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**ARIS Summary Report**

Regional Geologist, Prince George

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**ASSESSMENT REPORT: 27639**

Mining Division(s): Cariboo

Property Name: Dialite 906

Location:      **NAD 27**      **Latitude:** 52 58 11      **Longitude:** 122 32 30      **UTM:** 10      5868783      530781  
                  **NAD 83**      **Latitude:** 52 58 11      **Longitude:** 122 32 35      **UTM:** 10      5869000      530687  
**NTS:**            093B01W  
**BCGS:**         093B098

Camp:

Claim(s):            906A, 906E

Operator(s):        Dialite Industries Ltd.  
Author(s):            Fyles, Richard

Report Year:        2004

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Statement Nos.:    3220571

MINFILE Nos.:     093B 023

Related Reports:    00210, 26089

# **Title Page**

**Assessment Report Number 27639**

**Preliminary Geotechnical Assessment**

**Dailite 906 Property**

**Claims:** 906N, 906E, 906S, 906A and 906B

**Mining Division:** Cariboo Mining Division

**Latitude:** 52 °, 57 ', 37 "

**Longitude:** 122 °, 32 ', 14 "

**Owner of Claims:** W.E. (Bill) Poole

**Consultant:** Golder and Associates

**Author:** Mr. Greg Reid, P.Eng. P.Geo.

**Date Submitted:** May 4, 2005

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## Introduction

This geo-technical report is respectfully submitted for the 2004 work program for the 906 claims. The field work and related report was completed during July and August, 2004. The 906 claims are comprised of five contiguous 2 post claims. All claims are owned by Mr. W.E. (Bill) Poole of Quesnel. The claims are located in the Cariboo Mining District, NTS map sheet 93B 15E at Latitude- 52 °, 57 ‘, 37 “ and Longitude- 122 °, 32’, 14 “.

### **Location and Access**

The property is located near the west boundary of Quesnel and South of Baker Creek. They are accessed via Abbott Drive from West Quesnel. The area has access to the old MicroSil plant site via Abbott Drive from West Quesnel. See Figure 1 of technical report for the general location map.

### **Physiography, Vegetation and Climate**

The property is situated regionally within the Fraser Basin of the Interior Plateau physiographic area. The properties lie on an east facing slope straddling the top of the Fraser River and Baker Creek escarpments. Maximum relief is approximately 100 meters with an elevation range of 650 to 750 meters above sea level. Soils are generally a clayey veneer of glaciolacustrine origin a morainal material composed of varying degrees of sand, gravel and boulders. The claims are also located just west of the West Quesnel slide, which is an ongoing slide affecting many residences in West Quesnel. It is this proximity to an active slide that necessitated this geo-technical report.

The forest cover is comprised of a mixed stand of mature birch and aspen with scattered fir and spruce.

Climate is typical for the central interior with warm summers and moderately cold winters. Temperature extremes range from 30 °C summer and -30 °C in winter. Annual precipitation is approximately 40 centimetres.

## Claims

The claim records as noted in the recording office are listed as follows:

CLAIM	UNITS	TENURE NO.	EXPIRY DATE	TITLE
906N	1	353025	Oct. 31, 2005	W.E. (Bill) Poole
906S	1	353026	Oct. 31, 2005	W.E. (Bill) Poole
906E	1	360744	Oct. 31, 2005	W.E. (Bill) Poole
906B	1	367132	Oct. 31, 2005	W.E. (Bill) Poole
906A	1	367131	Oct. 31, 2005	W.E. (Bill) Poole

## **History and Previous Work**

Lot 906 is a past producer of diatomite, which was processed into granular domestic absorbent product. The two major past producers to which production was recorded are Dome Petroleum's Crownite operation 1968 – 1980 and MicroSil Industrial Minerals Ltd, 1981 – 1983.

Crownite and MicroSil's in-house research, directed by Mr. R.A. Fyles, P.Eng. (Mining) resulted in a technical success with all their objectives being met.

A new redesigned processing plant is proposed for the site of the older plant.

Proven and probable diatomaceous earth reserves are 1,300,000 tonnes.

## **Summary of Work**

The work that was conducted was a preliminary geotechnical study of regional slope stability hazards near the site of the 906 claims. It considered in particular the potential impact of resumption of diatomaceous earth extraction and production on slope stability in the vicinity of the site.

**Golder Associates Ltd.**

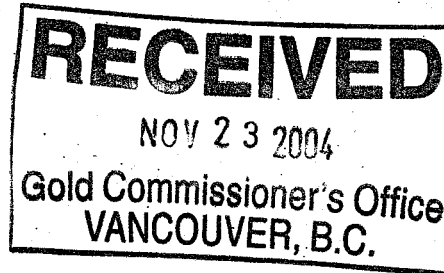
100 - 388 First Avenue  
Kamloops, British Columbia, Canada V2C 6W3  
Telephone 250-828-6116  
Fax 250-828-1215



August 25, 2004

04-1430-065

Dialite Industries Ltd.  
2490 Patterson Avenue  
P.O. Box 66  
Armstrong, BC  
V0E 1B0



Attention: Mr. Richard Fyles, P.Eng.

**RE: PRELIMINARY GEOTECHNICAL ASSESSMENT  
DIALITE 906 PROJECT  
QUESNEL, BC**

Dear Sirs:

As requested, Golder Associates Ltd. (Golder) has conducted a preliminary geotechnical study of regional slope stability hazards near the above-noted site, considering in particular the potential impact of resumption of diatomaceous earth extraction and production on slope stability in the vicinity of the site. The terms of reference for this project were provided in Golder's memorandum, "Geotechnical Study Dialite 906 Project, ref. P42-3072", dated June 24, 2004. Written authorization to proceed with the work was provided to Golder on June 25, 2004 by Mr. Richard Fyles., P.Eng. of Dialite Industries Ltd. (Dialite). This report provides the results of our assessment, including our comments and professional opinion regarding the anticipated impact of proposed development on terrain stability in the vicinity of the site.

Use of this report is subject to the Statement of General Conditions which is appended after the text of this report. The reader's attention is specifically drawn to these conditions, as it is essential that they be followed for the proper use and interpretation of this report.

**GEOLOGICAL SURVEY BRANCH  
ASSESSMENT REPORT**



27,639



## 1.0 BACKGROUND

The subject site contains a deposit of diatomaceous earth, also known as diatomite, an industrial mineral with absorbent properties. Diatomite consists of the skeletal remains of diatoms, aquatic micro organisms with siliceous skeletons, which in this case were deposited in a former lake which occupied the current Fraser River valley in the Quesnel area.

Dialite is considering reactivation of a former diatomite extraction and processing facility located within District Lot 906 and Mineral Claims 906N,S,E,A,B (Tenures 353025, 353026, 360744, 367131, and 367132, respectively), located on the west side of the Fraser River, adjoining the City of Quesnel (see Figure 1, Key Plan). We understand that the site has been subject to intermittent production of diatomaceous earth products, including from 1968-1980 (Crownite Mining, with processing off site), and from 1981 to 1983 by a successor company, Microsil Industrial Minerals). The previous mine operations at the site included an extraction site and processing facility, reached via an access road off of Abbott Road in the Abbott Heights region of Quesnel. The extraction site consisted of a relatively small "open cut" excavation on the ground surface, with a plant site nearby and down slope to the east of the extraction site. None of the original buildings at the plant site remain, but we understand that the concrete building foundations and floor slabs remain in place. We understand that Dialite's proposed development includes re-establishment of a processing/packaging facility at the former processing site, and re-activation of the open cut excavation.

## 2.0 INTRODUCTION

### 2.1 Terms of Reference

The purpose of this study is to consider geotechnical aspects of the potential impact of re-establishment of diatomite extraction and production at the site. Technical assessment is limited to consideration of the potential impact of proposed development on terrain stability and natural geo-hazards in the vicinity of the site: assessment of other aspects of the proposed development such as socio-economic factors, environmental impact etc. are outside our terms of reference and are not addressed as part of this report.

## 2.2 Study Methodology

The methodology followed for this study consists of the following main elements:

- review of available site information including maps, airphotos, past production information, and reports by others on areas of terrain instability in the vicinity of the site;
- completion of a field visit to observe the current condition of the site and surrounding terrain;
- analysis and assessment of relevant site information; and
- summary of the assessment results in report form.

## 2.3 Reference Information

The following sources of information were available to Golder and reviewed as part of our assessment:

- Topographic map 93B/15, orthophoto of the Baker Creek/Quesnel area (93B098.tif), Map of Mineral Tenures 353025, 353026, 360744, 367132, 367131 file dynamite.dgn rev. Jun 2004;
- Airphotos BC5070 No. 168-9 (1963) BC5709 No. 241-241(1976) A24743 No. 74-75, 30BCC967 No. 213-215 (1989), 30BCC97136 No. 72-74 (1997);
- BC Ministry of Energy and Mines MINFILE Production Report (Number 093B 023), and Capsule Geology and Bibliography 093B 023 <http://www.em.gov.bc.ca/cf/minfile/search/>;
- reports by others including:

Evans, S.G., Crook, R.L., 1973. *The Landslide Problem in the Quesnel Area: Its Implications for Sub-Division Approval*. Geotechnical and Materials Branch, BC Department of Highways.



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Golder, 1997. *Geotechnical Assessment of Probable Cause Gas leak at Anderson Road Near Abbott, Quesnel, BC.* Golder Associates Ltd., Kamloops, BC.

Hardy, 1980. *Geotechnical Investigation for Proposed Diatomaceous Earth Plant, Quesnel, B.C.* Hardy Associates Ltd. U 2442, Prince George, BC.

Morgenstern, N.R., Cruden, D.M., 1999. *Review of Evidence for Large Ancient Landslides in West Quesnel.*

Poole, W. 1999. *Prospectors Report on the 906 Claims Quesnel Area Cariboo Mining Division BC.* Quesnel BC.

Rouse, G.E. Matthews, W.H. 1979. Tertiary geology and palynology of the Quesnel area, BC. *Bulletin of Canadian Petroleum Geology*, Vol. 27, pp 418-445.

AGRA, 1994. *City of Quesnel Slope Stability Study, Quesnel BC.* AGRA Earth and Environmental Ltd. KX01651, Prince George, BC.

AMEC, 2001. *Stability Assessment, Ruric Springs Area, West Fraser Road, Quesnel BC.* AMEC Earth and Environmental KX03981, Prince George, BC.

