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Geotechnical Evaluation
Preliminary Site Assessment
Proposed YG Residential Subdivision
Mayo, Yukon - 2015

Prepared For: **Urban Systems**

Date : **September 7, 2015**

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1.0 INTRODUCTION

Chilkoot Geological Engineers Ltd. was retained by *Urban Systems* to conduct a preliminary site assessment for a proposed Yukon Government (YG) rural residential subdivision. The proposed sub-division is to be located within a ~ 280 ha study area which is located approximately 4 to 6 km north of Mayo, Yukon as noted in Figure 1.

The objective of our preliminary site assessment was to assess the development potential of regions within the study area relative to geotechnical aspects for rural residential subdivision development.

Authorization to proceed with the evaluation was granted by *Urban Systems* - Project Manager, Mr.Jeff Barrett, M.Sc., MLA on July 6th, 2015. The field work was conducted on July 7th, 2015 in accordance with our July 2nd, 2015 proposal.

The findings of our assessment have been presented herein along with a brief description of our methodology.

2.0 METHODOLOGY

Our methodology was comprised of a literature review and site reconnaissance.

2.1 Literature Review

A literature review was conducted to evaluate satellite imagery, a selection of aerial photos, topographical data and other technical resources which were readily available for the study area.

2.1.1 Satellite Imagery

A review of satellite imagery from *Google Earth* allowed for an assessment of the site conditions and trail locations relative to the more recent imagery. In brief, satellite imagery from June 15th, June 28th and September 9th, 2004 were available for review. A copy of the study area limits relative to the June 15th, 2004 imagery (which provided the best resolution relative to the other dates) has been attached as Figure 2.

2.1.2 Aerial Photos

In addition to the satellite imagery, a selection of aerial photos were obtained from the *YG – Energy, Mines and Resources* library to allow for a more detailed assessment.

Flight Line	Photos	Year	Comments
A12133	# 185-188	1949	20,000 foot altitude
A18953	# 114-115	1958	7,500 foot altitude
NW9582	# 4-9	1982	1:8000 scale
A26585	# 149-151	1984	13,000 foot altitude

In brief, the airphotos noted that a variety of activities have occurred with the limits of the study area. Specifically, the following general observations were individually noted;

1949 – Flight Line A12133

The airphoto notes the presence of a residence located just beyond the north-western limits. A number of large clearings are present in this area and along an access road which leads to the residence. The access road is located at the approximate location of present day Mayo River Interpretive Trail which runs roughly east-west on the north periphery of the study area. A trail crosses through the central areas of the study area. It appears that a borrow pit is located within the confines of the study area near the eastern periphery along the old Silver Trail. Some plots of land have been cleared in the *Nav Canada* site which is centrally located adjacent to the study areas southern periphery.

1958 - Flight Line A18953

The residence located just beyond the north-western limits is still present. A considerable amount of disturbances (indicative of potential mining/exploration bull-dozed test-pits or else oil/gas exploration) can be noted on either side of the present day *Nav Canada* access road. The *Nav Canada* site has been cleared and several structures can be noted. Several trails lead to the *Nav Canada* site directly from the Silver Trail. The present day power-line right-of-way which bisects the central regions of the study area approximately north-south can be seen. A slight re-alignment to the Silver Trail to essentially its present day configuration can be noted.

1982 - Flight Line NW9582

The exploration sites along the *Nav Canada* trail are overgrown. A considerable number of vehicles can be seen at the Nav Canada site. The width of the power-line right-of-way appears to have been increased. A prominent clearing (which appears to an agricultural plot) can be noted within the northern limits of the site. This area appears to be an expansion to clearing work conducted in the 1958 photo. It's apparent that a small cleared area (located approximately 100 m north-west of the *Nav Canada* access road) has

become overgrown. The purpose of the former clearing could not be determined.

1984 - Flight Line A26585

The overall conditions appear to be relatively unchanged compared to the 1982 aerial photos.

A selection of these airphotos have been attached as Figure 3. The approximate limits of the study area has been super-imposed on the respective aerial photos.

2.1.3 Topographical Data

Information regarding local elevations were obtained from the *Yukon Government – Water Placer Atlas* to better assess the terrain and local geomorphology. The prominent meltwater channel which bisects the site with an approximate north-east to south-west trend is clearly apparent.

2.1.4 Surficial Geology Map

A 1:20,000 scale surficial geology map, Yukon Geological Survey - Open File 2011-3 – Surficial Geology of the Village of Mayo (part of NTS 105M/12) Yukon (by Kristen E.Kennedy) was reviewed to assist in our assessment. In general, the surficial geology map noted that the study area was located within a glacio-fluvial deposit.

The northern and eastern regions of the study area were described in surficial geology map as ‘gszFGtf//zsEw’. The primary materials in this region are comprised of glaciofluvial deposits which include materials which have been deposited by glacial meltwater. The materials typically range from non-sorted and non-bedded gravel made up of a vast range of particle sizes to moderately to well sorted, stratified gravel. Kettled structures within these deposits are indicative of the collapse of material due to the melting of underlying ice. The secondary soil unit which (may comprise 10-29% of the map unit) is comprised of eolian deposits. These materials

are comprised of fine grained sands and coarse silts which are transported and deposited by wind. The open file suggested that the thickness of the deposits are typically 10 to 30 cm thick in regions which have not undergone modification since deposition. However, thicker deposits which measure up to 1 meter thick are present near the meltwater channel based upon our field observations. The agricultural report suggests the eolian cover is generally thicker in the south-eastern regions of the site relative to the north-western areas.

The central and southern-western regions of the site were described as 'zsEv\gszFGp-E'. These materials are comprised of fine grained eolian deposits which overly coarse grained glacio-fluvial materials. The deposits have been channeled by meltwater.
The regions to the north were described as morainal deposits. The moraines are generally comprised of a heterogeneous mixture of sand, silt and clay particle sizes.

The regions to the east were described as lacustrine and organic deposits. The lacustrine deposits are lake bed sediments which are comprised of stratified layers of sand, silt and clay. The organic deposits are comprised of materials which contain greater than 30 percent organic matter and are located in low-lying commonly wet areas.

A selection of the surficial geology map in the region of the study area has been attached in Figure 4.

2.1.5 Agricultural Report

A report entitled *'Potential Development of Mayo Area Lands'*, was provided to our firm by *Urban Systems* to provide additional background information. In brief, the report summarizes the development potential of the residual portion of two lots (# 41 & # 1010) following partitioning of the lots to allow for ongoing operation and maintenance of the hydroelectric facility and briefly discusses the adjacent vacant lands. The approximate northern limits of the study were noted on Figure 2.

In brief, the report discusses the agricultural potential of regions located within the (approximate) southern half of the proposed study area. The report provides general information as to the thickness of the silt and organic overburden located above the granular glacio-fluvial materials. In brief, the report indicated that of the 134 ha of (YG purchased) land within the study area, 70.5 ha appeared to be suitable for either agricultural or else other development. In addition, the report suggested a phased development approach as 100 to 175 ha of good agricultural soils were available on vacant territorial lands adjacent to Lots 41 and 1010 however 'the primary limitation to this site is the poor potential for access to irrigation water'. The report also referenced a 1998 study conducted by YG – Agricultural Branch which was conducted to assess the agricultural capability of lands in the Mayo area. The study classified the majority of the regions within their study area as (Agricultural Class) 4CM. contained < 30 cm of loamy soils which overlay the granular glacio-fluvial deposits.

