L. BADKE

(District of Mission Subdivision Application S89-53)

HYDROGEOLOGIC EVALUATION IN REGARD TO DISPOSAL OF WASTEWATER AND STORM WATER ON A PROPOSED SUBDIVISION AT 10056 STAVE LAKE STREET IN THE DISTRICT OF MISSION

PACIFIC HYDROLOGY CONSULTANTS LTD.

OCTOBER 23, 1989

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October 23, 1989

Mr. L. Badke
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MISSION, B. C. V2V 6B2

Subject: **Hydrogeologic Evaluation in Regard to Disposal of Wastewater and Storm Water on a Proposed Subdivision at 10056 Stave Lake Street in the District of Mission**
District of Mission Subdivision Application S89-53

Dear Sir:

This letter is further to a discussion between Larry Badke and Ed Livingston, P. Eng., of Pacific Hydrology Consultants Ltd., onsite at the subject property on Stave Lake Street in Mission on October 11. It is also further to several telephone discussions concerning District of Mission Subdivision Application S89-53.

1.0 INTRODUCTION

The purpose of this letter-report is to discuss our hydrogeologic evaluation concerning Phase 1 of the Proposed Subdivision of a parcel of land at 10056 Stave Lake Street, legally described as Lot 3, Section 3, Township 18, Plan 8436, New Westminster District. The regional topographic setting of the subject property is shown on Figure 1 in Appendix A; the proposed lot layout is shown on Figure 2.

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In preparation of this letter-report, we have understood that:

1. The proposed subdivision of the 7.32 hectare (18.1 acre) parcel consists of a total of eight residential lots with a minimum parcel size of 0.9 hectares (2.22 acres).

2. At this time, application will be made for subdivision of Lots 1 and 2 in the proposed first phase of the development.

3. Individual onsite wastewater disposal systems consisting of a septic tank and tile drain field will be used.

4. The subject area is not served by municipal water; therefore, water supply will have to come from individual wells.

Preparation of this letter-report is based on the following:

1. N.T.S. topographic map 92 G/1, **Mission**, of scale 1:50,000.

2. Geological Survey of Canada Map 1485A, **Surficial Geology Mission British Columbia**; scale 1:50,000, 1980.

3. Geological Survey of Canada Bulletin 322, **Post-Vashon Wisconsin Glaciation, Fraser Lowland, British Columbia**; by J. E. Armstrong, 1981, 34 pp.

4. Geological Survey of Canada Paper 82-23, **Environmental and Engineering Applications of the Surficial Geology of the Fraser Lowland, British Columbia**; by John E. Armstrong, 1984, 54 pp.

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5. **Design Manual Onsite Wastewater Treatment and Disposal Systems**; United States Environmental Protection Agency, October 1980, 392 pp.

6. B. C. Ministry of Health **Sewage Disposal Regulation** (B.C. Reg. 411/85, O.C. 2398/85), Sept. 30/86, 17 pp.

7. An undated sketch map of the proposed subdivision by JMC Wade & Associates Ltd. (Sketch M-2541).

8. Miscellaneous correspondence to the subdivider (L. Badke) from the District of Mission and B. C. Ministry of Health.

9. Examination of five test pits dug on October 11 on the four lots of Phase 1 of the proposed subdivision and general hydrogeologic reconnaissance at the time of the test pit examination.

As required by the District of Mission, the purpose of this letter-report is to:

1. Investigate soil and groundwater conditions to assess their suitability for disposal of surface storm water and wastewater from domestic systems.

2. Provide a recommendation as to whether the proposed subdivision layout is acceptable or whether revision is advisable.

3. Examine the short and long term effects on adjacent properties of the disposal of storm water and wastewater from the proposed subdivision.

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2.0 TOPOGRAPHY AND SURFICIAL GEOLOGY

The subject property is at elevation about 150 metres in the drainage basin of Currie Creek which flows into Hatzic Lake. The 1:50,000 scale topographic map (NTS 92 G/1, **Mission**; see Figure 1 in Appendix A) shows the property to be located on a broad area of low relief. However, superimposed on this is an irregular rather hummocky terrain. The area, except where it has been cleared, is covered with rather dense brushy second growth forest.