AMEC, 2002. *West Quesnel Land Stability Study, Quesnel BC.* AMEC Earth and Environmental KX03904, Prince George, BC.

## 2.4 SITE DESCRIPTION

As indicated above, the study area includes the diatomaceous earth deposit and open cut extraction area, and former/proposed processing facility, both located in the northeast corner of District Lot 906. The diatomite deposit extends north, south, and west from DL 906, with resource access to undeveloped portions secured by the adjoining mineral tenures. Figure 2 attached shows a plan of the study area and vicinity, using recent (1997) airphoto imagery as a base. The study area is located approximately 2 km west of the Fraser River, and at an elevation about 200 m above the Fraser River at Quesnel (nominal elevation 485 m ASL).

The study area is located within the Fraser Basin of the Interior Plateau physiographic region. It occupies part of an upland plateau formed between Baker Creek to the

northwest, and the Fraser River valley to the east. The study area includes part of the upland plateau, and sidewall slopes along the crest and upper west side of the Fraser River valley. The topography within the study area is variable, and includes low undulating terrain on the plateau west of the deposit area; "benched" topography within the exposed/developed parts of the diatomaceous earth deposit at the valley crest; and gentle to moderately sloping terrain in the rest of the study area; i.e., within the upper valley sidewall slopes of this part of the Fraser River valley.

The former plant/processing site is located at an approximate elevation of 640 m ASL, in a cleared area south of the west end of Abbott Drive. The diatomaceous earth deposit is located about 350 m west of the plant site, with the base of the deposit approximately 60 m in elevation above the plant site.

The deposit is reported (R. Fyles, W. Poole, personal communication) to have been exposed in subcrop form, basically "daylighting" at or near the crest of the original valley side along the plateau margin. It is reported (Poole, 1999) to be on the order of 20 m in thickness, with a conformable cap of basalt lava. The basalt varies in thickness from 1 to 5 m and has been largely removed from the former mine area, but is visible particularly along the north end of the upper bench. Overburden above the lava is reported to include a veneer of glaciolacustrine silts and sandy gravels, and a thicker blanket of silty sand and gravel till.

The basalt cap and underlying diatomaceous earth deposit represent the uppermost (youngest) horizons of a sequence of Tertiary age volcanic and sedimentary deposits. Older units within the Tertiary sequence underlying the diatomite are reported to include the Fraser Bend Formation (coarse to fine-grained clastic sediments and minor lignite), Australian Creek Formation (lignite, claystone, siltstone, sandstone and conglomerate), and Kamloops Group equivalent lava, pyroclastics and breccias. The Tertiary age deposits are underlain at depth by Triassic age Cache Creek Group siliceous sediments, phyllites and granitic intrusives (Rouse and Matthews, 1979).

A previous geotechnical investigation conducted at the former processing site (Hardy, 1980) included completion of six mud rotary boreholes to an average depth of 6 m below surface. While a variety of soil materials were encountered near surface including organic silts, silty clays, silty diatomaceous earth, and gravelly fills, the site was described as being underlain by stiff to hard silty till deposits, encountered in all of the boreholes at depths from 1 to 3.5 m below ground surface.

### 3.0 REGIONAL TERRAIN INSTABILITY

#### 3.1 Previously Identified Features

Several areas of terrain instability in the vicinity of the study area have been identified and described in a number of technical reports and studies in recent years. This section of the report provides a brief description of such terrain features in the region adjoining the study area. The approximate locations of these features are also illustrated on Figure 2, attached. From south to north, previously identified landslide features include:

*Subdivision Slides* (identified in Evans and Crook, 1973): consist of a series of five smaller "scallop" along the plateau crest, including semicircular backscarps, adjoining steep slopes and short portions of downslope gullies or draws, approximately 1.5 km southeast of the study area. These slides are considered to be sloughing/slumping of steeper slopes along an elevated terrace crest.

*Ruric Springs Slide* (AMEC, 2001): consists of a slumping scarp and adjoining debris apron along part of the west bank of the Fraser River, approximately 400 m wide by 550 m long, located about 1.8 km SE of the study area. The lower part of this feature was previously identified by Evans and Crook, 1973 as the West Quesnel Slide. The area of instability area was considered by AMEC to be somewhat larger than previously identified in 1973; i.e., extending further upslope to the west and including several of the smaller "subdivision slides" identified above. Instability may be relatively deep seated, with the slide toe area subject to ongoing erosion from the Fraser River. Parts of this feature may still be active; i.e., subject to occasional displacement at the present time.

*Plateau Slide* (Evans and Crook, 1973): consists of a flow slide from a larger gully headwall and plateau margin, down onto a low terrace above the Fraser River. The debris apron widens downslope to a maximum of about 800 m, with a maximum runout distance of about 1300 m. The relative degree of activity of this feature is unknown.

*West Quesnel Landslide* (Golder, 1997, AMEC, 2002): consists of a large, deep-seated zone of instability, located north-east of the study area. The apparent zone of instability covers approximately 2.25 km<sup>2</sup>, and is known to have been subject to ongoing, gradual movement since monitoring commenced in 1998.

*Baker Creek Landslides* (Evans and Crook, 1973, Golder, 1997, AMEC 2002): a number of areas of instability have been identified along the steep sidewall slopes of the Baker Creek valley. The slides range in size from smaller active cutbank sloughs

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affecting localized parts of the banks above the stream channel, to larger scale, apparently more deep-seated rotational slide zones.

### 3.2 Other Terrain Features

As part of our research for this project, a review of the available stereo airphotos was undertaken to determine whether any other indications of possible terrain instability may be evident in the study area or immediate vicinity. The most useful photos for this purpose turned out to be the 1976 series (BC5709 No 241-3), a high contrast set of black and white photos, which were taken from a lower elevation than earlier photos, and apparently relatively shortly after much of the study area had been selectively logged to remove mature tree cover, both of which factors combine to allow the clearest representation of ground surface features and landforms of all of the photos available. Consequently the comments following are based largely on interpretation of the 1976 airphotos.

In the vicinity of the study area, the west flank of the Fraser River valley is comprised of three main plateaus or terraces of lower slope and relief, separated by steeper intermediate slopes. The upper plateau forms the height of land between the Fraser valley and Baker Creek to the northwest. The mine site is developed along a portion of the eastern margin of the upper plateau. The former plant/processing site portion of the study area lies on a northern extension of the intermediate level terrace. The lowest terrace is an alluvial feature likely representing a former elevated meander channel of the Fraser River. North of the study area, the West Quesnel slide feature truncates the intermediate level terrace, with the slide scarp forming the crest of the upper terrace, and the slide toe impinging on the lower alluvial terrace. South of the study area, the intermediate terrace is bisected by the headscarp of the Plateau slide.

Review and interpretation of the 1976 photos suggests that an additional larger scale landslide feature may be present on the south side of the study area, south of the mine site. This feature includes a steep, arcuate scarp exposing basalt lava along a subvertical bluff along part of the upper plateau margin, with a region of ridged topography along its base, well above the intermediate level terrace. This feature is interpreted to represent the back scarp of an ancient, large scale landslide feature (identified as "exposed escarpment" in Figure 3).

The Plateau Slide has apparently developed downslope from this larger slide feature, and may represent subsequent reactivation of a portion of the original slide mass. As evident on the 1976 photos, the headscarp of the Plateau slide feature may be somewhat larger

than originally postulated by Evans and Crooks, to include terrain downslope from the middle of the east margin of the ridged terrain area, and above the original slide crest.

Figure 3, attached, shows the terrain and major landform features described above, illustrated on one of the 1976 airphotos (BC 5709 No. 242).

### 3.3 BC Ministry of Mines Records

As part of the research for this assessment, a review of available information from the BC Ministry of Mines was requested regarding whether Ministry staff (Mine Inspectors) may have noted any concerns about terrain instability during the course of inspections made during previous operation of mining at the site. As noted above, diatomite mining occurred on the site from 1968-1980 and 1981-83. Correspondence received from the Ministry (see Appendix I) indicates that their files do not contain any geotechnical reports regarding terrain instability noted by Ministry staff during the operation of previous mines at the site.

### 4.0 SITE RECONNAISSANCE

A reconnaissance of the site was carried out by Mr. Greg Reid, P.Eng., P.Geo. of Golder's Kamloops office on July 13, 2003. Mr. Reid was accompanied by Mr. Richard Fyles, P.Eng. of Dialite, and Mr. Tony Bensted and Mr. Bill Poole who own the property. The reconnaissance consisted of a foot traverse within the study area, including the former processing site, mine access road, mine site, adjoining plateau crest, and the terrain south of the mine, above the Plateau Slide head scarp. Key observations are summarized below.

- Abundant surface vegetation is present across much of the study area. Forested areas consist of mixed deciduous/coniferous cover with thick undergrowth in previously logged areas (i.e., between the processing site and minesite, and on the plateau surface west of the mine site). Selective logging was recently carried out within mature forest cover south of the mine site, with part of the former overburden stockpile area cleared for use as a landing. Surface reclamation was carried out over much of the processing site, with most building foundations buried by a cover of local borrow, and a thick cover of grasses and shrubs. No indications of recent or active terrain instability were observed in the general vicinity of the former processing area.

- Former roadways associated with previous mine work in the study area remain largely in place. The road surfaces are heavily rutted from ATV and other unauthorized traffic, and locally subject to erosion and deposition from surface runoff. A gate at the property boundary has been destroyed, and several piles of refuse, including burned car bodies have been left in the study area, mainly in the vicinity of the processing site.
- No indications of terrain instability, other than surface erosion described above, were observed during reconnaissance of existing roadways in the study area.
- Several ATV "trails" have been established within the mine site, traversing all of the benches perpendicular to the slope. Other than some small areas of very minor surface erosion, and localized disturbance along the ATV trails, exposed slopes of diatomite within the mine area appear to be stable.
- Along the crest of the mine area, particularly at the north end of the site, remnant exposures of the basalt lava cap above the diatomite deposit are present on parts of the uppermost bench face.
- Overburden above the deposit has been excavated above the uppermost bench, forming a cutbank on the order of 5 m in height. The overburden appears to consist of loose to compact silty till with trace to some clay, sand, cobbles, and boulders. The overburden slopes have been naturally re-vegetated with a cover of grasses, trees, and shrubs, and appear to be stable.
- A traverse was conducted along a trail along the plateau, immediately west of the mine site (i.e., just upslope from the crest of previous mine work and site disturbance). No indications of terrain instability or ground distress were observed in this part of the study area.
- Ground reconnaissance in the study area included a walk-over of the southern part of the study area. Visual observations confirm the presence of a steep bluff exposing basalt bedrock forming part of the upper plateau margin south of the mine site. The terrain below this feature consists of several parallel steep-sided ridges and draws, oriented roughly north-south. Exposed materials along the ridges include zones of basalt rubble, tills, colluvium and localized altered diatomite. The mature forest cover in this part of the study area remaining after recent selective harvest does not appear to include trees

showing evidence of distress due to terrain instability. Other than rockfall off parts of the exposed basalt bluff, no indications of recent terrain instability were observed in this part of the study area.

