Yukon
Community Services

Hotsprings Road Rural Residential Subdivision
Draft Environmental Screening

November 2005

INUKSHUK PLANNING & DEVELOPMENT

In association with

Quest Engineering Group

EBA Engineering Consultants Ltd.

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Executive Summary

A 20-lot Rural residential subdivision is proposed for an area northwest of the intersection of Hotsprings Road and Mayo Road (Klondike Highway). The Aishihik Lake to Faro power line forms the north boundary with the existing Pilot Mountain Subdivision to the west, Hotsprings Road to the south and Mayo Road to the east. The site also surrounds the Ta'an Kwäch'än C-59B land selection (**Figure 1**).

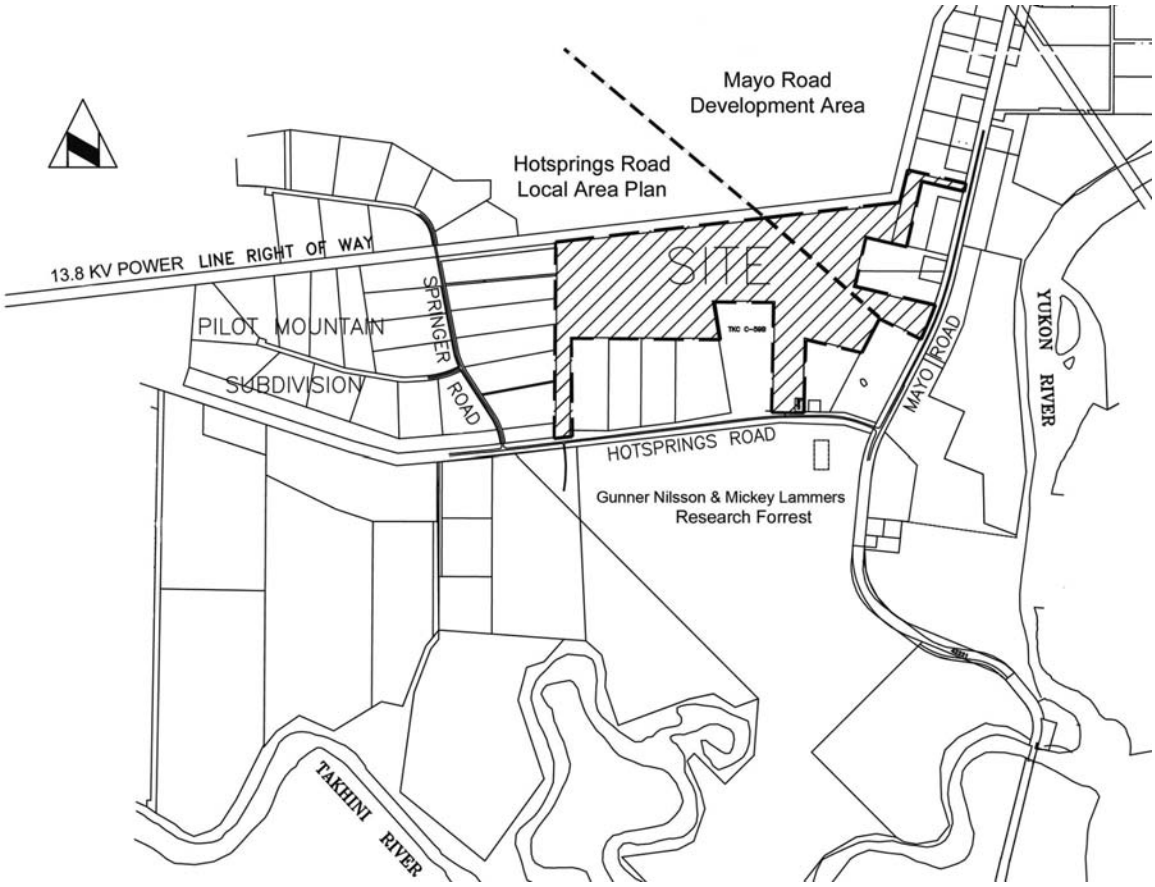

Figure 1 – Location Map

The bulk of the study area lies within the Hotsprings Road Local Planning Area except for the northeast corner that is within the Mayo Road Local Planning Area. For subdivision planning purposes, the Mayo Road Plan has a minimum lot size of 6 ha while the Hotsprings Road Plan has a 3 ha minimum. The 2002 Hotsprings Road Local Area Plan acknowledges that the portion of land within its' plan boundaries is suitable for single-family rural residential use and designates the land future development. The land within the Mayo Road Planning Area is similar in character and equally suitable for this type of development.

There is some existing recreational trail use and firewood cutting for personal use in this area now[1]. Five different subdivision concepts were generated and refined during the subdivision planning process and 3 public meetings were held to obtain public input. The final subdivision plan addresses most of the issues raised. Principal existing resident concerns included:

- Opposition to any infill development or encroachment into areas of personal use
- Support for infill development if it facilitated subdivision of their existing lot
- A desire to protect the meadows in the northwest corner of the site;
- A desire to retain the existing trail network.
- Opposition to a Stringer Road connection.

The new subdivision will generate approximately 60 additional residents. Road and school capacity is sufficient to accommodate the additional traffic and student generation. There are no significant wildlife impacts and little visible evidence to confirm the level of recreational use, area residents suggest is occurring there now. The main trail corridors are retained including an allowance for development of a link to the Gunnar Nilsson & Mickey Lammers Research Forest.

Aside from land conversion, approximately 6 local woodcutters will be displaced by the new subdivision.

As discussed in this report, there is a significant demand for rural residential development within the Whitehorse periphery. This infill project responds to that demand and encourages planned development rather than the sprawl that results from multiple spot applications.

The development is consistent with adjacent development and offers smaller lots resulting in an overall higher density but limited area footprint. The final plan addresses the issues identified through the public consultation process including the specific concerns raised by neighbours abutting the property.

The cumulative impacts associated with this project are generally positive. The higher density and compact development form will not distort real estate prices and keep the lots affordable for those interested in a more rural lifestyle. The site is close to existing services (e.g. power/telephone), major roads and the local fire hall. School buses already pass the site and the double entrance facilitates road maintenance, traffic circulation and school bus movement.

Negative impacts include the conversion of open space to residential land use, loss of a local wood-cutting area, more use of the hinterland area to the north and the possibility of some air quality concerns depending on the extent of wood stove use for heating. The later concern is due to the proximity of the site to the higher terrain to the north, the nature of the prevailing winds and the potential for winter air inversions.

The subdivision concept is also consistent with both local area plans. There is no alternate location in this general area that can be used for this purpose.

[1] On average 6 personal use dead wood cutting permits have been issued each year

GENERAL ENVIRONMENTAL ASSESSMENT INFORMATION

Project Title:	Hotsprings Road Rural Residential Subdivision
Proponent:	Community Development Branch, Community Services, Government of Yukon, PO Box 2703, Whitehorse, Yukon Y1A 2C6
Designated Office	Whitehorse
EA Type:	Environmental screening
EA Start Date:	November 14,2005
EA Completion Date:	

RESPONSIBLE AUTHORITY IDENTIFICATION

Lead Responsible Authority:	Community Development Branch, Community Services
Proponent Project Manager	Brian Ritchie, Program Manager Tel: 667-3093 Fax 393-6216 E-mail: brian.ritchie@gov.yk.ca
Other Responsible Authority:	Bryony McIntyre, Manager Lands Client Services, Energy, Mines and Resources
Consultant Contact	Ian D. Robertson MCIP Inukshuk Planning & Development Tel: 667-4759 Fax: 667-4020 E-mail: ian@inukshukplanning.ca
Screening Trigger:	Subdivision, land development funding, land use permit and public land disposition

PROJECT LOCATION

Region:	Southern Lakes (Whitehorse & Teslin)
Topographic Map Sheet:	115A (14) 1:50,000
Geographic Location:	North West corner of Hotsprings Road and Mayo Road (Klondike Highway)
Latitude & Longitude:	60º 51′ 42″ N 135º 13′ 08″E
Drainage Region:	Yukon River
Watershed:	Takhini River
Street Name:	Hotsprings Road
Nearest Community:	East of Pilot Mountain Subdivision
Traditional Territory:	Ta'an Kwäch'än & Kwanlin Dun First Nations
Surrounding Land Status	YEC right-of-way, crown land to the north, private land to west, south and southeast, abuts Ta'an Kwäch'än Council C-59B selection.

Hotsprings Road Rural Residential Subdivision
Project Description

Introduction

A 20-lot rural residential subdivision is proposed. The site was identified for future residential development in the Hotsprings Local Area Plan and has been reserved for that purpose by the Government of Yukon. The decision to proceed at this time is related to the absence of a suitable inventory of rural residential lots in the Whitehorse periphery and the continual demand for spot land approvals because of the absence of an alternative means to acquire land. Subject to receipt of all necessary approvals, development will take place in the spring of 2006 with lots available for purchase by the fall. The 2002 Hotsprings Road Local Area Plan identifies this area as suitable for the intended use.

The site is approximately 112 hectares in size. As noted earlier, it is bounded by the 138kv hydro transmission corridor to the north, Pilot Mountain subdivision to the west, the Klondike Highway (Mayo Road) to the east and private development fronting on Hotsprings Road to the south. The area known as "Gruberville" lies adjacent to the southeast corner of the site.

View from the hill above the 138kv transmission line looking south

Site Inventory

Terrain Analysis

The site is generally flat, with the nose of a ridge of the mountain to the north jutting into the north central part of the site approximate (elevation 680m). The land slopes southeast and west with an average site elevation of 665m throughout the majority of the site.

Detailed terrain analysis was conducted by EBA Engineering Consultants Ltd. Their report is in **Appendix 1**. The terrain analysis included a literature review of existing records, air photo review to determine test pit locations, supervision of the excavation of 8 test pits with percolation tests conducted in two test pit locations. An additional site inspection was conducted to the meadow area at the west end of the site to assist the design team in refining the lat layout for this area in response to public input.

EBA reports, "The study area is characterized by well-drained soils and mature pine forest with minor aspen and spruce. Isolated open meadows exist in the western third of the study area, where near-surface glaciolacustrine parent soils dominate flat gradient terrain and moderately drained soils. Groundwater was intersected at only one test pit".
Bedrock was not encountered and the higher water table noted in TP01 coincides with the meadow area behind lots 1009 and 1010 as expected because this is part of a natural depression.

The three main meadow areas absorb surface drainage from the higher ground in Pilot Mountain subdivision to the west that drains through two drainage easements. Residents living next to these easements note that they have been consistently dry year round, which suggests the meadows receive minimal surface water recharge.

EBA notes that quaternary-age gullying in thick sand in the central and northeast areas of the proposed development have formed north-northwest oriented swell and swale topography. This creates a moderately undulating and interesting landscape with gentle slopes, well-rounded minor ridges interspersed with shallow depressions capped by discontinuous, medium/fine-grained Aeolian sand. The terrain provides a range of attractive building sites especially in the north-central portion of the study area where the higher ground provides view opportunities.

The EBA report confirms the site is feasible for the intended subdivision use. Geotechnical conditions are conducive to roadway and foundation construction, as well as on-site sewage disposal. The report notes however that the glaciolacustrine soils in the western portion of the site, generally in the vicinity of the meadows are marginal at best for on-site sewage disposal. Initially, this was addressed in the subdivision design by increasing the size of the lots in this area. In response to area resident preference to see the meadow areas conserved as public open space, the final design submitted for approval accommodates that objective.

Surficial Drainage & Groundwater

The topography, soils and gradient determine the surficial drainage. There are no permanent or ephemeral watercourses present. As noted by EBA, groundwater was only encountered in test pit #1 at 3.2m within the meadows where expected. Generally, the sandy soils permit rapid infiltration of surface runoff. Even the meadows that are in shallow depressions are generally dry in most years. This is supported by the percentage of grass cover as opposed to sedges and related plant species that are commonly associated with a perched or near-surface water table. The test pit data does not suggest a perched condition is present.

The swell/swale topography in portions of the site also corresponds with a thicker sand layer and, as a result, surface runoff is not trapped in the shallow depressions. Given the nature of the soils, roadside ditches will be dry in most instances and the principal concern following road construction will be stabilizing ditch slopes and re-establishing groundcover.

According to existing residents drilling water wells in this area can be costly and problematic. Results in the Hotsprings area and adjacent Pilot Mountain subdivision have been quite variable with residents commonly drilling to depths of 130-150m or more to reach water with variable results. Trucked water service is available from commercial operators for those who choose not to drill wells because of the expense and risk involved.

Main meadow, west side of study area with willow shrub perimeter

Forest Values

The east side of the area is a mature, mixed coniferous and deciduous forest with pine and aspen poplar the dominant species. The eastern portion has proportionally more spruce and pine on the drier sandy soils with some poplar and shrub willow particularly around the meadows. Much of the forest is relatively open with minimal shrub cover due to the thinning that has occurred through firewood cutting and in part because of the maturity of the stands themselves. Two particular specimen trees were found with diameters twice the size of the largest trees in the vicinity. Based on their girth, both the white spruce and lodgepole pine appear to have survived historical fire events and look to be over 150 years old.

White Spruce

Lodgepole Pine

Approximately 6 individual woodcutting permits are issued each year covering the north-central portion of the study area. These permits are for personal use only and only for dry or dead wood according to Todd Pilgrim of Energy Mines & Resources Client Services & Inspections. Cutting outside the permit area behind Gruberville was observed during site visits and this included the removal of live and wind blown trees. The net result of the activity to date has been to reduce the fuel capacity and associated forest fire risk. The proposed

road layout and double entrance are all appropriate risk management practices while the proximity of the development to the local fire hall ensures a better and more predictable response time should a forest fire be started.

Woodcutting Activity June 2005

Wildlife Values:

The Hotsprings Road Local Area Plan rates the general area as having moderate wildlife values except for the small meadows that are rated as high. Area residents also suggested the meadows were important to local wildlife. Forest meadows are typically an integral part of the boreal forest ecosystem. Meadows provide seasonal habitat and a food supply source for a variety of species particularly birds. In this case, a site inspection revealed little evidence to substantiate the high wildlife values assigned to these areas. This does not mean that there will not be occasional sightings of wildlife use but that the relative importance of these specific sites may be over-rated. For example, while rabbit, squirrel, moose, fox, coyote and deer are known to inhabit the general area, there was no evidence of any substantive use (e.g. browse patterns, scat, tracks, nests etc.). Yukon Environments' regional biologist confirms their records do not support the high wildlife value assigned to these meadow areas.

Heritage:

Thomas Heritage Consulting conducted a Heritage Overview Assessment in May 2005. The assessment did not reveal the presence of any heritage features within the study area. The author concluded no additional field studies were required as the chance of unearthing artefacts was low. No mitigation measures prior to development are required.
According to the Heritage Overview Assessment Report, the study area is considered to have low potential for the presence of heritage resources. The heritage consultant feels that heritage resources will not be impacted by the proposed development. For this reason it is the consultant's opinion that further heritage resource inventory and assessment work is *not* needed in advance of the development of the Government reserve.

Agricultural Suitability

A minor portion of the site is classified as 5CM, marginally suitable for soil-based agriculture. Two fields have been cleared adjacent to the site on the flatter ground but have not been put into production. There is also some evidence of past free range grazing in the meadows.

