Alaska Department of Transportation & Public Facilities (DOT&PF)

Foreword

There has been controversy surrounding this document, some of which stems from confusion regarding its purpose. As a public document each reader is welcome to review the report and draw his/her own conclusion. However it is important with any technical document to consider why it was created as well as how and when it will be used in project development.

The mountainous slopes along the east side of Lynn Canal between Independence Creek and the Katzehin River are steep in many areas, and have active avalanches and other geologic hazards. The Final EIS for the Juneau Access Improvements Project acknowledged the existence of geologic hazards and included a commitment to conduct geotechnical investigations to address them. To meet this commitment, DOT&PF contracted with Golder Associates, an internationally recognized geotechnical engineering firm.

The purpose of the Phase I Zone 4 Geotechnical Investigation is to provide DOT&PF with preliminary mapping of soil and bedrock units and to catalogue geologic hazards that could impact highway construction and/or operation. The catalogued hazards are presented in a database and will be used by DOT&PF engineering geologists and highway designers to minimize impacts to the road by avoiding, removing or mitigating any hazards.

The Phase I Zone 4 Geotechnical Investigation does not provide an indication of safety risks for travelers using the East Lynn Canal Highway. It is a preliminary (hence "Phase I" of the title) assessment of potential hazards that may need to be addressed. DOT&PF will eliminate or reduce many of these potential hazards by making adjustments to the preliminary Zone 4 alignment during design. During Phase II geotechnical investigations, more detailed surface mapping will be prepared relative to the adjusted alignment, and sub-surface investigations will begin. As the design progresses each remaining hazard will be assessed and mitigated to the extent warranted.

All hazards were rated using a Hazard Index Number (HIN) system adapted for this project, which has 46 possible scores, with 405 as the highest score and 15 as the lowest score, based on several hazard analysis categories. Although all hazards will be considered and mitigated if warranted, it is important to note that there are no identified hazards with a HIN score in the top five highest possible scores, and only three with a score in the ten highest possible rankings (see Table 4). The data in the Phase I report do not support a conclusion that the constructed highway will be unsafe. The report's geotechnical information adds complexity to the design task; nonetheless DOT&PF, as a responsible transportation agency, will construct and maintain the highway to the same standard as similar highways in the state.

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FINAL REPORT

LYNN CANAL HIGHWAY
PHASE I
ZONE 4 GEOTECHNICAL INVESTIGATION

STATE PROJECT NUMBER: 71100

Submitted to:

Alaska Department of Transportation and Public Facilities
Southeast Region, Design and Engineering Services
6860 Glacier Highway
Juneau, Alaska 99801-7999

Submitted by:

Golder Associates Inc.
1750 Abbott Road, Suite 200
Anchorage, Alaska 99507

Distribution:

10 Copies - ADOT&PF-SE (Ralph Swedell)
3 Copies - Golder Associates Inc.

December 2006 Job No. 063-5782

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December 29, 2006

Our Ref.: 063-5782

Alaska Department of Transportation and Public Facilities
6860 Glacier Highway
Juneau, AK 99801-7999

Attention: Ralph Swedell, Regional Geologist

RE: FINAL REPORT
LYNN CANAL HIGHWAY PHASE I
ZONE 4 GEOTECHNICAL INVESTIGATION

Dear Ralph:

Golder Associates Inc. Is pleased to present 10 copies of our Final Report for the Lynn Canal Highway Phase I – Zone 4 Geotechnical Investigation. The material presented in this report covers the proposed highway alignment from Independence Creek to the Katzehin River.

Please call if you have any questions.

Sincerely,

GOLDER ASSOCIATES INC.

Robert G. Dugan, C.P.G.
Principal Engineering Geologist

RGD/lcm

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LIST OF ABREVIATIONS

ADOT&PF-SE	Alaska Department of Transportation and Public Facilities – Southeast Region
ASTM	American Society for Testing and Materials
C.E.	Common Era, year given
CSV	Comma separated value file
CY	Cubic yard(s)
ELC	East Lynn Canal, from Glude and others (2004) snow avalanche report
°F	Degrees Fahrenheit
ft	Foot, feet
g	Acceleration due to gravity, approximately 32 ft/second^2
GHRS	Geologic Hazard Rating System
Golder	Golder Associates Inc.
GPS	Global Positioning System
HIN	Hazard Index Number
IRP 2006	Inertial Reference Point 2006 alignment
in	Inch(es)
km	Kilometer(s)
lb	Pound(s)
LIDAR	Light detection and ranging
m	Meter(s)
MPa	Megapascal
PDOP	Position Dilution of Precision, GPS term for position uncertainty
psi	Pounds per square inch
WAAS	Wide Area Augmentation System, GPS location correction system
WGS 84	World Geodetic System 84, GPS datum
yr	Year(s)
yr B.P.	Radiocarbon years before present with respect to the year 1950 C.E.

1.0 INTRODUCTION

The Alaska Department of Transportation and Public Facilities (ADOT&PF-SE) is conducting studies of a highway corridor linking the community of Juneau, Alaska to a ferry terminal on the north side of the Katzehin River near Haines, Alaska. As part of this project, Golder Associates Inc. (Golder) conducted Phase I of a multi-phase geotechnical investigation for Zone 4, which is a 22.2 mile segment extending along the east side of Lynn Canal from Independence Creek to the Katzehin River. This segment traverses a steep side-slope near tidewater. The slopes above the proposed corridor are typically mountainous and extend to elevations that are typically 3,000 ft to 6,000 ft above the proposed highway. The ADOT&PF-SE staked the proposed Inertial Reference Point 2006 (IRP 2006) alignment in the spring of 2006 which was the working alignment for Golder during Phase I field work. After completion of fieldwork, some segments of the alignment were realigned. However, for this report, all alignment locations are referred to in terms of the staked alignment in spring of 2006, the IRP 2006 alignment.

The Golder work was conducted for ADOT&PF-SE Project No. 71100 under Agreement No. 36863003.

1.1 Purpose

The purpose of the Phase I investigation was to more precisely characterize the in situ soil and rock conditions and geologic hazards, and to make recommendations for Phase II design level geotechnical investigations.

1.2 Scope

The Phase I scope of work included the development of surficial soils maps of the route corridor, identification of geologic and slope hazards, and recommendations for design level geotechnical investigations. The scope of work for Phase II will include the collection and evaluation of subsurface information along centerline plus engineering evaluations and geotechnical recommendations relevant to the design and construction of the project. Phase III would include geotechnical assistance as necessary when geotechnical issues arise during construction.

The specific scope of work for Phase I included the following tasks:

- Conduct office review, data and air photo acquisition, and field plan development.

- Conduct surficial geologic mapping of the route corridor extending from tidewater to 1,000 ft right of the proposed centerline at a scale of 1 inch = 200 ft. The mapping was to include delineation of soil and bedrock units and discontinuity orientations of the bedrock. Mega-boulders, defined as boulders greater than 10 ft in diameter for the smallest dimension, were to be identified and catalogued. Preliminary structural rock mapping was to be carried out on relevant outcrops.

- Develop an area map showing the limits of geologic hazards that could impact the proposed highway. Hazard mapping was to extend beyond the road corridor cut and fill limits. The hazard mapping results were to be presented as 1 inch = 500 ft scale maps.

- Evaluate the IRP 2006 alignment in concert with the ADOT&PF-SE to develop a design level geotechnical investigation to include centerline and foundation test drilling.

1.3 Project Team

The project was managed and carried out by personnel from the Golder office in Anchorage, Alaska with assistance from staff in our office in Redmond, Washington. Norm Norrish of Wyllie & Norrish Rock Engineers made field inspections of selected rock slopes, provided input on data gathering, and provided other insights relevant to the design. Helicopter support was provided by Temsco Helicopters out of Juneau, Alaska. Golder established a field office in Haines, Alaska as a base to carry out the field operations.

1.4 Project Location

The proposed Lynn Canal Highway is located in southeast Alaska (Figure 1) and extends from Echo Cove near Juneau to the mouth of the Katzehin River near the communities of Haines and Skagway (Figure 2). Zone 4 of the proposed highway begins on the east side of Lynn Canal, approximately 40 miles north of Juneau (20 miles north of the end of the existing road at Echo Cove) and extends approximately 22.2 miles to the Katzehin River delta opposite the community of Haines (Figure 3). The IRP 2006 alignment closely follows the coastline at the base of steep mountain slopes and intersects several steep side valleys. The terrain is roadless and mantled by old-growth forest that typically extends from tidewater to elevations exceeding 1500 ft. As there are no trails or developed access to the area, boat or helicopter transportation is required.

Lynn Canal is a prominent fjord and marine highway corridor with a northerly trend. It is approximately 40 miles long, three to five miles wide, and up to 1,000 ft deep. It is bound to the west by the Chilkat Range and to the east by the Coast Mountains. The northern reaches of Lynn Canal are divided by the Chilkat Peninsula, with Chilkat Inlet to the west and Chilkoot Inlet to the east (Figure 3). Chilkoot Inlet, approximately 3 miles wide, extends northward to its junction with Taiya Inlet and Lutak Inlet a few miles north of Haines. Taiya Inlet extends 15 miles northward to Skagway and Dyea. The southern part of Lynn Canal extends southward to the junction of Chatham and Icy Straits (Figure 1).

2.0 PROJECT DESCRIPTION AND SETTING

2.1 Site Conditions

2.1.1 Regional Geology

The project area spans the east Lynn Canal region from Independence Creek, at the south end, to the mouth of the Katzehin River at the north end. The east side of Lynn Canal comprises the western margin of the Coast Range, with mountains exceeding elevations of 6,000 ft. The topography is characterized by steep, glaciated, mountainous terrain and U-shaped side valleys. Rock knobs, colluvial aprons, and rock cliffs are common. The mountainous slopes generally extend steeply into the waters of Lynn Canal to depths exceeding 600 ft. Relatively broad flat deltas have built up at the mouths of large rivers such as the Katzehin River.

The northern part of Southeast Alaska lies within the active tectonic belt that rims the Pacific Basin (Lemke, 1974). Tectonic activity has resulted in northwesterly trending arcuate bands of faults and folded sedimentary, volcanic, and metamorphic rocks. Lynn Canal occupies the Chatham Strait fault, a right-lateral fault which is a southerly extension of the Denali Fault system that arcs northward across interior Alaska. There are also northwest/southeast trending faults that are sub-parallel to Lynn Canal and typically occupied by linear stream courses.

The Katzehin River valley was carved by the Meade Glacier, a large piedmont glacial system that covers more than a hundred square miles. The glacier has been retreating and currently terminates 8 miles east of Chilkoot Inlet. The river has a heavy sediment load and has created a large sandy delta where it enters Lynn Canal.

The steep, high slopes and high precipitation rates have created conditions for snow avalanches. Numerous avalanche zones intersecting the Zone 4 alignment have been mapped (Glude and others, 2004). Other types of geologic hazards, particularly related to slope stability, are also present and these are addressed in subsequent sections.

Permafrost is not likely to be present in the vicinity of the proposed highway alignment.

2.1.1.1 Bedrock

The bedrock on the east side of Lynn Canal consists of several rock lithologies within the immediate vicinity of the study area (Figure 4) (Gehrels and Berg, 1992). The bedrock on the west side of Lynn Canal consists primarily of Paleozoic sedimentary and volcanic rocks. The rock lithologies encountered within the project area are predominantly Cretaceous to Permian basalt, metasedimentary rock, and weakly to strongly foliated Cretaceous to Tertiary gneissic rocks, apparently derived from a granitic parent rock. The basalt, typically massive and vesicular, underlies the southern end of Zone 4. The metasedimentary bedrock, which is strongly foliated and contains gneissic elements, underlies much of the middle portion of Zone 4. The gneiss is generally massive and typically underlies the northern part of Zone 4. Detailed descriptions of these rock types can be found in Section 3.2.5. The occurences and extents of units can be seen on the surficial geologic maps presented in Appendix E as well as in Section 4.1.

The bedrock is prominently exposed over much of the alignment in the intertidal area, and on the many cliffs, despite the heavy forest cover.

2.1.1.2 Unconsolidated Deposits

Upland areas are generally characterized by shallow, glacially-scoured bedrock overlain by glacially-derived deposits, except at the base of steep slopes where there are predominantly colluvial/alluvial deposits and talus that can include mega-talus fields. The extremely coarse talus is present over much of the alignment and includes some clasts with diameters greater than 40 ft. Many unconsolidated deposits, up to elevations of over 200 ft, have been re-worked by wave action and uplifted through isostatic rebound following de-glaciation. Detailed descriptions of the unconsolidated deposits can be found in Section 3.2.4. The occurences and extents of units can be seen on the surficial geologic maps presented in Appendix E as well as in Section 4.1.

2.1.1.3 Glaciation and Isostatic Rebound

During the last Ice Age (70,000–12,000 yr B.P.), much of southeast Alaska was covered in ice several thousand ft thick. Lynn Canal was filled with ice that flowed southward from the valleys north of Haines and Skagway, and from the side valleys along Lynn Canal. Following the Last Glacial Maximum (12,000 yr B.P.), the Earth's climate reached a thermal maximum (6,000-7,000 yr B.P.), at which point glacial coverage was slightly less than modern day glaciers (Connor and O'Haire, 1988). More recently, during the period 1200-1770 C.E., a global cooling known as the Little Ice Age produced regional glacial advances throughout southeast Alaska including the Juneau Icefield, Glacier Bay, and tributaries to Lynn Canal.

As these large ice sheets melted, weight was removed and the Earth's crust began to rebound slowly. Rebound following the Last Glacial Maximum has raised the shorelines 300 ft in upper Lynn Canal (Larsen and others, 2005). Glacial rebound may have stalled during the Little Ice Age. Following the Little Ice Age, however, isostatic rebound resumed and the upper Lynn Canal coast has risen by 18.7 ft, at a rate of 0.95 in/yr. Other modern rebound rates in the region include 0.51 in/yr (Juneau), 0.67 in/yr (Skagway), and 1.05 in/yr (Glacier Bay) (Larsen and others, 2004).

Crustal uplift has produced frequent elevated, wave cut terraces throughout southeast Alaska and Lynn Canal. Elevated beaches are common where beach deposits worked by wave action have been uplifted out of the intertidal zone.

Rapid retreat of ice sheets may have generated pervasive joint sets in Lynn Canal bedrock by removing overburden pressure and stress on the Earth's crust. While bedrock at depth remained under pressure and deformed plastically, near-surface bedrock responded with brittle deformation. This resulted in an exfoliation joint set typically observed in the field as joint planes parallel to the local hill slope. Other regional joint sets exist with more consistent orientation and may result from tectonic forces such as faulting and terrane accretion. The exfoliation joint set likely originated prior to the Little Ice Age during post-Last Glacial Maximum uplift or prior interglacial periods. Persistence and aperture of exfoliation jointing may vary with elevation, as deglaciation relieved varying amounts of stress at different elevations and times (Motyka, 2006).

2.2 Climate

The Lynn Canal region of southeast Alaska is located in a maritime climate zone with cool to moderate temperatures and high amounts of precipitation falling in the coastal mountains (WRCC, 2006). Average annual maximum and minimum temperatures show similar values for stations along Lynn Canal, mid-to upper-40's °F and mid-30's °F, respectively (Table 1). Lynn Canal has temperatures in the range of 45 to 65 °F in the summer and 18 to 37 °F in the winter (Glude and others, 2004).

Upper Lynn Canal near Haines and Skagway receives less precipitation than Juneau with the heaviest precipitation falling from November through January (Glude and others, 2004). Average annual total precipitation ranges from about 48 inches/year in Haines, 46 inches/year at Eldred Rock, and 57 inches/year at the Juneau Airport (Table 1). Glude and others (2004) estimate snowfall for east Lynn Canal at 147 inches/year. Average annual total snowfall ranges from about 123 inches/year in Haines, 71 inches/year at Eldred Rock, and 94 inches/year at the Juneau Airport (WRCC, 2006).

2.3 Seismicity

Lynn Canal is situated on the circum-Pacific earthquake belt, one of the most tectonically active areas in the world. Several major and minor north and northwest-trending lineaments interpreted to represent potential faults transect the region. Along the east shore of Lynn Canal, creeks and debris flow paths occupy many lineaments. In addition to crustal uplift caused by isostatic rebound, Lemke and Yehle (1972) note that large earthquakes could potentially cause land uplift or subsidence on the order of several ft or tens of ft.

Seismicity of the area is characterized by right-lateral strike-slip motion along several faults of the Chatham Strait and the Queen Charlotte-Fairweather fault systems. The Chatham Strait fault system is approximately 190 miles (300 km) long with displacements up to 90 miles (150 km). The fault system extends the length of Chatham Strait, up Lynn Canal and into Chilkat Inlet, continuing northwest as the Denali fault (see Fogleman and others, 1993). There is no recent onshore or submarine evidence of displacement along the fault system (Connor and O'Haire, 1988).

The Queen Charlotte-Fairweather fault system is currently active and presents the greatest earthquake hazard to the area (Wesson and others, 1999a; Haeussler and Plafker, 2003). The fault is several hundred miles long, paralleling the southeast Alaskan coast, approximately 75 miles (120 km) west of Lynn Canal. Earthquakes with a Richter magnitude of up to 8.1 have occurred on the fault system. The most recent rupture on the fault system occurred in 1958. The March 9, 1952 magnitude 6.0 earthquake located approximately 30 miles northwest of Haines represents the closest and most recent magnitude ≥ 6.0 earthquake relative to Zone 4 (Lemke and Yehle, 1972).

Wesson and others (1999b) estimate 15-20% g peak horizontal acceleration with 10% probability of exceedance in 50 years for the Zone 4 region from Berners Bay to the Katzehin River delta.

3.0 METHODOLOGY

3.1 Mapping Equipment & Tools

3.1.1 Light Detection and Ranging (LIDAR) & Topographic Maps

Light Detection and Ranging (LIDAR) was used extensively by the field staff. A LIDAR image is created by transmitting a light at an object (in this case the eastern side of Lynn Canal), and timing the reflection and refraction of that light to return to the transmitting vessel. The measured time of that light to return to the transmitter is used to determine that object's range (Kavaya, 1999). The data are collected as point data, processed to remove the effects of vegetation, and a digital surface is created from the "bare earth model" (Figure 5). The data used in the 2006 field season had a density of 1 LIDAR data point per 1.5 square m. These models were used to create the topographic maps that the field staff used daily for the duration of the field work. The models were also used by the field staff to view the surrounding topography in a 3-dimensional image. QT Modeler (Version 5.1) was used to view and manipulate the LIDAR data.

The LIDAR data and images that were used for the Zone 4 mapping effort did have some inconsistencies with field observations. Processing of coastal wave artifacts produced offshore contours that indicated landforms at 10 ft or 20 ft elevation, whereas field observations clearly indicated an offshore environment. Also noted was the inability of LIDAR to correctly map overhanging or vertical cliffs, possibly due to poor ray paths between the transmitter and terrain. In these rare cases, the slopes may appear to be much shallower than in reality because of these data artifacts. In other cases, the ground surface was smoothed and did not accurately reflect the ground conditions. This was possibly due to poor coverage of the area or interference from the surrounding vegetation.

3.1.2 Thales MobileMapper™

During the field season, Thales MobileMapper™ GPS units were utilized for data collection and GPS navigation.

All point data collected with the MobileMapper™ were geo-referenced using WGS 84 in the field during data collection and then converted to the local Eldred Grid 2003 coordinate system (easting, northing, altitude) developed by ADOT in the office for the final product. The MobileMapper™ utilized the Wide Area Augmentation System (WAAS) for real time position correction in the field, when satellite coverage was available. Horizontal position accuracy is generally considered to be 2-3 m under optimal conditions (MobileMapper™ Office Users Manual, 2005).

The MobileMapper™ was often used as a GPS unit in order to locate the field staff in relation to the proposed IRP 2006 alignment for the purposes of field documentation and route finding. Sections of the IRP 2006 alignment were loaded into the MobileMapper™ daily. These sections were determined by field staff prior to the field day and were representative of the areas of interest for that day. The information loaded daily consisted of the IRP 2006 alignment with stationing every 100 ft, the mapping boundary, and any eagle nests, landing zone locations, or waypoints of interest.

3.1.3 Data Collection

Data collection in the field utilized two data dictionaries that work like flow charts, one for surficial mapping (Figure 6) and one for hazard mapping (Figure 7). The data dictionaries were used by scrolling through the menus to enter the appropriate data for a particular data point. The data dictionaries were constructed by the field staff prior to any data collection and covered all of the features expected to be encountered while in the field. The data dictionary allowed the field staff to scroll through a list of features and choose one that was applicable to the location (e.g., soil, bedrock, hazard, mega-boulder, and photo). The user was then prompted to enter all of the applicable data concerning that point. For example, when making a soil point, the field staff would choose "soil" from the main menu. A secondary menu would then appear that would allow the field staff to choose which type of soil was encountered, where it was located (e.g., upslope, downslope, up alignment, down alignment, or if it was a mid point), any underlying unit associated with the point, and enter a photo number if a photo was taken. The reason for this particular method of data collection was flexibility in downloading points to an AutoCAD® drawing, and to easily create a Microsoft Access™ database.

In order to create the Access™ database and point files to import into AutoCAD®, the data collected in each MobileMapper™ were downloaded at the end of each working day and processed by a technician. Shape files were made of the points to import into AutoCAD®. The Access™ database was updated daily by exporting the data as comma separated value (CSV) files. A quality control check was done at this time in order to determine if any data was lost or corrupted. There were instances where data was lost and a site had to be revisited at a later date.

3.2 Surface Geologic Mapping

Surface geology maps were produced at the 1 inch = 200 ft scale throughout the Zone 4 IRP 2006 alignment from shoreline to 1,000 ft east of the IRP 2006 alignment. Geologic contacts were drawn on field maps and later digitized, in-house, using AutoCAD® software. Surface material, bedrock type, structure, and orientation were recorded where observable. Where stream channels intersected the IRP 2006 alignment, qualitative size and bedload data was collected. Overburden material thickness was noted wherever possible, commonly where incised by streams, avalanche chutes, or debris flows.

3.2.1 Corridor of Study

The 1,000 ft wide corridor presented a larger area than could be mapped in high detail by the available field staff. To accomplish complete coverage, two teams were used. A low elevation team mapped the area between tidewater up to 100-200 ft upslope (east) of the IRP 2006 alignment with high detail. This team was responsible for collecting all hydrologic and mega-boulder data relevant to the IRP 2006 alignment. The second team mapped the remaining corridor area at greater distances upslope and at and higher elevations than the lower team. This team was also responsible for mapping geologic hazards. Because of rugged terrain and the greater area covered by this team, map detail and accuracy decrease at greater distances from the IRP 2006 alignment.

3.2.2 Site Access

Access to East Lynn Canal was difficult due to its remote nature without road access. Field crews were stationed in Haines the nearest town, and transported to the field daily by a Hughes 500 helicopter. Field team drop-off and pick-up locations were largely limited to beach landing zones, requiring crews to cover the mapping area on foot over rugged, densely vegetated terrain. In two locations, helicopter traffic was restricted for a 3,000 ft radius surrounding sea lion haul outs at Met Point (IRP 2006 1606) and Gran Point (IRP 2006 2361). Access to these areas typically required long approaches on foot. On one occasion, access was provided by a local boat with beach landing capabilities.

3.2.3 Map Completion and Validation

Field mapping had two stages: preliminary map production and revision/map validation. First, the entire corridor was mapped from Independence Creek to the Katzehin River delta. Second, mapping teams revisited key sites throughout the corridor to validate map accuracy and ensure complete coverage. 45 days were spent mapping in the field (June 15 to August 6). During the first five weeks, field mapping teams worked to complete initial drafts of both the surficial geology and hazard maps. Daily mapping rates averaged 4,300 ft/day and varied greatly depending on rugged terrain and complexity of the geology. This initial pass left 13 field days for field teams to revisit select sites and review previous mapping techniques, interpretation and data collection. As teams initially mapped northward, understanding of local and regional geology improved, as did interpretations and descriptions of geologic units. Returning to the southern part of the IRP 2006 alignment was a key step in establishing consistency in geologic interpretation, unit identification, nomenclature, and hazard mapping accuracy.

3.2.4 Surficial Geologic Units

Prior to field work, definitions for expected materials were created for guidance and to assure consistent data collection for all staff for the extent of the project. The soil and bedrock units created are as follows, presented in such order to imply possible age relationships from youngest to oldest. However, absolute and definitive relative ages were not determined. Appendix A presents photographs of each soil type and rock type.

Colluvium (Qc): Material deposited through gravity and/or overland water flow on moderately-angled slopes (Appendix A-1). In Zone 4, colluvium typically varies in size from sand to boulder, and typically is angular to sub rounded especially at lower elevations. Colluvium may be intermixed with talus or elevated beach deposits. Generally, colluvium has a density ranging from loose to dense.

Talus (Qct): Gravity-transported rock material that has been deposited by falling, rolling, or sliding off of nearby cliffs (Appendix A-2). Typically angular to sub angular but in some areas may also be sub rounded. The degree of roundness and the size of vegetation (e.g., trees) growing on top of the talus provide a rough indicator of the relative age of the talus, with the most recent talus typically very angular and absent of vegetation. The talus ranges in size from gravel to boulders, with boulders greater than 10 ft in diameter often encountered near the source cliffs. In many instances, the talus extends to the shoreline. In rare occasions, boulders greater than 40 ft in diameter were encountered. Especially in areas dominated by larger boulders, the talus will often contain voids exceeding several ft in width and depth. Thickness of the talus varies greatly, from a few ft of talus over bedrock to 40 ft or more. Talus, especially at lower elevations, may have been partially reworked by wave action, and may be intermixed with other soil types, such as colluvium or beach deposits. Typically, talus forms steep slopes at around 20 to 40 degrees. In some instances talus slopes will exceed 40 degrees, especially near the base of cliffs and in areas dominated by very large clasts greater than 10 ft diameter. The talus may have been deposited as individual clasts over time, or as large, infrequent events totaling 1,000 CY or more per event.

Modern Beach Deposits (Qb): Soil worked by wave action within the intertidal zone. Modern beach deposits consist of sub rounded to rounded sand- to cobble-size clasts (Appendix A-3). Modern beach deposits may be intermixed with other soil types, such as colluvium or talus. The source for beach deposits is often glacial outwash or debris flow deposits. Modern beach deposits may contain minor amounts of organic matter, such as shells and driftwood. Typically beach deposits are well sorted (i.e., poorly graded) and loose to compact.

Elevated Beach Deposits (Qeb): Beach deposits that have been raised above the intertidal zone by isostatic rebound and/or tectonic uplift (Appendix A-4, A-5). Typically forms low-angle slopes (i.e., less than 10 degrees). Linear ridges and valleys trending roughly parallel to the modern shoreline typically represent elevated wave cut platforms of elevated beach deposits. Elevated beach deposits consist of sub rounded to rounded sand- to cobble-size clasts and minor amounts of organic matter, such as shells and driftwood. Elevated beach deposits may be intermixed with other soil types, such as colluvium or talus. Elevated beach deposits generally have a density of loose to compact and may be weakly cemented.

Debris Flow Deposits (Qdf): Typically an unsorted mix of sand- to boulder-size clasts, often mixed with splintered and broken trees, and other vegetation (Appendix A-6). Deposited in narrow channels or spread out on low-angle surfaces as a mix of water and debris during periods of high run-off, such as during heavy precipitation, snowmelt, or rain-on-snow events. Debris flow material is often multi-lithic, with sub angular to rounded clasts ranging in size from less than 1 ft to more than 5 ft in diameter.

Alluvial Fan Deposits (Qaf): Sediment deposited where a high-energy stream encounters a relatively flat slope (Appendix A-7). Alluvial fan deposits are typically triangular in map view, and have been sorted by flowing water. Alluvial fan clasts typically range in size from sand to boulders, and may provide a good source of borrow material where thick enough. In the project area, the alluvial fan deposits are usually derived from glacial deposits, and consist of sub rounded to rounded clasts.

Landslide Deposits (Qls): Historically recent (i.e., within the last few hundred years) mass wasting deposits from one or few events (Appendix A-8). These areas are generally vegetated by deciduous trees and brush, or smaller coniferous trees in contrast to the adjacent old growth forest. Landslide materials are typically unsorted masses of coarse soil and rock and may include trees and other organic materials.

River Deposits (Qr): Sediments deposited at the mouth of the Katzehin River at the north end of the IRP 2006 alignment (Appendix A-9). The sediments are influenced both by the flow of the Katzehin River and daily tidal changes. These deposits primarily consist of silt and sand, with gravel present. The river deposits may contain organic material such as logs, seaweed, shells, or other organic matter washed down the Katzehin River or floated in during high tide/storm events. They generally have densities ranging from loose to compact.

Glacial Outwash (Qgo): Sediment deposited by meltwater streams originating from glaciers (Appendix A-10, A-11). Glacial outwash consists of poorly to well-sorted sand, gravel, cobbles, and boulders with silt interbeds. Glacial outwash typically forms low-angle deposits. In areas where the slope has been over steepened, such as by wave erosion, glacial outwash is prone to scallop-shaped slope failures on steeper slopes. May be overlain or intermixed with talus or colluvium, especially near steep cliffs. Glacial outwash is typically encountered at the mouth of "U"-shaped glacial valleys. These deposits generally have densities ranging from compact to very dense and may be weakly cemented in areas. Can be an excellent source of borrow material.

3.2.5 Bedrock Units

Basalt Bedrock (Bxv): Lightly to moderately metamorphosed massive vesicular basalt, typically phaneritic with fine to medium grains (Appendix A-12). Typically has a compressive strength of R4 to R5 based on field assessment (Table 2). An exfoliation joint set can form parallel to the local hillside slope. The basalt displays multiple joint sets ranging from tightly spaced to extremely wide. In localized zones, the basalt appears to have been hydrothermally altered, resulting in a significant reduction of rock strength (to approximately R2). Many outcrops have been smoothed and rounded, by glacial processes, wave action, and erosion by flowing water.

Metasedimentary Bedrock (Bxms): Metamorphic bedrock with a sedimentary parent rock (Appendix A-13). Typically consists of a mix of biotite-rich schist, quartzite, marble, with intrusions of metamorphosed diorite (gneiss). Usually forms strongly defined, tightly spaced foliations steeply dipping to the northeast. Outcrops may contain several pervasive joint sets. Typically has a compressive strength of R4 to R5 based on field assessment (Table 2). May display original cross-bedding and typically has a tabular fabric. The metasedimentary bedrock is typically intermixed with gneiss near the gneiss contact.

Gneiss Bedrock (Bxmg): Metamorphic bedrock that appears to have originated as a dioritic or granodioritic pluton (Appendix A-14, A-15). The gneiss has weak to strong foliation. The foliation typically dips steeply to the northeast. Typically forms large vertical cliffs (100+ ft high), and is a common source for mega-talus. The gneiss tends to form more massive cliffs than the metasedimentary bedrock. Typically has a compressive strength of R5 to R6 based on field assessment (Table 2). An exfoliation joint set typically forms parallel to the cliffs. The gneiss may be massive or may display several joint sets (some pervasive). Many outcrops have been smoothed and rounded by glacial processes, wave action, and erosion by flowing water. The gneiss is sporadically intermixed with the metasedimentary bedrock, particularly in transition zones between the gneissic and metasedimentary bedrock.

Undifferentiated Metamorphic Bedrock (Bxm): Metamorphic bedrock that shares characteristics of both the metasedimentary and gneissic bedrock, or consists of intermixed metasedimentary and gneissic bedrock either observed or inferred at a scale too small to be resolved on the surficial geology maps (Appendix A-16, A-17).

3.2.6 Surface Hydrology

Per the direction of the Regional Hydraulics Engineer, streams encountered in the field were classified as Type I, II, III, or IV. Guidelines for assigning these classifications were provided by ADOT&PF and outlined below. The purpose of qualitative characterizations was to identify potential design challenges and priorities at stream crossings along the alignment. These classifications were not to be interpreted as design recommendations. Final engineering design and pipe size selection is the responsibility of ADOT&PF.

Streams were characterized at locations crossing the IRP 2006 alignment centerline. Four features (described below) were collected at a stream crossing using the MobileMapper™: type, bed, width, and photo. Sometimes ephemeral streams were encountered. Ephemeral streams with evidence of water flow (e.g., aligned tree needles, vegetation and duff pushed up against tree roots and rock) were categorized. These observations represent one-time visits to streams. The weather varied greatly during the summer field season, from clear and warm, to moderate rain lasting several days. Hydrologic observations could change if the streams were visited in a different season.

Type is based on visual or audible stream detection.

- Type 1 – Stream channel is easy to step over, typically up to 2 ft wide.
- Type 2 –Stream channel is more difficult to step over, typically 2 to 3 ft wide.
- Type 3 – Stream channel is typically greater than 3 ft wide.
- Type 4 – A Type 3 stream with an additional complicating factor – bridge sites, multiple stream channels, meandering channel, debris flow channel or avalanche path, unconfined flow down bedrock slope or cliff.
- Audible – Water flow not visible but flow is audible in the subsurface (e.g., water flowing through coarse talus).

Bed refers to the stream channel material observed or inferred in the stream bed:

- Fine
- Sand
- Gravel
- Cobble
- Boulder
- Bedrock

Width is based on visual estimates of stream width:

- 0-3 ft
- 3-6 ft

- >6 ft

Photo documentation of the streams was conducted, with field personnel or field gear used for scale. A photo number of #1000 means that no photo was taken.

3.2.7 Rock Structure Mapping

Detailed rock structure mapping data was collected at 117 locations representing roughly one site per 1,000 ft of the IRP 2006 alignment (Appendix B). Rock mass and discontinuity descriptions and measurements were typically taken at sites proposed for large rock cuts, fills, bridge abutments, or where mitigation is likely needed for rockfall hazard. Effort was made to select outcrops that are representative of the local bedrock conditions. For all relevant and accessible rock discontinuity sets, the orientation of dip and dip direction were measured using Brunton™ Geo Transit structural compasses set to 23.5° east magnetic declination for “true north” measurements. Additionally, data concerning discontinuity persistence, aperture, shape, surface roughness, number, and spacing were collected. Data were collected using a uniform template (Figures 8 & 9) and locations were noted on the surficial geology maps. The results of the rock structure mapping is presented as a separate addendum.

3.2.8 Mega-Boulders

Extremely large boulders and talus are widespread along east Lynn Canal and may present unique challenges to excavation, road construction and hazard management. In this project, clasts greater than 10 ft diameter for the smallest dimension are referred to as *mega-boulders*. Typical mega-boulders range from 10 ft to 20 ft diameter with some boulders reaching 50 ft diameter. In particular areas, mega-boulders are so common that they form entire talus fields, often interlocked on steep slopes. Removal of mega-boulders may present challenges to mechanical excavation by earth moving equipment and may require blasting. Large voids (up to 6 ft wide and 15 ft deep) are common between mega-boulders and mega-talus, which may complicate fill and compaction for road grading. The size and location of mega-boulders were routinely recorded using MobileMapper™ units and noted on maps. Because mega-boulders are so frequent and widespread in some areas, their appearance on geologic maps simply indicates their presence, not necessarily their number.

3.2.9 Alternative Mapping Methods

In many locations, particularly at higher elevations, rugged terrain was impassible or too hazardous to be mapped directly on the ground. Where walking was not possible, completion of map coverage depended on alternative or supplementary mapping methods listed below.

- Airborne/helicopter flights allowed visual mapping of otherwise impassible areas, such as cliff-dominated sites or steep shorelines.
- High altitude and low angle/oblique aerial photography gave insight into regional and local bedrock structures affecting surface processes. Appendix C presents a sequence of aerial photographs along the alignment from IRP 2006 1445+00 to 2620+00.
- LIDAR bare earth images were frequently used to interpret slope morphology or spatial extent of surface deposits.

3.2.10 Geologic Map Nomenclature

Surficial geologic maps were drawn as an outline of areas in which an observed bedrock or soil type persists at the surface. These areas are outlined on topographic maps and labeled with symbols specific to the observed conditions. In areas where a combination of more than one material or condition persists, the area may be labeled with more than one symbol type. For example, an area in which shallow talus (Qct) overlies basalt bedrock (Bxv), the label used is $\frac{Qct}{Bxv}$. The upper term is the material seen on the surface and the lower term is the underlying material. "Shallow" is interpreted to be between approximately 3 ft and 10 ft depth. In the example above, basalt bedrock is estimated to be not more than 10 ft below the talus surface. This is an approximation and localized exceptions certainly exist. In areas characterized by both deposits and bedrock at the surface, for example talus and basalt bedrock, the two terms can be combined, as in "Qct + Bxv". The first term indicates the dominant or primary surface material, followed by the secondary or less common material.

Geologic mapping was based on direct field observation, in addition to LIDAR and aerial photograph interpretation in the field and office. Even with direct field observation, thick vegetation often obscured deposits or bedrock exposures. Thus, in an area mapped as a soil deposit, some bedrock may be encountered, and vice versa. Vegetation removal is required for positive identification of geologic materials.

3.3 Geologic Hazard Identification

Geologic hazard maps were produced at the 1 inch = 500 ft scale throughout Zone 4 from tidewater to 3,000 ft east of the IRP 2006 alignment. Geologic contacts were drawn on field maps and later digitized, in-house, using AutoCAD® software. At frequent points, data was digitally recorded using the MobileMapper™ to document surface and underlying materials, in addition to data being entered into field notebooks.

Identifying geologic hazards in Zone 4 of the Lynn Canal Highway area required a multifaceted approach since many of the hazards were observed on a regional scale. The required mapping limits often led into terrain that was impassable or otherwise too difficult to attempt. The large area designated for geologic hazard mapping was too large for the team to walk in the time allowed. As a result of the immense study area, the hazard mapping team often employed means other than walking and physically observing the terrain in order to create the geologic hazard map.

Topographic maps produced from LIDAR, as well as bare earth LIDAR were used to identify geologic features and assist in mapping the geologic hazards encountered. Topographic maps and LIDAR imagery were employed to identify the extent of some hazards and the bounds of those hazards were then interpolated when possible. LIDAR was particularly useful for seeing large features such as bedrock cliffs, massive talus fields, and gullies that were potential debris flow paths. In LIDAR images, certain hazard conditions present relatively consistent patterns, often allowing hazards to be interpreted by the texture of their digital image (Figure 5). Both of these tools, coupled with helicopter reconnaissance of the corridor, allowed the hazard investigation team to target areas for further investigation that posed a threat to the proposed IRP 2006 alignment.

Another crucial element in completing the hazard map was coordination with the centerline mapping team. Radio communication between the two teams was often used to resolve questions about potential hazard conditions encountered by each team. The teams would often communicate site conditions to one another in order to determine spatial continuity of a potential hazard and its severity.

The hazard investigation team used two MobileMapper™ units as well as two digital cameras to document and collect data about all hazards encountered. The type of data collected is listed and described below and was used to create the hazard database. The method of digitally collecting point data is described in the MobileMapper™ Section 3.1.2.

3.3.1 Definitions of Hazards

The definitions of each geologic hazard type encountered are as follows.

Rock Slide: Characterized by large volume events that fail from bedrock outcrops. These events create talus deposits described in Section 3.2.4.

Debris Flow: Episodic, channelized, gravity driven events that are mixtures of sediment and water. These events can produce a wide range of particle sizes, and create debris flow deposits described in Section 3.2.4. These deposits also have the potential to create thick organic deposits at the beach line.

Rockfall: Detachment of individual rocks or relatively small groups of rocks from a steep rock face. There is generally little or no shear displacement. These events create talus soils described in Section 3.2.4.

Hazard Rock: Perched boulders that could become dislodged either during or after construction of the road. These rocks are often mega-boulders.

Soil Raveling: Particle by particle failure over time from steep soil slopes. This type of event is common in glacial outwash deposits described in Section 3.2.4.

Translational Sliding: Slope failure via planar sliding of soils that can include trees and other debris. This type of event is seen in glacial outwash deposits described in Section 3.2.4.

Avalanche: Evidence of avalanche activity. Avalanches have the potential to transport logs and soil which can result in thick organic deposits at the beach line. Avalanche paths are frequently associated with debris flow paths.

A comprehensive study of snow avalanches was carried out by Glude and others (2004) prior to Golder's work on the project, and the identification and assessment of avalanche hazards are outside the scope of this report.

3.3.2 Hazard Characteristics

At each point where hazard data was collected, a value was recorded for each of the following characteristics. A definition of each characteristic and the possible values follows.

IRP 2006 Location represents the unique 4-digit numerical identifier for each hazard. The value is based on assigning one IRP 2006 value to the hazard (e.g., 1493), and was primarily used when entering data into the MobileMapper™ during the field season. However, the value does not provide information on the scale of the hazard, only the general location of the hazard.

IRP 2006 South and North Margin refers to the beginning and ending IRP 2006 stationing at centerline that the hazard is considered to impact or potentially impact, for example 1498+90 and 1492+90, respectively. The values were often determined after field mapping of the hazard and map revisions were completed. Thus, the values provide information on locations of the hazard boundaries.

Bounds refers to the location of the hazard relative to the observation point. For example, “up alignment” indicates that the hazard occurs up (north) the IRP 2006 alignment from the perspective of the observer.

- Up alignment
- Down alignment
- Upslope
- Downslope
- Mid

Impacts alignment refers to whether or not the hazard being observed has impacted the proposed IRP 2006 alignment in the past.

- Yes
- No

Frequency is divided into five different time frames which approximate the recurrence interval of the hazard in years. The category is estimated from field observations of vegetation disturbance, degree and type of revegetation, and freshness of rockfall and talus in terms of weathering and moss/lichen growth on rock face and talus. For some hazards, frequency is unknown, possibly due to loss of MobileMapper™ data or hazard identification after fieldwork was completed. In these cases, frequency was estimated based on field notes, photographs, and information on site specific factors, and labeled as *Unk([frequency]?)* with the frequency estimate noted in the brackets.

The frequency values presented should be considered preliminary estimates. The accuracy and precision of frequency values have not been established. Frequency values could change based on a more complete time series of direct observations, weather and climate factors, and absolute age dating of vegetation and lichen.

- >25 yrs
- 5 to 25 yrs
- 1 to 5 yrs
- 0 to 1 yr
- Unk([frequency value]?)

Quantity is measured in cubic yards (CY) and reflects the approximate volume of material during the most recent event.

- 1000+ yds
- 100 to 1000 yds
- 10 to 100 yds
- < 10 yds

Source Elevation refers to the vertical height in ft above the proposed IRP 2006 alignment that the hazard originates from. Note: this is not elevation.

- >3000 ft
- 2000 to 3000 ft
- 1000 to 2000 ft
- 500 to 1000 ft
- 100 to 500 ft
- <100 ft

Alignment Exposure is the total length in ft of the highway estimated to be at risk from the hazard.

- 500+ ft
- 200 to 500 ft
- 50 to 200 ft
- <50 ft

Predictability refers to how predictable a hazard is. For example, if a debris flow is often catalyzed by heavy rain events, then the predictability may be "high". By contrast, rockfalls can occur at any time and are relatively unpredictable.

- High
- Moderate
- Low
- Unpredictable

Source Material is the material type supplying, or moved by, the hazard event. The definitions for each material type can be found in Sections 3.2.4 for deposits and Section 3.2.5 for bedrock.

- Qc Colluvium deposits
- Qct Talus deposits
- Qb Modern beach deposits
- Qeb Elevated beach deposits
- Qdf Debris flow deposits
- Qaf Alluvial fan deposits
- Qls Landslide deposits
- Qr River deposits
- Qgo Glacial outwash
- Qm Glacial moraine deposits
- Bxv Basalt bedrock
- Bxms Metasedimentary bedrock
- Bxmg Gneiss bedrock
- Bxm Metamorphic bedrock

Centerline Slope identifies the terrain characteristics on centerline for each hazard. This characteristic is specific to the IRP 2006 alignment. Note that the terrain characteristics at the source, along the path, or in the deposition zone could be different than the terrain characteristics at centerline.

- Open soil slope
- Open bedrock slope

- Single channel
- Multi-channel
- Fan
- Deciduous trees
- Other

Clast Size indicates the typical or mean clast diameter in ft that has been transported.

- >4 ft
- 3 to 4 ft
- 2 to 3 ft
- 1 to 2 ft
- 0 to 1 ft

Alignment Location describes the location of the proposed IRP 2006 alignment with respect to the observed hazard.

- Below deposition zone
- Deposition zone
- Path

Slope Angle is the slope angle of the hazard at its origin. This number was often estimated using topographic maps and measured in degrees.

- >60
- 50 to 60
- 40 to 50

- 30 to 40
- 20 to 30
- 10 to 20

Slope Drainage refers to how water is moving in relation to the hazard deposits.

- Into slide
- Off of slide
- Unknown

Vegetation is a generalized characterization of the vegetation type within the hazard area.

- Denuded
- Disturbed
- Undisturbed
- Deciduous Trees

The following categories all have *yes/no* answers and refer to whether or not specific characteristics are present within the hazard limits.

- Tension Cracks
- Seeps
- Tilting Trees
- Curving Trunks
- Deciduous Trees

3.3.3 Geologic Hazard Rating Systems

Two independent systems were developed to rate the geologic hazards encountered in Zone 4. The Geologic Hazard Rating System (GHRS) and Hazard Index Number (HIN) scale (Table 3) were created to assign preliminary, estimated relative and absolute rankings to geologic hazards. The GHRS was created by Golder staff in conjunction with Norm Norrish. The GHRS is a relative scale with each hazard being assigned an *"A"*, *"B"*, or *"C"* rating. The ratings are defined as follows:

- "A": Field evidence that the hazard condition has affected the proposed IRP 2006 alignment within the past 25 years, and that the conditions of hazard origin still exist OR failure would generally be of sufficient volume to close the highway for several days to weeks and could result is loss of the roadway prism.

- "B": Field evidence that the hazard condition has affected the proposed IRP 2006 alignment more than 25 years ago, and the hazard condition persists OR failure would be of sufficient volume to close the highway for several hours to a few days.

- "C": No field evidence that the hazard condition has ever affected the proposed IRP 2006 alignment but the potential is judged to be present. Failure would generally not close the highway but could pose a significant hazard to vehicular traffic.

The HIN scale (Table 3) was adapted from the United States Department of Transportation, Federal Highway Administration Rockfall Hazard Rating System (Pierson and Van Vickle, 1993). Ascending HIN values indicate a greater estimated geologic hazard. The HIN for each hazard represents the weighted sum of five hazard characteristics: frequency, quantity, source elevation, alignment exposure, and predictability. Each hazard characteristic has four attributes. Each attribute is assigned a weighted value of 3, 9, 27, or 81, with higher values indicating a greater estimated geologic hazard. The HIN scale has minimum and maximum values of 15 and 405, respectively. These values are estimates based on preliminary coverage of Zone 4.

The GHRS and HIN scale values for Zone 4 presented in this report are preliminary and subject to revision. No estimates of accuracy or uncertainty have been provided for the GHRS or HIN scale. Since values are dependent on the location of the proposed IRP 2006 alignment, any future shifts in the alignment will require additional GHRS and HIN scale calculations. Sepecifically, alignment shifts will change the source elevation and alignment exposure characteristics of the HIN value for a given hazard. Additional work to constrain hazard characteristics, weather and climate change, and absolute age dating of vegetation and lichen will further constrain GHRS and HIN scale values.

Table 4 lists all hazards sorted by ascending IRP 2006 location while Table 5 lists all hazards by hazard type and ascending HIN value. The HIN weighting scheme for all hazards sorted by ascending HIN and IRP 2006 location is presented in Table 6. HIN scale values for Zone 4 range from 33 to 279.

3.4 Geophysical Surveying

Geophysical surveys were carried out in an effort to determine the depth to bedrock. Electromagnetic methods (e.g., EM-31, Time Domain) were attempted but were not effective in determining depth to bedrock. Seismic reflection profiling provided the best results. These data are presented in a separate addendum. The locations where the seismic profiles were conducted are shown on the surficial geologic maps (Appendix E).

3.5 Helicopter Landing Zones

As described in Section 3.2.2 regarding site access, helicopter transport was essential for the successful completion of this project. The helicopter landing zone database (Appendix D) served several purposes, including documenting the location and ground conditions of the landing zones, updating ADOT&PF-SE on newly identified landing zones used, and providing crews in the field with landing zone positions to decrease travel over extremely rugged terrain.

4.0 RESULTS

The following section provides a general station by station review of surficial geology, including geologic materials and geomorphology, found along the IRP 2006 alignment.

4.1 IRP 2006 Alignment Surficial Geologic Map Descriptions

The descriptions begin at Independence Creek (IRP 2006 1454+30) to the south and end at the Katzehin River (IRP 2006 2626+20) in the north. The descriptions represent a condensed, written summary of the preliminary surficial geologic map (Appendix E). Descriptions for IRP 2006 alignment segments are provided to the nearest 10 ft on centerline where possible (e.g. IRP 2006 1525+60). 100 ft identifiers (e.g., IRP 2006 1525) are used to provide general position information in some cases.

4.1.1 IRP 2006 Segment 1454+30 to 1483+70

Beginning on the north bank of Independence Creek, the IRP 2006 alignment traverses a wide band (up to several hundred ft wide) of low-angle elevated beach deposits. A steep slope of basalt bedrock, with some talus cover, rises several thousand ft above the elevated beach deposits. The base of the slope is more than 100 ft from the proposed centerline.

4.1.2 IRP 2006 Segment 1483+70 to 1501+90

The IRP 2006 alignment crosses mostly alluvial fan and debris flow deposits that originate from a avalanche chute upslope. The IRP 2006 alignment also crosses modern beach deposits with some mega-boulders. The avalanche chute descends and broadens into a wide, low-angle alluvial fan at the IRP 2006 alignment. Along the shoreline, wave action has reworked the alluvial fan, modern beach, and debris flow deposits.

4.1.3 IRP 2006 Segment 1501+90 to 1557+80

The IRP 2006 alignment traverses low-angle to moderate slopes of basalt bedrock and talus with mega-boulders, plus several debris flows. A large rockslide centered above IRP 2006 1524 released approximately five years ago. The slide stopped approximately 150 ft upslope of the IRP 2006 alignment. The slide debris included basalt slabs more than 40 ft across. The IRP 2006 alignment traverses beneath basalt bedrock cliffs at IRP 2006 segment 1525 to 1537.

4.1.4 IRP 2006 Segment 1557+80 to 1574+20

The IRP 2006 alignment crosses a side valley, traversing low-angle to moderate slopes of alluvial fan and some beach deposits, and basalt bedrock. Alluvial fan deposits 5 ft to 15 ft thick and approximately 30 ft thick were observed along with mega-boulders. Several hundred feet upslope of the IRP 2006 alignment, basalt bedrock cliffs are present on the north and south valley walls.

4.1.5 IRP 2006 Segment 1574+20 to 1695+00

The IRP 2006 alignment traverses colluvium, talus, and debris flow deposits beneath basalt bedrock cliffs covered intermittently with talus, mega-talus, and landslide deposits. Numerous mega-boulders appear in some regions. The Met Point sea lion haulout is located at approximately IRP 2006 1606. The IRP 2006 alignment traverses beneath cliffs in the following regions:

- IRP 2006 segment 1603 to 1606
- IRP 2006 segment 1609 to 1611
- IRP 2006 segment 1622 to 1628
- IRP 2006 segment 1650 to 1661
- IRP 2006 segment 1690 to 1692

4.1.6 IRP 2006 Segment 1695+00 to 1725+30

The IRP 2006 alignment continues to traverse talus, debris flows, mega-boulders, and basalt bedrock beneath steep bedrock slopes covered intermittently by talus. The inferred bedrock contact between gneiss bedrock (upslope) and basalt bedrock (downslope) trends obliquely north-northwest down the slope above the IRP 2006 alignment. Basalt bedrock cliffs exist above the IRP 2006 alignment at IRP 2006 segment 1697 to 1703, and IRP 2006 segment 1705 to 1716.

4.1.7 IRP 2006 Segment 1725+30 to 1748+30

Bedrock along centerline changes from basalt to gneiss. The IRP 2006 alignment traverses gneiss, talus, mega-boulders, and debris flow deposits beneath gneiss and metasedimentary bedrock cliffs, with some slopes intermittently overlain by talus. Upslope, an additional north-northwest-trending bedrock contact is inferred between gneiss and metasedimentary bedrock. The IRP 2006 alignment traverses beneath cliffs in the following regions:

- IRP 2006 segment 1725 to 1730
- IRP 2006 segment 1729 to 1739 – Steep to overhanging cliffs are upwards of 350 ft high. The slopes drop off steeply into the water.
- IRP 2006 segment 1745 to 1746

4.1.8 IRP 2006 Segment 1748+30 to 1766+70

The IRP 2006 alignment traverses talus, mega-boulder zones, debris flow deposits, and metasedimentary bedrock beneath steep metasedimentary bedrock slopes intermittently covered by talus. Several steep, narrow gullies descend down the slope with debris flow deposits found in deposition zones across centerline. The IRP 2006 alignment traverses beneath cliffs in the following regions:

- IRP 2006 segment 1748 to 1751
- IRP 2006 segment 1755 to 1758
- IRP 2006 segment 1759 to 1767

4.1.9 IRP 2006 Segment 1766+70 to 1797+20

The IRP 2006 alignment traverses low-angle to moderate slopes of mostly talus, with some debris flow deposits, and metasedimentary bedrock. Talus deposits greater than 10 ft thick and 15-30 ft thick were observed in places. The moderate to steep slopes upslope of the IRP 2006 alignment are composed of talus and colluvium, in addition to metasedimentary bedrock intermittently covered by talus.

4.1.10 IRP 2006 Segment 1797+20 to 1935+00

The IRP 2006 alignment traverses talus and colluvium, glacial outwash, elevated beach, debris flow, and alluvial fan deposits, and metasedimentary bedrock. Upslope of the IRP 2006 alignment, moderate slopes are composed of glacial outwash, and metasedimentary bedrock and talus covering bedrock. The IRP 2006 alignment crosses three side valleys. Several landslide deposits found in the glacial outwash scarp at IRP 2006 segment 1857 to 1863 encroach as close as ~20 ft but do not cross the IRP 2006 alignment.

4.1.11 IRP 2006 Segment 1935+00 to 1950+40

The IRP 2006 alignment traverses moderate slopes of bouldery talus and mega-boulders, and some metasedimentary bedrock, beneath gneiss and metamorphic bedrock cliffs up to ~250 ft high.

4.1.12 IRP 2006 Segment 1950+40 to 1995+00

The IRP 2006 alignment traverses moderate slopes of glacial outwash and talus, crossing the debris flow of a side valley deeply incised into gneiss bedrock. 25 to 30 ft thick thick glacial outwash and talus deposits were observed. Upslope, cliffs composed of gneiss, metasedimentary, and metamorphic bedrock are covered intermittently with talus. Cliffs begin at IRP 2006 1935 and continue northward up to approximately IRP 2006 1953. Cliffs above the IRP 2006 alignment are found beginning at approximately IRP 2006 1993 and continue northward to IRP 2006 1999.

4.1.13 IRP 2006 Segment 1995+00 to 2182+20

The IRP 2006 alignment traverses mostly moderate and some low-angle slopes of talus, mega-boulders and mega-talus colluvium, and beach deposits, along with gneiss, metasedimentary, and metamorphic bedrock. Upslope of the IRP 2006 alignment, metasedimentary, gneiss, and metamorphic bedrock are intermittently overlain by talus. Several steep, narrow gullies descend down the slope with debris flow deposits found in deposition zones across centerline. The IRP 2006 alignment traverses beneath cliffs in the following regions:

- IRP 2006 segment 1993 to 1999
- IRP 2006 segment 2015 to 2019
- IRP 2006 segment 2064 to 2069
- IRP 2006 segment 2074 to 2088
- IRP 2006 segment 2103 to 2108
- IRP 2006 segment 2112 to 2115

- IRP 2006 segment 2124 to 2125

- IRP 2006 segment 2160 to 2174 – Gneiss bedrock cliffs are up to ~250 ft high.

- IRP 2006 segment 2179 to 2182

4.1.14 IRP 2006 Segment 2182+20 to 2225+00

The IRP 2006 alignment traverses mostly low-angle and some moderate slopes of colluvium and talus. Upslope of the IRP 2006 alignment, gneiss bedrock cliffs descend covered intermittently with talus extend northward at IRP 2006 segment 2200 to 2236.

4.1.15 IRP 2006 Segment 2225+00 to 2301+50

The IRP 2006 alignment traverses moderate to steep slopes of talus, mega-talus, colluvium, and landslide deposits, in addition to metasedimentary and gneiss bedrock. The steep slopes above the IRP 2006 alignment are composed of gneiss bedrock intermittently overlain by talus. Several steep, narrow gullies, including Yeldagalga Creek, are incised into gneiss bedrock. Some gullies have debris flow deposits found in deposition zones across centerline. The IRP 2006 alignment traverses beneath cliffs in the following regions:

- IRP 2006 segment 2236 to 2240

- IRP 2006 segment 2250 to 2280 – Cliffs exist above and below the IRP 2006 alignment.

- IRP 2006 segment 2290 to 2292

- IRP 2006 segment 2296 to 2302

4.1.16 IRP 2006 Segment 2301+50 to 2401+70

The IRP 2006 alignment traverses steep slopes of gneiss bedrock, talus, mega-talus, and mega-boulders. Upslope, cliffs of gneiss bedrock are intermittently covered by talus. Maximum cliff heights in some regions reach approximately 400 ft. Two steep gullies with debris flow deposits across centerline were identified. The Gran Point sea lion haulout is located at approximately IRP 2006 2361. The IRP 2006 alignment traverses beneath, and sometimes above cliffs in the following regions:

- IRP 2006 segment 2301 to 2308

- IRP 2006 segment 2321 to 2330 – A structural lineament and possible left-lateral fault is located at bridge site 14E at IRP 2006 2322.

- IRP 2006 segment 2344 to 2360

- IRP 2006 segment 2360 to 2372 – Considerable megatalus is present. Rockfall from the cliff above is embedded in trees on centerline.

- IRP 2006 segment 2372 to 2390 – Cliffs of gneiss slope into Lynn Canal.

- IRP 2006 segment 2390 to 2404

4.1.17 IRP 2006 Segment 2401+70 to 2445+40

The IRP 2006 alignment crosses a side valley, traversing mainly low-angle slopes with glacial outwash, some talus and alluvial fan deposits, and gneiss bedrock. Located on the north side of the creek, four landslide deposits cross the centerline, originating from the steep glacial outwash scarp. The glacial outwash deposits are probably at least 50 ft thick. Upslope, moderate slopes of glacial outwash deposits are inferred up to ~350 ft elevation. Steep gneiss bedrock cliffs crop out on the north and south sides of the valley, with cliffs immediately above the IRP 2006 alignment at IRP 2006 segment 2401+70 to 2405+00.

4.1.18 IRP 2006 Segment 2445+40 to 2571+30

The IRP 2006 alignment traverses steep slopes of talus, mega-talus, and debris flow deposits, along with predominantly gneiss and some metasedimentary and metamorphic bedrock. Talus in some locations is estimated to be 50 ft thick. Slopes above the IRP 2006 alignment have gneiss, metasedimentary, and metamorphic bedrock cliffs, intermittently overlain with talus.

4.1.19 IRP 2006 Segment 2571+30 to 2603+80

The IRP 2006 alignment crosses a side valley, traversing mainly low-angle slopes of glacial outwash, talus, and metasedimentary bedrock. Upslope of the IRP 2006 alignment, low-angle to moderate glacial outwash with gneiss bedrock cliffs crop out. Cliffs above the IRP 2006 alignment are located at IRP 2006 segment 2317 to 2583.

4.1.20 IRP 2006 Segment 2603+80 to 2626+20

The IRP 2006 alignment traverses low-angle and moderate slopes of talus, mega-talus and mega-boulders, and gneiss, metasedimentary, and metamorphic bedrock. Gneiss, metasedimentary, and metamorphic bedrock cliffs above the IRP 2006 alignment occur at IRP 2006 segment 2604 to 2615, and IRP 2006 segment 2620 to 2626.

4.1.21 Up alignment of IRP 2006 2626+20

The IRP 2006 alignment begins to cross river deposits composed primarily of silt and sand, with gravel present, of the Katzehin River delta and intertidal zone. The IRP 2006 alignment trends northwest away from gneiss bedrock cliffs, up to 450 ft high, located on the left bank of the river.

4.2 Geologic Hazards

Numerous hazards were encountered during Phase I of the Zone 4 Geotechnical Investigation and are presented on the Preliminary Geologic Hazard Maps (Appendix F). The most common of these hazards were rockfalls. Over the approximately 22.2 miles of proposed road, there were 52 catalogued rockfall hazard areas, 42 debris flow hazards, 5 hazard rocks, 4 soil raveling hazard areas, 4 translational sliding hazards, 3 landslide hazards, and 2 rockslide hazards. Each hazard was given a Hazard Index Number (HIN), as well as an ‘A’, ‘B’, or ‘C’ GHRS ranking, as described previously. Individual hazards are presented in Appendix G, with photographs and pertinent data for determining the HIN of each hazard.

5.0 PRELIMINARY RECOMMENDATIONS FOR PHASE II INVESTIGATIONS

Based on the work completed in Phase 1 of the geotechnical investigations, preliminary recommendations have been developed for Phase II investigations and are presented here for consideration.

The most significant design issue for the alignment is the overburden materials. The overburden is relatively coarse, and over much of the alignment, is extremely coarse, including mega-talus (clast size greater than 10 ft in the smallest diameter). Cuts in talus pose the greatest potential construction and operational hazards and therefore they require more attention. Based on the observed fragment sizes of the talus, there does not appear to be practical methods of retaining the talus without resorting to structural methods, such as retaining walls. Therefore cut heights in talus must be minimized by either putting the road in prism or removing the talus from above the cut slope. Both approaches will have environmental, right-of-way, and material quantity impacts.

The large talus also presents a significant challenge during investigation and construction as many clasts are too large to be moved with conventional earthmoving equipment, and the clasts create a ground surface that is too irregular to be trafficable. Contraction in these segments will require special measures, such as blasting large boulders to a manageable size and filling voids.

For the most part, the bedrock on the alignment is widely jointed, very strong, and competent. However, it appears that the jointing in the bedrock units is not conducive to 0.1H:1V cuts as depicted in the pre-design documents. A lower cut angle will result in a greater cut height, larger material volume, and a larger overall construction footprint. Because the bedrock surface is difficult to define with the borehole spacing typical of most highway projects, we anticipate that final design will have to depend on observations and investigations made in the field by geologists or engineers during construction as the subsurface conditions are revealed.

Except for investigations at bridge sites, most of the subsurface investigations are oriented to determining depth to bedrock and confirming the character of overburden so that appropriate excavations, retaining walls, and slope stabilization measures can be designed. Preliminary recommendations for the Phase II investigations are outlined below.

5.1 Alignment Optimization Collaboration

ADOT&PF is currently modifying portions of the IRP 2006 alignment used during summer 2006 field investigations. An alignment termed the "A" line was available by October 2006. The Golder geotechnical team should meet with the ADOT&PF design team in early January 2007 to begin to collaborate on optimization of the latest alignment. This initial collaboration should be carried out in a large room with multiple computer screens so the AutoCAD® maps, LIDAR, geologic maps, photos, and other data can be rapidly displayed. The team would go through the entire alignment and make appropriate changes based on all the geologic, hazard, and topographic information. This will be an iterative process and follow-up sessions will likely be necessary. Optimization of the alignment will consider the following:

- Establishing stream crossing locations to take advantage of terrain features.
- Avoiding deep cuts in talus because of the difficulty and expense of cut stabilization.
- Minimizing the potential impacts of geologic hazards and avalanches.
- Assessing terrain for potential major re-alignments.

Many realignments have already been discussed with ADOT&PF during summer and fall 2006, and incorporated into later versions of the alignment. Based on summer 2006 field work and observations, segments of the IRP 2006 alignment that should be considered for realignment are shown below. This list is by no means final but represents impressions from the initial field mapping effort.

IRP 2006 Segment 1727 to 1740

Gneiss and metasedimentary cliffs, steep to overhanging, rise from tidewater to greater than 500 ft elevation. Talus accumulations and debris flows will threaten any cut. This segment needs further evaluation for a possible tunnel or elevated highway closer to tidewater.

IRP 2006 Segment 1855 to 1885

The proposed alignment crosses a major creek and traverses along the base of the glacial outwash scarp which is cut by numerous landslide deposits. Moving the alignment upslope onto the glacial outwash surface would avoid the scallop-shaped landslide deposits and difficulties resulting from cutting into the unconsolidated glacial outwash scarp.