A copy of the report has been attached in Appendix A.

2.1.6 Other Resources

The *Yukon Government – Water Placer Atlas* website was also reviewed as it provided the boundaries of various land dispositions, highway kilometer posts, drainage regimes and other similar types of information. A selection of the *Water Placer Atlas* in the region of the study area has been provided in Figure 1.

2.2 Site Reconnaissance

A site reconnaissance was conducted on July 7th, 2015 to note relevant site features and stratigraphic conditions along the exposed road embankments which traverse the study area and to assess the overall field conditions. The intent of the reconnaissance was to identify regions within the study area which may be more favorable for rural residential subdivision development. The effectiveness of the site reconnaissance was somewhat restricted as it was not possible to complete the aerial photograph component of the literature review prior to the field work. As such, there were certain regions (such as the disturbed regions along the *Nav Canada* Access Road, which were not explored, as these areas were overgrown and thus not readily apparent at the time of our reconnaissance. In brief, the work involved traversing the site by 4x4 vehicle as well as on foot to note the local conditions. During this time our observations were documented through a combination of field notes, photographs and (hand held) GPS. A selection of photographs which were taken to document the field conditions have been attached as Appendix B. The approximate locations of these photos have been noted in Figure 2.

In general, excluding heavily sloped regions and remnants of a prominent meltwater channel (which trended approximately east-west through central regions of the site) the majority of the study area appeared to be favorable for development based upon the relatively level topography and nature of the vegetation. With respect to the existing trails which traversed the site, we noted that the condition of the *Nav Canada* access road was in generally worse condition relative to the access road which leads to the *Mayo River Interpretive Trail* (located on the north periphery of the study area).

3.0 SITE CONDITIONS

3.1 Study Area

The study area, which is approximately 280 ha in size, is located approximately 4 to 6 km north of the Village of Mayo, Yukon on (predominately) the left hand side of the Silver Trail (Hwy # 11). The site is located approximately 2 km south of *Yukon Energy's* – Mayo A & B hydro facility and associated Wareham Lake Reservoir.

The elevations in the region of the study area

510 meters were also noted in the kettled depressions and south-western. Higher elevations (ranging to ~ 590 meters) lie immediately north of the study area. The Mayo River which flows to the south, lies to the west of the study area near elevations of ~ 510 meters.

The vegetation is comprised of mixed deciduous and boreal forest. The understory consists of a variety of mosses, willow and shrubs.

The study area is dominated be a massive glacio-fluvial deposit which is bisected by a remnant glacial meltwater channel which appears to have flowed through the area from the north-east to the south-west. In general, higher elevations are encountered along the north regions of the study area. A low lying glacio-lacustrine deposit lies to the east.

Historically the area appears to have been intermittently developed through a number of various agricultural plots, (mining) exploration and a number of other activities, the purpose of which could not be determined. As such, there are a variety of existing and historical trails which traverse through the area. While the Silver Trail # 11 (which bisects the eastern side of the study area in an approximately north-south orientation) appears to be the primary road which has traversed through the site, there

are a number of other roads and historical trails which have spawned from the through-fare. Specifically, the origins of the existing *Nav-Canada* access road (which traverses the south-eastern quadrant of the site – See Figure 2) appears to have been from some type of exploration road as a number of exploration (possibly test pits appear to have been excavated on either side of it. These exploration features, which were likely created by bull-dozer test pits, are clearly evident on the 1958 air-photos (See Figure 3). This access road, which stems from the LHS of km 55 of the Silver Trail (# 11), and measures approximately 1.0 km long (within the study area) ultimately leads to the *Nav Canada* site which is centrally located immediately beyond the study areas southern periphery.

A right-of-way stems from the area of the *Nav Canada* site and centrally bisects the study area in an approximately north-south trend. An overhead powerline which originates from the hydro-electric facility located approximately 1.7 km north of the study area, is currently located within the right-of-way.

An access road which leads to the *Mayo River Interpretive Trail* traverses the northern region of the study area (approximately east-west).

3.2 Physiographic Setting

The Village of Mayo is located within the Stewart River Plateau near the confluence of the Stewart and Mayo Rivers. The physiography in this region is dominated by U-shaped valleys which contain terraces and ultimately rolling hills near the valley bottoms.

3.3 Surficial Geology

The region in and around the study area is dominated by glacial deposits. These are comprised of morainal deposits located at higher elevations, north of the study area.

Below this, the retreating ice left a series of deglacial lakes, deltas and terraces. These deposits were comprised of either fine grained lacustrine sediments or else coarse grained glacio-fluvial deposits.

The soils noted within the study area are comprised of predominately glacio-fluvial deposits which are overlain by a thin veneer of eolian deposits. The central and western regions of these deposits have been channeled by meltwater.

3.4 Geomorphology

The local geomorphology in the region of the study area is complex and has been heavily influenced by glaciation. The study area itself is comprised of a glacio-fluvial terrace which has been incised by glacial melt-water channels in an approximate north-east to south-west trend. Kettle-like features are located within these areas. Regionally, the meltwater flowed south-west towards the present day Mayo River.

3.5 Soil Stratigraphy

Based upon our observations of the road cut embankments along the power-line right-of-way, it appears that ~ 0.9 meters of fine grained silty soils overlie the granular glacio-fluvial deposit. These fine grained materials are overlain with approximately 0.1 to 0.2 meters of surficial organics.

3.6 Permafrost

As the area lies within the zone of discontinuous permafrost, it may be present within the study area, particularly in low-lying regions which are heavily shaded and located on the north slopes of local relief. The local depressions in the region of the meltwater channel (and other low lying areas), likely harbors permafrost.

3.7 Watercourses

The study area lies directly east of the Mayo River and approximately 1.7 km south of *Yukon Energy's* - Mayo hydro facility and Wareham Lake Reservoir.

4.0 DISCUSSIONS

As the intent of our assessment was to delineate regions within the study area which may be more favorable to rural residential subdivision development, our firm generated a terrain map which illustrates the relative geotechnical development potential within the study area. This terrain map (which was generated from *Google Earth* imagery) has been attached as Figure 5. In brief, regions within the study area were identified as having either low, moderate or high development potential relative to rural residential subdivision development based upon a number of terrain features, historical development, drainage characteristic etc. The secondary number noted adjacent to each of the classified areas (ie. (1), (2), etc.) have been provided merely for reference purposes. The numbers are not meant to represent a hierarchal classification of which areas may be more (or less) suited for development.

A brief description of each of the individual regions has been identified as follows;

High – While site specific limitations will need to be identified, development within these areas will generally be unrestricted provided standard design and construction practices are employed.

(1) – Some of the highest elevations of the study area are located within this region. The terrain profile is generally level and access to much of the area is available through the presence of the access road which leads to the Mayo River Interpretive Trail (photo # 6).