Existing Land Use

The subdivision is bounded by the existing Pilot Mountain rural residential subdivision to the west (**Figure 2**). Average lot size is 6-8 ha and some residents are now subdividing these larger lots given the reduction in the minimum lot size allowed in the 2002 Local Area Plan. There are also 5 large rural residential properties south of the subdivision fronting on the Hotsprings Road along with a 15.8 ha Ta'an Kwäch'än land selection (C-59B). The northwest corner of the intersection of the Mayo and Hotsprings Road is occupied by a development locally known as Gruberville. The corner portion includes a gas bar and convenience store with postal kiosks in the road right-of-way. The back portion of the lot is occupied by a number of cabins that are occupied year round and is identified as rural residential – multifamily in the 2002 Hotsprings Road Local Area Plan. There is also a small 2.9 ha area of land that is leased for five years for use as a horse corral to the owners of lot 1193. Lot 1104 on the Mayo Road is a commercial lot that includes an auto body repair business.

On the other side of Hotsprings Road is the Gunner Nilsson & Mickey Lammers Research Forest. A Draft Strategic Plan for this area was completed in January 2005. In addition to the research function, the plan calls for more public access, expansion of the education function and includes provision for trail integration. Concern about providing a link to the power line to the north through the site from the research station was identified during the public consultation but how this would be achieved in a practical sense is not identified in the Gartner Lee plan for the research station or by the residents who suggested it.

It is also noteworthy that the fire weather station at this site established in 1988 provides the longest continuous record of hourly weather data for this area and the data is used to assist the government in calculating the wildfire danger rating for the McPherson, Takhini Hotsprings and west Lake Laberge areas. The regional fire hall for this area is located on the Mayo Road just north of the Hotsprings Road intersection less than 1km from the proposed subdivision.

138kv Power Line ROW is also a well-used recreational corridor

Figure 2

Hotsprings Road Rural Residential Subdivision

Existing Land Use

0 100 200 300

1:1000

LEGEND

- Existing Trail
- Meadow Boundary
- Tree Line
- Major Contour Line
- Minor Contour Line
- Study Area

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The 138kv power line to the north is also a heavily used recreation corridor and there are 4 main trails leading out of the proposed subdivision that connect to this corridor and to the trail system on Pilot Mountain.

The western boundary trail and the trail north from Gruberville are the most frequently used while the two interior trails connect the power line corridor to the private lots along Hotsprings Road. These are clearly personal use trails.

There are no mineral claims within the study area.

Access and Utilities

The subdivision can be accessed from either the Mayo or Hotsprings roads. There is also an unopened road allowance from Springer Road that parallels the hydro line right-of-way. When the Pilot Mountain subdivision was designed a 75m buffer strip was reserved along lots fronting on Springer Road to allow sufficient room for a future road and buffer strip.

An existing 14.4kv single-phase power line extends along both the Hotsprings and Mayo roads and can easily be looped through the proposed subdivision. The individual lots will require transformers to bring the voltage to a household standard.

Public Consultation

Three public meeting opportunities were held during the planning process. The local MLA also held several constituency meetings at which the proposal was discussed and organized a meeting for a delegation of existing property owners who met with the Minister of Community Services.

The project manager and planning consultant attended a Hotsprings Road Planning Meeting May26, 2005, to advise area residents the subdivision planning study was underway. Approximately 30 people attended the meeting. A study area map and short questionnaire was handed out that focused on identifying local interests, values and concerns. The local knowledge collected was used to focus onsite investigations and provide a planning framework for design purposes.

Initial reaction was negative particularly from the adjoining property owners who claimed to make extensive use of the area for recreational purposes. Questionnaires were also mailed to property owners and this was followed up with deliveries by hand June 3rd. This resulted in 23 responses.

Concerns raised by respondents included:

- Loss of public open space and access to the Pilot Mountain and power line trails
- Potential impacts on wildlife and wildlife movement through the area (e.g. deer/moose)
- Perceived danger to people living close to 138kv power line
- Impacts on personal lifestyle of residents living next to the development
- A concern that larger lots would result in additional subdivision requests as is happening in Pilot Mountain now

- Loss of local woodcutting area
- Request to facilitate subdivision of the back portion of some lots fronting on Springer Road and opposition by others
- A desire not to link the new development to Springer Road
- A specific request to protect the meadows from any development
- A concern about emergency access and location of access points from the Mayo and Hotsprings roads
- A concern with what the First Nation has in mind for their land selection
- The need to control ATV/snowmobile use and related damage
- A concern that the horse corral lease not be eliminated
- Confirmation of demand to purchase lots if developed
- Concern that new development would force existing property owners to install or upgrade property fencing
- Requests to facilitate personal lot enlargements that had previously been turned down
- A concern regarding insufficient public consultation
- Advice to check school capacity, groundwater conditions and ensure driveways is sufficiently wide to accommodate emergency vehicle access.

The majority of respondents indicated they made year round use of the area for a variety of recreational purposes but the detailed site inspection did not support the level of use purported to occur. Two main trails are well used. The first follows the west side of the property behind Springer Road and it is used to provide a link between the Hotsprings Road and the power line corridor to the north. The second trail runs from behind Gruberville to the power line and is accessible by vehicle. It also provides access to the interior of the site for wood cutting purposes.

Similarly, references to extensive use of the area by wildlife could not be substantiated by direct evidence on the ground. This is not to imply that wildlife do not pass through or make some use of the area and sightings may occur but rather the level of use is not as substantive as was implied.

Based on the feedback received and consultation with affected government agencies, the consultants prepared 4 possible design alternatives. A fifth concept generated by several local residents and the MLA was also presented at a second public Open House September 8th. Area residents were notified of the date of the meeting and information was also posted on the government web site. Twenty-seven persons attended the September 08th meeting and 27 response forms were subsequently mailed in. Respondents were given the choice of supporting a specific option or identifying features they liked or disliked about any particular option.

The majority of respondents were from the immediate area and favoured the option that most closely reflected their personal interest. Option #5, the design generated by some of the immediate neighbours received the greatest support followed by option#2. The consultants further refined this option to create the subdivision plan presented in this project description.

Subdivision Design Concept

A 20-lot subdivision is now proposed with access from both the Mayo and Hotsprings roads. This is a compromise that accommodates neighbour concerns and interests while generating sufficient lots to ensure the lots can be priced to recover development cost without distorting market pricing.

The loop road balances traffic flows and provides an alternative exit in case of wildfire or an accident. Transportation Engineering has indicated that they will require acceleration / deceleration lanes and lighting at the Mayo Road intersection but not the Hotsprings Road access. Road construction and the installation of power and telephone service to the property line is estimated to cost $1.60m or $79,952 per lot.

The design retains 27% of the study area as public open space and trails, well in excess of the minimum 10% requirement. The two main existing trails are retained along with a central greenway connection between the Research Forest and the power-line right-of-way to the north. The two main meadows are retained for public open space and a Springer Road connection has been dropped at the request of the property owners most affected. The Hotsprings Road connector follows the back of 4 properties that front on Springer Road because these property owners expressed interest in subdividing these properties while the owners of the lots fronting on the Hotsprings Road did not. Allowance for a future trail connection from the Mayo Road to the 138kv power line was also provided in the northeast corner of the site. As the owner of lot 1104 had cleared a substantial amount of land behind their property and was concerned about security and vandalism, the Mayo Road access point was shifted slightly south to provide a small triangular shaped treed buffer. A new trail access was also provided from Gruberville to the main east side trail as part of the present trail crosses lot 1193. The present leased land used by this same lot owner as a corral is left in tact but can be consolidated with the adjoining greenway on expiration of the lease if so desired.

The lots are all between 3-4 ha in size except for two lots that are mainly within the Mayo Road Planning Area where the minimum lot size remains 6 ha. Although this boundary is an artificially imposed line bearing no relationship to any logical land use boundary, the compromise reflects area resident wishes. While some area residents remain opposed to any development of this area, the modifications proposed in the final plan accommodate the majority of local concerns.

Figure 3

Hotsprings Road Rural Residential Subdivision

Final Subdivision Plan

0 100 200 300

1:1000

LEGEND

- Existing Trail
- Meadow Boundary
- Study Area

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Mitigation Measures & Cumulative Impacts

Table 1 summarizes the anticipated impacts and potential mitigation measures. The principal impact is the change of land use from open space to rural residential subdivision. However, from a cumulative impact perspective, the net impact is positive because the footprint of a planned subdivision is substantially smaller than the sprawl associated with spot land transfers. It should also be noted that the Hotsprings Road Local Area Plan supports this type of land use conversion at this location.

The negative impacts are partly perceptive particularly from existing residents living next to the development who have enjoyed their proximity to the open space. It is noteworthy though, that a careful site inspection did not confirm either the level of recreational use or level of wildlife activity asserted to occur. This is not to imply that such activities do not occur or are not important but that the true impacts of this development are not likely to be as negative as some local residents claim, particularly as they have a vested interest in the development not proceeding.

Aside from land use conversion, up to 6 woodcutters will be displaced by the development. To some extent as the area develops, wildlife that moves through or uses the area on a casual basis may also be displaced because of the increase in human activity. Some conflicts can be anticipated but not quantified because of the wildland/urban interface. For example, if lot owners do not manage their garbage and pets properly, bears and wolves may be attracted, particularly during difficult years when natural food supplies are in short supply.

Air pollution may also become a concern depending on the level of woodstove use and the number of climatic inversions that occur because of this developments proximity to Pilot Mountain to the north. Existing residents did not raise this as a concern and this would suggest that to date, this has not been a problem in the Pilot Mountain subdivision next door, which has similar topographic conditions.

Up to 60 additional residents are anticipated to live in the new subdivision. There is no evidence to indicate that the new residents will create any significant or untoward cumulative impacts on traffic, schools or related infrastructure.

On balance the new subdivision responds to known demand, addresses the majority of local concerns in the design and mitigates predictable impacts in a reasonable manner.

Table 1 - Relevant Valued Ecosystem and Cultural Components (VECC's), Potential Effects on VECC's, Mitigation, Effects Assessment and Significance Ranking

				Significance of Effects								
VECC's	**Potential Effects**	**Effects Mitigable?**	**Mitigation**	**Duration of Interaction**	**Magnitude of Interaction**	**Geographic Extent of Interaction**	**Reversibility**	**Ecological Context**	**Economy & Social Context**	**Risk Characterization**	**Overall Significance Ranking**	**Significance**
Soils	Some disturbance during initial road construction and individual lot development	Yes	ROW ditches seeded and revegeted, individual lot landscaping lot owner responsibility.	short term	Low	Road right-of-way, driveways and building sites	yes	Low	Minimal	Low	Low	No
Vegetation	ROW is cleared and shrub layer disturbed, some wildlife habitat loss and displacement.	Yes	Limited disturbance - specimen trees and valued meadow lands protected as public open space. Some natural revegetation will occur.	Low	Moderate	Road row and building sites	yes	Low	Moderate	Low	Low	No
Hydrogeology & Surficial drainage	Surface drainage and groundwater.	Yes	Natural soil regime encourages runoff infiltration; culverts will ensure any Pilot Mountain drainage can recharge meadow where water table highest. Lot purchasers will be advised of depth of area water wells, yields and risks involved in well drilling. Commercial water delivery available locally.	Short term for surficial drainage events	Low	Throughout subdivision	No	Low	Moderate	Moderate to high in obtaining well water	Low	No
Wildlife	Some vegetation and habitat loss will occur aas well as some displacement. Lot fencing and presence of new houses may restrict large ungulate movement. Some potential for human/wildife conflict.	Partially	Little evidence of significant wildlife presence or movement through area. Minor impact on local populations. Area of highest wildlife interest (meadows) retained as open space. Occasional wildlife conflicts can be minimized by lot owner garbage management practices.Some minor disturbance of small mammals/rodents can be expected during construction. after construction.	Low but ongoing	Low	Local	No	Low	Minimal	Low	Low	No
Air Quality	Wood stove emissions	Partially	Depends on number of homes that use wood heat and frequency of air inversions. Restrictions on wood stove use could be adopted.	Short term but ongoing	Low	Local	Yes	Low	Moderate	Moderate health risk	Moderate	Yes
Aesthetics	Clearing, dust and noise during construction, loss of natural character	Yes	Watering for dust control; limits on working times during construction, revegetation of distubed areas	High	Moderate	Low	Low	Low	Moderate	Low	Low	No
Archaeology	Potential unearthing of artefacts during road construction and lot developmentgrading/debris removal.	Yes	Heritage assessment completed, confirms probability low. Contractor informed of standard procedure to halt construction and notify Government of Yukon if anything found.	Low	Low	Low	Low	Low	Moderate	Low	Low	No
Land Use	Change of use from open space to rural residential, restrictions on free use and movement. Displacement of woodcutters	No	Trail linkages preserved and connections enhanced.Open space deication exceeds 10% minimum by 17%	Permanent	Significant	Low	Low	Low	Moderate	Low	Low	No
Traffic & Circulation	Increased traffic and turning movements on Mayo Road	Yes	Two access points, balance circulation and traffic loading; no Springer Road conection to encourage shortcutting; acceleration/decelleration lanes provided at Mayo Road intersection	Low	Low	Low	Low	Low	Moderate	Low	Low	No

Legend: Level of interaction of Project Environmental Effects with VECC or significance ranking defined as low, moderate, or high considers mitigation success.

Duration of Interaction = short term (1-3 years); medium term (4-10 years); long term(>10 years)
Magnitude of Interaction defines magnitude of effects on VECC
Geographic Extent of interaction = low (local); moderate (regional); high (territorial or national)
Reversibility = low (non-reversible)

Table 2. Significance of Effects Descriptors

Descriptor	Duration of Interaction	Magnitude of Interaction	Geographic Extent of Interaction	Reversibility*	Ecological Context	Economic & Social Context	Risk Characterization
Low	<1 to 3 years	negligible - low effects to surrounding environment	local	75-100%	community with good ecological fitness and a high degree of resilience	community with good economic and social fitness and a high degree of resilience	negligible - low risk: negligible to high hazard assessment; low to medium exposure assessment; and low to medium consequence assessment
Moderate	4 to 10 years	moderate effects to surrounding environment	regional	40-75%	community with moderate ecological fitness and a moderate degree of resilience	community with moderate economic and social fitness and a moderate degree of resilience	low - medium risk: low to high hazard assessment; negligible to low exposure assessment; and negligible to low consequence assessment
High	>10 years	extreme - catastrophic effects to surrounding environment	territorial or national	<40%	community with poor ecological fitness and a low degree of resilience	community with a poor economic and social fitness and low degree of resilience	medium - high risk: low to high hazard assessment; medium to high exposure assessment; and medium to high consequence assessment

*Note: Reversibility values are opposite to other scales

July 27, 2005 EBA File: 1200153

Government of Yukon
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P.O. Box 2703
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Attention: **Mr. Brian Ritchie, Program Manager**
Community Development Branch

Subject: Geotechnical Evaluation For Planning and Design
Proposed Hot Springs Road Development Area

As requested, EBA has completed a terrain analysis and geotechnical evaluation of the above captioned study area. Geotechnical conditions and terrain features as well as recommendations for country residential site development are discussed in the following sections.

1.0 EXISTING GEOTECHNICAL INFORMATION

EBA has completed two geotechnical evaluations in the vicinity of the study area. Both projects included testholes and percolation testing. Details of each project are summarized below:

- Yukon Septic Systems Pilot Study – 1986 – A testpit and 5 percolation tests were completed at various elevations throughout the proposed absorption field location at Lot 19 – Pilot Mountain Subdivision. The absorption field at this location is the prototype for the absorption field configuration presented in the current Environmental Health Guidelines
- Gruber Service Station – Lot 608; Group 804 – Corner of the North Klondike Highway and the Hot Springs Road – 1997 - A testpit were excavated in the absorption field location and two percolation tests were completed to verify the percolation rate in the accepting soil strata and the percolation rate of the underlying glaciolacustrine silt to verify that although the percolation rate is not acceptable for system installation, the soil is not completely impervious, therefore, 1.2 m of separation was not required.

