

92H-4-13



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Project No. R706102

June 22, 1994

Rowan Industries Ltd.
19716 - 115 Avenue
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Attention: Mr. Dave Mussallem, P. Eng.

Subject: **Hydrogeology of the Ford Road/Nixon Hill Property near Ford Creek, Southeast of Chilliwack, B.C.**

Dear Sirs:

1.0 INTRODUCTION

This letter is further to discussions on June 1, 1994 in the field between Dave Mussallem, P. Eng., of Rowan Industries Ltd. (RIL) and Ed Livingston, P. Eng., of Pacific Hydrology Consultants Ltd. (PHCL) about the groundwater conditions on a property at 8658 Ford Road, west of Popkum, and what may be done to control water on several waterlogged areas of the property which is located on the northern part of Sec. 27, Tp. 29, East of Coast Meridian.

From the onsite discussions between Mussallem and Livingston, we understand:

1. Plans call for development of the subject parcel of land for residential subdivision.
2. At this time, only the western part of the property between Ford Road and the steep slope is being considered for development.
3. An environmental consultant, Mr. Jim Scott, has been engaged to advise on environmental issues.
4. You are considering culverting the dry creek over part of its length in the gently sloping area of the property.

The following documents have been used in the preparation of this letter report:

1. N.T.S. Map 92H/4 **Chilliwack**, of scale 1:50,000 with a 100 ft contour interval.
2. A contoured plan by Integrated Resources Photography Ltd., identified as Project No. 77-189, titled "Portion of Section 27 Chilliwack District", of scale 1" = 200' with 5 and 10 ft contours, probably prepared in 1977.
3. A portion of a map of scale 1:5,000 with two (2) metre contours.



MEMBER

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4. A letter-report dated June 10, 1991 by Klohn Leonoff to Rowan Industries Ltd. on the subject "Site Investigation at 8658 Ford Road District of Chilliwack" (KL File PB5680 0101).

2.0 TOPOGRAPHY AND SETTING

The subject Property is east of Ford Road which forms the western boundary, except in the northwest corner. Highway 1 passes through the northern edge leaving a small area of agricultural land between Highway 1 and Chilliwack Central Road. The main Fraser Valley high voltage transmission lines cut across the northwest corner of the Property limiting development in that area. Much of the subject Property consists of steep slopes of the north side of the Cascade Mountains - specifically, Mt. Thurston. This letter is concerned with the western part of the property where there is a gently northwesterly sloping area that seems to be associated with Ford Creek.

3.0 GEOLOGY

The steep slopes of the subject Property are likely to be underlain by bedrock under a thin covering of slopewash also called colluvium. The gently-sloping western part of the site which is being considered for development, appears at first glance to be the upper part of a large fan of Ford Creek which just touches the southwest corner of the subject Property. The outer part of the fan, which extends hundreds of metres north of Highway 1, has the uniform gentle slope of a typical fan. However, the upper part of the fan, southeast of the Highway 1 and on the subject Property, has rather irregular topography and may be part of a large landslide or perhaps a deposit of glacial debris. Ford Creek is actively cutting down

through these deposits and now flows westward down the extreme southwest edge of its fan. The fact that Ford Creek, and also a short intermittent creek which passes through the area being considered for development, are both actively eroding the "fan", indicates that the fan is a fossil feature which may have been deposited at the end of the last glacial event in the area about 10,000 years ago. Similar conditions are found at other creeks in the area.

About 150 metres west of Ford Road is an inactive borrow pit which was in use at the time of construction of Highway 1. This pit, which is partly overgrown, appears to have reached bedrock in one place but poor exposures show unsorted bouldery sediments that look more like landslide debris than fan deposits. If there is an old landslide in the area, it probably occurred about 10,000 years ago at the end of glaciation as did the well-known large slide at Popkum. We saw no evidence that there has been any instability since the slide, if, in fact, it is an old slide.

