



THURBER ENGINEERING LTD.

June 22, 2018

File: 13351

Alberta Transportation
3rd Floor, Provincial Building
9621 – 96 Avenue
Peace River, Alberta
T8S 1T4

Attention: Mr. Ed Szmata

**GEOHAZARD ASSESSMENT PROGRAM
CALL-OUT INSPECTION REPORT
HWY 684:02 KM 29.46
(PH053-2) SHAFTESBURY TRAIL NORTH SITE**

Dear Sir:

Under the Geohazard Assessment Program, Thurber was requested by Ed Szmata of Alberta Transportation (AT) on June 14, 2018, to conduct a call-out inspection at the above noted debris flow/rockfall site. The inspection was completed by Mr. Shawn Russell, P. Eng. of Thurber Engineering Ltd. (Thurber) in the presence of Mr. Szmata and AT's Maintenance Contract Inspector for CMA No. 4, Mr. Erwin Kurcz.

1. BACKGROUND

On July 5, 2017, two nearby sites (PH053-1 at km 29.53 and PH054-1 at km 29.92) were both visited as part of call-out inspections after the occurrence of mud/debris flows following heavy rainfall events from the east side of the roadway embankment onto residential properties at the toe of the valley slope.

The Peace River airport weather monitoring station recorded 32 mm of accumulated precipitation between June 11 and 12, 2018. During the evening of June 12, 2018, the occupants of 9005-105 Avenue, which is located immediately downslope and due east of Hwy 684, indicated that a loud noise was heard at about 9 pm and that they noticed that the west facing wall of their dwelling had moved inwards towards the east. It turned out that the noise and displacement of the wall was due to landslide debris that had crashed onto the dwelling wall.

2. SITE CONDITIONS

Selected photographs taken during the call-out inspection are attached to the report.

At this location, Hwy 684:02 (Shaftesbury Trail) runs north-south along the crest of a lower terrace slope of the Peace River Valley, with several residences located below on the lower terrace. Available surficial geology information indicates that the near surface soils consist primarily of a colluvium layer overlying fluvial deposits over weathered sandstone in the upper portion of the underlying bedrock stratum.



The overall slope varies in height from the top of pavement along Hwy 684 to the lower terrace from about 6 m to 8 m. There are no signs of distress to the guardrail, paved surface of the highway and the immediate sideslope of the embankment above the landslide. There is a slight dip in the ACP walkway and distinct bend in the chain link fence at the crest of the slope on the east side of the roadway.

The overburden soil in the upper portion of the slope is comprised of about 0.2 m of organic soil cover followed by silty/cobbly clay-based colluvium soils to a depth of about 2 m with an overall sideslope angle of about 25 degrees from horizontal. The colluvium is underlain by a 0.5 m thick layer of silty fluvial sand and gravel. The overburden is underlain by about 500 mm of fractured poorly cemented weathered sandstone. The weathered sandstone is underlain by a clean fine to medium grained sand lens with a thickness varying up to 300 mm. The sand lens is underlain by more cemented competent sandstone.

The debris accumulated at the toe of the slope consisted of a mix of clay, silt, sand, peat, dislodged trees in addition several slabs of poorly cemented and weathered sandstone that littered the base of the slope. The size of the sandstone slabs varied in thickness from 300 mm to 600 mm with sizes ranging from 1 m to 3 m. Several large pieces of the upper weathered sandstone layer are partially undermined and still could also topple down onto the lower terrace. The slide extends about 15 m laterally along the toe of the valley slope.

3. ASSESSMENT

In the past, similar debris flows in this area have typically occurred in the overlying organic and colluvium soils due to the concentration of surface runoff water from heavy rain fall events.

This debris flow and rockfall are considered to have been triggered by either a temporary rise in groundwater or a concentration of surface water runoff at this location. It is likely that the water entered fissures in the upper weathered portion sandstone bedrock after washing away the layer of colluvium that previous shed water away from the fissures and washed out the underlying sand lens. This caused large slabs of the undermined weakly cemented upper sandstone bedrock to shear and to fall onto the lower terrace level below.

The primary concerns at this site are listed as follows:

- The potential for further organic soil, colluvium and weathered sandstone bedrock debris from an expansion of the slide to continue to fall and to reach the residence below.
- Further retrogression and expansion of the slide into the pedestrian trail and the highway embankment.