Information collected from these two projects has been incorporated into the site development recommendations presented in the following sections.

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2.0 TERRAIN ANALYSIS

Detailed terrain mapping was completed by Mr. Jack Dennett, P.Geo(BC) of EBA's Whitehorse office. Concurrent with the terrain analysis, a testpitting program comprised of the excavation of eight testpits to between 4 m and 5 m in depth was completed on June 16, 2005. This data was used to field-check the air photograph interpretation of surficial geology. The following criteria was used to determine testpit location:

- Adequate representation of the study area
- Testing of an adequate variety of characterized terrain features to enhance confidence of the interpretation of the total study area
- Testing of areas identified as having specific planning significance
- Site access by existing trails to avoid clearing of new trails
- Ensure that testpit locations (or travel to testpit locations) did not encroach on private property

The study area is characterized by well-drained soils and mature pine forest with minor aspen and spruce. Isolated open meadows exist in the western third of the study area, where near-surface glaciolacustrine parent soils dominate flat gradient terrain and moderately drained soils. Groundwater was intersected at only one testpit (3.2 m in -TP01). Although bedrock outcrops were noted outside of the study area on the north side of the power line, bedrock was not encountered in any of the testpits.

Quaternary-age gullying in thick sand in the central and northeast areas of the proposed development have formed north-northwest oriented swell and swale topography (low-relief, undulating landscape with gentle slopes and well-rounded ridges separated by shallow depressions) capped by discontinuous, medium/fine-grained eolian sand. Slope gradients within the study area were gentle to flat, with some shallow gully side slopes approaching moderate gradient.

3.0 TESTPITTING PROGRAM

As mentioned above, the site testpitting program was conducted on June 16, 2005. A Komatsu PC 150LC tracked excavator, supplied by Arctic Backhoe Services of Whitehorse, Yukon was utilized to excavate the eight testpits throughout the study area. Testpit locations are shown on Figure 1, attached to this letter report.

At each testpit location, detailed testpit logs describing ground and tree cover, surficial terrain features and soil conditions were prepared. Disturbed grab samples were collected at select depths as deemed appropriate by the EBA representative at the site.

All soil samples were returned to EBA's Whitehorse laboratory for natural moisture content determination on all samples and particle size analysis on select representative samples. Testpit logs, showing detailed soil conditions and presenting laboratory results, are attached.

In two testpits, percolation test equipment was installed between 1.5 m and 1.8 m depth (testpits 1200153-TP04 and –TP05). On June 17, 2005, percolation testing was completed in the sandy soils which are considered typical of accepting soils found throughout much of the site. Because of the granular nature of the sand soil, no presoak was deemed necessary and test results were within the acceptable limits for on-site sewage disposal system design and construction.

4.0 GEOTECHNICAL CONDITIONS

Sub-surface materials in the study area are characteristic of a glaciofluvial delta depositional environment capped by a veneer (< 1 m) of eolian sand and overlying glaciolacustrine silt at depth. The dominant soil is generally non-cohesive, medium to fine grained, poorly graded sand, thickening from less than 1 m in the southwest to greater than 5.0 m over the rest of the study area. The thickest deposits of glaciofluvial sand in the central and northeast sections of the site are massive. In other areas, moderate (1 m to 2 m) to thin (<1 m) interbeds of sandy silt occur within the sand soil unit. Depth of the glaciofluvial sand deposit correlates directly with surface elevations, with the greatest depths occurring in the highest topographical areas in the central and north-eastern sections of the study area.

As previously stated, groundwater was encountered in a single testpit (testpit 1200153-TP01 at a depth of 3.2 m) and bedrock was not encountered in any of the testpits.

5.0 DEVELOPMENT CONSIDERATIONS

Development of the study area is considered feasible. Geotechnical conditions are generally conducive to roadway and foundation construction, as well as on-site sewage disposal system installation. However, glaciolacustrine soils, which are marginal at best for on-site sewage disposal system construction, were noted throughout the west end of the study area. The questionable area extends west from the access trail where testpit 1200153-TP03 was excavated and the potentially "difficult" soils are described on the logs for testpits 1200153-TP01 and –TP02.

On June 17, 2005, a review of five conceptual subdivision designs prepared by Inukshuk Planning and Development was completed and subsequent discussions regarding the location and construction of approved on-site sewage disposal systems were addressed and it was agreed that the lot density at the west end of the site should be kept to a minimum in order to take advantage of the areas where acceptable building sites are available.

5.1 Roadway Construction

Two typical subgrade soils will be encountered during construction. The central portion and east end of the site will have medium grained sand subgrade soils while roadways in the west end of the site will be founded on glaciolacustrine silt subgrade soils which may be wet and soft.

Stripping and grubbing must clear the vegetation and organic root mat from the limits of the roadway embankment. Once mineral soils are exposed, the subgrade surface should be scarified and moisture conditioned to approximately 3% below optimum moisture for the silt subgrade soils at the west end of the site (may require drying to attain a stable subgrade surface) while the sand soils throughout the central and east end of the site will require aggressive moisture conditioning to get to within a percent of optimum moisture to facilitate compaction.

Recommended roadway structure for light vehicular traffic consists of a total of 300 mm of granular structure comprised of a 200 mm thick sub-base course and a 100 mm thick basecourse gravel surface. To maximize the stability of the granular structure (especially throughout the west end of the site where silty subgrade soils exist), it is recommended that a Granular E pit run (coarse 200 mm maximum size pit run) be utilized for sub-base construction. Gradation specifications for sub-base and basecourse gravel are presented in Table 1, below.

Table 1
RECOMMENDED GRANULAR MATERIALS SPECIFICATIONS

200 mm PIT RUN GRAVEL		20 mm BASECOURSE GRAVEL	
SIEVE SIZE (mm)	% PASSING BY MASS	SIEVE SIZE (mm)	% PASSING BY MASS
200.000	100		
80.000	75 - 100		
25.000	55 - 100	20.000	100
12.500	42 - 84	12.500	64 - 100
5.000	26 - 65	5.000	36 - 72
1.250	11 - 47	1.250	12 - 42
0.315	3 - 30	0.315	4 - 22
0.080	0 - 8	0.080	3 - 6

Lift thickness of imported granular materials should not be an issue as long as suitable compaction equipment is available during construction. It is actually preferable that the Granular E sub-base course be placed in a single lift (this will act as a pad over the silty subgrade soils in the west portion of the site and minimize the amount of gravel lost into unstable subgrade soils). Once placed, the sub-base and basecourse gravels will require moisture conditioning to facilitate compaction to 98% of Standard Proctor maximum dry density. If the subgrade is

excessively wet and soft, additional subcut and backfill with additional Granular E or the use of a medium weight geotextile over the subgrade is recommended.

Subgrade inspection and compaction testing during sub-base and basecourse construction is recommended, along with associated laboratory tests to confirm compliance to aggregate specifications and the determination of Standard Proctor maximum dry densities for use during compaction testing. EBA can supply all testing services associated with subdivision development.

5.2 On-Site Sewage Disposal System Design and Construction

Soil conditions throughout the central and eastern portions of the study area are definitely conducive to the construction of on-site sewage disposal systems. The sandy subgrade soils tested suggest that percolation rates of less than 1 minute per 25 mm will be measured on all proposed lots throughout the central and east end of the site. Therefore, absorption field sizing can be based on a design percolation rate of 5 minutes per 25 mm. It is recommended that the field be located down gradient of proposed building and water well locations and additional setback requirements (as specified in the Environmental Health Guidelines) are presented as Figure 2, attached and a typical design for a three bedroom home is presented as Figure 3, also attached.

The glaciolacustrine silts found throughout the western end of the site will complicate the situating and construction of an approved on-site sewage disposal system. Past experience in the Pilot Mountain Subdivision and on specific lots located along the Hot Springs Road suggests that percolation rates will vary from 10 minutes per 25 mm to 180 minutes per 25 mm. The placement of an absorption field must be given careful consideration when creating a lot development plan in order to take advantage of areas where accepting soils exist (600 mm of soil with a percolation rate of less than 60 minutes per 25 mm is required to satisfy Environmental Health Guidelines for design and installation). Sizing of absorption fields in this area will be very site specific and based on actual percolation rates. Past experience suggests that establishing a percolation rate profile (percolation tests performed at various elevations throughout the depth of the testpit) to determine which elevations have acceptable sols may be beneficial. If accepting soils are identified at typical depths of 1.5 m to 2.0 m, conventional designs will apply. However, accepting soils are sometimes found at or near the surface and if this is the case, a pump may have to be installed in the siphon chamber of the septic tank.

Materials such as filter sand, drain rock, geotextile silt barrier and piping must comply with Environmental Health Guidelines and can be supplied by Whitehorse area contactors.

EBA can supply design (including percolation testing) and construction inspection services for all residential and commercial on-site sewage disposal system projects.

5.3 Foundations

The construction of conventional foundation systems, (strip & spread footings or monolithic thickened slab-on-grade foundations) are considered acceptable for use throughout the study area. All footings may be designed on the basis of an allowable static net bearing pressure of 96 kPa (2000 psf). Properly constructed foundations in the central and eastern portions of the site will have minimal potential for frost heave, as long as surface water and roof runoff are controlled, however, foundations constructed throughout the west end the study area will likely require frost protection to minimize the potential for heave. Mitigative measures may include the use of perimeter insulation or ensuring 2.5 m of soil cover (houses with full basements). Again, the control of surface drainage and roof runoff (especially in late fall when daily temperature fluctuations may promote the development of ice lenses) is considered very important.

6.0 CLOSURE

This report and the recommendations contained in it are intended for the sole use of the team working on this project. EBA does not accept any responsibility for the accuracy of any of the data, the analysis or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than that specified above for any project other than that described in this report. Any such unauthorized use of this report is at the sole risk of the user. Additional information regarding the use of this report is presented in the attached General Conditions, which form a part of this report.

If clarification of information provided in this letter report is required, please contact the undersigned.

Yours truly,
EBA Engineering Consultants Ltd.

PROFESSIONAL ENGINEER YUKON TERRITORY July 27/05

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PERMIT TO PRACTICE
Signature
Date July 27/05 EBA Engineering
PERMIT NUMBER: P006
Association of Professional Engineers of Yukon

This report incorporates and is subject to these "General Conditions".

A.1 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of EBA's client. EBA does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than EBA's client unless otherwise authorized in writing by EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of EBA. Additional copies of the report, if required, may be obtained upon request.

A.2 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. EBA does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

A.3 LOGS OF TEST HOLES

The test hole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance that requires precise definition of soil or rock zone transition elevations may require further investigation and review.

A.4 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. EBA does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

A.5 SURFACE WATER AND GROUNDWATER CONDITIONS

Surface and groundwater conditions mentioned in this report are those observed at the times recorded in the report. These conditions vary with geological detail between observation sites; annual, seasonal and special meteorologic conditions; and with development activity. Interpretation of water conditions from observations and records is judgmental and constitutes an evaluation of circumstances as influenced by geology, meteorology and development activity. Deviations from these observations may occur during the course of development activities.

A.6 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance that can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

A.7 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

A.8 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer, when the final design and construction techniques are known.

A.9 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

A.10 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems that will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

A.11 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

A.12 SAMPLES

EBA will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the client's expense upon written request, otherwise samples will be discarded.

A.13 STANDARD OF CARE

Services performed by EBA for this report have been conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practising under similar conditions in the jurisdiction in which the services are provided. Engineering judgement has been applied in developing the conclusions and/or recommendations provided in this report. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of this report.

A.14 ENVIRONMENTAL AND REGULATORY ISSUES

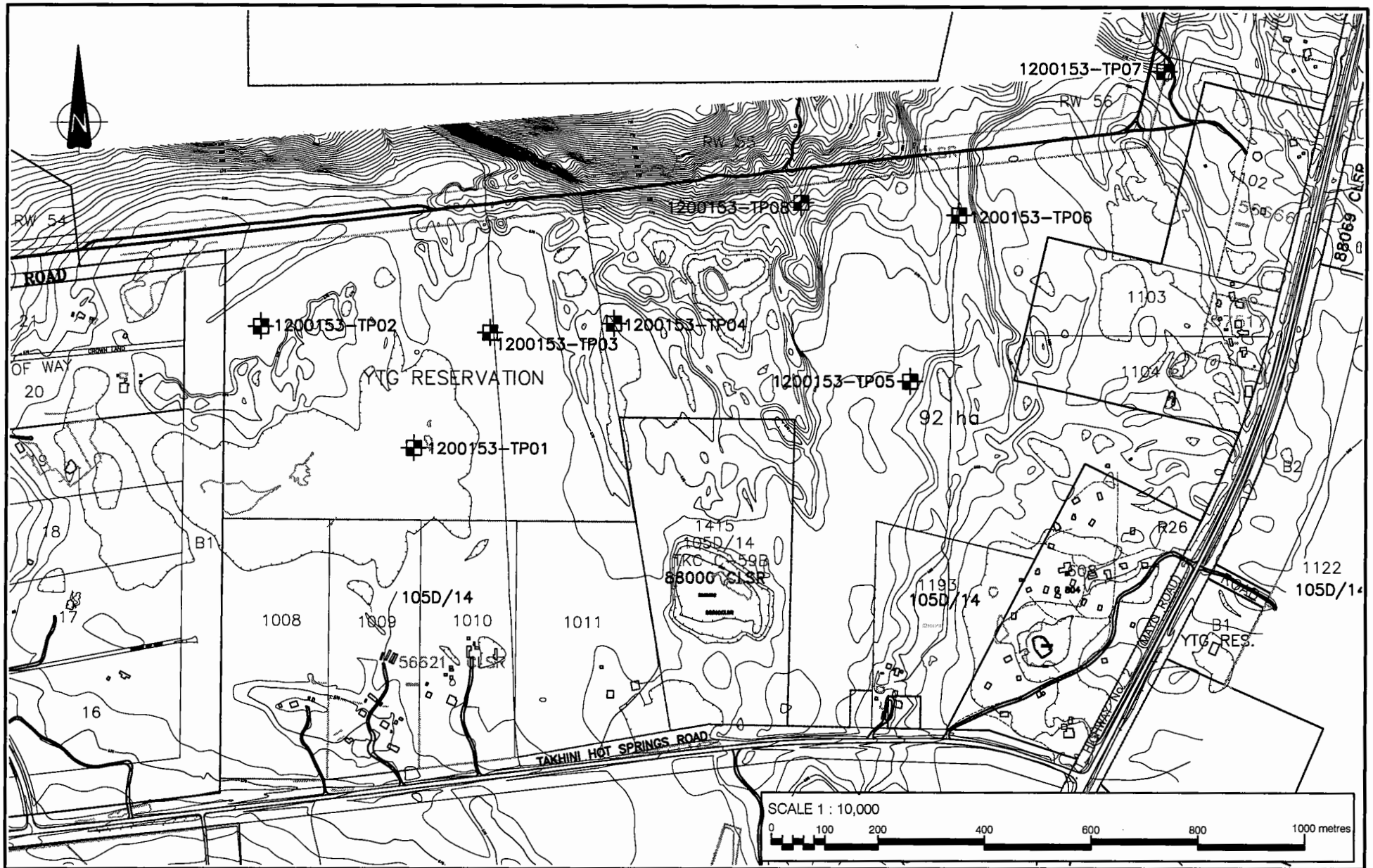
Unless stipulated in the report, EBA has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

