

**ALBERTA TRANSPORTATION GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION – PEACE-HIGH LEVEL
2015 CALLOUT**

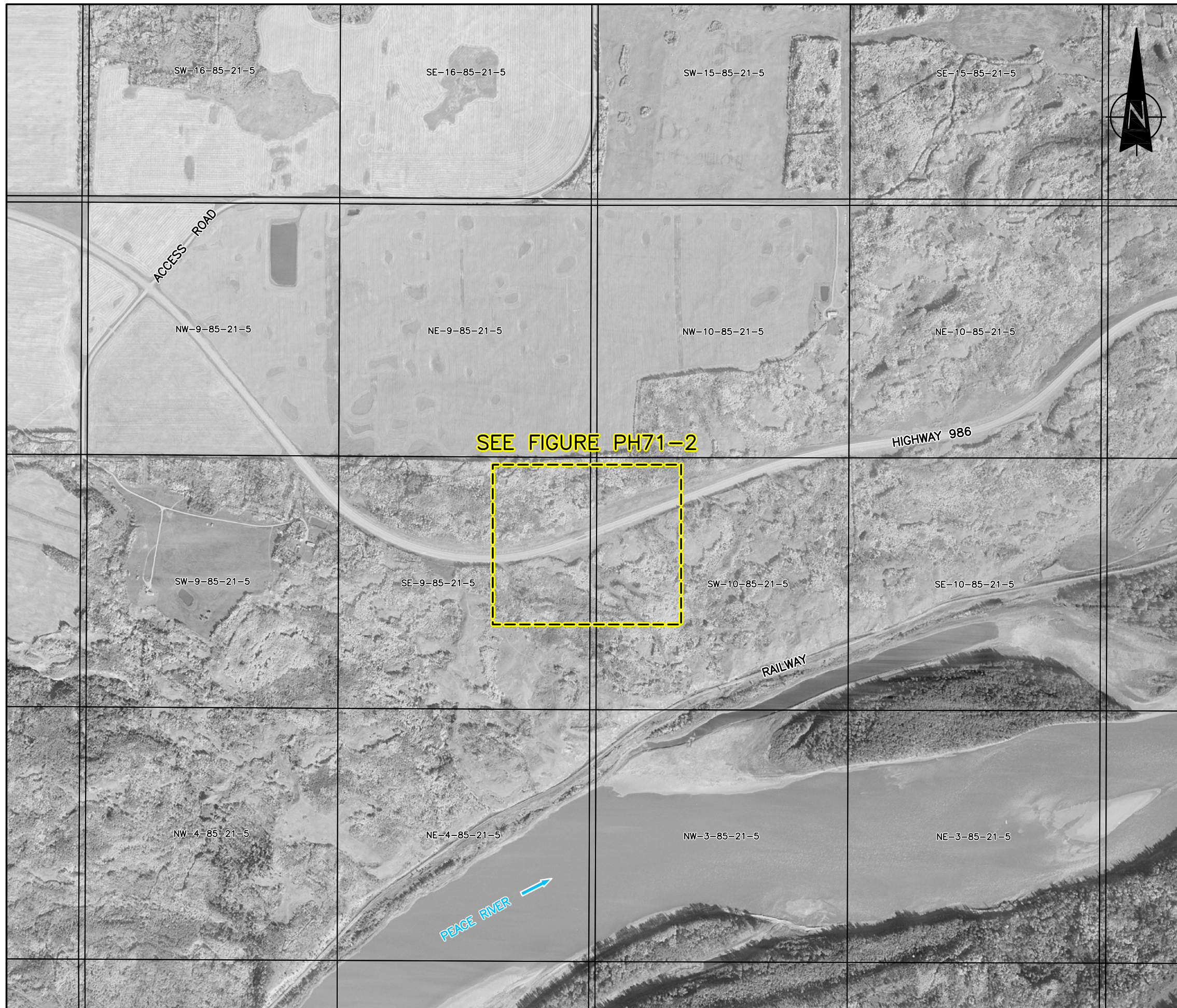
Site Number	Location	Name	Hwy	km
PH71	Daishowa West Hill	Daishowa West Hill Slide - Km 26.8	986:01	26.8
Legal Description		UTM Co-ordinates		
SE¼ 09-085-21 W5M		11V E 485015	N 6245524	