Observations made on site on June 13, 2018 indicated that there are no current signs of distress to the roadway embankment. These debris flows occur naturally in lower lying areas along the crest of the terrace slope and was not caused by the existing highway. It is very likely that the failed area will continue expand and grow. Therefore, measures should be taken to protect the residence below the affected area and the highway above.



The inferred slip surfaces of the movement are located at the base of the weathered sandstone bedrock and are estimated to be at about 2 m to 4 m below the top of Hwy 684.

The assessed risk level for this site, based on AT's guidelines is 80, based on a Probability Factor of 8 (Active, high probability of remobilization, or additional hazards, uncertainty level high) and a Consequence Factor of 10 (site where safety of public or privately-owned structures will occur if a slide occurs).

There are no available records of previous geotechnical investigations and there are currently no instruments installed at the site.

4. RECOMMENDATIONS

4.1 Short Term

The blocks and slabs of partially undermined weathered sandstone are still present and have the potential to shear and fall and should be dislodged as a matter of urgency prior to undertaking any other work at the site.

Barriers should be installed at the toe of the slope to prevent sandstone slabs, cobbles and other debris from reaching the residence below the slope. Consideration should also be given to relocating the residence further away from the slope.

The slide area below the pedestrian trail should be monitored and the pedestrian trail should be closed if the slide backscarp continues to retrogress.

4.2 Long Term

A solution such as rockfall protection nets/mesh and rock bolted fencing will likely be best solution for this site, as there appears to be no apparent deep slide surface, but mainly surficial erosion and weathering that are dislodging large blocks of sandstone. However, the upper overburden soils would still need some kind of support such a soil nails with a shotcrete surface or some more environmental surfacing. A ballpark cost for the option is estimated to be around \$300,000 to \$700,000.

Alternatively, a pile wall could be installed consisting of cast-in-place concrete piles drilled either along the toe of the slope, or from the roadway, anchored into more competent sandstone bedrock. The piles could extend all the way up to the toe of the embankment sideslope or the piles could be inserted with H beams that will stick up above ground and spanned with timber lagging to hold back the soil/rock. A ball park cost for a pile wall would be in the order of \$500,000, to \$900,000.

Realigning the roadway to the west away from the crest of the slope and flattening of the sideslope could also be considered. This would involve acquisition of land from several private landowners along Hwy 684 and likely would be a much more expensive option the previous two.




4.3 Investigation

A geotechnical investigation would be required to confirm the mechanism and depth of the failure to provide sufficient information to prepare a detailed design. The investigation would involve coring into the sandstone bedrock to confirm its integrity and stability. The estimated costs of the investigation would be of about \$60,000. With a wet rotary coring rig mobilized out of Edmonton

5. CLOSURE

We trust this is the information you require at this time. If you have any questions, or if you require further information or recommendations, please contact us at your convenience.

Yours very truly,
Thurber Engineering Ltd.
Renato Clementino, Ph.D., P. Eng. 
Principal/Review Engineer



Shawn Russell, B.A.Sc., P. Eng.
Associate/Senior Engineer
/meg

Attachments:

- Photos
- Figures



STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.
- c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.
- d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.



Photo 1: Looking SW at HWY 684 from the NE side of the intersection with 105 Avenue.



Photo 2: Looking N at the dip in the ACP trail and the bend in the fence above the slide.



Photo 3: Looking south along pathway at the bow in chain link fence



Photo 4: Looking southeast from chain link fence at the landslide



Photo 5: Looking northeast from chain link fence at the landslide



Photo 6: Looking east from chain link fence at the landslide scarp



Photo 7: Looking southwest towards the toe of the slide



Photo 8: Looking south at sandstone slabs at the toe of the slide.