A.15 ALTERNATE REPORT FORMAT

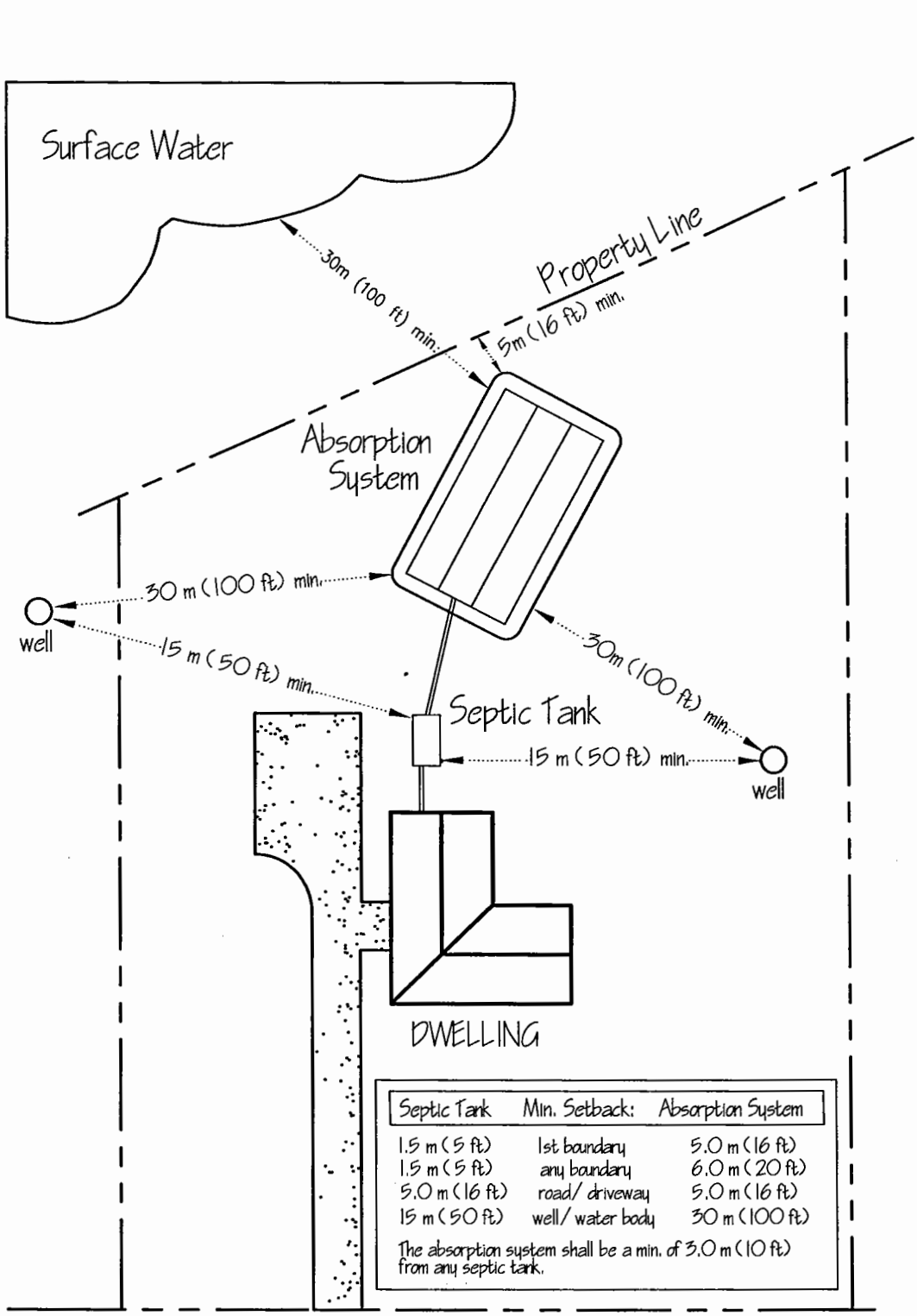
Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA's instruments of professional service), the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding. The hard copy versions submitted by EBA shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancies, the hard copy versions shall govern over the electronic versions. Furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed version archived by EBA shall be deemed to be the overall original for the Project.

The Client agrees that both electronic file and hard copy versions of EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. The Client warrants that EBA's instruments of professional service will be used only and exactly as submitted by EBA.

The Client recognizes and agrees that electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.



EBA Engineering Consultants Ltd.				PROJECT	TAKHINI HOT SPRINGS ROAD DEVELOPMENT WHITEHORSE, YUKON
CLIENT	GOVERNMENT OF YUKON LANDS BRANCH			TITLE	SITE PLAN SHOWING TESTPIT LOCATIONS
DATE	JUNE 2005	DWN. JSB	CHKD. MCP/JTD	FILE NO.	1200153 DRWG. FIGURE 1



Septic Tank	Min. Setback:	Absorption System
1.5 m (5 ft)	1st boundary	5.0 m (16 ft)
1.5 m (5 ft)	any boundary	6.0 m (20 ft)
5.0 m (16 ft)	road/ driveway	5.0 m (16 ft)
15 m (50 ft)	well/ water body	30 m (100 ft)

The absorption system shall be a min. of 3.0 m (10 ft) from any septic tank.

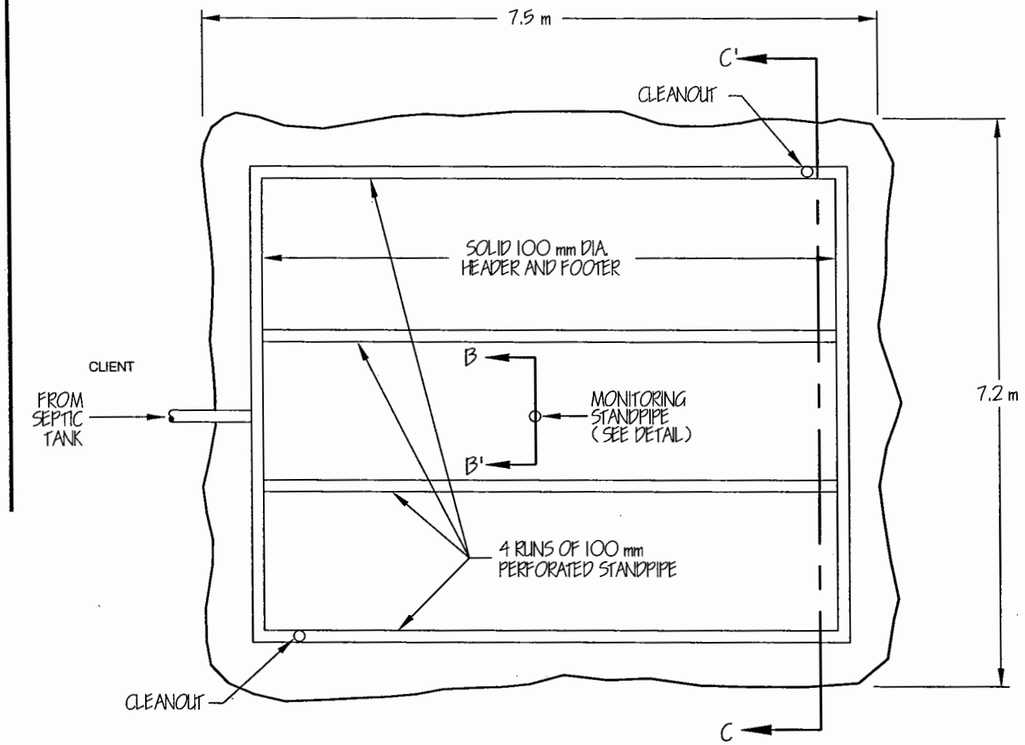
EBA Engineering Consultants Ltd.

PROJECT: HOT SPRINGS ROAD
SITE DEVELOPMENT - WHITEHORSE, YUKON

CLIENT: Yukon Government

TITLE: MINIMUM SETBACK REQUIREMENTS FOR ON-SITE SEWAGE DISPOSAL SYSTEMS

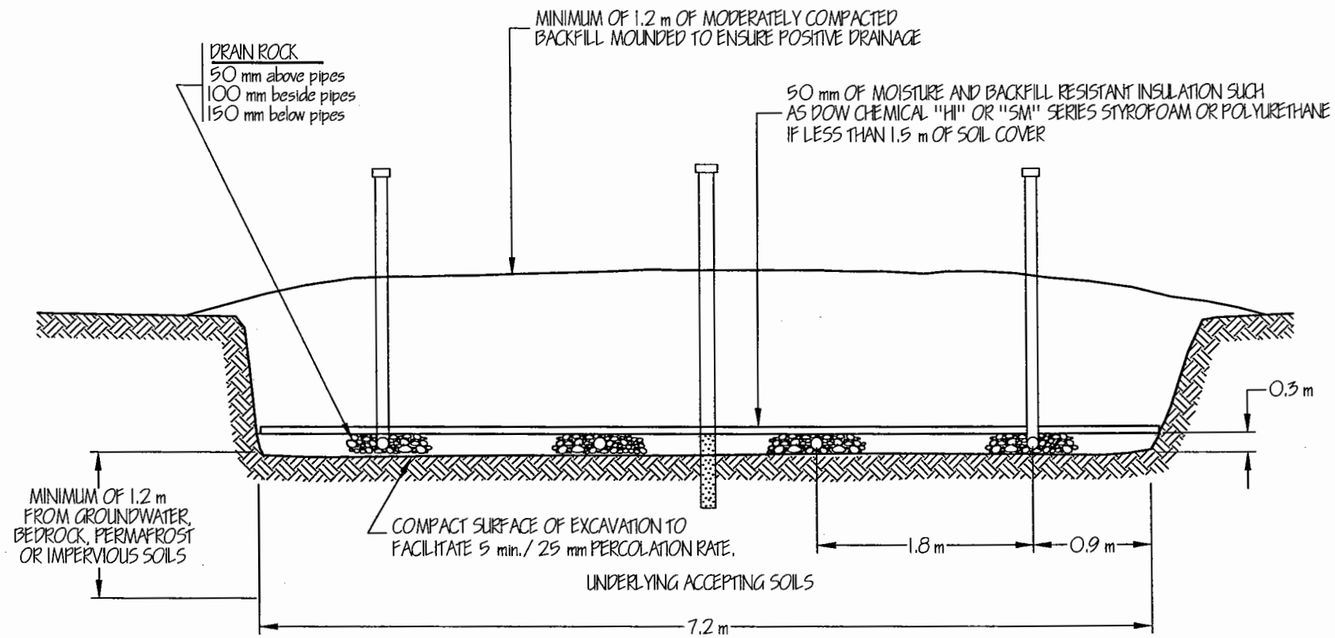
DATE	DWN.	CHKD.	FILE NO.	DRWG.
JUNE 2005	JSB	MCP	1200153	FIGURE 2



PLAN VIEW

ABSORPTION BED SYSTEM

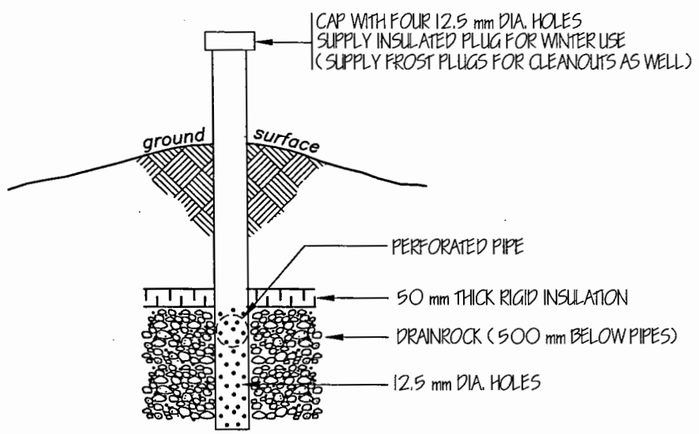
(not to scale)



SECTION C-C'

ABSORPTION BED SYSTEM

(not to scale)



SECTION B'-B

MONITORING STANDPIPE DETAILS

(not to scale)

*DESIGN IS BASED UPON A THREE BEDROOM RESIDENCE AND A SOIL PERCOLATION RATE OF 5 min./ 25 mm. OR LESS

EBA Engineering Consultants Ltd.

Yukon Government

PROJECT: HOT SPRINGS ROAD SITE DEVELOPMENT - WHITEHORSE, YUKON

TITLE: TYPICAL ABSORPTION BED SYSTEM INSTALLATION DETAILS

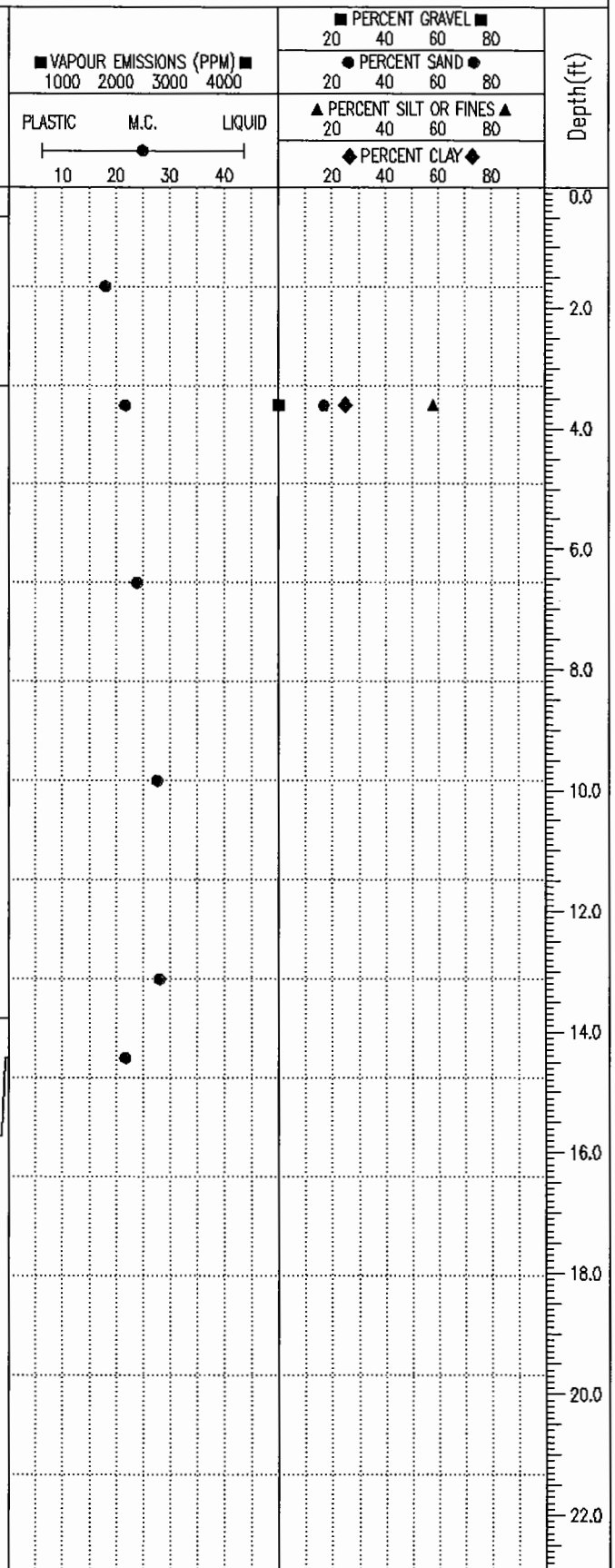
DATE	DWN.	CHKD.	FILE NO.	
JUNE 2005	JSB	MCP	1200153	FIGURE 3

Z:\0201Drawings\Whitehorse\1200000\1200153 Hot Springs Road Site Development\1200153 Fig 3 Typical Absorption.dwg, 6/27/2005 1:32:24 PM, \\whi-eb-dc001\WHI201COMMON