Selected site photos with captions, which illustrate aspects of the study area described above are provided on Figure 4.

## 5.0 PROPOSED MINE REACTIVATION

We understand that the proposal for reactivation of the mine includes re-establishment of a processing facility in the former processing area of the site, rehabilitation of site services and infrastructure, and re-opening of the mine. Further, we understand that mine operation will generally follow the mining sequence and methodology established during previous operations on the site. The mining methodology involves diatomite production in winter months using a loader and dump truck(s) to establish a production stockpile adjoining the processing facility. The mine will continue to be developed using a sequence of 15 ft benches, with stockpile volumes sufficient to support a 40 tonne per day processing operation. Winter mining only provides considerable advantage in the extraction and handling of raw diatomite, allows accumulation of a relatively "clean" stockpile, and greatly reduces road maintenance requirements along the mine access road.

Processing of diatomite products will be conducted year round. We understand that only limited new construction may be required to re-establish the processing facility, as the new facility will be smaller in area compared to what was originally on site. The plant has been designed using a modular concept, to use existing concrete floor slabs for support of any new buildings required. Services to be re-established at the site include reconnection of a natural gas supply, electrical and telephone lines, refurbishment of a well previously drilled on site for water supply, rehabilitation of existing roads and surface water management system (ditches, culverts etc.), and re-establishment of access control (fence and gate) to the site at the upper end of Abbott Road.

Based on Dialite's current understanding of the diatomite reserves at the site, we understand that reserves are sufficient for an approximately 80 year mine life, assuming average daily processing of 40 tonnes of diatomite. As mining progresses, additional overburden stripping will be required to expose more of the diatomite deposit. With regards to diatomite processing, we understand that the procedures used are quite efficient, with recovery rates in excess of 99% anticipated; i.e., such that very little if any "waste" material or by-product requiring on-site stockpiling or disposal will be generated.

## 6.0 GEOTECHNICAL ASSESSMENT AND OPINION

This section of the report provides discussion and commentary representing Golder's opinion as to the potential impact of proposed resumption of diatomite mining and processing at the site on terrain stability and natural geo-hazards in the vicinity of the study area. The commentary below is based on Golder's current understanding of terrain conditions within and in the general vicinity of the study area, as described in preceding sections of this report.

### 6.1 Terrain Instability

From the previous geotechnical work that Golder and others have done in the vicinity of the study area, it is clear that parts of the west side of the Fraser River valley south of Baker Creek have been subject to terrain instability. The terrain instability varies in size from smaller localized features to larger deep-seated features, and varies in relative activity from ancient and relict to apparently quiescent to currently active. The closest regions of terrain instability to the study area include the West Quesnel Slide (which adjoins the study area to the north and is apparently currently active, and the large ancient slide feature east of the exposed escarpment (see Figure 3) and the Plateau Slide south of the mine site (both of which are not known to be active at the present time).

Golder has not discovered or observed any indications that the former mine area or processing site fall within any areas of known terrain instability. Similarly, we have observed no terrain manifestations of active terrain instability on areas of exposed ground surface within the study area.

The stratigraphy represented by the basalt and diatomite deposit present in the mine area is another indication that the mine site in particular may not have been subject to spacial displacement or disturbance, resulting from landslide activity. The basalt layer, and underlying diatomite represent the two uppermost layers in the sequence of bedrock units considered to be present in the Quesnel region; i.e., part of an undisturbed sequence of sediment deposition and rock formation. It is unlikely that this stratigraphy would have been preserved at this location along the eastern edge of the upper plateau, if this area had been subject to movement similar to that of the adjoining West Quesnel Slide.

Consequently, Golder can find no evidence at this time that the mine site is subject to active (or previous) terrain instability. Airphoto interpretation and our site observations suggest that part of the study area, south of the mine may fall within the headscarp area of



an ancient landslide feature located upslope from the Plateau Slide. There were no terrain indications observed which suggest that this feature is active at the present time.

## 6.2 Impact of Diatomite Mining

The diatomite deposit lies at the crest of part of the western side of the Fraser River valley. Previous mine development has included establishment of an access road; logging and overburden stripping (and stockpiling at a location south of the mine site); and production from the deposit including development of four, 3 m (15 ft) high benches within the diatomite deposit. Reactivation of the mine is anticipated to have three principal impacts on terrain in the study area, which in turn may influence terrain stability: removal of the diatomite, stockpiling of overburden, and alteration of the normal pattern of precipitation infiltration and runoff within the study area.

**Diatomite Removal:** with regards to diatomite extraction and continued development of the mine area; i.e., expansion of the mine over time, the gross physical effect on the underlying area and immediate area downslope is anticipated to be benign to positive, in terms of potential impact to slope stability. In general terms, for any particular slope, removal of material from the crest area of the slope will have two impacts on the slope: the net overall gradient of the slope will be reduced, and the mass of material in the crest area will be reduced. With regards to stability of the overall slope, both effects have a net positive impact, as both serve to reduce the "driving" forces which may contribute to a zone of terrain instability. The only scenario in which this may not occur, is if slope stability is compromised within the removal area, by oversteepening the local slope in the area of material removal. When this occurs, stability of the overall slope is not a concern, but localized instability of the mined slope could be of concern.

The overall slope between the upper plateau to the west, and the Fraser River to the east of the study area is approximately 200 m in height. Development of the mine will result in local overburden removal of 5 to 10 m of till and basalt, and removal of an additional 15 to 20 vertical metres of diatomite. Mine development of this scale, at this location at the crest of the slope is anticipated to have a benign to positive impact on overall slope stability. Further, local stability within the mine area is not anticipated to be a concern if the mine is developed at a similar configuration (i.e., a series of low benches) to previous development at the site.

**Overburden Stockpiling:** development of an overburden stockpile at a mine may become a concern for slope stability, depending on the location and size of the stockpile, and the nature of the slope on which it is placed. For reasons complementary to those

described above, placement and accumulation of a stockpile can result in a negative influence on stability of an adjoining slope, depending on the proximity of the slope, its relative sensitivity, the size and accumulation rate of the stockpile. Development of a stockpile at the crest of a slope adds to "driving" forces acting on a slope by increasing the mass of material loading the slope.

A small overburden stockpile has been developed at the site during previous operations, to the south of the diatomite deposit. The stockpile area lies within the debris zone below the backscarp of the ancient landslide feature described in Section 3.2 above, about 400 m west of the crest of the intermediate terrace. It covers an area approximately 200 m long by up to 50 m wide, with overburden reported to be 1-2 m in depth. No slope stability concerns have been reported or observed at the site relating to placement of this stockpile. To date, development of a detailed mine plan has not included forecasts for future overburden generation and stockpiling requirements. Dialite considers that, at anticipated start-up production rates, current exposed diatomite reserves are sufficient for at least four years of production.

It is anticipated that additional overburden may be generated subsequently as mining progresses. The ultimate volume of overburden which may be generated over the life of the mine is not known in detail at this time; however, the relative volume is considerably less than that of the diatomite to be removed. It may be, depending on the rate of diatomite extraction and overburden removal requirements, that future overburden volume could be stockpiled in "worked out" portion(s) of the diatomite deposit. If this were the case then there would be no additional loading placed on terrain on other parts of the study area, or adjoining slopes.

Considering the above, Golder is of the opinion that development of the existing overburden stockpile does not appear to have had a significant impact of the stability of adjoining slopes to the east. By the end of the mine life, it is possible that accumulation of an overburden stockpile at a particular location in the study area could have an impact on slope stability, but only if such loads were concentrated in a small area close to an existing slope crest. Re-deposition of overburden in the mine area; i.e., partially replacing previously removed diatomite is not anticipated to have a significant impact on overall slope stability. Once in operation, a long term mine plan should be developed, to include projections of overburden volume and stockpile requirements.

**Precipitation and Runoff:** Precipitation and runoff can have an impact on slope stability in two ways: on terrain surfaces, particularly steeper slopes, erosion and slope attrition can occur, and infiltration (groundwater recharge) on flatter ground can result in

higher groundwater pressures which in turn can help to destabilize slopes. Development such as a surface mine can have an impact on both runoff and infiltration patterns, depending on the size of the mine and the extent to which natural runoff patterns are altered by mine development.

In this case, the mine site occupies a comparatively small area (350 m long by 200 m wide), with the former processing area occupying less than half that. There are no named or unnamed water bodies, creek, or swamps in the study area. Previous development at the site did not involve diversion of any watercourses, though ditches were constructed to control and direct surface runoff along the mine access road, and away from the former processing site and adjoining diatomite stockpile area. Reactivation of the mine would require re-establishment of appropriate surface water measures to control and direct runoff in the study area.

With regards to infiltration, re-activation of the mine is not expected to have a significant impact on the rate of infiltration. The overburden cover (till and basalt lava) is typically of low permeability. Diatomite has a higher permeability, and by its nature a high absorption capacity where exposed to surface, but also contains a component of clay size clasts. The deposit is characterized as dry, with no indications of seepage or springs. Considering the size of the mine area in relation to the overall slope region between the upper plateau and the Fraser River, and assuming good surface water management practices are followed, exposure of the diatomite deposit during mining is not anticipated to have a significant impact on relative groundwater recharge, or groundwater pressures at depth.

### 6.3 Summary

Based on the discussion above, it is Golder's professional opinion that re-activation of diatomite mining from the Crownite deposit at the study area, is unlikely to have a significant impact on the stability of terrain east of and downslope from the study area; as

- Though there are areas of known terrain instability in the vicinity of the study area, the mine site is not located directly upslope from such areas;
- The mineral deposit is located at the crest of a portion of the west wall of the Fraser valley at Quesnel, with a sequence of deposition apparently unaffected by past or present large-scale landslide activity;

- No concerns with regards to terrain instability at or downslope from the study area were noted by mine inspectors during previous years of operation; and
- Mine re-activation will result in net unloading of the slope crest above this part of the valley sidewall.