IRP 2006 Segment 1950 to 1995

The proposed alignment crosses a stream and traverses along the base of the glacial outwash scarp displaying numerous incised channels and scalloped topography. Moving the alignment upslope onto the glacial outwash surface would avoid a high cut in the outwash scarp.

IRP 2006 Segment 2250 to 2270

North of Yeldagalga Creek, the proposed alignment traverses steep gneiss bedrock with a maximum cut depth of approximately 150 ft. A more favorable alignment should be considered at a slightly higher elevation.

IRP 2006 Segment 2301 to 2317

The proposed alignment traverses mid-slope across gneiss bedrock cliffs found from tidewater to approximately 350 ft elevation. A cut would likely need to be at least 100 ft deep with a steep drop-off to tidewater on the downslope side. Exfoliated gneiss slabs upslope of the cut may produce rockfall hazards. The alignment design in this area should be revisited, including tunnel evaluation.

IRP 2006 Segment 2321 to 2323

The proposed alignment crosses a deep gneiss gorge interpreted as a structural lineament. The alignment design at this site should be revisited, considering a bridge and change in grade.

IRP 2006 Segment 2360 to 2372

The proposed alignment, opposite the Gran Point sea lion haulout, crosses above a gneiss gorge that descends steeply to tidewater. A bench cut would probably need to be at least 190 ft high. Exfoliated gneiss slabs upslope of the cut may produce rockfall hazards. The alignment design at this site should be revisited.

IRP 2006 Segment 2388 to 2391

The proposed alignment traverses the base of gneiss bedrock cliffs approximately 300 ft high from tidewater. A cut would probably need to be at least 120 ft high. Exfoliated gneiss slabs upslope of the cut may produce rockfall hazards. The alignment at this site should be revisited. A tunnel may be warranted if a higher elevation alignment is not feasible.

IRP 2006 Segment 2415 to 2440

The proposed alignment crosses a stream and to the north, traverses along the base of a glacial outwash scarp which is cut by numerous landslide deposits. Moving the alignment either downslope onto shallower glacial outwash deposits, or significantly upslope, may reduce slope stability problems associated with cutting into the unconsolidated glacial outwash deposits.

IRP 2006 Segment 2540 to 2585

The proposed alignment traverses gneiss bedrock and talus to the north bank of a side valley and stream, with very steep cliffs both above and below the alignment, and a maximum pre-design cut depth of approximately 165 ft. Moving the alignment upslope several hundred ft to a less steep slope of gneiss bedrock with talus over bedrock would result in the alignment avoiding the steep cliffs.

IRP 2006 Range 2623 to 2626

At the northern end of Zone 4, the proposed alignment has an approximately 300-ft-long bench cut before trending northwest across the Katzehin River delta. The cut may not be necessary if the alignment begins to cross the river at IRP 2006 2620+00.

5.2 Preliminary Stability Analyses

Preliminary global stability analyses need to be conducted for prospective walls on talus and mega-talus to determine if the required global factors of safety can be attained. The surficial geology cross-sections (as discussed in Section 5.3.1) in large talus will be used as the basis for the analyses. In addition, some limited provisional analyses and designs for proposed rock cuts should be undertaken, using the previously collected field data, in order to determine optimal slope angles and possible support requirements.

Some limited provisional analyses and designs should also be undertaken for possible tunnel locations. Provisional portal designs in mega-talus and the effects of side slopes and shallow cover should be considered in these provisional analyses.

5.3 Centerline Investigations

5.3.1 Mapping Geologic Cross-Sections

An effort has been made to develop cross-sections of the surficial geology between IRP 2006 1520+00 and 1603+00. The focus of this mapping was to confirm bedrock contacts, describe talus characteristics, measure void widths and depths, and estimate depth to bedrock. It is recommended that this type of work should be extended to cover the entire Zone 4 segment at approximate intervals of 100 ft, although the initial effort should be concentrated on IRP 2006 segment 1500+00 to 1660+00 (Met Point segment). The spacing of these cross-sections can be adjusted to cover specific structures or cuts, as required. The cross-section widths generally span about 600 ft horizontally. Quick sections, based on visual check of the geologic mapping, are recommended in regions of exposed bedrock. More detailed sections, based on taped measurements on brushed lines, should be carried out where upslope and downslope bedrock/talus contacts need to be identified for design purposes, particularly where slope stability could be an issue.

These cross-sections will provide useful and cost effective information in the most expedient manner.

5.3.2 Cuts

Golder has collected rock structure data at 117 locations, but the datasets have not been analyzed. Stereonet analyses of these data should be carried out so that kinematic failure modes can be identified and appropriate cut angles determined. Additional and more detailed rock structure mapping will be necessary and will depend on the location of the final alignment. Drilling at some prospective cuts may be warrranted if the surficial data is deemed inadequate.

The typical investigation standard for the higher cuts (say +80 ft) would be to have at least one core hole that penetrates the slope template in the toe region of the cut. While a single hole is somewhat limiting, the intent is to confirm that a low shear strength layer (fault) is not present near the toe. If the first exploratory hole encounters such a layer, a provision in the investigation should be made to drill a second hole to develop a cross-section. The above recommendation assumes that low angle faulting cannot be precluded on the basis of geologic interpretation.

5.3.3 Embankments

ADOT&PF geotechnical guidelines recommend boreholes on spacings of approximately 200 ft (cuts) and 400 ft (fills), to a minimum depth of 10 ft below proposed grade or refusal. Prior to the development of a pioneer road, these types of investigations are relatively impractical on Zone 4 from a cost standpoint because of the access difficulties and coarseness of the materials. Therefore, testpits are recommended on 400 ft centers from Independence Creek at IRP 2006 1454+30 to IRP 2006 1500+00. These investigations should be combined with material site explorations. Subsurface investigations north of IRP 2006 1500+00 should be limited to specific critical areas once the alignment is defined. Additional investigations can be conducted as deemed appropriate once a pioneer road is in place, or during construction.

5.3.4 Material Sites

Material sites are likely to be established on elevated beach, alluvial fan, and glacial outwash deposits, and debris flow accumulations. Boreholes and testpits are the primary methods for subsurface investigations. Because the unconsolidated materials are very difficult to drill and sample, testpits are recommended where the terrain is accessible to a tracked backhoe/excavator. Boreholes are recommended on all other terrain.

A preliminary list of potential areas for material sites is provided below:

IRP 2006 Segment 1455 to 1484

Elevated beach deposits were found on centerline and on shallow slopes up to several hundred ft right of centerline.

IRP 2006 Segment 1560 to 1570

Heavily-forested, bouldery alluvial fan deposits extend several hundred ft right of centerline.

IRP 2006 Segment 1797 to 1827

Glacial outwash deposits were found on centerline and up to several hundred ft upslope of the alignment. The alignment also traverses talus, elevated beach, and debris flow deposits, and metasedimentary bedrock.

IRP 2006 Segment 1856 to 1923

Glacial outwash deposits were found on centerline and up to several hundred ft upslope of the alignment at a creek. Glacial outwash thicknesses greater than 15 ft and 20 ft were noted. The alignment traverses additional elevated beach and debris flow deposits, and metasedimentary bedrock.

IRP 2006 Segment 1950 to 1985

Glacial outwash and talus deposits were found on centerline and up to several hundred ft upslope of the alignment, south of a stream. Glacial outwash and talus deposits 25-30 ft thick were noted.

IRP 2006 Segment 2404 to 2435

Glacial outwash deposits were found on centerline and up to several hundred ft upslope of the alignment at a glacially-carved side valley and creek. Glacial outwash thicknesses greater than 20 ft and 25 ft were noted. The alignment also locally traverses gneiss bedrock, landslide, and alluvial fan deposits.

IRP 2006 Segment 2435 to 2445

Talus over glacial outwash deposits were found on centerline and up to several hundred ft upslope of the alignment. One debris flow deposit was noted as close as 80 ft upslope of the alignment.

IRP 2006 Segment 2571 to 2604

Glacial outwash and talus deposits were found on centerline and up to several hundred ft upslope of the alignment at a glacially-carved side valley and creek. The alignment traverses additional beach deposits and metasedimentary bedrock. Gneiss bedrock cliffs several hundred ft high crop out south of the creek.

5.3.5 Materials Testing

The preliminary IRP 2006 alignment indicates that segments of the highway will be on the coast and need to be protected from wave attack. Although the bedrock and large talus in the intertidal zone appears to be very durable and would perform well as armor and riprap, there are no laboratory test results to confirm this assumption. Therefore, the basalt, metasedimentary, and gneiss should be bulk sampled and tested for parameters typically required for shore protection. These include but may not be limited to: petrographic analysis (no fatal flaws), freeze-thaw (ASTM D-5312), accelerated expansion by ethylene glycol immersion (CRD-C 148-69), wet-dry (ASTM D-1513), specific gravity/absorption (ASTM 127), LA abrasion (ASTM 131), sulfate soundness (ASTM C88), and degradation (Alaska T-13). Many of these tests take months to conduct due to the number of cycles; therefore, testing should be carried out relatively early on in the project to confirm that the different rock types are suitable. The rock quality is considered to be relatively uniform within a given rock type and the test results will generally confirm their suitability regardless of where the rock is obtained along the alignment.

In addition to the above tests, other testing will be necessary when material sites are investigated, for example to confirm material suitability as structural fill for embankments.

5.4 Foundation Investigations

5.4.1 Bridges and Elevated Structures

Once the location of bridges and elevated structures are determined, diamond drilling with core retrieval should then be undertaken at abutment and pier locations. In some locations where bedrock is exposed on the surface, it may be sufficient to undertake surface mapping rather than drilling. This will, however, depend on a number of factors including anticipated loads and the rock mass structure.

5.4.2 Walls

If the depth to bedrock proves to be critical to the global stability of walls on mega-talus, then subsurface investigations will be needed to determine depth to bedrock in critical sections. If ADOT&PF proceeds with construction of a pioneer road, then these investigations could be done at substantially less cost using a lightweight truck-mounted Odex or equivalent drilling system. Otherwise they will have to be heli-drilled.

5.4.3 Tunnels

Once tunnel locations are identified, detailed geologic mapping will need to be carried out to assess overburden depths and rock structure. Depending on tunnel length and the amount of bedrock that is exposed for detailed mapping, drilling plans will need to be formulated to collect adequate rock mass characterization for design. Drilling of portal locations will likely be a requirement once we better understand the potential locations for these structures.

5.4.4 Snow Sheds

There are a number of avalanche zones intersecting the alignment. Some of these zones may require construction of snow sheds to protect the highway. Once these locations are identified, detailed geologic mapping will need to be carried out to assess overburden depths and rock structure. Depending on snow shed length and the amount of bedrock that is exposed for detailed mapping, drilling plans will need to be formulated to collect adequate site characterization for design. Drilling of portal and intermediate locations will likely be a required.

6.0 LIMITATIONS

This report has been prepared exclusively for the use of ADOT&PF and their representatives for use in design of the proposed Lynn Canal Highway. The work program followed the standard of care expected of professionals undertaking similar work in the State of Alaska under similar conditions. No warranty expressed or implied is made.

7.0 CLOSING

Golder Associates, Inc. appreciates this opportunity to work with you on this project. Please call if you have any questions or comments.

Sincerely,

GOLDER ASSOCIATES INC.

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ALF/ECC/RGD/lcm

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APPENDIX A – SOIL UNITS

Colluvium (Qc) - View of typical colluvial material. Material is angular to subrounded and multi-lithic. Handheld MobileMapper™ is 3 inches wide for scale. Photo taken 75 ft right of IRP 2006 2008+50.

Golder Associates	CADD ALF/ECC	TITLE **SOIL UNITS**
	DATE 10/18/06	LYNN CANAL HIGHWAY PHASE I
	CHECK RGD	ZONE 4 GEOTECHNICAL INVESTIGATION
FILE No. SOIL_UNITS.PPT	DATE 10/19/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**A-1**

Talus deposits (Qct) - View of typical talus deposit. Person for scale to left of center. Photo taken 500 ft right of IRP 2006 2612+30.

Golder Associates	CADD ALF/ECC	TITLE **SOIL UNITS** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE 10/18/06		
	CHECK RGD		
FILE No. SOIL_UNITS.PPT	DATE 10/19/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**A-2**
PROJECT No. 063-5782	REV 0		

Modern beach deposits (Qb) - View north across typical modern beach deposits. Notice lack of fines and subrounded to rounded cobbles. Photo taken 100 ft left of IRP 2006 1455+00.

Golder Associates	CADD	ALF/ECC	TITLE	**SOIL UNITS** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	10/18/06		
	CHECK	RGD		
FILE No. SOIL_UNITS.PPT	DATE	10/19/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**A-3**
PROJECT No. 063-5782	REV	0		

Elevated beach deposits (Qeb) - View of typical elevated beach deposit material. Photo taken 490 ft right of IRP 2006 2418+00.

Golder Associates		CADD	ALF/ECC	TITLE	**SOIL UNITS** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
		DATE	10/18/06		
		CHECK	RGD		
FILE No.	SOIL_UNITS.PPT	DATE	10/19/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**A-4**
PROJECT No.	063-5782	REV	0		

Elevated beach deposits (Qeb) - View upslope at weakly cemented elevated beach deposits. Photo taken at centerline at IRP 2006 2158+00.

Golder Associates	CADD ALF/ECC	TITLE	**SOIL UNITS** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 10/18/06		
	CHECK RGD		
FILE No. SOIL_UNITS.PPT	DATE 10/19/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**A-5**
PROJECT No. 063-5782	REV 0		

Debris flow deposits (Qdf) - View upslope at typical debris flow deposits. Photo taken at centerline at IRP 2006 1747+00.

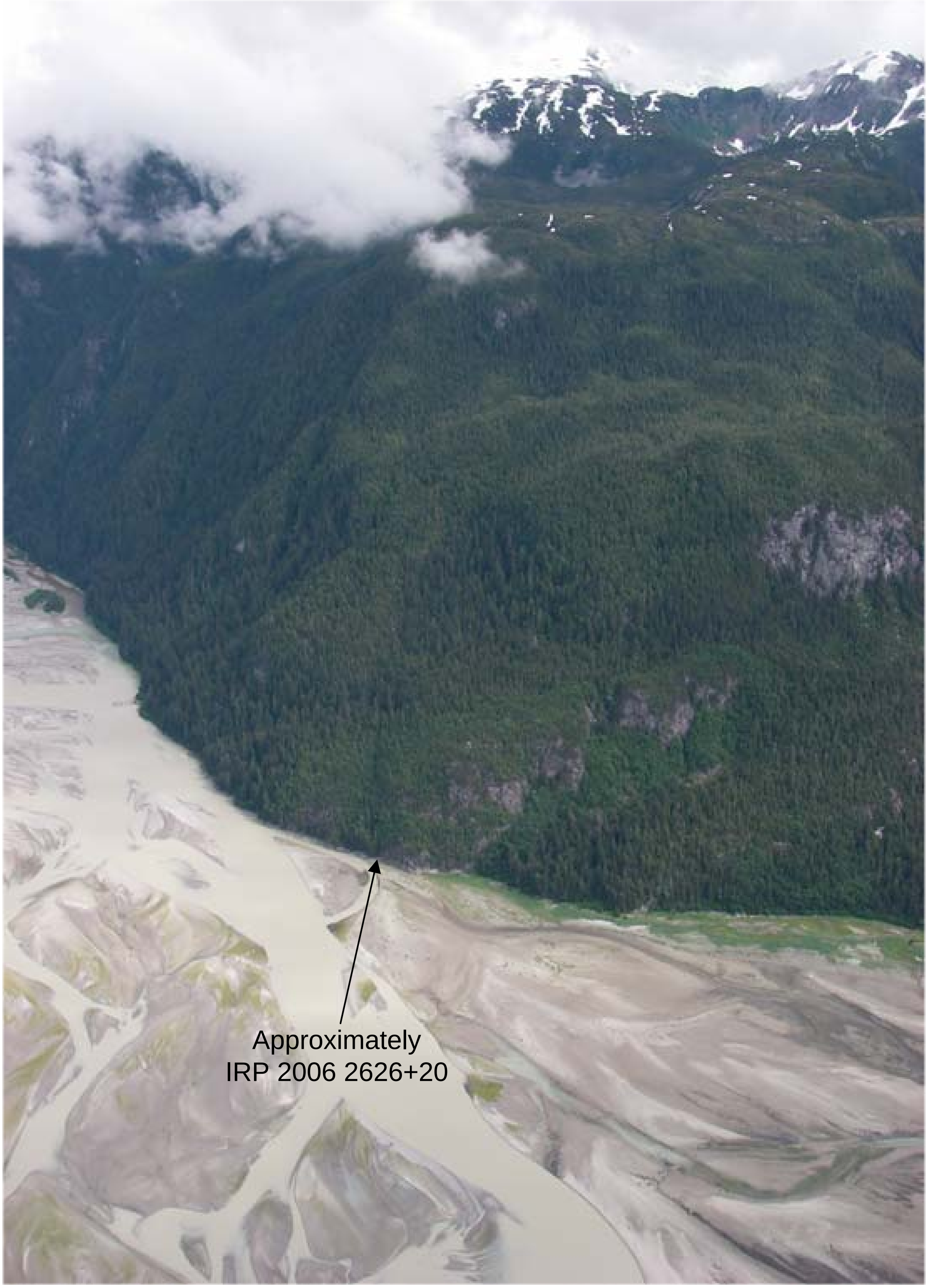
Golder Associates		CADD	ALF/ECC	TITLE	**SOIL UNITS** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
		DATE	10/18/06		
		CHECK	RGD		
FILE No.	SOIL_UNITS.PPT	DATE	10/19/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**A-6**
PROJECT No.	063-5782	REV	0		

Alluvial fan deposits (Qaf) - View of typical alluvial fan material. Notice presence of sand. Photo taken 225 ft right of IRP 2006 1976+00.

Golder Associates	CADD ALF/ECC	TITLE	**SOIL UNITS** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE 10/18/06			
	CHECK RGD			
FILE No. SOIL_UNITS.PPT	DATE 10/19/06	ADOT / LYNN CANAL HWY ZONE 4 / AK		**A-7**
PROJECT No. 063-5782	REV 0			

Landslide deposits (Qls) - View downslope at landslide deposits with glacial outwash as a parent material. Photo taken 100 ft right of IRP 2006 2427+00.

Golder Associates	CADD	ALF/ECC	TITLE	**SOIL UNITS** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	10/18/06		
	CHECK	RGD		
FILE No. SOIL_UNITS.PPT	DATE	10/19/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**A-8**
PROJECT No. 063-5782	REV	0		



River deposits (Qr) - View east at the mouth of the Katzehin River and typical river deposits.

Golder Associates	CADD	ALF/ECC	TITLE	**SOIL UNITS** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	10/18/06		
	CHECK	RGD		
FILE No. SOIL_UNITS.PPT	DATE	10/19/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**A-9**
PROJECT No. 063-5782	REV	0		

Glacial outwash deposits (Qgo) - View of typical glacial outwash deposit. Pencil approximately 6 inches long for scale. Photo taken 120 ft right of IRP 2006 2427+00.

Golder Associates		CADD	ALF/ECC	TITLE	**SOIL UNITS** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
		DATE	10/18/06		
		CHECK	RGD		
FILE No.	SOIL_UNITS.PPT	DATE	10/19/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**A-10**
PROJECT No.	063-5782	REV	0		

Glacial outwash deposits (Qgo) - View of typical glacial outwash deposit. Note stratification of sands. Field book approximately 5.5 inches wide for scale. Photo taken 120 ft right of IRP 2006 2427+00.

Golder Associates	CADD ALF/ECC	TITLE	**SOIL UNITS** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 10/18/06		
	CHECK RGD		
FILE No. SOIL_UNITS.PPT	DATE 10/19/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**A-11**
PROJECT No. 063-5782	REV 0		

Basalt bedrock (Bxv) - view of typical basalt bedrock outcrop. Note massive appearance and multiple joint sets. Photo taken 15 ft left of IRP 2006 1716+00.

Golder Associates	CADD ALF/ECC	TITLE	**SOIL UNITS** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 10/18/06		
	CHECK RGD		
FILE No. SOIL_UNITS.PPT	DATE 10/19/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**A-12**
PROJECT No. 063-5782	REV 0		

Metasedimentary bedrock (Bxms) - View of typical metasedimentary bedrock outcrop. Notice strong foliation. Photo taken 40ft left of IRP 2051+00.

Golder Associates	CADD ALF/ECC	TITLE **SOIL UNITS** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE 10/18/06		
	CHECK RGD		
FILE No. SOIL_UNITS.PPT	DATE 10/19/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**A-13**
PROJECT No. 063-5782	REV 0		

Gneiss bedrock (Bxmg) - View upslope of freshly exposed gneiss outcrop. Photo taken 140 ft right of IRP 2006 2605+00.

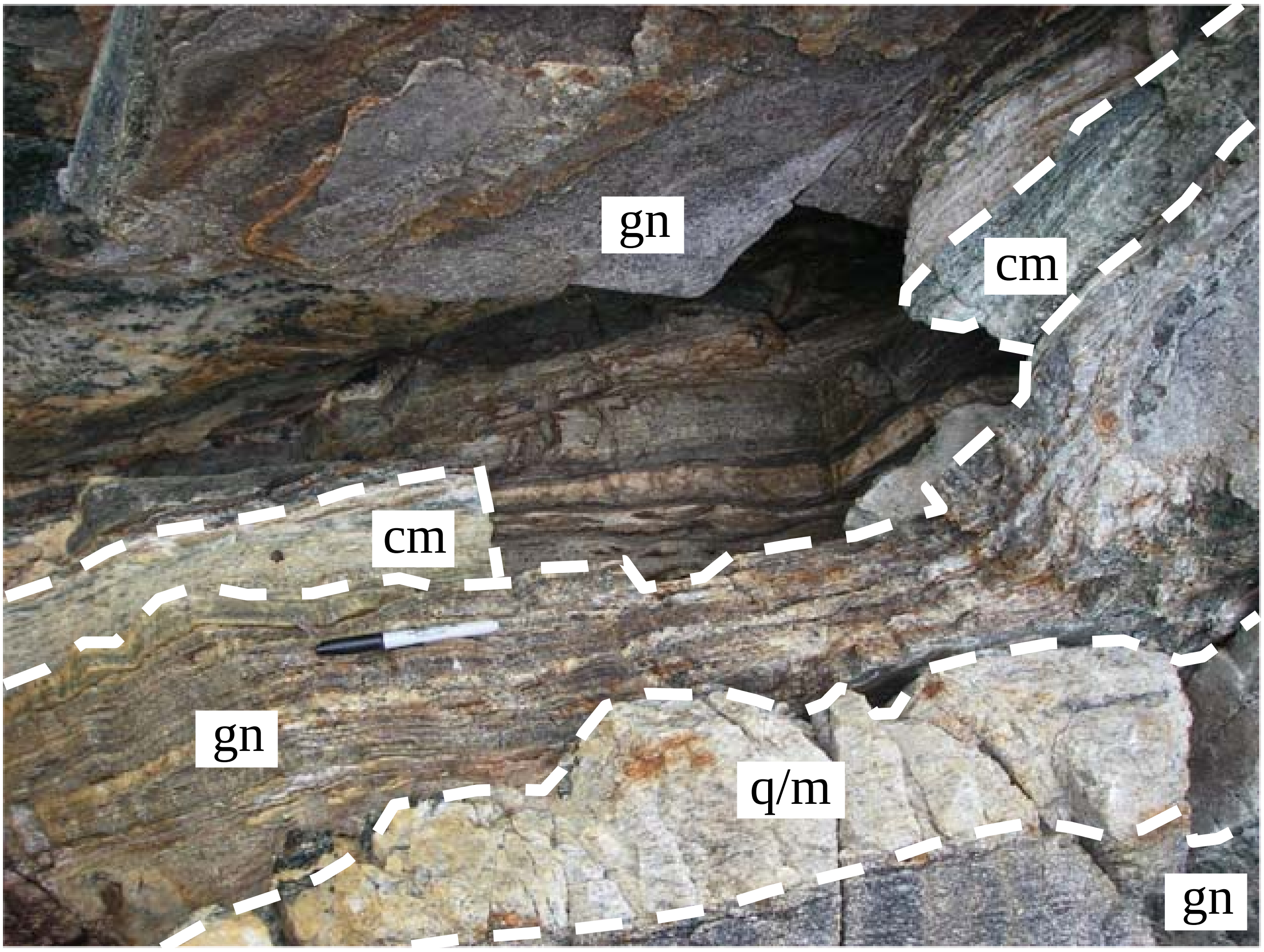
Golder Associates		CADD	ALF/ECC	TITLE	**SOIL UNITS** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
		DATE	10/18/06		
		CHECK	RGD		
FILE No.	SOIL_UNITS.PPT	DATE	10/19/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**A-14**
PROJECT No.	063-5782	REV	0		

Gneiss bedrock (Bxmg) - View of typical gneiss cliff. Note prominent joint set. Visible cliff is approximately 150 ft tall. Photo taken 100 ft right of IRP 2006 2365+00.

Golder Associates	CADD ALF/ECC	TITLE	**SOIL UNITS** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 10/18/06		
	CHECK RGD		
FILE No. SOIL_UNITS.PPT	DATE 10/19/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**A-15**
PROJECT No. 063-5782	REV 0		

Undifferentiated metamorphic bedrock (Bxm) – View east at a shoreline cliffs greater than 40 ft high, with banded gneiss and metasedimentary bedrock (quartzite and metamorphosed carbonate observed.) Photo taken on centerline at IRP 2006 2106+75.

Golder Associates	CADD ALF/ECC	TITLE **SOIL UNITS** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE 10/18/06		
	CHECK RGD		
FILE No. SOIL_UNITS.PPT	DATE 10/19/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**A-16**
PROJECT No. 063-5782	REV 0		



Undifferentiated metamorphic bedrock (Bxm) – Closeup view of banded metamorphic bedrock with (gn) gneiss, (cm) carbonate marble, and (q/m) quartzite vein/migmatite. Pen is approximately 5.5 inches long for scale. Photo taken on centerline at IRP 2006 2106+65.

Golder Associates	CADD ALF/ECC	TITLE **SOIL UNITS** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 10/18/06	
	CHECK RGD	
FILE No. SOIL_UNITS.PPT	DATE 10/19/06	ADOT / LYNN CANAL HWY ZONE 4 / AK — **A-17**
PROJECT No. 063-5782	REV 0	

APPENDIX B – ROCK STRUCTURE MAPPING INVENTORY

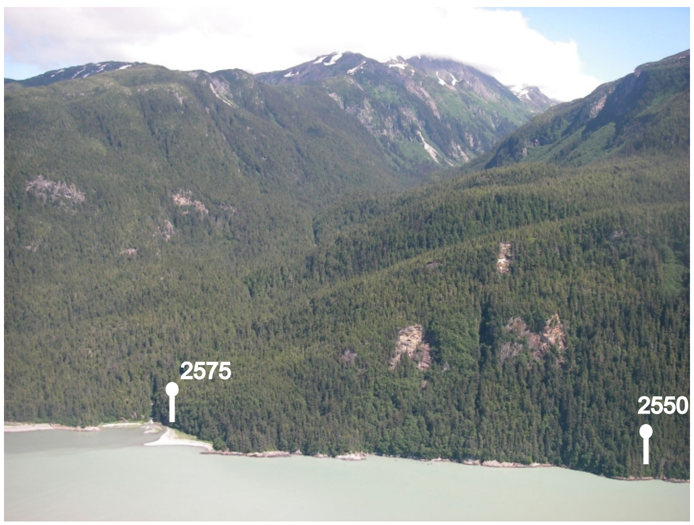
ROCK STRUCTURE MAPPING INVENTORY

#	IRP 2006	Offset	Photo #
R1	1500+50	70'R	1044
R2	1526+00	30'R	1664
R3	1535+50	70'L	1665
R4	1549+00	350'R	3051
R5	1556+00	170'L	3852
R6	1590+40	20'R	2049
R7	1605+50	100'L	2228
R8	1611+20	60'R	1688
R9	1623+00	CL	1690
R10	1629+30	15'R	none
R11	1636+50	CL	2229
R12	1650+25	180'L	1704
R13	1655+50	50'R	3777
R14	1660+00	74'L	1706
R15	1671+00	10'R	3849
R16	1677+00	20'R	6181
R17	1690+80	35'L	1109
R18	1705+00	70'R	6188
R19	1715+50	45'L	2082
R20	1728+00	CL	1129
R21	1737+30	CL	1134
R22	1738+00	assumed CL	none
R23	1739+00	50'R	none
R24	1739+00b	5'R	2220
R25	1744+50	50'L	6172
R26	1754+30	20'R	3744
R27	1760+00	172'L	2222
R28	1764+00	200'R	2269
R29	1766+30	40'R	6174
R30	1779+00	120'L	2224
R31	1790+00	315'L	2225
R32	1796+00	10'L	2226
R33	1804+50	40'L	1674
R34	1833+00	25'L	1714
R35	1841+00	CL	3791
R36	1865+50	20'R	2257
R37	1879+00	80'L	2260
R38	1919+50	110'L	1726
R39	1932+00	CL	1252
R40	1938+00	430'R	2235
R41	1944+00	230'R	4925
R42	1945+00	220'R	1727
R43	1948+50	320'R	4920
R44	1950+00	318'R	none
R45	1950+20	320'R	none
R46	1968+25	50'L	1269
R47	1998+00	150'R	none
R48	2002+00	110'R	3868
R49	2015+00	25'R	1737
R50	2061+15	80'L	6196
R51	2071+00	130'L	2244
R52	2080+00	75'L	6198
R53	2081+00	30'R	2247
R54	2084+00	50'R	1326
R55	2088+00	CL	6199
R56	2102+50	110'L	1334
R57	2106+75	CL	2248
R58	2107+20	CL	1337
R59	2117+40	70'L	1749
R60	2125+00	75'L	2252
R61	2134+10	70'L	1751
R62	2144+50	95'L	2255
R63	2155+00	120'L	1752
R64	2170+30	220'R	1375
R65	2180+00	100'R	3499
R66	2184+80	50'L	1736
R67	2224+00	240'R	1391
R68	2236+00	120'L	1738
R69	2246+50	160'R	3869
R70	2256+00	CL	1409
R71	2257+50	20'R	1739
R72	2257+50	250'R	3506
R73	2267+00	220'R	1415
R74	2271+00	40'L	1740
R75	2292+00	125'L	1747
R76	2301+00	150'R	3559
R77	2301+50	20'R	1455, 1456
R78	2304+00	assumed C	none
R79	2310+00	60'R	1462
R80	2314+00	75'L	2262
R81	2321+00	215'R	6048
R82	2321+50	CL	1467
R83	2339+00	320'L	2272
R84	2344+30	30'R	1619
R85	2345+00	60'R	none
R86	2353+00	CL	5417
R87	2365+00	50'R	1640, 1641
R88	2369+00	20'R	2214
R89	2372+50	CL	1655
R90	2384+00	50'R	3710
R91	2388+50	90'R	1644
R92	2390+00	60'L	1493
R93	2391+60	30'R	1492
R94	2398+00	230'R	none
R95	2401+60	CL	1485
R96	2449+00	200'R	3608
R97	2455+00	90'R	3609
R98	2455+50	30'R	1531
R99	2464+00	15'R	2194
R100	2471+80	20'R	1537
R101	2475+30	30'R	2196
R102	2482+70	CL	1544
R103	2495+90	10'R	1547
R104	2502+75	25'R	1550,1551
R105	2529+00	40'R	1564
R106	2537+40	40'L	2202
R107	2549+40	25'R	1568
R108	2556+00	20'L	1571
R109	2558+00	40'R	5359
R110	2566+00	80'R	1576
R111	2567+00	230'R	none
R112	2575+80	30'R	1585
R113	2580+00	35'L	1586
R114	2590+00	20'R	1589
R115	2607+30	10'R	2204
R116	2621+00	130'R	3684
R117	2624+00	40'L	1607

APPENDIX C – AERIAL PHOTOGRAPH SEQUENCE OF ALIGNMENT

IRP 2006 2620+00 (Katzehin River) to IRP 2006 2600+00

IRP 2006 2605+00 to IRP 2006 2580+00



IRP 2006 2585+00 to IRP 2006 2550+00

IRP 2006 2570+00 to IRP 2006 2540+00

Golder Associates
Anchorage, Alaska

SCALE	NONE		
CADD	ALF/ECC		
DATE	11/29/06		
CHECK	RGD		
FILE No.	AERIAL_ALIGN.CDR	DATE	12/03/06
PROJECT No.	063-5782	REV.	0

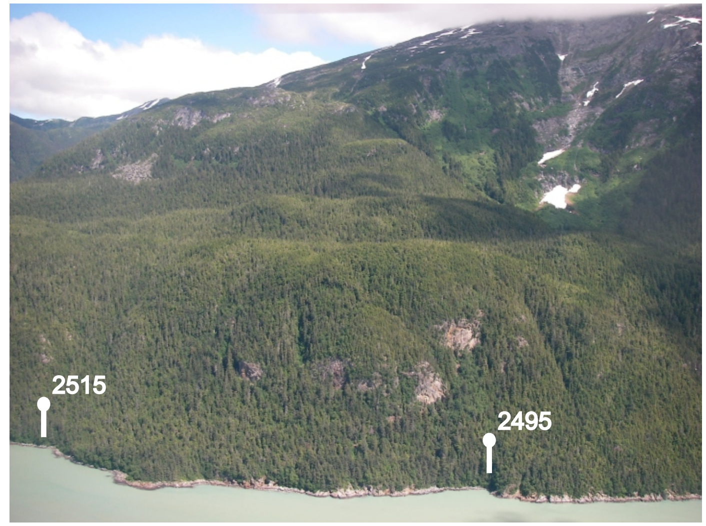
AERIAL PHOTOGRAPH SEQUENCE OF ALIGNMENT
LYNN CANAL HIGHWAY PHASE 1
ZONE 4 GEOTECHNICAL INVESTIGATION

ADOT&PF / LYNN CANAL HWY / ALASKA

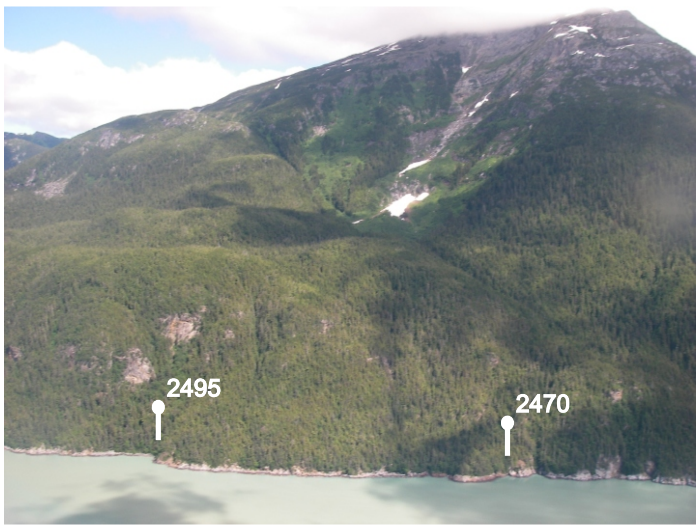
C-1

063-5782 Appendix C Aerial Alignment

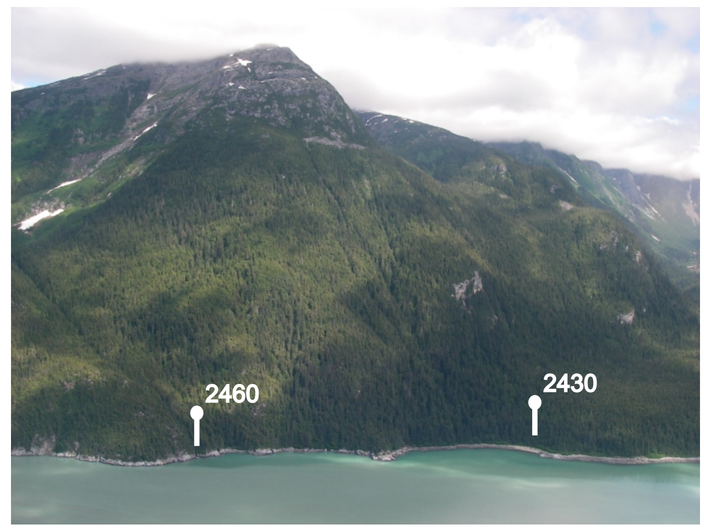
IRP 2006 2540+00 to IRP 2006 2510+00



IRP 2006 2515+00 to IRP 2006 2485+00

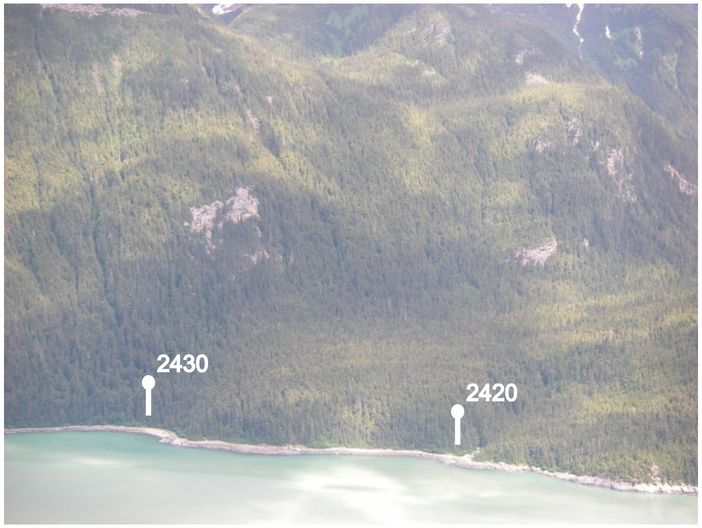


IRP 2006 2500+00 to IRP 2006 2465+00



IRP 2006 2470+00 to IRP 2006 2420+00

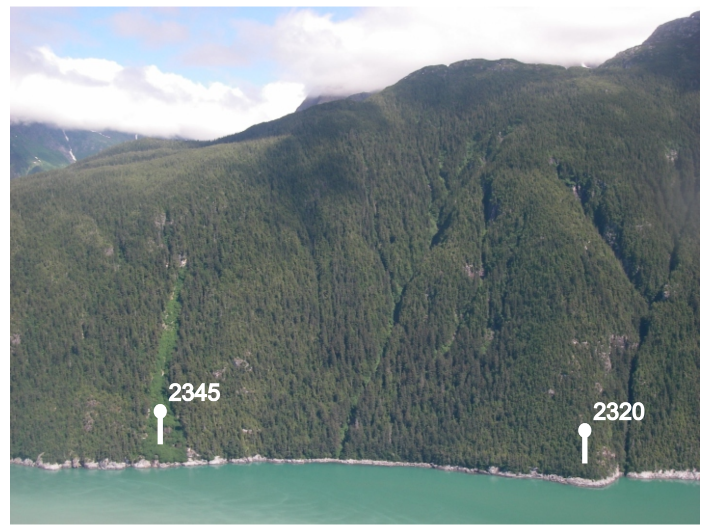
Golder Associates Anchorage, Alaska	SCALE NONE CADD ALF/ECC DATE 11/29/06 CHECK RGD	**AERIAL PHOTOGRAPH SEQUENCE OF ALIGNMENT** LYNN CANAL HIGHWAY PHASE 1 ZONE 4 GEOTECHNICAL INVESTIGATION	
FILE No. AERIAL_ALIGN.CDR PROJECT No. 063-5782	DATE 12/03/06 REV. 0	ADOT&PF / LYNN CANAL HWY / ALASKA	**C-2**



IRP 2006 2440+00 to IRP 2006 2410+00

IRP 2006 2380+00 to IRP 2006 2360+00

IRP 2006 2375+00 to IRP 2006 2340+00



IRP 2006 2350+00 to IRP 2006 2315+00

Golder Associates
Anchorage, Alaska

FILE No.	AERIAL_ALIGN.CDR	SCALE	NONE
PROJECT No.	063-5782	CADD	ALF/ECC
		DATE	11/29/06
		CHECK	RGD
		DATE	12/03/06
		REV.	0

AERIAL PHOTOGRAPH SEQUENCE OF ALIGNMENT
LYNN CANAL HIGHWAY PHASE 1
ZONE 4 GEOTECHNICAL INVESTIGATION

ADOT&PF / LYNN CANAL HWY / ALASKA

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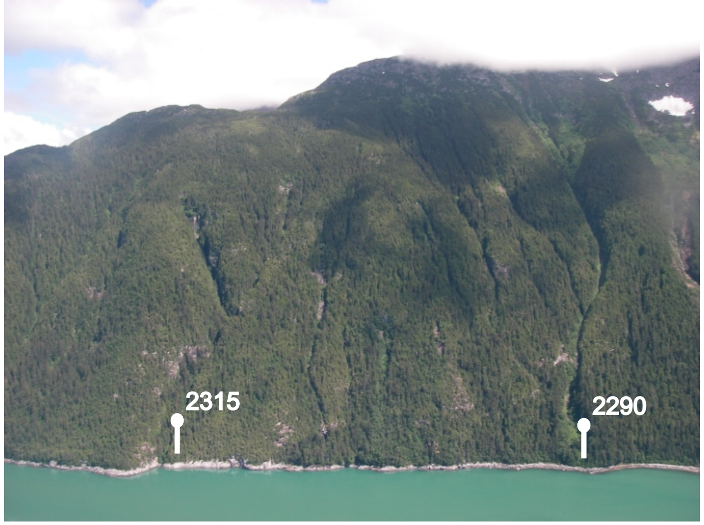
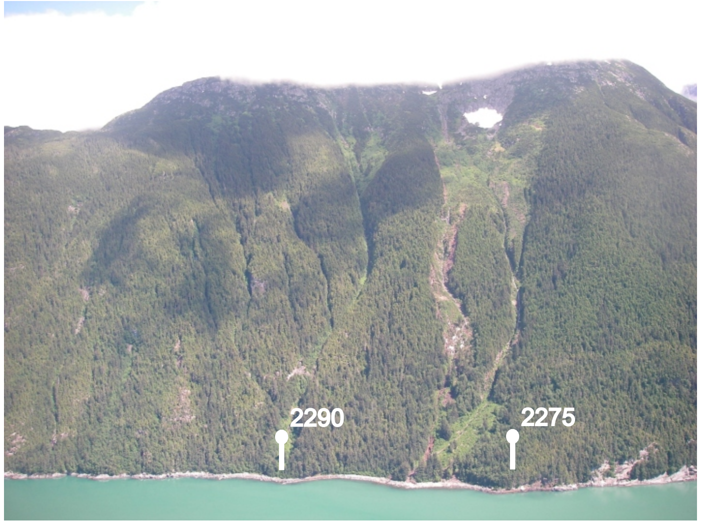
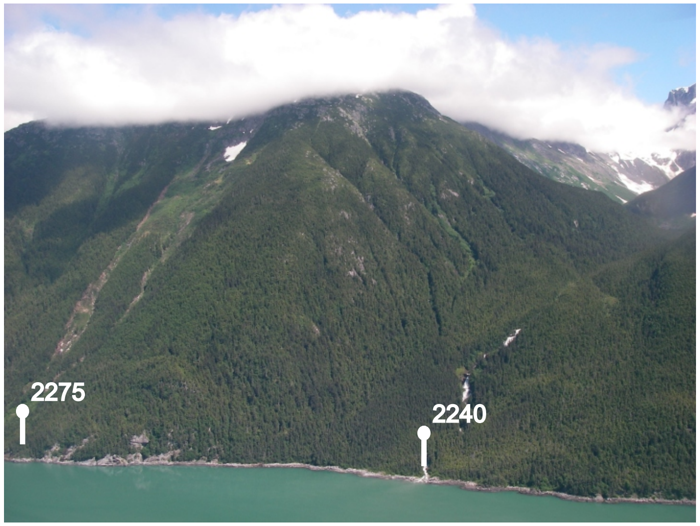


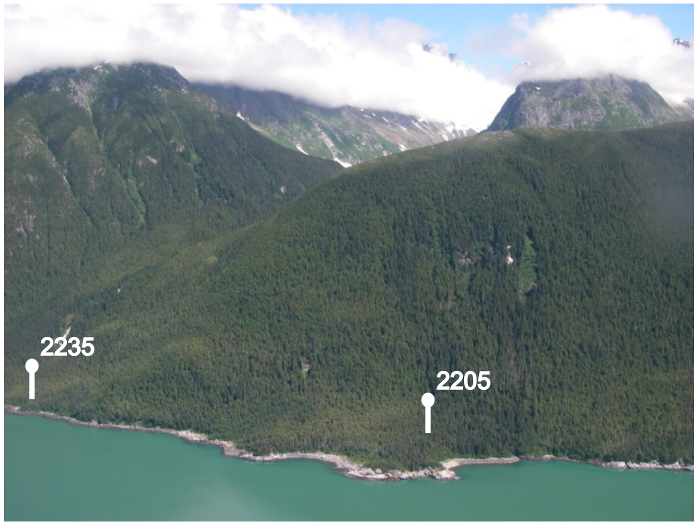
IRP 2006 2325+00 to IRP 2006 2285+00



IRP 2006 2305+00 to IRP 2006 2260+00



IRP 2006 2275+00 to IRP 2006 2230+00



IRP 2006 2235+00 to IRP 2006 2195+00

Golder Associates
Anchorage, Alaska

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CHECK	RGD		
FILE No. AERIAL_ALIGN.CDR	DATE	12/03/06	
PROJECT No. 063-5782	REV.	0	

AERIAL PHOTOGRAPH SEQUENCE OF ALIGNMENT
LYNN CANAL HIGHWAY PHASE 1
ZONE 4 GEOTECHNICAL INVESTIGATION

ADOT&PF / LYNN CANAL HWY / ALASKA

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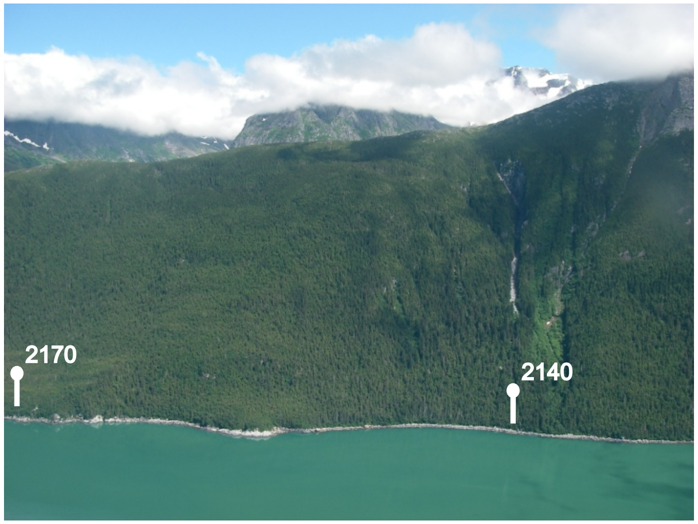
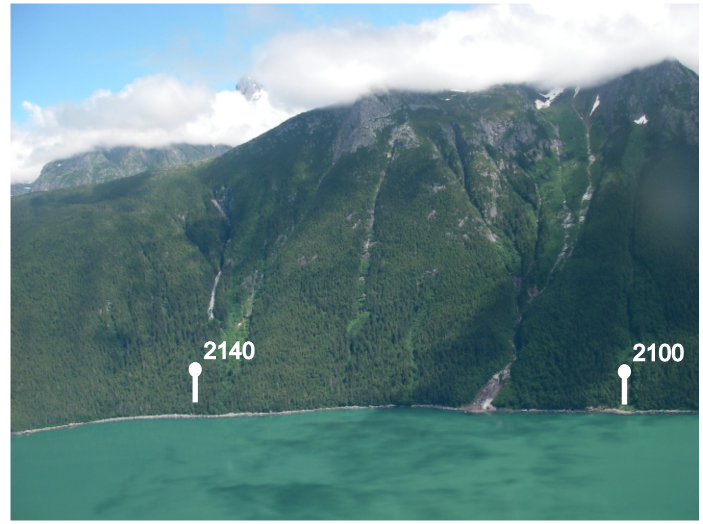
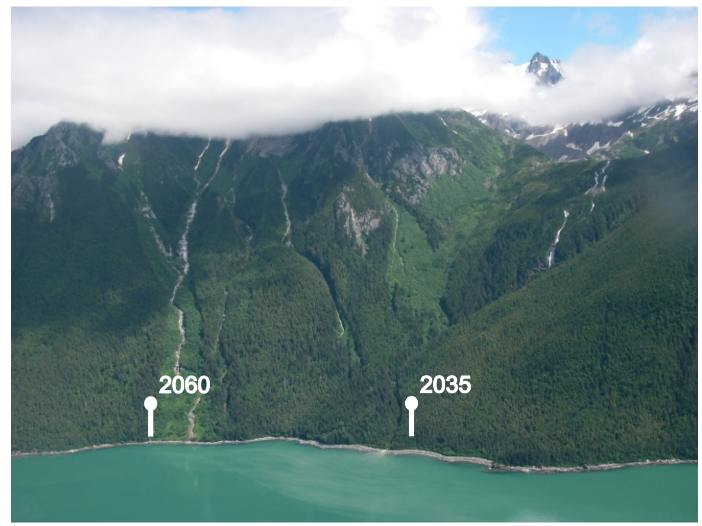


IRP 2006 2170+00 to IRP 2006 2135+00



IRP 2006 2150+00 to IRP 2006 2100+00

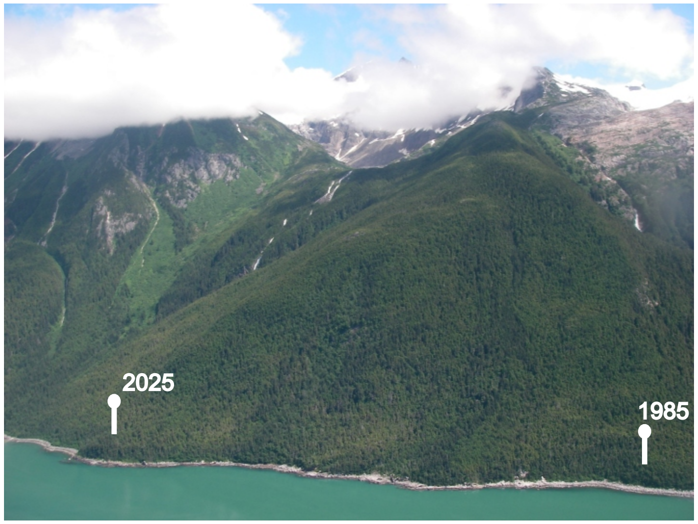
IRP 2006 2115+00 to IRP 2006 2055+00



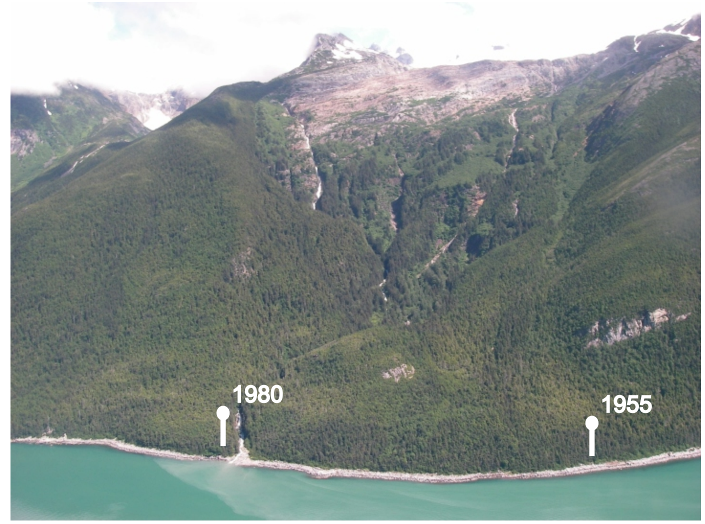
IRP 2006 2070+00 to IRP 2006 2015+00

Golder Associates Anchorage, Alaska	SCALE NONE	**AERIAL PHOTOGRAPH SEQUENCE OF ALIGNMENT** LYNN CANAL HIGHWAY PHASE 1 ZONE 4 GEOTECHNICAL INVESTIGATION	
	CADD ALF/ECC		
	DATE 11/29/06		
	CHECK RGD		
FILE No. AERIAL_ALIGN.CDR	DATE 12/03/06	ADOT&PF / LYNN CANAL HWY / ALASKA	**C-5**
PROJECT No. 063-5782	REV. 0		

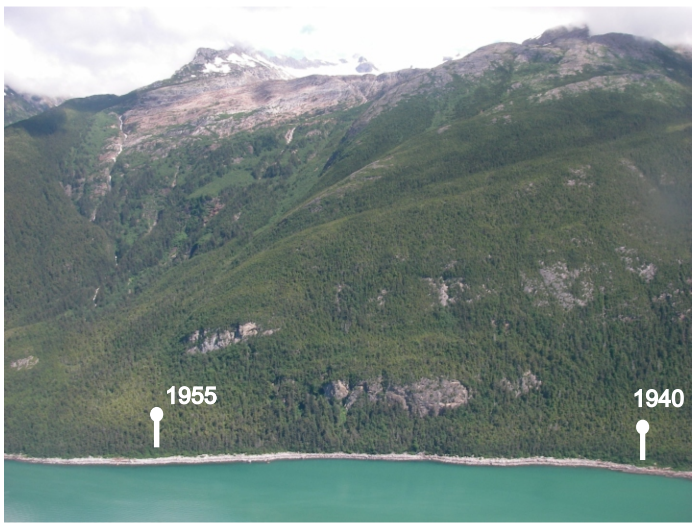
063-5782 Appendix C Aerial Alignment



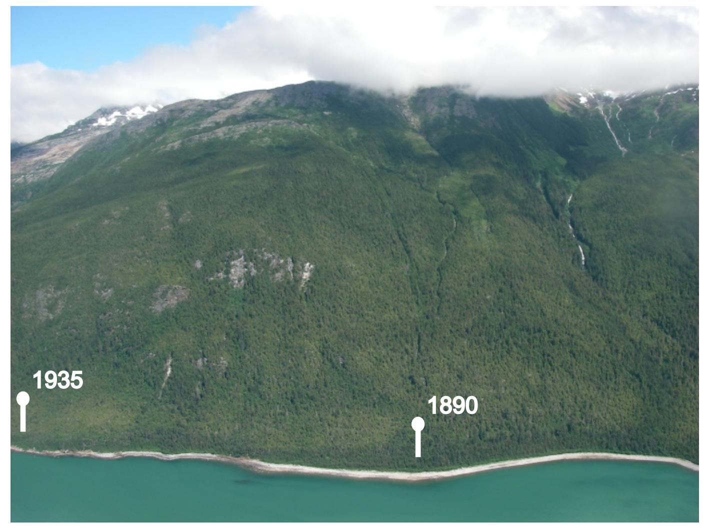
IRP 2006 2035+00 to IRP 2006 1985+00



IRP 2006 1990+00 to IRP 2006 1955+00

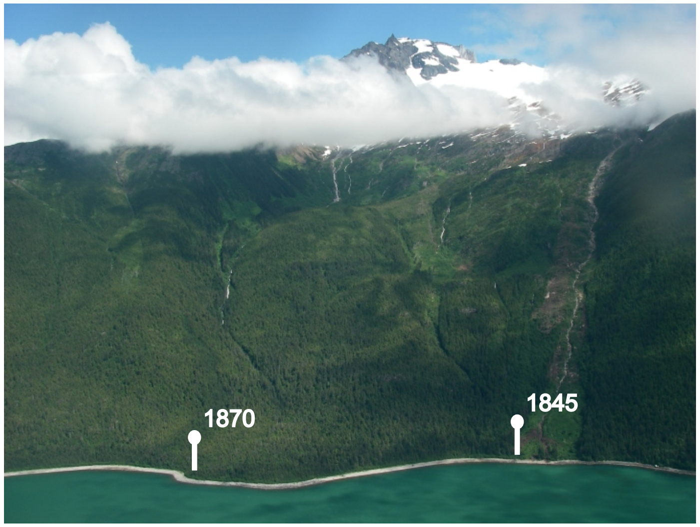


IRP 2006 1970+00 to IRP 2006 1940+00

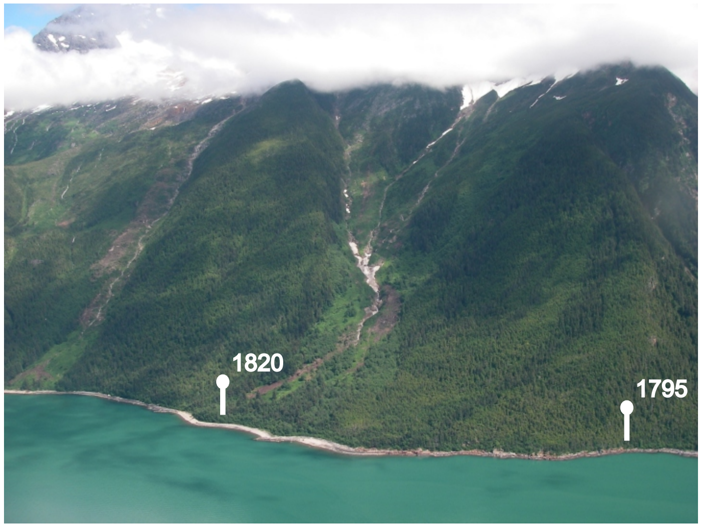


IRP 2006 1935+00 to IRP 2006 1870+00

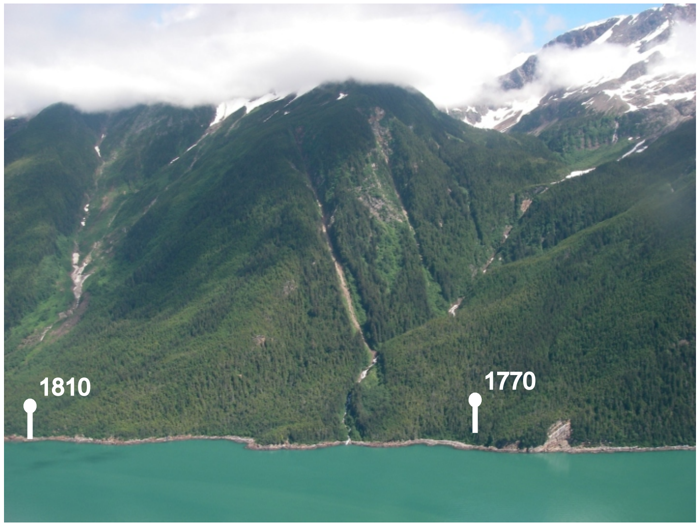
Golder Associates, Anchorage, Alaska		SCALE NONE	AERIAL PHOTOGRAPH SEQUENCE OF ALIGNMENT LYNN CANAL HIGHWAY PHASE 1 ZONE 4 GEOTECHNICAL INVESTIGATION	
		CADD ALF/ECC		
		DATE 11/29/06		
		CHECK RGD		
FILE No.	AERIAL_ALIGN.CDR	DATE 12/03/06	ADOT&PF / LYNN CANAL HWY / ALASKA	C-6
PROJECT No.	063-5782	REV. 0		



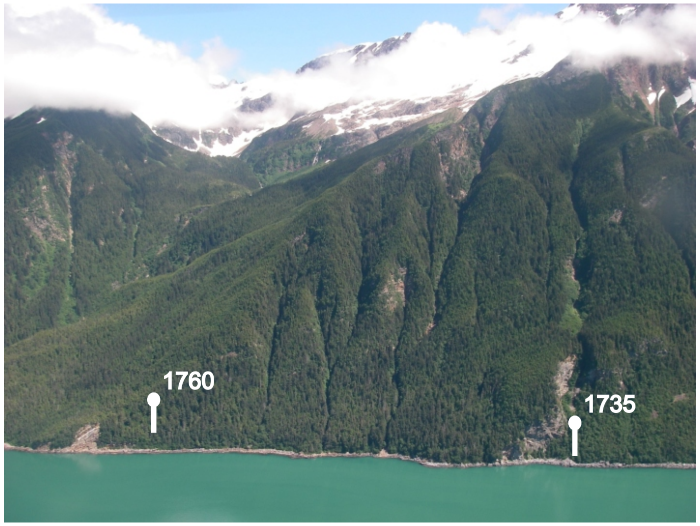
IRP 2006 1880+00 to IRP 2006 1835+00



IRP 2006 1845+00 to IRP 2006 1795+00



IRP 2006 1810+00 to IRP 2006 1760+00



IRP 2006 1765+00 to IRP 2006 1730+00

Golder Associates
Anchorage, Alaska

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DATE	11/29/06
CHECK	RGD
DATE	12/03/06
REV.	0
FILE No.	AERIAL_ALIGN.CDR
PROJECT No.	063-5782

AERIAL PHOTOGRAPH SEQUENCE OF ALIGNMENT
LYNN CANAL HIGHWAY PHASE 1
ZONE 4 GEOTECHNICAL INVESTIGATION

ADOT&PF / LYNN CANAL HWY / ALASKA

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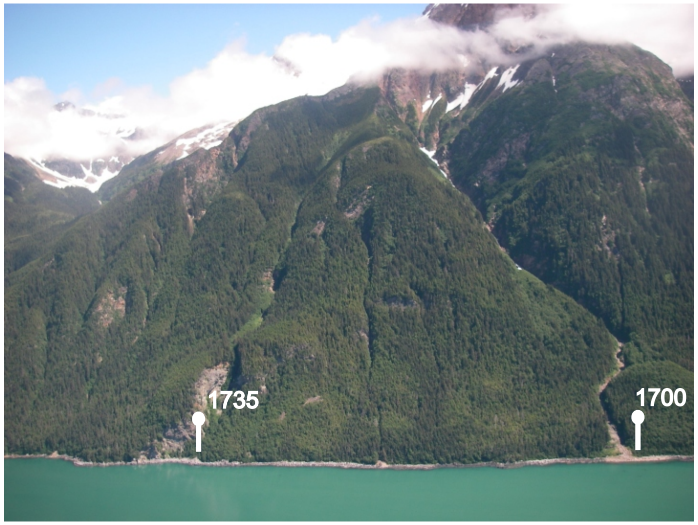
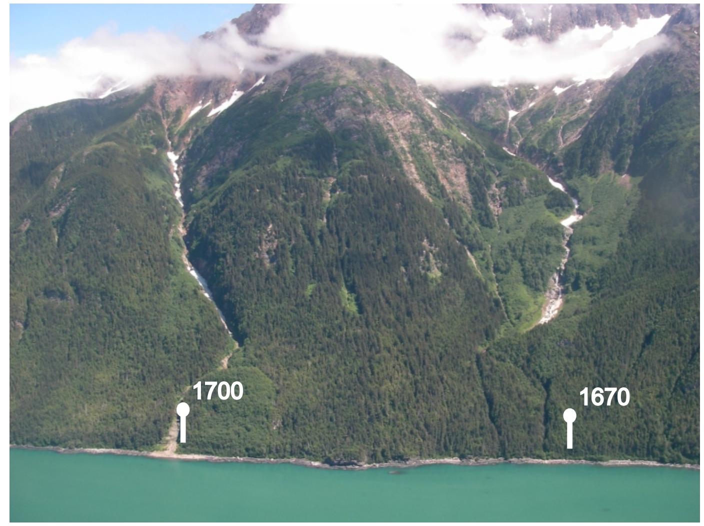
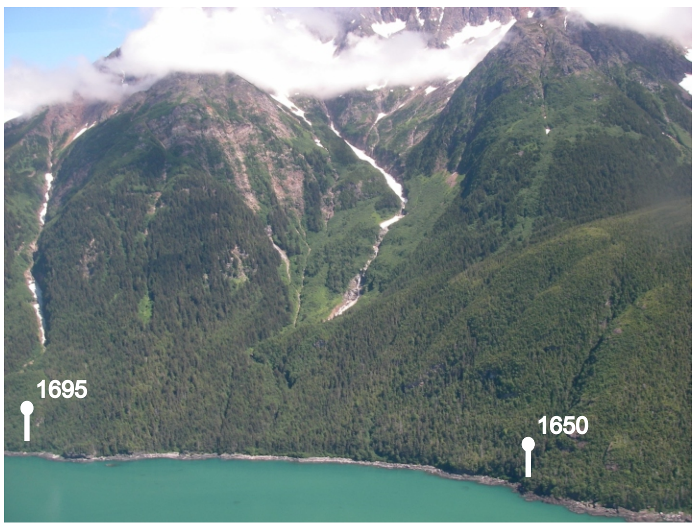