	Date	PF	CF	Total
Previous Inspection:	17-Jun-2014	11	4	44
Current Inspection:	23-July-2015	14	5	70
Road AADT:	1060		Year:	2012
Inspected By:	Ed Szmata		Luis Martinez	
Report Attachments:	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input checked="" type="checkbox"/> Maintenance Items			

Primary Site Issue:	A landslide is retrogressing and is affecting the original EBL and WBLs of the road embankment. The landslide backscarp is currently encroaching onto the south WBL (Photo 71-01). Tension cracks and dips in the pavement can be observed on the north WBL (Photo 71-02 and Photo 71-03).		
Dimensions:	The highway at the site runs east to west on a sidehill cross-section. Originally, in the vicinity of the site, there were two westbound lanes and one eastbound lane. The lanes were about 4 m wide. The road embankment was about 21.5 m high with side slopes in the order of 3H:1V. A CSP culvert is traversing under the road embankment. Currently, the main landslide area is retrogressing and has increased in size from 100 m to about 130 m long (since June 2015) measured from east to west, and is encroaching into the original south WBL.		
Maintenance:	A temporary westbound detour lane was built in November 2013 after the initial slope failure.		
Observations:	Description	Worsened?	
<input checked="" type="checkbox"/> Pavement Distress	There are 4 distress patterns (settlement and tension cracks) along the road embankment is as shown in Figure PH71-2 and Figure PH71-3.	<input checked="" type="checkbox"/>	

	The main distress pattern (Distress 2, Figure PH71-3) consist of a vertical drop of up to 250 mm and is 65 m long. The other important pattern (Distress 3, Figure PH71-3) extends 30 to 35 m to the west from the proposed pile wall.	
<input checked="" type="checkbox"/> Slope Movement	<p>In 2013, the original EBL was partially lost due to a landslide and a temporary detour was built to shift the highway to the north. In 2014, the landslide retrogressed and completely removed the original EBL. In 2015, the landslide continue encroaching further north into the original south WBL. By the time of the inspection, tension cracks and highway settlement have developed throughout the remaining original WBLs upslope of the retrogressing landslide backscarp (Figure PH71-4 and Photo 71-04).</p> <p>One of the observed tension cracks is encroaching into the north shoulder of the highway (Photo 71-02) suggesting that the deep failure surface observed during the initial geotechnical investigation may have retrogressed and may be impacting the whole road embankment (Section B-B', Figure PH71-4).</p> <p>The landslide backscarp has retrogressed and is at or slightly upslope of the jersey barrier (Photo 71-01). The center line of the proposed pile wall coincides with the location of jersey barrier. The difference in elevation between the road pavement surface and the toe of the backscarp is about 6.0 to 6.5 m.</p>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Erosion		<input type="checkbox"/>
<input type="checkbox"/> Seepage		<input type="checkbox"/>
<input checked="" type="checkbox"/> Bridge/Culvert Distress	The inlet of the 900 mm CSP culvert traversing the highway embankment was temporarily plugged with clay soil during detour construction (2013). It will be fully plugged with grout during the ultimate slope repair.	<input checked="" type="checkbox"/>

<input type="checkbox"/> Other		<input type="checkbox"/>
<p>Instrumentation:</p> <p>Four testholes were drilled at this site. Pneumatic piezometers and SIs were installed in three of them. The other testhole was completed with a standpipe piezometer. All of these instruments have since been decommissioned or sheared off.</p>		
<p>Assessment:</p> <p>The recent substantial retrogression of the landslide may have been caused by loss of soil strength due to a local increase in groundwater table in the vicinity of the site.</p> <p>Retrogression is expected to continue if mitigation measures are not implemented. The rate of movement is difficult to assess without proper instrumentation installed at this site.</p>		
Recommendations:		Cost
<p><u>Short Term:</u></p> <p>Inspect the slides regularly (particularly after heavy and/or prolonged rain or rapid snowmelt).</p> <p>Temporary work could include construction of a shear key pile wall about 65 m long located in front of the main settlement pattern (vertical drop of 250 mm), and the installation of a geofoam berm (Section B-B', Figure PH71-5). The shear key is to slow down the slope movements until a permanent pile wall is built. The geofoam berm is to provide a safe platform for pile wall installation and subsequently for anchor installation. There will be no need to adjust the proposed highway or pile wall alignment if this option is approved. This temporary work (at least the shear key) should be completed soon to avoid full development of a potential deep failure surface beyond the highway north shoulder and further settlement of the road.</p> <p>Rather than temporary works, we understand that AT prefers to implement a permanent repair as soon as possible.</p>		
<p><u>Longer Term:</u></p> <p>Long term stabilization measures of the landslide area should consist of grouting of the existing traversing culvert and construction of a permanent anchored pile wall. Highway realignment and an additional temporary detour construction will be required. Design works for such an installation is underway with tendering and construction to start late in 2015.</p>		<p>\$ 2,000,000</p> <p>\$ 11,000,000</p>