4.0 HYDROLOGY AND DRAINAGE

There is no perennial surface water flow on the subject area except for flow from a spring south of Allan Road. An intermittent stream which more or less bisects the area being considered for development, was dry at the time of Ed Livingston's site visit of June 1, and the general appearance of the stream bed shows that flow is never large. From occasional visits by Mr. Mussallem, following intense precipitation events, the creek carries flow only very intermittently and lasts only a few days. Inspection of the grass-covered creek bed along Hack Brown Road, which is parallel to Highway 1, confirms such intermittent flow. We can see no reason why the intermittent creek should not be directed through a culvert over part of its length as long as the culvert is properly sized.

It is evident that the creek catchment area, reported by Klohn Leonoff in their report (see Reference Document 4) to be about 45 ha., produces very little surface flow in an area where precipitation is fairly high; further, the flow after storm events even in winter is not high considering the large catchment area. This is evidence that:

1. Conditions for groundwater recharge are very good. This agrees with our observation of near-surface conditions where there is a loose gravelly soil which is probably very permeable.
2. The groundwater flow system is probably fairly long and deep. In other words, groundwater does not move through a short, shallow flow system discharging into the creek.

A spring, located on the adjoining lot to the south, a short distance south of Allan Road about 80 m from the mouth of the culvert of Ford Creek under Nixon Road, has a flow estimated about 2 l/sec (26 igpm), that comes from a very small area at the base of a poorly exposed rock outcrop. In spite of the fact that this spring is very close to Ford Creek, it does not join Ford Creek but, rather, flows through a culvert under Allan Road and then northward quite close to the foot of the steep slope before discharging into several water-logged areas on the northwesterly-sloping surface. From the waterlogged areas, the water disappears into the ground. Control of surface and groundwater in the waterlogged areas would be an essential part of residential development.

Our impression is that the waterlogged area on the proposed development area comes mostly from the spring mentioned previously. The amount of water required to maintain a waterlogged condition is not large and from our observations and past experience, it seems likely that the spring flow is sufficient to maintain this condition.

5.0 COURSE OF ACTION

Based on our analysis of the hydrology and drainage conditions of the subject Property, we recommend that the spring flow be diverted along the south side of Allan Road into Ford Creek. This can be done by means of a shallow ditch along the road or through a buried pipe; a ditch is preferred. Such works would enhance the flow of Ford Creek, especially in times of low flow and would certainly be beneficial to the Creek environment. The water from the spring, under existing conditions, is partly returned to the atmosphere by evapotranspiration; the remainder seeps into the ground to flow as groundwater into the Ford Creek fan and eventually into the main sedimentary fill of the Fraser Valley.

Since it is not possible to establish how effective the diversion of the spring would be in relieving the waterlogging on the subject Property, we suggest installing several small diameter water level observation wells in, or close to, the waterlogged areas. Such observation wells can be constructed of 50 mm (2") diameter PVC, slotted appropriately; they should be in place before diversion of the spring. Regular water level observations in such wells will show how effective the spring diversion is in relieving waterlogging. If diversion of the spring is not effective, or is only partly effective in lowering the water table in the problem area, standard drainage methods can be used.

7.0 RECOMMENDATIONS

Based on the foregoing discussion, the following is recommended as a basis for improving the waterlogging on the subject parcel of land near Fork Creek and for monitoring the effectiveness of the drainage improvements.

1. Divert the flow of the spring along the south side of Allan Road and into Ford Creek.
2. Before diverting the creek, install several small diameter water level observation wells in or near the waterlogged areas.
3. Take regular water level observations before and after to indicate the effectiveness of the spring diversion.

Rowan Industries Ltd.

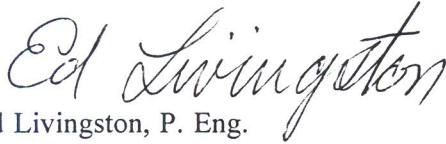
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We trust that this letter contains the information you require at this time. However, please do not hesitate to call for further discussion of any aspect of the contents of the letter or if you feel that further clarification of the issue is needed.

Yours truly,

PACIFIC HYDROLOGY CONSULTANTS LTD.

A handwritten signature in cursive script that reads "Ed Livingston". The signature is written in dark ink and is positioned above the printed name and title.

Ed Livingston, P. Eng.
Associate Consultant