Geotechnical Evaluation–Site Development	CLIENT: Government of Yukon	TEST PIT NO: 1200153-TP01
Hot Springs Road	EXCAVATOR: Komatsu PC150LC	PROJECT NO: 1200153
Whitehorse, YT	UTM ZONE: 8 N6747518 E487768	ELEVATION:

SAMPLE TYPE ■ GRAB ⊘ NO RECOVERY

Depth(m)	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	SOIL DESCRIPTION
0.0					ORGANICS – 150 mm vegetation horizon
					SAND – some silt to silty, moist, loose to slightly compact, light grey–brown
1.0					SILT – clayey, some sand, frozen, moist (when thawed), light brown
2.0					– becomes SILT – trace sand, unfrozen, moist, slightly compact, light brown – light brown (oxidizing) to 2.5 m – grey (reducing) wet, loose below 2.5 m
3.0					– trace clay, trace sand, firm
4.0					SAND – some silt to silty, medium grain, poorly graded – loose, saturated, medium brown – medium brown
					END OF TESTPIT 4.4 m
5.0					SITE DESCRIPTION: Large (100 m dia.) opening surrounded by pine/aspen forest, alpine willow, alpine birch, kinnikinik, 10 m dia. grassy area, flat
6.0					
7.0					



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Whitehorse, Yukon

LOGGED BY: JTD	COMPLETION DEPTH: 4.4 m
REVIEWED BY: JRT	COMPLETE: 05/06/14
	Page 1 of 1

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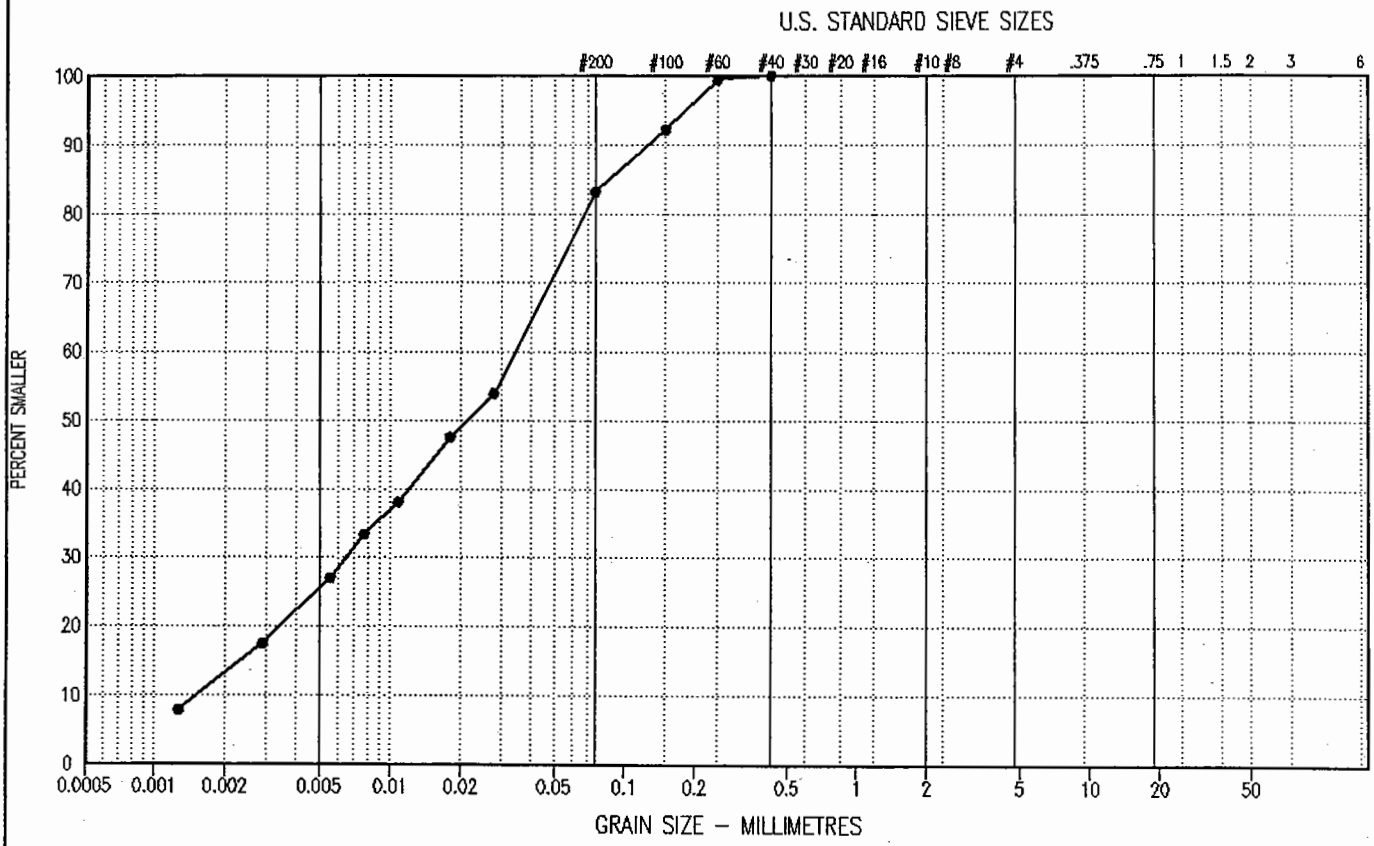
EBA Engineering

PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C
			CLAY %	SILT %	SAND %	GRAVEL %			
●—●	TP01	0.90 – 1.10	24.9	58	17	0	23.1	0.7	

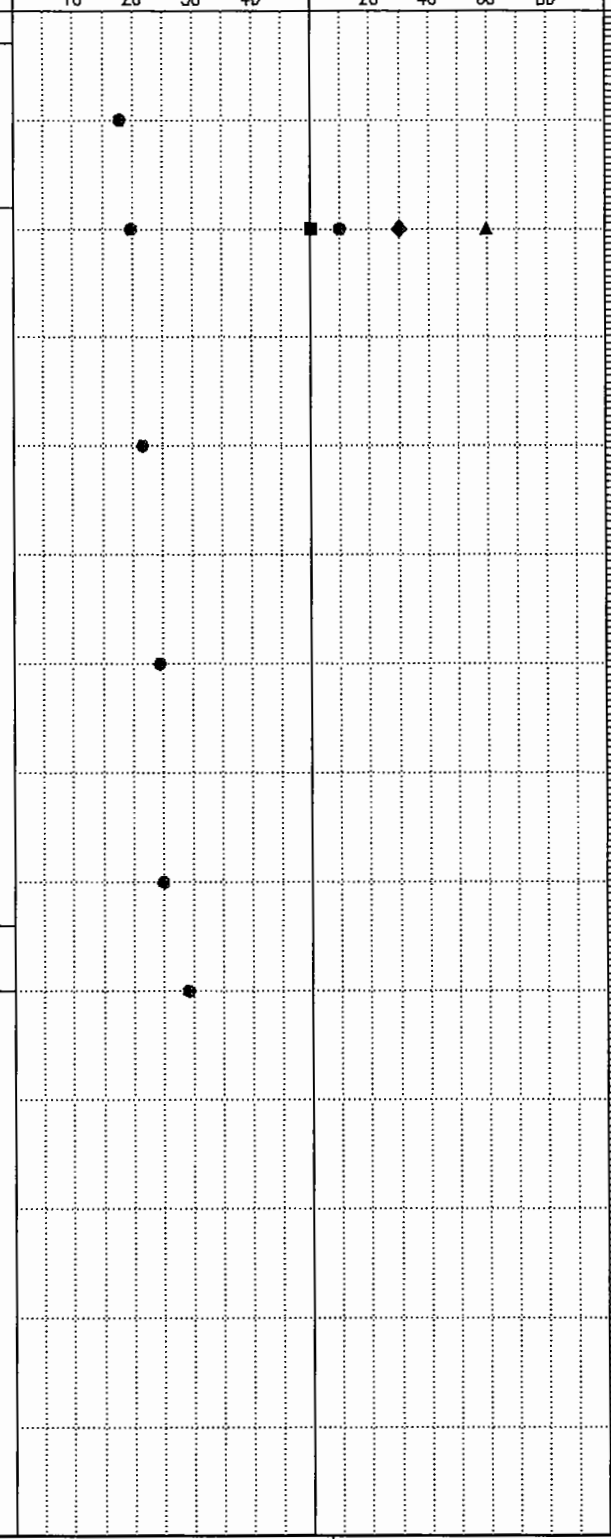
Project: 0201-1200153 Date Tested: / / BY: MB

Tested in accordance with ASTM D422 unless otherwise noted.

Geotechnical Evaluation–Site Development	CLIENT: Government of Yukon	TEST PIT NO: 1200153–TP02
Hot Springs Road	EXCAVATOR: Komatsu PC150LC	PROJECT NO: 1200153
Whitehorse, YT	UTM ZONE: 8 N6747731 E487475	ELEVATION:

SAMPLE TYPE ■ GRAB ⊘ NO RECOVERY

Depth(m)	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	SOIL DESCRIPTION
0.0					ORGANICS – 150 mm vegetation horizon
					SAND – some silt, frozen, moist when thawed, loose, light brown
1.0					SILT – clayey, trace sand, unfrozen, damp, soft, light brown
2.0					– frozen from 1.8 to 2.3 m, may be permafrost (Nbn)
					– unfrozen below 2.3 m
3.0					– becomes firm with depth
4.0					SILT – clayey, trace sand, wet to moist, varved, firm, light brown
					END OF TESTPIT 4.5 m
5.0					NOTE: No free water observed SITE CONDITIONS: Large opening (100 m dia.) surrounded by pine/aspen forest, alpine willow, alpine birch, kinnikinik, 10 m dia. grassy area, firm
6.0					
7.0					



EBA Engineering Consultants Ltd.
Whitehorse, Yukon

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REVIEWED BY: JRT	COMPLETE: 05/06/14

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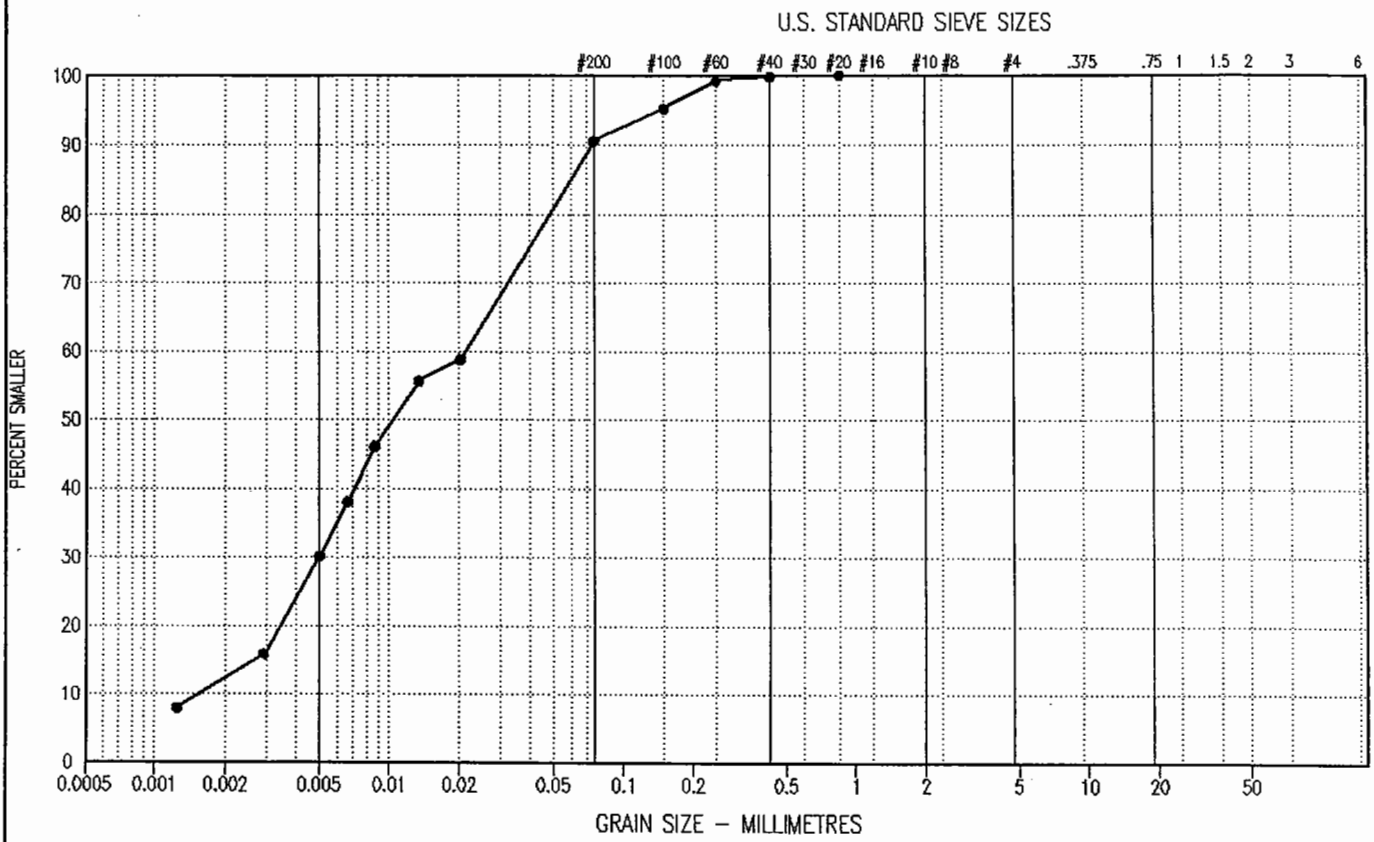
EBA Engineering

PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C
			CLAY %	SILT %	SAND %	GRAVEL %			
●—●	TP02	0.90 – 1.10	30.1	60	10	0	13.4	0.7	

Project: 0201-1200153 Date Tested: / / BY: MB

Tested in accordance with ASTM D422 unless otherwise noted.