The area of the subject property is underlain by dioritic rocks of the Coast Range Complex. The rock is overlain by glacial debris which is believed to form the hummocky terrain mentioned above. The area may be one of glacial moraine, deposited by ice which moved down the Hatzic Valley from the Coast Range Mountains. The glacial debris is described on Geological Survey of Canada Map 1485A, **Surficial Geology Mission British Columbia**, as "Recessional glaciofluvial deposits: Sa, recessional channel and floodplain deposits laid down by proglacial streams; gravel and sand up to 40 m thick, normal range of thickness 5-25 m". However, the sediments exposed in the test pits, and also in a nearby road cut along Wilkinson Street, are best described as ice contact deposits; these are glacial sediments deposited in contact with melting ice and they tend to have a rather jumbled character. In any case, the sediments are of glacial origin and were deposited at the end of the last glacial episode.

3.0 GROUNDWATER HYDROLOGY

On the subject property, only the local groundwater flow system within the glacial sediments overlying the bedrock is of concern with respect to the disposal of storm water and wastewater from the proposed subdivision. In this flow system, water moves by the force of gravity through the ground from the recharge area to the discharge area. The recharge area includes the terraced part of the property along Stave Lake Road and the land on the north side of Stave Lake Road. In the recharge area, water from precipitation, except that used by evapotranspiration, moves downward into the ground. In the discharge area, water moves toward the ground surface causing swampy conditions, seepages and springs. The topographically lower part of the subject property is clearly in a groundwater discharge area.

Recharge of groundwater is not constant because of the seasonal variations of rainfall and particularly because of evapotranspiration during the growing season. Because the movement of water through the flow system is quite slow, and because there is much water stored in the system, discharge is more constant than recharge. Thus the flow of seepages and springs continues even in long dry periods. However, in discharge areas, there may be fairly large fluctuations in the position of the water table. The repeated rise and fall of the water table produces distinctive colour mottling

in the sediments and such mottling is a reliable indication of regular saturation. Where mottling is found within one metre of surface, conditions are not considered to be suitable for disposal fields.

There is a small spring, probably on the southeast part of Lot 2 and close to the boundary between Lots 2 and 3. There is also spring flow in the southern part of the small creek which crosses the Stave Lake Road at Wilkinson Street. On October 11, at the time of Ed Livingston's field investigation, the creek was completely dry at the road crossing. The aforementioned springs are likely to be at a minimum after the long growing season and recent drought conditions.

4.0 FIELD INVESTIGATION

Because the lower part of the subject property is clearly in a groundwater discharge area, unsuitable for the operation of wastewater disposal facilities, the pits were dug on the central and upper parts of the proposed lots. The work on Lots 3 and 4 had to be terminated because of very slippery conditions caused by rain; at least one more pit will be required on Lot 3. Figure 2 in Appendix A shows the approximate (unsurveyed) locations of the test pits.

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Five test pits were dug to a minimum depth of two metres; Appendix B contains the lithologs of the materials encountered during the digging of the pits. Following inspection, the pits were backfilled to a depth about 1.2 m (4 ft) so that they can be inspected during the winter months.

The test pits show that a red-brown forest soil has developed on top of the glacial sediments; the soil is about 0.5 to 0.7 m thick and is underlain by a less brightly coloured sub-soil, usually a slightly compact stony sand with minor silt. On Lots 1 and 2 of Phase 1 of the proposed subdivision (see Figure 2 in Appendix A), the fresh sediments are semi-compact sands and gravels. On Lots 3 and 4, the fresh material is a compact, grey, sandy stony till.

5.0 WASTEWATER DISPOSAL

The digging of the five test pits on Lots 1, 2, 3 and 4 of the proposed Subdivision shows the following concerning wastewater disposal:

1. Test Pit 1 on Lot 1 was dug in permeable materials with good filtering properties and there was no evidence that the water table ever reaches within two metres of surface. Conditions on the terrace making up the cleared part of the Lot near Stave lake Street are quite suitable for proper operation of a wastewater disposal field.