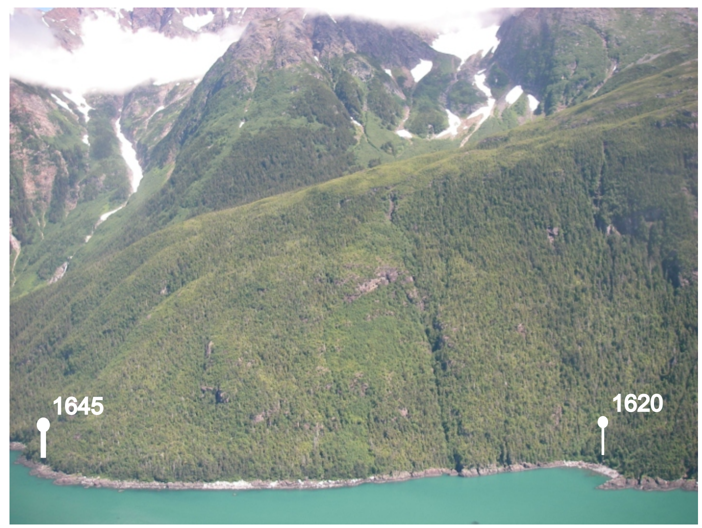
IRP 2006 1740+00 to IRP 2006 1700+00



IRP 2006 1710+00 to IRP 2006 1665+00

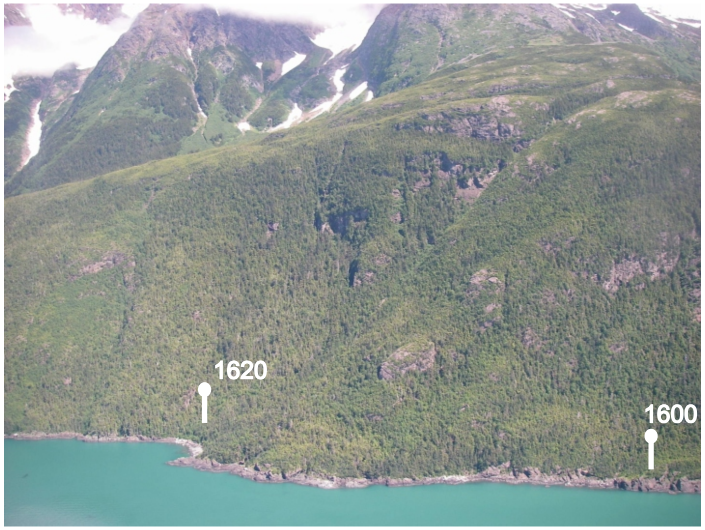


IRP 2006 1695+00 to IRP 2006 1645+00

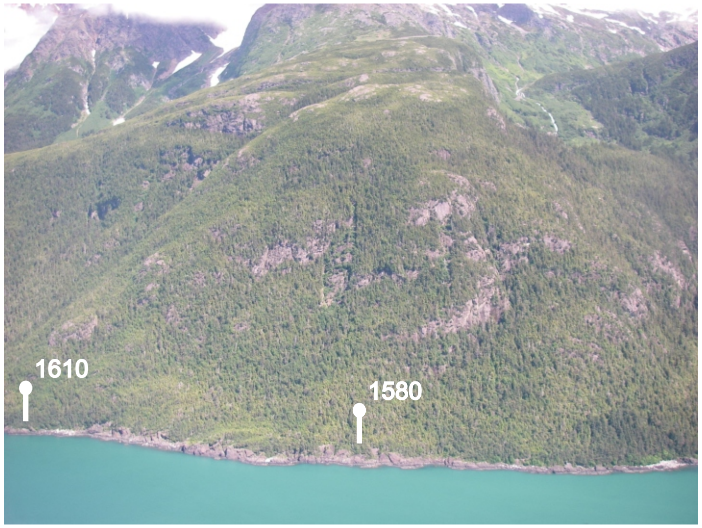


IRP 2006 1650+00 to IRP 2006 1620+00

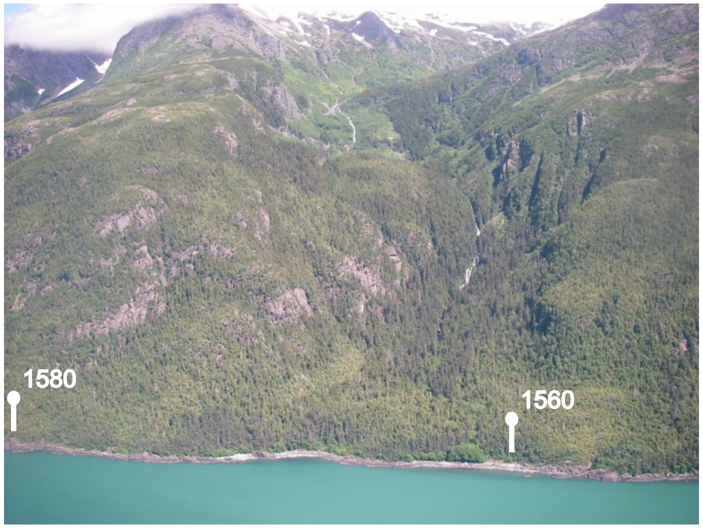
Golder Associates Anchorage, Alaska	SCALE NONE CADD ALF/ECC DATE 11/29/06 CHECK RGD	**AERIAL PHOTOGRAPH SEQUENCE OF ALIGNMENT** LYNN CANAL HIGHWAY PHASE 1 ZONE 4 GEOTECHNICAL INVESTIGATION
FILE No. AERIAL_ALIGN.CDR PROJECT No. 063-5782	DATE 12/03/06 REV. 0	ADOT&PF / LYNN CANAL HWY / ALASKA — **C-8**



IRP 2006 1630+00 to IRP 2006 1600+00



IRP 2006 1610+00 to IRP 2006 1565+00



IRP 2006 1580+00 to IRP 2006 1555+00

IRP 2006 1570+00 to IRP 2006 1525+00

Golder Associates
Anchorage, Alaska

SCALE	NONE		
CADD	ALF/ECC		
DATE	11/29/06		
CHECK	RGD		
FILE No.	AERIAL_ALIGN.CDR	DATE	12/03/06
PROJECT No.	063-5782	REV.	0

AERIAL PHOTOGRAPH SEQUENCE OF ALIGNMENT
LYNN CANAL HIGHWAY PHASE 1
ZONE 4 GEOTECHNICAL INVESTIGATION

ADOT&PF / LYNN CANAL HWY / ALASKA

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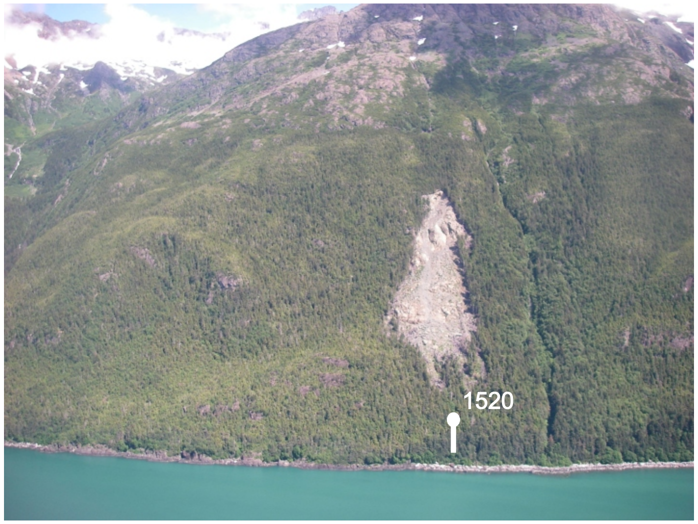

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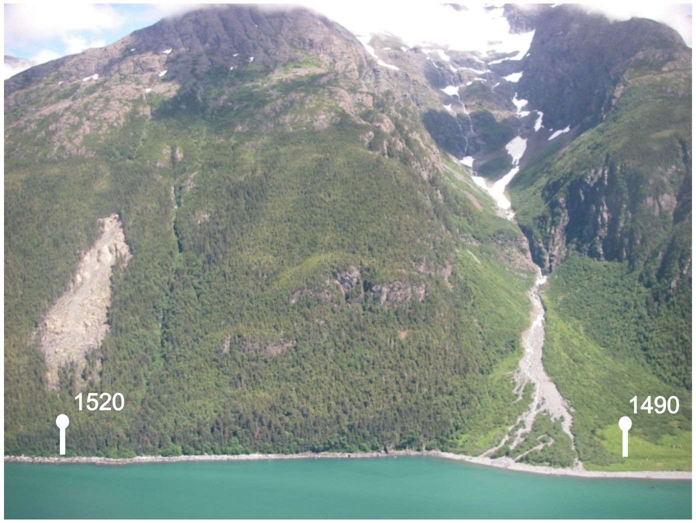
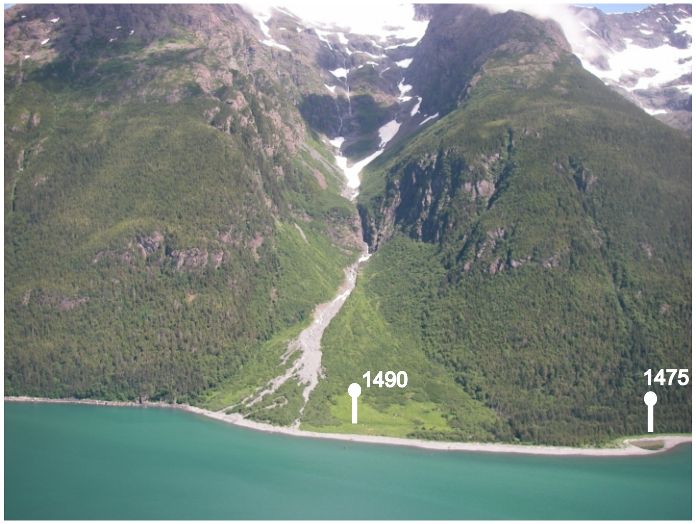


IRP 2006 1520+00 to IRP 2006 1490+00



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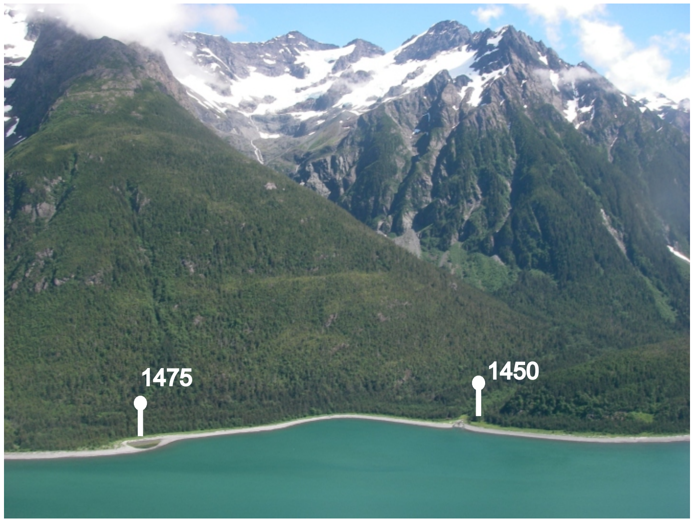


IRP 2006 1480+00 to IRP 2006 1445+00

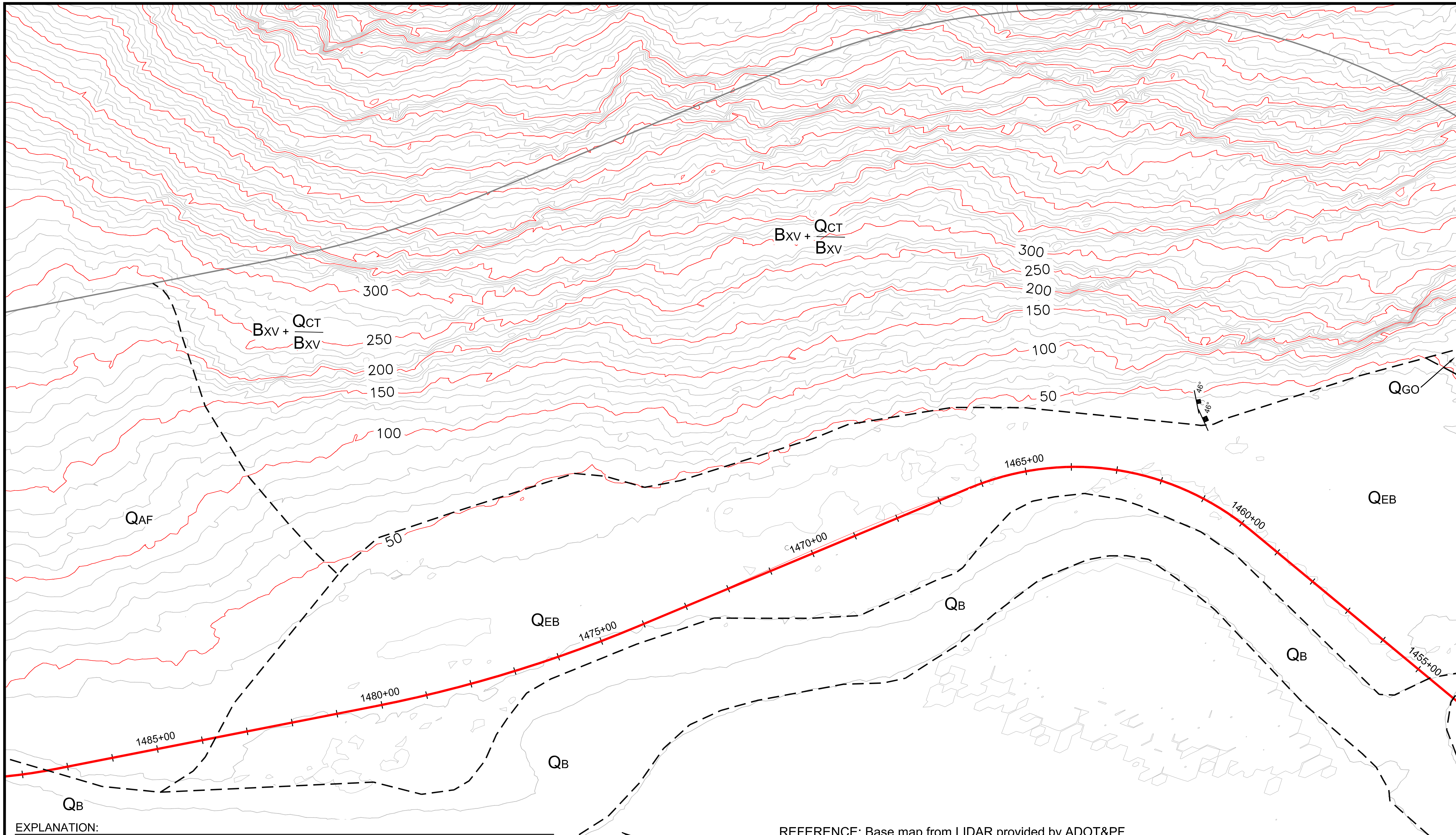
Golder Associates Anchorage, Alaska	SCALE NONE	TITLE
	CADD ALF/ECC	**AERIAL PHOTOGRAPH SEQUENCE OF ALIGNMENT** LYNN CANAL HIGHWAY PHASE 1 ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/29/06	
	CHECK RGD	
FILE No. AERIAL_ALIGN.CDR	DATE 12/03/06	ADOT&PF / LYNN CANAL HWY / ALASKA
PROJECT No. 063-5782	REV. 0	C-10

APPENDIX D – HELICOPTER LANDING ZONES

SUMMER 2006 HELICOPTER LANDING ZONES (LZ) - LYNN CANAL HIGHWAY				
IRP 2006 Location	**West Longitude (degrees)**	**North Latitude (degrees)**	**LZ Name**	**Comments**
LZ 2625	not obtained	not obtained	none	South bank Katzehin River delta, shutdown ok in vicinity where above tide line
LZ 2621	not obtained	not obtained	Survey 241	No description available
LZ 2599	not obtained	not obtained	Survey 239	No description available
LZ 2584	not obtained	not obtained	Survey 234	North side of Redlinger Creek
LZ 2580	not obtained	not obtained	none	South side of Redlinger Creek, shutdown ok
LZ 2577	not obtained	not obtained	Survey 240	South side of Redlinger Creek
LZ 2568	-135.27865	59.18170	none	Sandy beach cove, toe-in or shoreline ridge 1-skid landing
LZ 2538	not obtained	not obtained	Survey 236	LZ cleared at 100' elevation, gneiss rock knob, hot load 1-skid landing, low winds and a light payload
LZ 2513	not obtained	not obtained	Survey 235	Improved LZ hot load required
LZ 2509	not obtained	not obtained	none	Possible toe-in; 1-skid landing may be a problem due to a rock at the tail rotor position
LZ 2495	-135.26933	59.16267	none	Metasedimentary rock on shoreline, south side of gully, 1-skid landing
LZ 2475	-135.26350	59.15783	Survey 257	Trees cleared for LZ at top of small cliff, hot load required only in low winds, grassy rock slab, toe-in
LZ 2452	not obtained	not obtained	none	Trees cleared, 1-skid landing, could not find Survey 248, LZ used by Mitch McDonald
LZ 2434	not obtained	not obtained	none	LZ used by Mitch McDonald, near Survey 195
LZ 2428	not obtained	not obtained	none	Shoreline ridge, 1-skid landing
LZ 2426	not obtained	not obtained	none	LZ used by Mitch McDonald
LZ 2419	-135.2509	59.1499	Survey 232	Wildbird Creek
LZ 2401	not obtained	not obtained	Survey 233	**Do not use due to eagle tree proximity**
2361	**-135.23780**	**59.13130**	**Gran Point**	**Gran Point sea lion haulout, maintain 3000' horizontal and vertical distance away from haulout when sea lions are present**
LZ 2337	-135.23350	59.12549	Survey 238	Toe-in on shoreline gneiss boulder ridge
LZ 2325	-135.23250	59.12200	Survey 246	Shoreline gneiss ridge, toe-in
LZ 2324	-135.23250	59.12167	none	Shoreline gneiss knob, 1-skid landing
LZ 2313	-135.23028	59.11887	Survey 251	1-skid landing on west-dipping shoreline gneiss outcrop
LZ 2295	-135.22786	59.11442	Survey 250	Shutdown ok at LC026 avalanche chute; pad is talus and stacked cleared timber
LZ 2281	not obtained	not obtained	Survey 201	LZ used by Mitch McDonald
LZ 2248	not obtained	not obtained	Survey 230	North of Yeldagalga Creek, no description available
LZ 2222	not obtained	not obtained	Survey 252	LZ in grass, good for high tide, protected from south wind and possibly ok for shutdown
LZ 2210	-135.22182	59.09120	Camper Beach	Grassy knoll on gneiss knob Survey 196 shutdown ok; good cobble beach LZ to southeast with shutdown ok
LZ 2168	-135.21268	59.08130	Survey 227	North-trending shoreline ridge, toe-in
LZ 2164	-135.21140	59.08009	none	1-skid landing on flat beach boulder in sheltered cove
LZ 2114	-135.20464	59.06814	Survey 247	Intertidal zone, cobble beach, 2-skid landing, bedrock cliffs to south and east at LC021 avalanche chute
LZ 2104	-135.20479	59.06515	Survey 226	LC020 avalanche chute, hot load with 2-skid landing on cobbles and log, shutdown ok noted by Mitch McDonald
LZ 2071	-135.20191	59.05596	Survey 231	North-trending metasedimentary shoreline rock ridge, toe-in or 1-skid landing probably
LZ 2067	not obtained	not obtained	none	LZ used by Mitch McDonald
LZ 2050	-135.19870	59.05103	none	Cobble beach, toe-in; **CAUTION:** horizontal log projects seaward, land north of log
LZ 2035	not obtained	not obtained	Survey 202	No description available
LZ 1984	-135.20315	59.03300	none	Improved, cobble/boulder and log level pad on south bank of Trey Creek, shutdown ok
LZ 1961	-135.20210	59.02700	Survey 222	Two metasedimentary rock ridges, probably 1-skid landing, toe-in, and perhaps 2-skid landing
LZ 1954	not obtained	not obtained	none	No description available
LZ 1920	not obtained	not obtained	none	Near Survey 197
LZ 1901	not obtained	not obtained	none	LZ used by Mitch McDonald
LZ 1898	-135.19226	59.01077	none	North of two vertical poles on beach, several 100's of beach north and south for LZ, shutdown should be OK above tide line
LZ 1892	-135.18947	59.00917	none	South of two vertical poles on beach, cobble beach, shutdown OK
LZ 1886	-135.1928	59.0116	none	Hot load on beach
LZ 1873	not obtained	not obtained	Survey 198	Kakuhan Creek, cobble and boulder beach, good for shutdown

SUMMER 2006 HELICOPTER LANDING ZONES (LZ) - LYNN CANAL HIGHWAY				
IRP 2006 Location	**West Longitude (degrees)**	**North Latitude (degrees)**	**LZ Name**	**Comments**
LZ 1847	-135.17740	59.00030	Survey 223	Good LZ for shutdown at LC014 avalanche chute, might get spray with 19'+ tide (Photo #1208)
LZ 1826	not obtained	not obtained	Survey 237	No description available
LZ 1815	-135.17904	58.99142	none	Improved flat pad on cobble beach above high tide, shutdown ok
LZ 1812	not obtained	not obtained	Survey 199	Cobble and boulder beach, type locality of quartzite and schist
LZ 1780	not obtained	not obtained	Survey 221	No description available
LZ 1762	not obtained	not obtained	none	LZ used by Mitch McDonald
LZ 1760	-135.17400	58.97667	none	1-skid landing on flat beach boulder
LZ 1749	not obtained	not obtained	Survey 220	No description available
LZ 1747	-135.17317	58.97317	none	Improved, built-up level boulder platform in LC009 avalanche/debris chute, toe-in with most or all of 2 skids
LZ 1736	not obtained	not obtained	Survey 245	No description available
LZ 1722	not obtained	not obtained	none	Improved hot load LZ in LC007 avalanche chute/rockslide, good at high tide.
LZ 1702	-135.17378	58.96080	Survey 219	Level gravel beach, shutdown should be ok
LZ 1686	-135.17301	58.95638	Survey 229	Toe-in on log
LZ 1680	not obtained	not obtained	none	Hot load at tide elevation <14'
LZ 1664	-135.17243	58.95070	none	Bedrock bench with cobbles, LZ used by Mitch McDonald only at low tide
LZ 1651	-135.17653	58.94752	Survey 218	**Do not use due to eagle tree proximity**
LZ 1640	-135.17613	58.94449	none	Gneiss boulder on beach, flat for 2-skid landing, 2' above barnacle line
LZ 1620	**not obtained**	**not obtained**	**none**	**Cobble/sand beach in northern Met Point sea lion haulout - only available certain months of the year, possible shutdown LZ**
1606	**-135.17620**	**58.93720**	**Met Point**	**Met Point sea lion haulout, maintain 3000' horizontal and vertical distance away from haulout when sea lions are present**
LZ 1590	**-135.17170**	**58.93127**	**Survey 216**	**Hot load on boulder, within Met Point no-fly zone**
LZ 1574	not obtained	not obtained	none	Improved elevated cobble and boulder pad, just big enough for A-Star to land, **just south of Met Point no-fly zone**
LZ 1560	-135.16599	58.92362	Brenner Creek	Improved cobble pad, shutdown ok; enough room for A-Star to land
LZ 1544	-135.166	58.9234	none	**Do not use due to eagle tree proximity;** located in vicinity of Survey 217
LZ 1522	-135.16004	58.91376	Survey 215	Flat boulder, 1-skid landing, toe-in
LZ 1498	-135.15502	58.90766	none	Improved level cobble debris flow pad, 2-skid landing with A-Star, ok for shutdown
LZ 1489	-135.15442	58.90539	Lupine Meadow	Level elevated beach deposit, shutdown ok at LC 002 avalanche chute
LZ 1456	-135.14895	58.89749	Independence Creek	Cobble beach for 100's of feet along shoreline, North bank, shutdown ok

APPENDIX E – PRELIMINARY SURFICIAL GEOLOGIC MAP



EXPLANATION:

— — APPROXIMATE GEOLOGIC CONTACT
UPSLOPE MAPPING BOUNDARY
STRUCTURAL LINEAMENT
MEGA-BOULDER(S) NOTED
GEOPHYSICAL SURVEY LINE
R1 STRUCTURAL MAPPING LOCATION
42° FOLIATION ORIENTATION AND DIP
42° JOINT ORIENTATION AND DIP
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

QB MODERN BEACH
QEB ELEVATED BEACH
QDF DEBRIS FLOW
QC COLLUVIUM
QCT TALUS
QGO GLACIAL OUTWASH
QAF ALLUVIAL FAN
QLS LANDSLIDE
QR RIVER DEPOSIT

BEDROCK UNITS

BXV BASALT
BXMG GNEISS
BXMS METASEDIMENTARY
BXM METAMORPHIC

BXV + QCT / BXV
UNIT LISTED FIRST IS PREDOMINANT
UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

0 200 400
SCALE IN FEET

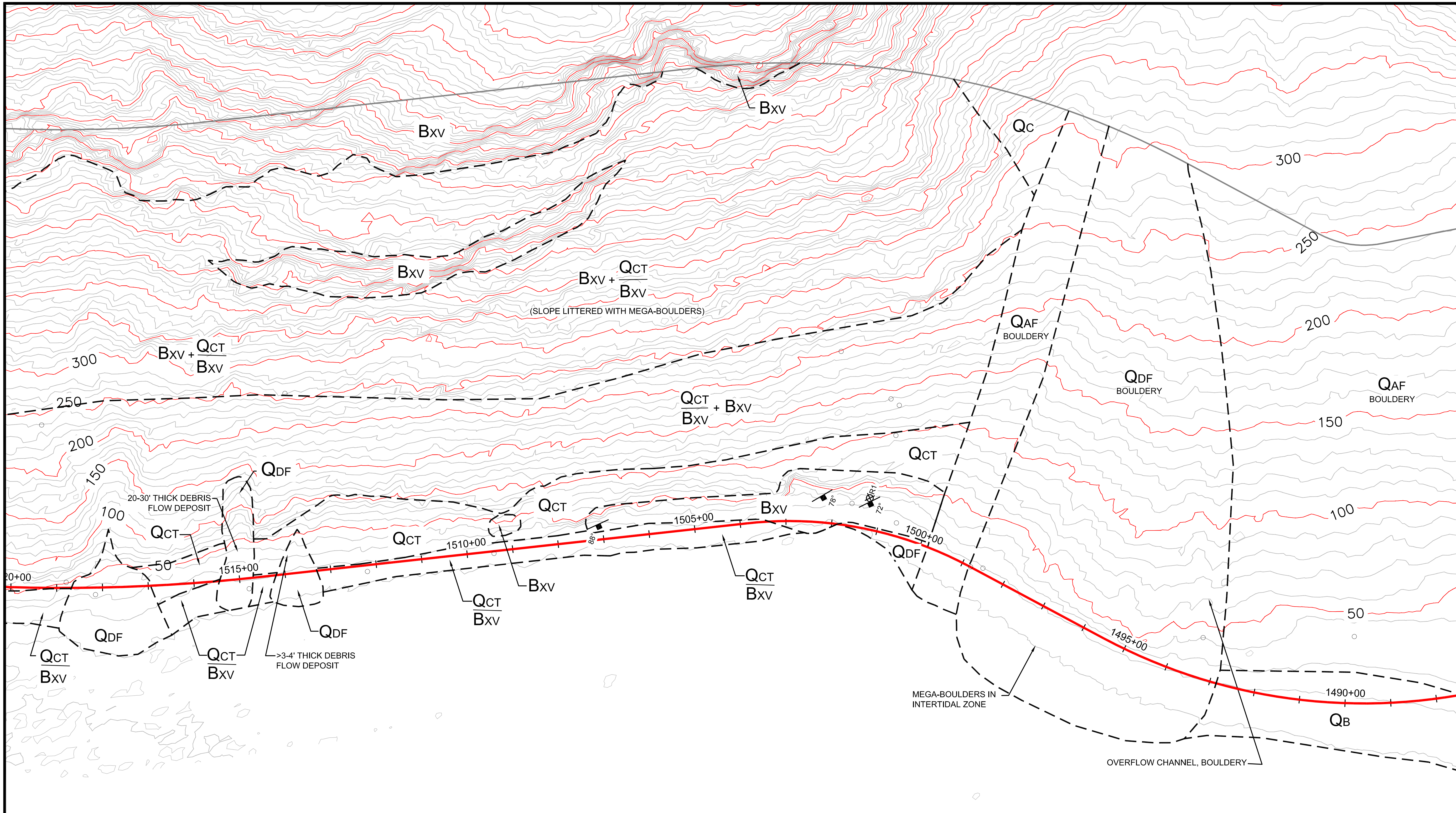
10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	**PRELIMINARY SURFICIAL GEOLOGY MAP** IRP 2006 1454+00 - 1488+00 LYNN CANAL, ALASKA
CADD	AM/EC/AF		
DATE	12/21/06		
CHECK	RGD		
FILE No. 1 to 200 soil.dwg	DATE 12/29/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 1
PROJECT No. 063–5782	REV. 0		



EXPLANATION:

- APPROXIMATE GEOLOGIC CONTACT
- UPSLOPE MAPPING BOUNDARY
- STRUCTURAL LINEAMENT
- MEGA-BOULDER(S) NOTED
- GEOPHYSICAL SURVEY LINE
- R1 STRUCTURAL MAPPING LOCATION
- 42° FOLIATION ORIENTATION AND DIP
- 42° JOINT ORIENTATION AND DIP
- 1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

- QB MODERN BEACH
- QEB ELEVATED BEACH
- QDF DEBRIS FLOW
- QC COLLUVIUM
- QCT TALUS
- QGO GLACIAL OUTWASH
- QAF ALLUVIAL FAN
- QLS LANDSLIDE
- QR RIVER DEPOSIT

BEDROCK UNITS

- BXV BASALT
- BXMG GNEISS
- BXMS METASEDIMENTARY
- BXM METAMORPHIC

BXV + QCT/BXV — UNIT LISTED FIRST IS PREDOMINANT; UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

SCALE IN FEET

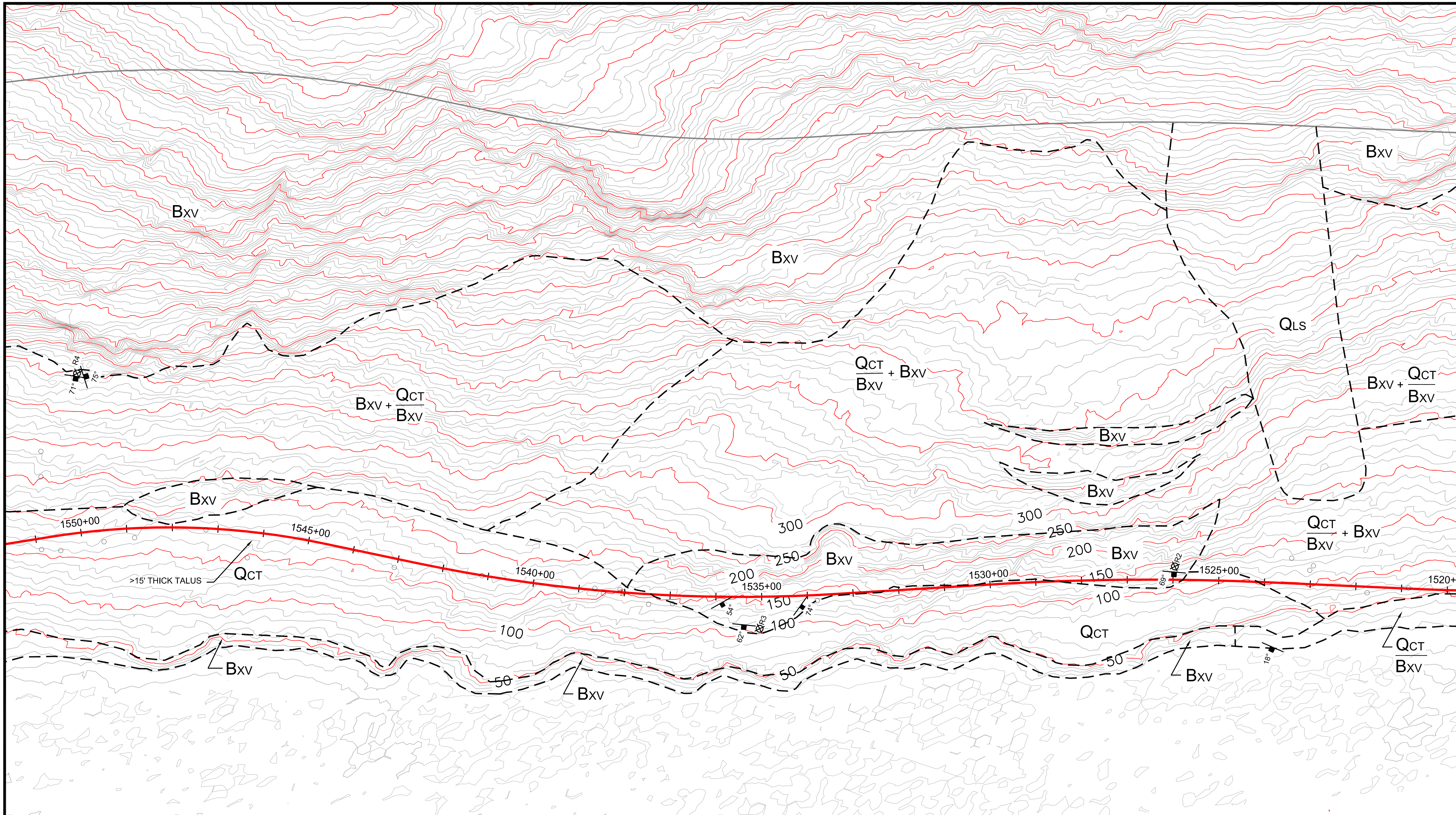
10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	PRELIMINARY SURFICIAL GEOLOGY MAP IRP 2006 1488+00 - 1520+00 LYNN CANAL, ALASKA
CADD	AM/EC/AF		
DATE	12/21/06		
CHECK	RGD		
FILE No. 1 to 200 soil.dwg	DATE 12/29/06		
PROJECT No. 063–5782	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 2



EXPLANATION:

APPROXIMATE GEOLOGIC CONTACT
UPSLOPE MAPPING BOUNDARY
STRUCTURAL LINEAMENT
MEGA-BOULDER(S) NOTED
GEOPHYSICAL SURVEY LINE
R1 STRUCTURAL MAPPING LOCATION
42° FOLIATION ORIENTATION AND DIP
42° JOINT ORIENTATION AND DIP
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

QB	MODERN BEACH
QEB	ELEVATED BEACH
QDF	DEBRIS FLOW
QC	COLLUVIUM
QCT	TALUS
QGO	GLACIAL OUTWASH
QAF	ALLUVIAL FAN
QLS	LANDSLIDE
QR	RIVER DEPOSIT

BEDROCK UNITS

BXV	BASALT
BXMG	GNEISS
BXMS	METASEDIMENTARY
BXM	METAMORPHIC

BXV + QCT/BXV

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

UNIT LISTED FIRST IS PREDOMINANT

N

0 200 400

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

FILE No.	1 to 200 soil.dwg	SCALE	AS SHOWN
PROJECT No.	063–5782	CADD	AM/EC/AF
		DATE	12/21/06
		CHECK	RGD
		DATE	12/29/06
		REV.	0

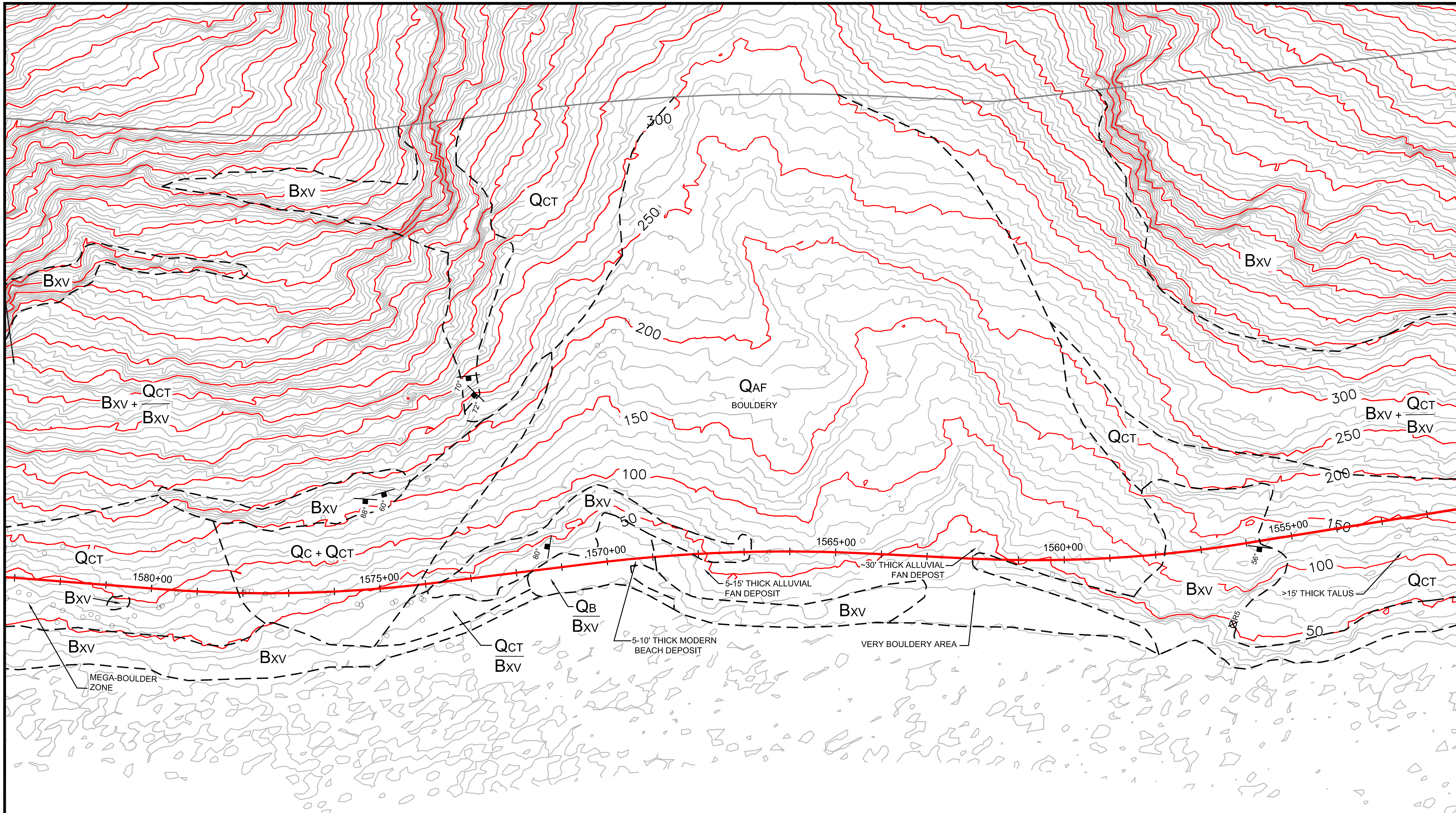
TITLE

PRELIMINARY SURFICIAL GEOLOGY MAP

IRP 2006 1520+00 - 1551+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 3



EXPLANATION:

APPROXIMATE GEOLOGIC CONTACT
UPSLOPE MAPPING BOUNDARY
STRUCTURAL LINEAMENT
MEGA-BOULDER(S) NOTED
GEOPHYSICAL SURVEY LINE
R1 STRUCTURAL MAPPING LOCATION
42° FOLIATION ORIENTATION AND DIP
42° JOINT ORIENTATION AND DIP
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

QB MODERN BEACH
QEB ELEVATED BEACH
QDF DEBRIS FLOW
QC COLLUVIUM
QCT TALUS
QGO GLACIAL OUTWASH
QAF ALLUVIAL FAN
QLS LANDSLIDE
QR RIVER DEPOSIT

BEDROCK UNITS

BXV BASALT
BXMG GNEISS
BXMS METASEDIMENTARY
BXM METAMORPHIC

BXV + QCT / BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

SCALE IN FEET

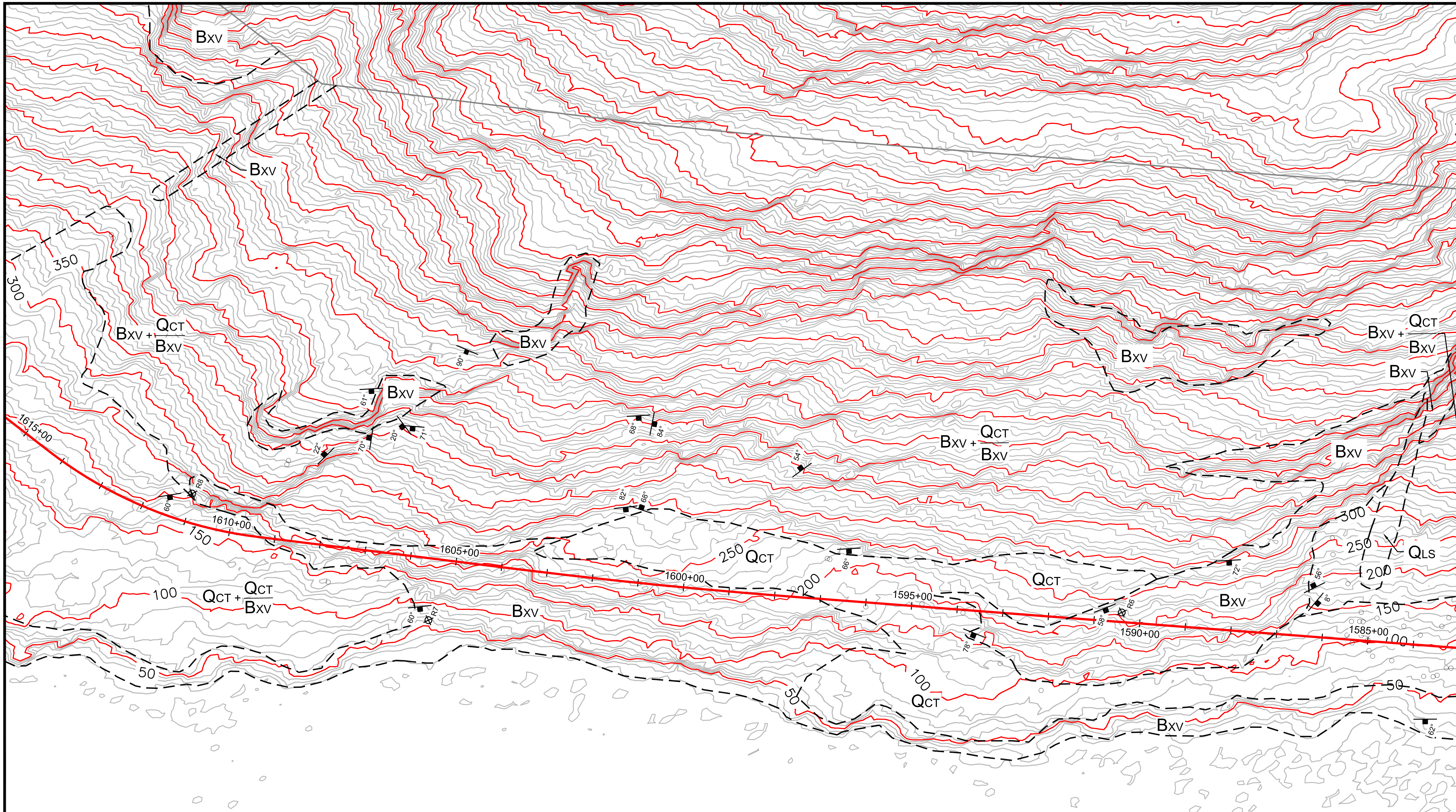
10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	PRELIMINARY SURFICIAL GEOLOGY MAP IRP 2006 1551+00 - 1583+00 LYNN CANAL, ALASKA
CADD	AM/EC/AF		
DATE	12/21/06		
CHECK	RGD		
FILE No. 1 to 200 soil.dwg	DATE 12/29/06		
PROJECT No. 063–5782	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 4



EXPLANATION:

— —	APPROXIMATE GEOLOGIC CONTACT
——	UPSLOPE MAPPING BOUNDARY
- -	STRUCTURAL LINEAMENT
o	MEGA-BOULDER(S) NOTED
	GEOPHYSICAL SURVEY LINE
R1	STRUCTURAL MAPPING LOCATION
42°	FOLIATION ORIENTATION AND DIP
42°	JOINT ORIENTATION AND DIP
1530+00	INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

QB	MODERN BEACH
QEB	ELEVATED BEACH
QDF	DEBRIS FLOW
QC	COLLUVIUM
QCT	TALUS
QGO	GLACIAL OUTWASH
QAF	ALLUVIAL FAN
QLS	LANDSLIDE
QR	RIVER DEPOSIT

BEDROCK UNITS

BXV	BASALT
BXMG	GNEISS
BXMS	METASEDIMENTARY
BXM	METAMORPHIC

BXV + QCT / BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

FILE No.	1 to 200 soil.dwg
PROJECT No.	063–5782
SCALE	AS SHOWN
CADD	AM/EC/AF
DATE	12/21/06
CHECK	RGD
DATE	12/29/06
REV.	0

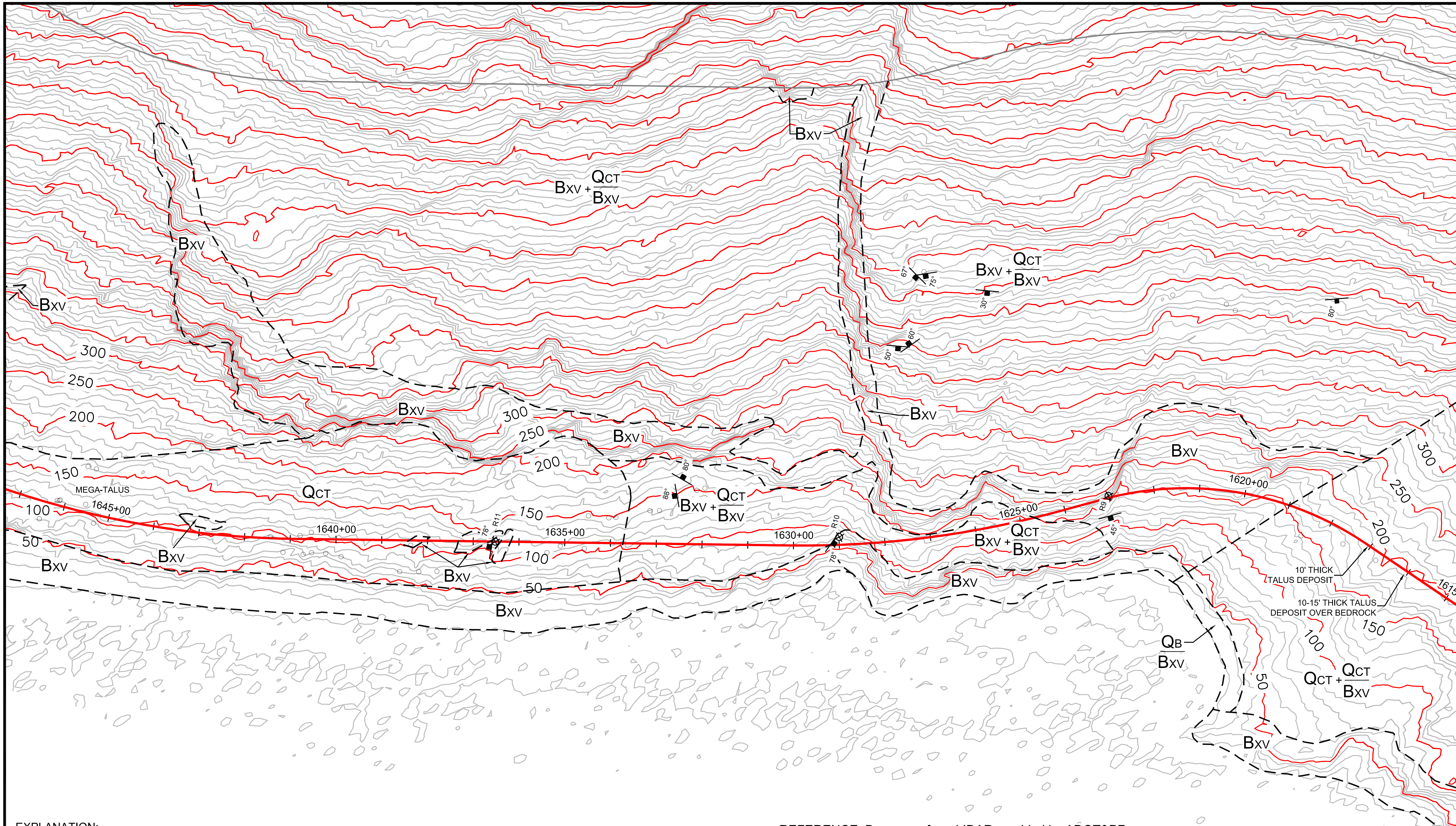
TITLE

PRELIMINARY SURFICIAL GEOLOGY MAP

IRP 2006 1583+00 - 1615+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 5



EXPLANATION:

APPROXIMATE GEOLOGIC CONTACT
UPSLOPE MAPPING BOUNDARY
STRUCTURAL LINEAMENT
MEGA-BOULDER(S) NOTED
GEOPHYSICAL SURVEY LINE
R1 STRUCTURAL MAPPING LOCATION
42° FOLIATION ORIENTATION AND DIP
42° JOINT ORIENTATION AND DIP
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

QB MODERN BEACH
QEB ELEVATED BEACH
QDF DEBRIS FLOW
QC COLLUVIUM
QCT TALUS
QGO GLACIAL OUTWASH
QAF ALLUVIAL FAN
QLS LANDSLIDE
QR RIVER DEPOSIT

BEDROCK UNITS

BXV BASALT
BXMG GNEISS
BXMS METASEDIMENTARY
BXM METAMORPHIC

BXV + QCT/BXV
UNIT LISTED FIRST IS PREDOMINANT
UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400
SCALE IN FEET
10 ft contour interval
50 ft Index contours
True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN
CADD	AM/EC/AF
DATE	12/21/06
CHECK	RGD
DATE	12/29/06
REV.	0
FILE No.	1 to 200 soil.dwg
PROJECT No.	063-5782

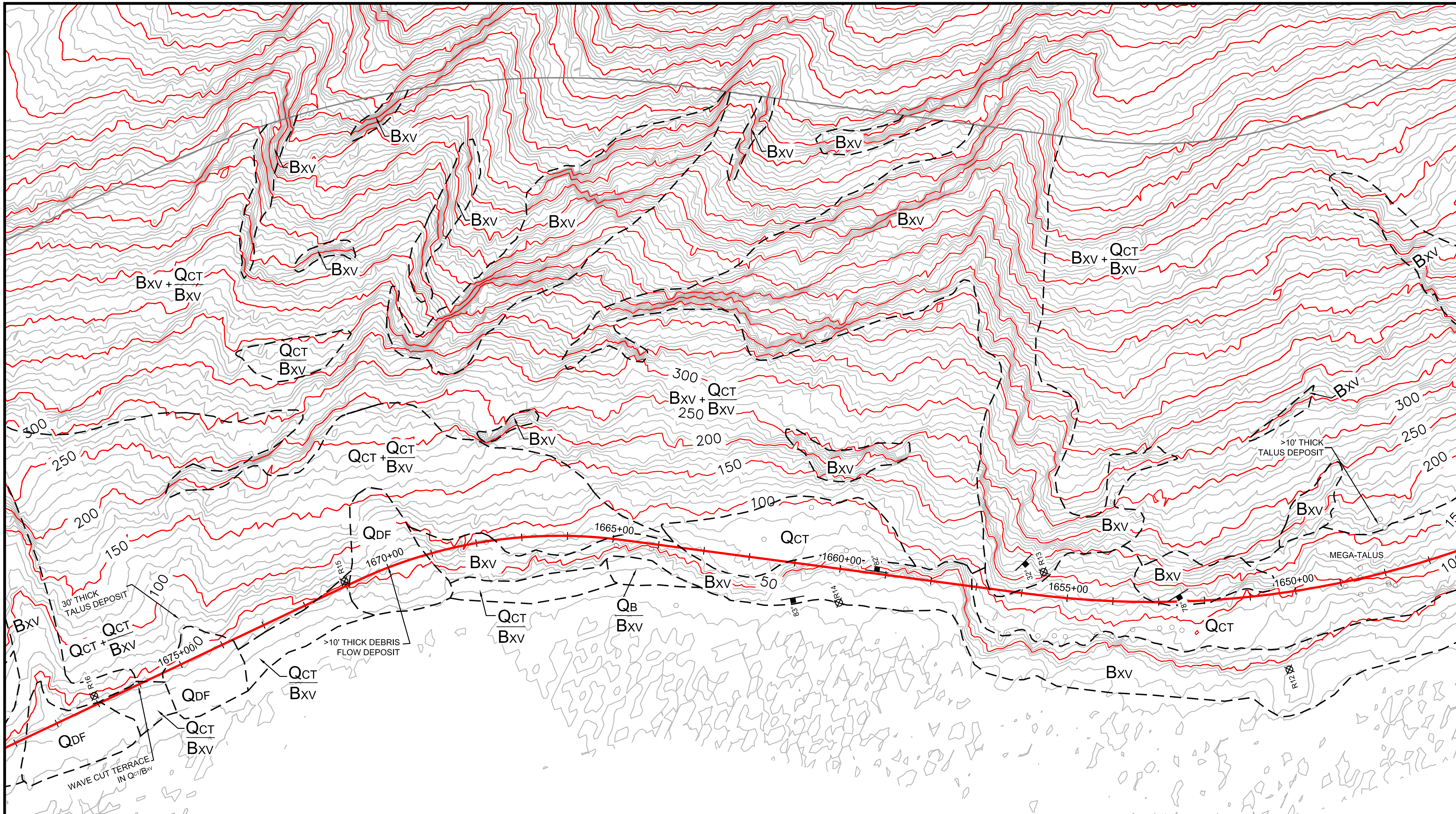
TITLE

PRELIMINARY SURFICIAL GEOLOGY MAP

IRP 2006 1615+00 - 1647+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 6



EXPLANATION:

— —	APPROXIMATE GEOLOGIC CONTACT	*UNCONSOLIDATED UNITS*		*BEDROCK UNITS*	
——	UPSLOPE MAPPING BOUNDARY	QB	MODERN BEACH	BXV	BASALT
— —	STRUCTURAL LINEAMENT	QEB	ELEVATED BEACH	BXMG	GNEISS
○	MEGA-BOULDER(S) NOTED	QDF	DEBRIS FLOW	BXMS	METASEDIMENTARY
	GEOPHYSICAL SURVEY LINE	QC	COLLUVIUM	BXM	METAMORPHIC
R1	STRUCTURAL MAPPING LOCATION	QCT	TALUS		
42°	FOLIATION ORIENTATION AND DIP	QGO	GLACIAL OUTWASH		
42°	JOINT ORIENTATION AND DIP	QAF	ALLUVIAL FAN		
1530+00	INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT	QLS	LANDSLIDE		
		QR	RIVER DEPOSIT		

BXV + QCT/BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

SCALE IN FEET

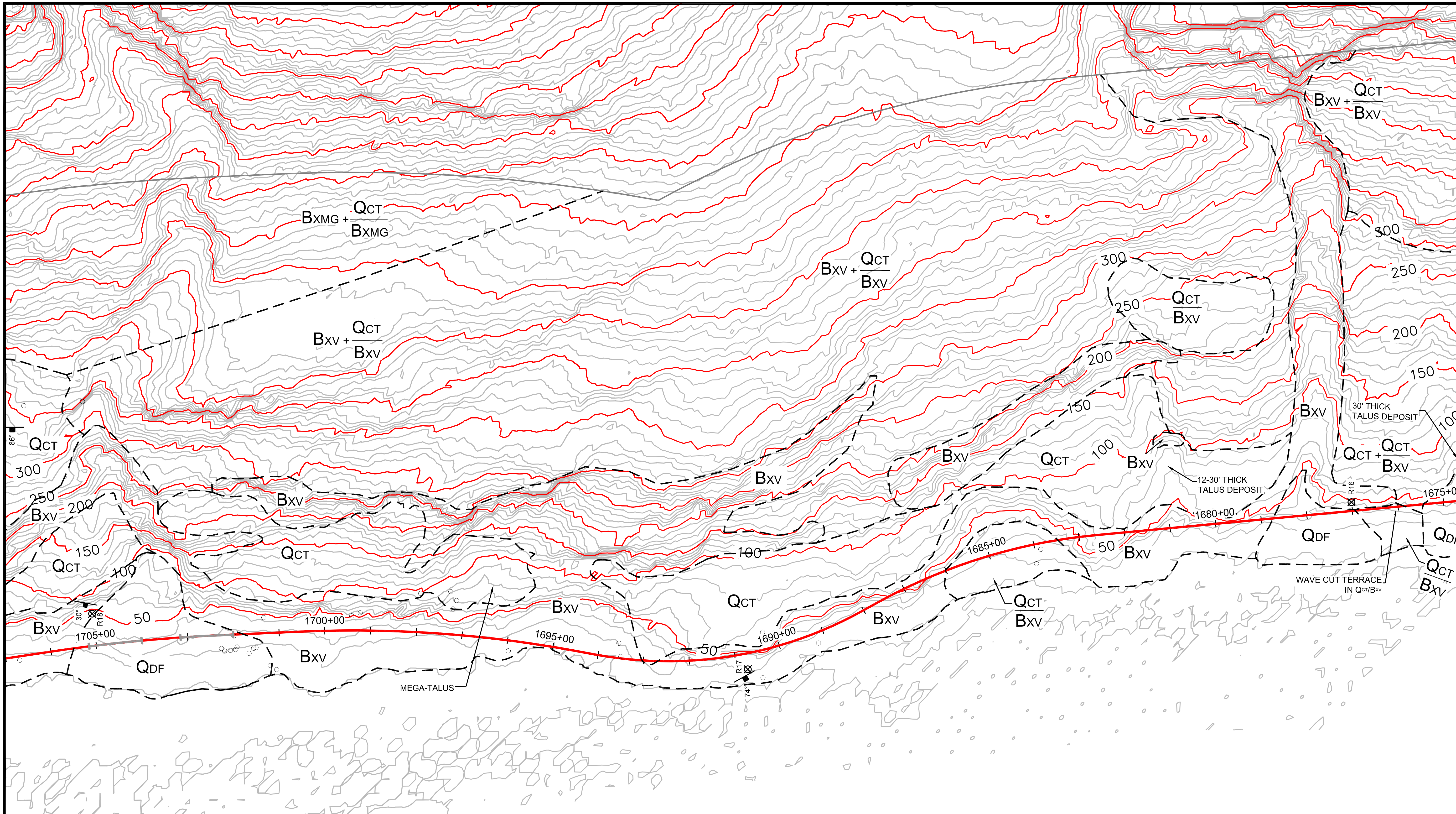
10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	**PRELIMINARY SURFICIAL GEOLOGY MAP** IRP 2006 1647+00 -1679+00 LYNN CANAL, ALASKA
CADD	AM/EC/AF		
DATE	12/21/06		
CHECK	RGD		
FILE No. 1 to 200 soil.dwg	DATE 12/29/06		
PROJECT No. 063–5782	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 7



EXPLANATION:

APPROXIMATE GEOLOGIC CONTACT
UPSLOPE MAPPING BOUNDARY
STRUCTURAL LINEAMENT
MEGA-BOULDER(S) NOTED
GEOPHYSICAL SURVEY LINE
R1 STRUCTURAL MAPPING LOCATION
42° FOLIATION ORIENTATION AND DIP
42° JOINT ORIENTATION AND DIP
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

QB MODERN BEACH
QEB ELEVATED BEACH
QDF DEBRIS FLOW
QC COLLUVIUM
QCT TALUS
QGO GLACIAL OUTWASH
QAF ALLUVIAL FAN
QLS LANDSLIDE
QR RIVER DEPOSIT

BEDROCK UNITS

BXV BASALT
BXMG GNEISS
BXMS METASEDIMENTARY
BXM METAMORPHIC

BXV + QCT/BXV — UNIT LISTED FIRST IS PREDOMINANT; UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

SCALE IN FEET

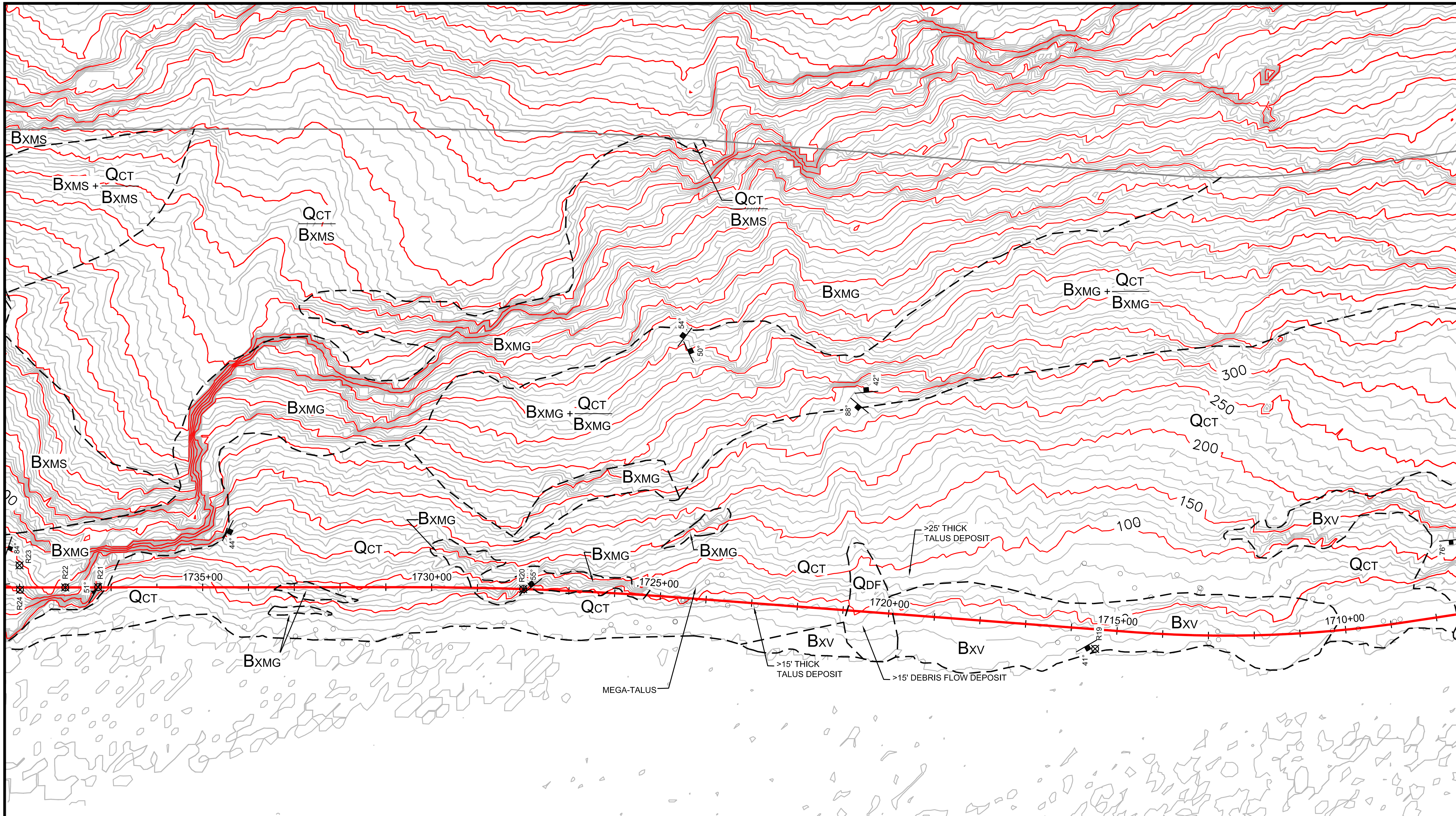
10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	**PRELIMINARY SURFICIAL GEOLOGY MAP** IRP 2006 1675+00 - 1707+00 LYNN CANAL, ALASKA
CADD	AM/EC/AF		
DATE	12/21/06		
CHECK	RGD		
FILE No. 1 to 200 soil.dwg	DATE 12/29/06		
PROJECT No. 063–5782	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 8



EXPLANATION:

APPROXIMATE GEOLOGIC CONTACT
UPSLOPE MAPPING BOUNDARY
STRUCTURAL LINEAMENT
MEGA-BOULDER(S) NOTED
GEOPHYSICAL SURVEY LINE
R1 STRUCTURAL MAPPING LOCATION
42° FOLIATION ORIENTATION AND DIP
42° JOINT ORIENTATION AND DIP
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

QB	MODERN BEACH
QEB	ELEVATED BEACH
QDF	DEBRIS FLOW
QC	COLLUVIUM
QCT	TALUS
QGO	GLACIAL OUTWASH
QAF	ALLUVIAL FAN
QLS	LANDSLIDE
QR	RIVER DEPOSIT

BEDROCK UNITS

BXV	BASALT
BXMG	GNEISS
BXMS	METASEDIMENTARY
BXM	METAMORPHIC

BXV + QCT/BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

FILE No.	1 to 200 soil.dwg
PROJECT No.	063-5782
SCALE	AS SHOWN
CADD	AM/EC/AF
DATE	12/21/06
CHECK	RGD
DATE	12/29/06
REV.	0

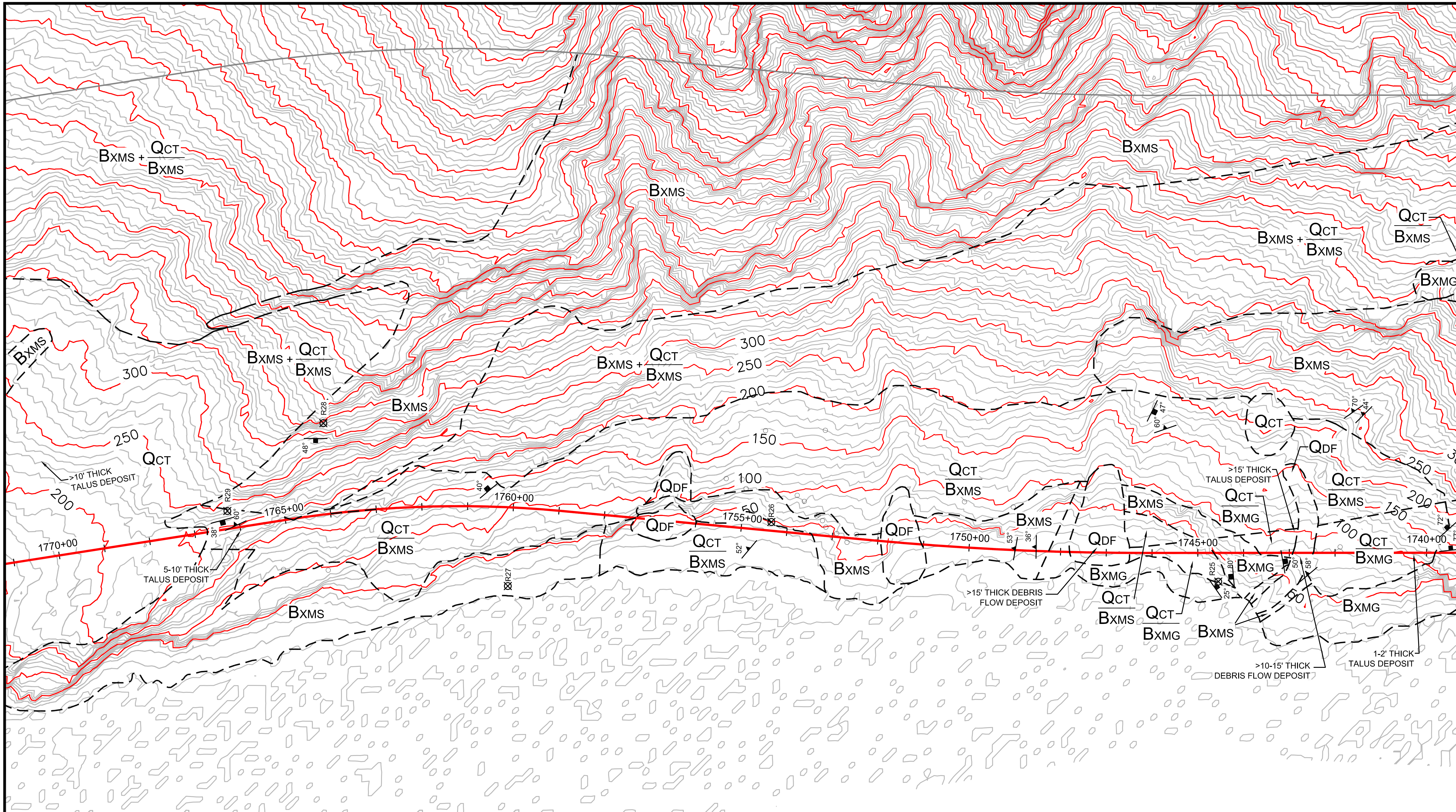
TITLE

PRELIMINARY SURFICIAL GEOLOGY MAP

IRP 2006 1708+00 - 1739+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 9



EXPLANATION:

APPROXIMATE GEOLOGIC CONTACT
UPSLOPE MAPPING BOUNDARY
STRUCTURAL LINEAMENT
MEGA-BOULDER(S) NOTED
GEOPHYSICAL SURVEY LINE
R1 STRUCTURAL MAPPING LOCATION
42° FOLIATION ORIENTATION AND DIP
42° JOINT ORIENTATION AND DIP
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

QB	MODERN BEACH
QEB	ELEVATED BEACH
QDF	DEBRIS FLOW
QC	COLLUVIUM
QCT	TALUS
QGO	GLACIAL OUTWASH
QAF	ALLUVIAL FAN
QLS	LANDSLIDE
QR	RIVER DEPOSIT

BEDROCK UNITS

BXV	BASALT
BXMG	GNEISS
BXMS	METASEDIMENTARY
BXM	METAMORPHIC

BXV + QCT/BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

0 200 400

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN
CADD	AM/EC/AF
DATE	12/21/06
CHECK	RGD
DATE	12/29/06
REV.	0
FILE No.	1 to 200 soil.dwg
PROJECT No.	063-5782

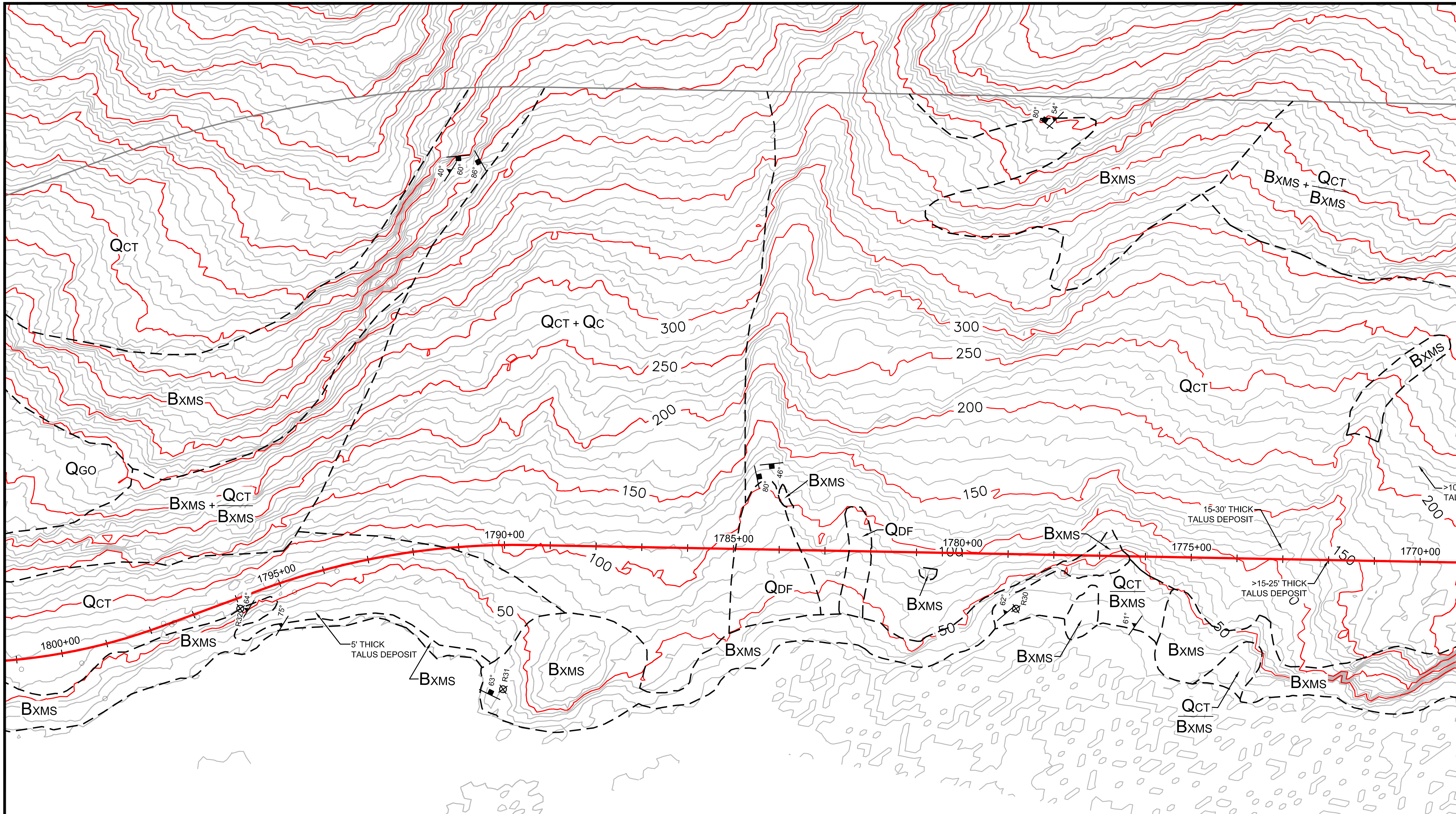
TITLE

PRELIMINARY SURFICIAL GEOLOGY MAP

IRP 2006 1739+00 - 1771+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 10



EXPLANATION:

- APPROXIMATE GEOLOGIC CONTACT
- UPSLOPE MAPPING BOUNDARY
- STRUCTURAL LINEAMENT
- MEGA-BOULDER(S) NOTED
- GEOPHYSICAL SURVEY LINE
- R1 STRUCTURAL MAPPING LOCATION
- 42° FOLIATION ORIENTATION AND DIP
- 42° JOINT ORIENTATION AND DIP
- 1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

- QB MODERN BEACH
- QEB ELEVATED BEACH
- QDF DEBRIS FLOW
- QC COLLUVIUM
- QCT TALUS
- QGO GLACIAL OUTWASH
- QAF ALLUVIAL FAN
- QLS LANDSLIDE
- QR RIVER DEPOSIT

BEDROCK UNITS

- BXV BASALT
- BXMG GNEISS
- BXMS METASEDIMENTARY
- BXM METAMORPHIC

BXV + QCT/BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

SCALE IN FEET

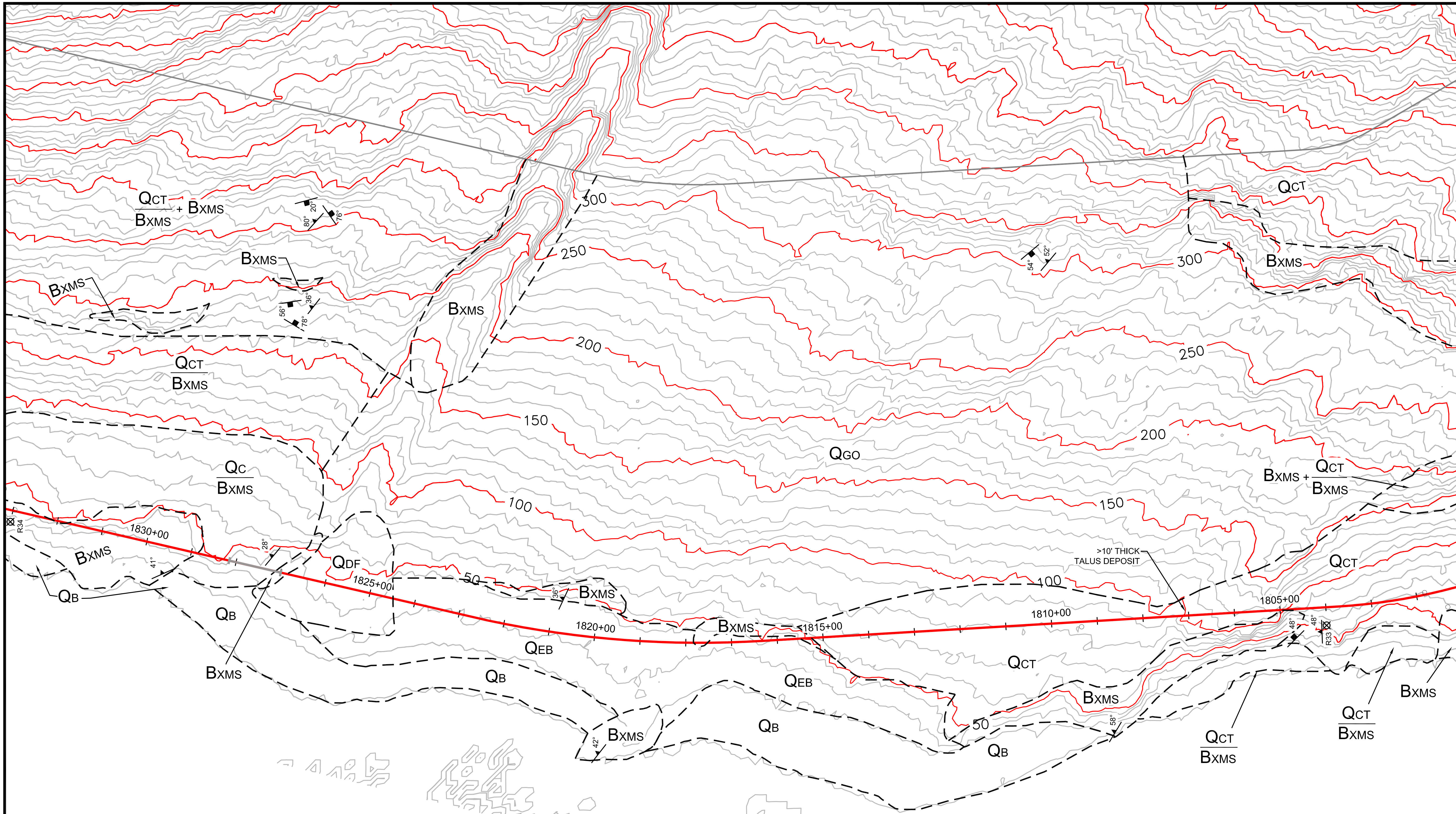
10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

	SCALE	AS SHOWN	TITLE	PRELIMINARY SURFICIAL GEOLOGY MAP IRP 2006 1769+00 - 1801+00 LYNN CANAL, ALASKA
	CADD	AM/EC/AF		
	DATE	12/21/06		
	CHECK	RGD		
FILE No. 1 to 200 soil.dwg	DATE	12/29/06		
PROJECT No. 063–5782	REV.	0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 11



EXPLANATION:

APPROXIMATE GEOLOGIC CONTACT	*UNCONSOLIDATED UNITS*	*BEDROCK UNITS*
UPSLOPE MAPPING BOUNDARY	QB MODERN BEACH	BXV BASALT
STRUCTURAL LINEAMENT	QEB ELEVATED BEACH	BXMG GNEISS
MEGA-BOULDER(S) NOTED	QDF DEBRIS FLOW	BXMS METASEDIMENTARY
GEOPHYSICAL SURVEY LINE	QC COLLUVIUM	BXM METAMORPHIC
R1 STRUCTURAL MAPPING LOCATION	QCT TALUS	
42° FOLIATION ORIENTATION AND DIP	QGO GLACIAL OUTWASH	
42° JOINT ORIENTATION AND DIP	QAF ALLUVIAL FAN	
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT	QLS LANDSLIDE	
	QR RIVER DEPOSIT	

BXV + QCT / BXV — UNIT LISTED FIRST IS PREDOMINANT; UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

SCALE IN FEET

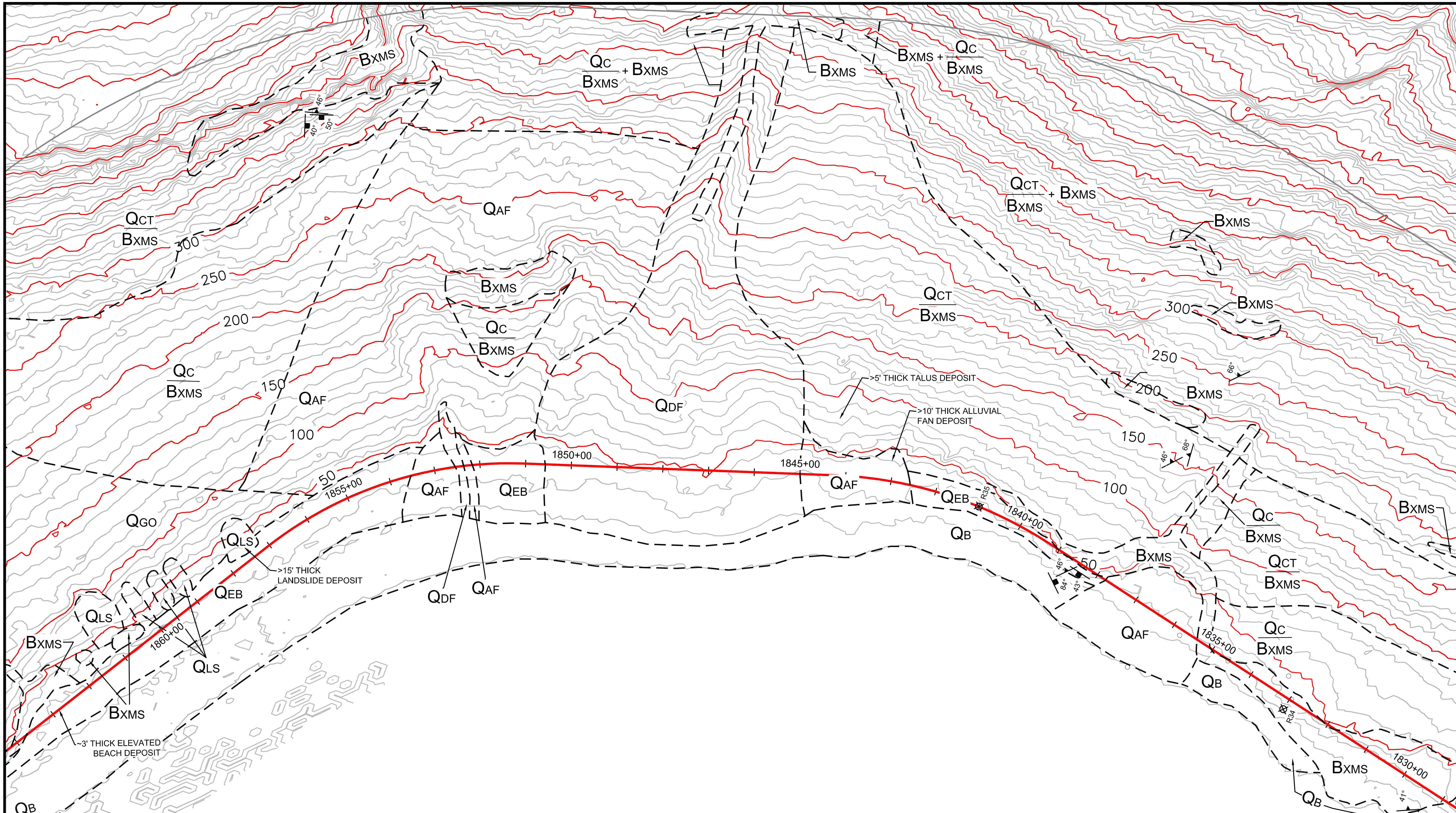
10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	**PRELIMINARY SURFICIAL GEOLOGY MAP**	
CADD	AM/EC/AF		IRP 2006 1801+00 - 1833+00	
DATE	12/21/06		LYNN CANAL, ALASKA	
CHECK	RGD			
FILE No. 1 to 200 soil.dwg	DATE 12/29/06			
PROJECT No. 063–5782	REV. 0		ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 12



EXPLANATION:

	UNCONSOLIDATED UNITS	BEDROCK UNITS
APPROXIMATE GEOLOGIC CONTACT	QB MODERN BEACH	BXV BASALT
UPSLOPE MAPPING BOUNDARY	QEB ELEVATED BEACH	BXMG GNEISS
STRUCTURAL LINEAMENT	QDF DEBRIS FLOW	BXMS METASEDIMENTARY
MEGA-BOULDER(S) NOTED	QC COLLUVIUM	BXM METAMORPHIC
GEOPHYSICAL SURVEY LINE	QCT TALUS	
R1 STRUCTURAL MAPPING LOCATION	QGO GLACIAL OUTWASH	
42° FOLIATION ORIENTATION AND DIP	QAF ALLUVIAL FAN	
42° JOINT ORIENTATION AND DIP	QLS LANDSLIDE	
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT	QR RIVER DEPOSIT	

BXV + QCT / BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

SCALE IN FEET

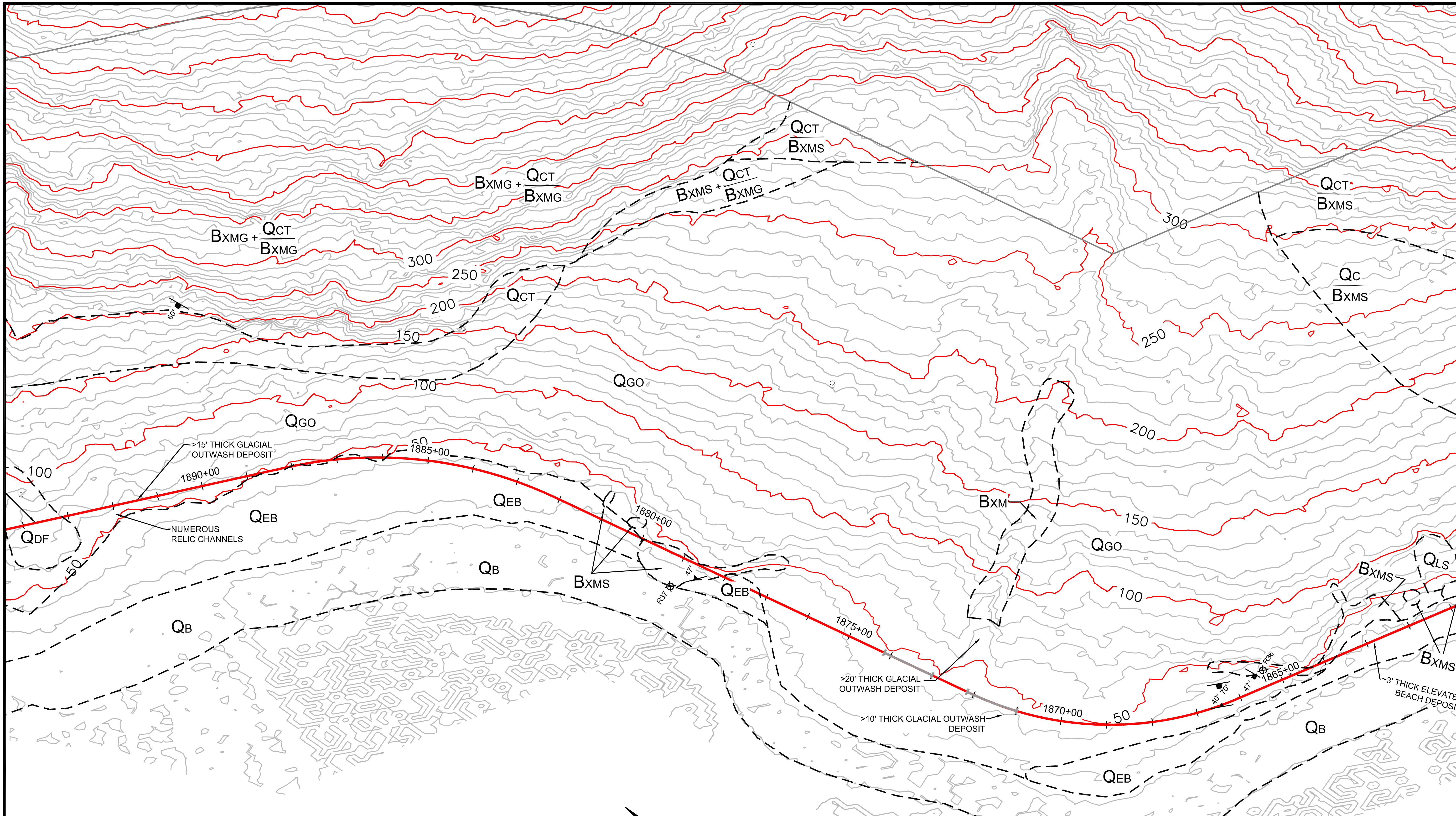
10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	PRELIMINARY SURFICIAL GEOLOGY MAP IRP 2006 1829+00 - 1864+00 LYNN CANAL, ALASKA
CADD	AM/EC/AF		
DATE	12/21/06		
CHECK	RGD		
FILE No. 1 to 200 soil.dwg	DATE 12/29/06		
PROJECT No. 063-5782	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 13



EXPLANATION:

APPROXIMATE GEOLOGIC CONTACT
UPSLOPE MAPPING BOUNDARY
STRUCTURAL LINEAMENT
MEGA-BOULDER(S) NOTED
GEOPHYSICAL SURVEY LINE
R1 STRUCTURAL MAPPING LOCATION
42° FOLIATION ORIENTATION AND DIP
42° JOINT ORIENTATION AND DIP
1530+00 INERTIAL REFERENCE POINT 2006
(IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

QB	MODERN BEACH
QEB	ELEVATED BEACH
QDF	DEBRIS FLOW
QC	COLLUVIUM
QCT	TALUS
QGO	GLACIAL OUTWASH
QAF	ALLUVIAL FAN
QLS	LANDSLIDE
QR	RIVER DEPOSIT

BEDROCK UNITS

BXV	BASALT
BXMG	GNEISS
BXMS	METASEDIMENTARY
BXM	METAMORPHIC

BXV + QCT / BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

0 200 400

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	CADD	AM/EC/AF
DATE	12/21/06	CHECK	RGD
FILE No.	1 to 200 soil.dwg	DATE	12/29/06
PROJECT No.	063-5782	REV.	0

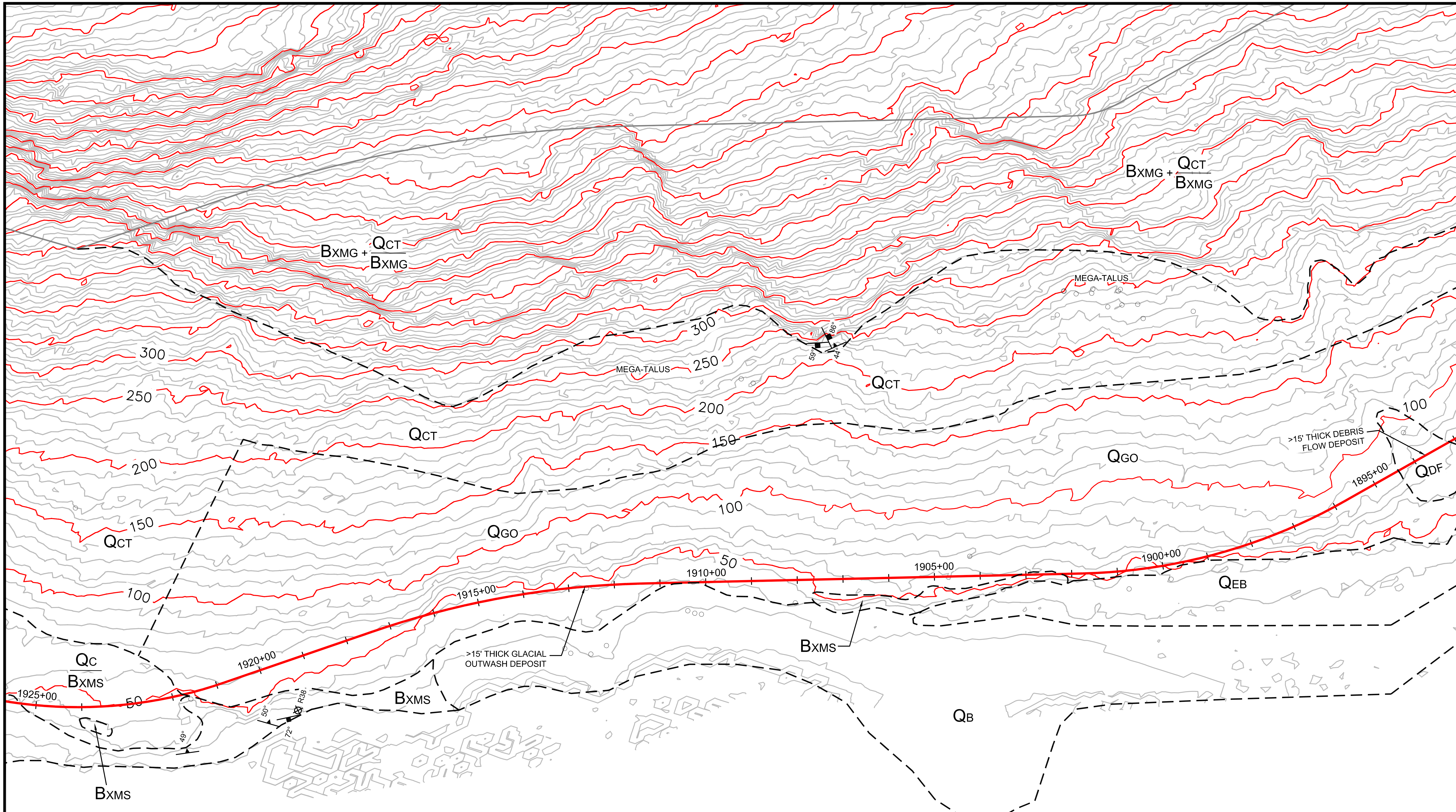
TITLE

PRELIMINARY SURFICIAL GEOLOGY MAP

IRP 2006 1861+00 - 1894+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 14



EXPLANATION:

APPROXIMATE GEOLOGIC CONTACT
UPSLOPE MAPPING BOUNDARY
STRUCTURAL LINEAMENT
MEGA-BOULDER(S) NOTED
GEOPHYSICAL SURVEY LINE
R1 STRUCTURAL MAPPING LOCATION
42° FOLIATION ORIENTATION AND DIP
42° JOINT ORIENTATION AND DIP
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

QB MODERN BEACH
QEB ELEVATED BEACH
QDF DEBRIS FLOW
QC COLLUVIUM
QCT TALUS
QGO GLACIAL OUTWASH
QAF ALLUVIAL FAN
QLS LANDSLIDE
QR RIVER DEPOSIT

BEDROCK UNITS

BXV BASALT
BXMG GNEISS
BXMS METASEDIMENTARY
BXM METAMORPHIC

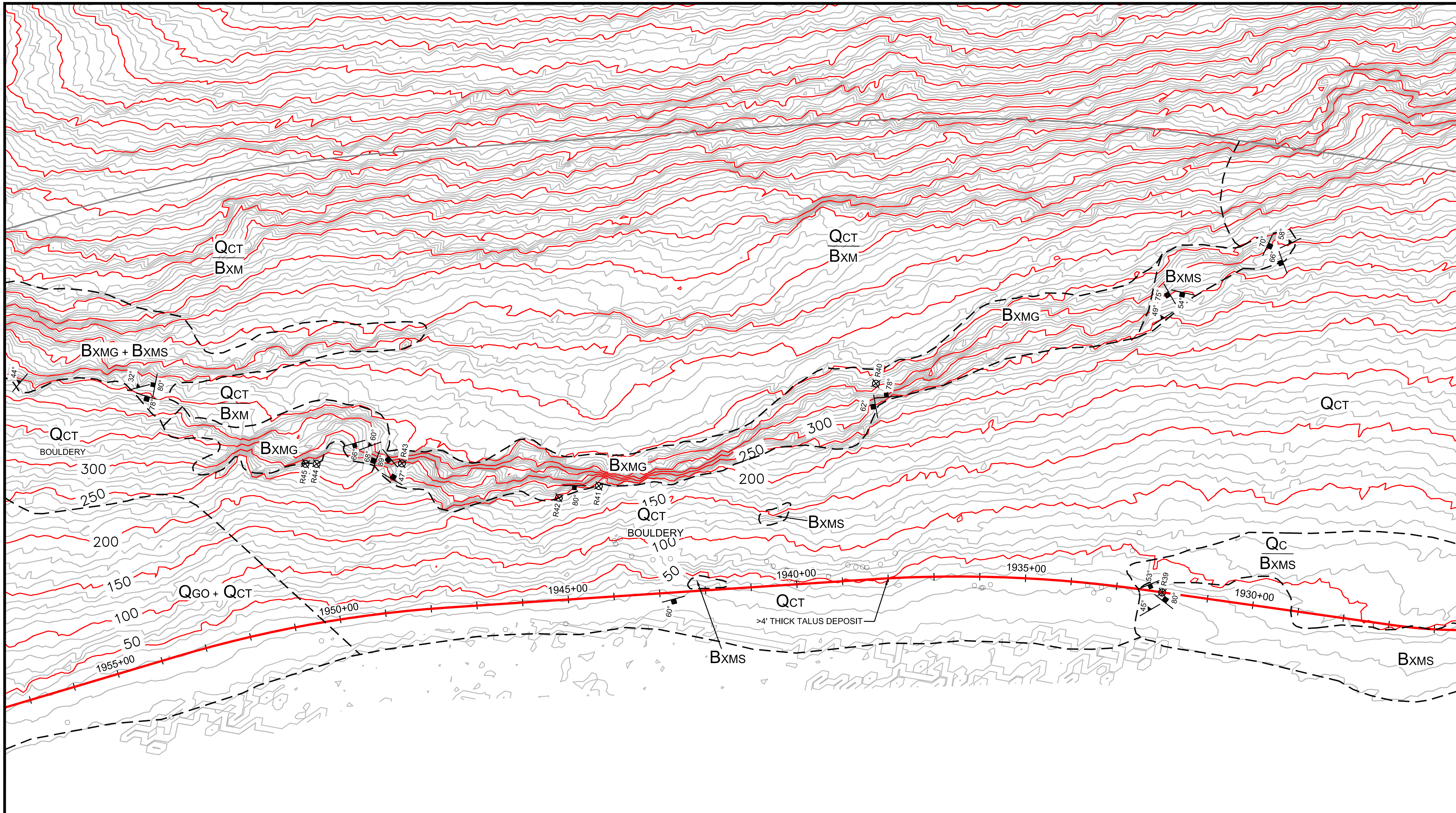
BXV + QCT / BXV
UNIT LISTED FIRST IS PREDOMINANT
UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400
SCALE IN FEET
10 ft contour interval
50 ft Index contours
True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates, Anchorage, Alaska	SCALE AS SHOWN	TITLE	PRELIMINARY SURFICIAL GEOLOGY MAP
	CADD AM/EC/AF		IRP 2006 1893+00 - 1925+00
	DATE 12/21/06		LYNN CANAL, ALASKA
	CHECK RGD		
FILE No. 1 to 200 soil.dwg	DATE 12/29/06		
PROJECT No. 063–5782	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 15



EXPLANATION:

— — APPROXIMATE GEOLOGIC CONTACT	*UNCONSOLIDATED UNITS*		*BEDROCK UNITS*
UPSLOPE MAPPING BOUNDARY	QB	MODERN BEACH	BXV BASALT
STRUCTURAL LINEAMENT	QEB	ELEVATED BEACH	BXMG GNEISS
MEGA-BOULDER(S) NOTED	QDF	DEBRIS FLOW	BXMS METASEDIMENTARY
GEOPHYSICAL SURVEY LINE	QC	COLLUVIUM	BXM METAMORPHIC
R1 STRUCTURAL MAPPING LOCATION	QCT	TALUS	
42° FOLIATION ORIENTATION AND DIP	QGO	GLACIAL OUTWASH	
42° JOINT ORIENTATION AND DIP	QAF	ALLUVIAL FAN	
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT	QLS	LANDSLIDE	
	QR	RIVER DEPOSIT	

BXV + QCT / BXV — UNIT LISTED FIRST IS PREDOMINANT; UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

SCALE IN FEET

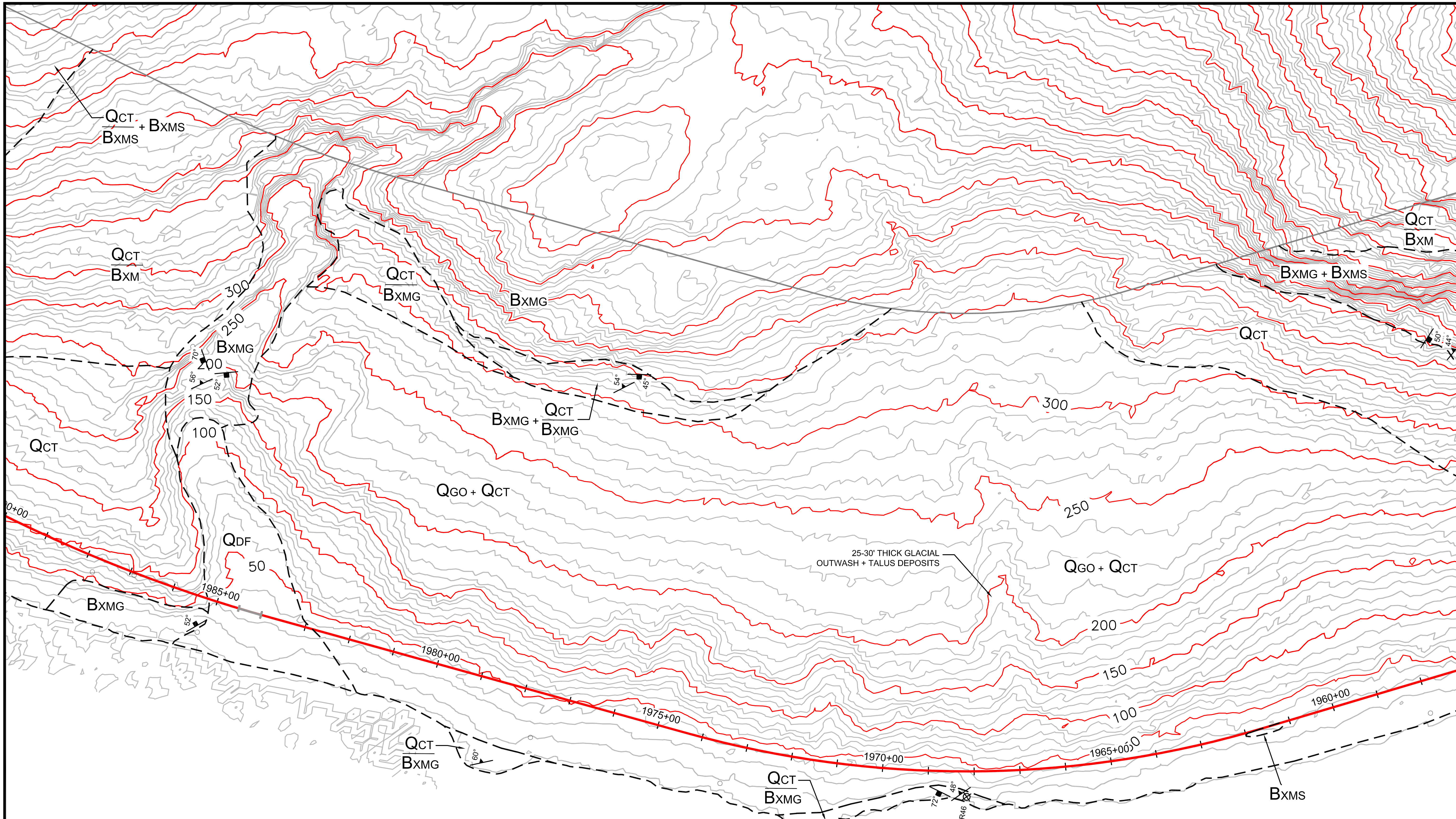
10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	**PRELIMINARY SURFICIAL GEOLOGY MAP** IRP 2006 1925+00 - 1957+00 LYNN CANAL, ALASKA
CADD	AM/EC/AF		
DATE	12/21/06		
CHECK	RGD		
FILE No. 1 to 200 soil.dwg	DATE 12/29/06		
PROJECT No. 063-5782	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 16



REFERENCE: Base map from LIDAR provided by ADOT&PF.

EXPLANATION:

- APPROXIMATE GEOLOGIC CONTACT
- UPSLOPE MAPPING BOUNDARY
- STRUCTURAL LINEAMENT
- MEGA-BOULDER(S) NOTED
- GEOPHYSICAL SURVEY LINE
- R1 STRUCTURAL MAPPING LOCATION
- 42° FOLIATION ORIENTATION AND DIP
- 42° JOINT ORIENTATION AND DIP
- 1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

- QB MODERN BEACH
- QEB ELEVATED BEACH
- QDF DEBRIS FLOW
- QC COLLUVIUM
- QCT TALUS
- QGO GLACIAL OUTWASH
- QAF ALLUVIAL FAN
- QLS LANDSLIDE
- QR RIVER DEPOSIT

BEDROCK UNITS

- BXV BASALT
- BXMG GNEISS
- BXMS METASEDIMENTARY
- BXM METAMORPHIC

BXV + QCT/BXV — UNIT LISTED FIRST IS PREDOMINANT; UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN
CADD	AM/EC/AF
DATE	12/21/06
CHECK	RGD
DATE	12/29/06
REV.	0
FILE No.	1 to 200 soil.dwg
PROJECT No.	063-5782

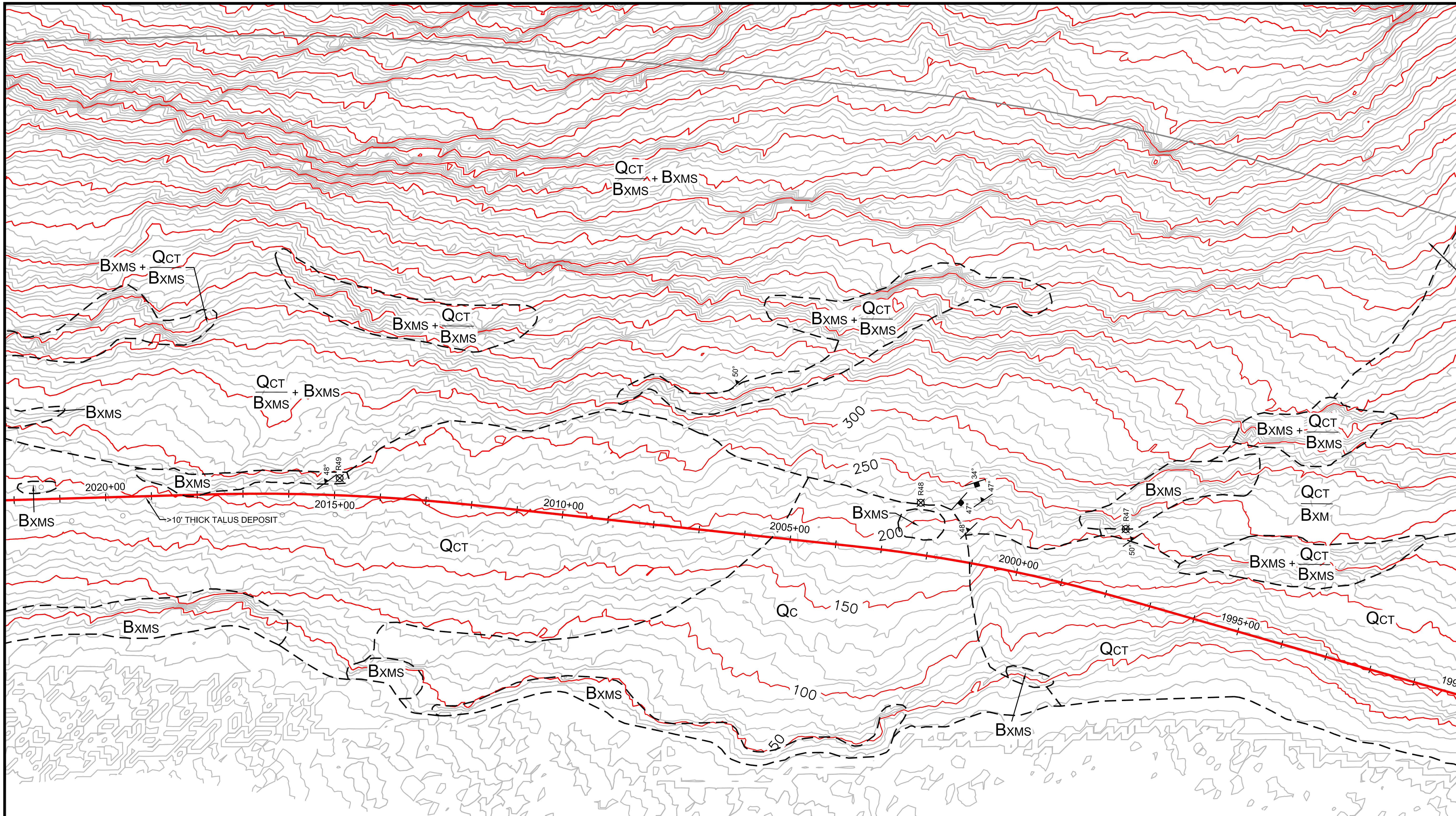
TITLE

PRELIMINARY SURFICIAL GEOLOGY MAP

IRP 2006 1957+00 -1990+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 17



REFERENCE: Base map from LIDAR provided by ADOT&PF.

EXPLANATION:

— — APPROXIMATE GEOLOGIC CONTACT
UPSLOPE MAPPING BOUNDARY
STRUCTURAL LINEAMENT
MEGA-BOULDER(S) NOTED
GEOPHYSICAL SURVEY LINE
R1 STRUCTURAL MAPPING LOCATION
42° FOLIATION ORIENTATION AND DIP
42° JOINT ORIENTATION AND DIP
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

- QB MODERN BEACH
- QEB ELEVATED BEACH
- QDF DEBRIS FLOW
- QC COLLUVIUM
- QCT TALUS
- QGO GLACIAL OUTWASH
- QAF ALLUVIAL FAN
- QLS LANDSLIDE
- QR RIVER DEPOSIT

BEDROCK UNITS

- BXV BASALT
- BXMG GNEISS
- BXMS METASEDIMENTARY
- BXM METAMORPHIC

BXV + QCT / BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

0 200 400

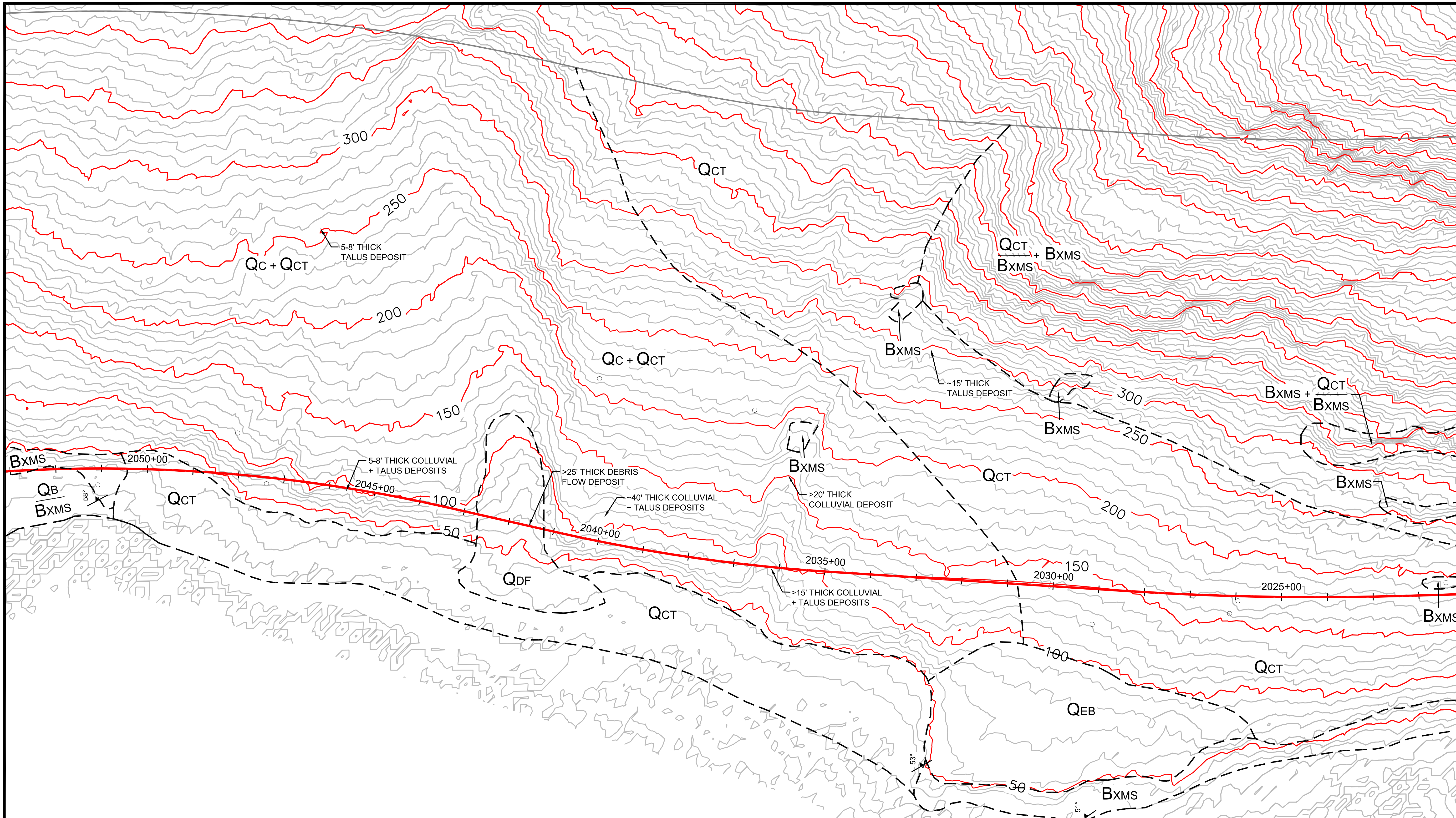
SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	**PRELIMINARY SURFICIAL GEOLOGY MAP** IRP 2006 1990+00 - 2022+00 LYNN CANAL, ALASKA
CADD	AM/EC/AF		
DATE	12/21/06		
CHECK	RGD		
FILE No. 1 to 200 soil.dwg	DATE 12/29/06		
PROJECT No. 063–5782	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 18



REFERENCE: Base map from LIDAR provided by ADOT&PF.

EXPLANATION:

- APPROXIMATE GEOLOGIC CONTACT
- UPSLOPE MAPPING BOUNDARY
- STRUCTURAL LINEAMENT
- MEGA-BOULDER(S) NOTED
- GEOPHYSICAL SURVEY LINE
- R1 STRUCTURAL MAPPING LOCATION
- 42° FOLIATION ORIENTATION AND DIP
- 42° JOINT ORIENTATION AND DIP
- 1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

- QB MODERN BEACH
- QEB ELEVATED BEACH
- QDF DEBRIS FLOW
- QC COLLUVIUM
- QCT TALUS
- QGO GLACIAL OUTWASH
- QAF ALLUVIAL FAN
- QLS LANDSLIDE
- QR RIVER DEPOSIT

BEDROCK UNITS

- BXV BASALT
- BXMG GNEISS
- BXMS METASEDIMENTARY
- BXM METAMORPHIC

BXV + QCT / BXV — UNIT LISTED FIRST IS PREDOMINANT; UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

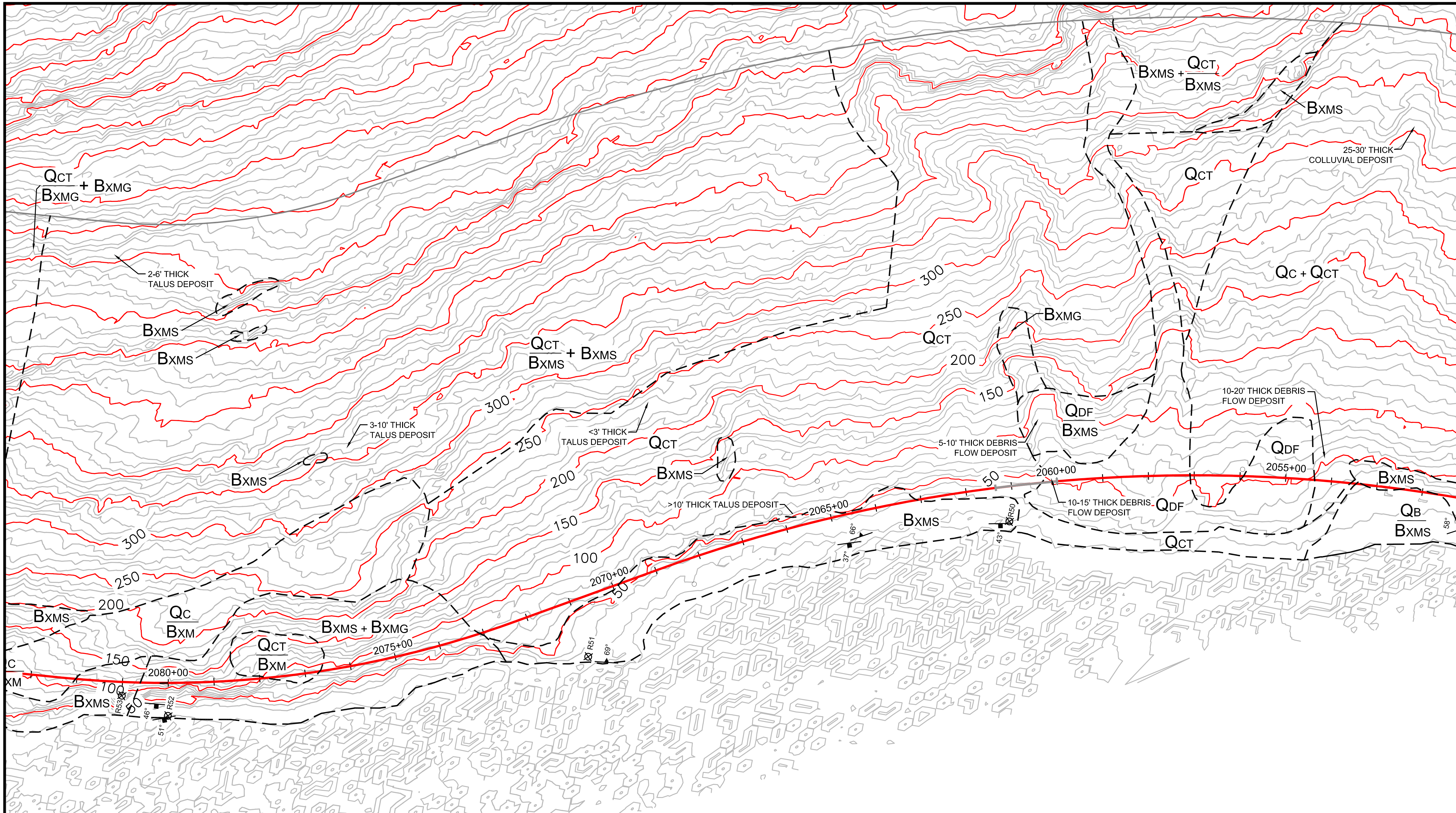
0 200 400

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

Golder Associates, Anchorage, Alaska	SCALE AS SHOWN	TITLE	**PRELIMINARY SURFICIAL GEOLOGY MAP** IRP 2006 2021+00 - 2053+00 LYNN CANAL, ALASKA
	CADD AM/EC/AF		
	DATE 12/21/06		
	CHECK RGD		
FILE No. 1 to 200 soil.dwg	DATE 12/29/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 19
PROJECT No. 063–5782	REV. 0		



EXPLANATION:

- APPROXIMATE GEOLOGIC CONTACT
- UPSLOPE MAPPING BOUNDARY
- STRUCTURAL LINEAMENT
- MEGA-BOULDER(S) NOTED
- GEOPHYSICAL SURVEY LINE
- R1 STRUCTURAL MAPPING LOCATION
- 42° FOLIATION ORIENTATION AND DIP
- 42° JOINT ORIENTATION AND DIP
- 1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

- QB MODERN BEACH
- QEB ELEVATED BEACH
- QDF DEBRIS FLOW
- QC COLLUVIUM
- QCT TALUS
- QGO GLACIAL OUTWASH
- QAF ALLUVIAL FAN
- QLS LANDSLIDE
- QR RIVER DEPOSIT

BEDROCK UNITS

- BXV BASALT
- BXMG GNEISS
- BXMS METASEDIMENTARY
- BXM METAMORPHIC

BXV + QCT / BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

SCALE IN FEET

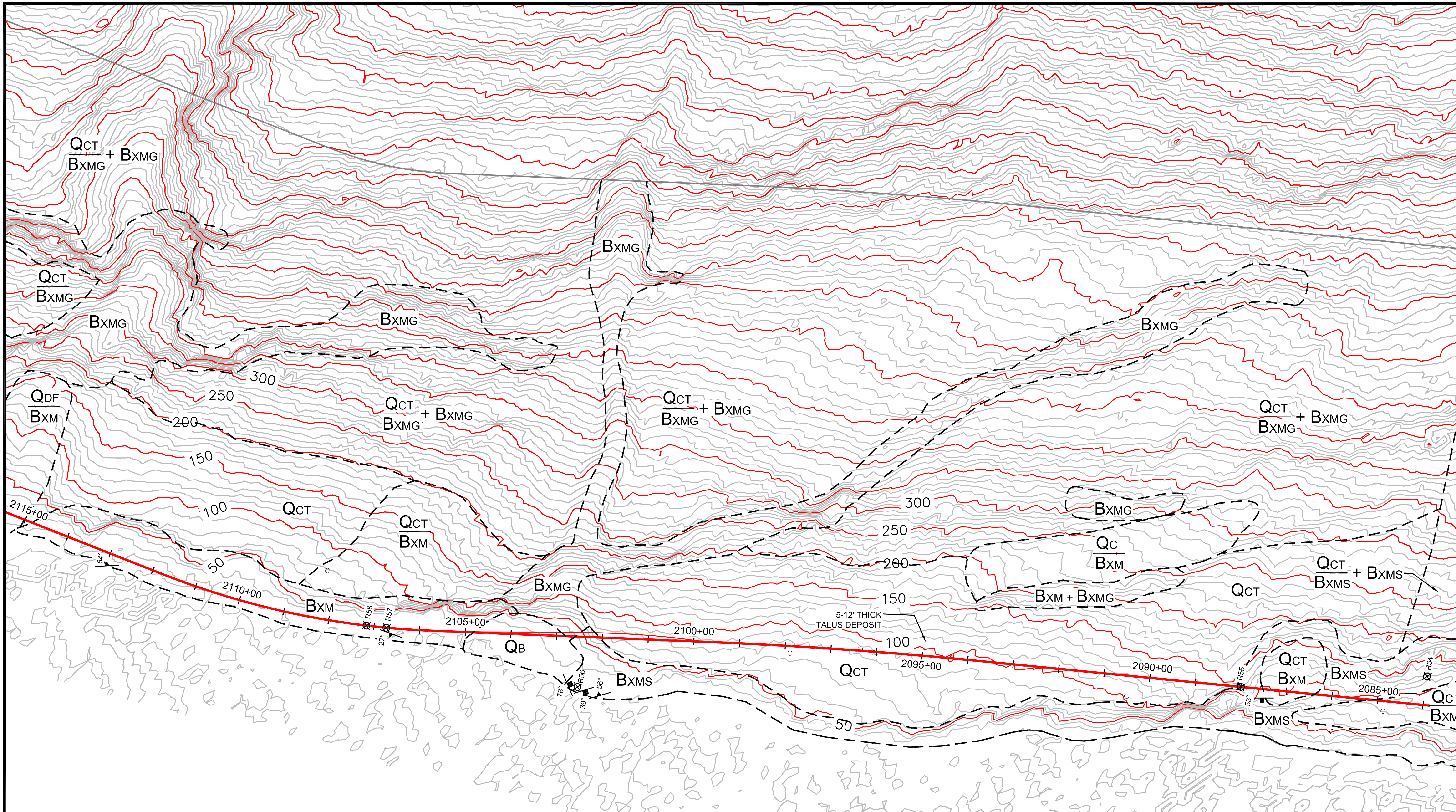
10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	**PRELIMINARY SURFICIAL GEOLOGY MAP** IRP 2006 2051+00 - 2083+00 LYNN CANAL, ALASKA
CADD	AM/EC/AF		
DATE	12/21/06		
CHECK	RGD		
FILE No. 1 to 200 soil.dwg	DATE 12/29/06		
PROJECT No. 063-5782	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 20



EXPLANATION:

APPROXIMATE GEOLOGIC CONTACT
UPSLOPE MAPPING BOUNDARY
STRUCTURAL LINEAMENT
MEGA-BOULDER(S) NOTED
GEOPHYSICAL SURVEY LINE
R1 STRUCTURAL MAPPING LOCATION
42° FOLIATION ORIENTATION AND DIP
42° JOINT ORIENTATION AND DIP
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

QB	MODERN BEACH
QEB	ELEVATED BEACH
QDF	DEBRIS FLOW
QC	COLLUVIUM
QCT	TALUS
QGO	GLACIAL OUTWASH
QAF	ALLUVIAL FAN
QLS	LANDSLIDE
QR	RIVER DEPOSIT

BEDROCK UNITS

BXV	BASALT
BXMG	GNEISS
BXMS	METASEDIMENTARY
BXM	METAMORPHIC

BXV + QCT / BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN
CADD	AM/EC/AF
DATE	12/21/06
CHECK	RGD
DATE	12/29/06
REV.	0
FILE No.	1 to 200 soil.dwg
PROJECT No.	063–5782

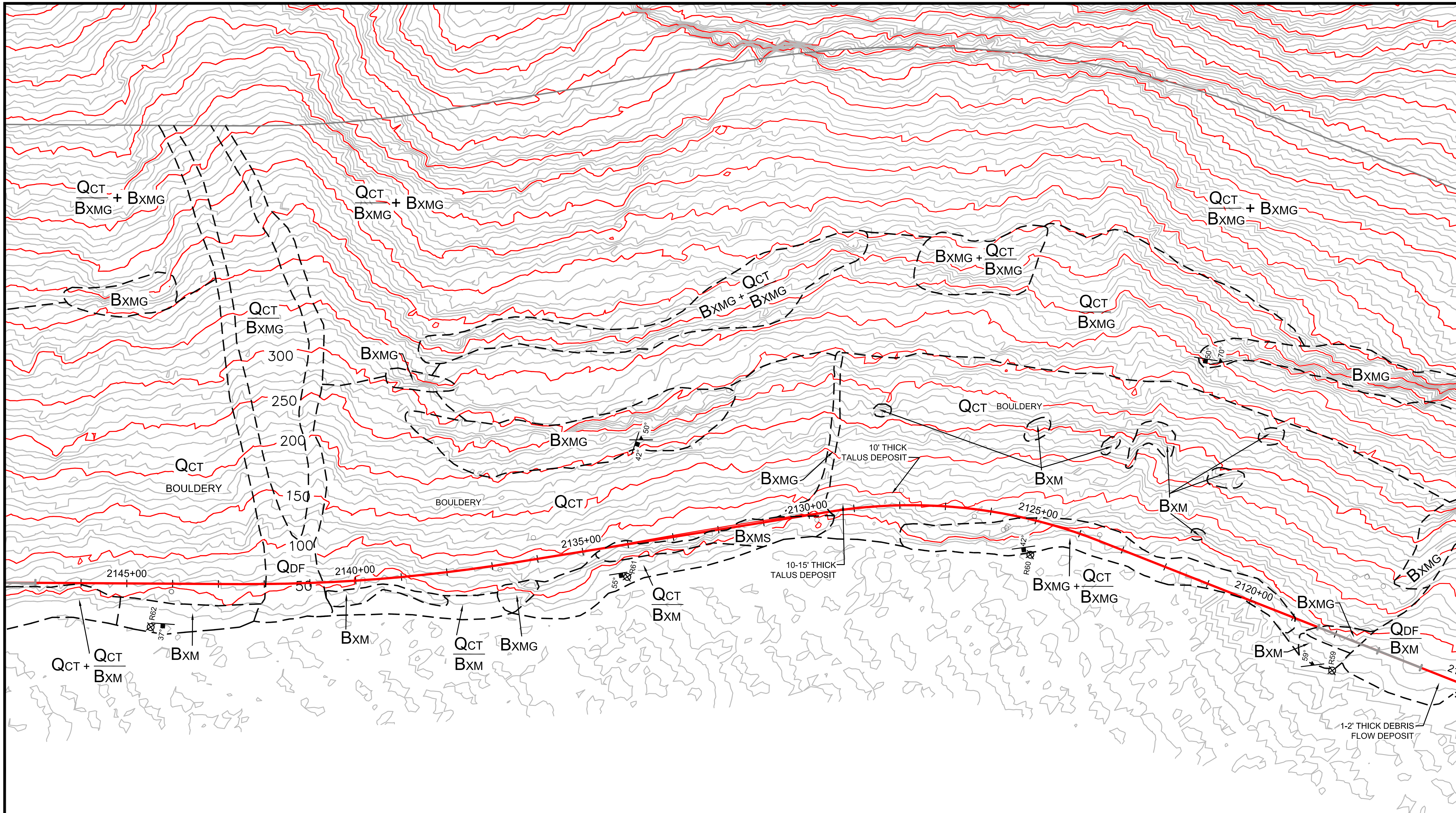
TITLE

PRELIMINARY SURFICIAL GEOLOGY MAP

IRP 2006 2083+00 - 2115+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 21



REFERENCE: Base map from LIDAR provided by ADOT&PF.