(2) – Located on the right-hand-side of the Silver Trail, this region is also situated in areas where some of the highest elevations within the study area are noted. The eastern periphery of this area should have a minimum set-back of 100 meters from the top of the prominent escarpment located to the east. The access to this area will need to be carefully considered as the

elevations to the Silver Trail will vary along the south-western periphery.

(3) – Located on the south side of the prominent meltwater channel, this region is well situated given generally level terrain and its proximity to the powerline right-of-way.

Moderate – This central region was given a moderate rating due to the historical mining activities that occurred in the area. The test-pits and disturbed sub-surface may represent potential geotechnical liabilities due to the unconsolidated nature of the disturbed materials in these areas. In addition, given the mining activities, there would be a higher potential for the presence of environment liabilities in these areas further reducing the overall development potential.

Low – The low rating was given to these areas due to generally poor site access, poor local drainage considerations and/or presence of steep slopes. Construction of infrastructure within these zones should be carefully considered on a case-by-case basis.

(1) – This region is located on the west side of the remnant meltwater channel. The area harbors some of the lower elevations within the study area.

(2) – This region is located on the east side of the remnant meltwater channel. The presence of higher ground to the west (Area A) makes this area a local depression where overall drainage will be poor.

(3) – Located on the eastern periphery of the study area, the region is comprised of steep slopes and associated 100 meter setbacks. These setback distances can be reduced provided a slope stability analysis supports favorable conditions.

(4) – This location may harbor a thermokarst pond.

Area A – This region should be explored in greater detail as it may allow for the construction of a secondary access road to link the ‘High (1)’ and ‘High (2)’ regions and essentially create a ring road to allow for secondary means of egress from either of the two areas.

5.0 RECOMMENDATIONS

A geotechnical evaluation should be conducted by qualified personnel prior to subdivision development to verify our findings and identify the geotechnical parameters related to residential building construction, septic system feasibility and access road construction/upgrading. Specifically, the evaluation should characterize the local subsurface conditions through comprehensive auger drilling and laboratory work programs and provide geotechnical recommendations regarding; building foundations, allowable bearing capacities, septic field suitability and road structures.

Standard 30 meter setbacks should be maintained from the melt-water channel (top of slope). These setbacks should be increased to 100 meters in regions located on the eastern and western peripheries (where prominent slopes are present) until more detailed subsurface evaluations are conducted. Additional consideration will also be required to ascertain whether or not there may be hazards due to the study areas proximity to *Yukon Energy's* – Mayo A & B hydro facility.

A detailed topographical survey (which extends beyond the limits of the study area) should be conducted to allow for additional evaluation from a geotechnical perspective.

Further to the proposed regional geotechnical evaluation, site specific evaluations should be conducted once building sites and septic system locations have been identified to verify the founding and anticipated construction conditions. As a minimum, subsequent evaluation(s) should characterize the sub-surface soil and (if encountered) bedrock and groundwater conditions

6.0 CONCLUSIONS

Our evaluation suggests that development of a proposed rural residential subdivision will be feasible within the study area in the regions which were noted as having high to moderate development potential in Figure 5.

While the glacio-fluvial deposits (which are predominately comprised of sand and gravel with varying amounts of silt as well as cobbles and boulder sized materials), generally provide favorable geotechnical conditions for the construction of roadways, residential foundations and septic systems, the fine grained nature of the overlying eolian deposits (which measured up to 1 meter thick) will require additional geotechnical consideration as they are frost susceptible and will generally have poor bearing capacities.

As glacio-fluvial deposits are typically consolidated and well drained they should provide adequate bearing for standard dwellings. However, they can become geotechnical liabilities where;

the composition of the soil matrix is predominately fine grained as silty soils will be susceptible to a loss of strength if they become wet or are disturbed.

steep slopes are present as they may be susceptible to slope failure or movement.

large cobbles and/or boulders are encountered within the sub-strata as they present a hazard to workers, foundation components and sub-surface infrastructure.

At this scale, engineering considerations (which take into account the soil, drainage and topographical limitations) suggest that development within designated setback limits (from steep slopes, gullies, etc.) should be restricted (to noted setbacks) until otherwise determined through future geotechnical evaluation.

A geotechnical evaluation will be required to verify the subsurface soil and (potential) groundwater conditions such that geotechnical parameters can be formulated for any proposed roads and residential building (foundation and septic systems) areas.

7.0 LIMITATIONS

This report is intended for the sole use of *Urban Systems*. No portion of this report may be used as a separate entity; it is intended to be read in its entirety. Any use of this report by a third party is the responsibility of such third party.

Given the nature of our assessment and scale of mapping, the information contained herein will not be sufficient to assess all factors that may have an effect upon design and construction and so this should be considered from a project management perspective. Our assessment was limited as the subdivision layout was not yet determined and that a detailed terrain hazards assessment was not conducted. As such our findings should be confirmed (or refuted) through subsequent geotechnical evaluations. These evaluations should be conducted by qualified geotechnical personnel utilizing auger drilling methodologies and laboratory work programs in order to confirm construction feasibility and geotechnical parameters.

The comments contained herein reflect our best judgment in light of the information available to our firm at the time of our assessment. They are based upon our collation of available literature, observations during our site reconnaissance, recognition of geomorphic features and generally accepted engineering practices.

Any reference to structures, roads or overall use of the property have been made for discussion purposes only. The actual use/purpose of the individual lots will need to be determined during the subdivision and zoning process.

Should unexpected subsurface conditions be identified within the region or study area, our firm should be notified in order to confirm the suitability of our findings. If required, our firm may alter or modify our recommendations and conclusions at such time.

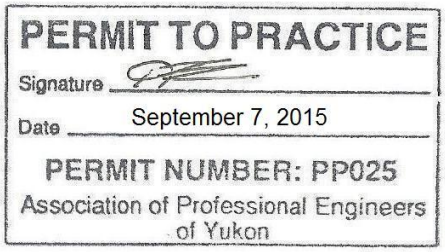
8.0 CLOSURE

Thank you for providing our firm with the opportunity to conduct the above noted assessment.

We trust that the information we have provided will be suitable for your purposes, however, if you should have any questions or concerns, please feel free to contact the undersigned at your convenience.

Respectfully Submitted,

CHILKOOT GEOLOGICAL ENGINEERS LTD.