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2. Test Pit 2 on Lot 2 encountered similar conditions to those in Test Pit 1 on Lot 1. Test Pit 2 is located part way down the slope of the terrace on which Test Pit 1 is located. The conditions at Test Pit 2 are suitable for satisfactory operation of a disposal field and conditions are also expected to be suitable everywhere at a similar or higher elevation on the Lot. However, the suitable conditions shown by Test Pit 2 are unlikely to extend to the lower part of Lot 2 which is in a groundwater discharge area. There is certainly plenty of area for a disposal field on the favourable part of the Lot; however, if a house were built on the lower part of the Lot, it would be necessary to use a pumped disposal system with the disposal field on the upper part of the Lot. The design of such facilities is thoroughly discussd in modern publications, including the aforementioned **Design Manual Onsite Wastewater Treatment and Disposal Systems.**

3. Test Pits 4 and 5 on Lot 4 show that conditions on the upper (northwest) parts of Lots 3 and 4 are also suitable for onsite wastewater disposal although the underlying till seems to be more compact. Test Pit 3 on the lower part of Lot 3 shows mottling in sand at a depth about one metre below surface. This mottling indicates that the water table rises to that level occasionally - probably annually; therefore, conditions on the lower parts of Lots 3 and 4, and probably also on the lower parts of Lots 6, 7 and 8 of Phase 2, are not suitable for conventional disposal fields.

In conclusion, properly designed, constructed and operated wastewater disposal facilities on the lots of the proposed subdivision will not cause pollution of groundwater. Additional test pits must be dug on the remaining lots of the proposed subdivision to confirm that conditions are suitable on Lot 3 and also on Lots 5, 6, 7 and 8 of Phase 2.

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The present investigation has clearly shown that conditions on Lots 1 and 2 of Phase 1 are suitable for onsite wastewater disposal. The filtering properties of the soil and the underlying sub-soil are good; this will take care of pathogens. Most phosphorus will be held in the soil; a small amount of nitrate will enter the groundwater but low levels of nitrate are not an health hazard. Considering the large lot size, the contribution of wastewater from an individual disposal field to the groundwater flow system would be insignificant and upon entering the groundwater, the renovated wastewater, which has moved through the zone of unsaturated flow, would become further diluted. The likelihood of negative impacts to adjacent properties from this disposal is very small.

6.0 WATER SUPPLY

Individual drilled water wells in rock, such as supply water to neighbouring properties on the north side of Stave Lake Road, are likely to be used for domestic water supplies on the lots of the proposed subdivison. There are no known water quality problems in the area; the groundwater quality is likely to be good for most domestic purposes.

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It may be possible to utilize an existing spring - probably on Lot 2 although the boundary between Lots 2 and 3 is uncertain - as a source of domestic water. Obviously it would be necessary to investigate this further by confirming the flow in late summer. If the spring is to be used, the wastewater disposal field would need to be carefully located so as not to be directly upslope of it. As defined in the B. C. Ministry of Health **Sewage Disposal Regulation**, listed previously, all domestic water sources must be located a minimum of 30.5 m (100 ft) from wastewater disposal fields.

7.0 STORM WATER DISPOSAL

Since there is already a perennial water course on the lower end of Lot 2, we assume that storm water from Lots 1 and 2, which would be of good quality in a residential area, would be directed into this water course.

However, if required, it should be possible to dispose of storm water in dry wells; such wells should be located a sufficient distance from disposal fields so that they do not add water to the fields.

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8.0 CONCLUSIONS

From our hydrogeologic investigation and from our understanding of plans for the proposed subdivision at 10056 Stave Lake Street, we conclude the following:

1. The subject property is located in a broad area of low relief within the drainage basin of Currie Creek; locally, irregular rather hummocky terrain is superimposed on the gentle relief.

2. The proposed subdivision is underlain by glacial debris of average thickness 5 to 25 metres. The surficial geologic map of the area (GSC Map 1485A) describes the glacial debris as glaciofluvial sediments but road cut exposures and test pit excavations indicate that the sediments are more typical of ice contact deposits.

3. Contained within the glacial debris is a local groundwater flow system whose recharge area includes the upper part of the subject property along Stave Lake Street as well as neighbouring properties on the north side of the Street. This flow system discharges on the lower (south and southeastern) part of the proposed subdivision. The discharge is manifested in spring flow in the southeast corner of Lot 2, close to the proposed boundary between Lots 2 and 3.