EXPLANATION:

- APPROXIMATE GEOLOGIC CONTACT
- UPSLOPE MAPPING BOUNDARY
- STRUCTURAL LINEAMENT
- MEGA-BOULDER(S) NOTED
- GEOPHYSICAL SURVEY LINE
- R1 STRUCTURAL MAPPING LOCATION
- 42° FOLIATION ORIENTATION AND DIP
- 42° JOINT ORIENTATION AND DIP
- 1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

- QB MODERN BEACH
- QEB ELEVATED BEACH
- QDF DEBRIS FLOW
- QC COLLUVIUM
- QCT TALUS
- QGO GLACIAL OUTWASH
- QAF ALLUVIAL FAN
- QLS LANDSLIDE
- QR RIVER DEPOSIT

BEDROCK UNITS

- BXV BASALT
- BXMG GNEISS
- BXMS METASEDIMENTARY
- BXM METAMORPHIC

BXV + QCT / BXV — UNIT LISTED FIRST IS PREDOMINANT; UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

0 200 400
SCALE IN FEET
10 ft contour interval
50 ft Index contours
True North shown
23.5°East declination

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN
CADD	AM/EC/AF
DATE	12/21/06
CHECK	RGD
DATE	12/29/06
REV.	0
FILE No.	1 to 200 soil.dwg
PROJECT No.	063–5782

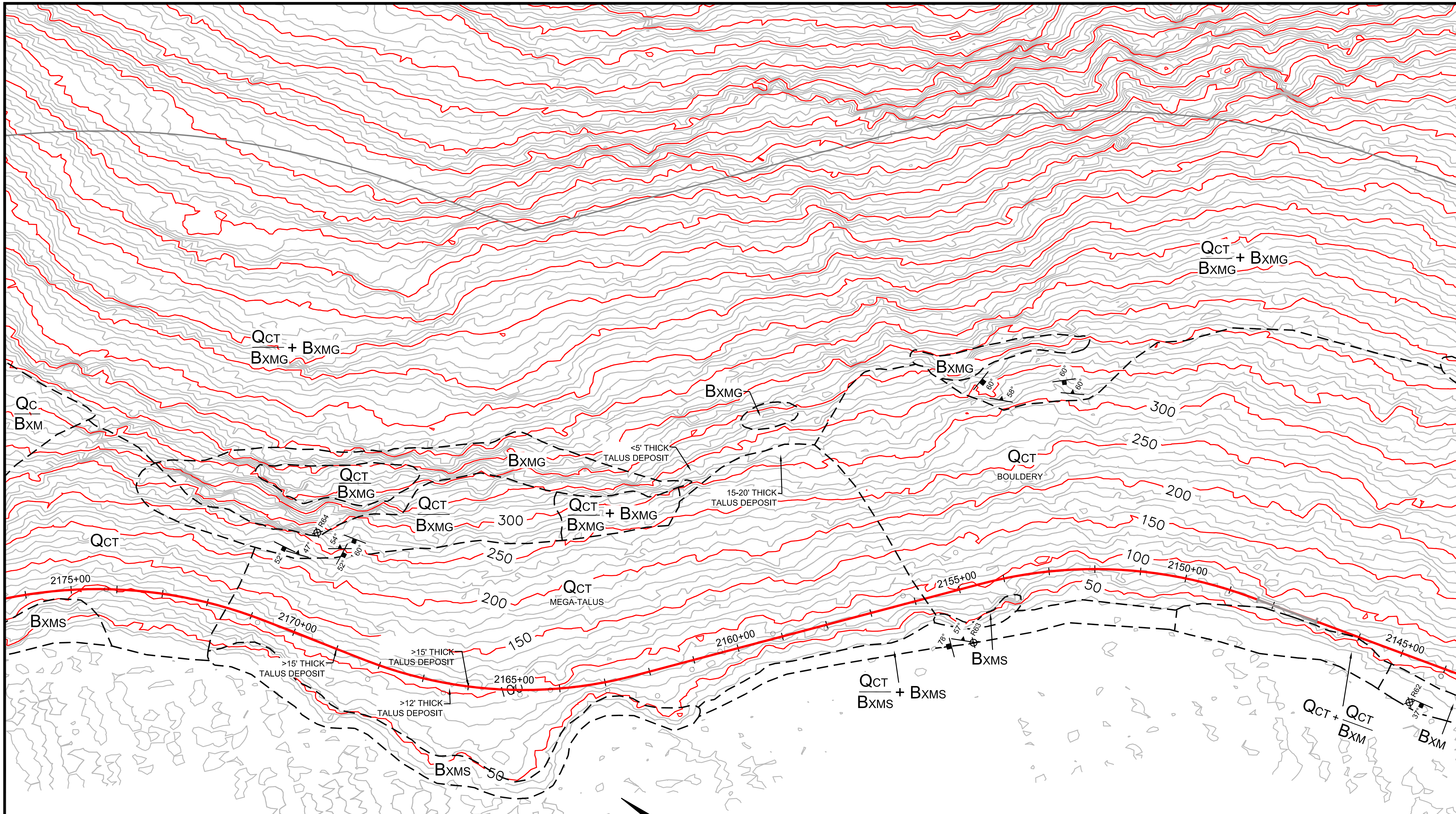
TITLE

PRELIMINARY SURFICIAL GEOLOGY MAP

IRP 2006 2115+00 - 2147+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 22



EXPLANATION:

- APPROXIMATE GEOLOGIC CONTACT
- UPSLOPE MAPPING BOUNDARY
- STRUCTURAL LINEAMENT
- MEGA-BOULDER(S) NOTED
- GEOPHYSICAL SURVEY LINE
- R1 STRUCTURAL MAPPING LOCATION
- 42° FOLIATION ORIENTATION AND DIP
- 42° JOINT ORIENTATION AND DIP
- 1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

- QB MODERN BEACH
- QEB ELEVATED BEACH
- QDF DEBRIS FLOW
- QC COLLUVIUM
- QCT TALUS
- QGO GLACIAL OUTWASH
- QAF ALLUVIAL FAN
- QLS LANDSLIDE
- QR RIVER DEPOSIT

BEDROCK UNITS

- BXV BASALT
- BXMG GNEISS
- BXMS METASEDIMENTARY
- BXM METAMORPHIC

BXV + QCT / BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

0 200 400

SCALE IN FEET

10 ft contour interval
50 ft Index contours

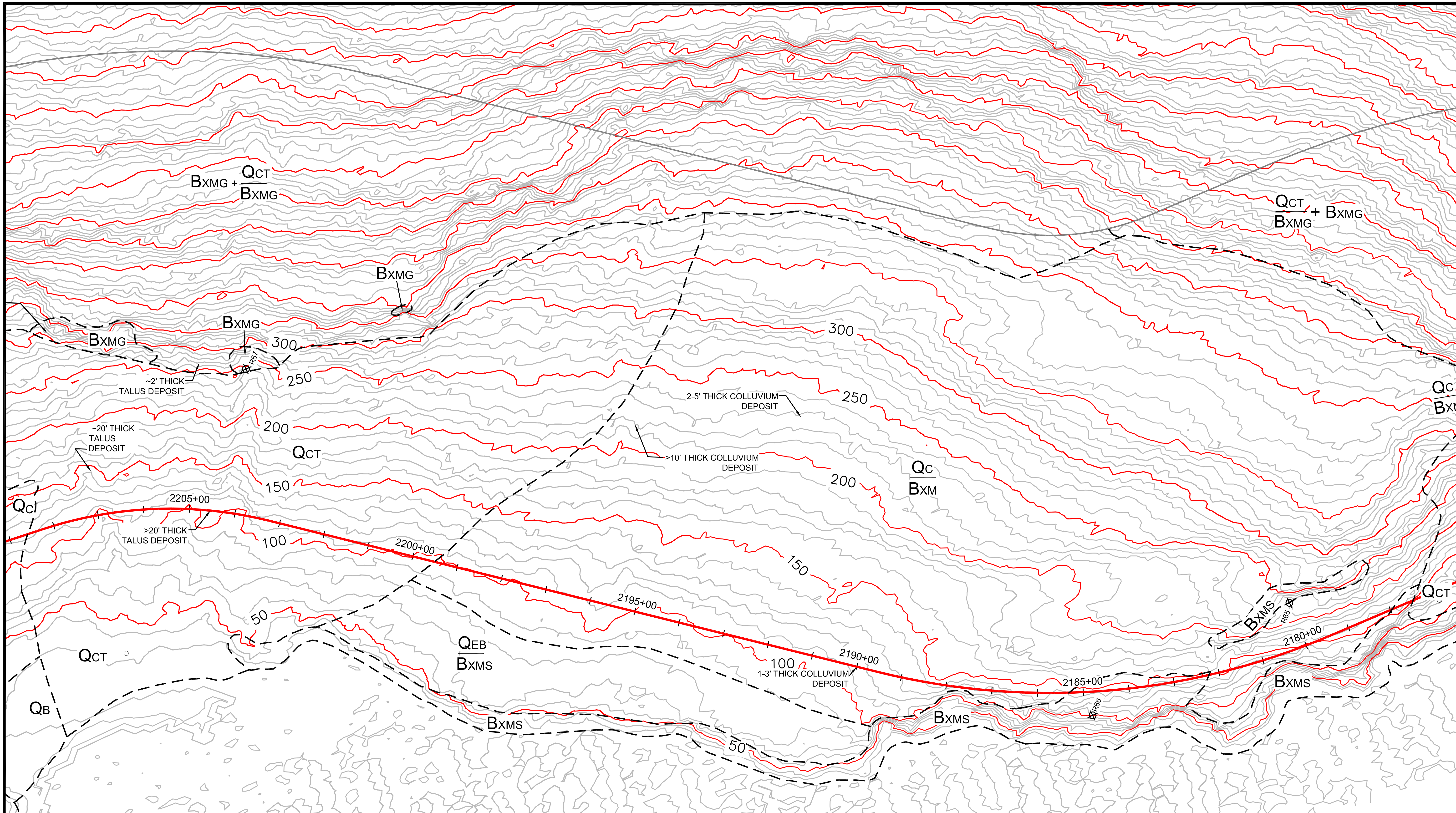
True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates, Anchorage, Alaska	SCALE AS SHOWN	TITLE	
	CADD AM/EC/AF		
	DATE 12/21/06		
	CHECK RGD		
FILE No. 1 to 200 soil.dwg	DATE 12/29/06		
PROJECT No. 063–5782	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 23

PRELIMINARY SURFICIAL GEOLOGY MAP

IRP 2006 2144+00 - 2176+00
LYNN CANAL, ALASKA



REFERENCE: Base map from LIDAR provided by ADOT&PF.

EXPLANATION:

- APPROXIMATE GEOLOGIC CONTACT
- UPSLOPE MAPPING BOUNDARY
- STRUCTURAL LINEAMENT
- MEGA-BOULDER(S) NOTED
- GEOPHYSICAL SURVEY LINE
- R1 STRUCTURAL MAPPING LOCATION
- 42° FOLIATION ORIENTATION AND DIP
- 42° JOINT ORIENTATION AND DIP
- 1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

QB	MODERN BEACH
QEB	ELEVATED BEACH
QDF	DEBRIS FLOW
QC	COLLUVIUM
QCT	TALUS
QGO	GLACIAL OUTWASH
QAF	ALLUVIAL FAN
QLS	LANDSLIDE
QR	RIVER DEPOSIT

BEDROCK UNITS

BXV	BASALT
BXMG	GNEISS
BXMS	METASEDIMENTARY
BXM	METAMORPHIC

BXV + QCT/BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

0 200 400

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN
CADD	AM/EC/AF
DATE	12/21/06
CHECK	RGD
DATE	12/29/06
REV.	0
FILE No.	1 to 200 soil.dwg
PROJECT No.	063-5782

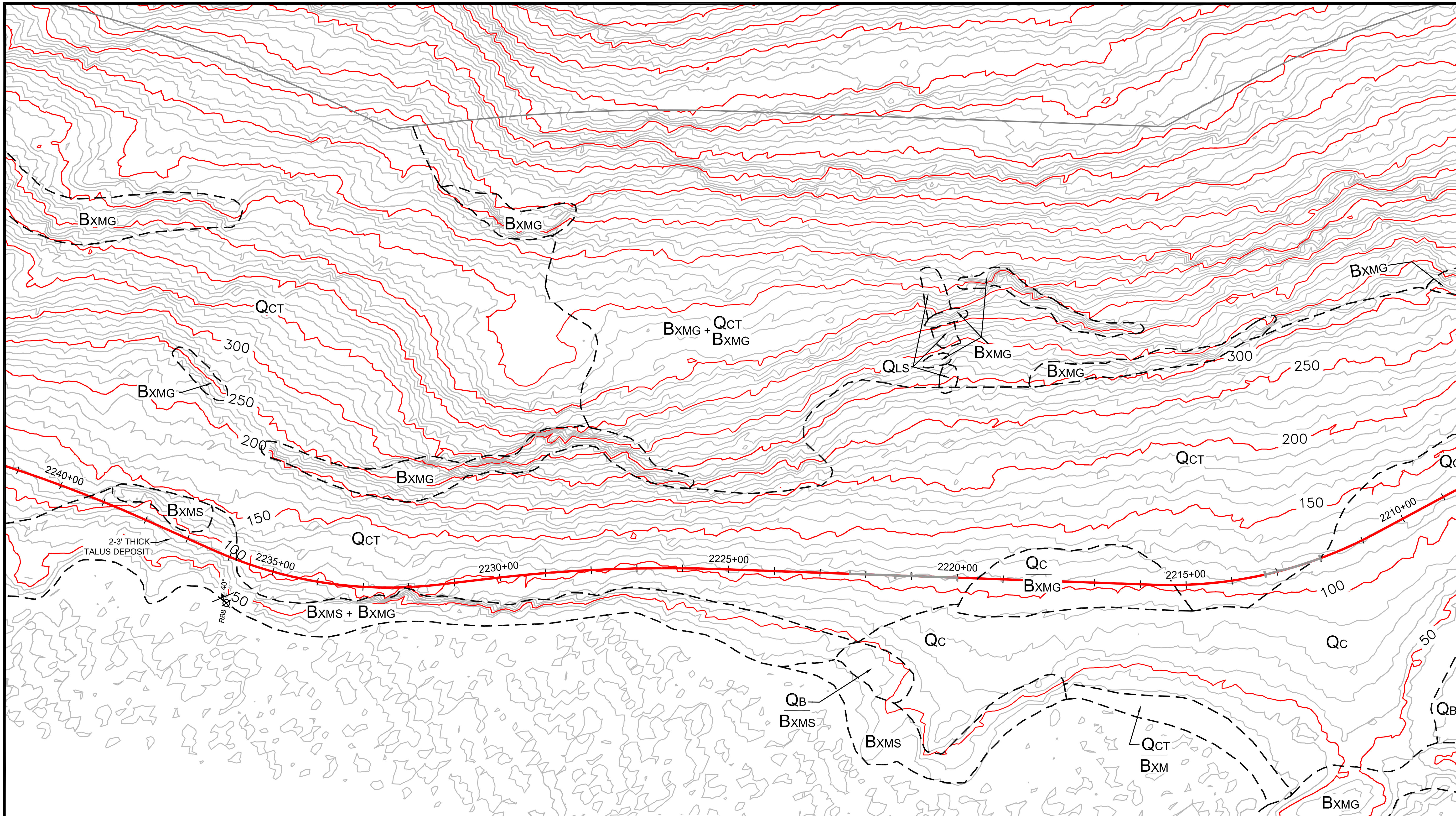
TITLE

PRELIMINARY SURFICIAL GEOLOGY MAP

IRP 2006 2176+00 - 2209+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 24



EXPLANATION:

— —	APPROXIMATE GEOLOGIC CONTACT
——	UPSLOPE MAPPING BOUNDARY
— —	STRUCTURAL LINEAMENT
○	MEGA-BOULDER(S) NOTED
——	GEOPHYSICAL SURVEY LINE
⊠R1	STRUCTURAL MAPPING LOCATION
42°	FOLIATION ORIENTATION AND DIP
42°	JOINT ORIENTATION AND DIP
1530+00	INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

QB	MODERN BEACH
QEB	ELEVATED BEACH
QDF	DEBRIS FLOW
QC	COLLUVIUM
QCT	TALUS
QGO	GLACIAL OUTWASH
QAF	ALLUVIAL FAN
QLS	LANDSLIDE
QR	RIVER DEPOSIT

BEDROCK UNITS

BXV	BASALT
BXMG	GNEISS
BXMS	METASEDIMENTARY
BXM	METAMORPHIC

BXV + QCT/BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

0 200 400

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

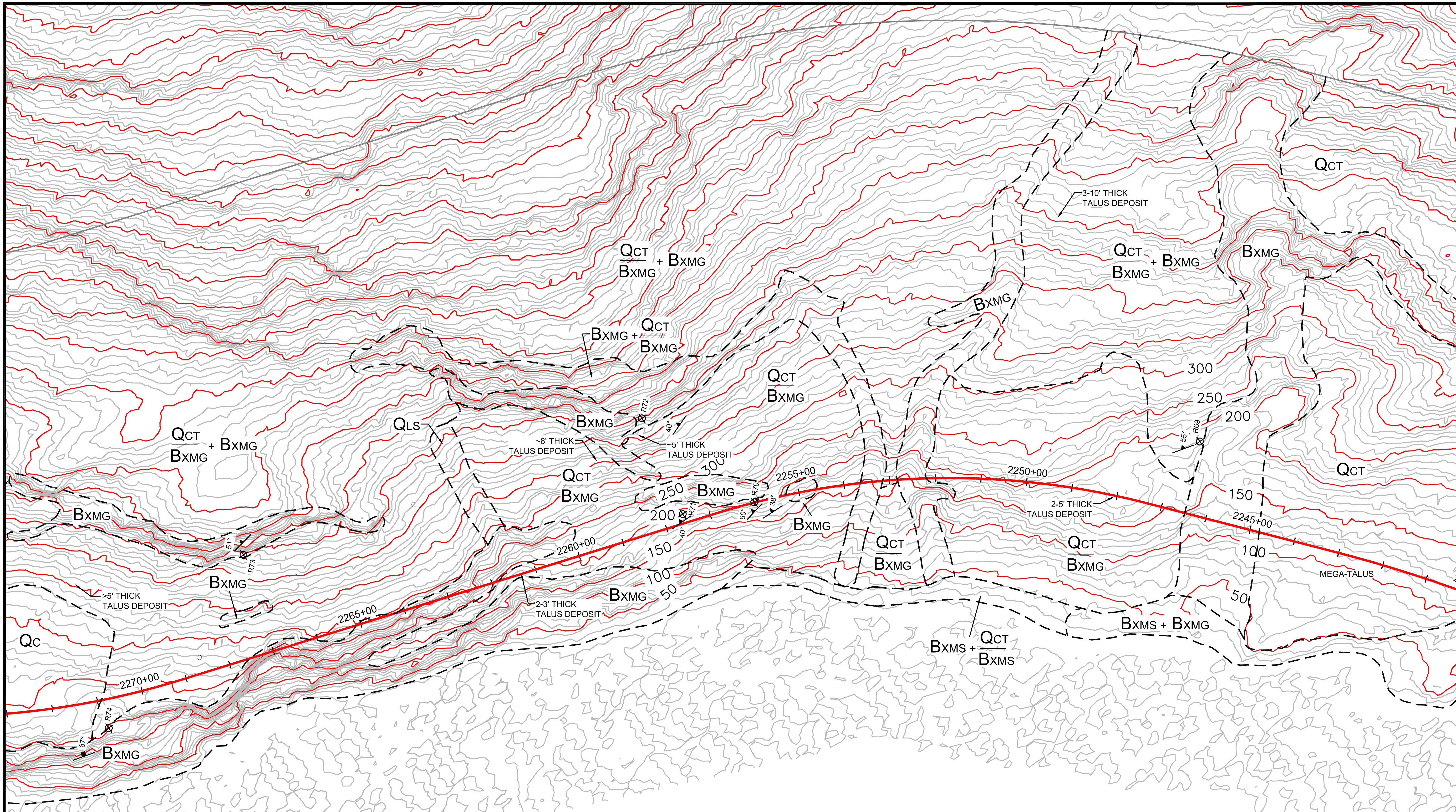
REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	**PRELIMINARY SURFICIAL GEOLOGY MAP** IRP 2006 2209+00 - 2241+00 LYNN CANAL, ALASKA
CADD	AM/EC/AF		
DATE	12/21/06		
CHECK	RGD		
FILE No.	1 to 200 soil.dwg	DATE	12/29/06
PROJECT No.	063–5782	REV.	0

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 25



EXPLANATION:

- APPROXIMATE GEOLOGIC CONTACT
- UPSLOPE MAPPING BOUNDARY
- STRUCTURAL LINEAMENT
- MEGA-BOULDER(S) NOTED
- GEOPHYSICAL SURVEY LINE
- R1 STRUCTURAL MAPPING LOCATION
- 42° FOLIATION ORIENTATION AND DIP
- 42° JOINT ORIENTATION AND DIP
- 1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

- QB MODERN BEACH
- QEB ELEVATED BEACH
- QDF DEBRIS FLOW
- QC COLLUVIUM
- QCT TALUS
- QGO GLACIAL OUTWASH
- QAF ALLUVIAL FAN
- QLS LANDSLIDE
- QR RIVER DEPOSIT

BEDROCK UNITS

- BXV BASALT
- BXMG GNEISS
- BXMS METASEDIMENTARY
- BXM METAMORPHIC

BXV + QCT / BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

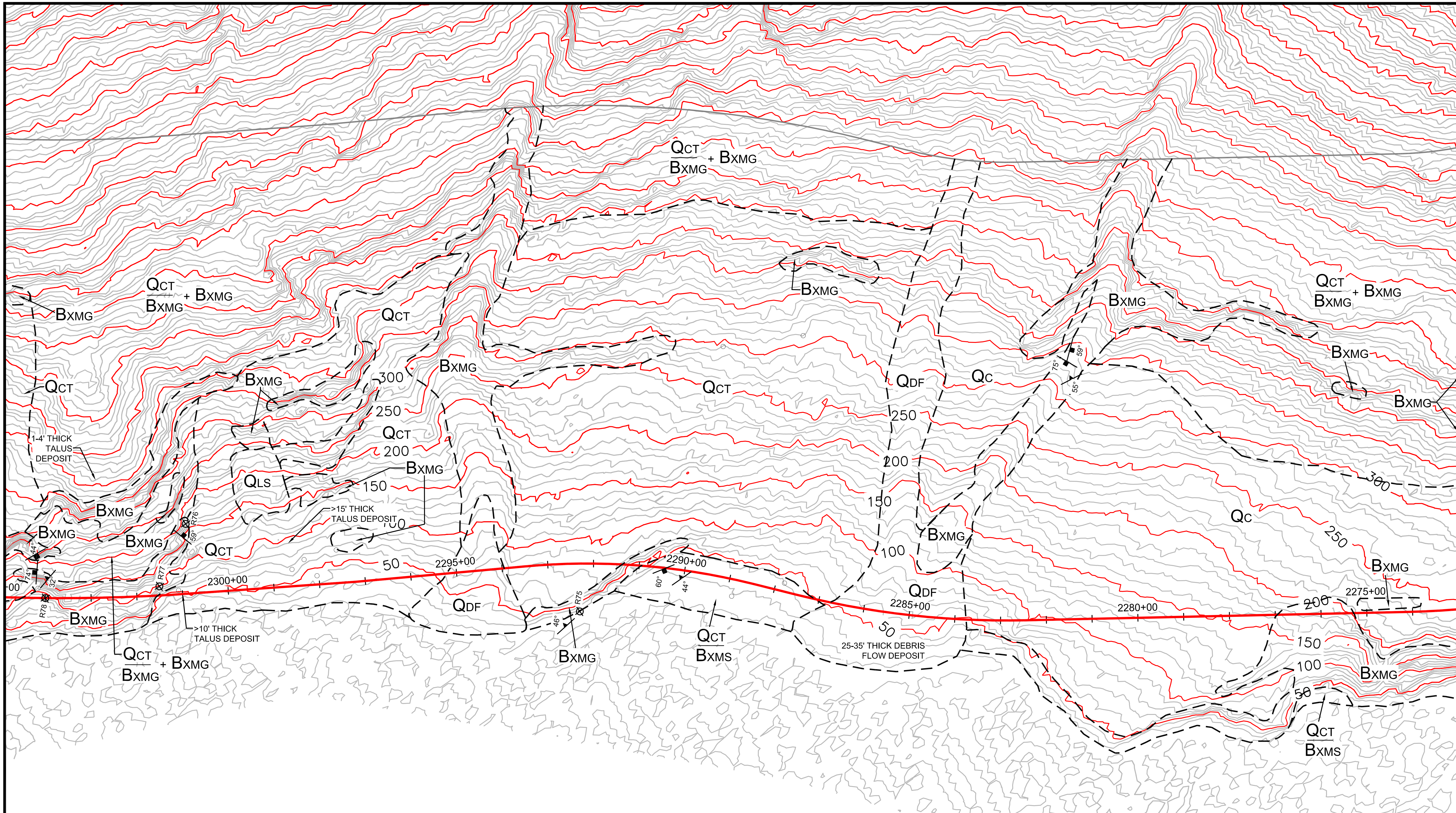
REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

FILE No. 1 to 200 soil.dwg	SCALE AS SHOWN	TITLE	
PROJECT No. 063–5782	CADD AM/EC/AF		
	DATE 12/21/06		
	CHECK RGD		
	DATE 12/29/06		
	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 26

PRELIMINARY SURFICIAL GEOLOGY MAP

IRP 2006 2241+00 - 2273+00
LYNN CANAL, ALASKA



EXPLANATION:

APPROXIMATE GEOLOGIC CONTACT	*UNCONSOLIDATED UNITS*	*BEDROCK UNITS*
UPSLOPE MAPPING BOUNDARY	QB MODERN BEACH	BXV BASALT
STRUCTURAL LINEAMENT	QEB ELEVATED BEACH	BXMG GNEISS
MEGA-BOULDER(S) NOTED	QDF DEBRIS FLOW	BXMS METASEDIMENTARY
GEOPHYSICAL SURVEY LINE	QC COLLUVIUM	BXM METAMORPHIC
R1 STRUCTURAL MAPPING LOCATION	QCT TALUS	
42° FOLIATION ORIENTATION AND DIP	QGO GLACIAL OUTWASH	
42° JOINT ORIENTATION AND DIP	QAF ALLUVIAL FAN	
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT	QLS LANDSLIDE	
	QR RIVER DEPOSIT	

BXV + QCT / BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

SCALE IN FEET

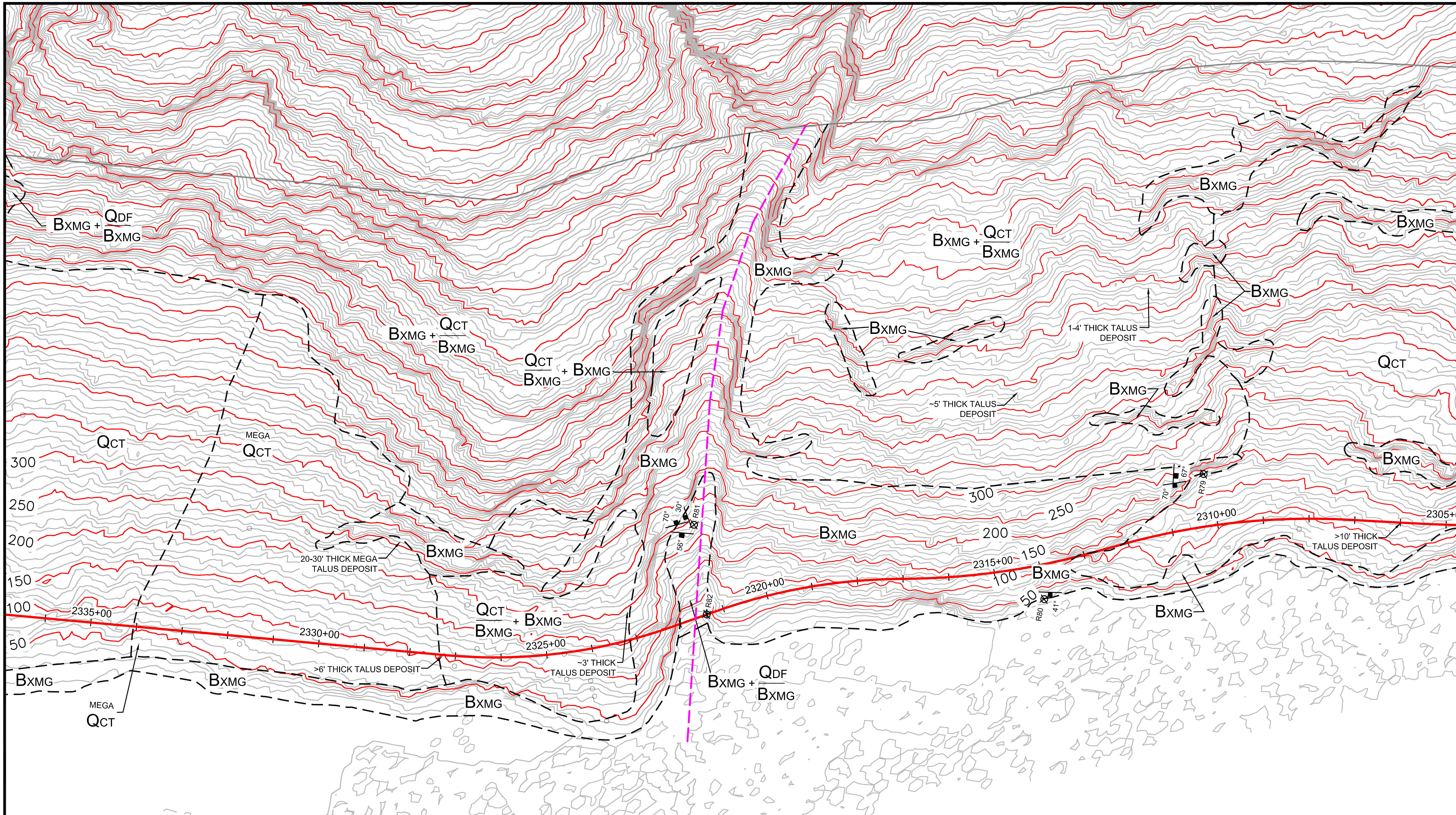
10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	**PRELIMINARY SURFICIAL GEOLOGY MAP**
CADD	AM/EC/AF		IRP 2006 2273+00 - 2304+00
DATE	12/21/06		LYNN CANAL, ALASKA
CHECK	RGD		
FILE No. 1 to 200 soil.dwg	DATE 12/29/06		
PROJECT No. 063-5782	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 27



REFERENCE: Base map from LIDAR provided by ADOT&PF.

EXPLANATION:

— — APPROXIMATE GEOLOGIC CONTACT
UPSLOPE MAPPING BOUNDARY
STRUCTURAL LINEAMENT
MEGA-BOULDER(S) NOTED
GEOPHYSICAL SURVEY LINE
R1 STRUCTURAL MAPPING LOCATION
42° FOLIATION ORIENTATION AND DIP
42° JOINT ORIENTATION AND DIP
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

QB MODERN BEACH
QEB ELEVATED BEACH
QDF DEBRIS FLOW
QC COLLUVIUM
QCT TALUS
QGO GLACIAL OUTWASH
QAF ALLUVIAL FAN
QLS LANDSLIDE
QR RIVER DEPOSIT

BEDROCK UNITS

BXV BASALT
BXMG GNEISS
BXMS METASEDIMENTARY
BXM METAMORPHIC

BXV + QCT / BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

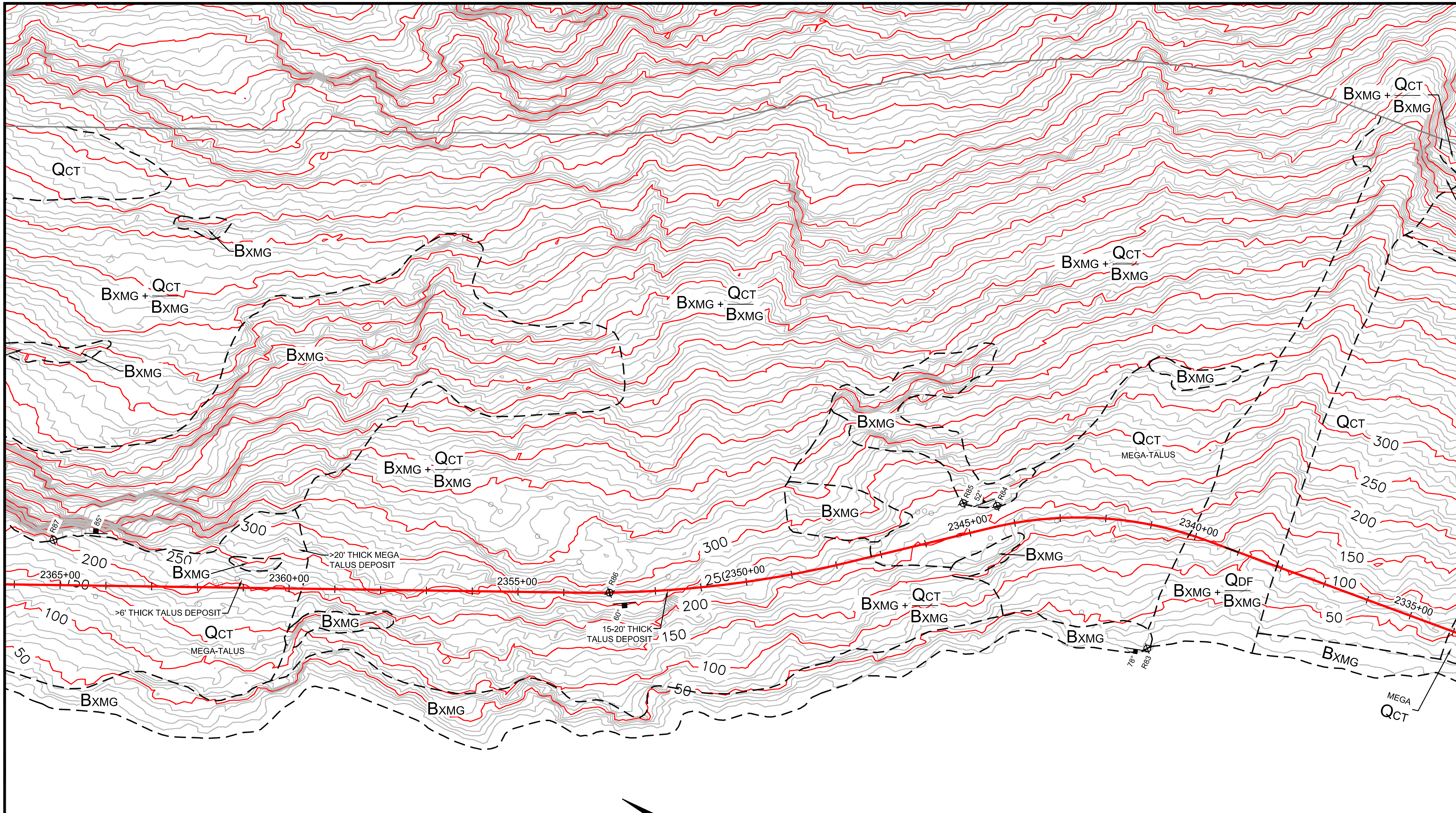
SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	PRELIMINARY SURFICIAL GEOLOGY MAP IRP 2006 2305+00 - 2336+00 LYNN CANAL, ALASKA
CADD	AM/EC/AF		
DATE	12/21/06		
CHECK	RGD		
FILE No. 1 to 200 soil.dwg	DATE 12/29/06		
PROJECT No. 063-5782	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 28



EXPLANATION:

APPROXIMATE GEOLOGIC CONTACT	*UNCONSOLIDATED UNITS*	*BEDROCK UNITS*
UPSLOPE MAPPING BOUNDARY	QB MODERN BEACH	BXV BASALT
STRUCTURAL LINEAMENT	QEB ELEVATED BEACH	BXMG GNEISS
MEGA-BOULDER(S) NOTED	QDF DEBRIS FLOW	BXMS METASEDIMENTARY
GEOPHYSICAL SURVEY LINE	QC COLLUVIUM	BXM METAMORPHIC
R1 STRUCTURAL MAPPING LOCATION	QCT TALUS	
42° FOLIATION ORIENTATION AND DIP	QGO GLACIAL OUTWASH	BXV + QCT / BXV — UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT
42° JOINT ORIENTATION AND DIP	QAF ALLUVIAL FAN	
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT	QLS LANDSLIDE	UNIT LISTED FIRST IS PREDOMINANT
	QR RIVER DEPOSIT	

0 200 400

SCALE IN FEET

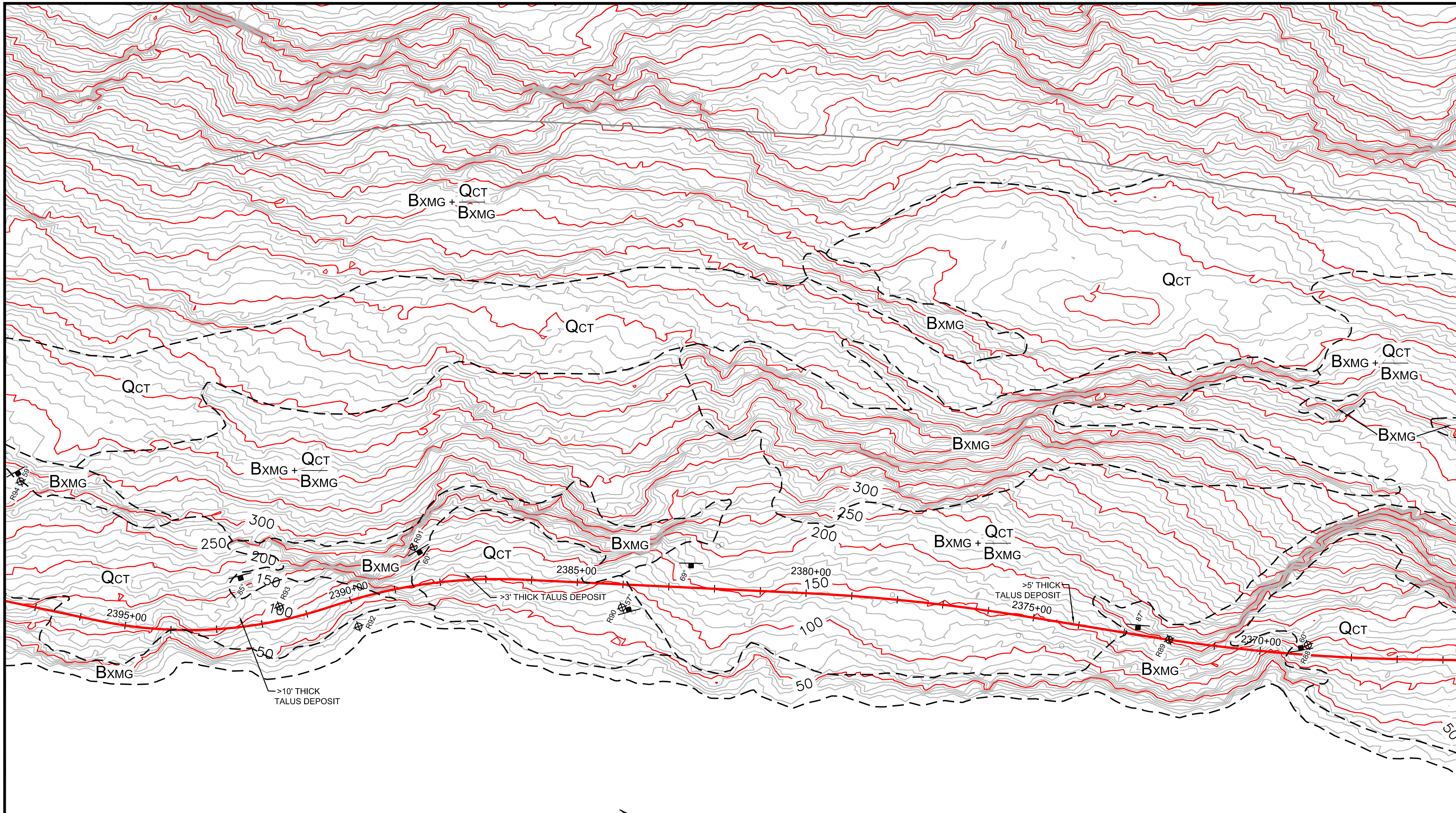
10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	**PRELIMINARY SURFICIAL GEOLOGY MAP**
CADD	AM/EC/AF		IRP 2006 2334+00 - 2366+00
DATE	12/21/06		LYNN CANAL, ALASKA
CHECK	RGD		
FILE No. 1 to 200 soil.dwg	DATE 12/29/06		
PROJECT No. 063-5782	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 29



EXPLANATION:

APPROXIMATE GEOLOGIC CONTACT
UPSLOPE MAPPING BOUNDARY
STRUCTURAL LINEAMENT
MEGA-BOULDER(S) NOTED
GEOPHYSICAL SURVEY LINE
R1 STRUCTURAL MAPPING LOCATION
42° FOLIATION ORIENTATION AND DIP
42° JOINT ORIENTATION AND DIP
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

QB	MODERN BEACH
QEB	ELEVATED BEACH
QDF	DEBRIS FLOW
QC	COLLUVIUM
QCT	TALUS
QGO	GLACIAL OUTWASH
QAF	ALLUVIAL FAN
QLS	LANDSLIDE
QR	RIVER DEPOSIT

BEDROCK UNITS

BXV	BASALT
BXMG	GNEISS
BXMS	METASEDIMENTARY
BXM	METAMORPHIC

BXV + QCT/BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN
CADD	AM/EC/AF
DATE	12/21/06
CHECK	RGD
DATE	12/29/06
REV.	0

FILE No. 1 to 200 soil.dwg

PROJECT No. 063–5782

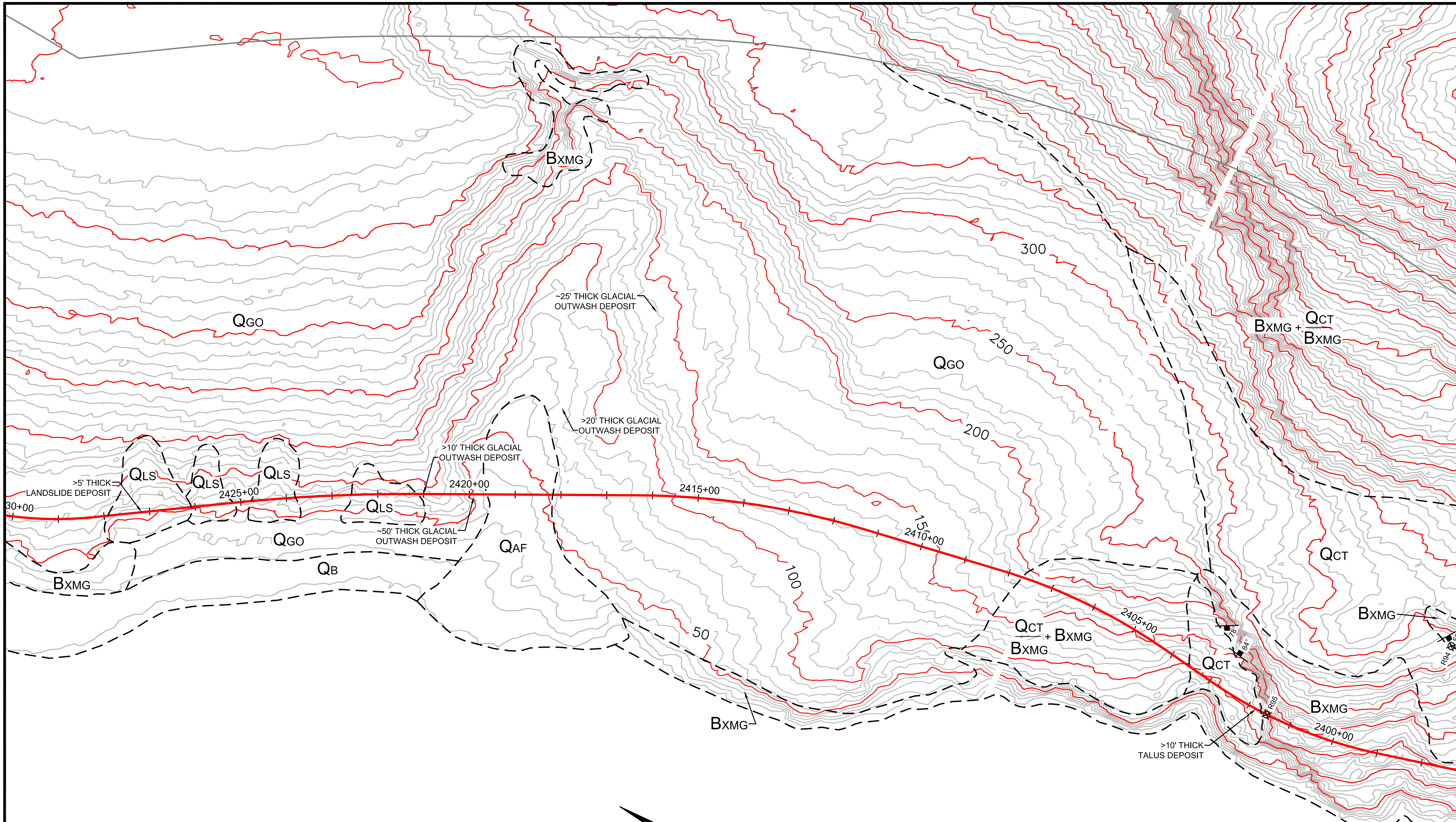
TITLE

PRELIMINARY SURFICIAL GEOLOGY MAP

IRP 2006 2366+00 - 2397+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 30



REFERENCE: Base map from LIDAR provided by ADOT&PF.

N

0 200 400

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

EXPLANATION:

- APPROXIMATE GEOLOGIC CONTACT
- UPSLOPE MAPPING BOUNDARY
- STRUCTURAL LINEAMENT
- MEGA-BOULDER(S) NOTED
- GEOPHYSICAL SURVEY LINE
- R1 STRUCTURAL MAPPING LOCATION
- 42° FOLIATION ORIENTATION AND DIP
- 42° JOINT ORIENTATION AND DIP
- 1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

- QB MODERN BEACH
- QEB ELEVATED BEACH
- QDF DEBRIS FLOW
- QC COLLUVIUM
- QCT TALUS
- QGO GLACIAL OUTWASH
- QAF ALLUVIAL FAN
- QLS LANDSLIDE
- QR RIVER DEPOSIT

BEDROCK UNITS

- BXV BASALT
- BXMG GNEISS
- BXMS METASEDIMENTARY
- BXM METAMORPHIC

BXV + QCT / BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

Golder Associates
Anchorage, Alaska

FILE No.	1 to 200 soil.dwg	SCALE	AS SHOWN
PROJECT No.	063-5782	CADD	AM/EC/AF
		DATE	12/21/06
		CHECK	RGD
		DATE	12/29/06
		REV.	0

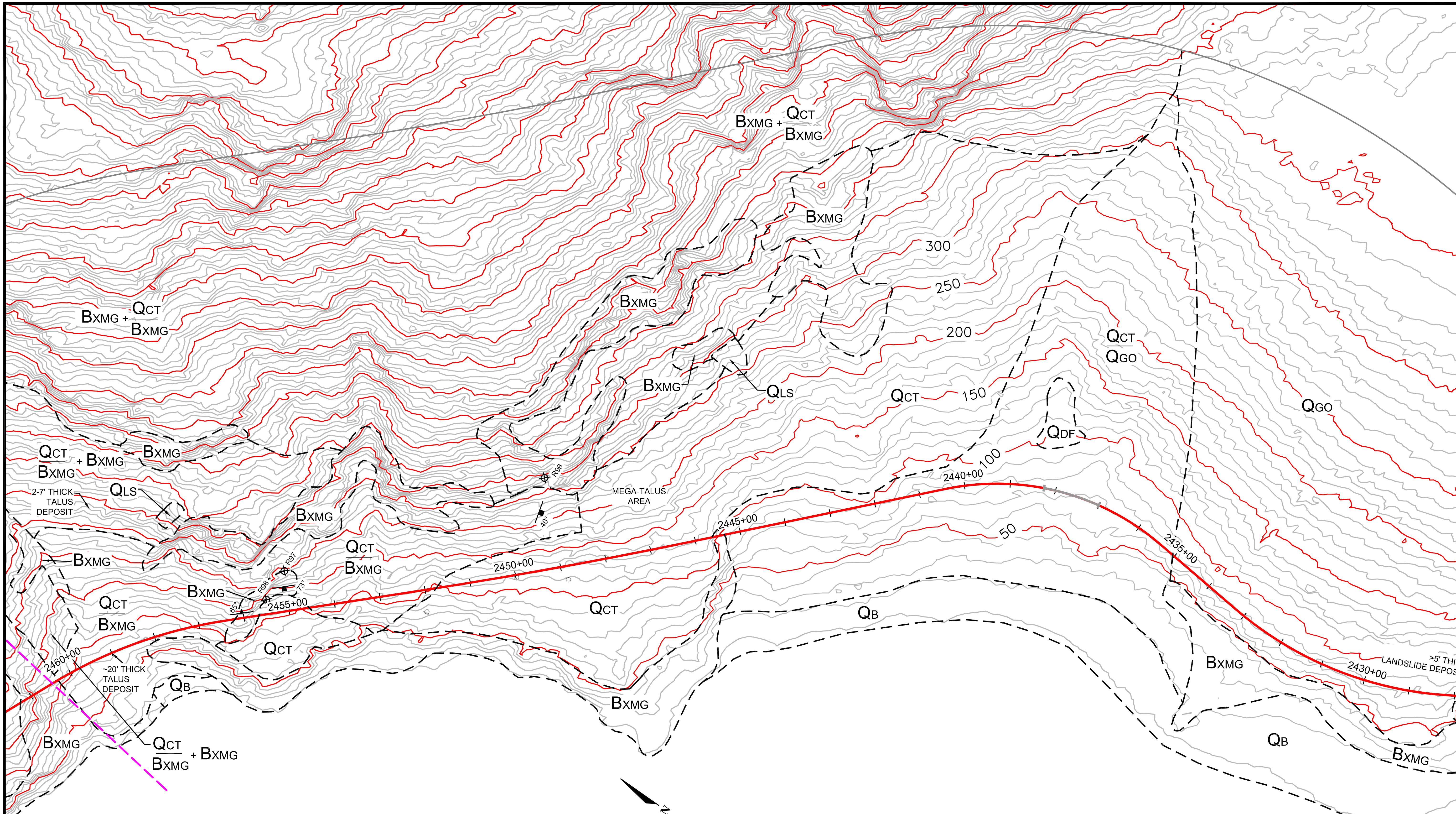
TITLE

PRELIMINARY SURFICIAL GEOLOGY MAP

IRP 2006 2397+00 - 2430+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 31



EXPLANATION:

APPROXIMATE GEOLOGIC CONTACT
UPSLOPE MAPPING BOUNDARY
STRUCTURAL LINEAMENT
MEGA-BOULDER(S) NOTED
GEOPHYSICAL SURVEY LINE
R1 STRUCTURAL MAPPING LOCATION
42° FOLIATION ORIENTATION AND DIP
42° JOINT ORIENTATION AND DIP
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

QB	MODERN BEACH
QEB	ELEVATED BEACH
QDF	DEBRIS FLOW
QC	COLLUVIUM
QCT	TALUS
QGO	GLACIAL OUTWASH
QAF	ALLUVIAL FAN
QLS	LANDSLIDE
QR	RIVER DEPOSIT

BEDROCK UNITS

BXV	BASALT
BXMG	GNEISS
BXMS	METASEDIMENTARY
BXM	METAMORPHIC

BXV + QCT / BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

0 200 400

SCALE IN FEET

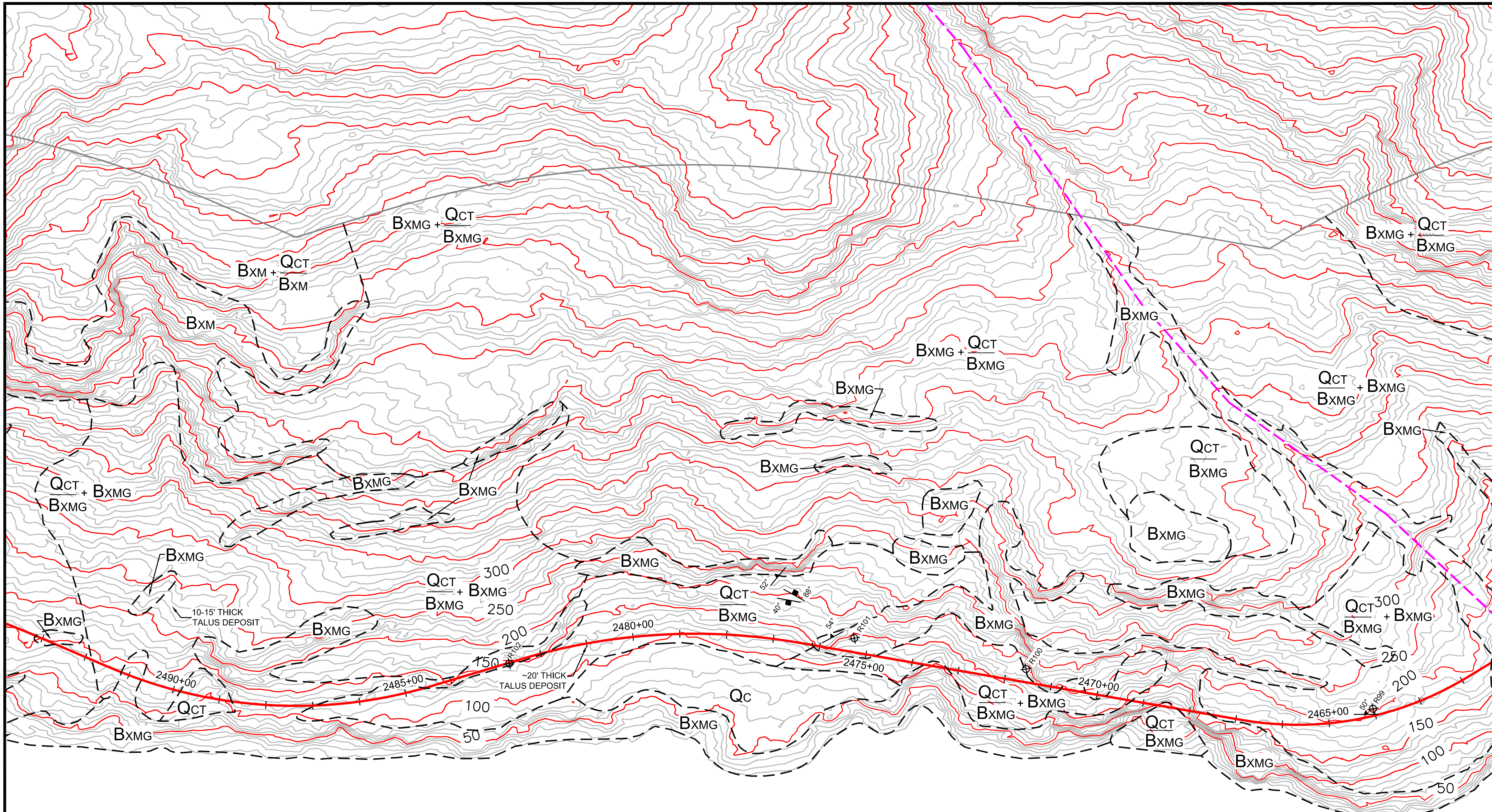
10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	**PRELIMINARY SURFICIAL GEOLOGY MAP**
CADD	AM/EC/AF		IRP 2006 2428+00 - 2461+00
DATE	12/21/06		LYNN CANAL, ALASKA
CHECK	RGD		
DATE	12/29/06		
FILE No.	1 to 200 soil.dwg		
PROJECT No.	063–5782		
REV.	0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 32



EXPLANATION:

APPROXIMATE GEOLOGIC CONTACT	*UNCONSOLIDATED UNITS*	*BEDROCK UNITS*
UPSLOPE MAPPING BOUNDARY	QB MODERN BEACH	BXV BASALT
STRUCTURAL LINEAMENT	QEB ELEVATED BEACH	BXMG GNEISS
MEGA-BOULDER(S) NOTED	QDF DEBRIS FLOW	BXMS METASEDIMENTARY
GEOPHYSICAL SURVEY LINE	QC COLLUVIUM	BXM METAMORPHIC
R1 STRUCTURAL MAPPING LOCATION	QCT TALUS	
42° FOLIATION ORIENTATION AND DIP	QGO GLACIAL OUTWASH	
42° JOINT ORIENTATION AND DIP	QAF ALLUVIAL FAN	
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT	QLS LANDSLIDE	
	QR RIVER DEPOSIT	

BXV + QCT/BXV — UNIT LISTED FIRST IS PREDOMINANT; UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

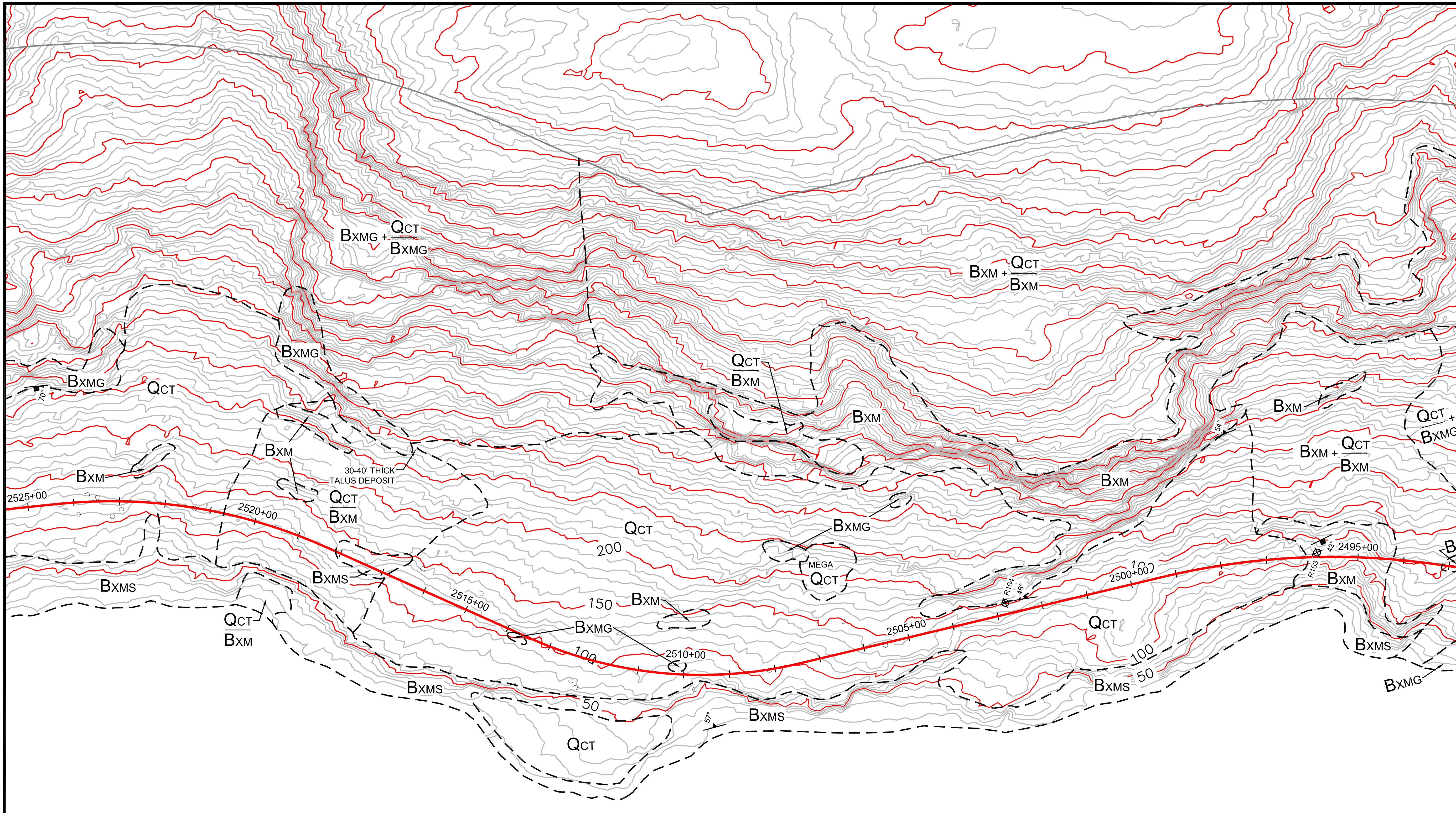
N

0 200 400
SCALE IN FEET
10 ft contour interval
50 ft Index contours
True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	**PRELIMINARY SURFICIAL GEOLOGY MAP** IRP 2006 2461+00 - 2493+00 LYNN CANAL, ALASKA
CADD	AM/EC/AF		
DATE	12/21/06		
CHECK	RGD		
FILE No. 1 to 200 soil.dwg	DATE 12/29/06		
PROJECT No. 063-5782	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 33



EXPLANATION:

APPROXIMATE GEOLOGIC CONTACT	*UNCONSOLIDATED UNITS*	*BEDROCK UNITS*
UPSLOPE MAPPING BOUNDARY	QB MODERN BEACH	BXV BASALT
STRUCTURAL LINEAMENT	QEB ELEVATED BEACH	BXMG GNEISS
MEGA-BOULDER(S) NOTED	QDF DEBRIS FLOW	BXMS METASEDIMENTARY
GEOPHYSICAL SURVEY LINE	QC COLLUVIUM	BXM METAMORPHIC
R1 STRUCTURAL MAPPING LOCATION	QCT TALUS	BXV + QCT/BXV
42° FOLIATION ORIENTATION AND DIP	QGO GLACIAL OUTWASH	UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT
42° JOINT ORIENTATION AND DIP	QAF ALLUVIAL FAN	UNIT LISTED FIRST IS PREDOMINANT
1530+00 INERTIAL REFERENCE POINT 2006	QLS LANDSLIDE	
(IRP 2006) ALIGNMENT	QR RIVER DEPOSIT	

N

0 200 400
SCALE IN FEET

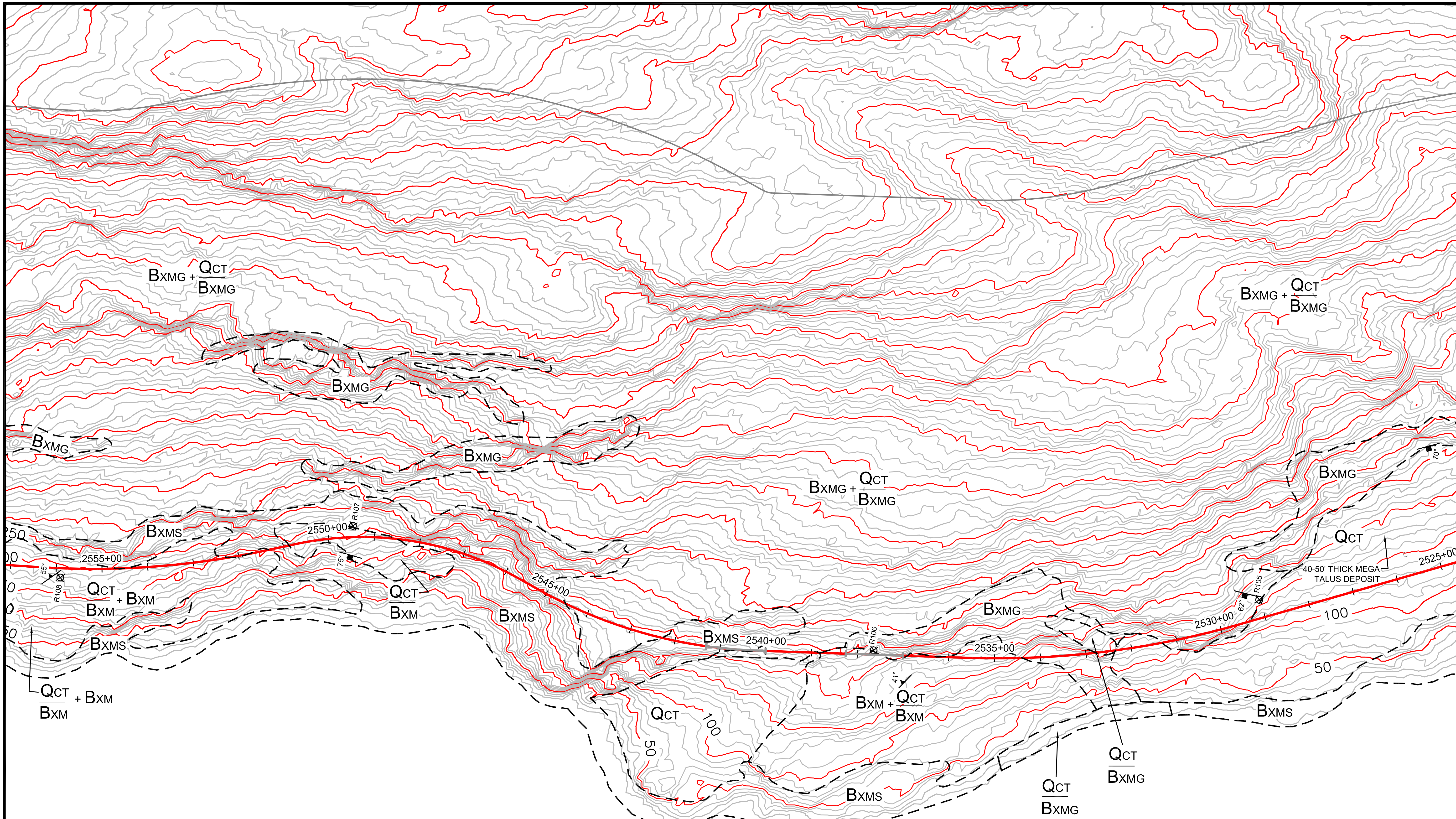
10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	**PRELIMINARY SURFICIAL GEOLOGY MAP** IRP 2006 2493+00 - 2525+00 LYNN CANAL, ALASKA
CADD	AM/EC/AF		
DATE	12/21/06		
CHECK	RGD		
FILE No. 1 to 200 soil.dwg	DATE 12/29/06		
PROJECT No. 063-5782	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 34



REFERENCE: Base map from LIDAR provided by ADOT&PF.