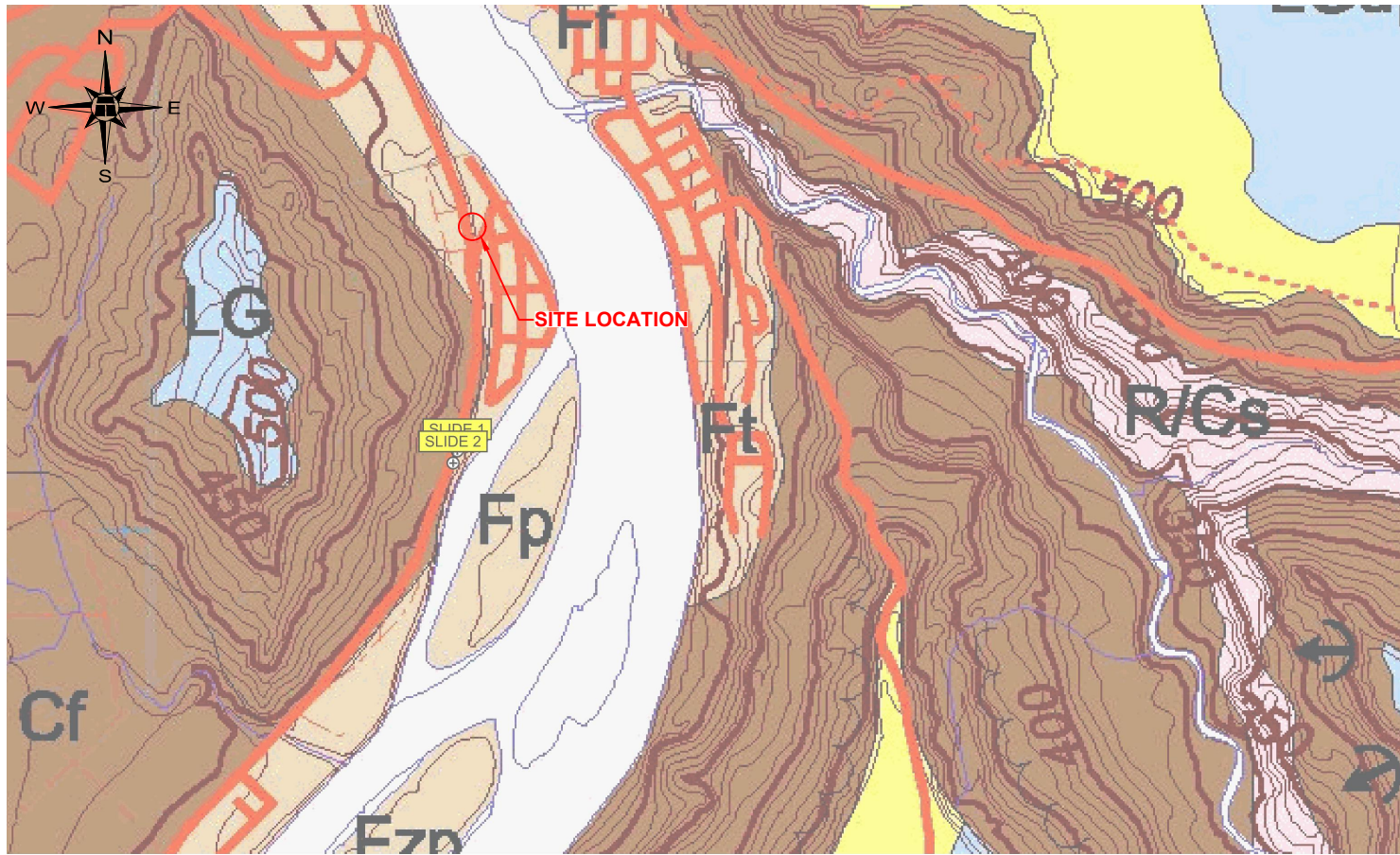
Photo 9: Looking northwest at the slide from the toe



Photo 10: Looking west at upper weathered sandstone layer that did not shear and fall



Photo 11: Looking southwest at upper weathered sandstone layer underlain by sand lens