4. The test pits show that a red-brown forest soil, of thickness about 0.5 to 0.7 metres, has developed on the glacial sediments.

5. Conditions on Lots 1 and 2 of the first phase of the proposed subdivision are clearly suitable for proper operation of wastewater disposal systems. Test Pits 4 and 5 on the upper part of Lot 4 indicate that conditions on the upper parts of Lots 3 and 4 are quite similar to those on Lots 1 and 2; however, an additional test pit needs to be dug on Lot 3 to confirm that conditions are suitable on this Lot.

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6. Experience on neighbouring properties to the north shows that individual drilled wells in rock are likely to provide sufficient good quality groundwater for domestic use. The sites for such wells should be located either upslope or in a lateral direction from wastewater disposal systems.

7. It is assumed that storm water from residential areas would be directed into existing water courses; such a perennial water course is present on the lower ends of Lots 1 and 2. If required, dry wells could be used to dispose of storm water.

8. All things considered, properly located, designed, constructed and maintained onsite wastewater disposal facilities on Lots 1 and 2 of Phase 1 of the proposed subdivision should perform satifactorily and are unlikely to negatively impact adjoining properties.

9.0 RECOMMENDATIONS

The following recommendations are made in regard to the use of onsite wastewater disposal facilities on the proposed subdivision at 10056 Stave Lake Street:

1. Locate the disposal field on Lot 1 on the terrace on the upper (northern) part of the Lot; locate the disposal field on Lot 2 at the same elevation or higher on the slope than Test Pit 2.

2. Confirm that conditions on the uper part of Lot 3 are suitable for onsite wastewater disposal by digging an additional test pit.

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3. Choose the locations for domestic water wells with care ensuring that disposal fields are not directly upslope of the wells.

4. Dispose of storm water in existing water courses.

Yours truly,

PACIFIC HYDROLOGY CONSULTANTS LTD.

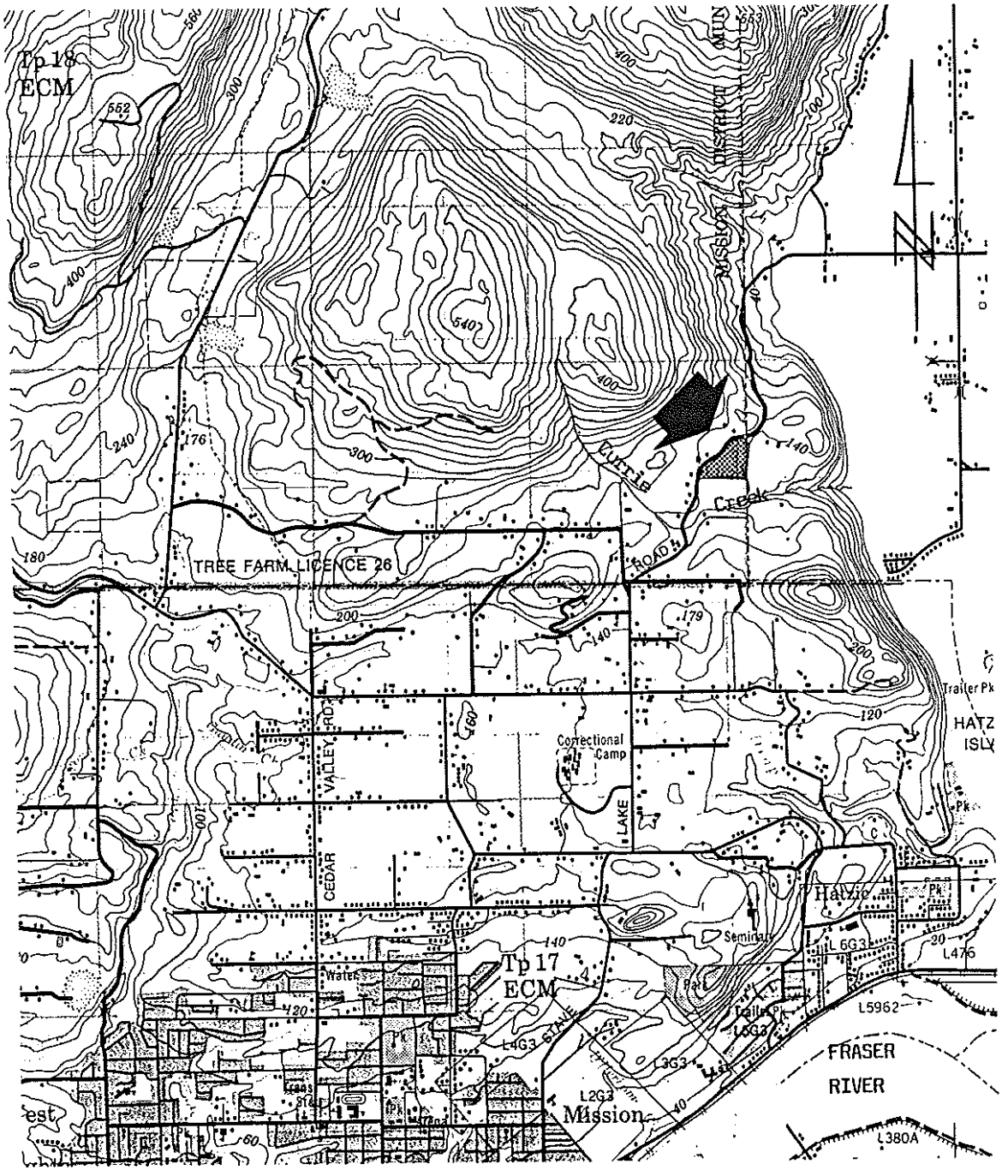
E. Livingston, P. Eng.