NOTES:
 1 DRAWING MUST BE USED IN CONJUNCTION WITH THE ATTACHED REPORT REFERENCE 15-16-363 DATED AUGUST 2015 AND IS SUBJECT TO THE STATEMENT OF LIMITATIONS AND CONDITIONS INCLUDED IN THE REPORT.
 2 AIR PHOTO BASE (2001).

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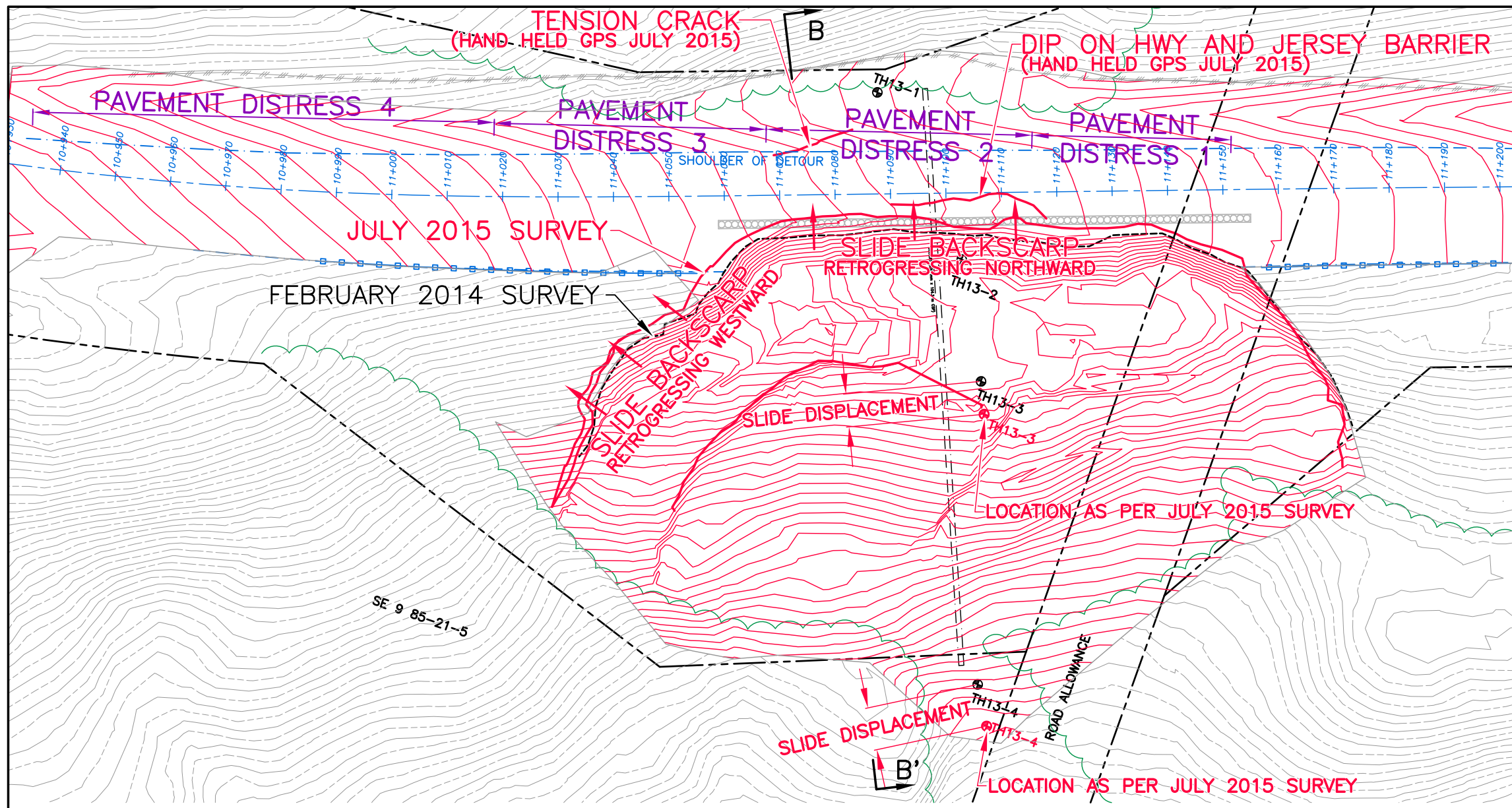
PEACE REGION (PEACE RIVER/HIGH LEVEL)