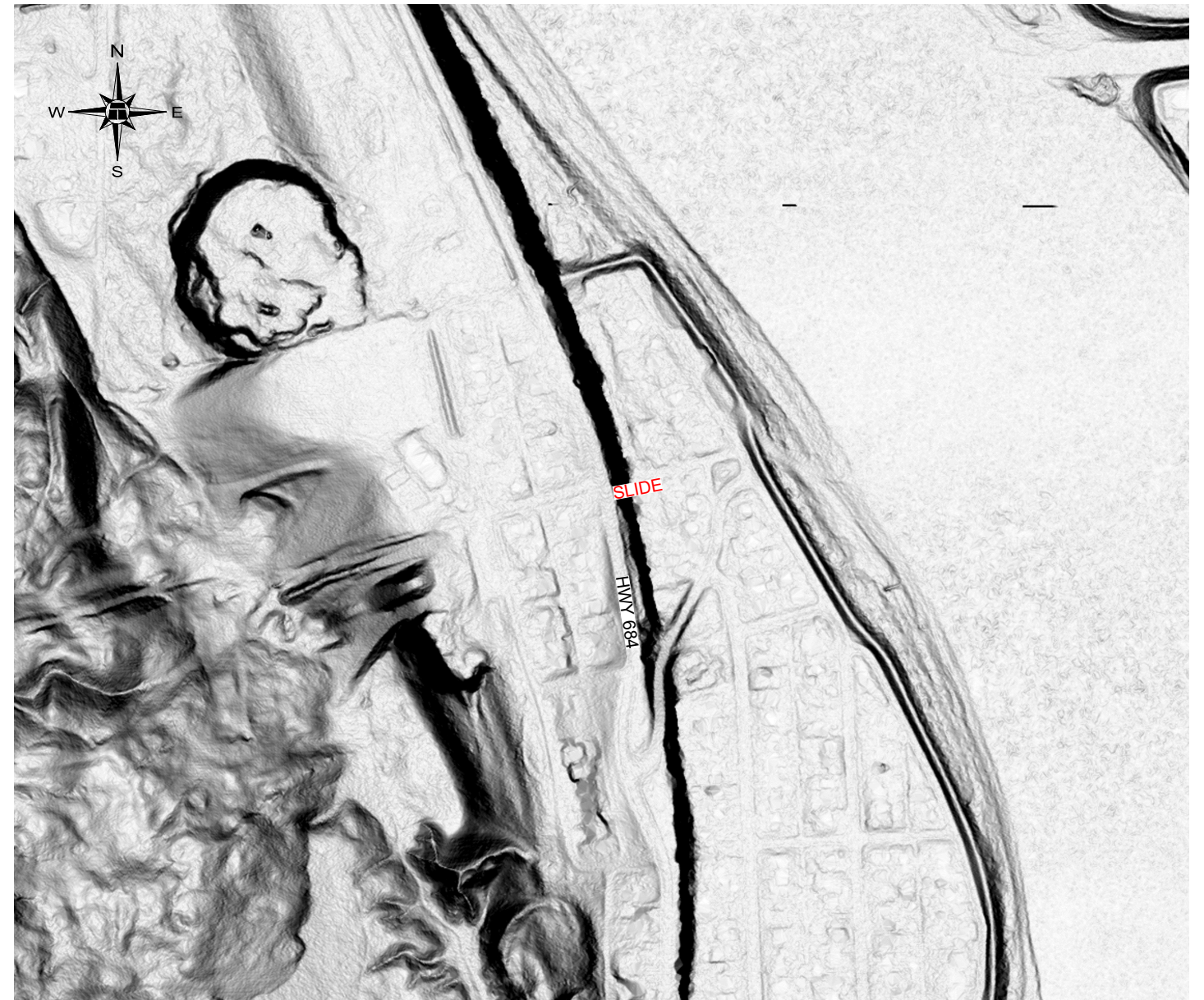
SURFICIAL GEOLOGY MAP
APPROX. SCALE 1:30000

LEGEND

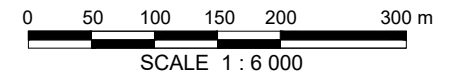
- ROAD, PAVED
- FLUVIAL DEPOSITS
- AEOLIAN DEPOSITS
- COLLUVIAL DEPOSITS
- GLACIOLACUSTRINE DEPOSITS

REFERENCE:

R.C. Paulen, Map 291, Surficial Geology of the Grimshaw Area (NTS 84C/SW), 2004, Alberta Geological Survey/Alberta Energy and Utilities Board. 1:100,000 Scale.



SITE LOCATION PLAN
SCALE 1:6000



PEACE REGION (PEACE RIVER/HIGH LEVEL)

**PH053-2: HWY 684:02, km 29.461
2018 CALLOUT PLAN**

DWG No. 13351-PH053-2 CALLOUT-1

DRAWN BY	ML
DESIGNED BY	SGR
APPROVED BY	RVC
SCALE	AS SHOWN
DATE	JUNE 2018
FILE No.	13351





SATELLITE IMAGERY FROM ESRI WORLD IMAGERY (DOWNLOADED 2016-12-21)



**PEACE REGION (PEACE RIVER/HIGH LEVEL)
CALLOUT: HWY 684:02, km 28.4**

**PH053-2: HWY 684:02, km 29.461
2018 CALLOUT PLAN**

DWG No. 13351-PH053-2 CALLOUT-2

DRAWN BY	ML
DESIGNED BY	SGR
APPROVED BY	RVC
SCALE	1:2500
DATE	JUNE 2018
FILE No.	13351