Attachments

APPENDIX A

AREA LOCATION MAP AND SITE PLAN

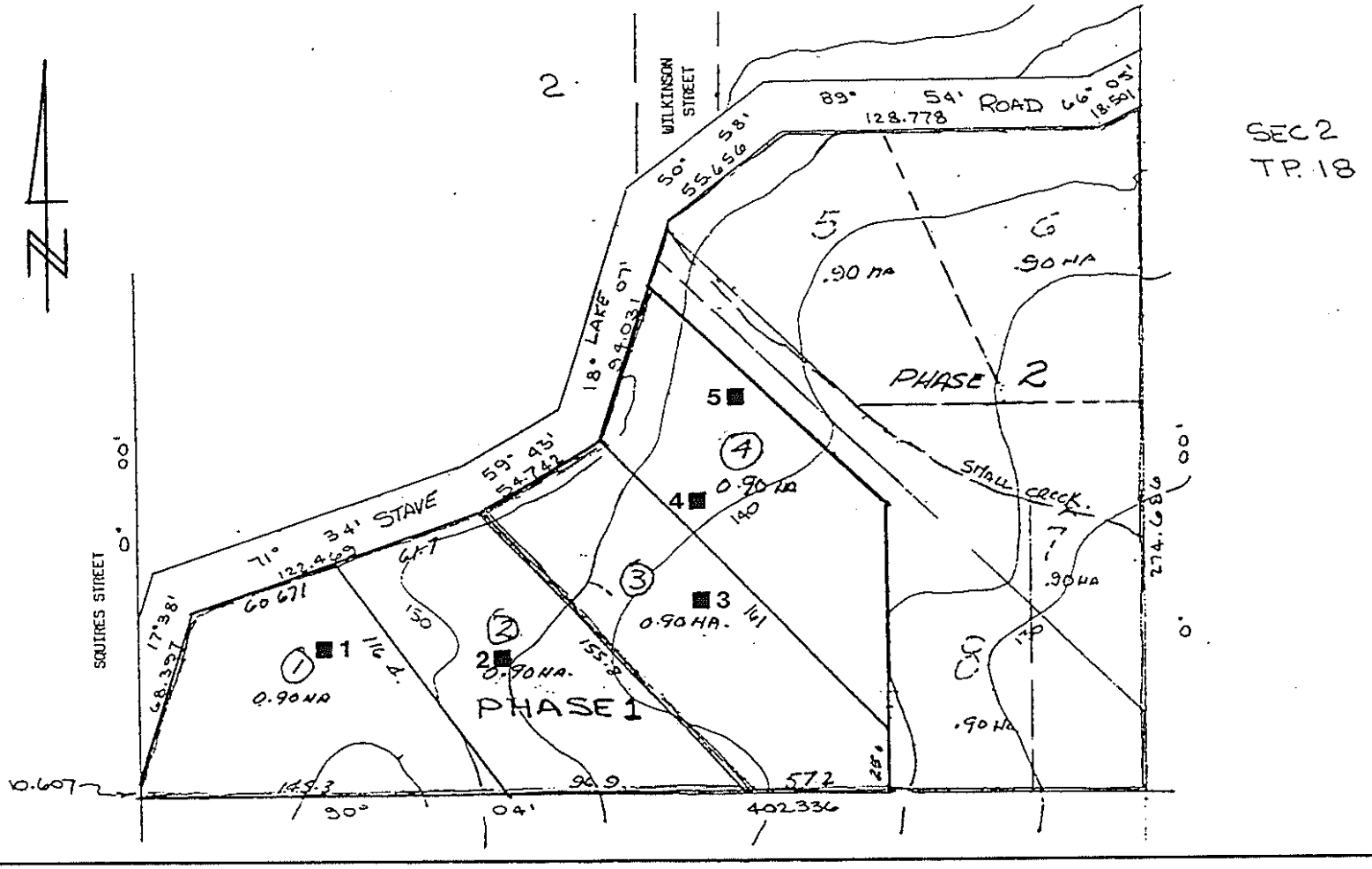
FIGURE 1	AREA LOCATION MAP PROPOSED SUBDIVISION AT 10056 STAVE LAKE STREET, DISTRICT OF MISSION