**DAISHOWA
 HWY 986:01 (PH71)
 KEY PLAN**

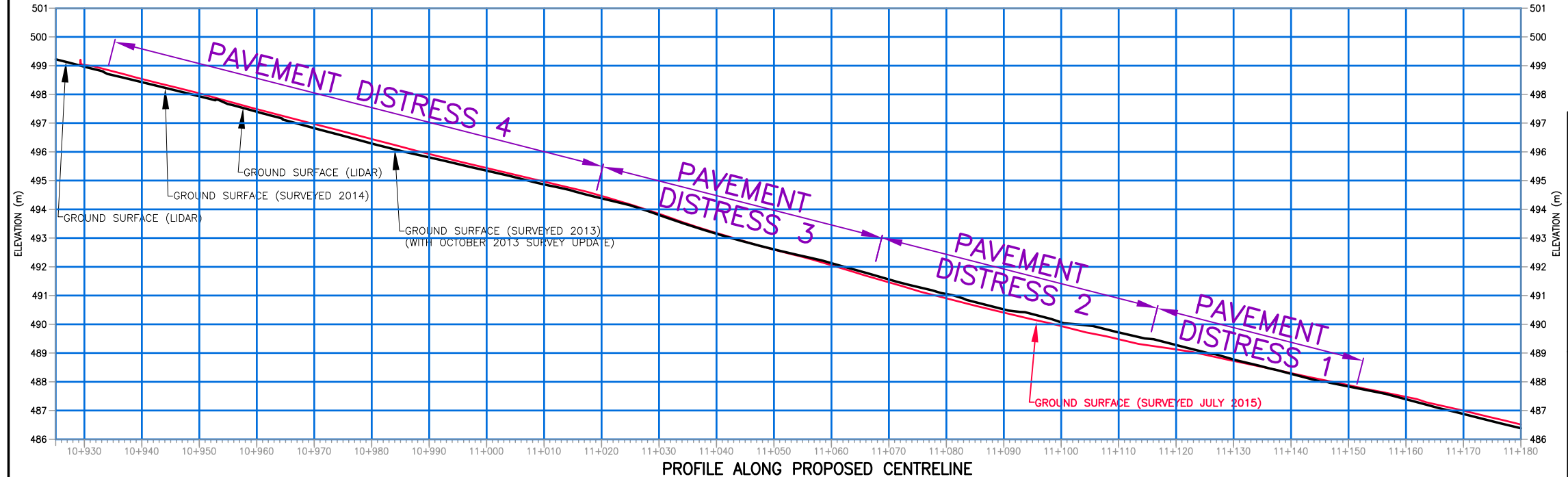
FIGURE PH71-1

DRAWN BY	ICB
DESIGNED BY	LAM
APPROVED BY	WCW
SCALE	1:12 500
DATE	AUGUST 4, 2015
FILE No.	15-16-363-A6B






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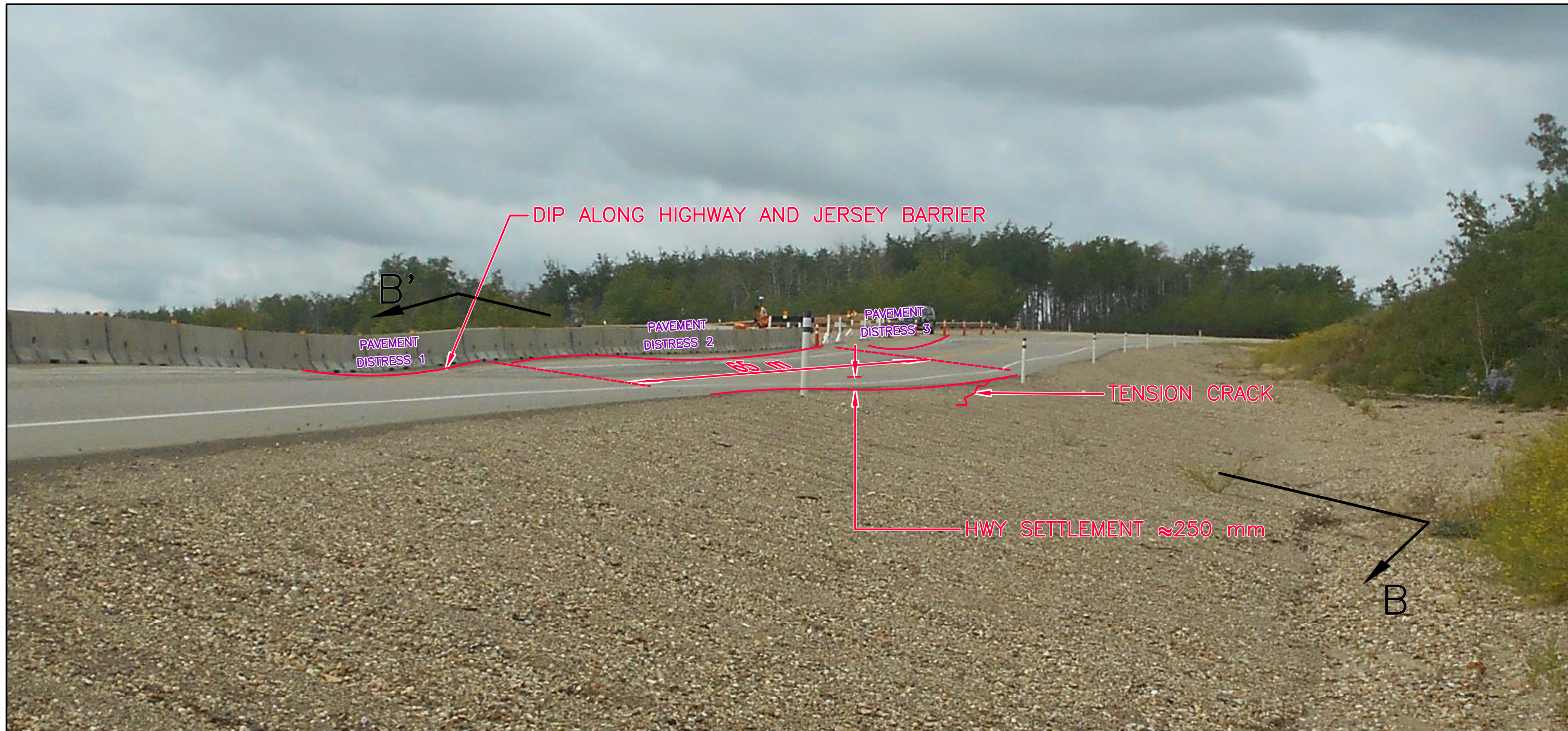
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 PEACE REGION (PEACE RIVER/HIGH LEVEL)

SITE PLAN AND PROFILE ALONG PROPOSED CENTRELINE
 FIGURE PH71-2

DRAWN BY	SEC
DESIGNED BY	LAM
APPROVED BY	WCW
SCALE	1:300
DATE	AUGUST 4, 2015
FILE No.	15-16-363-A8A



THURBER ENGINEERING LTD.