Geotechnical Evaluation–Site Development	CLIENT: Government of Yukon	TEST PIT NO: 1200153-TP03
Hot Springs Road	EXCAVATOR: Komatsu PC150LC	PROJECT NO: 1200153
Whitehorse, YT	UTM ZONE: 8 N6747720 E487905	ELEVATION:

SAMPLE TYPE ■ GRAB ⊘ NO RECOVERY

Depth(m)	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	SOIL DESCRIPTION
0.0					ORGANICS – 150 mm vegetation horizon
					SAND – poorly graded, orange brown, eolian, dry, loose – some silt, light brown
1.0					SAND (eolian veneer) – some silt to silty, poorly graded, dry, loose, orangey brown
2.0					SILT – some sand, moist becoming damp with depth, firm below frozen soil horizon, light brown – frozen from 1.9 to 2.1 m – unfrozen, wet below
3.0					
4.0					SAND – some silt, medium grained, poorly graded, dry, loose, medium grey – becomes wet from 4.5 to 5.0 m
5.0					END OF TESTPIT 5.0 m NOTE: no water observed SITE CONDITIONS: flat, mixed spruce and pine forest, minor willow, kinnikinik, lichen (caribou)
6.0					
7.0					

■ VAPOUR EMISSIONS (PPM) ■ 1000 2000 3000 4000

PLASTIC M.C. LIQUID 10 20 30 40

■ PERCENT GRAVEL ■ 20 40 60 80

● PERCENT SAND ● 20 40 60 80

▲ PERCENT SILT OR FINES ▲ 20 40 60 80

◆ PERCENT CLAY ◆ 20 40 60 80

Depth(ft) 0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0

EBA Engineering Consultants Ltd. Whitehorse, Yukon	LOGGED BY: JTD	COMPLETION DEPTH: 5 m
	REVIEWED BY: JRT	COMPLETE: 05/06/14
		Page 1 of 1

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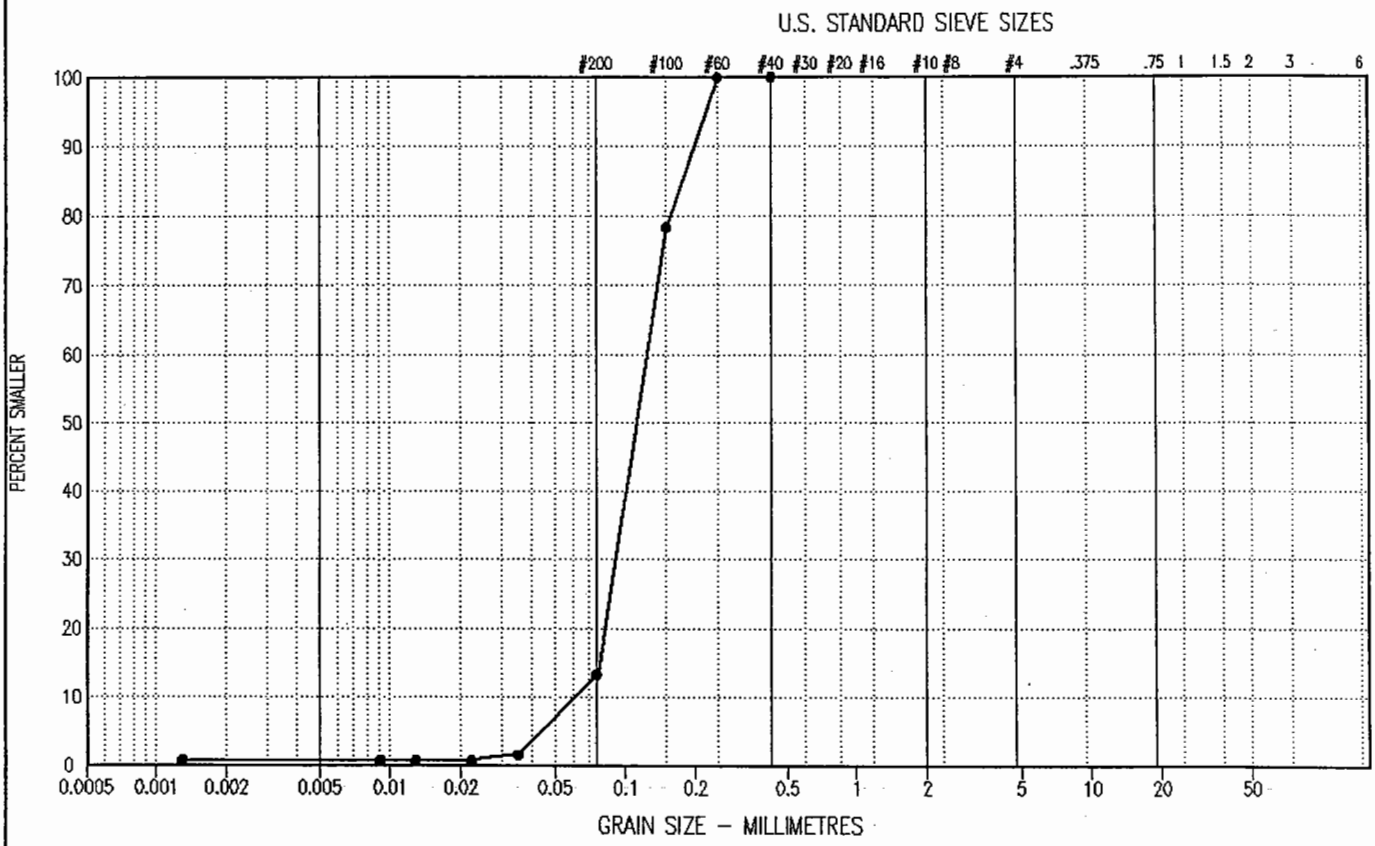
EBA Engineering

PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



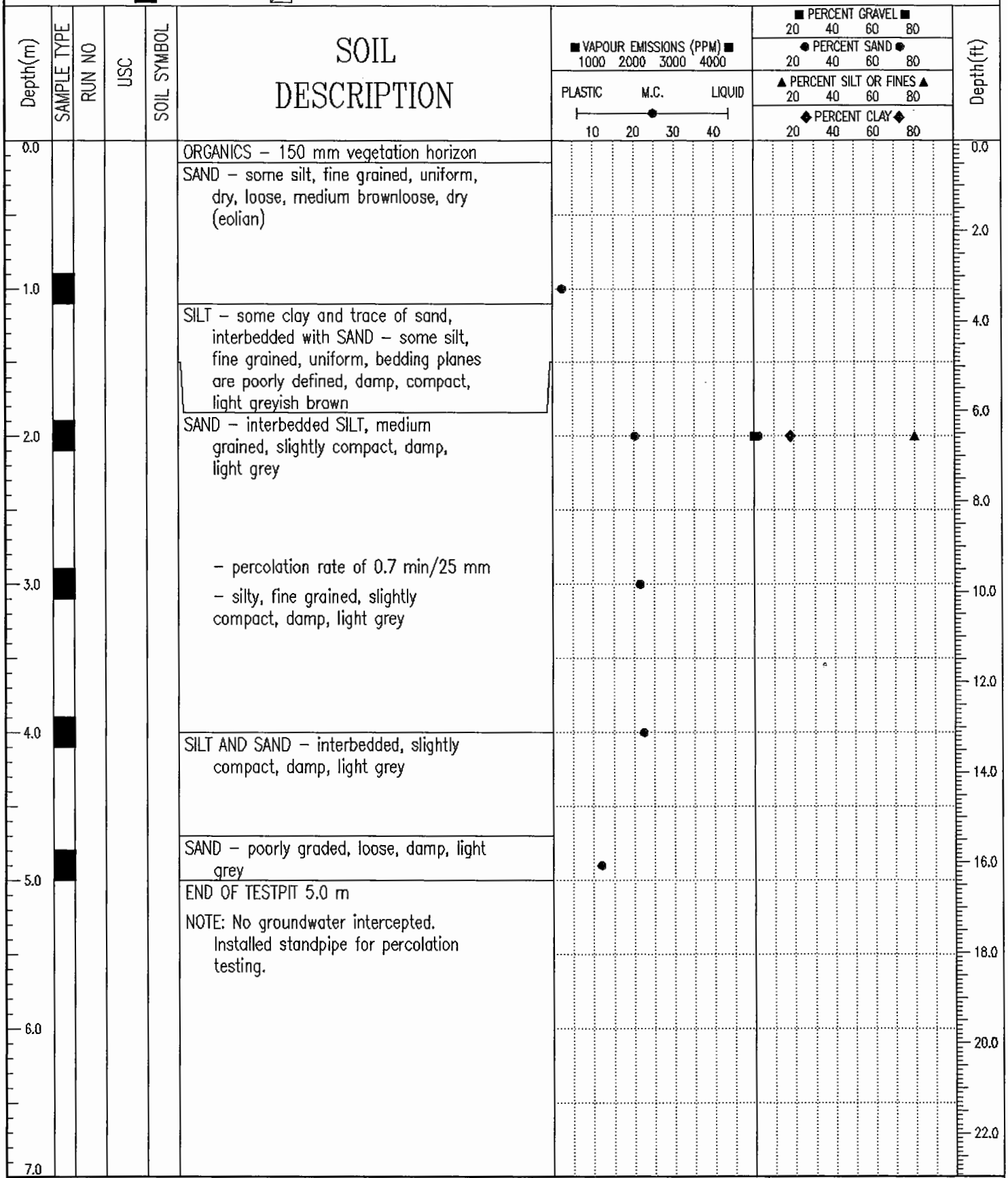
SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C
			CLAY %	SILT %	SAND %	GRAVEL %			
●——●	TP03	4.90 – 5.10	0.0	13	87	0	2.0	1.1	SM

Project: 0201-1200153 Date Tested: / / BY: MB

Tested in accordance with ASTM D422 unless otherwise noted.

Geotechnical Evaluation–Site Development	CLIENT: Government of Yukon	TEST PIT NO: 1200153-TP04
Hot Springs Road	EXCAVATOR: Komatsu PC150LC	PROJECT NO: 1200153
Whitehorse, YT	UTM ZONE: 8 N6747737 E488138	ELEVATION:

SAMPLE TYPE: ■ GRAB ⊘ NO RECOVERY



ORGANICS – 150 mm vegetation horizon

SAND – some silt, fine grained, uniform, dry, loose, medium brownloose, dry (eolian)

SILT – some clay and trace of sand, interbedded with SAND – some silt, fine grained, uniform, bedding planes are poorly defined, damp, compact, light greyish brown

SAND – interbedded SILT, medium grained, slightly compact, damp, light grey

– percolation rate of 0.7 min/25 mm

– silty, fine grained, slightly compact, damp, light grey

SILT AND SAND – interbedded, slightly compact, damp, light grey

SAND – poorly graded, loose, damp, light grey

END OF TESTPIT 5.0 m

NOTE: No groundwater intercepted. Installed standpipe for percolation testing.

EBA Engineering Consultants Ltd. Whitehorse, Yukon	LOGGED BY: JTD	COMPLETION DEPTH: 5 m
	REVIEWED BY: JRT	COMPLETE: 06/14/05
		Page 1 of 1

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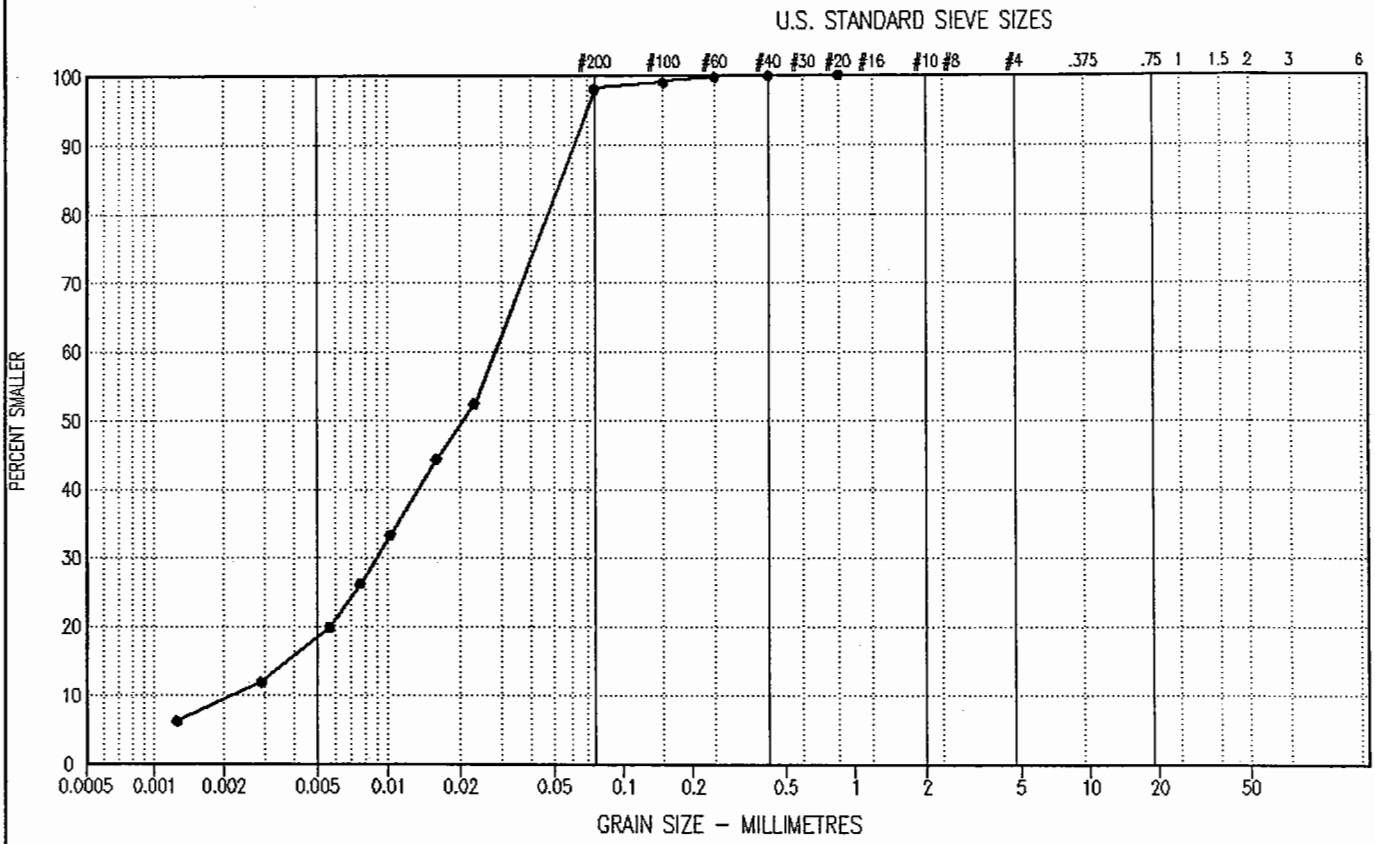
PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C
			CLAY %	SILT %	SAND %	GRAVEL %			
●—●	TP04	1.90 – 2.10	17.9	80	2	0	13.6	1.1	

Project: 0201-1200153 Date Tested: / / BY: MB

Tested in accordance with ASTM D422 unless otherwise noted.