EXPLANATION:

- APPROXIMATE GEOLOGIC CONTACT
- UPSLOPE MAPPING BOUNDARY
- STRUCTURAL LINEAMENT
- MEGA-BOULDER(S) NOTED
- GEOPHYSICAL SURVEY LINE
- R1 STRUCTURAL MAPPING LOCATION
- 42° FOLIATION ORIENTATION AND DIP
- 42° JOINT ORIENTATION AND DIP
- 1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

- QB MODERN BEACH
- QEB ELEVATED BEACH
- QDF DEBRIS FLOW
- QC COLLUVIUM
- QCT TALUS
- QGO GLACIAL OUTWASH
- QAF ALLUVIAL FAN
- QLS LANDSLIDE
- QR RIVER DEPOSIT

BEDROCK UNITS

- BXV BASALT
- BXMG GNEISS
- BXMS METASEDIMENTARY
- BXM METAMORPHIC

BXV + QCT / BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

0 200 400

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

N

Golder Associates
Anchorage, Alaska

FILE No.	1 to 200 soil.dwg
PROJECT No.	063-5782
SCALE	AS SHOWN
CADD	AM/EC/AF
DATE	12/21/06
CHECK	RGD
DATE	12/29/06
REV.	0

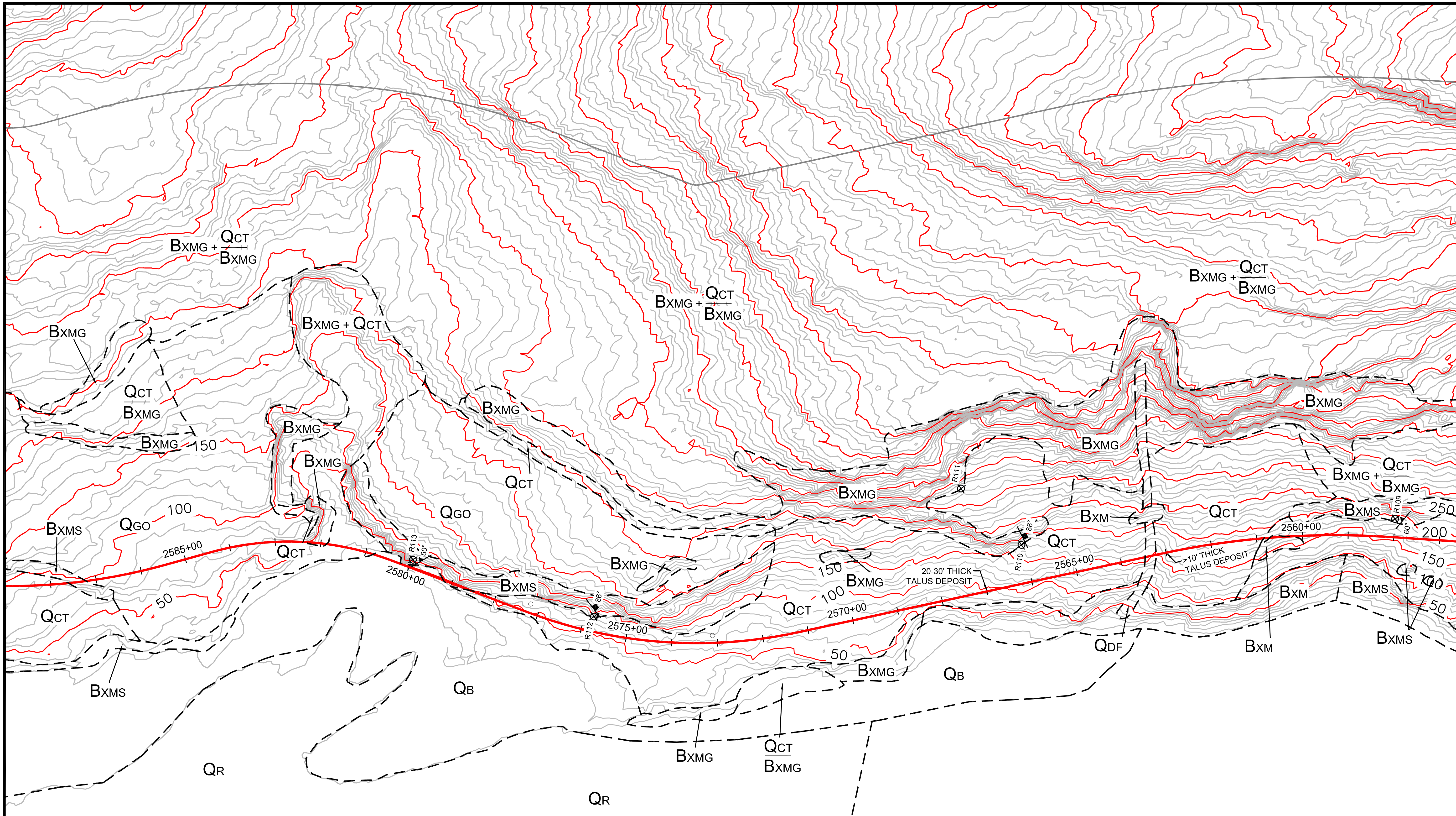
TITLE

PRELIMINARY SURFICIAL GEOLOGY MAP

IRP 2006 2525+00 - 2557+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 35



REFERENCE: Base map from LIDAR provided by ADOT&PF.

EXPLANATION:

- APPROXIMATE GEOLOGIC CONTACT
- UPSLOPE MAPPING BOUNDARY
- STRUCTURAL LINEAMENT
- MEGA-BOULDER(S) NOTED
- GEOPHYSICAL SURVEY LINE
- R1 STRUCTURAL MAPPING LOCATION
- 42° FOLIATION ORIENTATION AND DIP
- 42° JOINT ORIENTATION AND DIP
- 1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

- QB MODERN BEACH
- QEB ELEVATED BEACH
- QDF DEBRIS FLOW
- QC COLLUVIUM
- QCT TALUS
- QGO GLACIAL OUTWASH
- QAF ALLUVIAL FAN
- QLS LANDSLIDE
- QR RIVER DEPOSIT

BEDROCK UNITS

- BXV BASALT
- BXMG GNEISS
- BXMS METASEDIMENTARY
- BXM METAMORPHIC

BXV + QCT/BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN
CADD	AM/EC/AF
DATE	12/21/06
CHECK	RGD
DATE	12/29/06
REV.	0
FILE No.	1 to 200 soil.dwg
PROJECT No.	063–5782

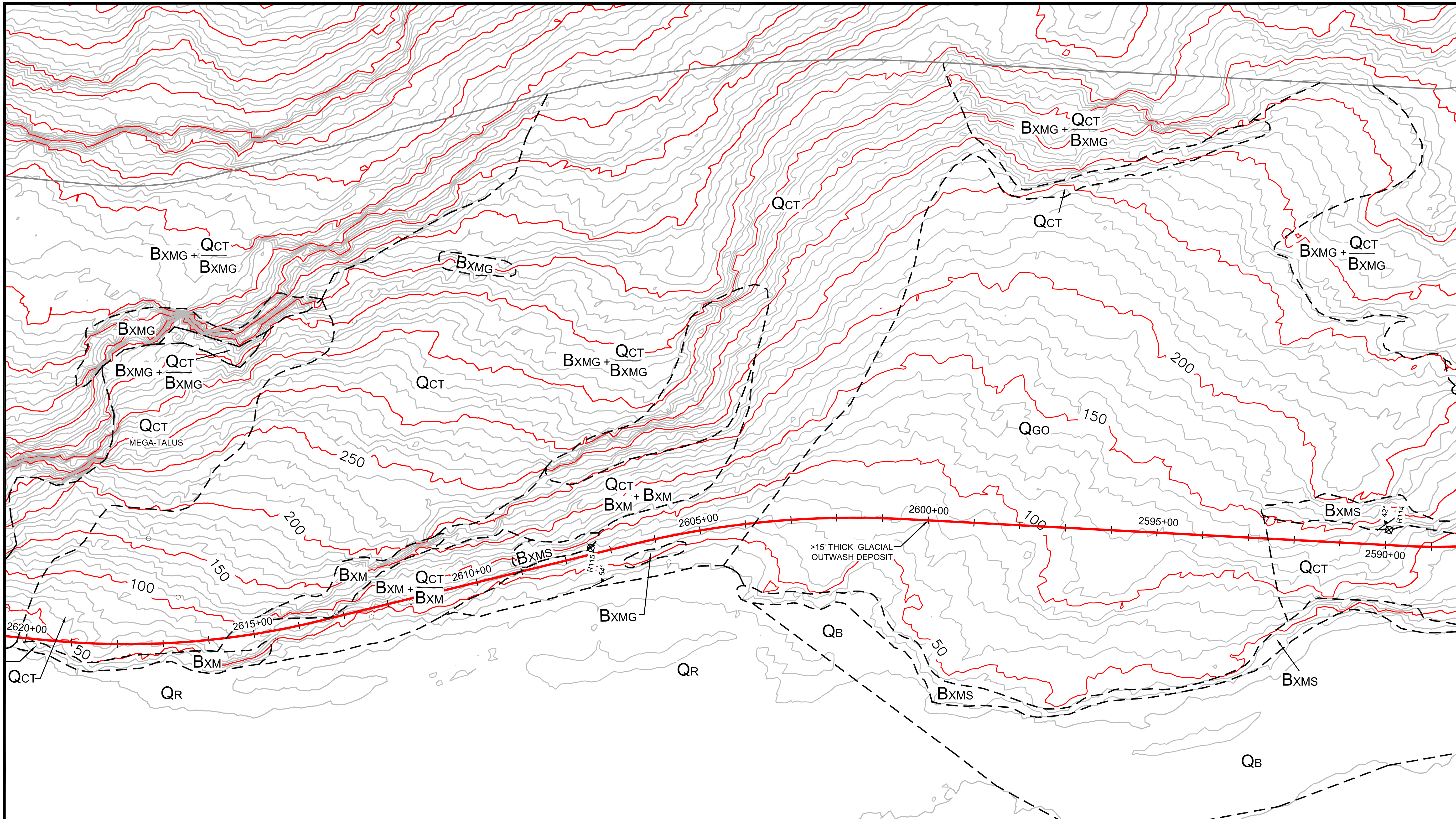
TITLE

PRELIMINARY SURFICIAL GEOLOGY MAP

IRP 2006 2557+00 - 2588+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 36



EXPLANATION:

APPROXIMATE GEOLOGIC CONTACT	*UNCONSOLIDATED UNITS*	*BEDROCK UNITS*
UPSLOPE MAPPING BOUNDARY	QB MODERN BEACH	BXV BASALT
STRUCTURAL LINEAMENT	QEB ELEVATED BEACH	BXMG GNEISS
MEGA-BOULDER(S) NOTED	QDF DEBRIS FLOW	BXMS METASEDIMENTARY
GEOPHYSICAL SURVEY LINE	QC COLLUVIUM	BXM METAMORPHIC
R1 STRUCTURAL MAPPING LOCATION	QCT TALUS	
42° FOLIATION ORIENTATION AND DIP	QGO GLACIAL OUTWASH	
42° JOINT ORIENTATION AND DIP	QAF ALLUVIAL FAN	
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT	QLS LANDSLIDE	
	QR RIVER DEPOSIT	

BXV + QCT / BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	
CADD	AM/EC/AF	
DATE	12/21/06	
CHECK	RGD	
FILE No.	1 to 200 soil.dwg	DATE 12/29/06
PROJECT No.	063-5782	REV. 0

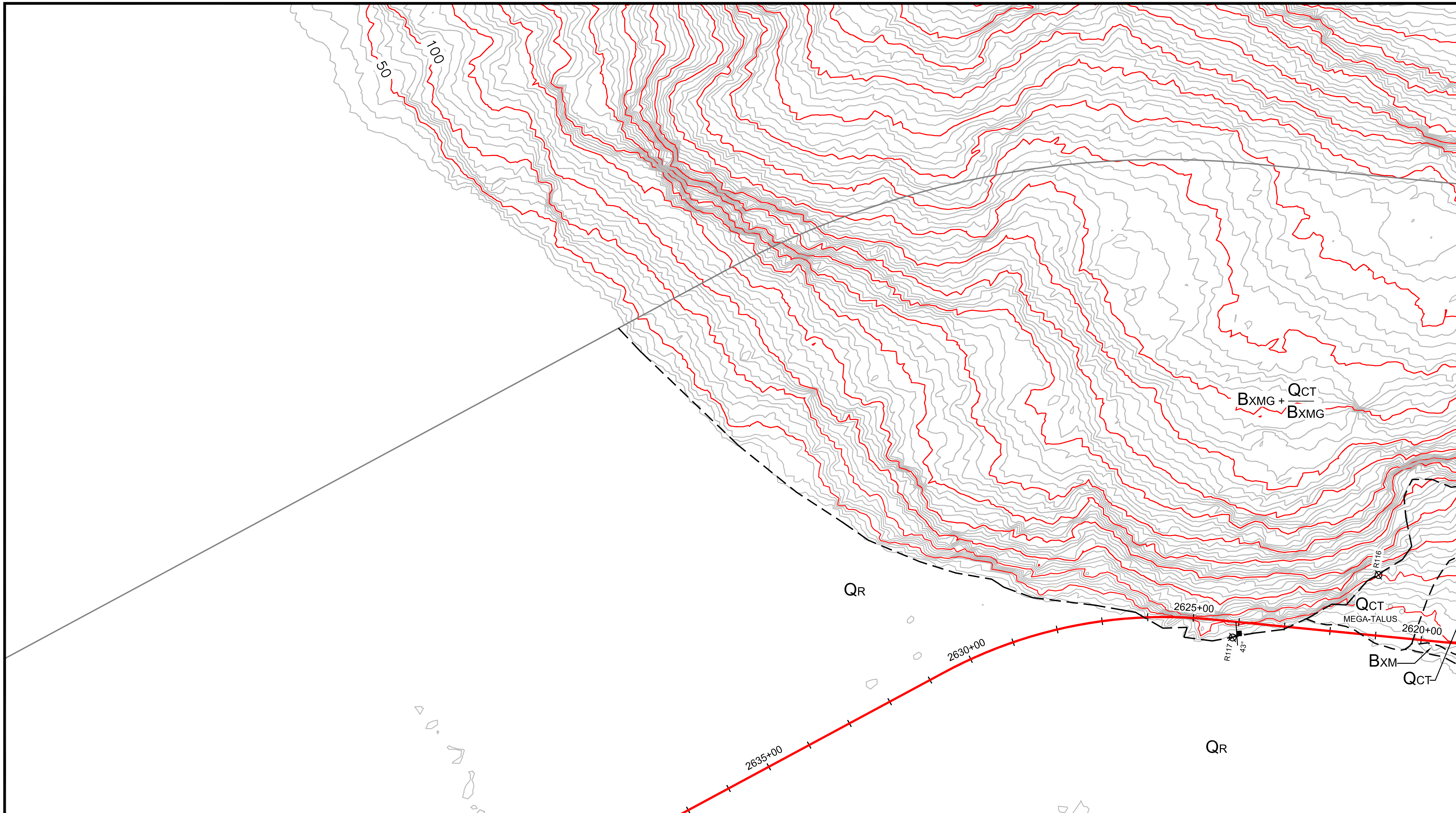
TITLE

PRELIMINARY SURFICIAL GEOLOGY MAP

IRP 2006 2588+00 - 2620+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 37



EXPLANATION:

APPROXIMATE GEOLOGIC CONTACT
UPSLOPE MAPPING BOUNDARY
STRUCTURAL LINEAMENT
MEGA-BOULDER(S) NOTED
GEOPHYSICAL SURVEY LINE
R1 STRUCTURAL MAPPING LOCATION
42° FOLIATION ORIENTATION AND DIP
42° JOINT ORIENTATION AND DIP
1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

UNCONSOLIDATED UNITS

- QB MODERN BEACH
- QEB ELEVATED BEACH
- QDF DEBRIS FLOW
- QC COLLUVIUM
- QCT TALUS
- QGO GLACIAL OUTWASH
- QAF ALLUVIAL FAN
- QLS LANDSLIDE
- QR RIVER DEPOSIT

BEDROCK UNITS

- BXV BASALT
- BXMG GNEISS
- BXMS METASEDIMENTARY
- BXM METAMORPHIC

BXV + QCT / BXV

UNIT LISTED FIRST IS PREDOMINANT

UPPER UNIT APPROX. 3-10' DEEP, OVERLYING BOTTOM UNIT

N

0 200 400

SCALE IN FEET

10 ft contour interval
50 ft Index contours

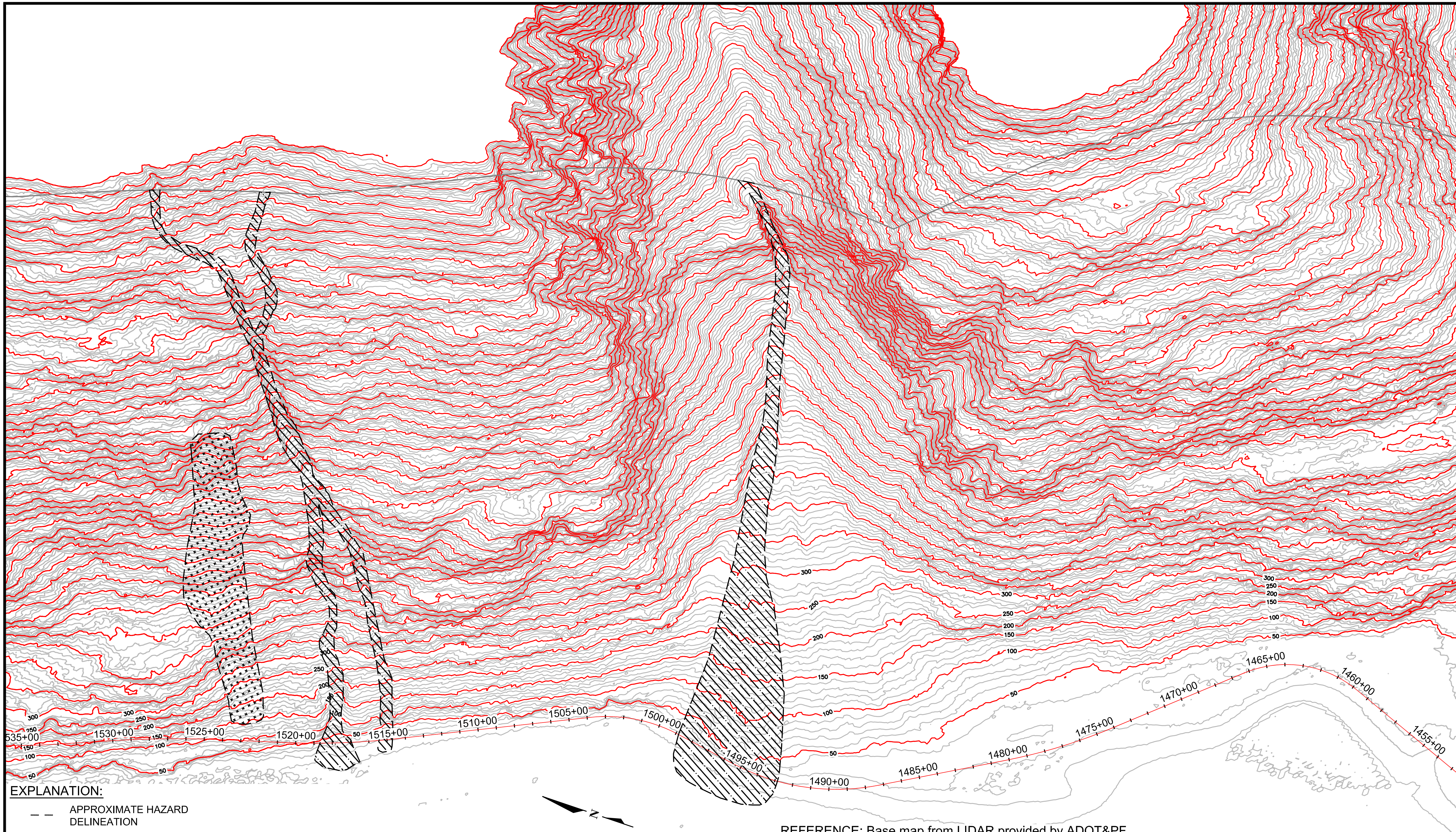
True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	**PRELIMINARY SURFICIAL GEOLOGY MAP** IRP 2006 2619+00 - 2640+00 LYNN CANAL, ALASKA
CADD	AM/EC/AF		
DATE	12/21/06		
CHECK	RGD		
FILE No. 1 to 200 soil.dwg	DATE 12/29/06		
PROJECT No. 063–5782	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 38

APPENDIX F – PRELIMINARY GEOLOGIC HAZARD MAP



REFERENCE: Base map from LIDAR provided by ADOT&PF.

EXPLANATION:

— — APPROXIMATE HAZARD DELINEATION

SYMBOL	GEOLOGIC HAZARD
	DF - DEBRIS FLOW
	RF - ROCKFALL
	RS - ROCKSLIDE
	SR - SOIL RAVELING
	LS - LANDSLIDE
	HR - HAZARD ROCK

UPSLOPE MAPPING BOUNDARY

1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

0 500 1000

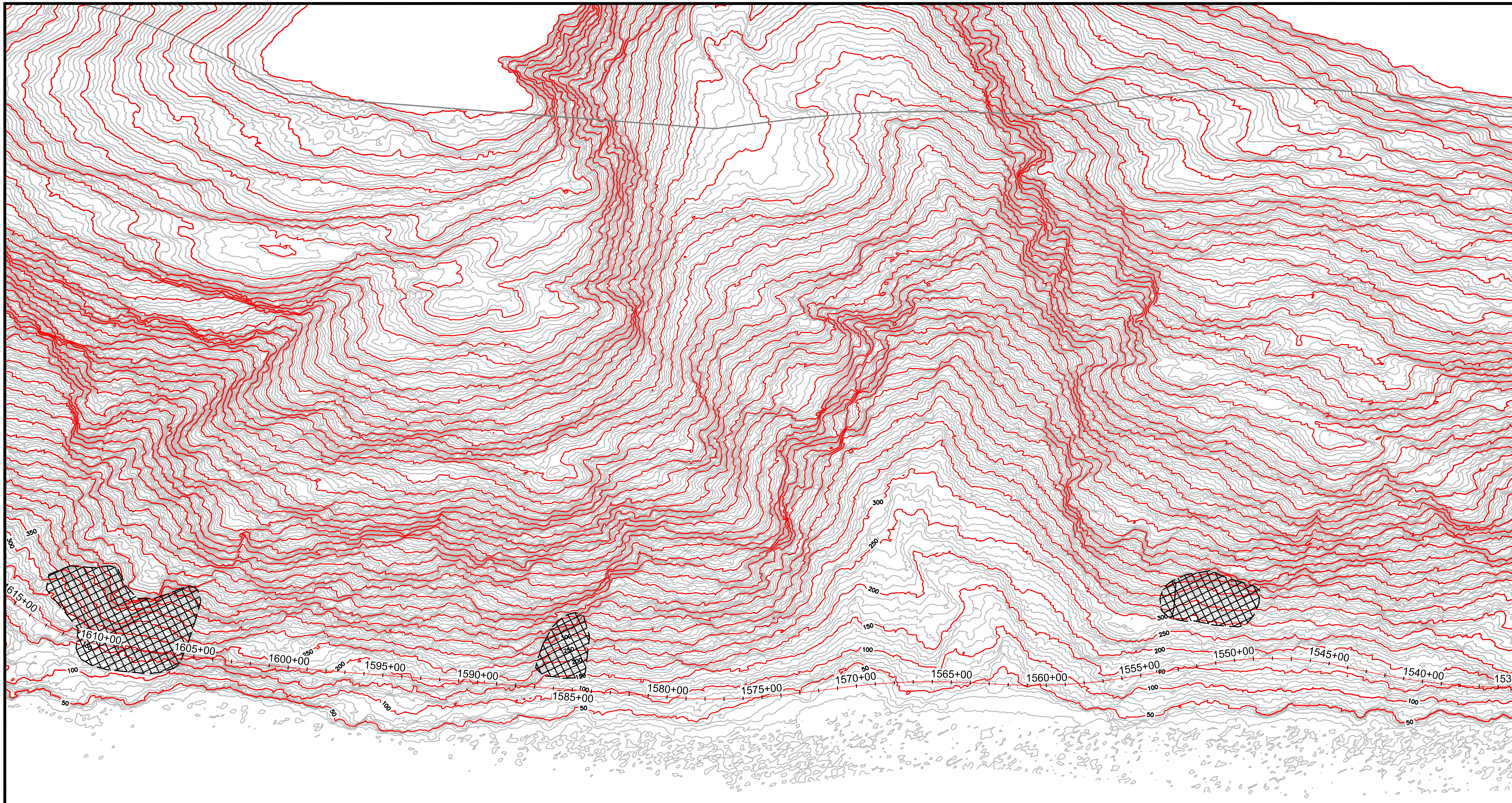
SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	PRELIMINARY GEOLOGIC HAZARD MAP IRP 2006 1452+00 - 1535+00 LYNN CANAL, ALASKA
CADD	AM/AF/EC		
DATE	12/21/06		
CHECK	RGD		
FILE No. 1 to 500 hazard.dwg	DATE 12/29/06		
PROJECT No. 063-5782	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 1



EXPLANATION:

— — APPROXIMATE HAZARD DELINEATION

SYMBOL	GEOLOGIC HAZARD
	DF - DEBRIS FLOW
	RF - ROCKFALL
	RS - ROCKSLIDE
	SR - SOIL RAVELING
	LS - LANDSLIDE
	HR - HAZARD ROCK

UPSLOPE MAPPING BOUNDARY

1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

N

0 500 1000

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN
CADD	AM/AF/EC
DATE	12/21/06
CHECK	RGD
DATE	12/29/06
REV.	0
FILE No.	1 to 500 hazard.dwg
PROJECT No.	063–5782

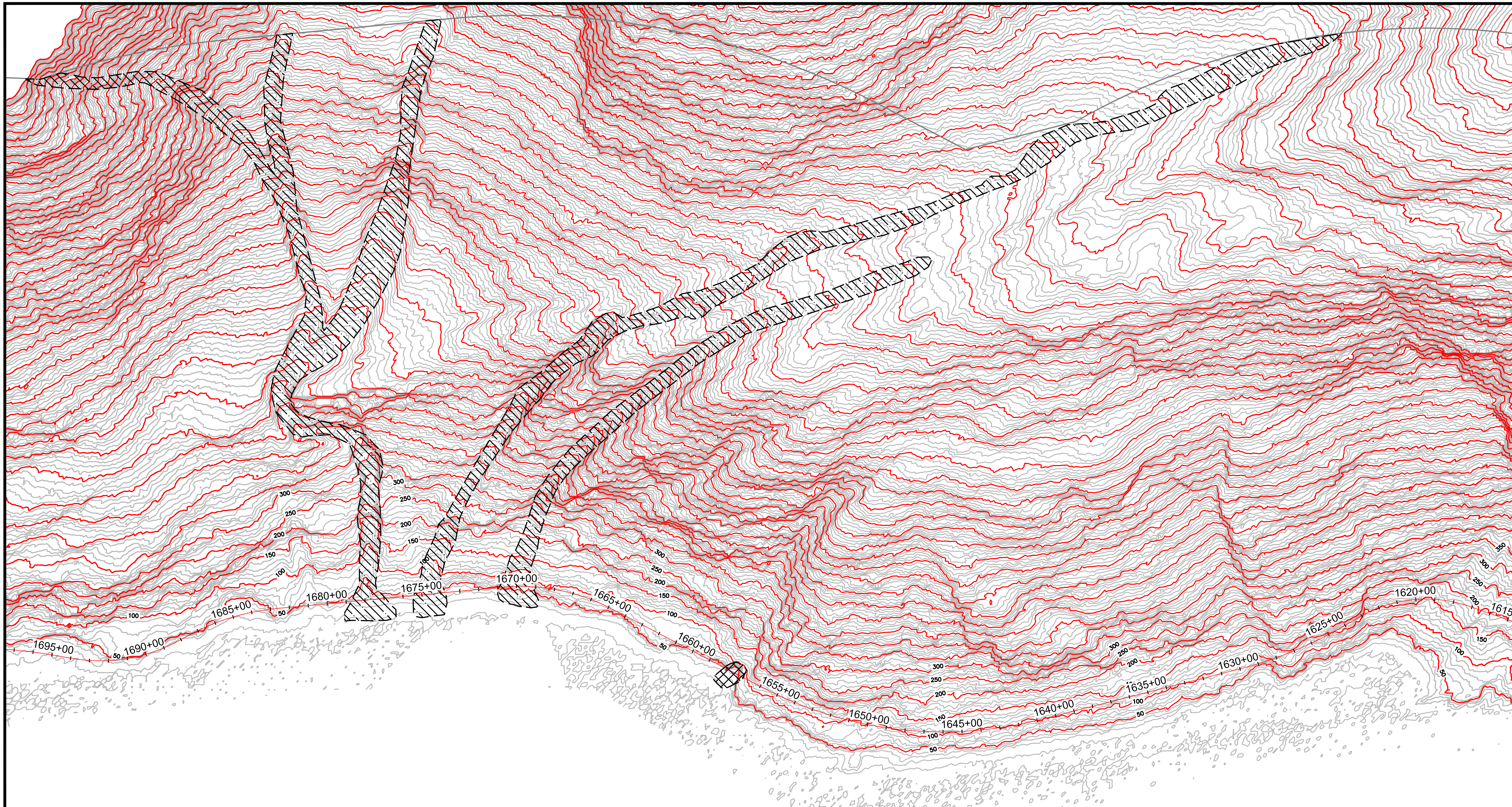
TITLE

PRELIMINARY GEOLOGIC HAZARD MAP

IRP 2006 1535+00 - 1615+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 2



EXPLANATION:

_ _ APPROXIMATE HAZARD DELINEATION

SYMBOL	GEOLOGIC HAZARD
	DF - DEBRIS FLOW
	RF - ROCKFALL
	RS - ROCKSLIDE
	SR - SOIL RAVELING
	LS - LANDSLIDE
	HR - HAZARD ROCK

UPSLOPE MAPPING BOUNDARY

1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

N

0 500 1000

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN
CADD	AM/AF/EC
DATE	12/21/06
CHECK	RGD
DATE	12/29/06
REV.	0
FILE No.	1 to 500 hazard.dwg
PROJECT No.	063–5782

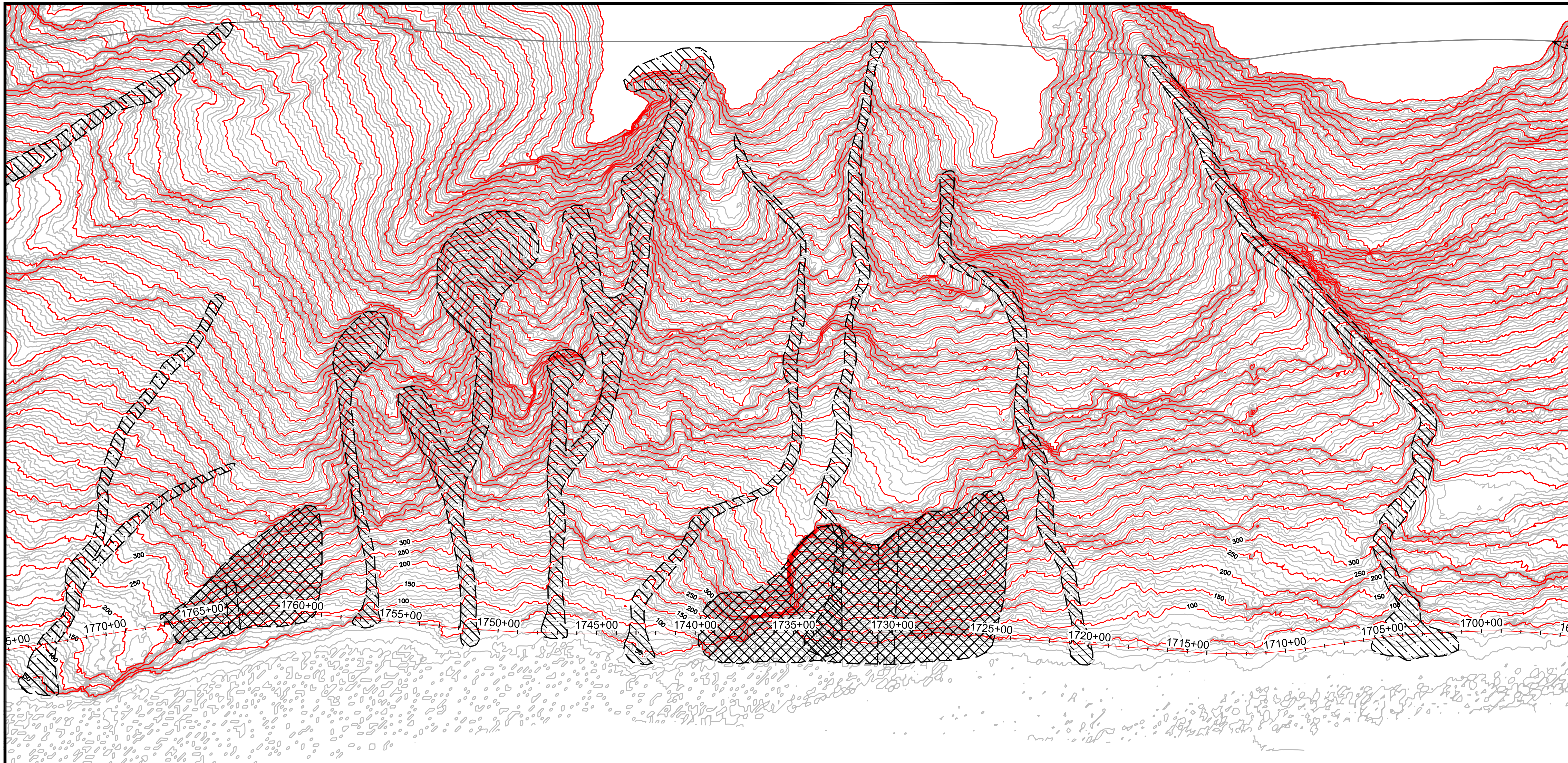
TITLE

PRELIMINARY GEOLOGIC HAZARD MAP

IRP 2006 1615+00 - 1697+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 3



EXPLANATION:

_ _ APPROXIMATE HAZARD DELINEATION

SYMBOL	GEOLOGIC HAZARD
	DF - DEBRIS FLOW
	RF - ROCKFALL
	RS - ROCKSLIDE
	SR - SOIL RAVELING
	LS - LANDSLIDE
	HR - HAZARD ROCK

UPSLOPE MAPPING BOUNDARY

1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

N

0 500 1000

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

FILE No.	1 to 500 hazard.dwg	SCALE	AS SHOWN
PROJECT No.	063–5782	CADD	AM/AF/EC
		DATE	12/21/06
		CHECK	RGD
		DATE	12/29/06
		REV.	0

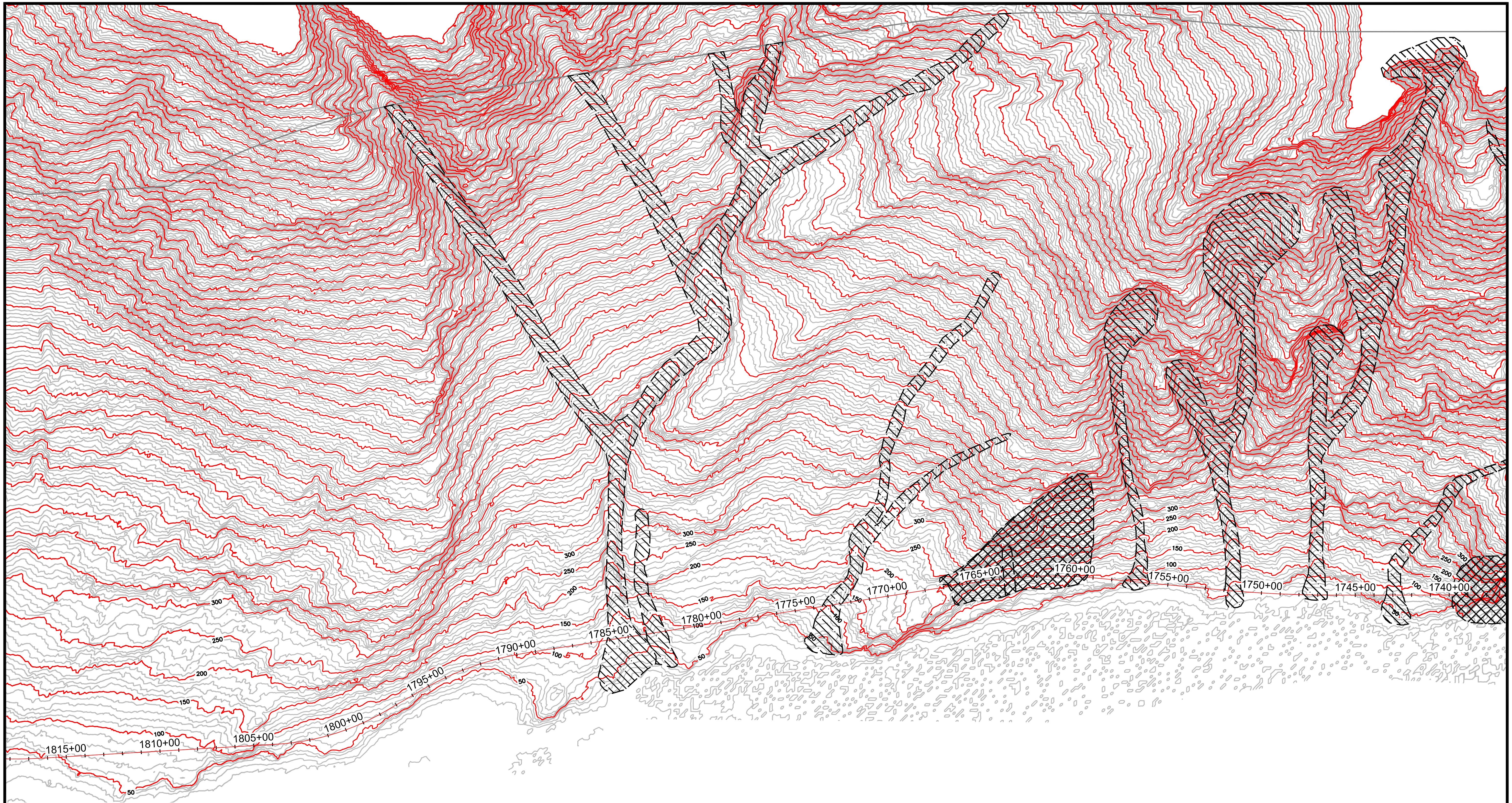
TITLE

PRELIMINARY GEOLOGIC HAZARD MAP

IRP 2006 1695+00 - 1775+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 4



EXPLANATION:

— — APPROXIMATE HAZARD DELINEATION

SYMBOL	GEOLOGIC HAZARD
	DF - DEBRIS FLOW
	RF - ROCKFALL
	RS - ROCKSLIDE
	SR - SOIL RAVELING
	LS - LANDSLIDE
	HR - HAZARD ROCK

UPSLOPE MAPPING BOUNDARY

1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

N

0 500 1000
SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	
CADD	AM/AF/EC	
DATE	12/21/06	
CHECK	RGD	
FILE No.	1 to 500 hazard.dwg	
DATE	12/29/06	
PROJECT No.	063–5782	
REV.	0	

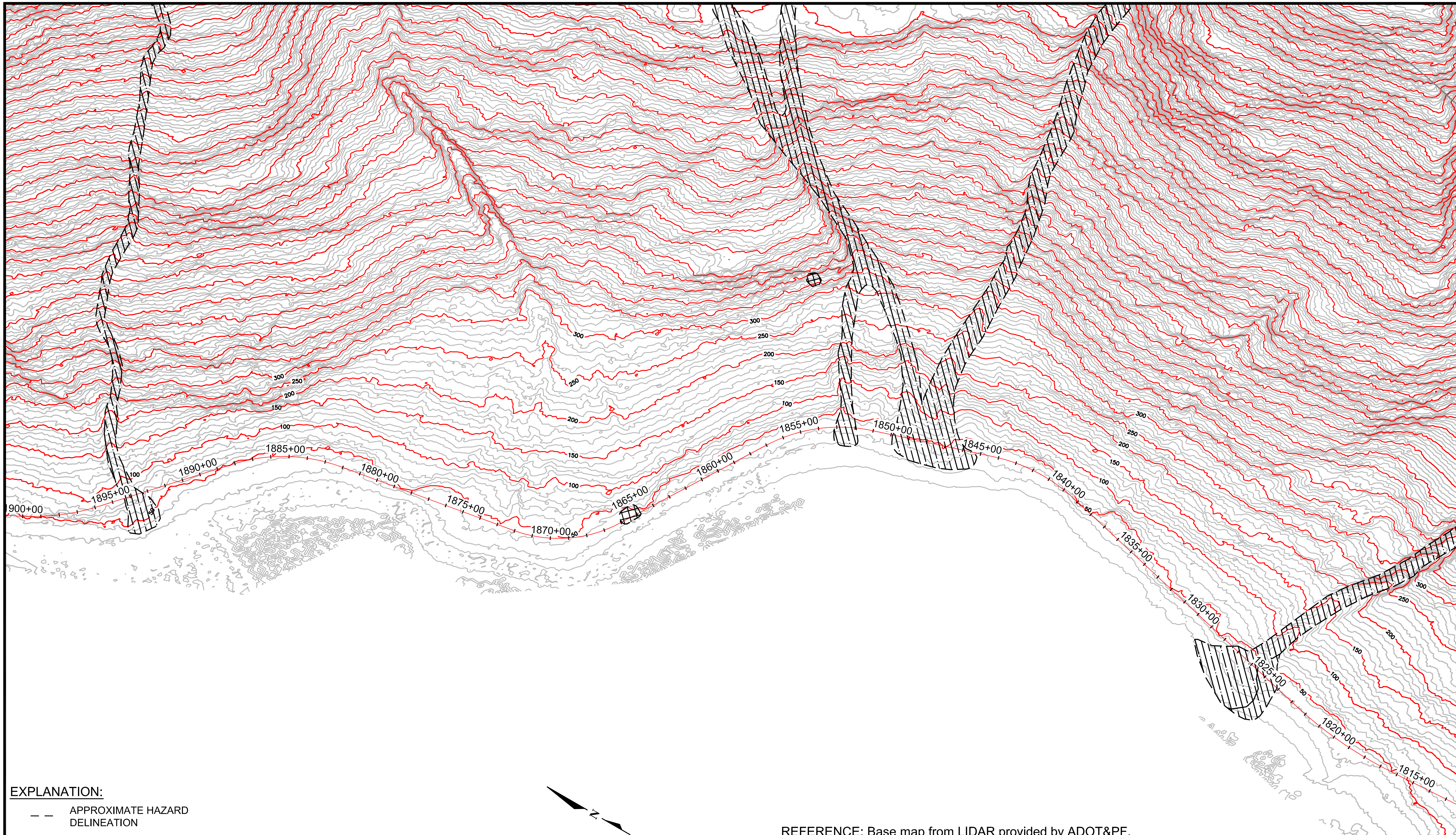
TITLE

PRELIMINARY GEOLOGIC HAZARD MAP

IRP 2006 1737+00 - 1818+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 5



EXPLANATION:

_ _	APPROXIMATE HAZARD DELINEATION
SYMBOL	GEOLOGIC HAZARD
	DF - DEBRIS FLOW
	RF - ROCKFALL
	RS - ROCKSLIDE
	SR - SOIL RAVELING
	LS - LANDSLIDE
	HR - HAZARD ROCK

UPSLOPE MAPPING BOUNDARY

1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

N

0 500 1000
SCALE IN FEET

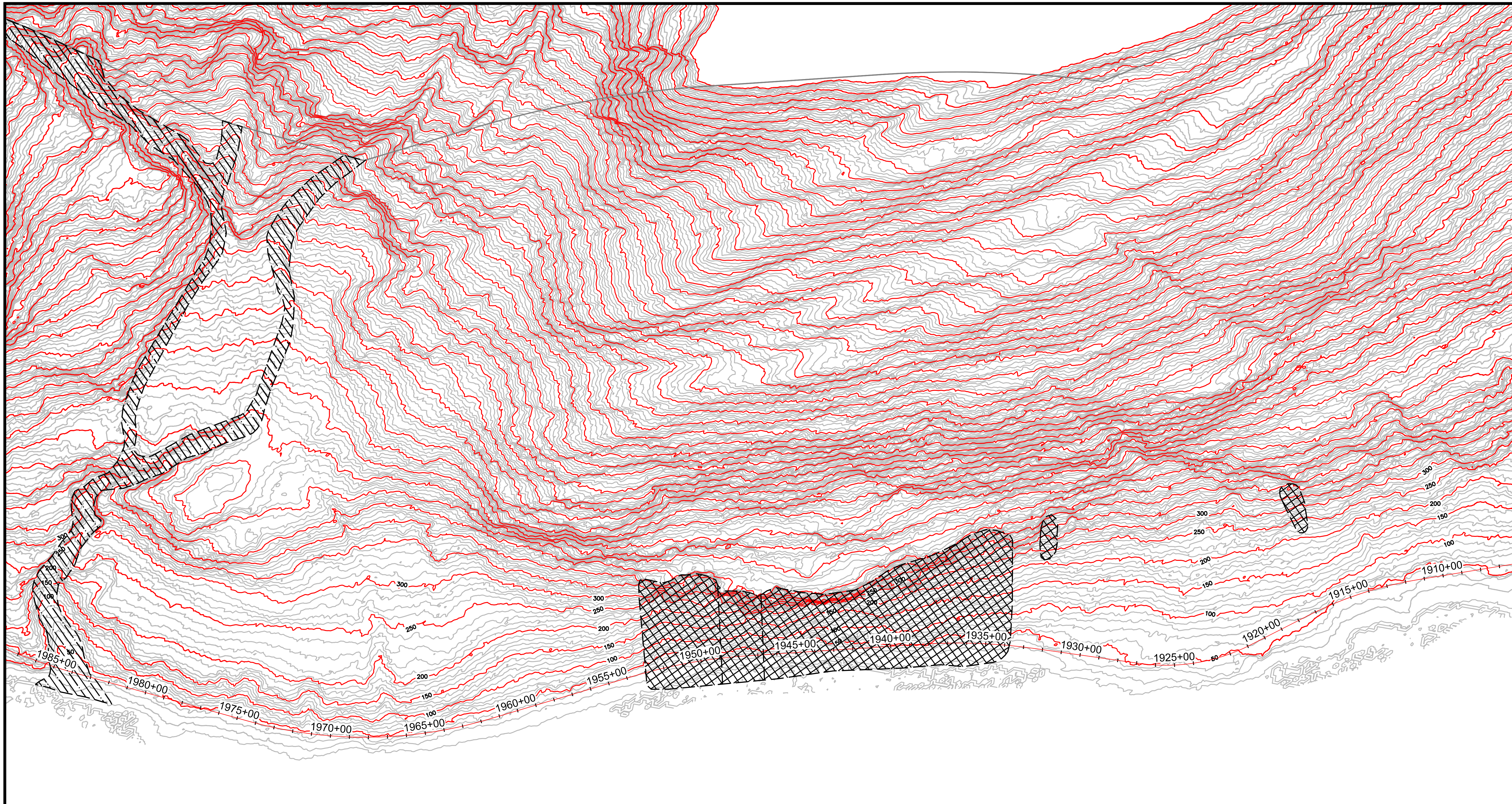
10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	PRELIMINARY GEOLOGIC HAZARD MAP IRP 2006 1812+00 - 1900+00 LYNN CANAL, ALASKA
CADD	AM/AF/EC		
DATE	12/21/06		
CHECK	RGD		
FILE No. 1 to 500 hazard.dwg	DATE 12/29/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 6
PROJECT No. 063–5782	REV. 0		



EXPLANATION:

— — APPROXIMATE HAZARD DELINEATION

SYMBOL	GEOLOGIC HAZARD
	DF - DEBRIS FLOW
	RF - ROCKFALL
	RS - ROCKSLIDE
	SR - SOIL RAVELING
	LS - LANDSLIDE
	HR - HAZARD ROCK

UPSLOPE MAPPING BOUNDARY

1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

N

0 500 1000

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN
CADD	AM/AF/EC
DATE	12/21/06
CHECK	RGD
DATE	12/29/06
REV.	0
FILE No.	1 to 500 hazard.dwg
PROJECT No.	063-5782

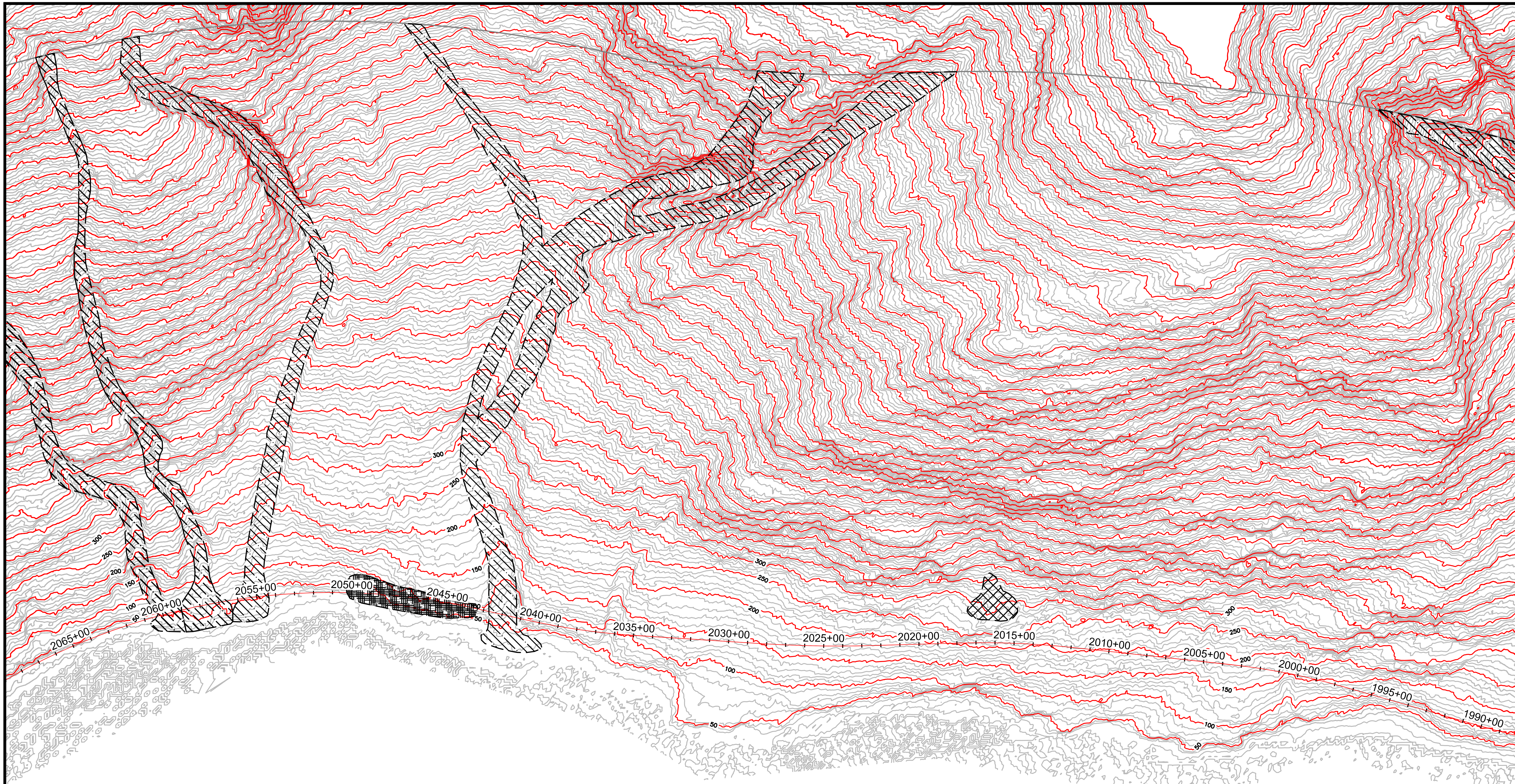
TITLE

PRELIMINARY GEOLOGIC HAZARD MAP

IRP 2006 1906+00 - 1987+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 7



EXPLANATION:

_ _ APPROXIMATE HAZARD DELINEATION

SYMBOL	GEOLOGIC HAZARD
	DF - DEBRIS FLOW
	RF - ROCKFALL
	RS - ROCKSLIDE
	SR - SOIL RAVELING
	LS - LANDSLIDE
	HR - HAZARD ROCK

UPSLOPE MAPPING BOUNDARY

1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

N

0 500 1000
SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN
CADD	AM/AF/EC
DATE	12/21/06
CHECK	RGD
DATE	12/29/06
REV.	0
FILE No.	1 to 500 hazard.dwg
PROJECT No.	063-5782

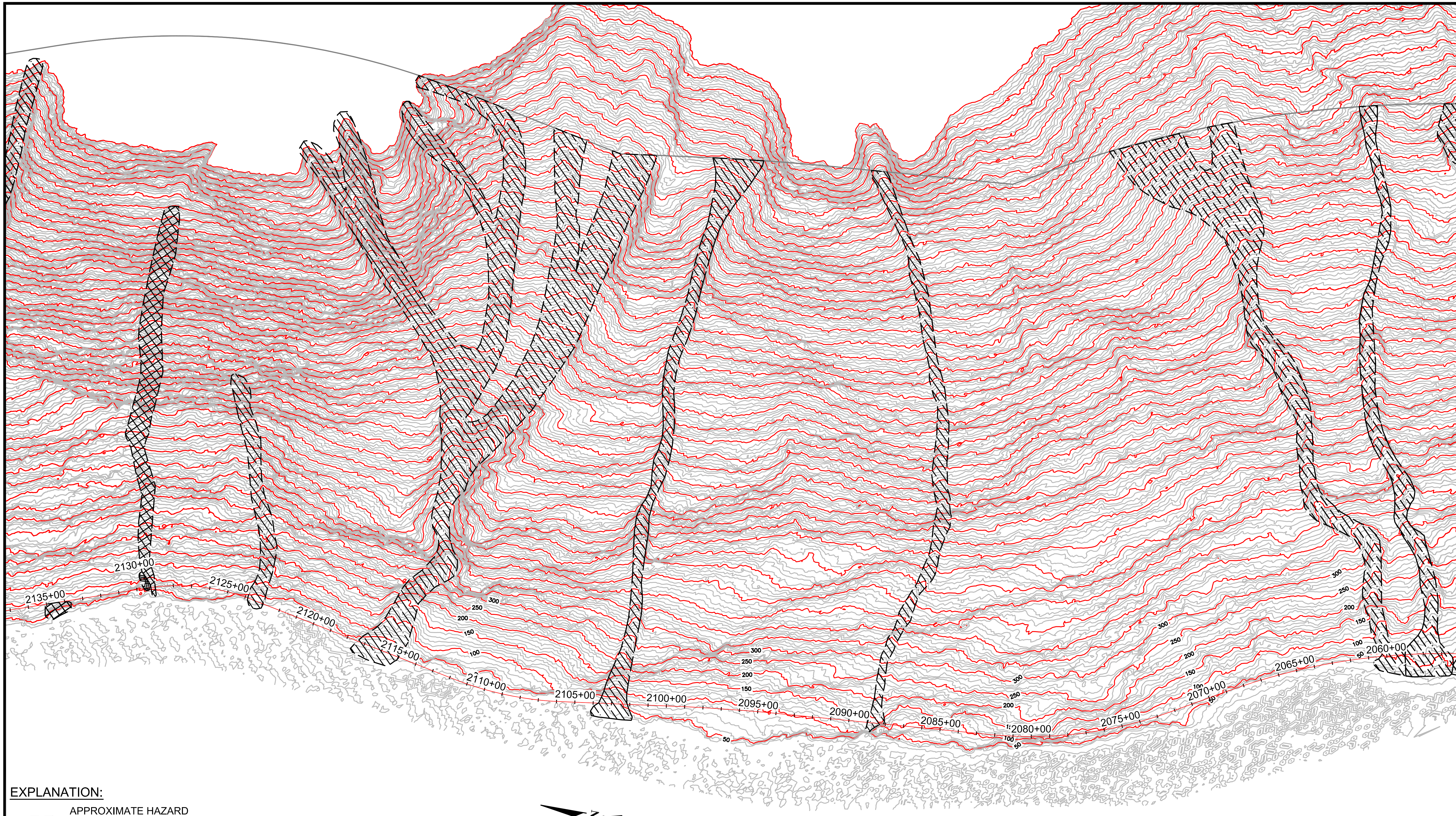
TITLE

PRELIMINARY GEOLOGIC HAZARD MAP

IRP 2006 1988+00 - 2068+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 8



REFERENCE: Base map from LIDAR provided by ADOT&PF.