Notes:

1. The base map is 1:50,000 scale topographic map N.T.S. 92G/1, **Mission**; contour interval is 20 metres.
2. ▶▩ indicates the location of the proposed subdivision.

FIGURE 2	TEST PIT LOCATIONS ON LOTS 1, 2, 3 AND 4 OF A PROPOSED SUBDIVISION AT 10056 STAVE LAKE STREET, DISTRICT OF MISSION



Notes:

1. The base map is a 1:2000 scale plan by JMC Wade & Associates which has been reduced to an approximate scale of 1: 2700.
2. ■ 1 indicates the approximate (unsurveyed) location of a test pit (see Appendix B for the lithologs).

APPENDIX B

TEST PIT LITHOLOGS

BADKE TEST PIT LITHOLOGS

Location of Property: In the District of Mission at 10056 Stave Lake Street.

Legal Description of Property: Lot 3, Section 3, Township 18, Plan 8436, New Westminster District.

Date of digging test pits: October 11, 1989.

Test Pit 1

0 - 0.6 m	loose, brown, sandy stony loam
0.6 - 1.0 m	grey, compact sandy gravel
1.0 - 2.0 m	more compact sand and gravel with very little silt, not stratified, very variable, almost dry; may be ablation till.

Test Pit 2

0 - 0.5 m	debris from burning slash and stumps
0.5 - 1.2 m	red-brown, loose, sandy loam soil
1.2 - 1.5 m	light brown, more compact sandy loam, with a few stones
1.5 - 2.3 m	grey, very sandy, slightly compact till, dry; may be ablation till.

Test Pit 3

0 - 0.6 m	loose, red-brown, sandy loam soil
0.6 - 1.6 m	slightly compact sand with stones, no stratification, prominent rusty mottling; texture is very variable; may be ablation till
1.6 - 2.2 m	compact, grey, sandy silty till, with a few stones.

Test Pit 4

0 - 0.6 m	red-brown, loose, sandy loam with many roots
0.6 - 1.0 m	tan, sandy stony loam with many fine roots; probably weathered till
1.0 - 2.0 m	compact, light grey, sandy silty till, with a few stones; looks almost like very compact sand.

Test Pit 5

0 - 0.4 m	red-brown, loose sandy loam with a few roots
0.4 - 0.6 m	grey-brown, sandy sub-soil
0.6 - 1.0 m	variable brown colour soil, rare charcoal
1.0 - 2.1 m	grey, compact, sandy silty till with small stones; a few small root holes.