Geotechnical Evaluation–Site Development	CLIENT: Government of Yukon	TEST PIT NO: 1200153-TP05
Hot Springs Road	EXCAVATOR: Komatsu PC150LC	PROJECT NO: 1200153
Whitehorse, YT	UTM ZONE: 8 N6747630 E488694	ELEVATION:

SAMPLE TYPE ■ GRAB ▨ NO RECOVERY

Depth(m)	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	SOIL DESCRIPTION
0.0					ORGANICS – 150 mm vegetation horizon
					SILT – some fine grained sand, damp, firm, light grey
1.0					
					SAND – trace of silt to clean, medium grained, poorly graded, dry, loose, light grey
					– percolation rate of 0.2 min/25 mm
2.0					
3.0					– testpit sloughing badly
					– testpit terminated at 4.0 due to sloughing soil
4.0					END OF TESTPIT 4.0 m
					NOTE: No groundwater intercepted. Installed standpipe for percolation testing.
					SITE DESCRIPTION: gentle rolling mature pine forest with minor spruce, willow, aspen and flax, lupine, sphagnum moss
5.0					– on existing trail
6.0					
7.0					

■ VAPOUR EMISSIONS (PPM) ■
1000 2000 3000 4000

PLASTIC M.C. LIQUID
10 20 30 40

■ PERCENT GRAVEL ■
20 40 60 80

● PERCENT SAND ●
20 40 60 80

▲ PERCENT SILT OR FINES ▲
20 40 60 80

◆ PERCENT CLAY ◆
20 40 60 80

Depth(ft)
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0

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Whitehorse, Yukon

LOGGED BY: JTD	COMPLETION DEPTH: 4 m
REVIEWED BY: JRT	COMPLETE: 06/05/14

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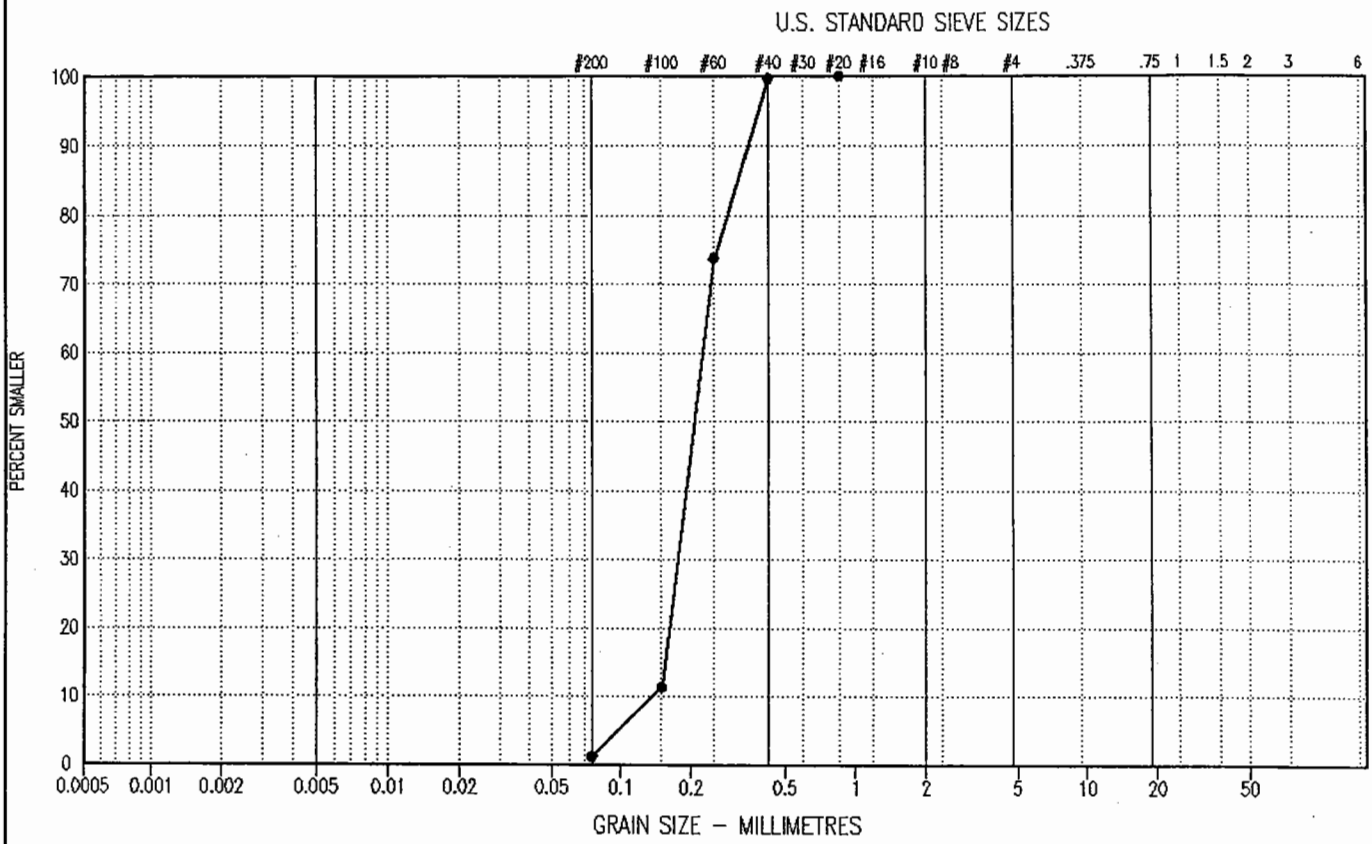
PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION			Cu	Cc	U.S.C
			CLAY & SILT %	SAND %	GRAVEL %			
●——●	TP05	1.90 – 2.10	1	99	0	1.6	1.0	SP

Project: 0201-1200153 Date Tested: 05/06/17 BY: MB

Tested in accordance with ASTM D422 unless otherwise noted.

Geotechnical Evaluation–Site Development	CLIENT: Government of Yukon	TEST PIT NO: 1200153–TP06
Hot Springs Road	EXCAVATOR: Komatsu PC150LC	PROJECT NO: 1200153
Whitehorse, YT	UTM ZONE: 8 N6747941 E488783	ELEVATION:

SAMPLE TYPE ■ GRAB ⊘ NO RECOVERY

Depth(m)	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	SOIL DESCRIPTION
0.0					ORGANICS – 100 mm vegetation horizon
					SAND AND SILT (eolian) – fine to medium grained, dry, medium orange/brown,
1.0					SILT – trace of fine sand, damp, loose, light grey
2.0					SAND – some silt, very fine grained, uniform, damp, loose, light brown
3.0					– silt lens from 3.0 – 3.1 m – medium grained, poorly graded, damp, loose, light grey
4.0					
5.0					END OF TESTPIT 5.0 m
					SITE CONDITIONS: Gentle to flat rolling, mature open pine forest, minor aspen and spruce, caribou lichen, kinnikinik
6.0					
7.0					

■ VAPOUR EMISSIONS (PPM) ■ 1000 2000 3000 4000

PLASTIC M.C. LIQUID 10 20 30 40

■ PERCENT GRAVEL ■ 20 40 60 80

● PERCENT SAND ● 20 40 60 80

▲ PERCENT SILT OR FINES ▲ 20 40 60 80

◆ PERCENT CLAY ◆ 20 40 60 80

Depth(ft): 0.0, 2.0, 4.0, 6.0, 8.0, 10.0, 12.0, 14.0, 16.0, 18.0, 20.0, 22.0

EBA Engineering Consultants Ltd. Whitehorse, Yukon	LOGGED BY: JTD	COMPLETION DEPTH: 5 m
	REVIEWED BY: JRT	COMPLETE: 06/14/05
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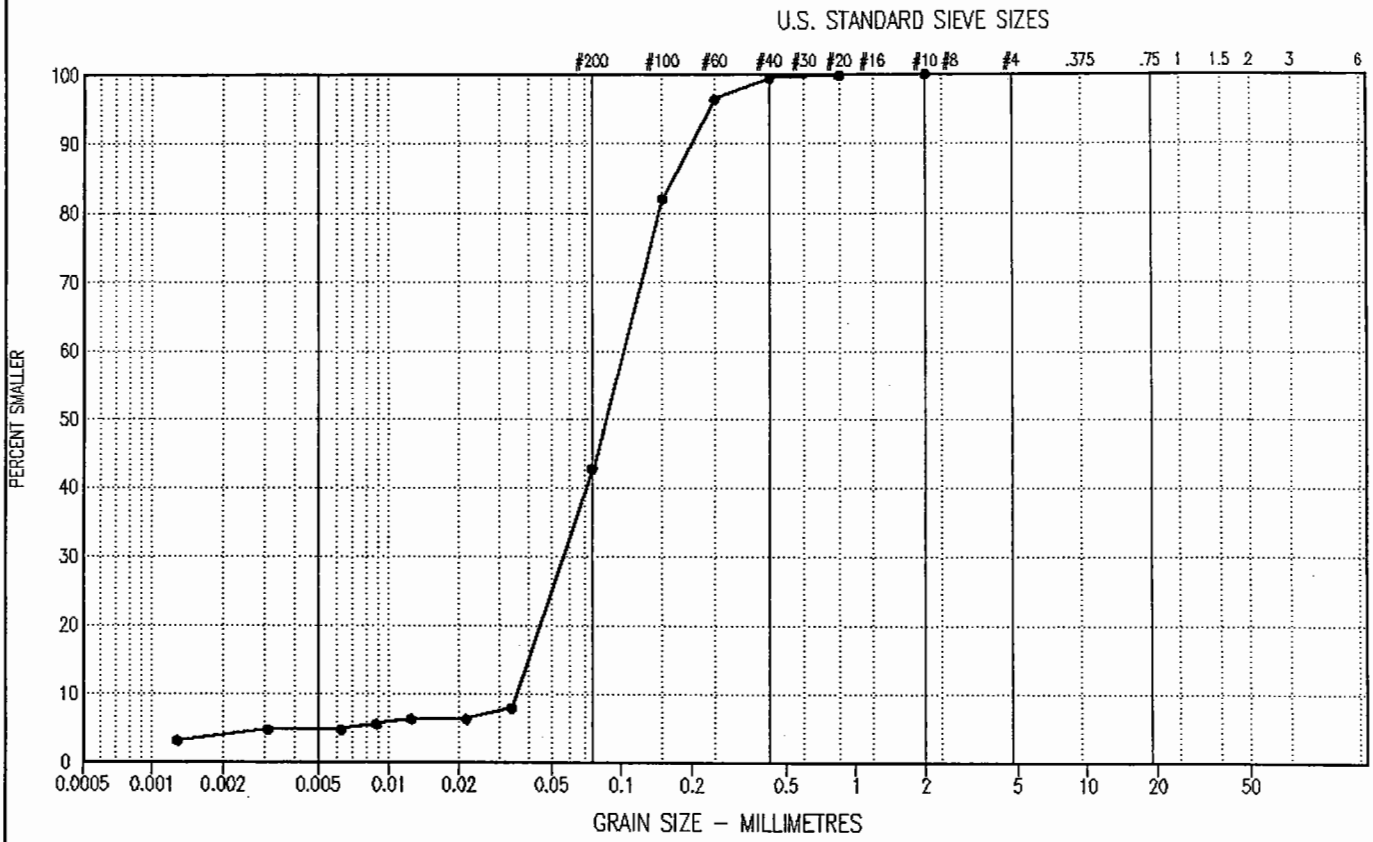
PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION				Cu	Cc	U.S.C
			CLAY %	SILT %	SAND %	GRAVEL %			
●	TP06	0.40 – 0.60	4.7	38	57	0	3.0	0.9	SM

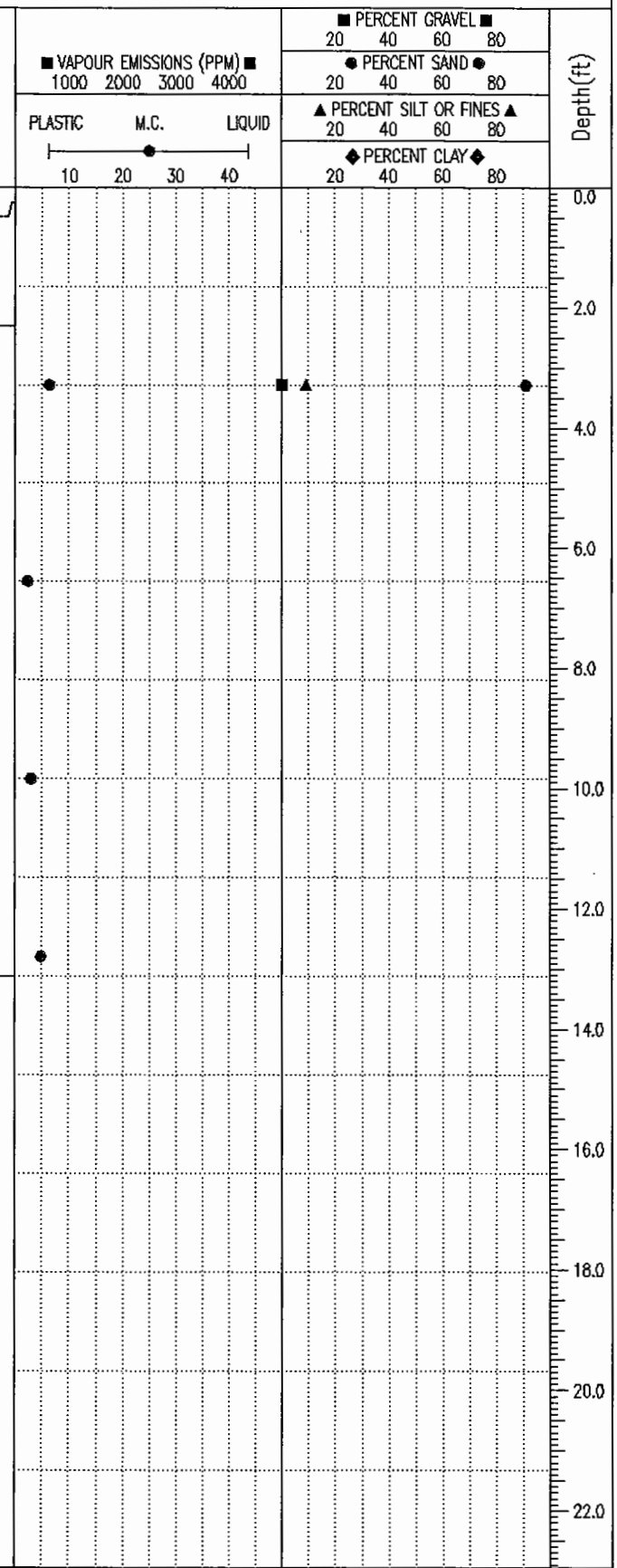
Project: 0201-1200153 Date Tested: / / BY: MB

Tested in accordance with ASTM D422 unless otherwise noted.

Geotechnical Evaluation–Site Development	CLIENT: Government of Yukon	TEST PIT NO: 1200153-TP07
Hot Springs Road	EXCAVATOR: Komatsu PC150LC	PROJECT NO: 1200153
Whitehorse, YT	UTM ZONE: 8 N6748214 E489167	ELEVATION:

SAMPLE TYPE ■ GRAB ⊘ NO RECOVERY

Depth(m)	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	SOIL DESCRIPTION
0.0					ORGANICS – 80 mm vegetation horizon
					SAND (eolian) – some silt, poorly graded, dry, loose, medium orange brown
1.0					SAND – trace to some silt, poorly graded, damp, loose, light grey
					– medium grained, slightly compact
4.0					END OF TESTPIT 4.0 m
					SITE CONDITIONS: Gentle rolling pine forest, open with minor aspen, spruce, caribou lichen, toadflax, kinnikinik
5.0					
6.0					
7.0					



EBA Engineering Consultants Ltd. Whitehorse, Yukon	LOGGED BY: JTD	COMPLETION DEPTH: 4 m
	REVIEWED BY: JRT	COMPLETE: 06/14/05
		Page 1 of 1