EXPLANATION:

– – APPROXIMATE HAZARD DELINEATION

SYMBOL	GEOLOGIC HAZARD
	DF - DEBRIS FLOW
	RF - ROCKFALL
	RS - ROCKSLIDE
	SR - SOIL RAVELING
	LS - LANDSLIDE
	HR - HAZARD ROCK

UPSLOPE MAPPING BOUNDARY

1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

0 500 1000
SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN
CADD	AM/AF/EC
DATE	12/21/06
CHECK	RGD
DATE	12/29/06
REV.	0
FILE No.	1 to 500 hazard.dwg
PROJECT No.	063–5782

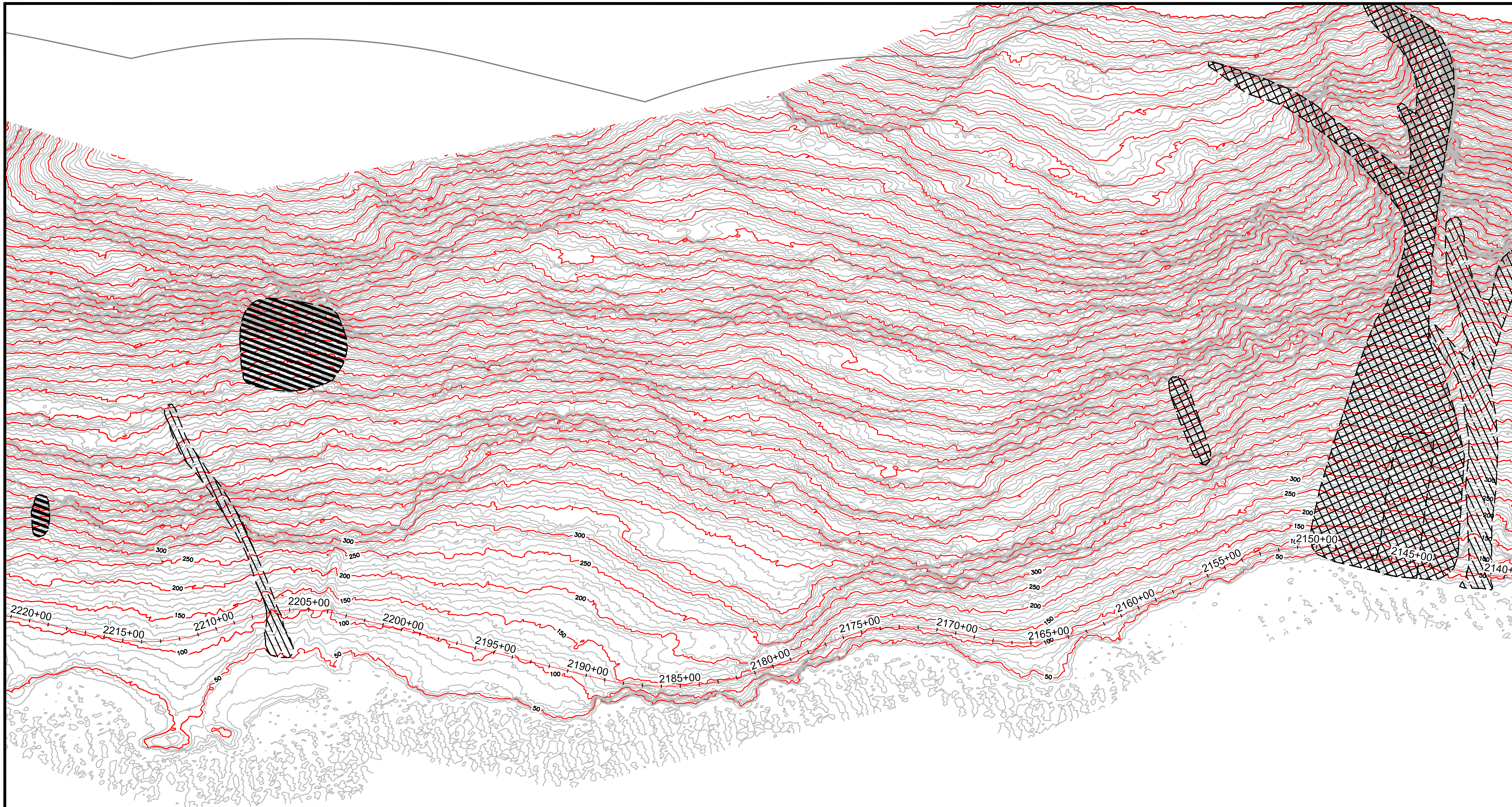
TITLE

PRELIMINARY GEOLOGIC HAZARD MAP

IRP 2006 2056+00 - 2137+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 9



EXPLANATION:

– – APPROXIMATE HAZARD DELINEATION

SYMBOL	GEOLOGIC HAZARD
	DF - DEBRIS FLOW
	RF - ROCKFALL
	RS - ROCKSLIDE
	SR - SOIL RAVELING
	LS - LANDSLIDE
	HR - HAZARD ROCK

UPSLOPE MAPPING BOUNDARY

1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

N

0 500 1000
SCALE IN FEET

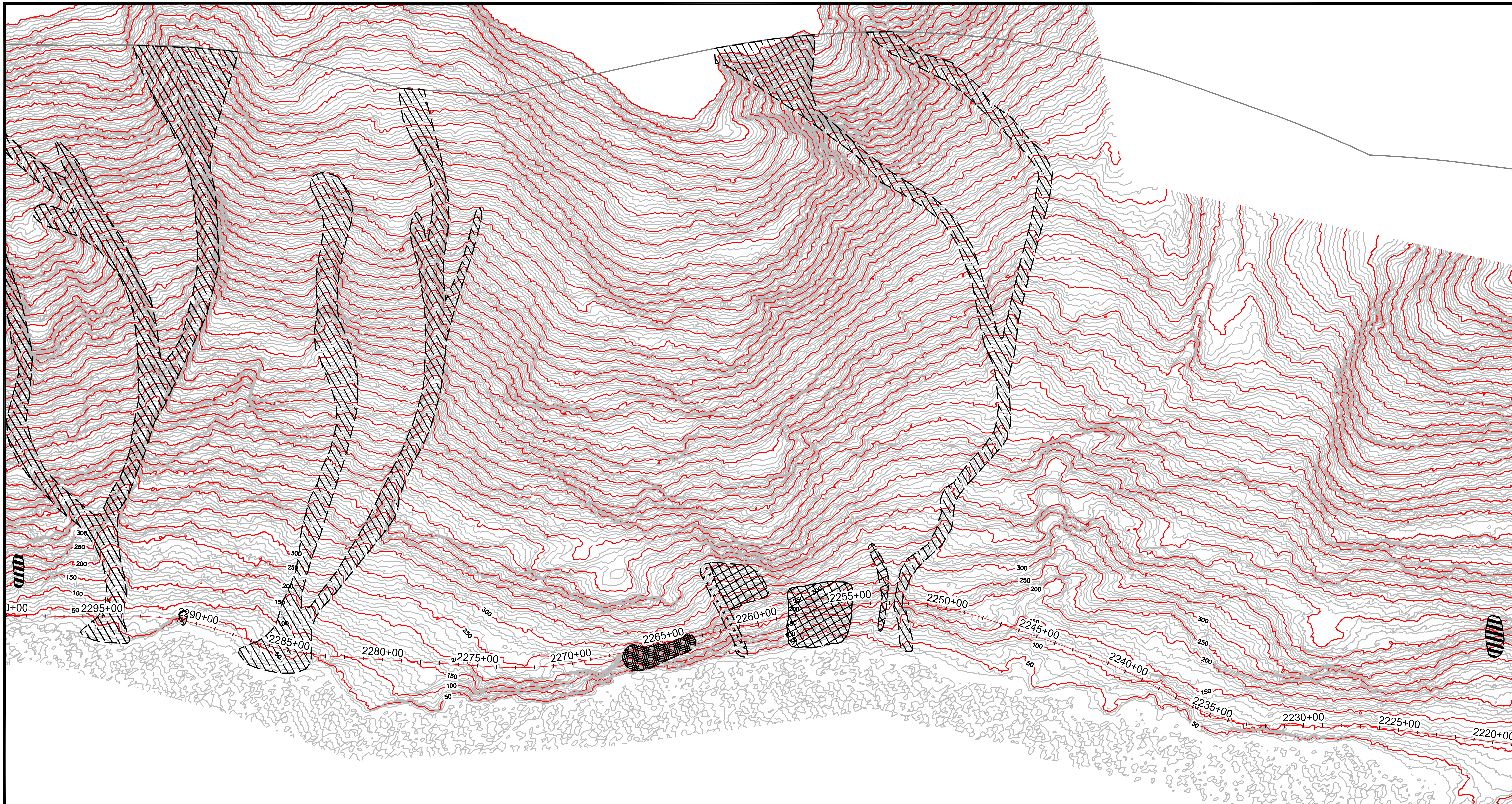
10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	PRELIMINARY GEOLOGIC HAZARD MAP IRP 2006 2139+00-2221+00 LYNN CANAL, ALASKA
CADD	AM/AF/EC		
DATE	12/21/06		
CHECK	RGD		
FILE No. 1 to 500 hazard.dwg	DATE 12/29/06		
PROJECT No. 063–5782	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 10



EXPLANATION:

- - APPROXIMATE HAZARD DELINEATION

SYMBOL GEOLOGIC HAZARD

DF - DEBRIS FLOW

RF - ROCKFALL

RS - ROCKSLIDE

SR - SOIL RAVELING

LS - LANDSLIDE

HR - HAZARD ROCK

UPSLOPE MAPPING BOUNDARY

1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

0 500 1000

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	PRELIMINARY GEOLOGIC HAZARD MAP IRP 2006 2219+00-2300+00 LYNN CANAL, ALASKA
CADD	AM/AF/EC		
DATE	12/21/06		
CHECK	RGD		
FILE No. 1 to 500 hazard.dwg	DATE 12/29/06		
PROJECT No. 063-5782	REV. 0	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 11

EXPLANATION:

— — APPROXIMATE HAZARD DELINEATION

SYMBOL	GEOLOGIC HAZARD
	DF - DEBRIS FLOW
	RF - ROCKFALL
	RS - ROCKSLIDE
	SR - SOIL RAVELING
	LS - LANDSLIDE
	HR - HAZARD ROCK

UPSLOPE MAPPING BOUNDARY

1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

N

0 500 1000

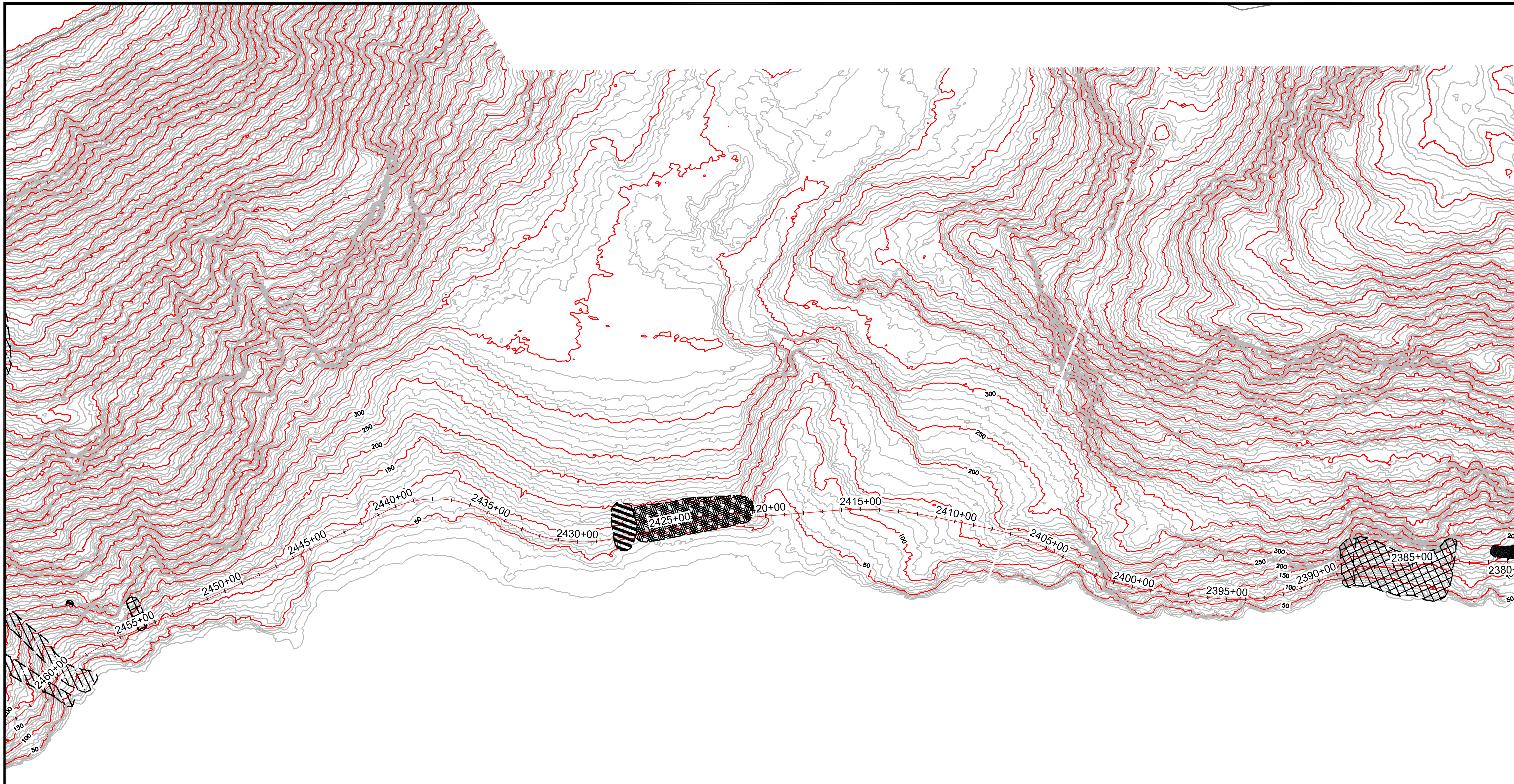
SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates, Anchorage, Alaska	SCALE: AS SHOWN	TITLE	**PRELIMINARY GEOLOGIC HAZARD MAP** IRP 2006 2301+00 - 2381+00 LYNN CANAL, ALASKA
	CADD: AM/AF/EC		
	DATE: 12/21/06		
	CHECK: RGD		
FILE No.: 1 to 500 hazard.dwg	DATE: 12/29/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	FIGURE 12
PROJECT No.: 063–5782	REV.: 0		



EXPLANATION:

APPROXIMATE HAZARD DELINEATION

SYMBOL	GEOLOGIC HAZARD
	DF - DEBRIS FLOW
	RF - ROCKFALL
	RS - ROCKSLIDE
	SR - SOIL RAVELING
	LS - LANDSLIDE
	HR - HAZARD ROCK

UPSLOPE MAPPING BOUNDARY

1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

N

0 500 1000
SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

FILE No.	1 to 500 hazard.dwg	SCALE	AS SHOWN
PROJECT No.	063–5782	CADD	AM/AF/EC
		DATE	12/21/06
		CHECK	RGD
		DATE	12/29/06
		REV.	0

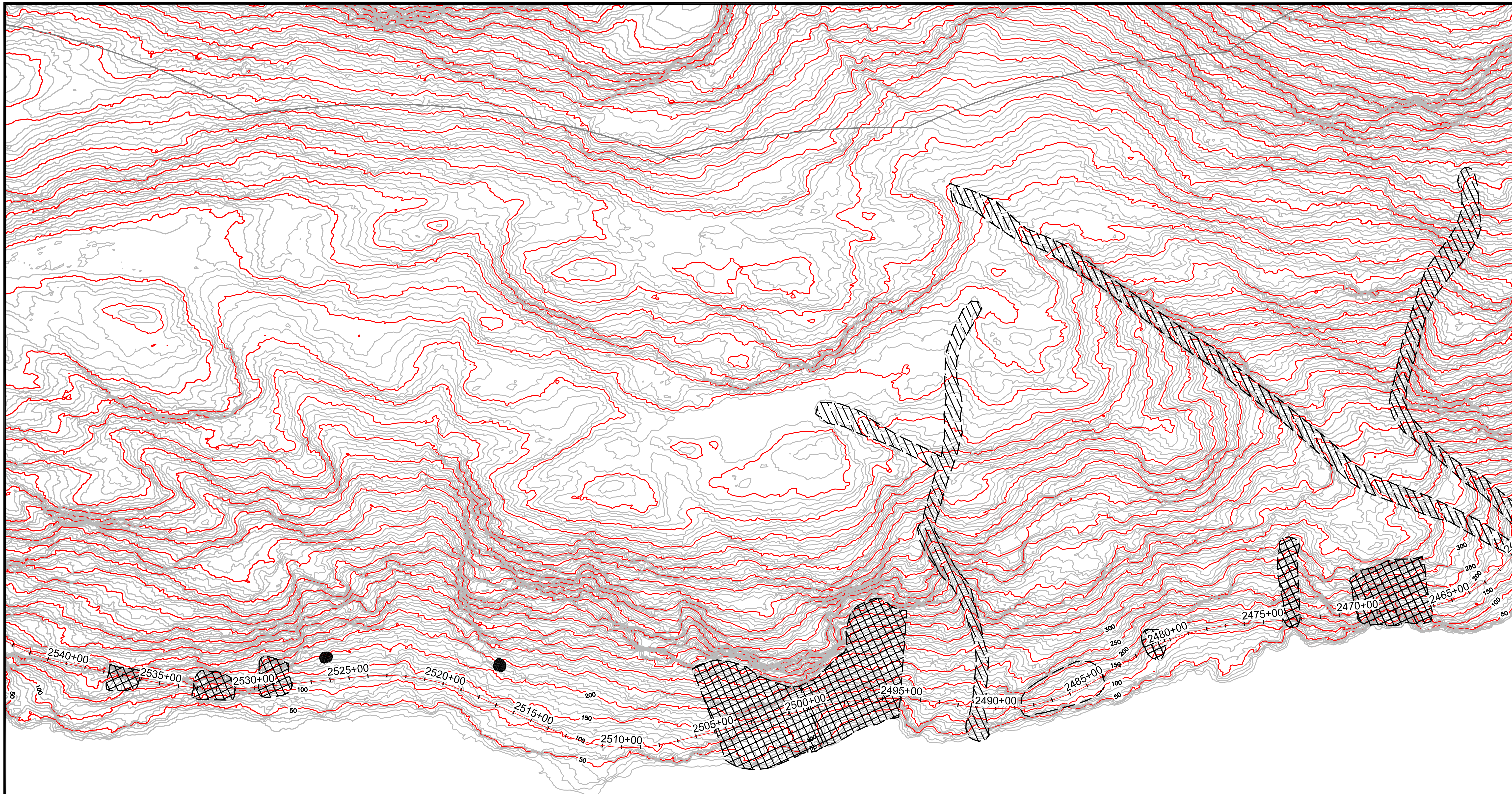
TITLE

PRELIMINARY GEOLOGIC HAZARD MAP

IRP 2006 2379+00 - 2463+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 13



EXPLANATION:

– – APPROXIMATE HAZARD DELINEATION

SYMBOL	GEOLOGIC HAZARD
	DF - DEBRIS FLOW
	RF - ROCKFALL
	RS - ROCKSLIDE
	SR - SOIL RAVELING
	LS - LANDSLIDE
	HR - HAZARD ROCK

UPSLOPE MAPPING BOUNDARY

1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

N

0 500 1000

SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

REFERENCE: Base map from LIDAR provided by ADOT&PF.

Golder Associates
Anchorage, Alaska

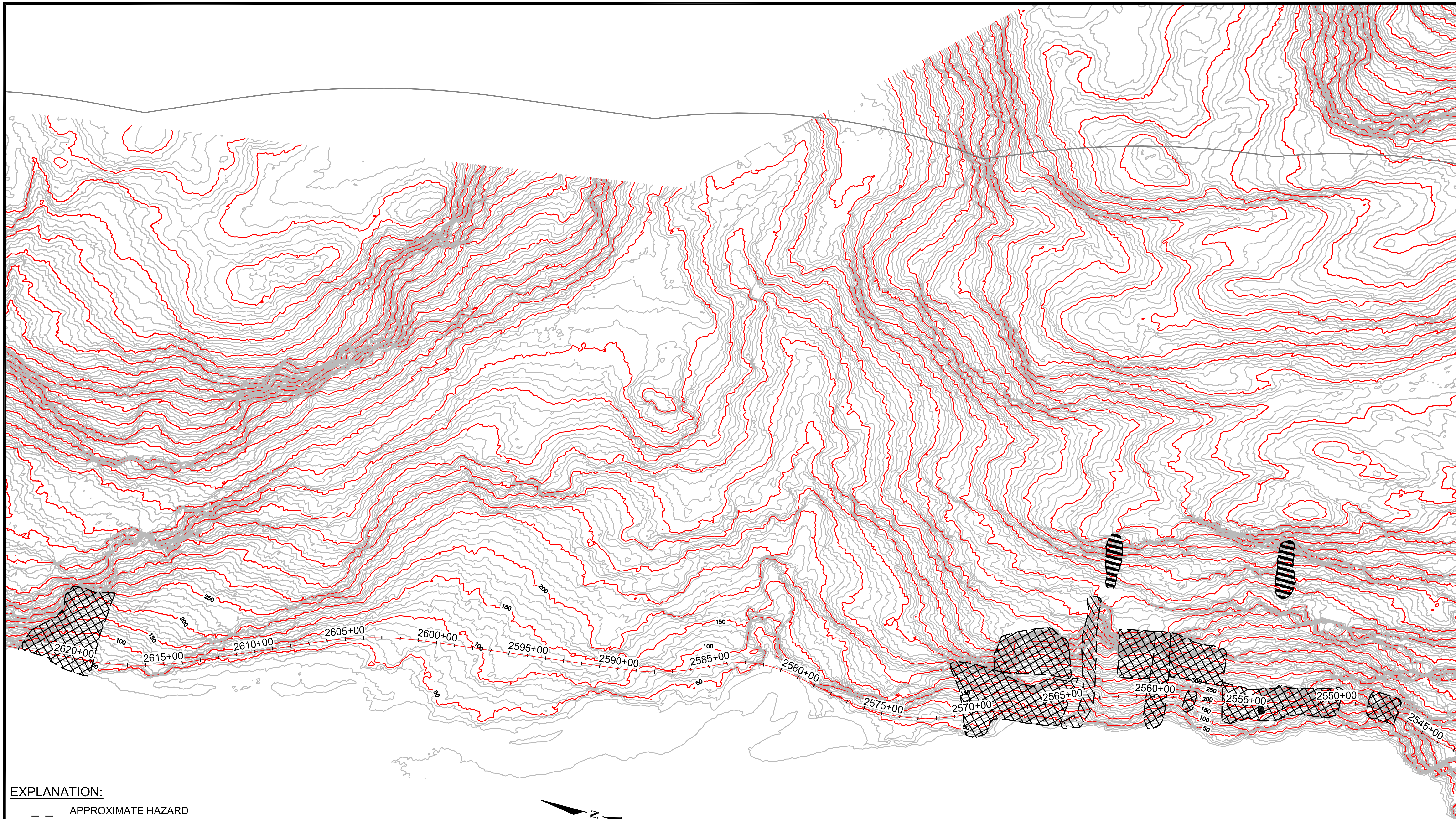
FILE No. 1 to 500 hazard.dwg	SCALE AS SHOWN	TITLE	
PROJECT No. 063–5782	CADD AM/AF/EC		
	DATE 12/21/06		
	CHECK RGD		
	DATE 12/29/06		
	REV. 0		

PRELIMINARY GEOLOGIC HAZARD MAP

IRP 2006 2461+00 - 2543+00
LYNN CANAL, ALASKA

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 14



REFERENCE: Base map from LIDAR provided by ADOT&PF.

EXPLANATION:

APPROXIMATE HAZARD DELINEATION

SYMBOL	GEOLOGIC HAZARD
	DF - DEBRIS FLOW
	RF - ROCKFALL
	RS - ROCKSLIDE
	SR - SOIL RAVELING
	LS - LANDSLIDE
	HR - HAZARD ROCK

UPSLOPE MAPPING BOUNDARY

1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

0 500 1000

SCALE IN FEET

10 ft contour interval
50 ft Index contours

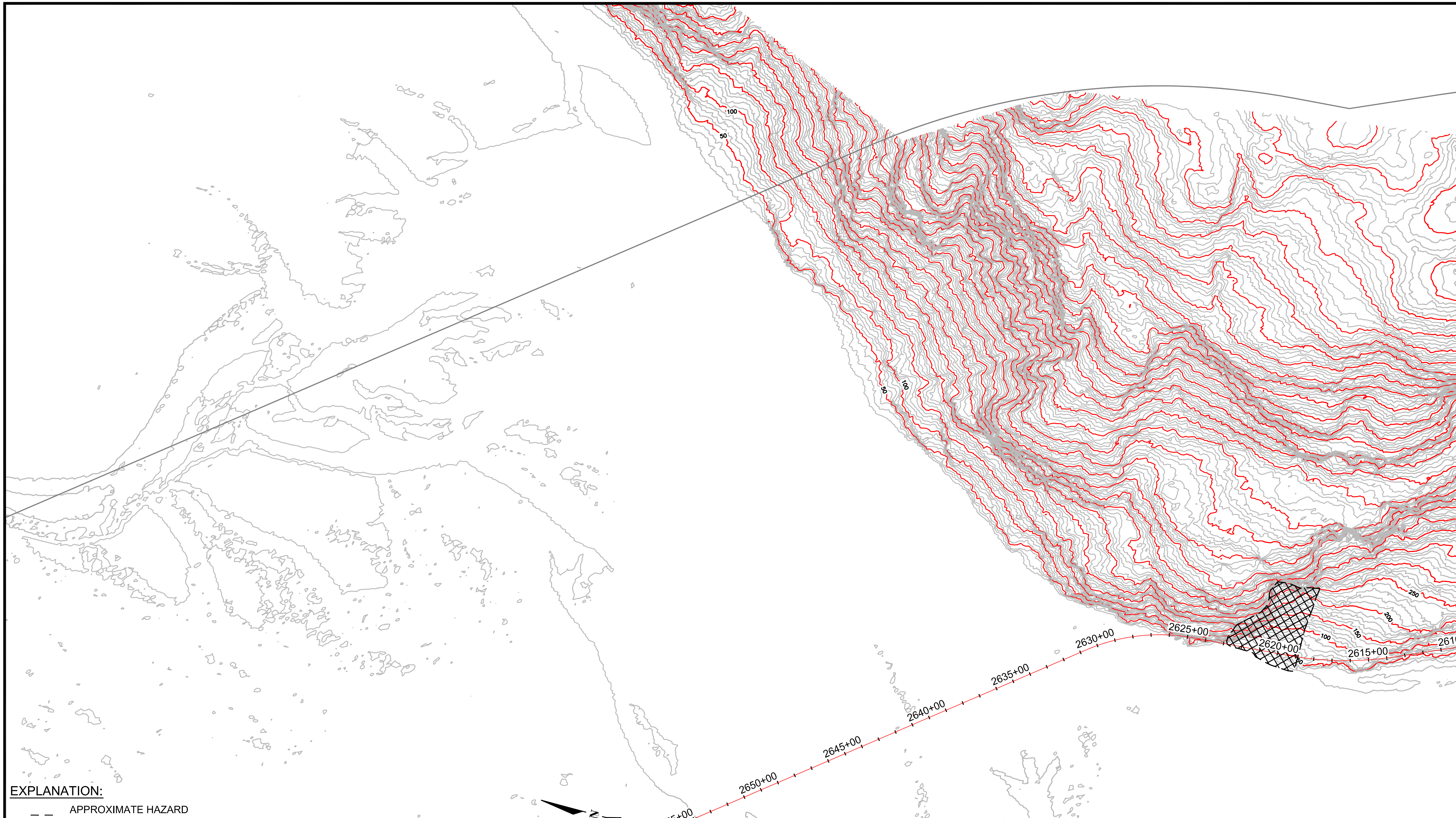
True North shown
23.5°East declination

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	**PRELIMINARY GEOLOGIC HAZARD MAP** IRP 2006 2543+00 - 2623+00 LYNN CANAL, ALASKA
CADD	AM/AF/EC		
DATE	12/21/06		
CHECK	RGD		
FILE No.	1 to 500 hazard.dwg	DATE	12/29/06
PROJECT No.	063-5782	REV.	0

ADOT / LYNN CANAL HWY ZONE 4 / AK

FIGURE 15



REFERENCE: Base map from LIDAR provided by ADOT&PF.

EXPLANATION:

— — APPROXIMATE HAZARD DELINEATION

SYMBOL	GEOLOGIC HAZARD
	DF - DEBRIS FLOW
	RF - ROCKFALL
	RS - ROCKSLIDE
	SR - SOIL RAVELING
	LS - LANDSLIDE
	HR - HAZARD ROCK

UPSLOPE MAPPING BOUNDARY

1530+00 INERTIAL REFERENCE POINT 2006 (IRP 2006) ALIGNMENT

0 500 1000
SCALE IN FEET

10 ft contour interval
50 ft Index contours

True North shown
23.5°East declination

Golder Associates
Anchorage, Alaska

SCALE	AS SHOWN	TITLE	PRELIMINARY GEOLOGIC HAZARD MAP IRP 2006 2610+00-2670+00 LYNN CANAL, ALASKA
CADD	AM/AF/EC		
DATE	12/21/06		
CHECK	RGD		
FILE No. 1 to 500 hazard.dwg		DATE	12/29/06
PROJECT No. 063–5782		REV.	0
ADOT / LYNN CANAL HWY ZONE 4 / AK		FIGURE	16

APPENDIX G – GEOLOGIC HAZARD SUMMARY

DF01. View east/upslope at alluvial fan with debris flow deposition zone (gray) and avalanche path ELC002.

Hazard ID #:	DF01
Hazard Type:	debris_flow
HIN:	225
Rating:	A
IRP 2006 Location:	1493
Frequency (yrs):	1-5
Predictability:	moderate
Material Volume (CY):	100-1000
Clast Size (ft):	1-2
Source Elev. (ft):	>1000
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	500+
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	1492+90
IRP 2006 North Margin:	1498+90
Photo #:	4098, 4099, 5146

Golder Associates	CADD: ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06		
	CHECK: RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-1**
PROJECT No. 063-5782	REV: 0		

DF01. View south/down alignment at debris flow deposition zone at beach. Stake represents IRP 2006 1494+00.

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-2**
PROJECT No. 063-5782	REV	0		

DF02. View east/upslope at debris flow channel and avalanche path ELC003.

Hazard ID #:	DF02
Hazard Type:	debris_flow
HIN:	129
Rating:	A
IRP 2006 Location:	1515
Frequency (yrs):	1-5
Predictability:	moderate
Material Volume (CY):	<10
Clast Size (ft):	0-1
Source Elev. (ft):	2000-3000
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1514+50
IRP 2006 North Margin:	1515+50
Photo #:	1515, 2036, 5865

Golder Associates	CADD ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	G-3
PROJECT No. 063-5782	REV 0		

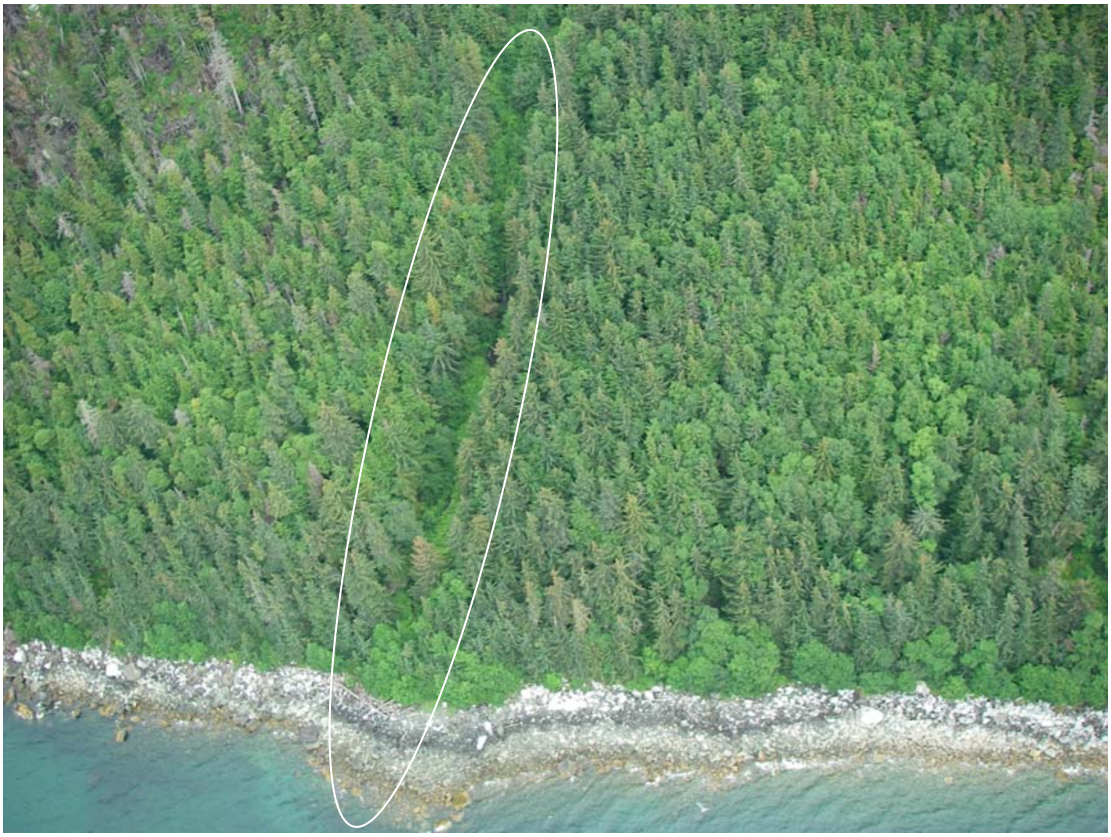
DF02. View east/upslope up debris flow channel incised into overburden. Photo taken 50 ft right of IRP 2006 1515+00.

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-4**
PROJECT No. 063-5782	REV	0		

DF03. View east/upslope at debris flow channel.

Hazard ID #:	DF03
Hazard Type:	debris_flow
HIN:	183
Rating:	A
IRP 2006 Location:	1517
Frequency (yrs):	0-1
Predictability:	moderate
Material Volume (CY):	<10
Clast Size (ft):	0-1
Source Elev. (ft):	2000-3000
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1517+00
IRP 2006 North Margin:	1518+20
Photo #:	3893, 5148, 5865, 6256

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-5**



DF03. View east/upslope at debris flow channel, deposition zone, and fan near IRP 2006 1518+00.

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE	11/27/06			
	CHECK	RGD			
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06		ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-6**
PROJECT No. 063-5782	REV	0			

DF03. View east/upslope up debris flow channel. Photo taken 10 ft right of IRP 2006 1517+50.

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE	11/27/06			
	CHECK	RGD			
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06		ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-7**
PROJECT No. 063-5782	REV	0			

RS01. View east/upslope at 2001 rockslide and avalanche path ELC003-1.

Hazard ID #:	RS01
Hazard Type:	rock_slide
HIN:	219
Rating:	A
IRP 2006 Location:	1522
Frequency (yrs):	unknown(>25?)
Predictability:	unpredictable
Material Volume (CY):	100-1000
Clast Size (ft):	4+
Source Elev. (ft):	>1000
Centerline Slope:	open_bedrock_slope
Alignment Location:	deposition_zone
Impact Alignment:	no
Alignment Exposure (ft):	200-500
Vegetation:	denuded
Deciduous Trees:	no
IRP 2006 South Margin:	1521+80
IRP 2006 North Margin:	1525+50
Photo #:	4123, 4124, 4126, 5148, 5865

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-8**
PROJECT No. 063-5782	REV 0		

RS01. View east/upslope of area directly under rockslide. Some debris approaches the IRP 2006 alignment which is located just east/upslope of the beach.

RS01. View east/upslope of 40 ft diameter boulder at bottom of rockslide and avalanche path ELC003-1. Photo taken 360 ft right of IRP 2006 1522+00.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-9**
PROJECT No. 063-5782	REV 0		

RS01. View east/upslope of fresh rockslide mega-boulder at southwest (downslope and down alignment) corner of rockslide and avalanche path ELC003-1. Photograph taken 360 ft right of IRP 2006 1522+50.

Golder Associates	CADD ALF	TITLE GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK — G-10
PROJECT No. 063-5782	REV 0	

RF01. View east/upslope at rockfall hazard area.

Hazard ID #:	RF01
Hazard Type:	rockfall
HIN:	147
Rating:	C
IRP 2006 Location:	1549
Frequency (yrs):	1-5
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	3-4
Source Elev. (ft):	100-500
Centerline Slope:	open_soil_slope
Alignment Location:	below_deposition_zone
Impact Alignment:	no
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1549+00
IRP 2006 North Margin:	1552+50
Photo #:	4212, 4214, 5148

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-11**
PROJECT No. 063-5782	REV 0		

RF01. Basalt cliff that is the origin of rockfall hazard. Photo taken 350 ft right of IRP 2006 1551+00.

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-12**
PROJECT No. 063-5782	REV 0		

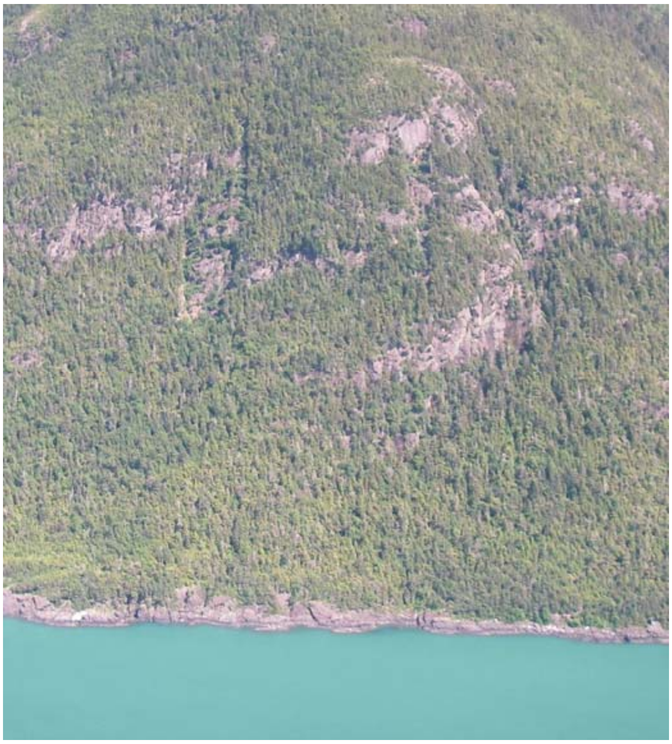
RF02. View east/upslope at rockfall hazard area.

Hazard ID #:	RF02
Hazard Type:	rockfall
HIN:	111
Rating:	C
Station Location:	1553
Frequency (yrs):	5-25
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	0-1
Source Elev. (ft):	100-500
Centerline Slope:	open_soil_slope
Alignment Location:	below_deposition_ zone
Impact Alignment:	no
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1553+00
IRP 2006 North Margin:	1554+00
Photo #:	3049, 5149

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-13**
PROJECT No. 063-5782	REV 0		

RF02. View west/downslope at rockfall deposition. Photo taken 350 ft right of IRP 2006 1552+00.

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-14**
PROJECT No. 063-5782	REV	0		



RF03. View east/upslope at rockfall area.

RF03. View east/upslope at rockfall area.

Hazard ID #:	RF03
Hazard Type:	rockfall
HIN:	129
Rating:	B
IRP 2006 Location:	1586
Frequency (yrs):	5-25
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	4+
Source Elev. (ft):	100-500
Centerline Slope:	single_channel
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1584+50
IRP 2006 North Margin:	1587+00
Photo #:	4259, 5873

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK — **G-15**
PROJECT No. 063-5782	REV 0	

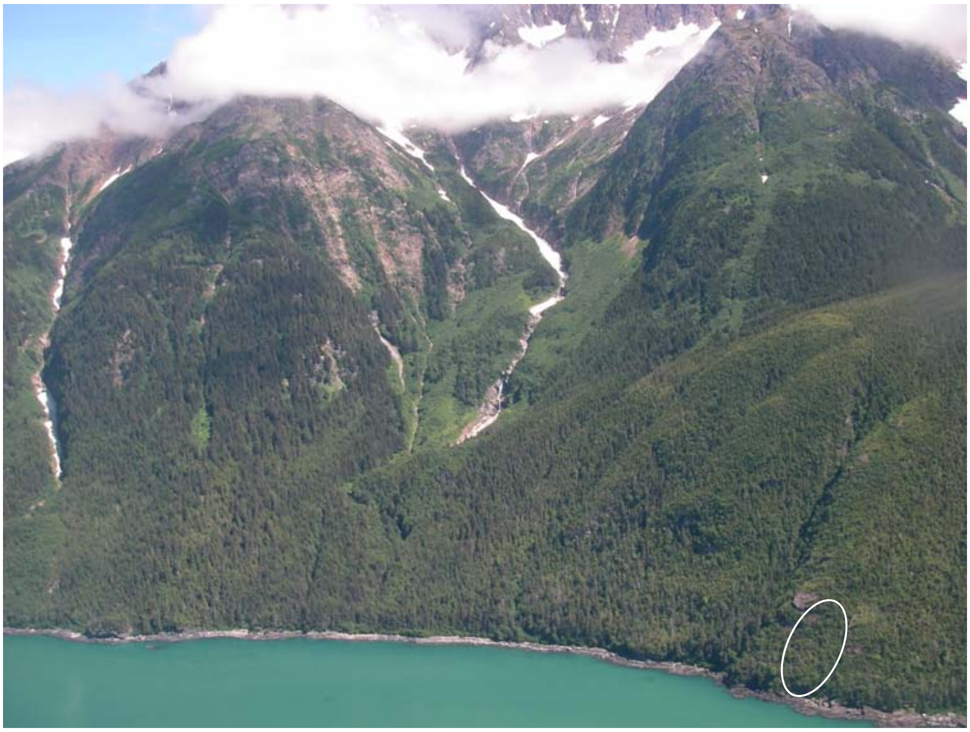
RF04. View east/upslope at rockfall area.

RF04. Base of vertical basalt cliff creating rockfall hazard. Photo taken 400 ft right of IRP 2006 1610+00.

Hazard ID #:	RF04
Hazard Type:	rockfall
HIN:	183
Rating:	B
IRP 2006 Location:	1609
Frequency (yrs):	unknown (5-25?)
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	4+
Source Elev. (ft):	100-500
Centerline Slope:	open_soil_slope
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	500+
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1605+50
IRP 2006 North Margin:	1611+10
Photo #:	4245, 4246, 4247, 4249

Hazard ID #:	RF05
Hazard Type:	rockfall
HIN:	105
Rating:	B
IRP 2006 Location:	1657
Frequency (yrs):	5-25
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	4+
Source Elev. (ft):	<100
Centerline Slope:	open_bedrock_slope
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1657+00
IRP 2006 North Margin:	1658+00
Photo #:	1086, 3904-3908, 5154, 6266

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-17**



RF05. View east/upslope at rockfall hazard area. Rockfall occurs near beach at base of gully in lower right of photo.

RF05. View east/upslope at basalt cliffs and rockfall. Photo taken 50 ft left of IRP 2006 1657+00.

Golder Associates	CADD ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	G-18
PROJECT No. 063-5782	REV 0		

RF05. View west/downslope at rockfall from basalt cliffs. Photo taken at centerline of IRP 2006 1657+50.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-19**
PROJECT No. 063-5782	REV 0		

DF04. View east/upslope at debris flow channel, incision visible as gully.

Hazard ID #:	DF04
Hazard Type:	debris_flow
HIN:	117
Rating:	B
IRP 2006 Location:	1670
Frequency (yrs):	5-25
Predictability:	moderate
Material Volume (CY):	10-100
Clast Size (ft):	0-1
Source Elev. (ft):	1000-2000
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1668+50
IRP 2006 North Margin:	1670+50
Photo #:	3875

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-20**
PROJECT No. 063-5782	REV	0		


DF04. Debris flow deposit at IRP 2006 1670+50.

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-21**
PROJECT No. 063-5782	REV	0		

DF05. Debris flow channel visible as incised gully through trees in lower part of photo, left of center.

Hazard ID #:	DF05
Hazard Type:	debris_flow
HIN:	129
Rating:	A
IRP 2006 Location:	1674
Frequency (yrs):	1-5
Predictability:	high
Material Volume (CY):	10-100
Clast Size (ft):	0-1
Source Elev. (ft):	1000-2000
Centerline Slope:	single_channel
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	denuded
Deciduous Trees:	no
IRP 2006 South Margin:	1673+80
IRP 2006 North Margin:	1675+30
Photo #:	6203, 6204

Golder Associates			
CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
DATE	11/27/06		
CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-22**
PROJECT No. 063-5782	REV 0		

DF05. View north/up alignment along debris flow incision and levee. Photo taken 40 ft right of IRP 2006 1674+20.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-23**
PROJECT No. 063-5782	REV 0		

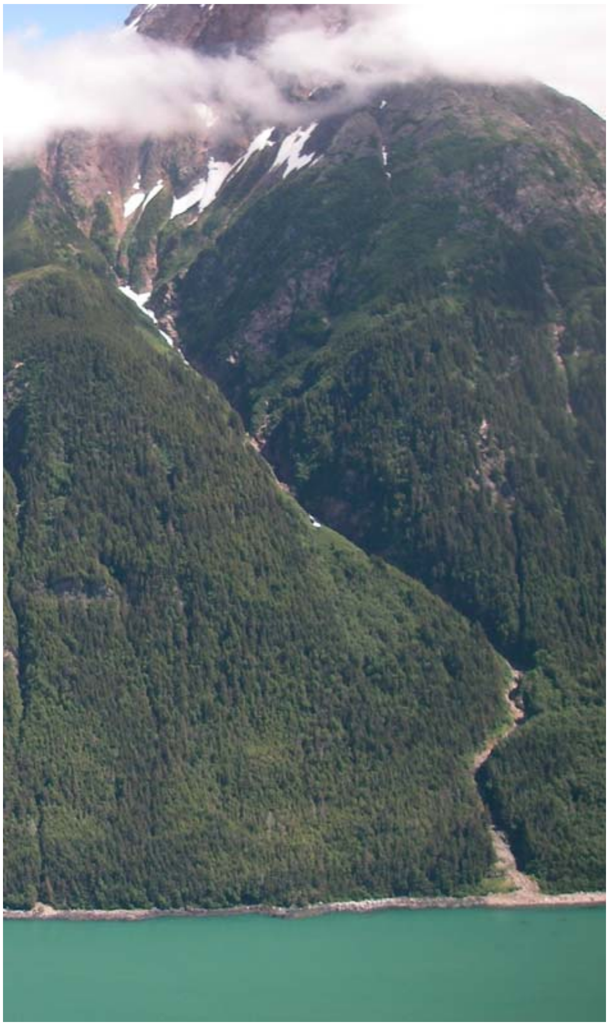
DF06. View east/upslope at debris flow channel and avalanche path ELC005.

Hazard ID #:	DF06
Hazard Type:	debris_flow
HIN:	201
Rating:	A
IRP 2006 Location:	1678
Frequency (yrs):	0-1
Predictability:	high
Material Volume (CY):	10-100
Clast Size (ft):	0-1
Source Elev. (ft):	2000-3000
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1677+00
IRP 2006 North Margin:	1679+00
Photo #:	3876

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06	
	CHECK: RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV: 0	**G-24**

DF06. View southeast (upslope and down alignment) across debris flow deposition zone at tide line. Photo taken 20 ft left of IRP 2006 1677+50.

Golder Associates	CADD: ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06		
	CHECK: RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-25**
PROJECT No. 063-5782	REV: 0		



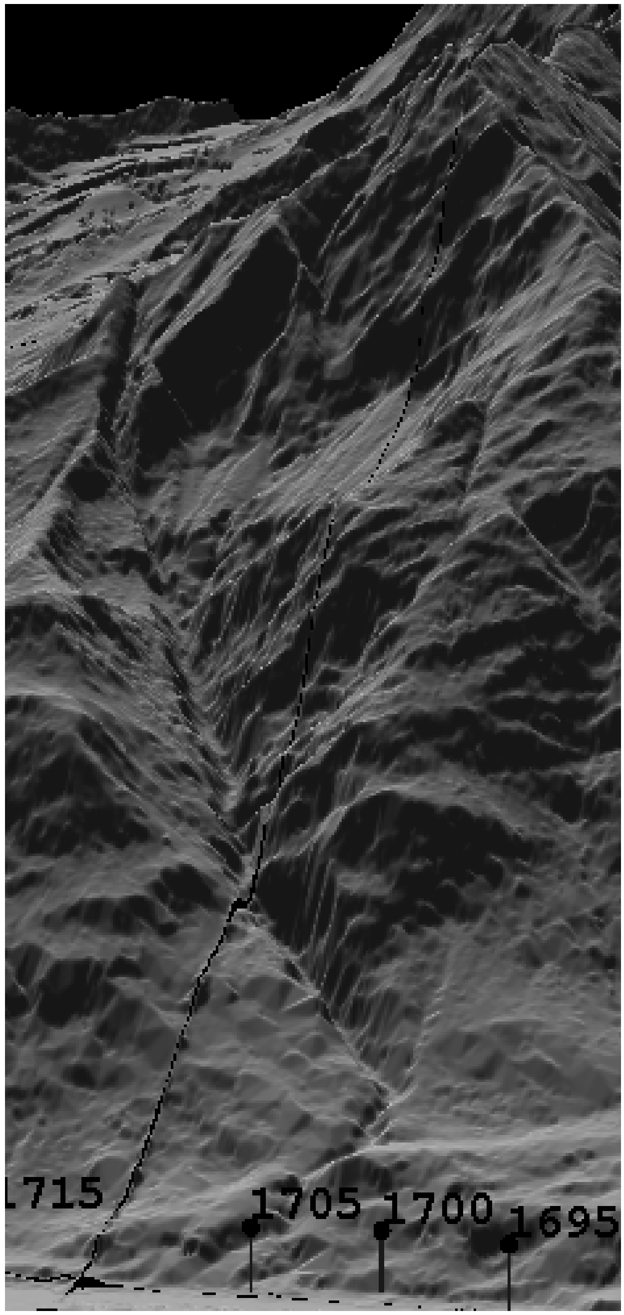
DF07. View east/upslope of debris flow channel and avalanche path ELC006.

Hazard ID #:	DF07
Hazard Type:	debris_flow
HIN:	171
Rating:	A
IRP 2006 Location:	1704
Frequency (yrs):	1-5
Predictability:	moderate
Material Volume (CY):	100-1000
Clast Size (ft):	1-2
Source Elev. (ft):	>1000
Centerline Slope:	multi_channel
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	1701+50
IRP 2006 North Margin:	1705+50
Photo #:	4366, 5155

Golder Associates	CADD: ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06		
	CHECK: RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-26**
PROJECT No. 063-5782	REV: 0		

DF07. Path and terminus of debris flow channel. IRP 2006 alignment located on beach.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-27**
PROJECT No. 063-5782	REV 0		



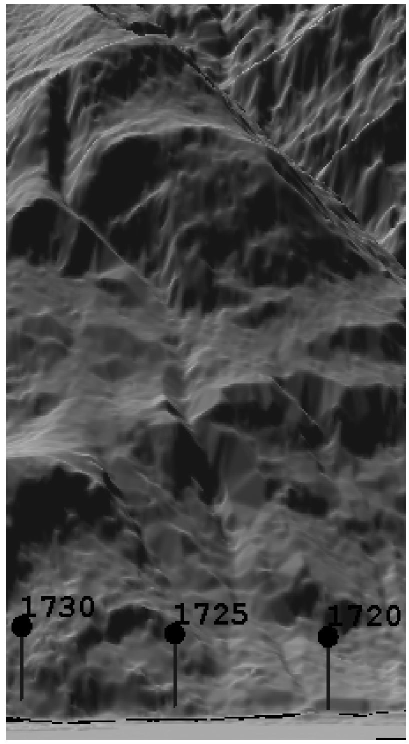
DF07. LIDAR image of debris flow channel and avalanche path ELC006.

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-28**
PROJECT No. 063-5782	REV	0		

DF08. View east/upslope at debris flow channel and avalanche path ELC007.

Hazard ID #:	DF08
Hazard Type:	debris_flow
HIN:	129
Rating:	A
IRP 2006 Location:	1720
Frequency (yrs):	1-5
Predictability:	high
Material Volume (CY):	10-100
Clast Size (ft):	1-2
Source Elev. (ft):	>1000
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	1719+90
IRP 2006 North Margin:	1720+80
Photo #:	1126, 5156

Golder Associates	CADD: ALF	TITLE: GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06	
	CHECK: RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV: 0	G-29



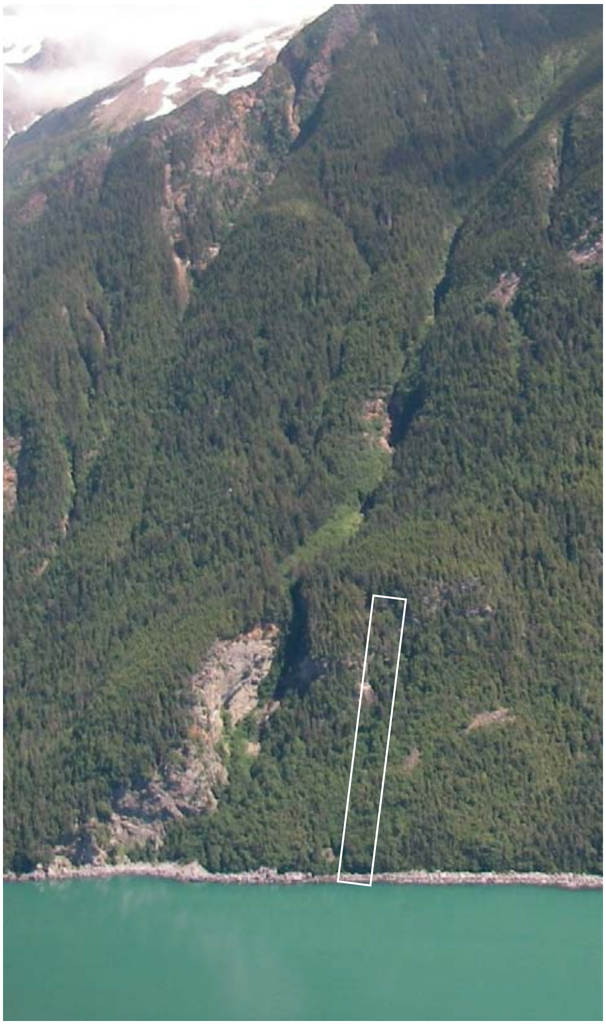
DF08. Bare earth LIDAR image of debris flow path.

DF08. View east/upslope at debris flow chute and avalanche path ELC007, 490 ft east of IRP 2006 1720+50.

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-30**

DF08. Debris flow deposition fan and avalanche path ELC007 at centerline at IRP 2006 1720+00.

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-31**
PROJECT No. 063-5782	REV	0		



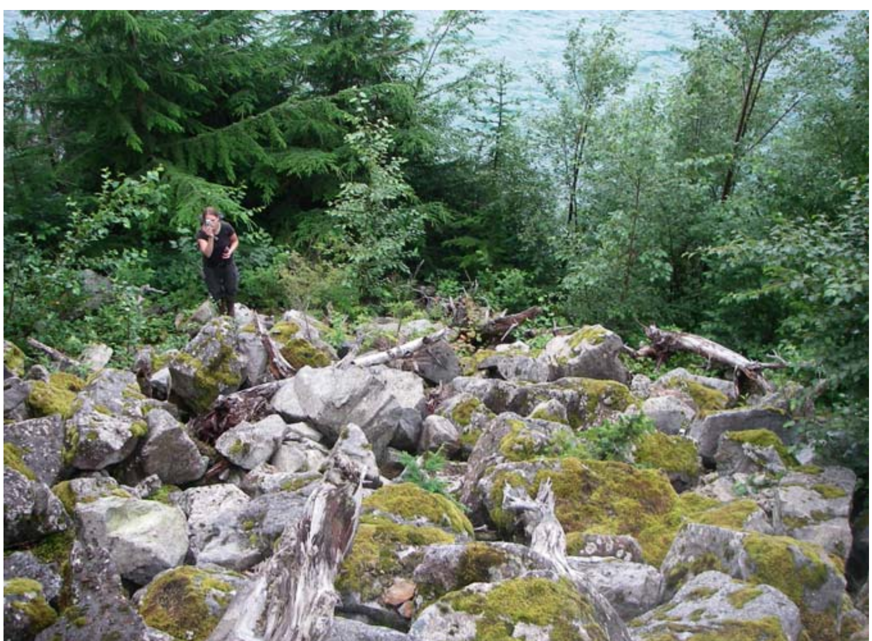
RF06. View east/upslope at rockfall area.

Hazard ID #:	RF06
Hazard Type:	rockfall
HIN:	183
Rating:	A
IRP 2006 Location:	1730
Frequency (yrs):	0-1
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	3-4
Source Elev. (ft):	100-500
Centerline Slope:	open_bedrock_slope
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1729+90
IRP 2006 North Margin:	1730+80
Photo #:	4674, 6206

Golder Associates

CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
DATE	11/27/06		
CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-32**
PROJECT No. 063-5782	REV 0		

RF06. View east/upslope at rockfall zone. IRP 2006 alignment located upslope of beach.



RF06. View west/downslope at rockfall. IRP 2006 1730+00 located at point where photo was taken.

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY**
	DATE 11/27/06	**ARRANGED BY IRP 2006 STATIONING**
	CHECK RGD	LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-33**

DF09. View east/upslope at debris flow channel and avalanche path ELC008.

Hazard ID #:	DF09
Hazard Type:	debris_flow
HIN:	153
Rating:	A
IRP 2006 Location:	1733
Frequency (yrs):	unknown (1-5?)
Predictability:	low
Material Volume (CY):	10-100
Clast Size (ft):	1-2
Source Elev. (ft):	>1000
Centerline Slope:	single_channel
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1732+50
IRP 2006 North Margin:	1734+40
Photo #:	3307

Golder Associates	CADD ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE 11/27/06			
	CHECK RGD			
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06		ADOT / LYNN CANAL HWY ZONE 4 / AK	G-34
PROJECT No. 063-5782	REV 0			

DF09. View east/upslope at debris flow path and avalanche path ELC008 through dense deciduous trees.

DF09. Debris flow and talus cone at base of debris flow and avalanche path ELC008 located at IRP 2006 1733+00.

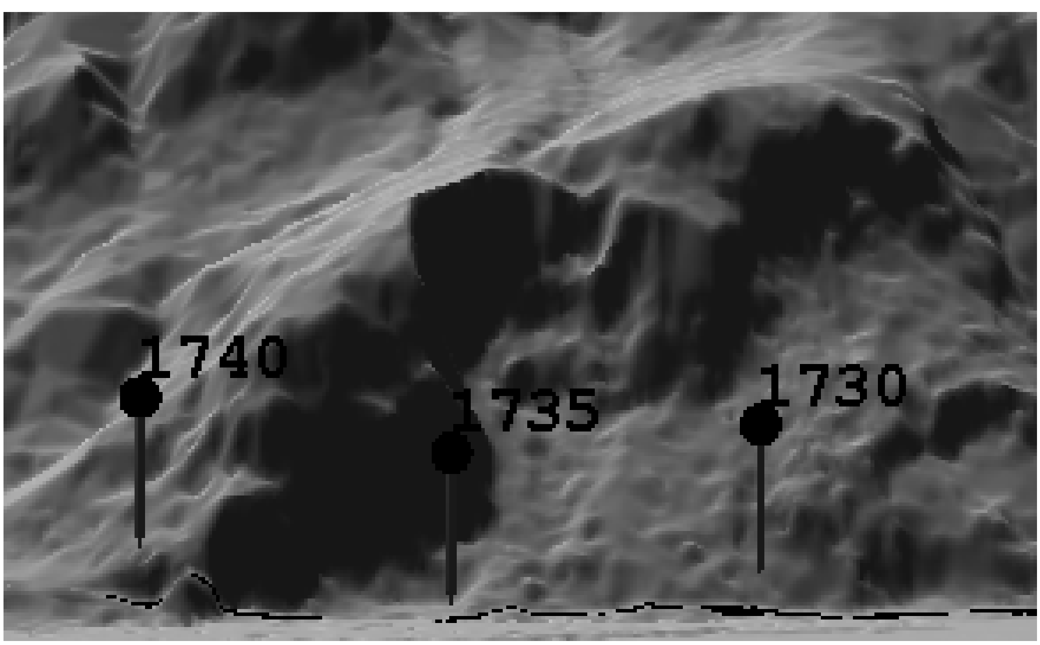
Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-35**
PROJECT No. 063-5782	REV 0		

RF07. View east/upslope at rockfall hazard area.

Hazard ID #:	RF07
Hazard Type:	rockfall
HIN:	279
Rating:	A
IRP 2006 Location:	1734
Frequency (yrs):	0-1
Predictability:	unpredictable
Material Volume (CY):	10-100
Clast Size (ft):	4+
Source Elev. (ft):	500-1000
Centerline Slope:	open_bedrock_slope
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	500+
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1724+80
IRP 2006 North Margin:	1739+80
Photo #:	4674

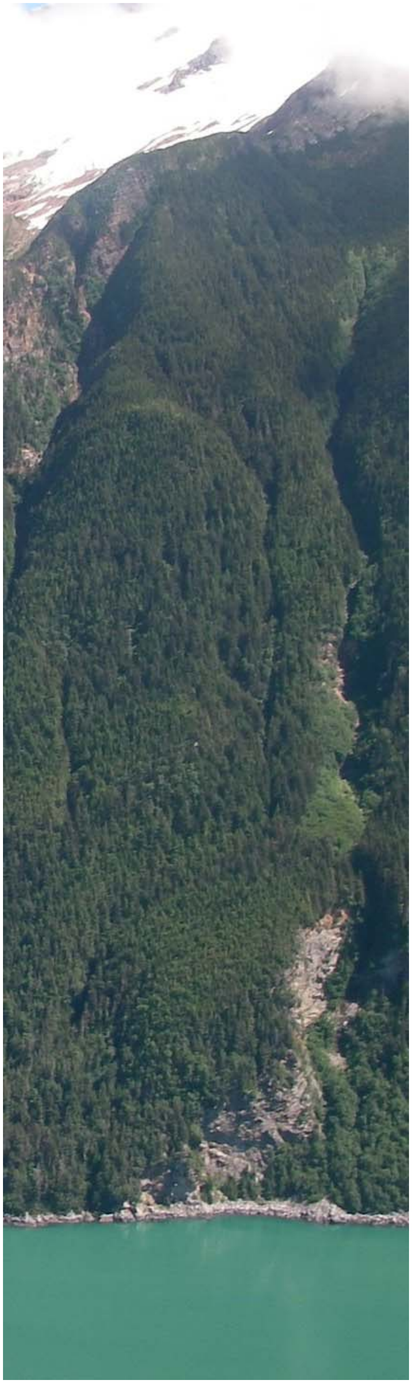
Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-36**

RF07. View east/upslope at 500 ft high gneiss cliffs with strong jointing and rockfall.



RF07. LIDAR image of rockfall hazard area.

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-37**
PROJECT No. 063-5782	REV	0		



DF10. View east/upslope at debris flow channel.

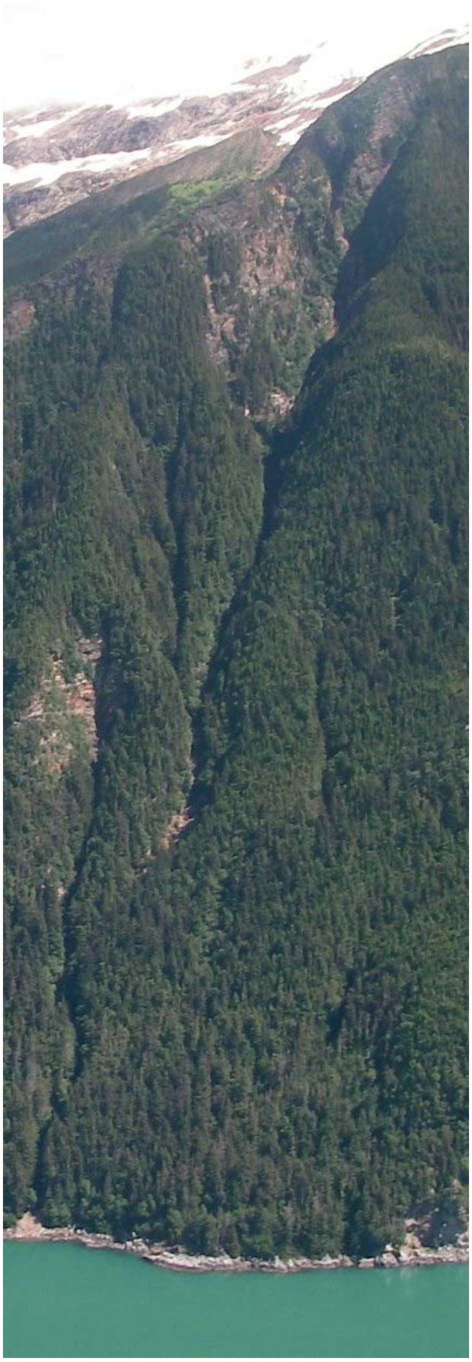
Hazard ID #:	DF10
Hazard Type:	debris_flow
HIN:	129
Rating:	A
IRP 2006 Location:	1743
Frequency (yrs):	1-5
Predictability:	high
Material Volume (CY):	10-100
Clast Size (ft):	0-1
Source Elev. (ft):	>1000
Centerline Slope:	multi_channel
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	denuded
Deciduous Trees:	no
IRP 2006 South Margin:	1742+50
IRP 2006 North Margin:	1743+40
Photo #:	4745-4748

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-38**

DF10. View southwest (downslope and down alignment) at multichannel debris flow deposits at centerline at IRP 2006 1743+00.

DF10. View east/upslope at debris flow terminus and deposition zone.

Golder Associates	CADD ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	G-39
PROJECT No. 063-5782	REV 0		



DF11. View east/upslope at debris flow channel and avalanche path ELC009.

Hazard ID #:	DF11
Hazard Type:	debris_flow
HIN:	129
Rating:	A
IRP 2006 Location:	1748
Frequency (yrs):	1-5
Predictability:	high
Material Volume (CY):	10-100
Clast Size (ft):	2-3
Source Elev. (ft):	>1000
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	1746+40
IRP 2006 North Margin:	1748+20
Photo #:	4741, 4742, 5157

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-40**
PROJECT No. 063-5782	REV 0		

DF11. View east/upslope at debris flow deposition zone.

DF11. View east/upslope at debris flow channel and avalanche path ELC009. Photo taken at centerline at IRP 2006 1747+00.

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-41**

DF12. View east/upslope at debris flow channel and avalanche path ELC010.

Hazard ID #:	DF12
Hazard Type:	debris_flow
HIN:	111
Rating:	A
IRP 2006 Location:	1752
Frequency (yrs):	5-25
Predictability:	high
Material Volume (CY):	10-100
Clast Size (ft):	2-3
Source Elev. (ft):	>1000
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1751+00
IRP 2006 North Margin:	1752+00
Photo #:	4738, 4739, 5157

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-42**

DF12. View east/upslope at debris flow channel and avalanche path ELC010. Photo taken 85 ft right of IRP 2006 1751+50.

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-43**
PROJECT No. 063-5782	REV	0		

DF13. View east/upslope at debris flow channel and avalanche path ELC011.

Hazard ID #:	DF13
Hazard Type:	debris_flow
HIN:	129
Rating:	A
IRP 2006 Location:	1757
Frequency (yrs):	1-5
Predictability:	high
Material Volume (CY):	10-100
Clast Size (ft):	2-3
Source Elev. (ft):	>1000
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	1756+10
IRP 2006 North Margin:	1757+50
Photo #:	4736, 4737, 5157

DF13. View east/upslope at debris flow channel and avalanche path ELC011. Photo taken 30 ft right of IRP 2006 1757+00.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-45**
PROJECT No. 063-5782	REV 0		

RF08. View east/upslope at rockfall hazard.