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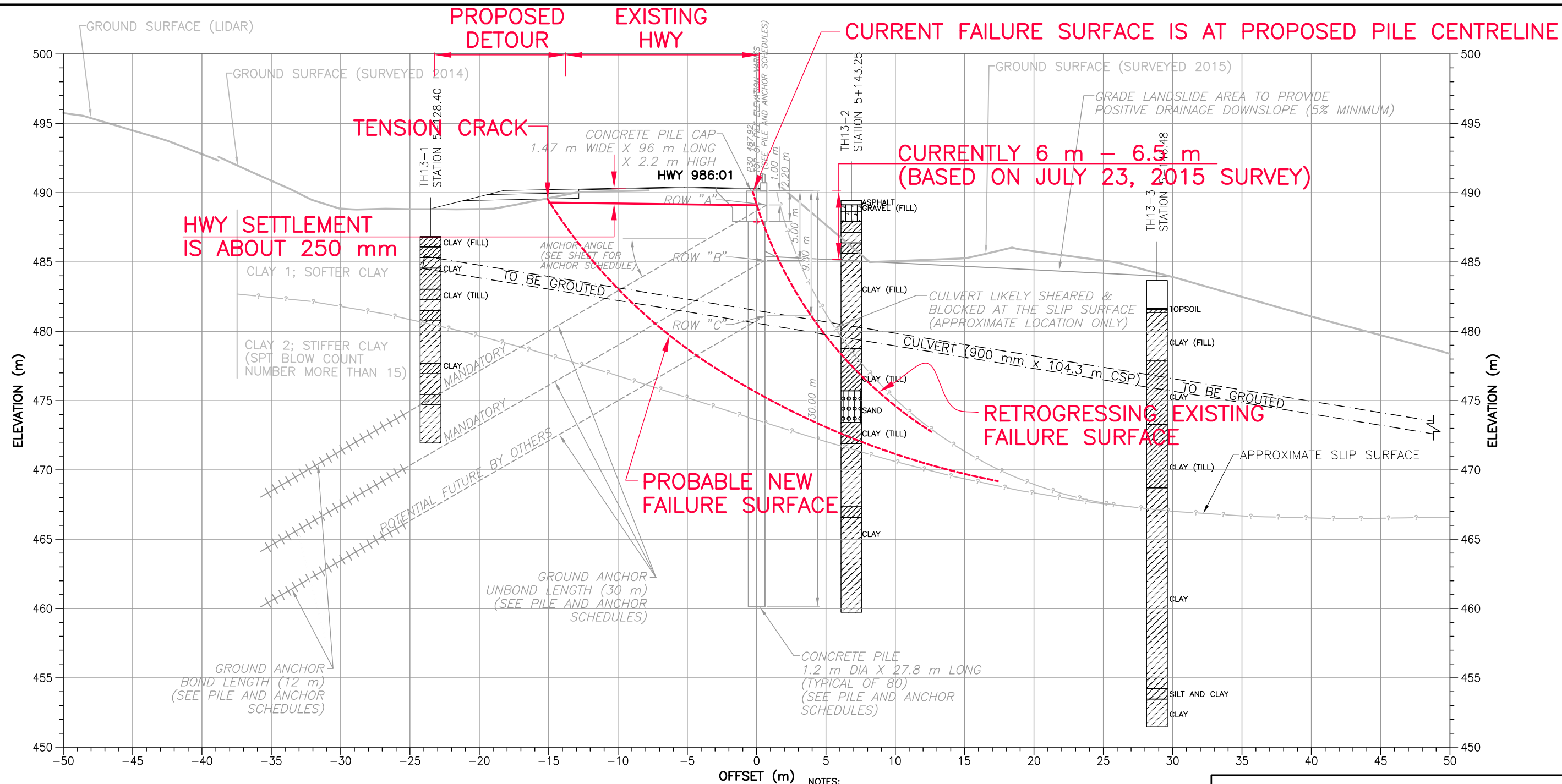
PEACE REGION (PEACE RIVER/HIGH LEVEL)

