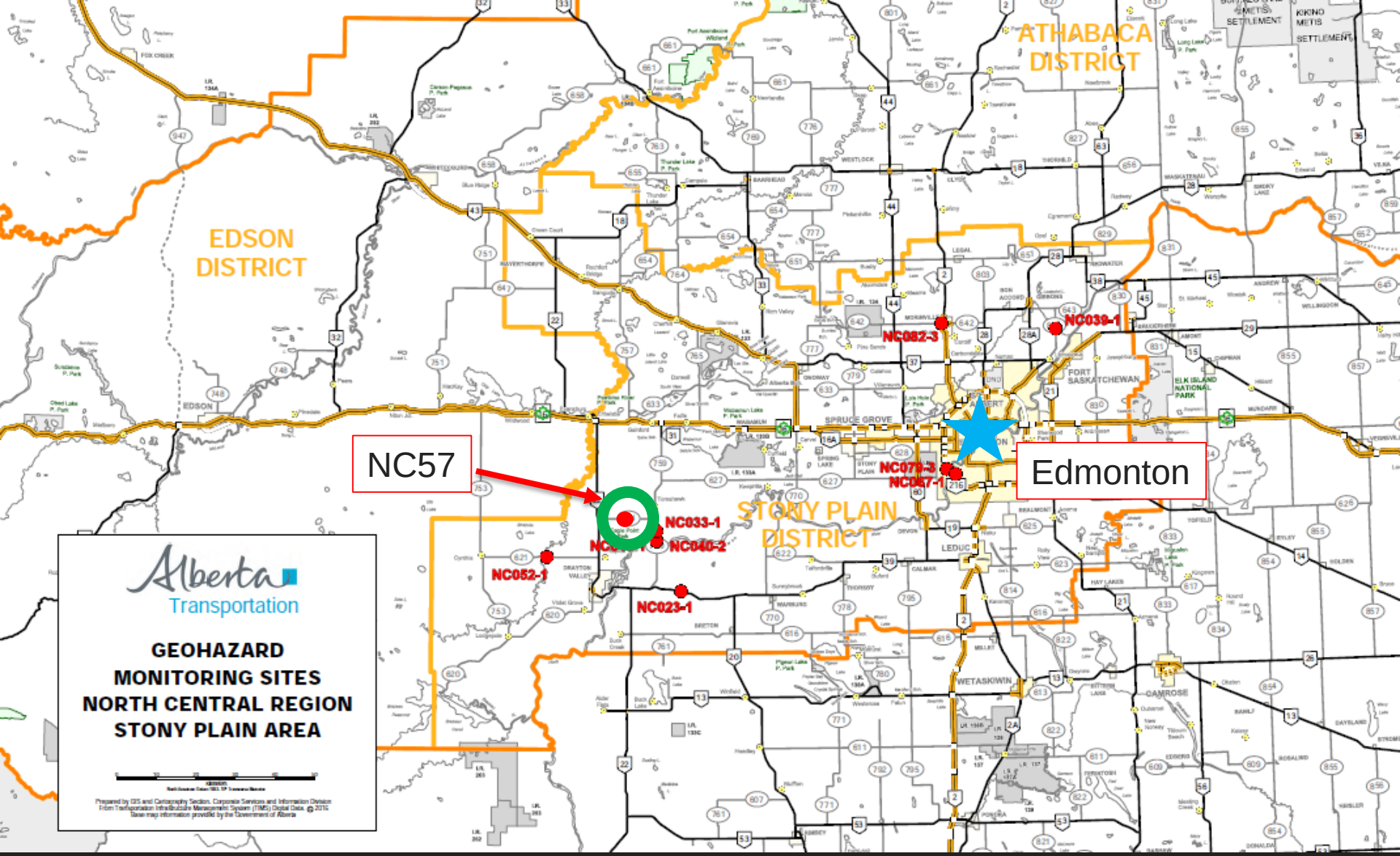
Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Clay (CI)	Mohr-Coulomb	19	2	24
	Clay Fill_2	Mohr-Coulomb	18.5	3	20
	Clay Fill-Residual (3)	Mohr-Coulomb	18.5	1	13
	Pit Run Fill	Mohr-Coulomb	20	0	35