Tares Dhara, P.Eng.
Senior Geotechnical Engineer

TD/td

Geotechnical Evaluation – Preliminary Site Assessment
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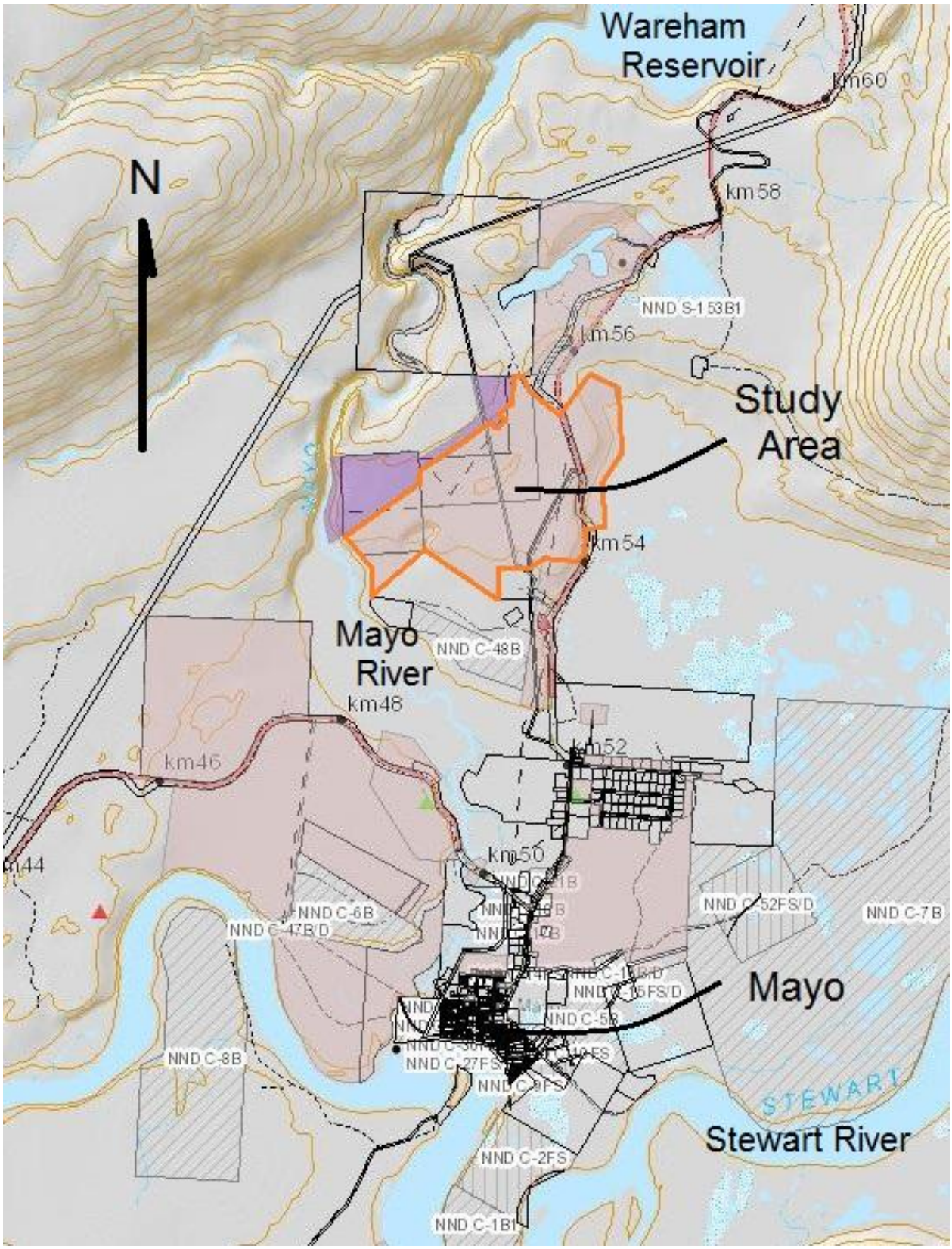
FIGURE 1 – Location of Study Area



Based map modified from Water Placer Atlas – Locations are approximate Compiled July 14, 2015 by T.Dhara

Geotechnical Evaluation – Preliminary Site Assessment
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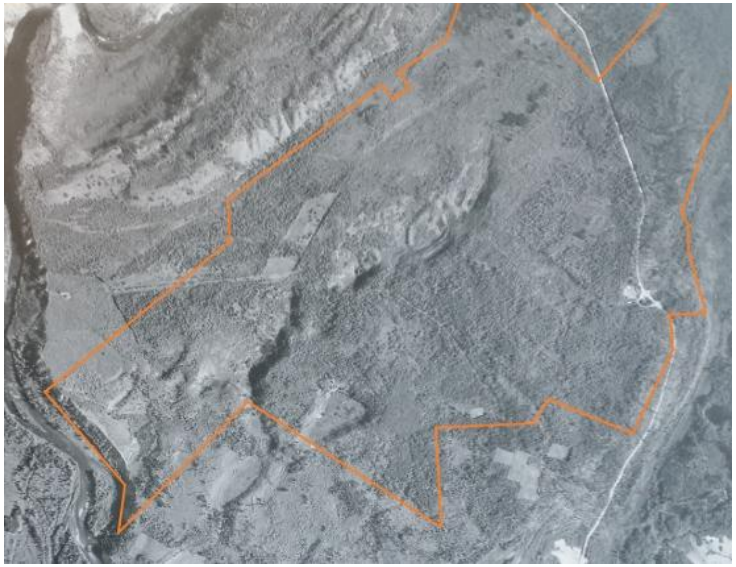
FIGURE 2 – Site Plan & Photo Locations

Based map modified from Google Earth – Not to Scale – Locations are approximate

Compiled July 14, 2015 by T.Dhara

FIGURE 3 – Selection of Airphotos



1949
(left)

1958
(right)

1982
(left)

1984
(right)

Geotechnical Evaluation – Preliminary Site Assessment
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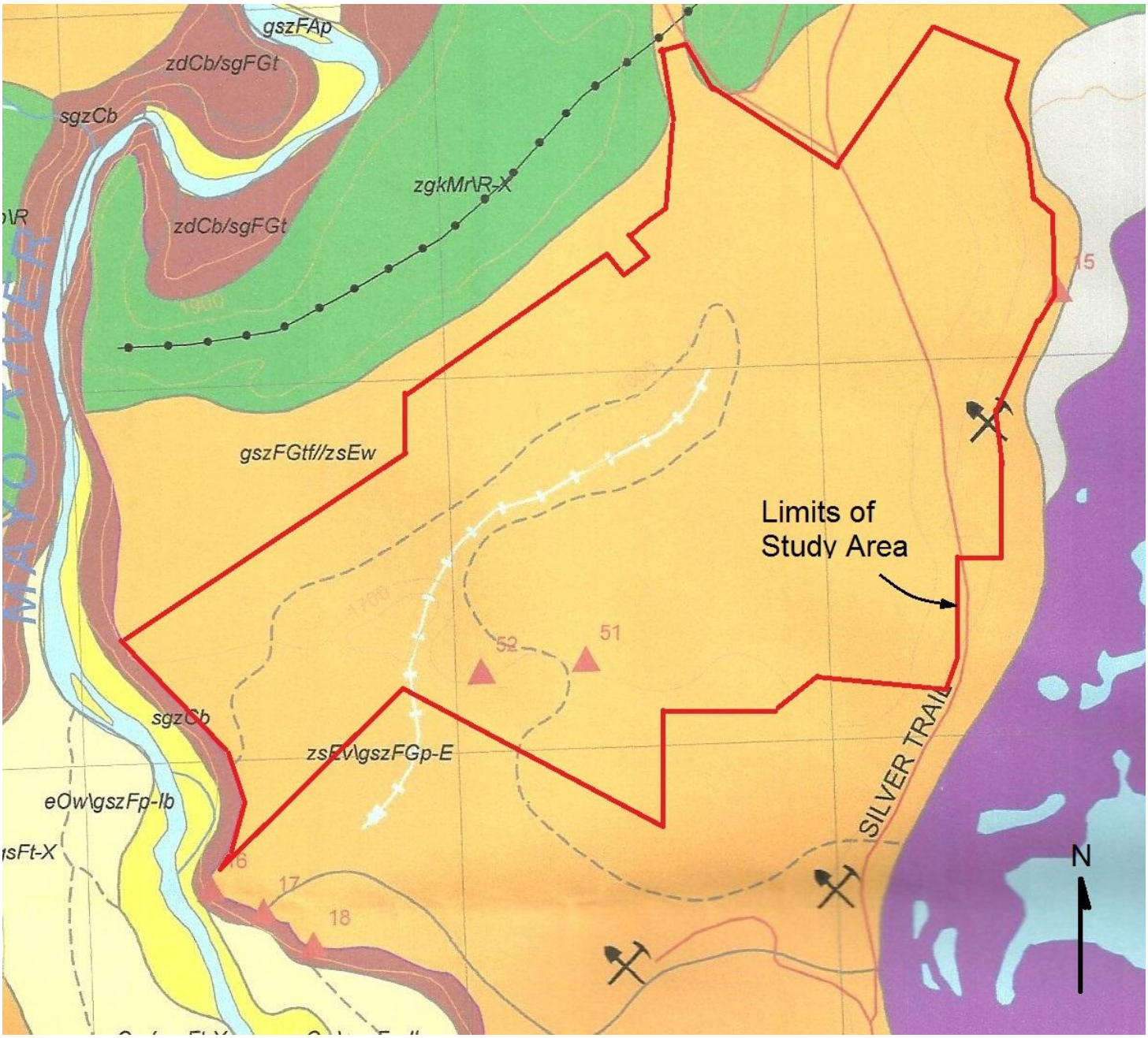
FIGURE 4 – Surficial Geology