Therefore, Golder considers that if the mine plan described by Dialite is implemented, reactivation of diatomite mining and processing at the study area is feasible from a geotechnical perspective, as mine development and operation is not anticipated to have a significant impact on slope stability in the vicinity of the study area.

## 7.0 RECOMMENDATIONS

This study has considered the potential impact of mine re-activation on overall slope stability. Successful reactivation of the mine will depend on implementation of a detailed mine development plan, consistent with the requirements of all regulatory agencies and executed in accordance with good engineering and construction practices. Some aspects of the mine development plan will need to be considered in greater detail, or in the longer term, to facilitate development of the mine such that the impact of operations on adjoining slope stability will continue to be minimal throughout the life of the mine. Recommendations for further consideration include:

1. Conduct appropriate civil engineering/hydrological design studies to integrate mine site surface water management with natural runoff patterns and surface water drainage provisions in downslope areas administered by the City of Quesnel and Cariboo Regional District; and
2. Consider long term mine planning for overburden stockpile requirements including geotechnical review, and integrate these into the detailed mine plan to the satisfaction of the regulatory authorities.

## 8.0 CLOSURE

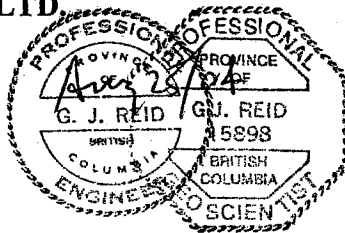
We trust this report provides the information you require at the present time. Please contact the undersigned if you have any questions or require further information or assistance.

Yours truly,

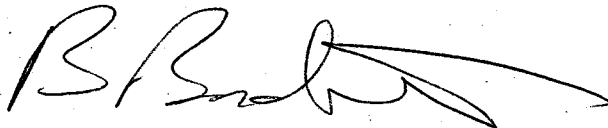
**GOLDER ASSOCIATES LTD.**



Greg Reid, P.Eng., P.Geo.  
Senior Geological Engineer



Reviewed by:



Bruce Bosdet, M.A.Sc., P.Eng.  
Principal/Senior Geotechnical Engineer

GR/BB/lp

Attachments	Statement of General Conditions
	Figure 1 Key Plan
	Figure 2 Site Plan and Terrain Features
	Figure 3 Terrain Features
	Figure 4 Selected Site Photographs
	Appendix I Correspondence

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## STATEMENT OF GENERAL CONDITIONS

**1.0 STANDARD OF CARE:** This report has been prepared in accordance with generally accepted geotechnical engineering practices in this area. No other warranty, expressed or implied, is made.

**2.0 BASIS OF THE REPORT:** This report has been prepared for the specific site, design objective, development and purpose that was described to Golder Associates Ltd. (Golder) by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in this report are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Golder, unless Golder is requested by the Client to review and revise the report in light of such alteration or variation.

**3.0 USE OF THE REPORT:** The information and opinions expressed in this report are for the sole benefit of the Client. *No other party may use or rely upon this report or any portion thereof without GOLDER'S express written consent. GOLDER will consent to any reasonable request by the CLIENT to approve the use of this report by other parties as approved users.* The contents of this report remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, and only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof, or any copy of the report or portion thereof, to any other party without the express written permission of Golder.

**4.0 COMPLETE REPORT:** The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report.

*In order to properly understand the suggestions, recommendations, and opinions expressed in this report, reference must be made to the whole of the report. GOLDER cannot be responsible for the use by any party of portions of the report without reference to the whole report.*

**5.0 NATURE AND EXACTNESS OF SOIL DESCRIPTION:** Classification and identification of soils, rocks, and geologic units have been based upon commonly accepted methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from these systems have been used they are specifically mentioned. Classification and identification of the type and condition of soils, rocks, geologic units are judgmental in nature. Accordingly, Golder cannot warranty or guarantee the exactness of the descriptions of insitu ground conditions set forth in the Report.

**6.0 INFLUENCE OF CONSTRUCTION ACTIVITY:** Construction activities can alter and damage insitu ground conditions. The influence of all anticipated construction activities on the geologic environment should be considered in formulating and implementing the final design and construction techniques.

**7.0 INTERPRETATION OF THIS REPORT:** This report contains information which is valid as of this date. However, conditions that are beyond our control or that may occur with the passage of time may invalidate, either partially or wholly, the conclusions and recommendations presented herein. Any person using this report for bidding or construction purposes should perform such independent investigations as he/she deems necessary to satisfy him/herself as to the subsurface conditions to be encountered and procedures to be used in the performance of work on this project.

Wherever changes in the site occur after the preparation of the report or conditions are observed which indicate results clearly incompatible with the information on which this report is based, the client and or any other users of this report should notify Golder as soon as possible so that Golder will be able to provide necessary revisions to its report prior to commencement of or alteration in design and construction.

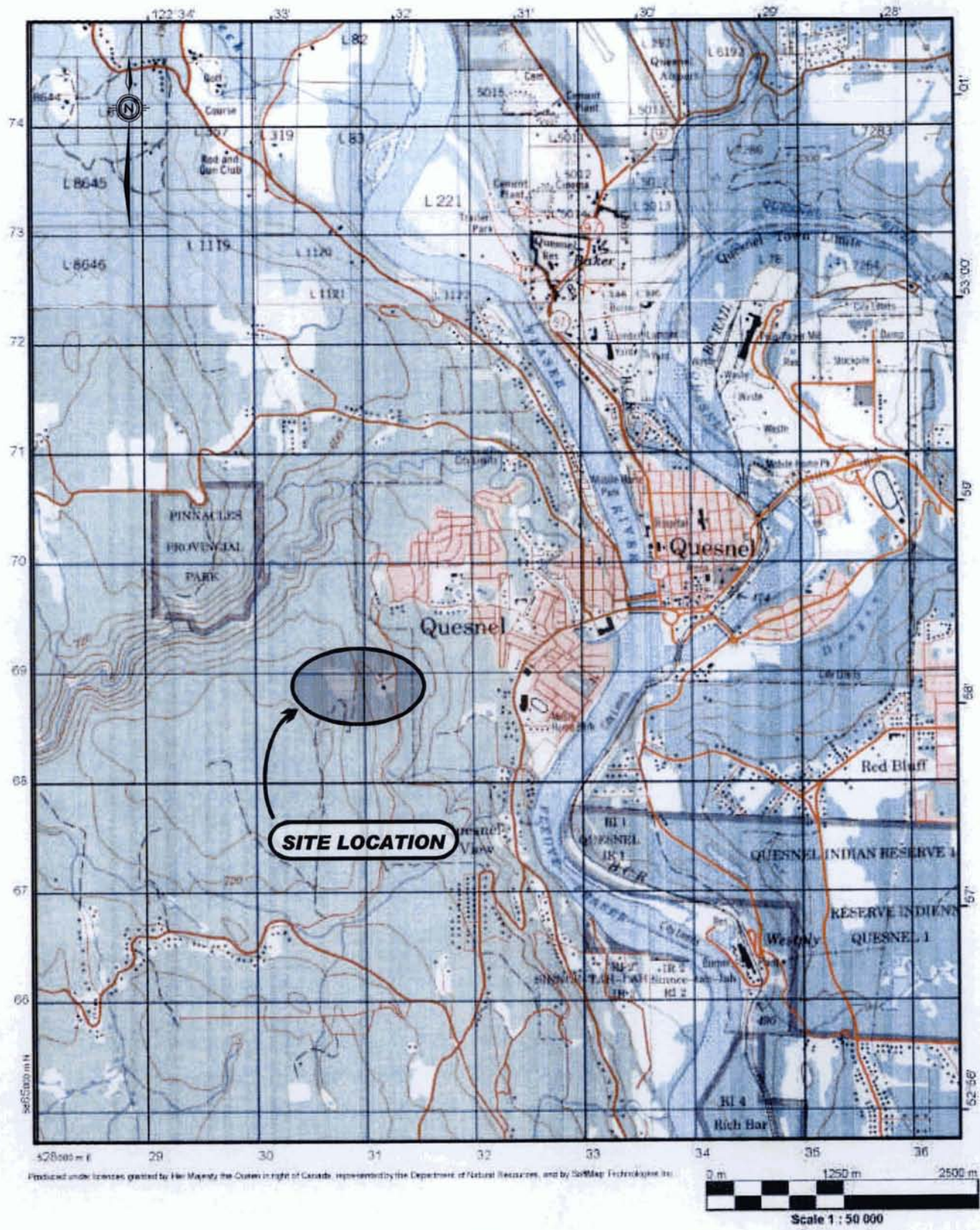
**8.0 CONSTRUCTION SERVICES:** Post investigation services are an important and necessary continuation of this evaluation.

Final project plans and specifications should be reviewed by the geotechnical consultant prior to construction, to confirm that the full intent of the recommendations presented herein have been applied to the designs. Following review of plans and specifications, sufficient and timely observations of encountered conditions during construction should be performed to correlate the findings of this investigation with the actual subsurface conditions exposed during construction.

Observation and testing should be performed under the direction of the geotechnical consultant during construction (1) to confirm that the slopes recommended are suitable for the altered site conditions; (2) to observe and approve the stability of drainage measures; and (3) to observe fill placement and see that competent materials are properly placed and compacted.