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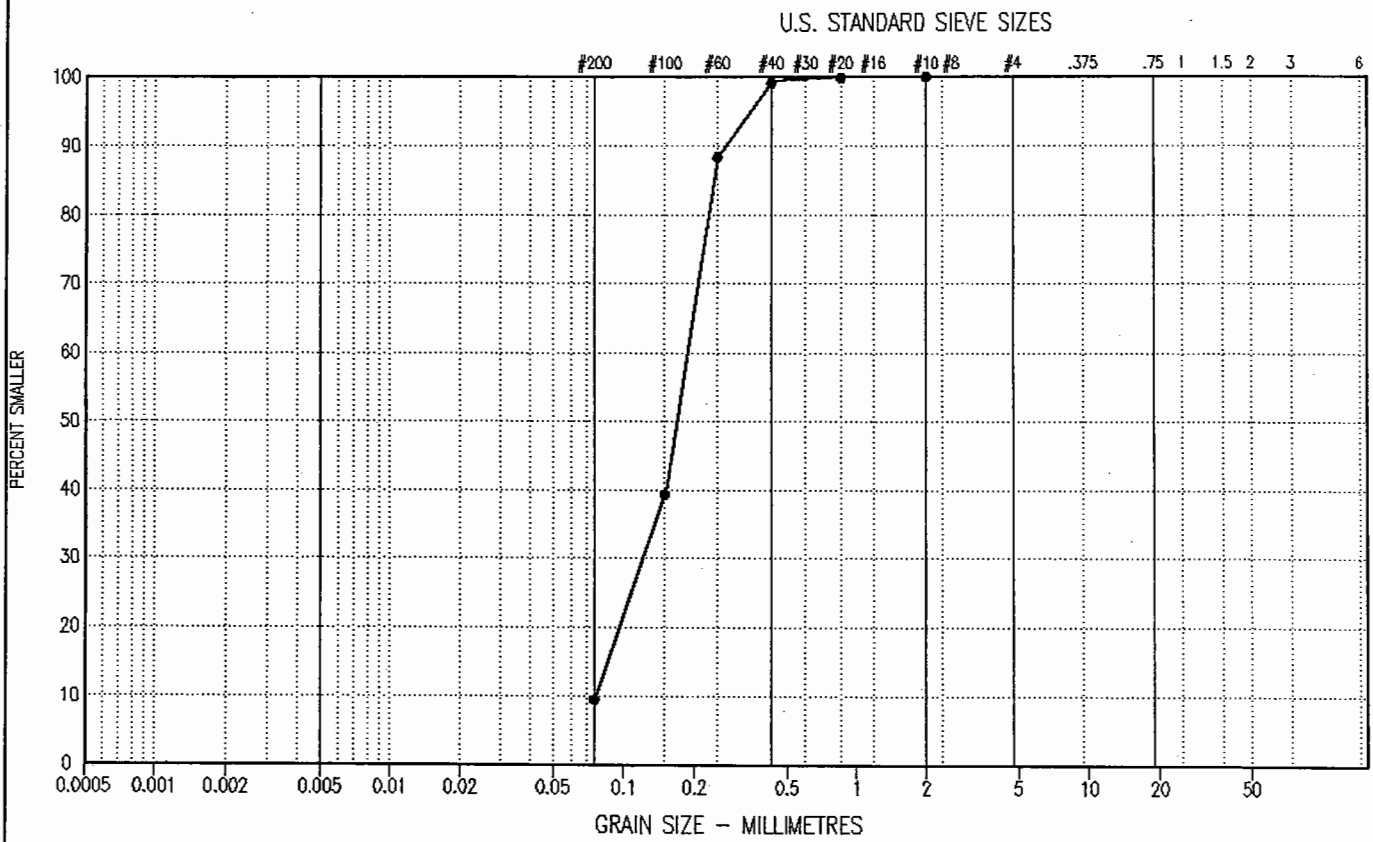
PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION			Cu	Cc	U.S.C
			CLAY & SILT %	SAND %	GRAVEL %			
●——●	TP07	0.90 – 1.10	9	91	0	2.5	1.1	SP-SM

Project: 0201-1200153 Date Tested: 05/06/17 BY: MB

Tested in accordance with ASTM D422 unless otherwise noted.

Geotechnical Evaluation–Site Development	CLIENT: Government of Yukon	TEST PIT NO: 1200153–TP08
Hot Springs Road	EXCAVATOR: Komatsu PC150LC	PROJECT NO: 1200153
Whitehorse, YT	UTM ZONE: 8 N6747963 E488487	ELEVATION:

SAMPLE TYPE ■ GRAB ▨ NO RECOVERY

Depth(m)	SAMPLE TYPE	RUN NO	USC	SOIL SYMBOL	SOIL DESCRIPTION
0.0					ORGANICS – 100 mm vegetation horizon
					SAND – trace to some silt, medium grained, poorly graded, dry to damp, loose, light brown to light grey
1.0	■				
2.0	■				
3.0	■				– dry sand sloughing during excavation
4.0	■				
5.0	■				END OF TESTPIT 5.0 m
					SITE CONDITIONS: Gentle ridged/gullied pine forest with minor aspen, kinnikinik, minor caribou lichen
6.0					
7.0					

■ VAPOUR EMISSIONS (PPM) ■ 1000 2000 3000 4000

PLASTIC M.C. LIQUID 10 20 30 40

■ PERCENT GRAVEL ■ 20 40 60 80

● PERCENT SAND ● 20 40 60 80

▲ PERCENT SILT OR FINES ▲ 20 40 60 80

◆ PERCENT CLAY ◆ 20 40 60 80

Depth(ft): 0.0, 2.0, 4.0, 6.0, 8.0, 10.0, 12.0, 14.0, 16.0, 18.0, 20.0, 22.0

EBA Engineering Consultants Ltd.
Whitehorse, Yukon

LOGGED BY: JTD	COMPLETION DEPTH: 5 m
REVIEWED BY: JRT	COMPLETE: 06/14/05

05/07/27 11:36AM (YUKON-T7)

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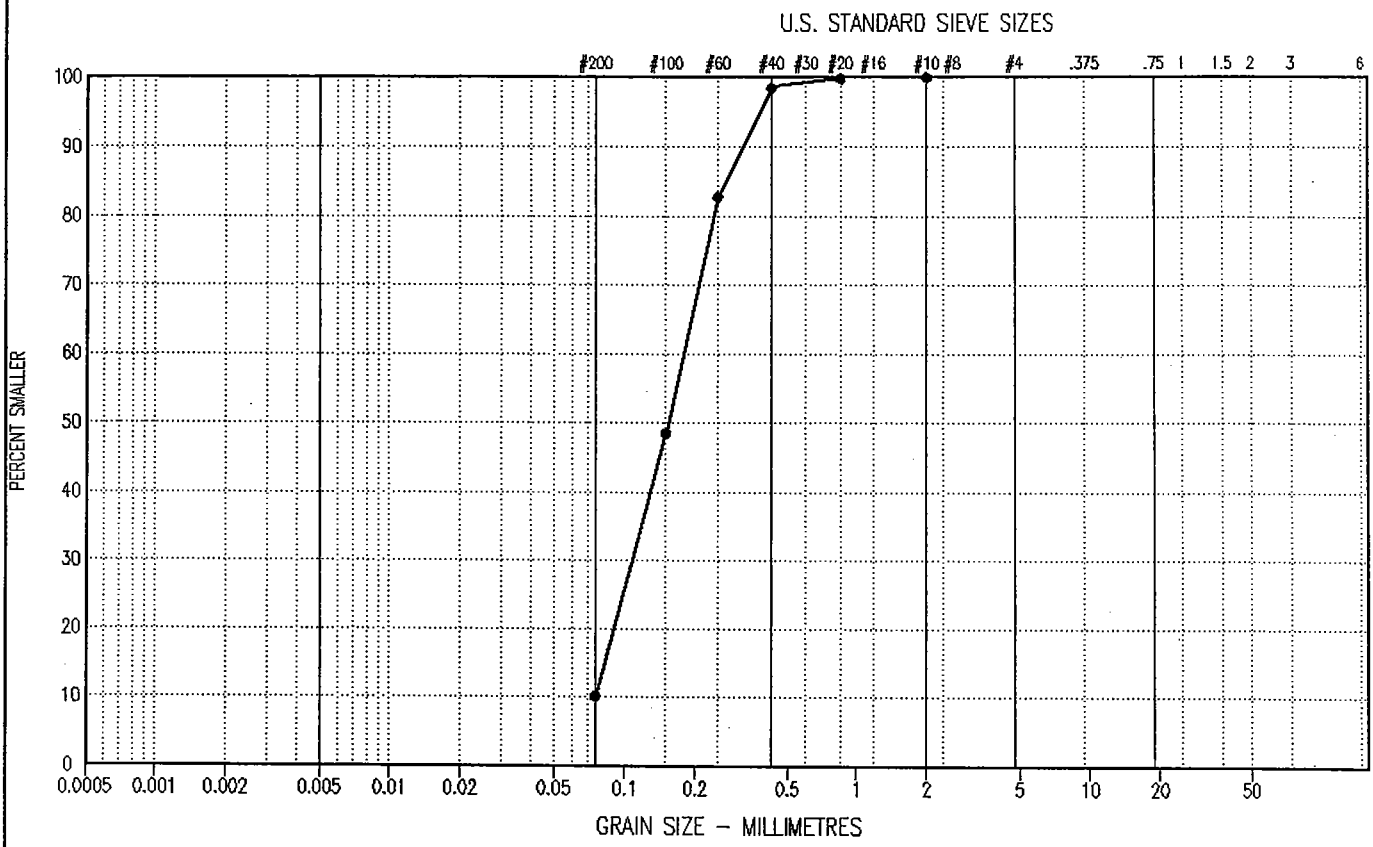
PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (m)	DESCRIPTION			Cu	Cc	U.S.C
			CLAY & SILT %	SAND %	GRAVEL %			
●——●	TP08	0.90 – 1.10	10	90	0	2.5	0.9	SP-SM

Project: 0201-1200153 Date Tested: 05/06/17 BY: MB

Tested in accordance with ASTM D422 unless otherwise noted.

Heritage Overview Assessment, Takhini Hot Springs Road

Preliminary Report

May 2005

Prepared by

Christian D. Thomas
of
Thomas Heritage Consulting
Whitehorse

for

Department of Community Services
Community Development Branch
Government of Yukon

Executive Summary

On 23 May 2005 the consultant visited the 104 ha Government of Yukon Reserve on the Northwest side of the Takhini Hot Springs Road between the power line right of way and the Pilot Mountain Subdivision (Figure 1). The centre of the study area is located at UTM coordinate Zone 8 V E048800 N6747500. The study area is being assessed for the purpose of developing a residential subdivision. The objectives of the study are to 1) visit the site and identify and assess topographic landforms with elevated potential for the presence of heritage sites, 2) Consult Cultural Service Branch, Government of Yukon regarding the presence of known sites, and 3) Consult with lands and resources staff from the Ta'an Kwatch'an Council and the Kwanlin Dun First Nation to assess past land use at the site and the presence of known historic resources.

The study site is directly to the south of Pilot Mountain on a low flat forested plain that is underlain by sands of either fluvial or eolian origin. The local vegetation is composed of closed white spruce forest with an under growth of grass, shrubs and moss (Figure 4, background). Linear transects of the study site revealed no prominent topographical variances from east to west. As one moves from south to north the topography begins to rise at the base of Pilot Mountain. No moving or standing water bodies exist within the study site.

The heritage assessment was completed by walking and driving transects through the study site with the intention of observing and documenting 1) sites that may have elevated potential for presence of heritage sites, and 2) surficial historic resources. In the former case the consultant focused primarily on the northern portion of the study area where base of Pilot Mountain where some elevated topography does exist (Figure 3). A program of shovel tests was not undertaken within the study area.

Transects of the study area did not result in the identification of moderate to high potential sites. Though some elevated topography exists, these features do not overlook water bodies or game habitat and as such are not considered to be the type of site that would have attract repeated human occupation and have led to the formation of an archaeological deposit.

Government agencies (Territorial and First Nation) were consulted regarding the presence of known heritage sites within the development area. No known sites have been observed or documented within the study site. A Ta'an Kwach'an land selection (C-59B) does adjoin the study area but is not considered to be related a specific heritage resource in the immediate area.

In conclusion, the study area is considered to have low potential for the presence of heritage resources. The consultant feels that heritage resources will not be impacted by the proposed development. For this reason it is the consultant's opinion that further

heritage resource inventory and assessment work is *not* needed in advance of the development of the Government reserve.

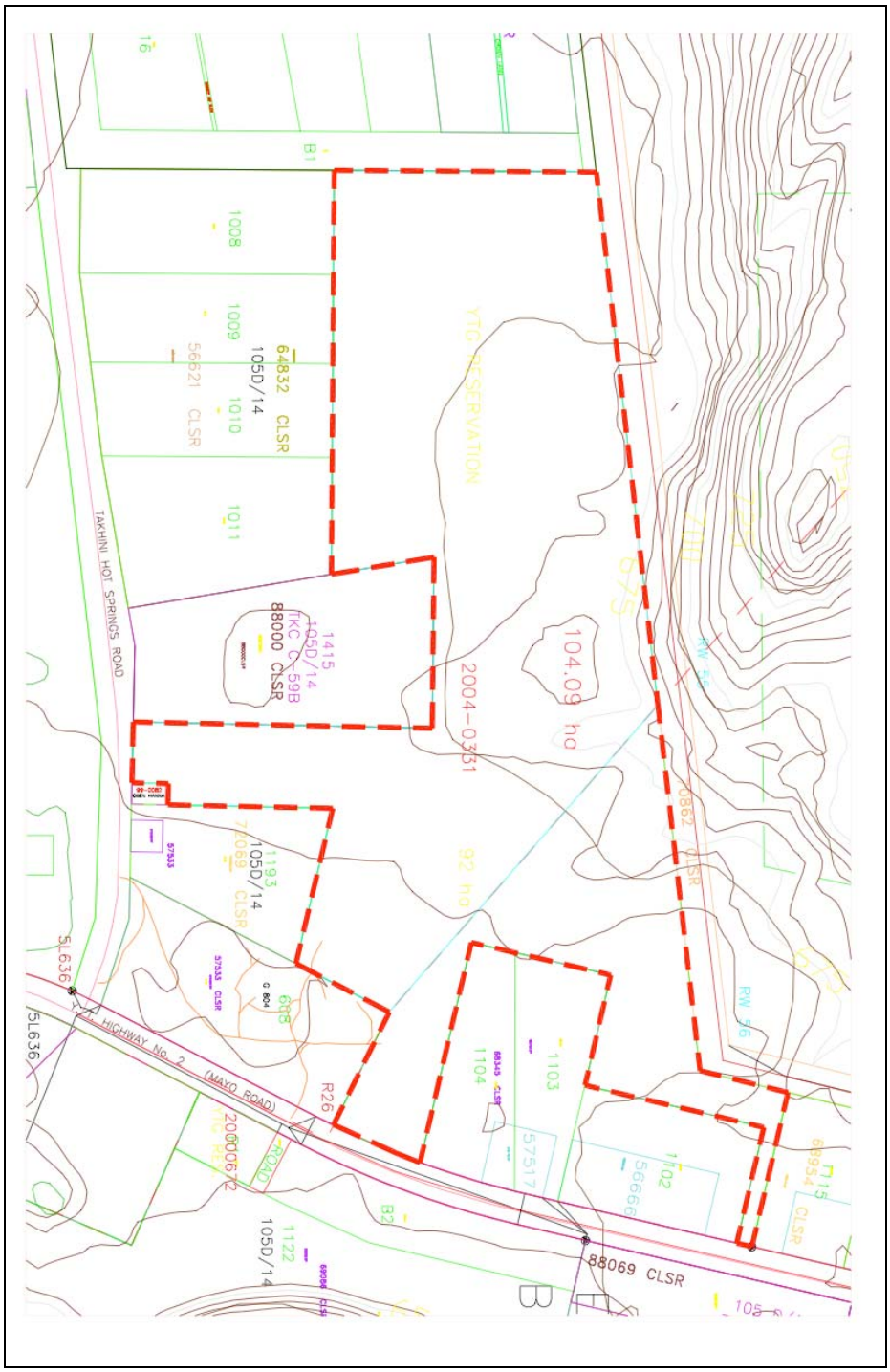


Figure 1: Map of the development area.

Figure 2: Photo of the northwest corner of the development area.

Figure 3: Elevated hills at the border of the development area.

Figure 4: View to south of the forested development area. Note the lack of elevated terrain features.

Responsible Authorities

Responsible Authorities for this project, subsequent to the mentioned EAA triggers in Section 1.3, are:

1. Yukon Government, Department of Community Services – Community Development Branch;
2. Yukon Government, Department of Energy Mines & Resources

EAA Determination

Section 16 (1) (a) – Project may proceed as it is not likely to cause significant adverse environmental effects.

_____ _____

Lyle Henderson Date
Director
EMR, Lands Branch

_____ _____

Eric Magnuson Date
Director
Community Services