Based map modified from Yukon Geological Survey - Surficial Geology of the Village of Mayo - by Kennedy, K.E., 2011
Limits are approximate
Compiled July 16, 2015 by T.Dhara

Geotechnical Evaluation – Preliminary Site Assessment
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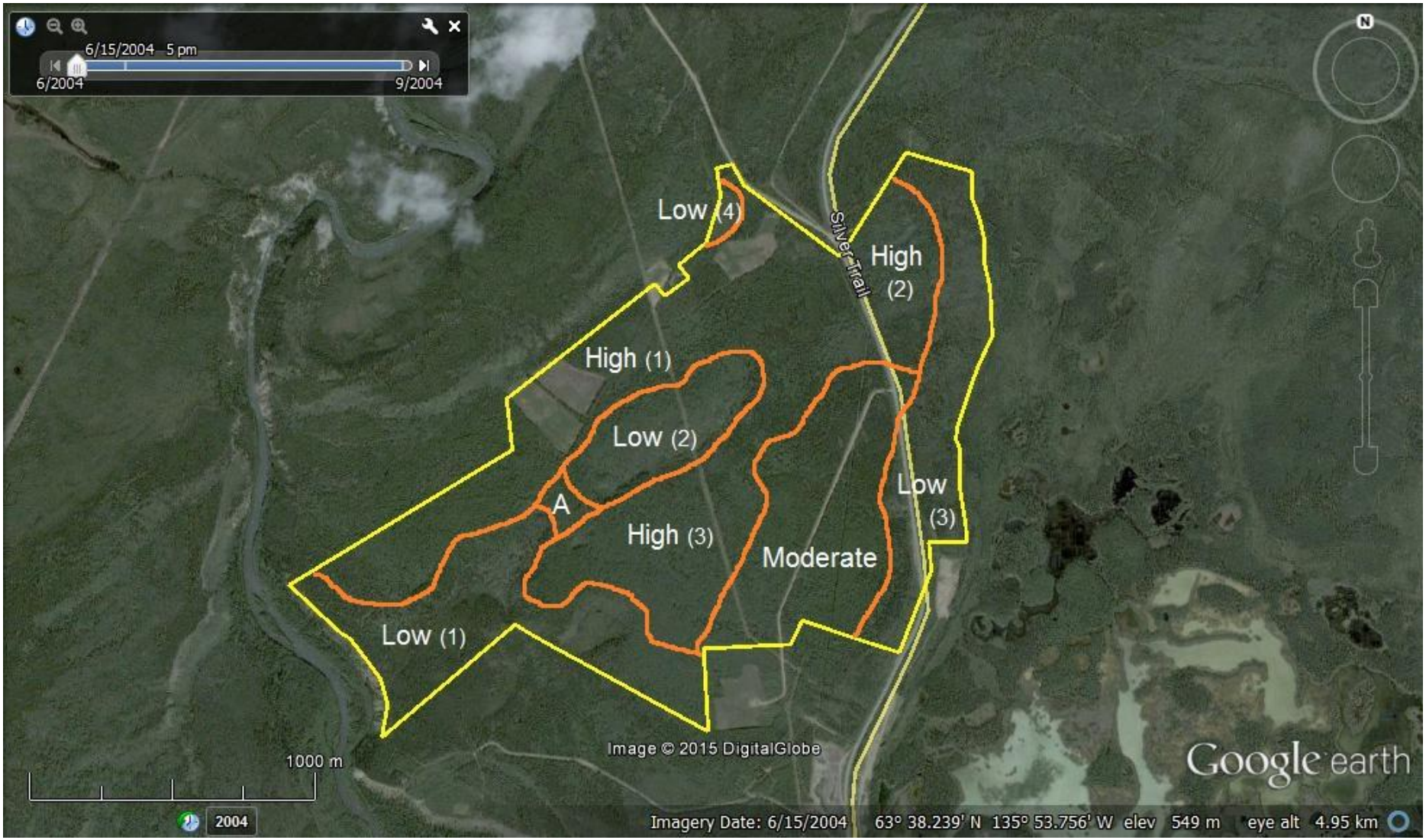
FIGURE 5 –Geotechnical Development Potential



Based map modified from Google Earth – Not to Scale – Limits are approximate

Compiled July 16, 2015 by T.Dhara

APPENDIX A

Report supplied by Urban Systems

POTENTIAL DEVELOPMENT OF MAYO AREA LANDS
RESIDUAL AREA OF LOTS 41 & 1010

Introduction:

Yukon purchased two agriculture parcels near the Mayo River north of the Village of Mayo to facilitate the development of increased generating capacity at the Mayo Hydroelectric Station. The subject lots are approximately 5 km north of Mayo on a glacial fluvial terrace on the east side of the Mayo River. This report summarizes the development potential of the residual area of the purchased lots after the partitioning of the lots to allow for ongoing operation and maintenance of the hydroelectric facility and discusses briefly (Appendix 1) the adjacent vacant lands.