Figure 7E - Repair Option (Long Term)
Remove and Replace with Granular Backfill



Challenges

- Excavations in soft soil
  - Limit construction widths to 5 m sections if shear key to be constructed
  - Must backfill shear key the same day it's excavated
- Construction in winter
  - Control the material going into the site for compaction
  - Benefit of winter shutdown – touch up in spring.
- Working with a brand new contractor
  - Work closely during development of work plan
  - Keep them informed on "why"



NC57 – HWY 624 Embankment Failure

- NC57 – Highway 624 Embankment Failure

Background

- 2 m embankment with 6H:1V to 7H:1V side slopes
- Settlement and lateral spreading of highway
- First embankment failure in 2006
- Repaired in 2007 with granular sub-drains installed.
- Highway 624 performed well until 2014

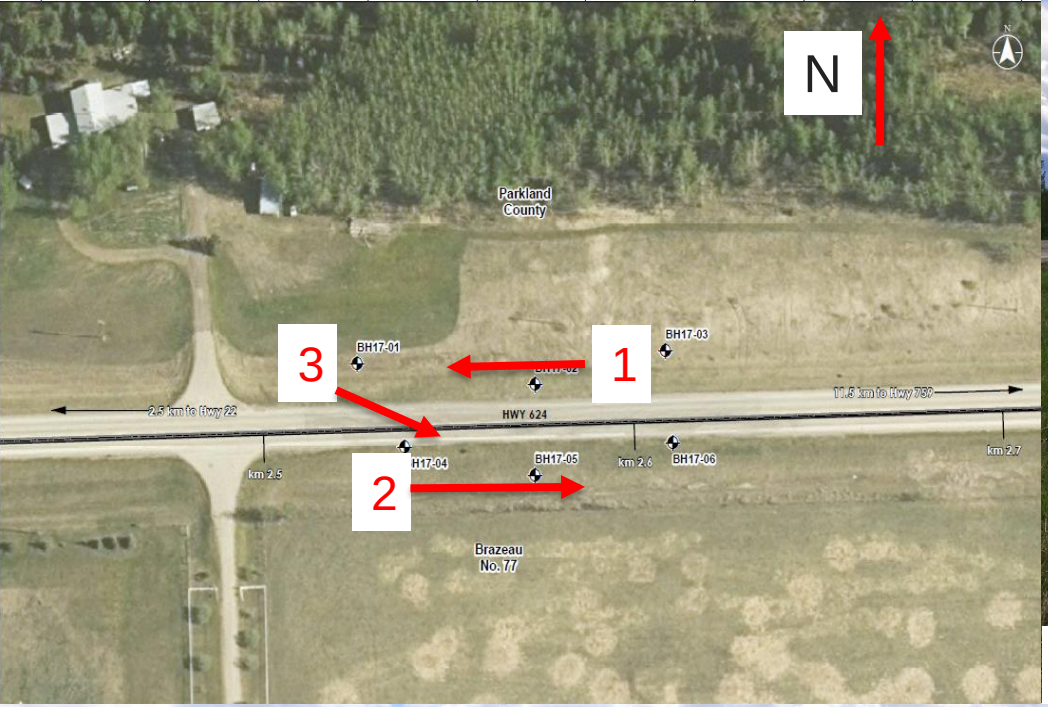