PROJECT NO. 04-1430-065 DATE: Jul-08-04 FILE LOCATION: n:\active\2004\1430\_Kamboops\Figures\Cores\Draw\Figure01.cdr



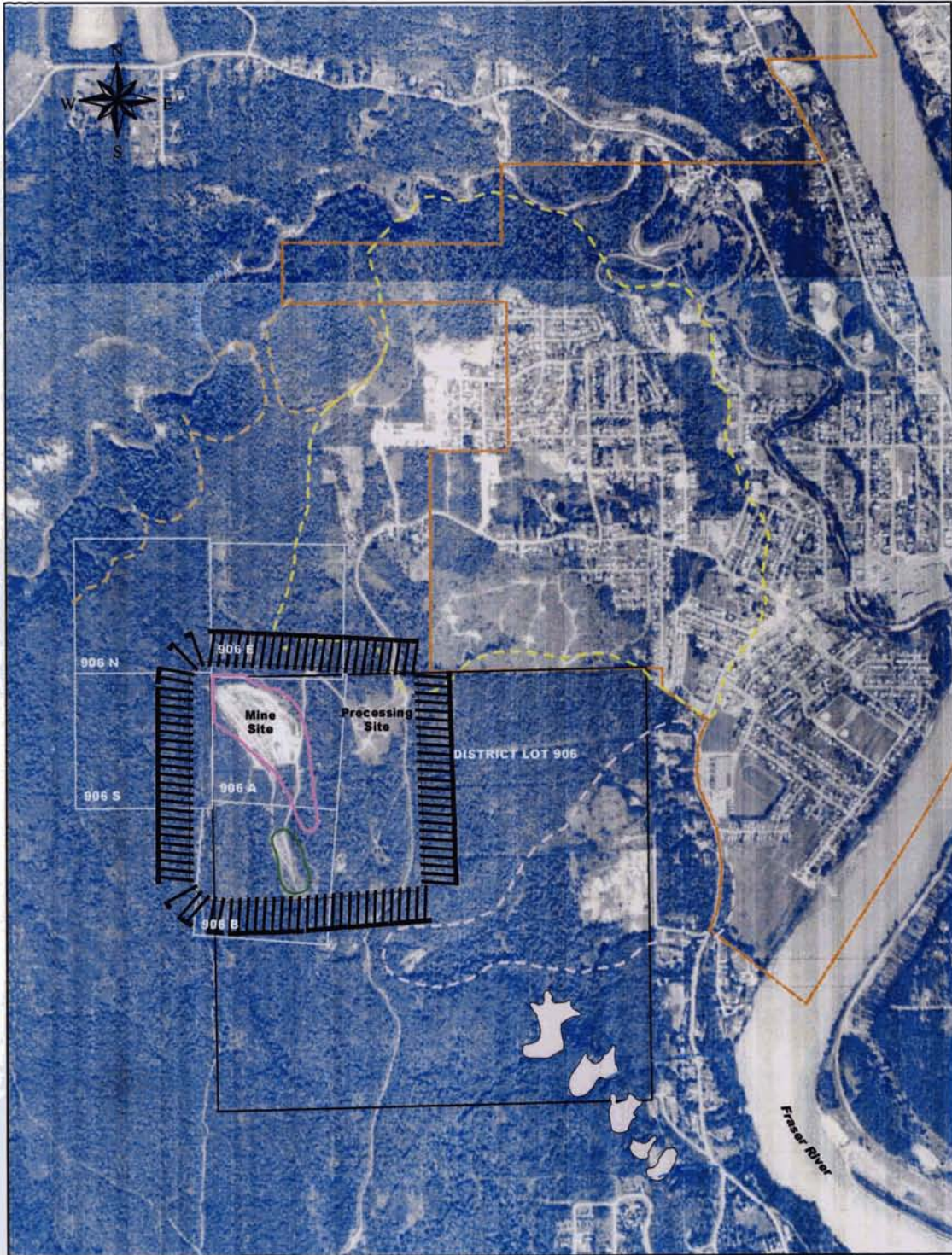
**KEY PLAN**  
**Quesnel, BC**

Drawn: MJM	App'd:	Date: Jul-23-04	Figure: <b>1</b>
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Project No.: 04-1430-065

Revision No.:



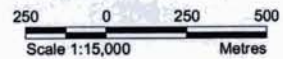


**LEGEND**

- Mineral Claims
- Plateau Slide (Evans & Crook)
- Ruric Springs Slide (AMEC)
- Baker Creek Slides
- West Quesnel Slide (AMEC)
- Overburden Stockpile Area
- Diatomite Deposit
- City of Quesnel Municipal Boundary
- Study Area
- Subdivision Slides

**REFERENCE**

Air Photo: 30BCC97136 No: 144, 73  
 Protection, 1997. Datum: NAD 83 Projection: UTM Zone 10

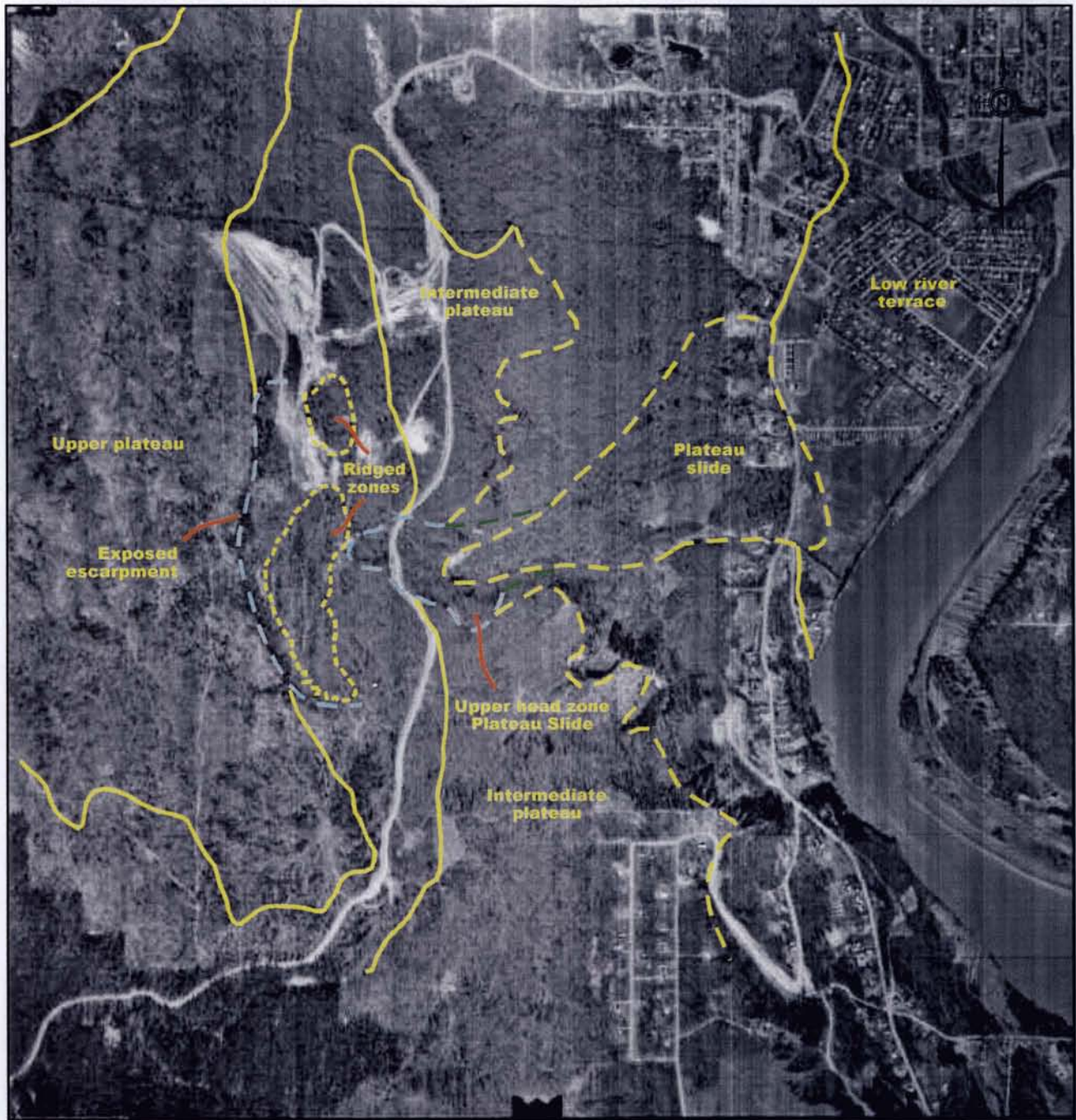



PROJECT		Diatomite Mine - Quesnel	
TITLE		SITE PLAN AND TERRAIN FEATURES	
PROJECT No. 04-1430-006	SCALE AS SHOWN	REV. 0	
DESIGN BY 12.24.2004			
GIS 19.24.2004			
CHECK			
REVIEW			
<b>Golder Associates</b> Kempton, British Columbia		<b>FIGURE 2</b>	

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PROJECT NO. 04-1430-065 DATE: Jul-19-04 FILE LOCATION: N:\active\2004\1430\_Kamlicopa\04-1430-065\Figures\Core\Draw\Figure03.cdr



	Diatomite Mine - Quesnel		
	TERRAIN FEATURES		
Drawn: MJM	App'd:	Date: Jul-20-04	Figure: <b>3</b>

Reference: Air Photo Bc5709 Number 242

Project No.: 04-1430-065

Revision No.:

**Selected Site Photographs**

**Figure 4**



**View of former processing area, looking northerly.  
Note burned car bodies/debris pile in centre of photo.**



**View looking southerly of uppermost bench  
and till overburden, SW corner of mine area.**



**View of mine area, looking north-westerly  
from the start of the access road. The diatomite  
deposit was mined in 15 ft. high benches or lifts  
(lowermost two benches in centre of photo.)**



**View looking northerly along uppermost  
bench at mine site. Thin (4 m) till overburden  
is present on the cutbank, far left of photo.**



**View of basalt cap and altered diatomite on  
the crest of the uppermost bench, NW corner  
of mine site.**



## **Greg Reid**

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**Education:** B.Sc. (Honours), Geological Engineering (Geotechnical Option), Queen's University, Kingston, Ontario, 1983.

**Affiliations:** Registered Professional Engineer and Professional Geoscientist in British Columbia Member, Canadian Geotechnical Society and Interior Geotechnical Group  
Director/Board Member, Kamloops Community Foundation  
Member, Rotary Club of North Kamloops

**Awards:** Tricolour Entrance Scholarship (1978). McNab (1979), Baker (1980), and Chevron Standard (1981) Scholarships for standing in Geological Engineering, Queen's University, Kingston, Ontario. Silver Acorn (Exemplary Service to Scouting, Governor-General of Canada, 2003).

**Experience:**

1991 to date

**Golder Associates Ltd.**

**Kamloops, BC**

*Senior Geological Engineer*

Project work and technical direction for various geological, geotechnical, rock mechanics, forestry, mining, and water resources projects, including slope stability assessments, site investigations, terrain hazard assessment, site characterisation, and terrain stability field assessments. Technical specialist for study and mitigation of natural terrain hazards in Western Canada, particularly in the BC Interior.

1985-1991

**Afton Mines**

**Kamloops, BC**

*Geological Engineer*

Technical direction and responsibility for all geotechnical matters relating to mine operations at Afton, including pit wall design, monitoring, and stability assessment; design and implementation of remedial measures for slopes, earthworks, and heavy construction supervision (haul roads, new structures, tailings impoundment, drainage improvements); blast vibration monitoring; and slope dewatering.