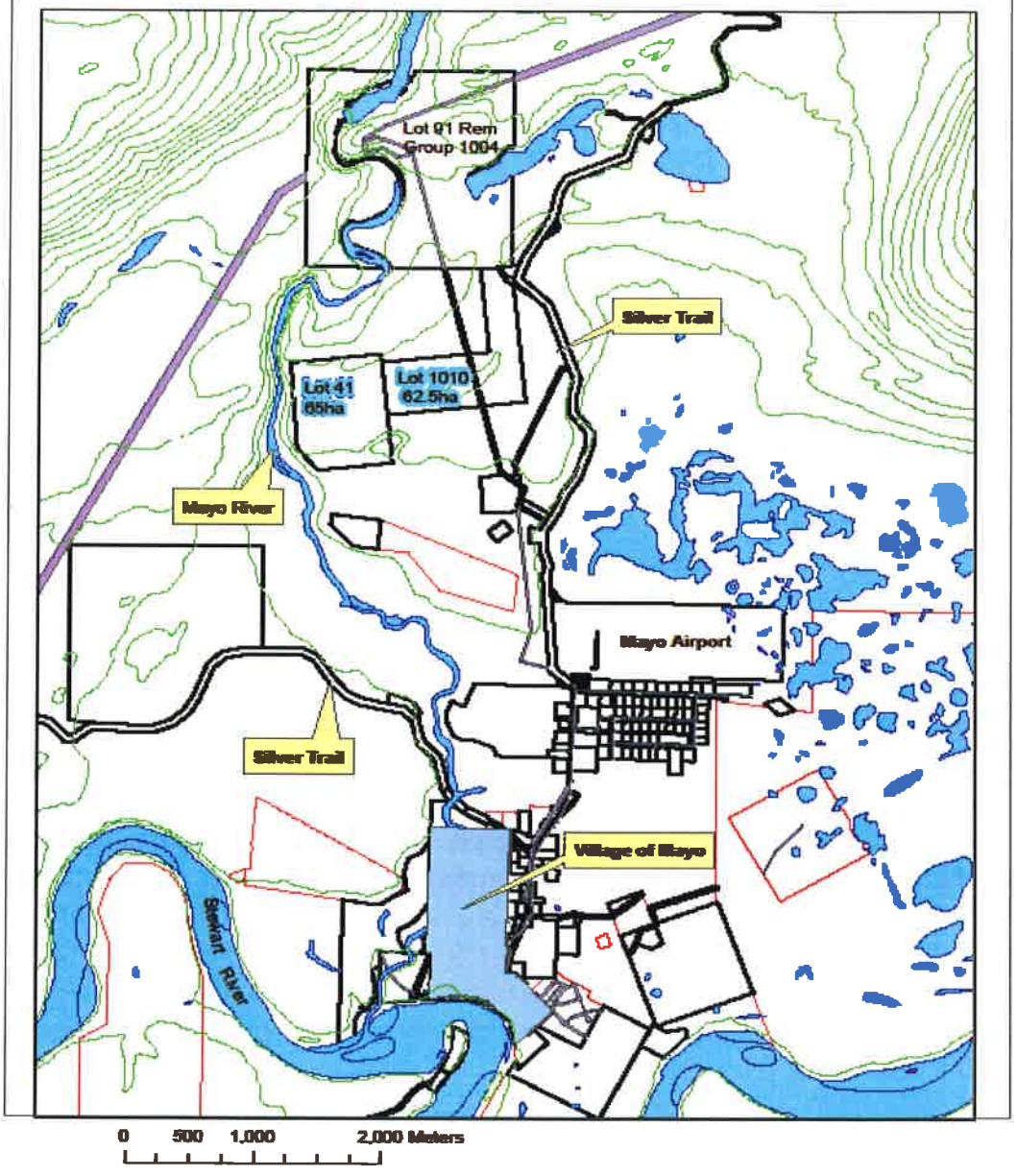
Lot 41

The lot closest to the Mayo River is Lot 41, Group 1004 (Map1: Location of Purchased Lands – Lot 41 and Lor 1010 – Near Mayo, Yukon). It is 64.7ha in size and was surveyed in August 1926. This lot is oriented along the terrace edge (approximately) parallel to the Mayo River. Topographic limitations for agriculture on this parcel include a section of a gravelly morainal ridge to the north (this is the feature that is of interest to YEC) and a series of deep depressions along the southern boundary.

Lot 1010

Immediately to the east of Lot 41 and touching the Silver Trail road right-of-way at one point in the northeast corner is Lot 1010, Quad 105 M/12 (Map1: Location of Purchased Lands). Lot 1010 (dating from 2010) resulted from a resurvey of Lot 49, Group 1004, Grant Homestead that was surveyed in 1937. This L- shaped parcel was probably configured to avoid the ridge (presumed reason for the L-shape) and maximize the available farmable land. If this assumption is correct the strategy was only partially successful in that the southern extent of this parcel encroaches onto the eastern most extension of the depressional areas and this parcel is significantly more complex topographically than Lot 41. Also, there is a triangular area of approximately 16ha measured from the base of the ridge and bounded by the two legs of the 'L'. This land is suitable for agriculture development and over the years parts of two fields as well as the entirety of a third have been developed in this triangle outside the surveyed boundaries of parcel.

Map 1: Location of Purchase Lands - Lot 41 and Lot 1010 - Near Mayo, Yukon



Surficial Geology

The glacial fluvial terrace that constitutes the majority of lands described in this report extends east and north across the Silver Trail Highway (see Appendix 1 Map 10 for the extent of the terrace). The elevation is approximately 550m. The terrace top is approximately 50m above the Mayo River.

The northern boundary of the terrace is delineated by a morainal ridge. This gravelly ridge is the feature of primary interest to Yukon Electric Corporation. The top of the ridge is 60-90m above the river.

The other notable feature of the area is series of depressions trending northeast to southwest across the terrace. Immediately adjacent to the depressions the topography is more variable with complex slopes. These depressions are related to the meltwater channel that drained the area at the end of the last glaciation.

The core of the terrace is gravelly sands and silts. The surface textures are the result of Eolian (wind) disposition of silts and sands. The Eolian materials are of variable thickness and generally less than one metre in depth.

Site and Soils:

Agriculture Branch is familiar with the soils of the general area because of participation in 1998 in field work to establish the agriculture capability of selected parcels in the Mayo area. The 1998 study was funded by the Canadian Adaptation and Rural Development Fund and sponsored by the Mayo Renewable Resources Council. The 1998 report dealt with the lands south and east of Lots 41 and 1010 and is discussed briefly in Appendix 1. Branch staff spent one day in August 2011 walking the remainder areas of the titled lands to assess the development potential of the residual areas once YEC has established its permanent boundary for the hydroelectric development.

Much of this land parcel is rated as 4CM. The agricultural capability is limited only by climate (C) in places where there is a layer >30 cm of sandy loam or finer textured soil, (Photo 1) and the agricultural capability is limited by moisture holding capacity (M) in places where the loamy veneer is >20cm but <30 cm (Photo 2). This agriculture capability rating is excellent in the Yukon context.

Photo 1: Class 4C land – deep fine textured soils

Photo 2: Class 4CM land – less than 30cm of fine textured material over gravel

Within the parcel there are a series of depressions rated as 6T. These areas have slopes too steep for farming or other development and the lowest parts of the depressions are ponded and underlain by permafrost (Photos 3 and 4). .

Photo 3: Permafrost and pond – depression bottom

Photo 4: Steep north aspect of depression

The escarpment edge overlooking the Mayo River is steep, but vegetated and is stable over most of its extent. There is evidence of some minor erosion along the terrace edge as evidenced below. There is a small rise between the escarpment edge and the

terrace top. A strip along the edge of the terrace is rated as 5M/6M. This area is less suitable for agriculture because the sand and gravel layer is too close to the surface

Photo 5: Minor erosion along escarpment. Most of the escarpment is vegetated as shown in distance.