Photo 1 – Looking west gentle slope

Photo 2 – Looking east, wet ground

Photo 3 – Looking southeast, pavement distress

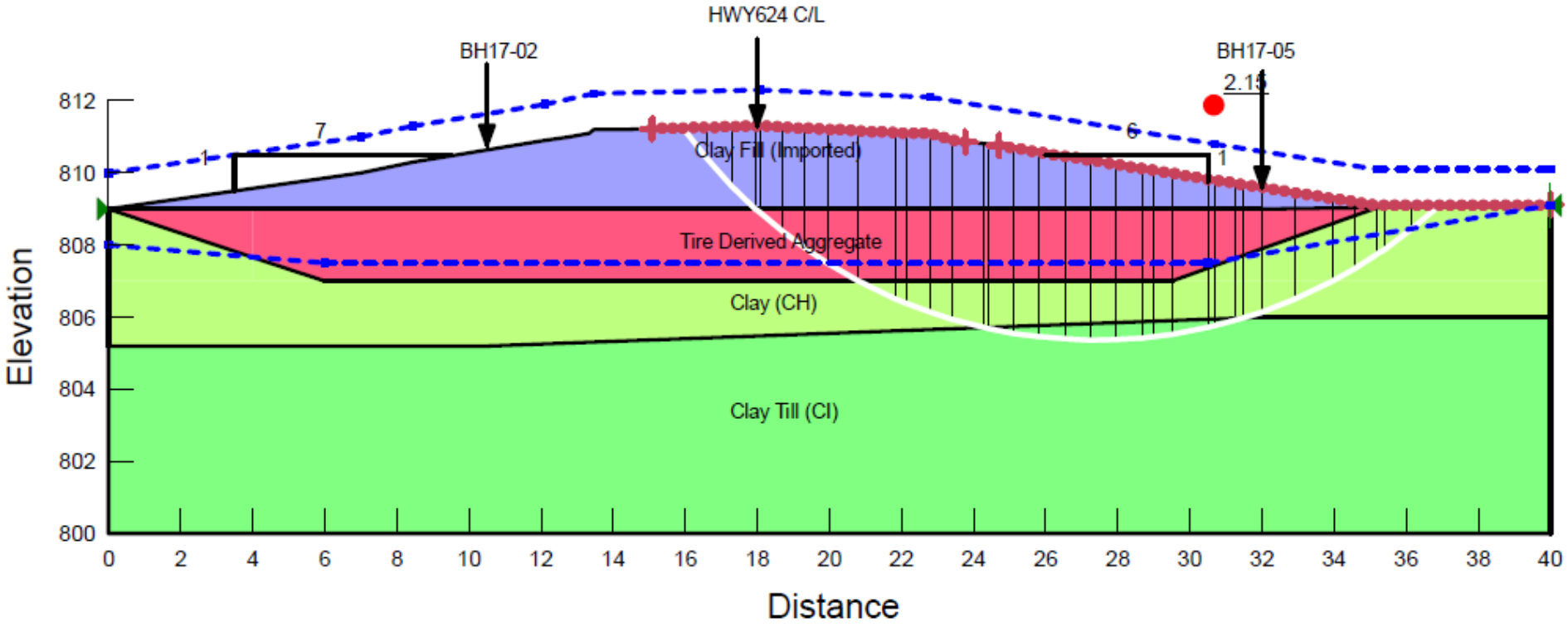
- NC57 – Highway 624 Embankment Failure

Challenges

- Very soft to soft clay
  - Need to improve strength. Remove and replace. Cematrix?
- High Groundwater Table
  - Boreholes drilled showed piezometric levels 1 m above highway surface
  - Need free draining material. Not Cematrix.
  - Gravel available nearby
  - Tire derived aggregate (TDA) also available from Alberta recycling

Figure E4 - Section A - Tire Derived Aggregate
Option 2

Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Piezometric Line
	Clay (CH)	Mohr-Coulomb	16.5	0	17	1
	Clay Fill (Imported)	Mohr-Coulomb	18	0	25	1
	Clay Till (CI)	Mohr-Coulomb	19	2	28	2
	Tire Derived Aggregate	Mohr-Coulomb	8	0	21	1




Questions?