1983-1985

**Afton Mines**

**Kamloops, BC**

*Junior Geologist*

Project work relating to ore production/grade control and slope stability, including geological mapping and interpretation; design and implementation of slope stability monitoring program; slope instability prediction, remediation, and hazard reduction.

1982-1983

**Queen's University**

**Kingston, ON**

**Department of Geological Sciences**

*Teaching Assistant*

Laboratory demonstration/manager for undergraduate courses in Terrain Analysis (geomorphology and air photo interpretation) and Sedimentary Petrology.



## **Greg Reid**

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### **PUBLICATIONS**

Reid, G. et al. 2003. "*The Yalakom...Maintain Access in High Consequence Terrain*". Terrain Workshop Proceedings, BC Ministry of Forests Tech. Report 003, pp 111-120.

Reid, G. and Stewart, D. 1986. "*A Large-Scale Toppling Failure at Afton*". Geotechnical Stability in Surface Mining. A.A. Balkema, pp 215-223.

Stewart, D. and Reid, G. 1988. "*Afton, A Geotechnical Pot Pourri*". Canadian Institute of Mining Bulletin, Volume 81, no. 917, pp 77-83.

Thornton, G. and Reid, G. 1986. "*Vacuum Enhancement of Horizontal Drains at Afton*". Canadian Institute of Mining Bulletin, Volume 79, no. 892, pp 69-72

## **Greg Reid**

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### **PROJECT RELATED EXPERIENCE – FORESTRY**

**Watershed Assessment** **Scotch Creek, Shuswap Lake Area, BC**  
Part of project team conducting Level 1 watershed assessment for 60,000-hectare area north of Shuswap Lake. Activities included terrain classification and airphoto interpretation, landform and soil unit identification, site reconnaissance, and hazard identification.

**Forest Management Audits** **Cranbrook, BC**  
Provided geotechnical and engineering component of internal Forest Practices Audits for small licensee in the Cranbrook area (part of Price Waterhouse audit team), focusing on *Forest Practices Code* compliance.

**Terrain Assessments** **Interior of British Columbia**  
Completed numerous assessments of proposed forest roads, cutblocks, and crossing locations in the South Central Interior of BC for a variety of licensees. Work areas to date include the Coast Mountains east and west of the Fraser Canyon; Thompson plateau; North Thompson valley; Shuswap, Adams, and Okanagan plateaus; Rocky Mountains; and Cariboo Mountains. Assessments conducted mostly at A and B intensity levels.

**Watershed Restoration** **Princeton, BC**  
Completed scoping assignment and detailed prescription for road deactivation, upgrading, and landslide rehabilitation adjacent to an S2 stream (10 km, 8 landslides, 6 sediment sources). Included construction monitoring (project construction mostly complete).

**Terrain Stability Mapping** **Vernon and Clearwater Forest Districts, BC**  
Project Manager and Senior Reviewer for mapping of several watershed clusters, ranging in size from 1000 hectares to 30,000 hectares, at Intensity Level C.

**Forest Road Rehabilitation** **Blue River, BC**  
Assessment, prescription, and design for several road segments located on a steep slope above a major transportation corridor. Site constraints accommodated by the design included removal of old timber crib retaining walls up to 6 m high, and elimination of blasting while minimising rock excavation volumes.

**Stream Crossings** **Interior of British Columbia**  
Assessed numerous crossing locations in the Southern Interior, including crossing structure recommendations, identification of alternate locations, identification of design constraints, abutment foundation inspections.

**Site Rehabilitation** **Lillooet Forest District, BC**  
Site assessment and development of rehabilitation prescriptions for various landslide areas and road segments in steep terrain or high consequence areas, in many locations across the Lillooet Forest District.

**Deactivation Assessment** **Robson Valley Forest District, BC**  
Assessed current condition and efficacy of temporary deactivation measures along 3 km of roadway. Included identifications of deficiencies and recommendations for improvements.

## **Greg Reid**

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### **PROJECT RELATED EXPERIENCE – TERRAIN EVALUATION**

#### **Subdivision Study**

**Anglemont, BC**

Project Manager and technical contributor for terrain hazard and development constraint study of an existing 1,250-lot subdivision. Implications of terrain features considered with respect to continuing infill development and future expansion.

#### **Pipeline Twinning Study**

**Savona, BC**

Technical contributor to project team for site characterisation, and geotechnical hazard identification as part of an Environmental Impact Assessment along a 3-km-long corridor.

#### **Site Hazard Assessments**

**Southern Interior of British Columbia**

Terrain assessments, including site investigation and airphoto interpretation, for numerous small subdivisions and other infrastructure and development projects in the Southern Interior. Includes siting studies for water storage reservoirs, septic disposal areas, and landfills.

#### **Regional-Scale Terrain Mapping**

**Southern Interior of British Columbia**

Project Manager and Senior Reviewer for several regional-scale terrain and terrain stability mapping projects in the Thompson-Okanagan-Shuswap basins. Aggregate area mapped to date is about 130,000 hectares.

#### **Site Hazard Identification**

**Quesnel, BC**

Project contributor: airphoto interpretation and identification of landslide hazards in the vicinity of West Quesnel, part of project team assisting with study of the area following an explosion at the site. At least one large-scale, previously unknown landslide feature was identified during the course of this project.

#### **Site Hazard Identification**

**Williams Lake, BC**

Project contributor: airphoto interpretation and identification of landslide hazards in the vicinity of a college campus building experiencing structural distress. Included subsurface site investigation, monitoring equipment installation, and interpretation of results. A previously unknown, large-scale, ancient landslide feature and several smaller internal features were identified as part of this project.

#### **Hazard Identification and Remediation Prescriptions**

**Lillooet Forest District, BC**

Geotechnical component of assessment of 80 km of Forest Service road, riverbank, and hillslope corridor in steep and hazardous terrain. Identification of areas of concern, development of treatment priority ratings, and hazard mitigation strategies for observed concerns.

#### **Slope Hazard Review**

**Mission Creek Valley, BC**

Third-party review of hazard report by others, identification of landslide potential, stability analysis and commentary on potential impact of upslope development on established infrastructure.

#### **Undergraduate Teaching Assistant**

**Kingston, ON**

Two years of instruction and laboratory demonstration for undergraduate courses in Terrain Analysis (geomorphology and airphoto interpretation) and Sedimentary Petrology.

## **Greg Reid**

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### **PROJECT RELATED EXPERIENCE – ROADS AND HIGHWAYS**

#### **Temporary Excavation Certification**

**Kamloops, BC**

Geological/geotechnical site assessment and WCB slope certification for excavation slopes in overburden and bedrock, to facilitate sewer line installation along an arterial roadway, including site inspections.

#### **Rural Road Upgrading**

**Bridge River, BC**

Characterisation, site and terrain stability assessment for proposed upgrading of 8 km of rural roadway in moderate to steep terrain, including seven stream crossings. Developed detailed prescriptions for hazard mitigation and road upgrading.

#### **Conceptual Highway Design Study**

**Pioneer 40 Road, Carpenter Lake, BC**

Site assessment of rock and soil slope stability and consideration of design options for upgrading of 1-km-long corridor located between a high, steep rock slope and a large lake. Included design recommendations and conceptual design, pre-construction planning, and identification of site constraints affecting construction.

#### **Conceptual Highway Design Study**

**Highway 12 near Texas Creek, BC**

Conceptual design study of corridor upgrading options for a two-lane highway segment that crosses a large, steep, and unstable rock slope directly above the Fraser River. Included geological mapping, surficial geology mapping, hazard identification, structural geology analysis, and related input to conceptual design identification, selection, and description. Report co-author.

#### **Functional Highway Design Study**

**Highway 12 near Texas Creek, BC**

Functional design study of corridor upgrading options for a two-lane highway segment that crosses a large, steep, and unstable rock slope directly above the Fraser River. Included design and supervision of a field investigation program, input to implementation of site safety plan, tunnel route selection, implications of detailed structural geology study, foundation conditions for conventional structures, rockfall mitigation, and siting of rock sheds. Report co-author.

#### **Overpass Approach**

**Kamloops, BC**

Geological assessment of existing rock cut, rock cut design, and recommendation of alternative design strategy and construction methodology. Included construction inspections and recommendations for post-excavation slope stability enhancement.

#### **Highway Widening Project**

**Highway 1, Spences Bridge to Ashcroft, BC**

Geological and geotechnical assessment of existing fill and natural slopes along fill segments where shoulder widening was required. Work included stability analysis of proposed fill slopes and retaining wall templates, design and construction recommendations, and field inspection during construction.

## **Greg Reid**

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### **PROJECT RELATED EXPERIENCE – GEOTECHNICAL**

#### **Landslide Study**

**Princeton, BC**

Technical contributor to project team for site characterisation, slope monitoring, instrumentation, and remedial treatment of a landslide within the municipality.

#### **Landslide Study**

**Kamloops, BC**

Technical contributor to project team for site characterisation, slope monitoring, instrumentation, and remedial treatment of a landslide within the municipality.

#### **Corridor Study**

**Kamloops, BC**

Site characterisation and hazard identification for proposed arterial connector road and highway crossing.

#### **Ministry of Forests Office Site**

**Kamloops, BC**

Rock slope design, blast design review, specification review, site characterisation, pre-blast surveys of adjacent structures, and blast monitoring of excavation blasts required to shape bedrock ridge to form helipad. The site is located in close proximity to adjacent structures, which include a reinforced concrete reservoir and concrete block warehouse.

#### **Aggregate Assessment**

**Kamloops, BC**

Site assessment of potential construction aggregate on vacant land on part of the University College of the Cariboo lands. Included air photo interpretation and test pitting to determine nature and extent of deposits.

#### **Pipeline Crossing Foundation Investigation**

**Lytton, BC**

Subsurface investigation and design recommendations for anchor foundations for an elevated pipeline crossing of the Fraser River near Lytton.

#### **Pedestrian Overpass**

**Kamloops, BC**

Subsurface investigation, installation and testing of a trial anchor, and design and testing supervision of soil anchors for 3rd Avenue Pedestrian Overpass.

#### **Dam Rehabilitation**

**Dam Lake, BC**

Design and supervision of replacement of irrigation outlet and dam rehabilitation.

#### **Peterson Creek**

**Kamloops, BC**

Design alternatives for engineered creek banks and setback allowance for proposed multi-stage office block adjacent to Peterson Creek.