Developmental Considerations:

General:

YG has acquired 127.5ha of land through the purchase of Lot 41, Group 1004 and Lot 1010, Quad 104 M/12. Once the permanent area of control is ceded to YEC the available lands within titled parcels is substantially downsized. Given the 'L' shape of Lot 1010 there is a small area outside the permanent area of YEC control that is also not within the titled lands. This area of vacant territorial lands is about 7.5ha.

There were approximately 49 ha of farmable lands on Lot 41after the gravelly ridge and the depressions at the south end of the parcel are removed. The permanent line of control proposed by YEC removes another 27 ha from consideration. This leaves approximately 21ha of land that is suitable for farming or other development.

The total remaining area of Lot 1010 outside the YEC permanent line of control is about. 52.5ha. Depressional areas account for another 9ha. This leaves about 43ha of developable lands within Lot 1010. Overall, including the 6.5ha of vacant territorial

lands total available lands outside of the YEC line of control but within the southern limits of the purchased lots is 70.5ha±. Usable portions of the subject lots are shown by Map 2: Available Developable Land on Lot 41 and Lot 1010 – Near Mayo.

Table 1: Breakdown of Purchased Lands

Lot #	Size (ha)	Residual Portion*	Developable Portion	Description of Constraints
41	65	28.8	21	7.8ha of Lot 41 is depressional areas
1010	62.5	52.5	43	9.1ha of Lot 1010 is depressional areas
Untitled	6.5	6.5	6.5	This fragment of vacant territorial lands has no development constraints.
Total	134	87.8	70.5	16.9 ha of surveyed lands are deemed to be not developable.

*Residual portion means lands that are beyond the proposed YEC line of permanent control and may be developed by Yukon.

Cost Recovery

Planned land sales for the Yukon government must recover costs. At this point the main cost is the purchase price of the lands. Subdivision and resale of the lands still available subsequent to the hydroelectric development is the obvious approach, but must consider the fact that land values in the Mayo area are low. Creation of sufficient lots to recover existing costs may be a determining factor in moving to rural residential size lots. The minimum parcel size for agriculture lots is 6ha. Given the constraints on the 70.5ha of land available it seems likely that the 8 to 10 agriculture parcels that may result will not yield enough revenue to cover developmental costs.

There are some excellent vistas of the Mayo River valley and general area from the escarpment edge above the Mayo River and potentially some very desirable building sites. Because of the configuration of the proposed YEC permanent line of control a relatively small portion of the escarpment edge is available for YG development for sale.

Map 2: Available Developable Lands on Lot 41 and Lot 1010 - Near Mayo

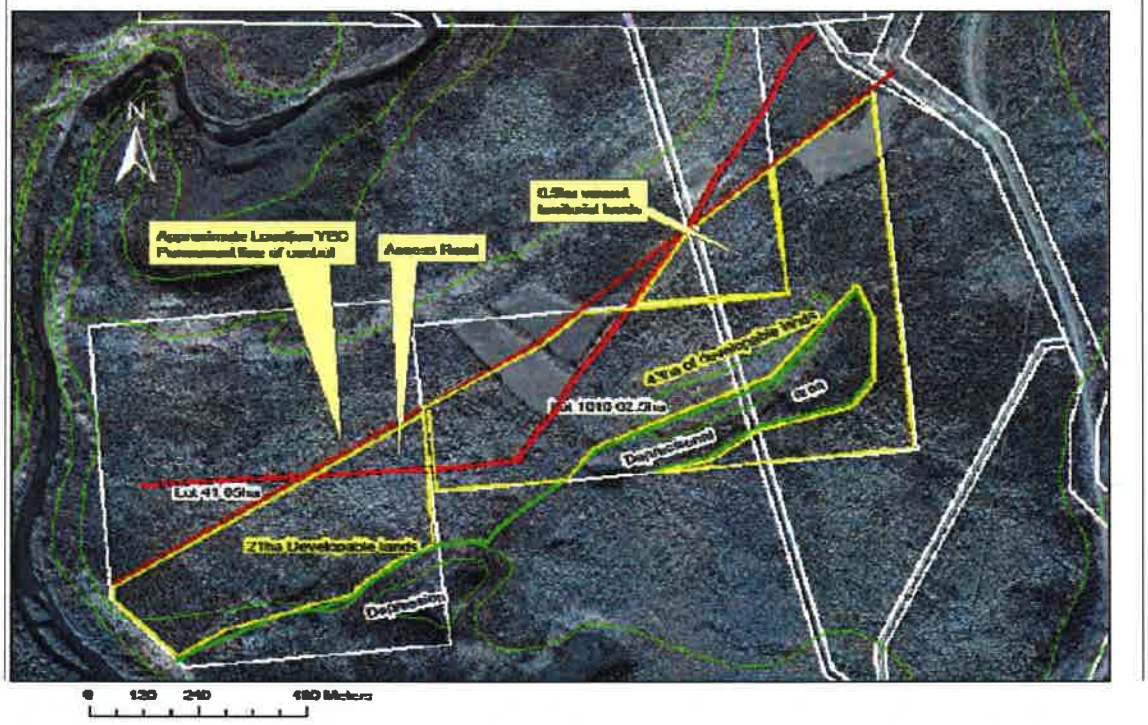


Photo 6: One example of the view from the escarpment

Photo 7: Second example of view along escarpment

Access

The access road to Lot 41 has been redeveloped as an industrial access during the construction phase of the hydroelectric project. Parts of the existing access are within the permanent line of control and parts of the existing access are outside the permanent line of control for YEC. The ability of YG to use and modify the upgraded access will have a direct and substantial effect on the developmental costs of creating a new subdivision.

Next Steps

The initial development proposal must deal comprehensively with the residual areas of Lots 41 and 1010 taking into consideration the usable areas and making an initial estimate of the required lot yield to account for incurred and future development costs. This step will provide the parameters of any proposed land sale.

More exact information is required regarding the existing access road. The particular question is whether YG will be able to use the access as infrastructure for general land sales where the access falls within the boundary of YEC's proposed line of permanent control. The other side to this question relates to the areas where the access currently is beyond the permanent line of YEC jurisdiction. YG needs to know what YEC's requirement will be for use of that portion of the road.

A plan is necessary to deal with the 6.5ha of vacant territorial lands that fall between Lot 1010 and the YEC permanent line of control. The geography of the area is such that efficient development should plan to include this fragment.