NEW HIGHWAY SETTLEMENT AND TENSION CRACK

FIGURE PH71-3

DRAWN BY	SEC
DESIGNED BY	LAM
APPROVED BY	WCW
SCALE	NOT TO SCALE
DATE	AUGUST 4, 2015
FILE No.	15-16-363-A7A





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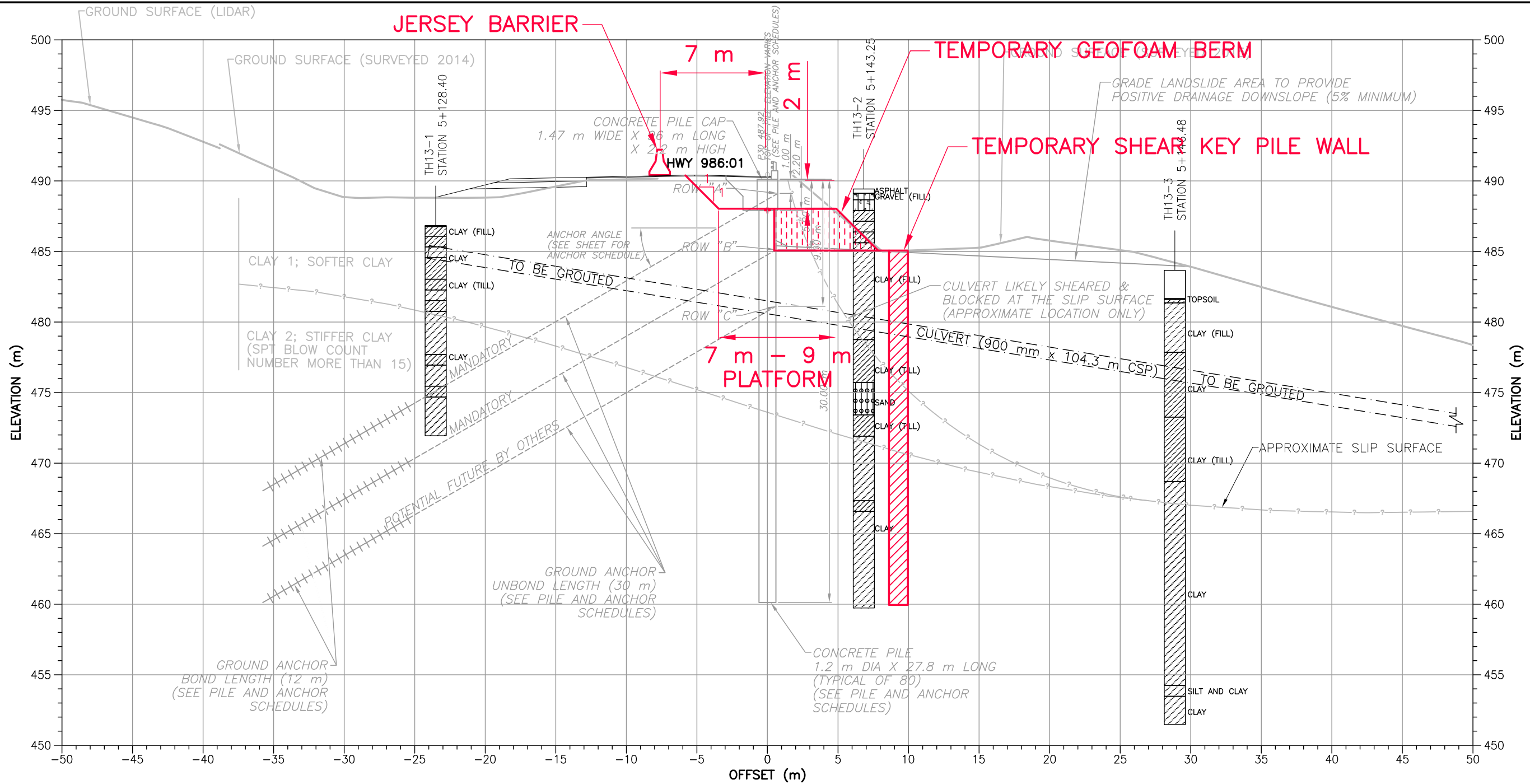
PEACE REGION (PEACE RIVER/HIGH LEVEL)

SECTION B - B'
PROBABLE NEW FAILURE SURFACE

FIGURE PH71-4

DRAWN BY	SEC
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APPROVED BY	WCW
SCALE	1:300
DATE	AUGUST 4, 2015
FILE No.	15-16-363-A7A





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PEACE REGION (PEACE RIVER/HIGH LEVEL)

SECTION B - B'
PROPOSED TEMPORARY SHEAR KEY

FIGURE PH71-5

DRAWN BY	SEC
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APPROVED BY	WCW
SCALE	1:300
DATE	AUGUST 4, 2015
FILE No.	15-16-363-A7A





Photo 71-01. Looking east at current back scarp along the highway south shoulder. The backscarp is about 6.0 to 6.5 m in height.



Photo 71-02. Tension crack developing just behind the highway north shoulder.



Photo 71-03. Tension cracks developing just behind the jersey barrier.



Photo 71-04. Landslide looking west. Slight bulging is developing mainly above the culvert outlet.