#### **Hazard Assessments**

**Southern Interior, BC**

Terrain assessments, including site investigation and airphoto interpretation, for numerous subdivisions and other development projects.

#### **Aggregate Study**

**Southern Interior of British Columbia**

Regional study of aggregate potential, including terrain evaluation and database preparation.

#### **Slope Stability Assessment**

**Southern Interior of British Columbia**

Field inspection and assessment of rock slope failures involving CP Rail right-of-way.



## **Greg Reid**

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### **PROJECT RELATED EXPERIENCE - PROJECT MANAGEMENT: EARTHWORKS**

#### **Home Depot Canada**

**Kamloops, BC**

Conceptual through detailed design studies, including construction services, for regrading of a sloping site to accommodate a 3,000 m<sup>2</sup> retail store. Work included installation of an insulated, permanent shotcrete retaining wall, integrated with other retaining wall systems, taking into account the presence of low strength bedrock.

#### **Campus Activity Centre, University College of the Cariboo**

**Kamloops, BC**

Contract Administrator and Project Manager for bulk excavation and foundation preparation for multi-storey institutional building on sloping site. Included subgrade preparation, inspections, foundation drain modifications, quality assurance testing, and placement of frost protection aggregate on level and sloping subexcavation surfaces. Supervision of technical personnel and contractor liaison.

#### **Tied-back Retaining Wall, CP Rail**

**Kamloops Lake, BC**

Contract Administrator and Project Manager for installation of rock anchors, concrete grade beam, and sheet pile retaining wall to support track grade between ballast and lakeshore. Included field inspections, field layout adjustment, quality assurance testing, and approvals. Included supervision of technical personnel.

#### **Kamloops District Forest Office, BCBC**

**Kamloops, BC**

Contract Administrator and Project Manager for site preparation of helipad, storage area, and building foundations, including rock slope design, blasting specification development, pre-blast surveys, third-party liaison (municipalities, adjacent land owners, utilities), and quality assurance testing. Included assessment of potential frost damage of exterior stucco.

#### **Ajax Haul Road Overpass**

**Lac Le Jeune, BC**

Project Manager and construction supervisor of heavy load multi-plate vehicle overpass over two-lane highway. Included supervision of foundation preparation fill placement and design revision to accommodate Ministry of Transportation & Highways and MEMPR requirements. Included use of gabions as road safety berms.

#### **Afton Concentrator**

**Kamloops, BC**

Contract Administrator and Project Manager and contractor supervision for heavy foundation construction during mill facility expansion and retrofit.

#### **Afton Thickener**

**Kamloops, BC**

Contract Administrator, Project Manager, Construction Supervisor for foundation preparation and contractor supervision for building construction. Included inspections, quality assurance testing, planning, and supervision of placement of large-diameter thickener tank within the building.

#### **Ajax Property - Drainage Improvement**

**Peterson Creek, BC**

Project Manager and Construction Supervisor for installation of large-diameter multi-culvert creek crossings and roadways, construction of 3 km of impervious creekbed, and design and supervision of construction of a 5-m-high water retention dam and associated works.

## **Greg Reid**

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### **PROJECT RELATED EXPERIENCE – EMERGENCY RESPONSE AND NATURAL HAZARD MITIGATION**

#### **Forest Road Landslide**

**Yalakom Valley, BC**

Assessment of a landslide involving the road shoulder, which caused closure of the road. Development of a response/mitigation plan that included identification of a realignment route, and detailed prescriptions for upgrading of the approaches to the new road segment.

#### **Rockfall Hazards**

**Kamloops, BC**

Consultation to municipality following intermittent rockfall events, including hazard mitigation recommendations and prescriptions for rock slope maintenance.

#### **Slope Collapse**

**North of Revelstoke, BC**

Response to collapse of temporary cut slope at a drill site; slope remediation and hazard abatement recommendations.

#### **Landslide**

**West of Valemount, BC**

Response to landslide affecting construction of a hydro scheme penstock pipeline. Site assessment and development of prescriptions for slope stabilisation, including stabilisation of debris apron immediately upslope from a major alpine stream.

#### **Road Closure**

**Highway 97A at Mara Lake, BC**

Site characterisation following rock slope failure at road construction site, including geological and geotechnical site assessment relating to safety hazards associated with temporary rock slopes along the shoreline of Mara Lake. Included WCB certification of temporary excavation slopes, and stipulations for operating procedures and safe worker entry at the work site.

#### **Post-fire Slope Hazard Mitigation Fish Trap Bluff, Hwy. 5 north of Kamloops, BC**

Emergency response during highway closure, hazard assessment and prescriptions for hazard reduction on large, steep rock cut and natural slope affected by the McClure-Barriere fire of 2003. Development of detailed prescriptions for targeted scaling and hazard tree removal.

#### **Highway Corridor Hazard Mitigation**

**Hwy. 5 north of Kamloops, BC**

Assessment of slope risk, hazard, and consequence from natural debris along segments of Highway 5 affected by wildfires during 2003. Identification of high consequence/risk areas where hazard mitigation was required on a high priority basis. Development of detailed prescriptions for hazard abatement.

#### **Shoreline Protection**

**Quesnel River at Quesnel, BC**

Member of response team for design and construction of shoreline stabilisation works to protect an existing water treatment lagoon facility. Geotechnical input to design team, site assessment, and field inspection during construction.

## **Greg Reid**

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### **PROJECT RELATED EXPERIENCE – WATER RESOURCES**

#### **Shoreline Stabilisation**

**Seton Lake, BC**

Site assessment of slope instability on an exposed shoreline segment, affecting a cemetery. Development of slope stabilisation recommendations and construction cost estimates for the preferred option identified.

#### **Channel and Diversion Upgrading**

**Big Creek, Chilcotin Plateau, BC**

Site assessment, slope stability assessment of eroding streambank and existing diversion channel. Development of bank stabilisation protective works to mitigate natural erosion and seepage.

#### **Stream Channel Development**

**Highland Valley, BC**

Design study of siting options for restoration of natural streamflow for a channel subject to diversion works within a former surface mine site. The project included establishment of design parameters for construction of a low maintenance channel capable of providing aquatic habitat for resident fish, and establishment of channel design capacity for anticipated flows. The study also included identification of site features for rehabilitation during construction.

#### **Off-channel Habitat Enhancement**

**Quesnel River, Quesnel, BC**

Feasibility assessment for creation of a new side channel as part of an off-channel aquatic enhancement project. Characterisation of soil and streambank conditions, assessment of site suitability, recommendations for channel inlet and outlet design configuration.

## **Greg Reid**

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### **PROJECT RELATED EXPERIENCE – MINING**

#### **Golden Sunlight Mine**

**Whitchall, MT**

Slope stability assessment, including investigation and characterisation of strength parameters and design review for a multi-stage, large-scale open pit mine.

#### **Izok Lake**

**Northwest Territories**

Slope stability assessment, design review, permafrost considerations, and construction and mining recommendations for feasibility study of a proposed open pit mine.

#### **Afton Mines**

**Kamloops, BC**

Preparation of slope stability and design studies for feasibility and permit application documents for Afton's Pothook, Crescent, Ajax East, and Ajax West pits.

#### **Pothook Haul Road – Artificial Support**

**Kamloops, BC**

Problem recognition, design, and construction supervision of artificial support (tied-back dowel array) of several sections of in-pit haul road.

#### **Afton Pit Slope Stability**

**Kamloops, BC**

Design, installation, and subsequent collection and interpretation of slope stability monitoring data pertaining to small- and large-scale slope failures in the Afton pit. Also included monitoring and prediction of two large-scale toppling failures.

#### **Pit Dewatering**

**Kamloops, BC**

Design, installation, and monitoring of in-pit dewatering systems, including vacuum-assisted horizontal drains in the Afton pit.

#### **Williams C Zone**

**Hemlo, ON**

Slope stability and design review of the Williams Mine backfill aggregate quarry (C Zone Pit).



## Golder Associates Ltd.

100-388 First Avenue  
Kamloops BC V2C 6W3

Telephone: (250) 828-6116

Fax: (250) 828-1215

Invoice #: 235503

Project: 041430065

Invoice Group: \*\*

Invoice Date: 8/9/2004

DIALITE INDUSTRIES LTD.  
2490 PATTERSON AVENUE  
P.O. BOX 66  
ARMSTRONG BC V0E 1B0

Attention: MR. RICHARD FYLES

### Detail of Current Charges

#### PROFESSIONAL SERVICES

	Project Roles)	Hours / Qt	Rate	Billable	
PRINCIPALS					
B.W. BOSDET	(senior technical review, report prep)	2.50	145.00	362.50	
PROFESSIONAL - LEVEL 5					
G.J. REID	(report author, project manager)	88.50	110.00	6,435.00	
REPORT PREPARATION					
W.M. FISCHER	(report prep)	0.75	50.00	37.50	
TECHNICAL - LEVEL A					
J.L. LEGAREE	(report prep)	0.50	55.00	27.50	
TECHNICAL - LEVEL C					
M.J. MADSEN	CAD/GIS/Drafting. (initial base drawings and prep. of report figures)	19.00	80.00	1,520.00	
				<b>Total Rate Schedule Labor</b>	<b>8,382.50</b>
				<b>4% Markup on Fees</b>	<b>335.30</b>
EMPLOYEE EXPENSE REPORTS					
G.J. REID		355.52	1.10	391.07	
<b>Total: EMPLOYEE EXPENSE REPORTS</b>				<b>391.07</b>	
				<b>Total Regular Expenses</b>	<b>391.07</b>
				<b>Total Phase :</b>	<b>9,108.87</b>