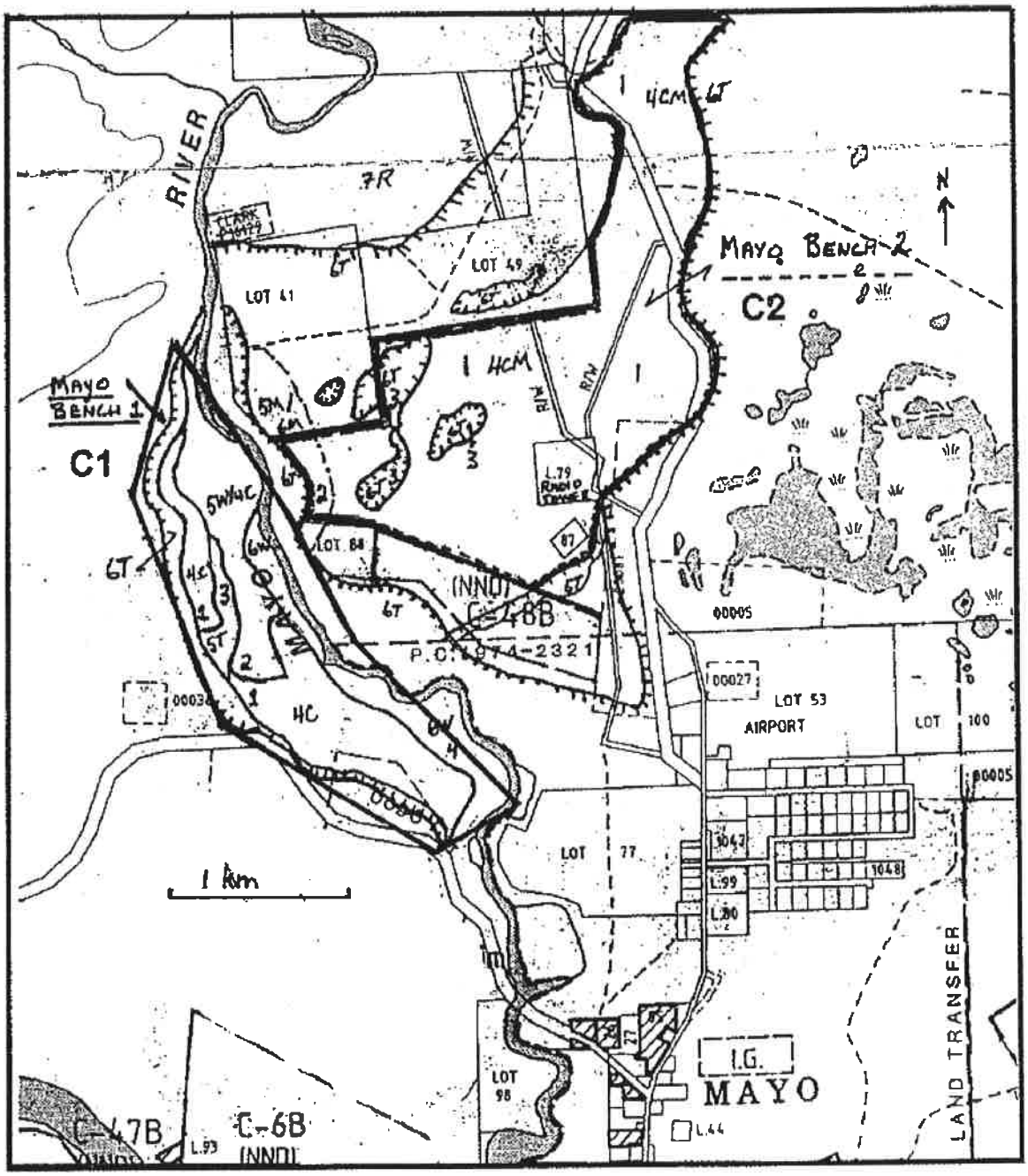
A preliminary analysis, based on 70.5ha of developable lands, tends to the conclusion that rural residential size lots will be a major component (or even the sole component) of the development on the remaining areas of the lots YG purchased. This tentative conclusion is based on the expectation that the lot yield will need to be higher than is possible for agriculture given the 6ha minimum parcel size for agriculture.

The fact that there are between 100 and 175ha of good agriculture soils on vacant territorial lands adjacent to Lots 41 and 1010 suggest that a phased development should be considered with agriculture lots as the focus for phase 2. To ensure an option for phase 2 development Agriculture Branch should apply for a reservation on the lands identified in Appendix 1.

Appendix 1:
Agriculture Potential of Vacant Territorial Lands Adjacent to Lots 41 and 1010

The attached *Map 10. Agriculture Capability Map reproduced from Murray report 1998* shows the agriculture capability of the lands on the glacio-fluvial terrace outside the boundary of Lots 41 and 1010. This map shows about 1750ha of Class 4 capable lands on both sides of the Silver Trail Highway to Keno. The agriculture capable lands abutting Lots 41 and 1010 are approximately 100ha in extent. The primary limitation of this site is the poor potential for access to irrigation water. The attached table summarizes the agriculture capability of the map units for Map 10.

It is notable that significant portions of the mapped area was farmed in the earlier part of the century, and today there are, in addition to Lots 41 and 1010, other titled lots and road right-of-ways in the area. Given the ease of access to power and also of the existence of an excellent basic road into Lot 79 group 1004 it may be relatively easy to create several agriculture parcels without incurring huge developmental costs.



Map 10. Agricultural Capability Map reproduced from Murray Report, 1998

Agriculture Capability Summary for Mayo Bench 2

(outlined solid black line on accompanying map)

Polygon #	Designation	Area (ha)	Explanation of Limitations	Developmental Constraints
1	4CM	174.6	Agriculture capability is limited by the regional climate (C) where 30 cm or more of sandy loam or finer textured material is present. A moisture holding restriction (M) applies where >20 cm, but <30 cm of fine textured material is present.	This soil unit is bounded by a number of titled properties and dissected by a number of road right-of-ways and configuring new parcels will have to be done carefully.
2	5M/6M	7.2	Agriculture capability is limited to Class 5 where sand and gravel is >10 cm, but <20 cm from the surface and limited to Class 6 where sand and gravel is <10 cm from the surface. Class 5M occurs in 60 to 80% of the polygon and 6M in 20 to 40% of the polygon.	This soil unit occurs at the edge of the terrace above the Mayo River and is bounded approximately by a trail parallel to the terrace edge. Any new agriculture development should avoid this area along the top of the terrace.
3	6T	15.3	Slopes of >20% limit the agriculture capability to Class 6 (non-arable). This designator applies to a series of depressions in the terrace surface.	These kettles are non-arable and pose constraints on parcel configuration.

The area calculation for this bench is complicated by the presence of titled land within the mapped area. Approximately 177 ha is arable.

Selected References:

Kennedy, K.E., 2011. Surficial geology of the Village of Mayo (part of NTS 105 M12), Yukon. 1: 20 000-scale. Yukon Geological Survey, Open File 2011-3; see also Northern Climat Exchange, 2011. Mayo Landscape Hazards: Geological Mapping for Climate Change Adaptation Planning, Yukon Research Centre, Yukon College, 64p and 2 maps.

Smith, P., 1999 Agricultural Lands Assessment and Description of Selected Lands in the Mayo area, Canadian Adaptation and Rural Development Fund

APPENDIX B

Selection of Photos

Photo # 1 – Silver trail facing north @ km 54.5

Photo # 2 – Nav. Canada road facing south-west

Photo # 3 (left) Powerline right-of-way facing north. Note meltwater channel crossing mid-photo.

gravel at 0.1 m of survey rod.

Photo # 4 (right) ROW trail embankment conditions. Note

Photo # 5 (left) – Embankment conditions along the powerline ROW, north of the meltwater channel. Note cobbles.

6 (right) Conditions along Mayo River Interpretive Trail facing west.