**Total Current Charges: 9,108.87**

#### Break Down of Fees/Charges:

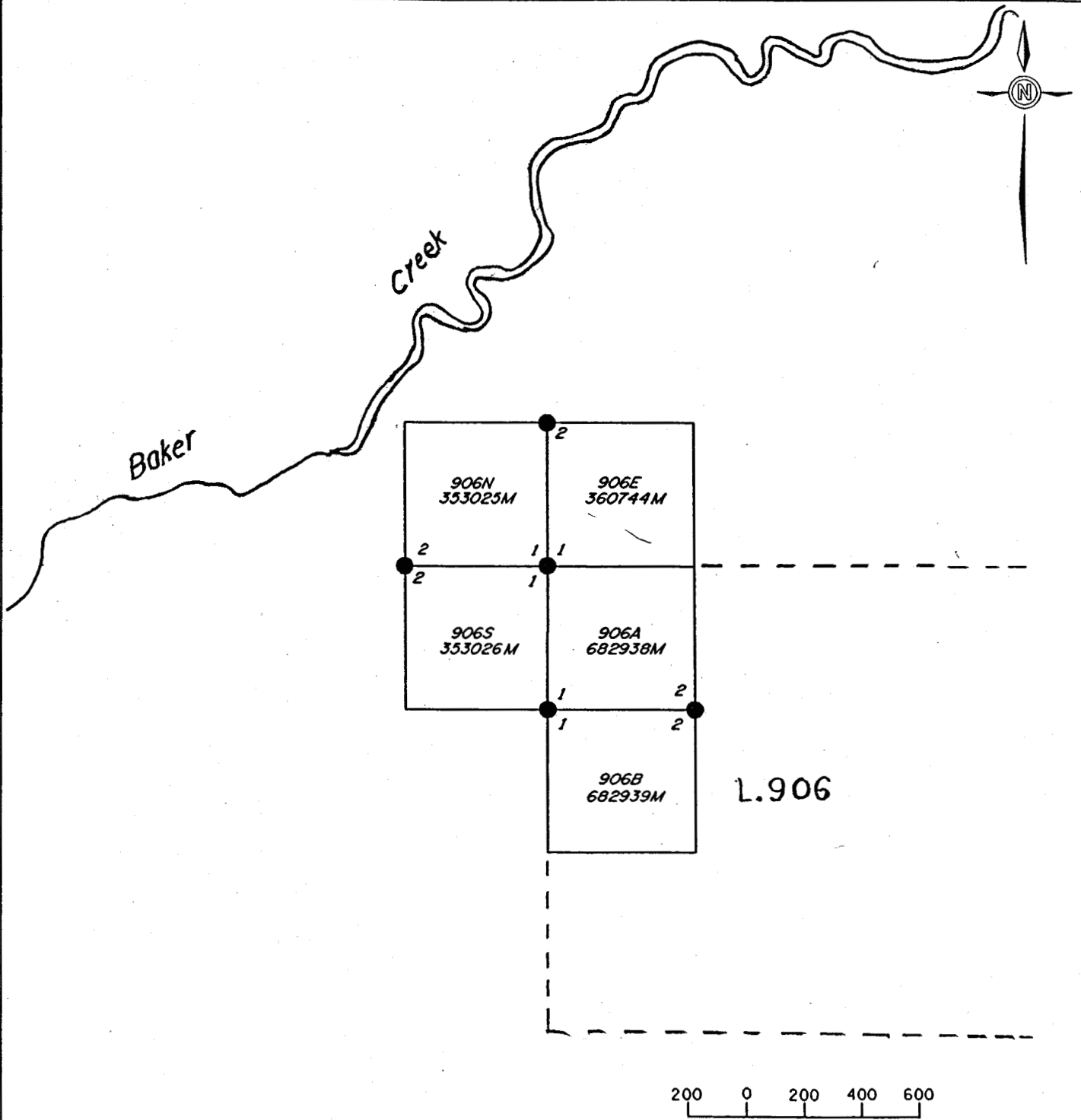
- office research & site characterization - approx 25% of invoiced amount - mainly GR (20.5 hr) + some CAD/GIS for base plans - Jun 25 to Jul 9/04
- field visit by G.R., incl travel expenses - approx 20% of invoiced amount - 15.5 hr, Jul 12-13/04
- report preparation (to draft report stage) - approx 55% of invoiced amount - draft report completed by Jul 23/04.

### Geo-Technical Report Itemized Cost Claim

The following is a detailed accounting of the invoice submitted by Golder Associates (Kamploops) for the completion of the geo-technical survey of the 906 properties.

Date work performed	Type of work	Individual	Number of hours	Rate \$/hour	Total
June 4/04 to July 9/04	office research and site characterization	G. Reid (Prof Eng)	20.5	\$110	\$2,255.00
July 16/04	Site Visit	G. Reid (Prof Eng)	15.5	\$110	\$1,705.00
July 17/04 to July 23/04	Data Analysis	G. Reid (Prof Eng)	10.0	\$110	\$1,100.00
June 4/04 to July 23/04	CAD/GIS/Drafting (initial base dwgs and prep of report figures)	M.J. Madsen Technician	19.0	\$80.00	\$1,520.00
July 17/04 to July 23/04	Report prep	G. Reid (Prof Eng)	12.5	\$110	\$1,375.00
	Report review	B.W. Bosdet (Senior P.Eng)	2.5	\$145	\$362.50
	Report prep (Technician)	J.L. Legaree	.5	\$55.00	\$27.50
	Report prep (Technician)	W.M. Fischer	.75	\$50.00	\$37.50
	4% mark-up of labour				\$335.30
July 16/04	Travel expenses				\$391.07
				Total	\$9,108.87

-5-  
CLAIMS MAP  
906 GROUP  
CARIBOO MINING DIVISION  
BRITISH COLUMBIA



200 0 200 400 600

SCALE = 1:20,000

FIGURE 3

## Drainage Plan DL 906

Prepared by: A.F. (Tony) Bensted

Date: November 10, 2004

Quesnel environment: The following precipitation data was derived from information supplied by Environment Canada, Canadian Climate Normals 1971-2000

Precipitation

Rainfall (mm)	386.9
Snowfall (cm)	177.9
Precipitation (mm)	540.3
Days with rainfall $\geq 25$ mm	.86
Days with precipitation $\geq 25$ mm	1.1
Days with snow depth $\geq 20$ cm	62.4
Extreme daily precipitation	55.1 mm June 25, 1955
Extreme snow depth (cm)	112 cm Feb 22, 1956

The site has been used for the mining and processing of Diatomaceous earth since the 1960's. There are drainage ditches in place from the most recent operation (1986) although some sections have been obliterated during reclamation or as a result of recent recreational traffic. There is deep rutting on the road from the mine site to the plant site, however, it is difficult to tell how much of this is due to 4X4 traffic on the road during wet weather and how much is due to water running down the road. The settling pond indicated at the base of the pit is in place and has been serving that purpose since the pit was last used in 1986.

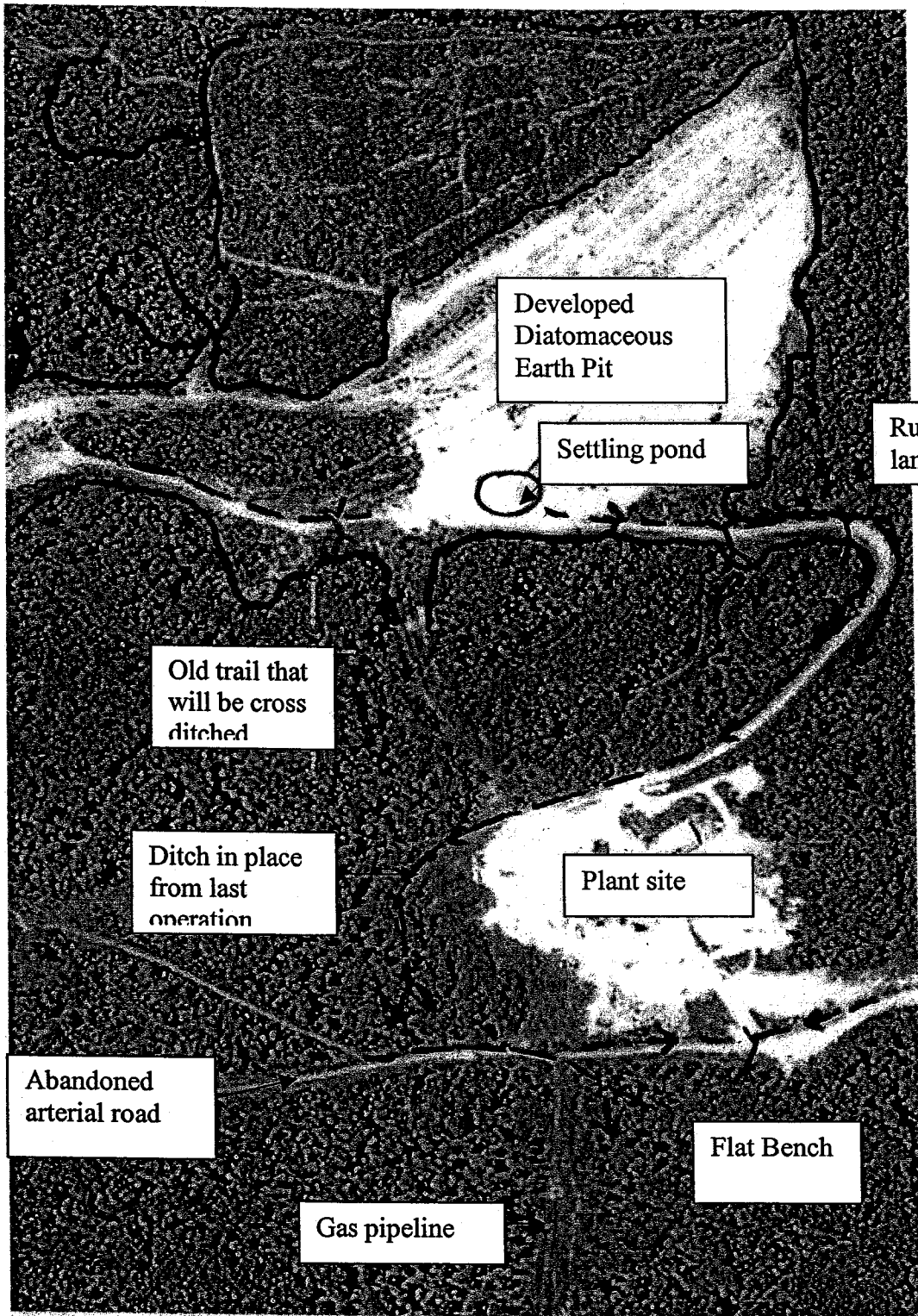
The snow loading on the site is probably similar to the Quesnel with maximum snow load of 112 cm and maximum single day rainfall of 55.1 mm.

The site is exposed to wind and sun, which should result in much of the snow going directly to atmosphere. Diatomaceous earth is also water absorbent so that most of the precipitation is absorbed directly into the ground.

The attached map indicates the location of the ditched, culverts and settling ponds that are either in place or proposed.

Our proposal is to re-establish the drainage patterns in place during the last operation and enhancing them with the installation of drainage culverts at the designated locations.





Culvert

Settling pond

Ditch and direction of water flow