Hazard ID #:	RF08
Hazard Type:	rockfall
HIN:	183
Rating:	A
IRP 2006 Location:	1759
Frequency (yrs):	5-25
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	4+
Source Elev. (ft):	100-500
Centerline Slope:	open_soil_slope
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	500+
Vegetation:	disturbed
Deciduous Trees:	no
IRP 2006 South Margin:	1759+30
IRP 2006 North Margin:	1767+00
Photo #:	5039, 5040, 5041, 5157, 6209

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06	
	CHECK: RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK — **G-46**
PROJECT No. 063-5782	REV: 0	

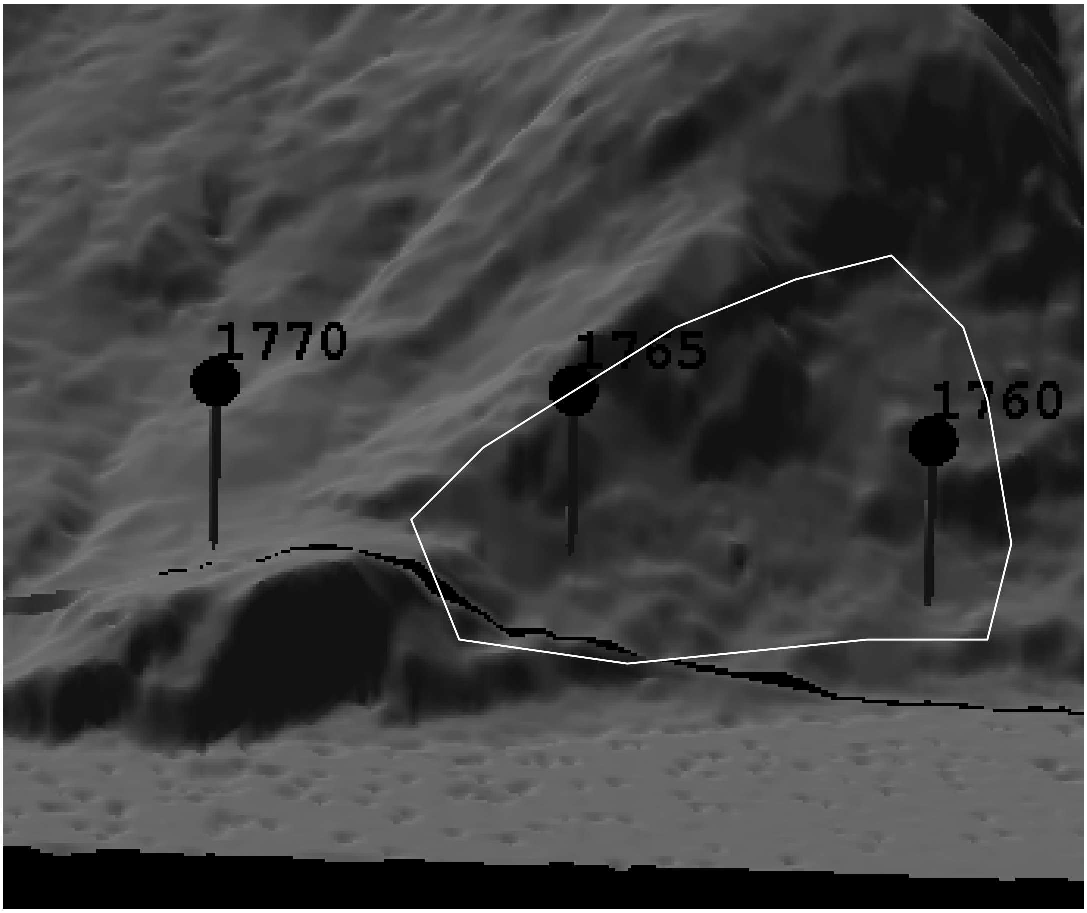
RF08. View southwest (downslope and down alignment) at rockfall debris at IRP 2006 1760+00.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-47**
PROJECT No. 063-5782	REV 0		

RF09. View east/upslope at area of greater frequency rockfall within rockfall area RF08.

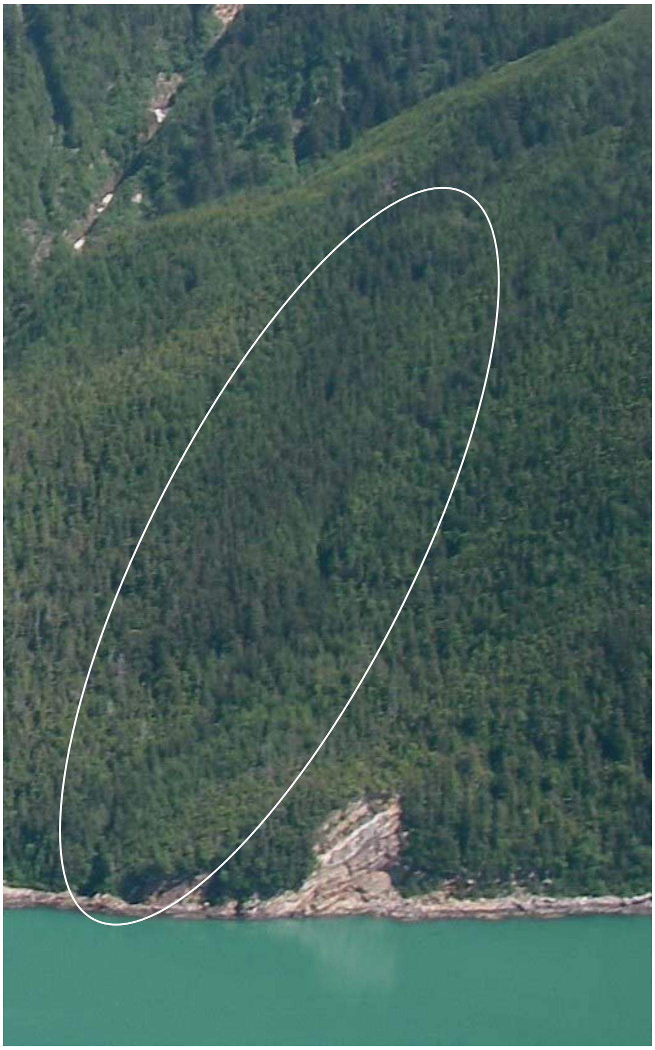
Hazard ID #:	RF09
Hazard Type:	rockfall
HIN:	129
Rating:	A
IRP 2006 Location:	1763
Frequency (yrs):	1-5
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	2-3
Source Elev. (ft):	100-500
Centerline Slope:	open_soil_slope
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1763+20
IRP 2006 North Margin:	1763+80
Photo #:	3878

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-48**
PROJECT No. 063-5782	REV 0		



RF09. LIDAR image of rockfall hazard.

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE	11/27/06			
	CHECK	RGD			
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06		ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-49**
PROJECT No. 063-5782	REV	0			



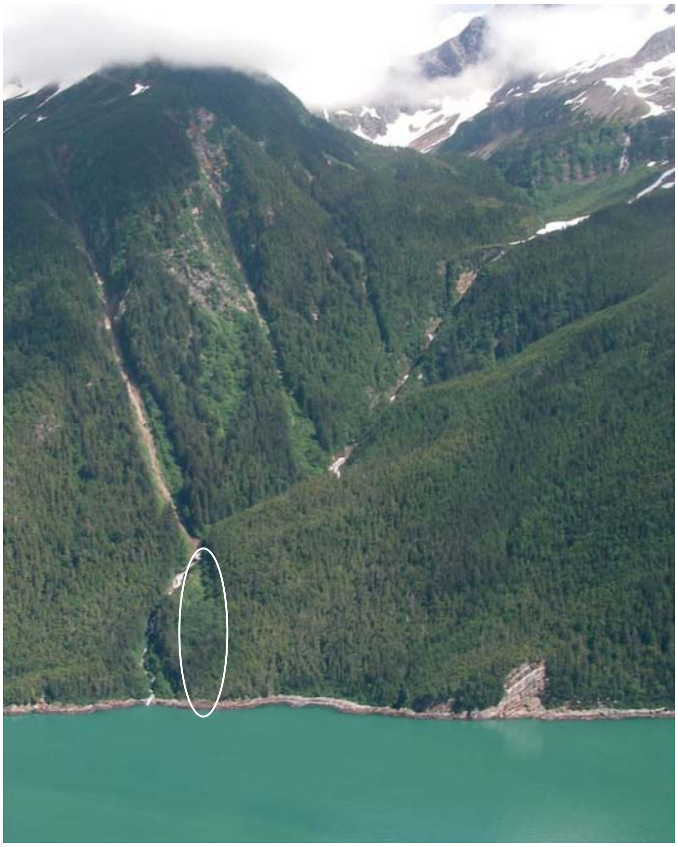
DF14. View east/upslope at debris flow channel.

Hazard ID #:	DF14
Hazard Type:	debris_flow
HIN:	111
Rating:	A
IRP 2006 Location:	1773
Frequency (yrs):	25+
Predictability:	moderate
Material Volume (CY):	10-100
Clast Size (ft):	2-3
Source Elev. (ft):	>1000
Centerline Slope:	single_channel
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	no
IRP 2006 South Margin:	1772+50
IRP 2006 North Margin:	1773+60
Photo #:	2093, 4714

Golder Associates	CADD: ALF	TITLE: GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING, LYNN CANAL HIGHWAY PHASE I, ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06	
	CHECK: RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV: 0	G-50

DF14. View east/upslope at debris flow channel. Old levee walls visible on far left and right sides of photo. Photo taken 30 ft left of IRP 2006 1773+00.

Golder Associates	CADD	ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	G-51
PROJECT No. 063-5782	REV	0		



DF15. View east/upslope at debris flow channel and avalanche path ELC012.

Hazard ID #:	DF15
Hazard Type:	debris_flow
HIN:	207
Rating:	B
IRP 2006 Location:	1782
Frequency (yrs):	5-25
Predictability:	moderate
Material Volume (CY):	1000+
Clast Size (ft):	2-3
Source Elev. (ft):	>1000
Centerline Slope:	multi_channel
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1782+00
IRP 2006 North Margin:	1783+00
Photo #:	3912

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06	
	CHECK: RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV: 0	**G-52**

DF15. View east/upslope at debris flow channel.

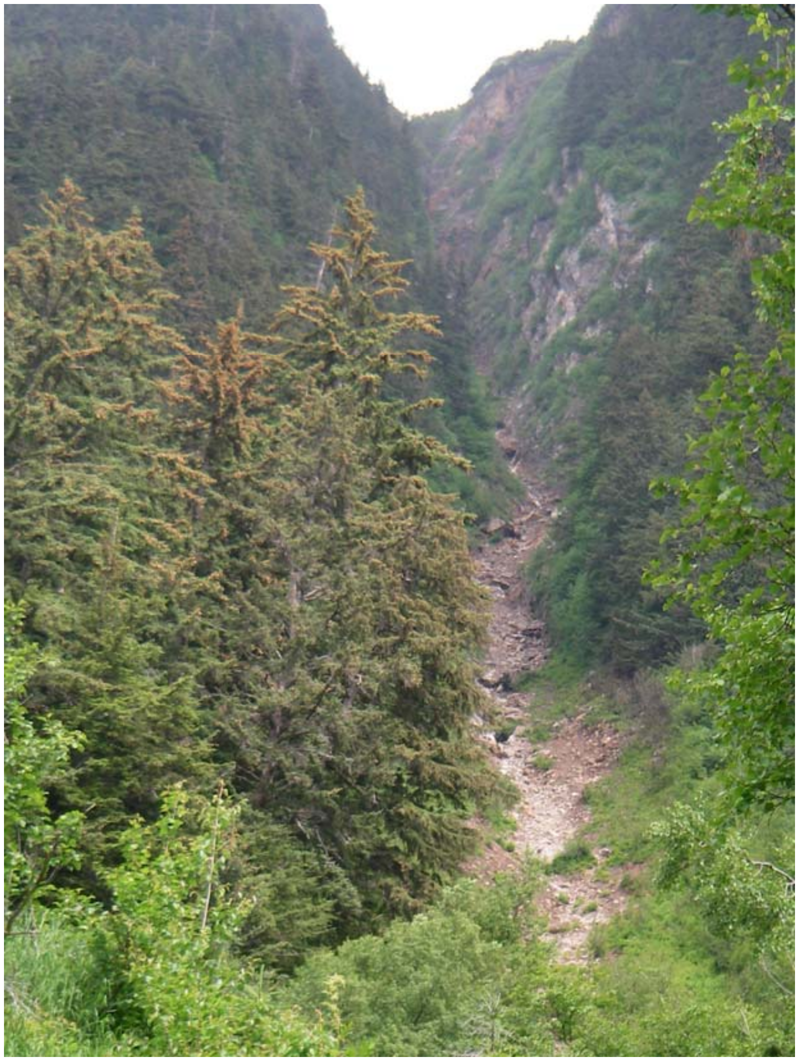
DF15. View east/upslope at abandoned/infrequently occupied debris flow path at IRP 2006 1782+00. During large events, this is believed to be an overflow channel from the adjacent, active debris flow channel at IRP 2006 1784+00.

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-53**
PROJECT No. 063-5782	REV	0		

DF16. View east/upslope at debris flow channel and avalanche path ELC012.

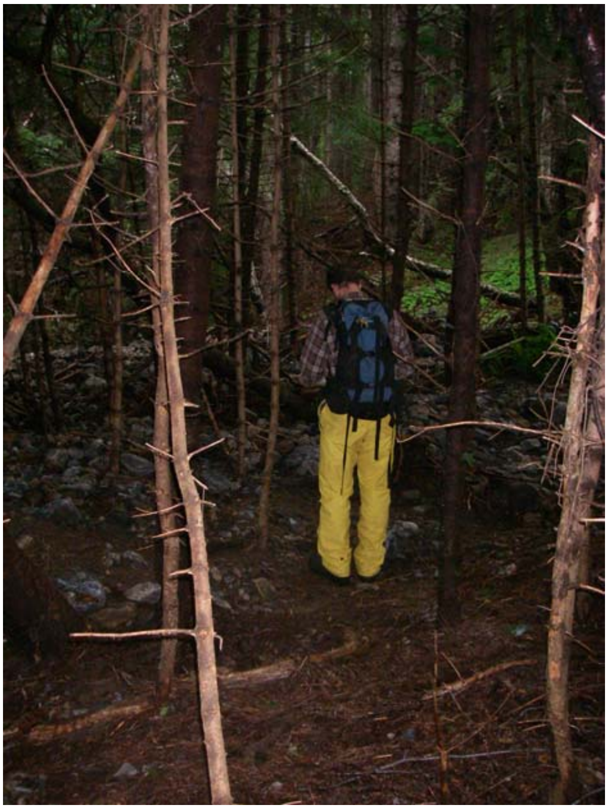
Hazard ID #:	DF16
Hazard Type:	debris_flow
HIN:	225
Rating:	A
IRP 2006 Location:	1783
Frequency (yrs):	1-5
Predictability:	moderate
Material Volume (CY):	1000+
Clast Size (ft):	2-3
Source Elev. (ft):	>1000
Centerline Slope:	multi_channel
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1783+00
IRP 2006 North Margin:	1785+30
Photo #:	1141, 2091, 5158

Golder Associates	CADD ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	G-54
PROJECT No. 063-5782	REV 0		



DF16. View east/upslope at tributary to debris flow channel and avalanche path ELC012. Photo taken 450 ft right of IRP 2006 1784+00.

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-55**
PROJECT No. 063-5782	REV	0		



DF17. View north/up alignment at margin of old debris flow and recent debris flow. Photo taken at centerline at IRP 2006 1825+00.

Hazard ID #:	DF17
Hazard Type:	debris_flow
HIN:	147
Rating:	B
IRP 2006 Location:	1824
Frequency (yrs):	25+
Predictability:	low
Material Volume (CY):	10-100
Clast Size (ft):	1-2
Source Elev. (ft):	2000-3000
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1824+10
IRP 2006 North Margin:	1825+50
Photo #:	1186, 4012, 4015, 5159, 6232

DF18. Debris flow and avalanche path ELC013.

Hazard ID #:	DF18
Hazard Type:	debris_flow
HIN:	147
Rating:	A
IRP 2006 Location:	1826
Frequency (yrs):	1-5
Predictability:	high
Material Volume (CY):	10-100
Clast Size (ft):	0-1
Source Elev. (ft):	2000-3000
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1825+50
IRP 2006 North Margin:	1827+50
Photo #:	1186, 4012, 4015, 5159, 6232

DF18. View east/upslope at debris flow.

Golder Associates	CADD: ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06		
	CHECK: RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	G-57
PROJECT No. 063-5782	REV: 0		

DF18. View east/upslope at debris flow and avalanche path ELC013. Photo taken 100 ft right of IRP 2006 1826+00.

Golder Associates	CADD	ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	G-58
PROJECT No. 063-5782	REV	0		

DF18. View southwest (downslope and down alignment) down a major creek, debris flow fan, and recent deposits that buried small conifer trees. Photo taken 50 ft right of IRP 2006 1826+50. Fan continues across alignment.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-59**
PROJECT No. 063-5782	REV 0		

DF19. View east/upslope at debris flow channel and avalanche path ELC014.

Hazard ID #:	DF19
Hazard Type:	debris_flow
HIN:	153
Rating:	A
IRP 2006 Location:	1847
Frequency (yrs):	5-25
Predictability:	low
Material Volume (CY):	10-100
Clast Size (ft):	0-1
Source Elev. (ft):	3000+
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	1845+30
IRP 2006 North Margin:	1849+90
Photo #:	4809, 4812, 4830, 5160

Golder Associates	CADD ALF	TITLE GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	G-60

DF19. View east/upslope from beach at debris flow and avalanche path ELC014. Photo taken 190 ft left of IRP 2006 1847+50.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-61**
PROJECT No. 063-5782	REV 0		

DF20. View east/upslope at debris flow channel.

Hazard ID #:	DF20
Hazard Type:	debris_flow
HIN:	153
Rating:	B
IRP 2006 Location:	1852
Frequency (yrs):	5-25
Predictability:	low
Material Volume (CY):	10-100
Clast Size (ft):	0-1
Source Elev. (ft):	3000+
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	1852+00
IRP 2006 North Margin:	1853+10
Photo #:	1210, 5160

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY**
	DATE 11/27/06	**ARRANGED BY IRP 2006 STATIONING**
	CHECK RGD	LYNN CANAL HIGHWAY PHASE I
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ZONE 4 GEOTECHNICAL INVESTIGATION
PROJECT No. 063-5782	REV 0	ADOT / LYNN CANAL HWY ZONE 4 / AK — **G-62**

DF20. View east/upslope at debris channel. Stream is poorly channelized as a result of a high sediment/debris supply. Photo taken at centerline at IRP 2006 1852+50.

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-63**
PROJECT No. 063-5782	REV	0		

RF10. View east/upslope at rockfall.

Hazard ID #:	RF10
Hazard Type:	rockfall
HIN:	111
Rating:	C
IRP 2006 Location:	1854
Frequency (yrs):	unknown (5-25?)
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	2-3
Source Elev. (ft):	100-500
Centerline Slope:	other
Alignment Location:	below_deposition zone
Impact Alignment:	no
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1853+30
IRP 2006 North Margin:	1854+30
Photo #:	4816

Golder Associates	CADD ALF	TITLE
	DATE 11/27/06	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-64**

RF10. View at basalt cliffs that create the rockfall zone. Photo taken 775 ft right of IRP 2006 alignment.

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-65**
PROJECT No. 063-5782	REV	0		

RF11. View east/upslope at rockfall area.

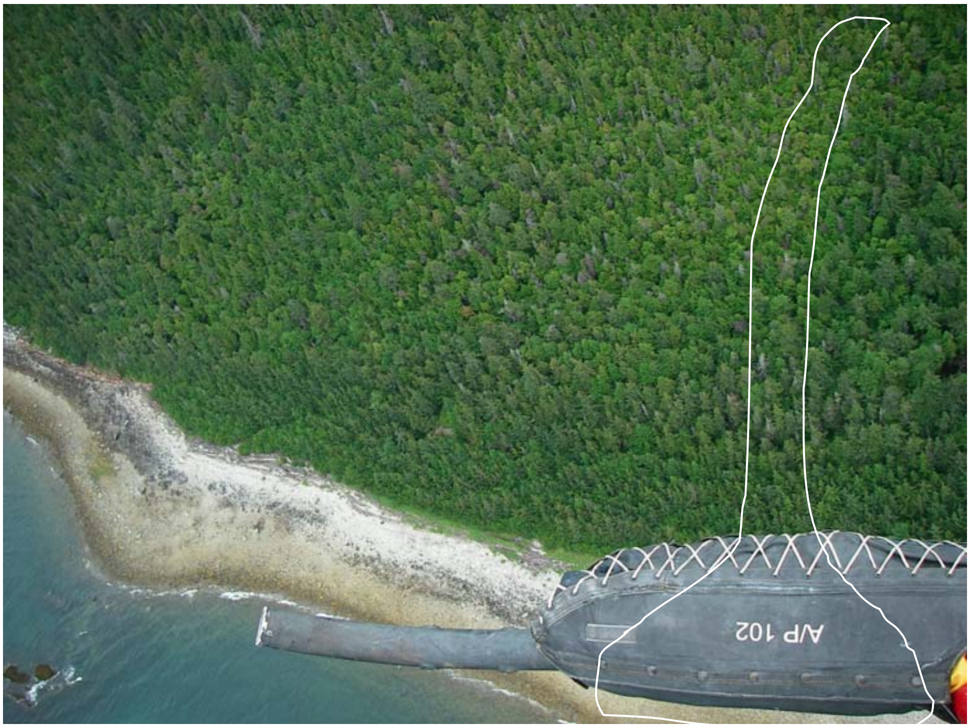
RF11. View east/upslope at minor rockfall hazard located at centerline at IRP 2006 1865+00.

Hazard ID #:	RF11
Hazard Type:	rockfall
HIN:	105
Rating:	B
IRP 2006 Location:	1865
Frequency (yrs):	5-25
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	2-3
Source Elev. (ft):	<100
Centerline Slope:	open_soil_slope
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1864+80
IRP 2006 North Margin:	1866+00
Photo #:	6234

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-66**
PROJECT No. 063-5782	REV 0		

DF21. View west/downslope at debris flow deposition zone, 250 ft left of IRP 2006 1894+00.

Hazard ID #:	DF21
Hazard Type:	debris_flow
HIN:	123
Rating:	B
IRP 2006 Location:	1894
Frequency (yrs):	1-5
Predictability:	high
Material Volume (CY):	<10
Clast Size (ft):	0-1
Source Elev. (ft):	2000-3000
Centerline Slope:	single_channel
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1893+30
IRP 2006 North Margin:	1894+40
Photo #:	5161, 6238



DF21. View east/upslope at moderate slope old growth covering the debris flow channel.

DF21. View east/upslope at debris flow channel 120 ft right of IRP 2006 1895+00.

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE	11/27/06			
	CHECK	RGD			
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK		**G-68**
PROJECT No. 063-5782	REV	0			

RF12. View east/upslope at rockfall area.

Hazard ID #:	RF12
Hazard Type:	rockfall
HIN:	105
Rating:	C
IRP 2006 Location:	1915
Frequency (yrs):	unknown (>25?)
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	4+
Source Elev. (ft):	100-500
Centerline Slope:	-
Alignment Location:	below_deposition_zone
Impact Alignment:	no
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1915+20
IRP 2006 North Margin:	1916+50
Photo #:	5162

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-69**

RF13. View east/upslope at rockfall area.

Hazard ID #:	RF13
Hazard Type:	rockfall
HIN:	111
Rating:	C
IRP 2006 Location:	1932
Frequency (yrs):	0-1
Predictability:	moderate
Material Volume (CY):	<10
Clast Size (ft):	1-2
Source Elev. (ft):	100-500
Centerline Slope:	-
Alignment Location:	below_deposition_zone
Impact Alignment:	no
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1931+80
IRP 2006 North Margin:	1933+00
Photo #:	5162

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-70**
PROJECT No. 063-5782	REV	0		

Hazard ID #:	RF14
Hazard Type:	rockfall
HIN:	129
Rating:	B
IRP 2006 Location:	1935
Frequency (yrs):	unknown (5-25?)
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	2-3
Source Elev. (ft):	100-500
Centerline Slope:	-
Alignment Location:	below_deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	no
IRP 2006 South Margin:	1933+70
IRP 2006 North Margin:	1953+00
Photo #:	5163, 5909, 5910, 5911

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY**
	DATE: 11/27/06	**ARRANGED BY IRP 2006 STATIONING**
	CHECK: RGD	LYNN CANAL HIGHWAY PHASE I
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ZONE 4 GEOTECHNICAL INVESTIGATION
PROJECT No. 063-5782	REV: 0	ADOT / LYNN CANAL HWY ZONE 4 / AK — **G-71**

RF14. View east/upslope at moderate rockfall hazard from IRP 2006 1933+00 to 1953+00, below massive gneiss cliffs.

RF14. View west/downslope at fresh rockfall at IRP 2006 1933+00, 3-4 ft diameter boulders.

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-72**

Hazard ID #:	RF15
Hazard Type:	rockfall
HIN:	129
Rating:	B
IRP 2006 Location:	1948
Frequency (yrs):	5-25
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	4+
Source Elev. (ft):	100-500
Centerline Slope:	other
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	1946+80
IRP 2006 North Margin:	1949+00
Photo #:	5163

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-73**

RF15. View east/upslope at rockfall area within rockfall area RF14.

RF15. View east/upslope at large cliffs, fresh rockfall scars, 240 ft right of IRP 2006 1948+00.

Golder Associates	CADD	ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE	11/27/06			
	CHECK	RGD			
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06		ADOT / LYNN CANAL HWY ZONE 4 / AK	G-74
PROJECT No. 063-5782	REV	0			

RF15. View north/up alignment across deposit of fresh 2 ft diameter rockfall. Photo taken 240 ft east of IRP 2006 1948+00.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-75**
PROJECT No. 063-5782	REV 0		

DF22. View east/upslope at debris flow channel and avalanche path ELC016.

DF22. View east/upslope at debris flow channel.

Hazard ID #:	DF22
Hazard Type:	debris_flow
HIN:	147
Rating:	A
IRP 2006 Location:	1984
Frequency (yrs):	1-5
Predictability:	high
Material Volume (CY):	10-100
Clast Size (ft):	1-2
Source Elev. (ft):	2000-3000
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	no
IRP 2006 South Margin:	1983+30
IRP 2006 North Margin:	1985+70
Photo #:	5047, 5164, 5914

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-76**

DF22. View southwest (downslope and down alignment) at debris flow fan and avalanche path ELC016. Photo taken 50 ft right of IRP 2006 1984+00.

Golder Associates	CADD	ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	G-77
PROJECT No. 063-5782	REV	0		

RF16. View east/upslope at rockfall hazard.

RF16. View east/upslope at rockfall area.

Hazard ID #:	RF16
Hazard Type:	rockfall
HIN:	129
Rating:	B
IRP 2006 Location:	2015
Frequency (yrs):	unknown (5-25?)
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	3-4
Source Elev. (ft):	100-500
Centerline Slope:	deciduous_trees
Alignment Location:	below_deposition _zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2015+00
IRP 2006 North Margin:	2017+40
Photo #:	5052, 5053, 6240

Golder Associates

CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
DATE	11/27/06		
CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-78**
PROJECT No. 063-5782	REV 0		

RF16. View north/up alignment across low frequency rockfall area 240 ft east of IRP 2006 2016+20.

Golder Associates	CADD ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	G-79
PROJECT No. 063-5782	REV 0		

DF23. View east/upslope at debris flow channel and avalanche path ELC017.

DF23. View east/upslope at debris flow channel and avalanche path ELC017.

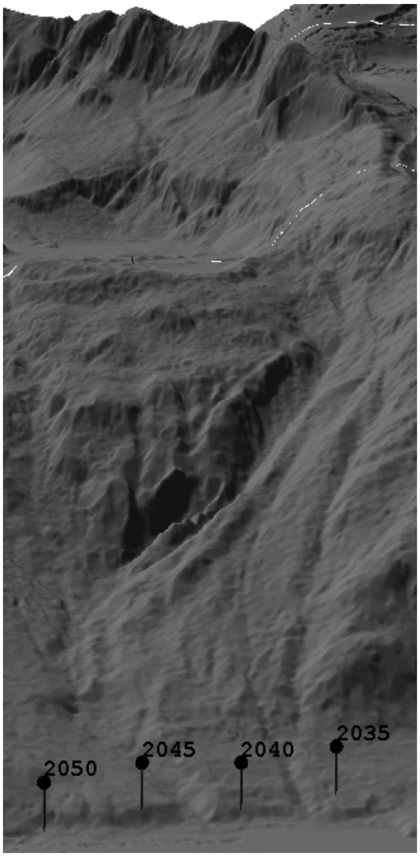
Hazard ID #:	DF23
Hazard Type:	debris_flow
HIN:	117
Rating:	A
IRP 2006 Location:	2038
Frequency (yrs):	5-25
Predictability:	moderate
Material Volume (CY):	10-100
Clast Size (ft):	1-2
Source Elev. (ft):	3000+
Centerline Slope:	multi_channel
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2041+20
IRP 2006 North Margin:	2042+70
Photo #:	5057, 5166

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-80**

DF23. View southwest (downslope and down alignment) into multi-channel debris flow at centerline. Secondary channel is seen to right of person. Person is located at centerline at IRP 2006 2042+00.

DF23. View east/upslope at debris flow channel and avalanche path ELC017. Photo taken 1,200 ft right of IRP 2006 2042+00.

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-81**



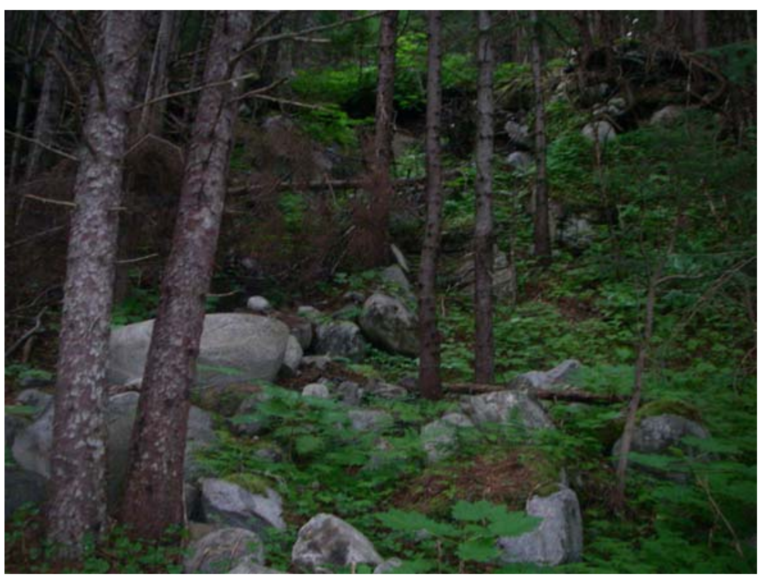
SR01. LIDAR image of soil raveling area.

SR01. View east/upslope at soil raveling area.

Hazard ID #:	SR01
Hazard Type:	soil_raveling
HIN:	171
Rating:	B
IRP 2006 Location:	2042
Frequency (yrs):	0-1
Predictability:	high
Material Volume (CY):	<10
Clast Size (ft):	1-2
Source Elev. (ft):	<100
Centerline Slope:	open_soil_slope
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	500+
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2043+40
IRP 2006 North Margin:	2050+10
Photo #:	5090, 5166, 6244

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-82**

SR01. View northwest (up alignment and downslope) across soil raveling slope with 1-3 ft diameter boulders being deposited 15 ft left or IRP 2006 2047+00.



SR01. View east/upslope at soil raveling with 0-3 ft diameter boulders deposited 15 ft left of IRP 2006 alignment.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-83**
PROJECT No. 063-5782	REV 0		

DF24. View east/upslope at debris flow channel and avalanche path ELC018 (circled, right) and avalanche path ELC019 (with major stream, center).

Hazard ID #:	DF24
Hazard Type:	debris_flow
HIN:	207
Rating:	B
IRP 2006 Location:	2054
Frequency (yrs):	1-5
Predictability:	high
Material Volume (CY):	10-100
Clast Size (ft):	1-2
Source Elev. (ft):	3000+
Centerline Slope:	multi_channel
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2054+40
IRP 2006 North Margin:	2056+50
Photo #:	2054, 2239, 3462, 3463, 5093, 6195

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-84**

DF24. View east/upslope at debris flow channel and avalanche path ELC018 (circled, right) and avalanche path ELC019 (with major stream, center).

DF24. View south/ down alignment across debris flow fan terminus at IRP 2006 2055+00.

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	G-85

DF24. View north/up alignment across debris flow fan at centerline at IRP 2006 2055+00.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-86**
PROJECT No. 063-5782	REV 0		

DF25. View east/upslope at debris flow channel.

DF25. View east/upslope at debris flow channel.

Hazard ID #:	DF25
Hazard Type:	debris_flow
HIN:	129
Rating:	B
IRP 2006 Location:	2055
Frequency (yrs):	5-25
Predictability:	moderate
Material Volume (CY):	<10
Clast Size (ft):	0-1
Source Elev. (ft):	3000+
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	no
IRP 2006 South Margin:	2056+50
IRP 2006 North Margin:	2059+00
Photo #:	3462, 3463, 5093, 6195

Golder Associates	CADD ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE 11/27/06			
	CHECK RGD			
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PROJECT No. 063-5782	REV 0			

DF26. View east/upslope at debris flow channel and avalanche path ELC019.

DF26. View east/upslope at debris flow channel and avalanche path ELC019 (center).

Hazard ID #:	DF26
Hazard Type:	debris_flow
HIN:	129
Rating:	B
IRP 2006 Location:	2056
Frequency (yrs):	1-5
Predictability:	high
Material Volume (CY):	10-100
Clast Size (ft):	0-1
Source Elev. (ft):	3000+
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2059+00
IRP 2006 North Margin:	2060+50
Photo #:	2241, 3470, 6195

Golder Associates	CADD: ALF	TITLE: GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06	
	CHECK: RGD	
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DF26. View east/upslope at debris flow channel and avalanche path ELC019. Photo taken 20 ft left of IRP 2006 2059+50.

Golder Associates	CADD: ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06		
	CHECK: RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-89**
PROJECT No. 063-5782	REV: 0		

DF27. View east/upslope at debris flow channel and avalanche path ELC019-1.

Hazard ID #:	DF27
Hazard Type:	debris_flow
HIN:	129
Rating:	B
IRP 2006 Location:	2088
Frequency (yrs):	5-25
Predictability:	Low
Material Volume (CY):	<10
Clast Size (ft):	0-1
Source Elev. (ft):	2000-3000
Centerline Slope:	open_soil_slope
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2088+00
IRP 2006 North Margin:	2089+00
Photo #:	3885, 5167, 5924, 6247

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
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DF27. View east/upslope at debris flow channel and avalanche path ELC019-1. Photo taken at centerline at IRP 2006 2088+50.

Golder Associates	CADD ALF	TITLE GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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	CHECK RGD	
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DF28. View east/upslope at debris flow channel.

DF28. View northwest (up alignment and downslope) at IRP 2006 2103+00 at deposition fan of debris flow.

Hazard ID #:	DF28
Hazard Type:	debris_flow
HIN:	183
Rating:	A
IRP 2006 Location:	2104
Frequency (yrs):	0-1
Predictability:	high
Material Volume (CY):	10-100
Clast Size (ft):	3-4
Source Elev. (ft):	3000+
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	2102+30
IRP 2006 North Margin:	2103+70
Photo #:	3886, 5916

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-92**
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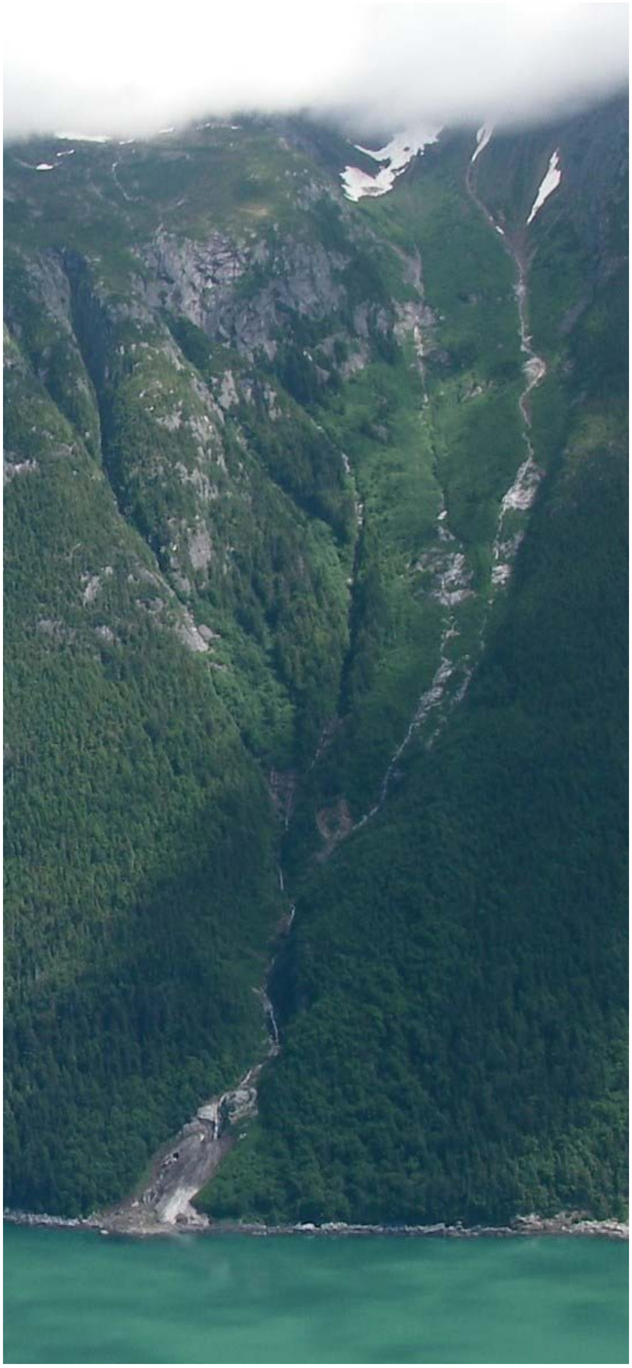

DF29. View east/upslope at debris flow channel and avalanche path ELC020.

Hazard ID #:	DF29
Hazard Type:	debris_flow
HIN:	153
Rating:	A
IRP 2006 Location:	2114
Frequency (yrs):	1-5
Predictability:	moderate
Material Volume (CY):	10-100
Clast Size (ft):	1-2
Source Elev. (ft):	3000+
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	2115+00
IRP 2006 North Margin:	2117+40
Photo #:	5125, 5926, 6248

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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	CHECK RGD		
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DF29. View northeast (up alignment and upslope) at debris flow deposition zone and avalanche path ELC020.

DF29. View north/up alignment across debris flow fan 15 ft left of IRP 2006 2117+00 at base of avalanche path ELC020.

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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PROJECT No. 063-5782	REV 0	

DF30. View east/upslope at debris flow path.

DF30. Disturbed vegetation marks path of debris flow.

Hazard ID #:	DF30
Hazard Type:	debris_flow
HIN:	135
Rating:	B
IRP 2006 Location:	2123
Frequency (yrs):	5-25
Predictability:	low
Material Volume (CY):	10-100
Clast Size (ft):	0-1
Source Elev. (ft):	1000-2000
Centerline Slope:	single_channel
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2123+00
IRP 2006 North Margin:	2123+90
Photo #:	5168, 5927, 6250

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE: 11/27/06		
	CHECK: RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-95**
PROJECT No. 063-5782	REV: 0		

RF17. View east/upslope at rockfall hazard area.

Hazard ID #:	RF17
Hazard Type:	rockfall
HIN:	201
Rating:	A
IRP 2006 Location:	2129
Frequency (yrs):	1-5
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	3-4
Source Elev. (ft):	1000-2000
Centerline Slope:	open_soil_slope
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2129+00
IRP 2006 North Margin:	2130+00
Photo #:	5928, 6251

Golder Associates	CADD ALF	TITLE GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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RF17. View east/upslope at rockfall path.

RF17. View south/down alignment across rockfall with 3-5 ft diameter boulders at IRP 2006 2129+50.

Golder Associates	CADD ALF	TITLE GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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SR02. View east/upslope at soil raveling area.

Hazard ID #:	SR02
Hazard Type:	soil_raveling
HIN:	171
Rating:	B
IRP 2006 Location:	2130
Frequency (yrs):	0-1
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	0-1
Source Elev. (ft):	<100
Centerline Slope:	single_channel
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	<50
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2129+40
IRP 2006 North Margin:	2129+80
Photo #:	3889, 5168

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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	CHECK: RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
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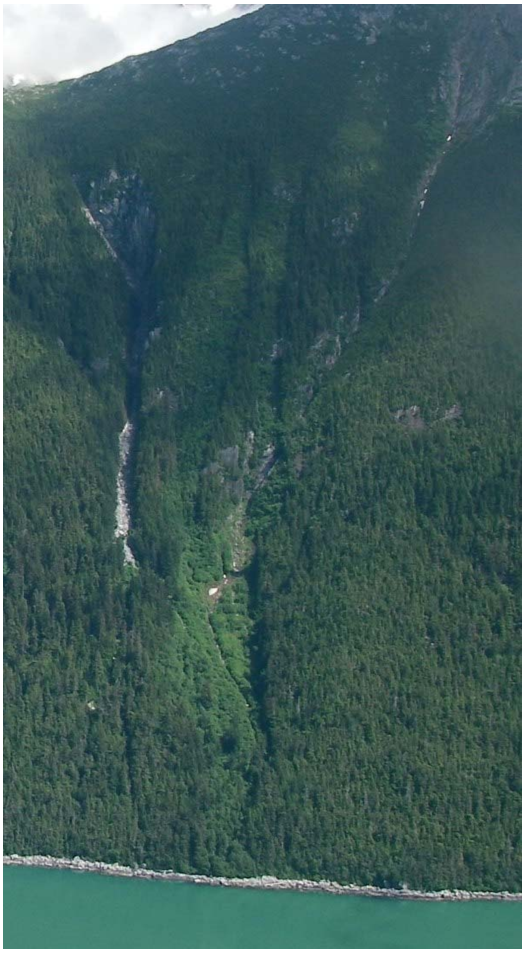

RF18. View east/upslope at rockfall area.

RF18. View east/upslope at rockfall area.

Hazard ID #:	RF18
Hazard Type:	rockfall
HIN:	105
Rating:	C
IRP 2006 Location:	2134
Frequency (yrs):	unknown (5-25?)
Predictability:	unpredictable
Material Volume (CY):	10-100
Clast Size (ft):	1-2
Source Elev. (ft):	<100
Centerline Slope:	open_bedrock_slope
Alignment Location:	starting_zone
Impact Alignment:	no
Alignment Exposure (ft):	<50
Vegetation:	-
Deciduous Trees:	no
IRP 2006 South Margin:	2134+00
IRP 2006 North Margin:	2134+50
Photo #:	1751, 3490, 5169, 5929

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-99**

DF31. View east/upslope at debris flow path and base avalanche path ELC021.

Hazard ID #:	DF31
Hazard Type:	debris_flow
HIN:	111
Rating:	A
IRP 2006 Location:	2142
Frequency (yrs):	5-25
Predictability:	high
Material Volume (CY):	10-100
Clast Size (ft):	1-2
Source Elev. (ft):	3000+
Centerline Slope:	multi_channel
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	2140+50
IRP 2006 North Margin:	2142+30
Photo #:	5168, 5169, 5929, 5930

RF19. View east/upslope at large rockfall area.

RF19. Fresh 6 ft diameter mega-boulder and related deforestation at centerline at IRP 2006 2144+00.

Hazard ID #:	RF19
Hazard Type:	rockfall
HIN:	273
Rating:	A
IRP 2006 Location:	2144
Frequency (yrs):	1-5
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	4+
Source Elev. (ft):	3000+
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	500+
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2142+70
IRP 2006 North Margin:	2150+30
Photo #:	1357, 3491, 3493, 3495, 3498, 5130, 5168

RF19. View west/downslope at rockfall debris deposited at centerline at IRP 2006 2144+00.

RF19. View west/downslope at rockfall path. Photo taken 400 ft right of IRP 2006 2145+00.

Golder Associates	CADD ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
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RF20. View east/upslope at rockfall area and avalanche path ELC023.

Hazard ID #:	RF20
Hazard Type:	rockfall
HIN:	165
Rating:	A
IRP 2006 Location:	2145
Frequency (yrs):	1-5
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	4+
Source Elev. (ft):	500-1000
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2144+60
IRP 2006 North Margin:	2146+80
Photo #:	1357, 3491, 3493, 3495, 3498, 5130, 5131, 5168

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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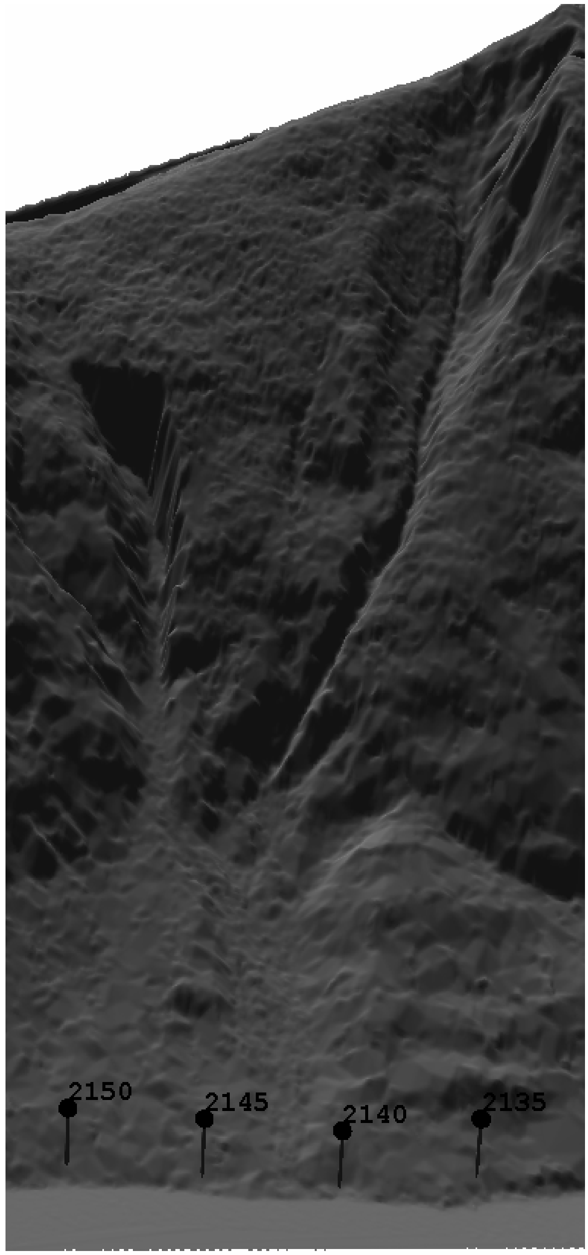
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV: 0	G-103



RF20. Bare earth LIDAR image view east/upslope at rockfall hazard area.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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RF21. View north/up alignment at rockfall hazard.

Hazard ID #:	RF21
Hazard Type:	rockfall
HIN:	147
Rating:	C
IRP 2006 Location:	2154
Frequency (yrs):	1-5
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	2-3
Source Elev. (ft):	500-1000
Centerline Slope:	-
Alignment Location:	below_deposition_zone
Impact Alignment:	no
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2154+00
IRP 2006 North Margin:	2155+00
Photo #:	6014

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY**
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	CHECK: RGD	LYNN CANAL HIGHWAY PHASE I
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ZONE 4 GEOTECHNICAL INVESTIGATION
PROJECT No. 063-5782	REV: 0	ADOT / LYNN CANAL HWY ZONE 4 / AK — **G-105**

LS01. View east/upslope at landslide area.

Hazard ID #:	LS01
Hazard Type:	landslide
HIN:	183
Rating:	C
IRP 2006 Location:	2205
Frequency (yrs):	unknown (>25?)
Predictability:	unpredictable
Material Volume (CY):	10-100
Clast Size (ft):	-
Source Elev. (ft):	1000-2000
Centerline Slope:	-
Alignment Location:	below_deposition_zone
Impact Alignment:	no
Alignment Exposure (ft):	<50
Vegetation:	disturbed
Deciduous Trees:	no
IRP 2006 South Margin:	2204+00
IRP 2006 North Margin:	2208+00
Photo #:	5171

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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	CHECK RGD	
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PROJECT No. 063-5782	REV 0	

DF32. View east/upslope at outlet of debris flow.

Hazard ID #:	DF32
Hazard Type:	debris_flow
HIN:	51
Rating:	B
IRP 2006 Location:	2207
Frequency (yrs):	5-25
Predictability:	high
Material Volume (CY):	<10
Clast Size (ft):	0-1
Source Elev. (ft):	500-1000
Centerline Slope:	single_channel
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2206+60
IRP 2006 North Margin:	2207+20
Photo #:	6018

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY**
	DATE 11/27/06		**ARRANGED BY IRP 2006 STATIONING**
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PROJECT No. 063-5782	REV 0		

Hazard ID #:	LS02
Hazard Type:	translational_slide
HIN:	135
Rating:	C
IRP 2006 Location:	2220
Frequency (yrs):	1-5
Predictability:	unpredictable
Material Volume (CY):	10-100
Clast Size (ft):	0-1
Source Elev. (ft):	100-500
Centerline Slope:	-
Alignment Location:	below_deposition_ zone
Impact Alignment:	no
Alignment Exposure (ft):	50-200
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	2219+60
IRP 2006 North Margin:	2221+00
Photo #:	5000, 5937

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
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LS02. View east/upslope at landslide area.

LS02. View south/down alignment at landslide and exposed bedrock. Photo taken 47 ft right of IRP 2006 2221+00.

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
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DF33. View east/upslope at debris flow channel.

Hazard ID #:	DF33
Hazard Type:	debris_flow
HIN:	183
Rating:	B
IRP 2006 Location:	2250
Frequency (yrs):	unknown (5-25?)
Predictability:	unpredictable
Material Volume (CY):	10-100
Clast Size (ft):	1-2
Source Elev. (ft):	3000+
Centerline Slope:	single_channel
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	<50
Vegetation:	denuded
Deciduous Trees:	no
IRP 2006 South Margin:	2252+50
IRP 2006 North Margin:	2252+80
Photo #:	6023

Golder Associates	CADD: ALF	TITLE	**GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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	CHECK: RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-110**
PROJECT No. 063-5782	REV: 0		

RF22. View east/upslope at fresh rockfall. Photo taken 150 left of IRP 2006 2253+50.

RF22. View east/upslope at rockfall path.

Hazard ID #:	RF22
Hazard Type:	rockfall
HIN:	147
Rating:	B
IRP 2006 Location:	2254
Frequency (yrs):	1-5
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	1-2
Source Elev. (ft):	500-1000
Centerline Slope:	single_channel
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	no
IRP 2006 South Margin:	2253+30
IRP 2006 North Margin:	2253+80
Photo #:	5941, 6024

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-111**
PROJECT No. 063-5782	REV 0		

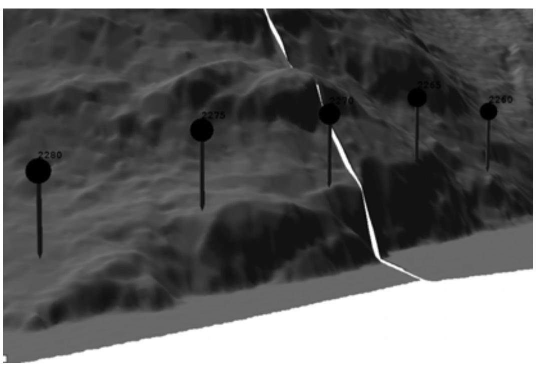
RF23. View east/upslope at rockfall area.

RF23. View south/down alignment at fresh rockfall hazard. Photo taken 100 ft right of IRP 2006 2256+00.

Hazard ID #:	RF23
Hazard Type:	rockfall
HIN:	147
Rating:	B
IRP 2006 Location:	2256
Frequency (yrs):	unknown (1-5?)
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	0-1
Source Elev. (ft):	100-500
Centerline Slope:	other
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	no
IRP 2006 South Margin:	2254+90
IRP 2006 North Margin:	2258+10
Photo #:	3505

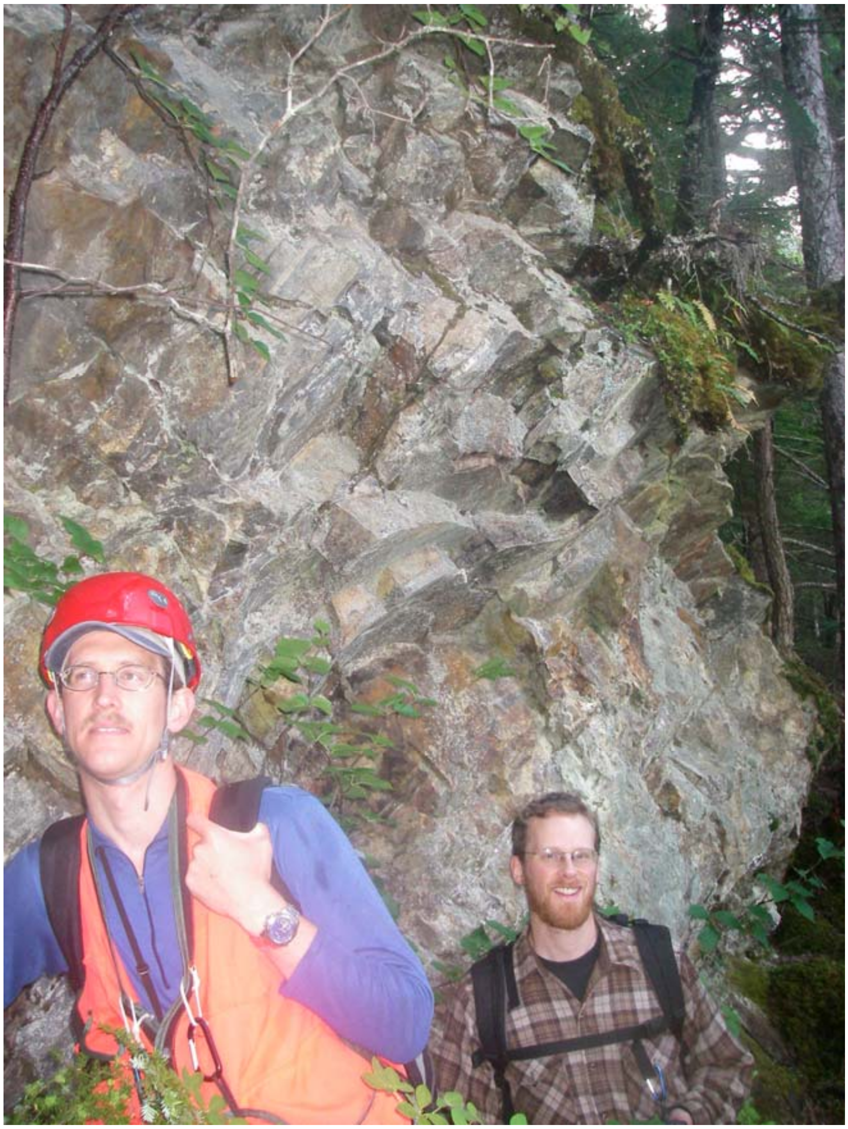
Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06	
	CHECK: RGD	
FILE No.: GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No.: 063-5782	REV: 0	**G-112**

RF24. View east/upslope at rockfall hazard.



RF24. LIDAR bare earth image of rockfall hazard.

Hazard ID #:	RF24
Hazard Type:	rockfall
HIN:	147
Rating:	C
IRP 2006 Location:	2260
Frequency (yrs):	unknown (1-5?)
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	4+
Source Elev. (ft):	100-500
Centerline Slope:	-
Alignment Location:	below_deposition_zone
Impact Alignment:	no
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2258+90
IRP 2006 North Margin:	2261+00
Photo #:	3507



RF24. View east of rockfall hazard with fresh scarring.
Photo taken 215 ft right of IRP 2006 2258+00.

Golder Associates	CADD	ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE	11/27/06			
	CHECK	RGD			
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06		ADOT / LYNN CANAL HWY ZONE 4 / AK	G-114
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RS02. View east/upslope at rockfall hazard and rockslide.

RS02. View east/upslope at rockslide path. Photo taken 270 ft right of IRP 2006 2261+00.

Hazard ID #:	RS02
Hazard Type:	rock_slide
HIN:	81
Rating:	A
IRP 2006 Location:	2261
Frequency (yrs):	1-5
Predictability:	moderate
Material Volume (CY):	10-100
Clast Size (ft):	1-2
Source Elev. (ft):	500-1000
Centerline Slope:	single_channel
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	no
IRP 2006 South Margin:	2261+10
IRP 2006 North Margin:	2261+80
Photo #:	3508, 3510, 3511

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
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SR03. View north/up alignment at soil raveling. Photo taken at centerline at IRP 2006 2267+00.

SR03. View east/upslope at soil raveling area.

Hazard ID #:	SR03
Hazard Type:	soil_raveling
HIN:	147
Rating:	B
IRP 2006 Location:	2265
Frequency (yrs):	1-5
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	2-3
Source Elev. (ft):	100-500
Centerline Slope:	open_bedrock_slope
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2263+50
IRP 2006 North Margin:	2267+40
Photo #:	5579, 5580, 5581

Golder Associates

CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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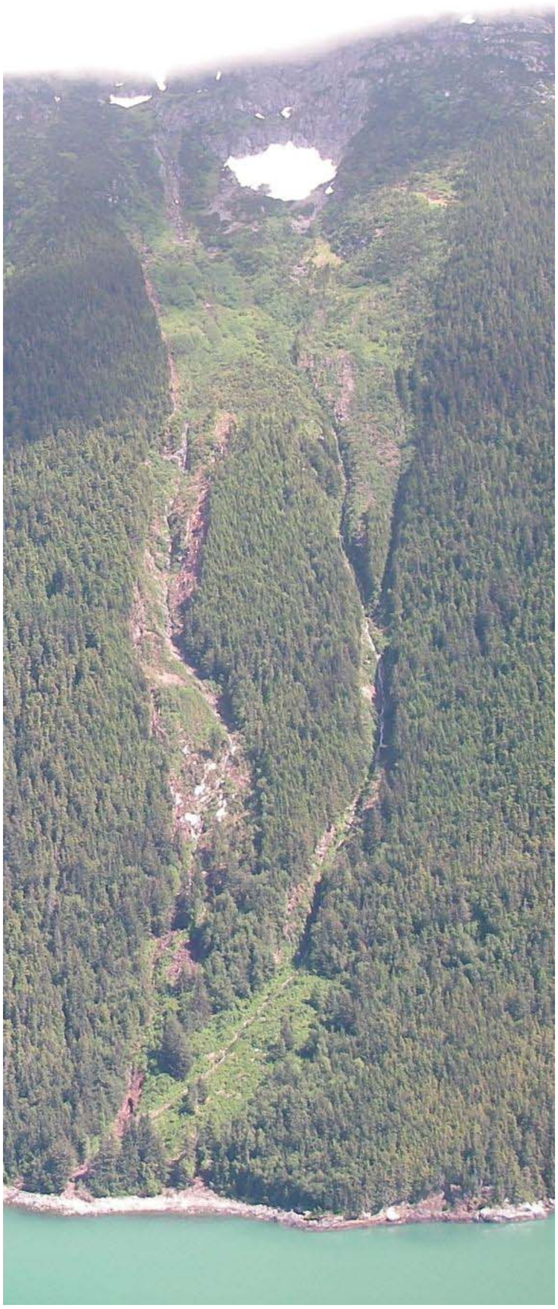
CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-116**
PROJECT No. 063-5782	REV 0		



DF 34. View east/upslope at debris flow channel and avalanche path ELC025.

Hazard ID #:	DF34
Hazard Type:	debris_flow
HIN:	147
Rating:	B
IRP 2006 Location:	2281
Frequency (yrs):	1-5
Predictability:	high
Material Volume (CY):	10-100
Clast Size (ft):	1-2
Source Elev. (ft):	3000+
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	2283+70
IRP 2006 North Margin:	2287+10
Photo #:	3527, 3528

Golder Associates	CADD: ALF	TITLE: GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06	
	CHECK: RGD	
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PROJECT No. 063-5782	REV: 0	G-117

DF34. View north/up alignment at debris flow channel/avalanche path ELC025.
Photo taken 580 ft right of IRP 2006 2284+00.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
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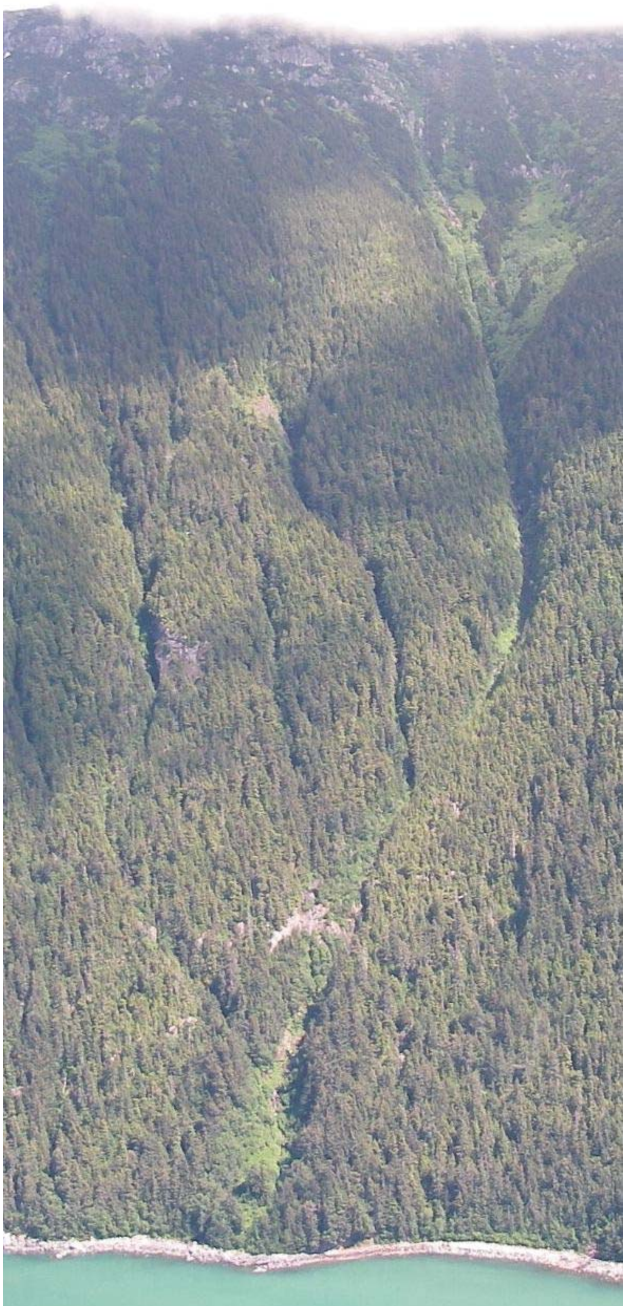
RF25. View north/up alignment at rockfall hazard impacting the alignment. Orange flagging represents alignment at IRP 2006 2291+50.

Hazard ID #:	RF25
Hazard Type:	rockfall
HIN:	123
Rating:	B
IRP 2006 Location:	2291
Frequency (yrs):	unknown (1-5?)
Predictability:	unpredictable
Material Volume (CY):	10-100
Clast Size (ft):	2-3
Source Elev. (ft):	<100
Centerline Slope:	open_bedrock_slope
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	<50
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	2290+60
IRP 2006 North Margin:	2291+00
Photo #:	3531

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06	
	CHECK: RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV: 0	**G-119**



DF35. View east/upslope at debris flow channel and avalanche path ELC026.

Hazard ID #:	DF35
Hazard Type:	debris_flow
HIN:	207
Rating:	B
IRP 2006 Location:	2296
Frequency (yrs):	unknown (1-5?)
Predictability:	unpredictable
Material Volume (CY):	10-100
Clast Size (ft):	3-4
Source Elev. (ft):	3000+
Centerline Slope:	fan
Alignment Location:	deposition _zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2293+80
IRP 2006 North Margin:	2294+90
Photo #:	3535

Golder Associates	CADD: ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06		
	CHECK: RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-120**
PROJECT No. 063-5782	REV: 0		

DF35. View east/upslope of debris flow channel and avalanche path ELC026. Photo taken 320 ft right of IRP 2006 2295+00.

Golder Associates	CADD: ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE: 11/27/06			
	CHECK: RGD			
FILE No.: GEO_HAZ_SUMM.PPT	DATE: 12/05/06		ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-121**
PROJECT No.: 063-5782	REV: 0			

LS03. View north/up alignment at landslide. Photo taken 200 ft right of IRP 2006 2299+50.

Hazard ID #:	LS03
Hazard Type:	translational_slide
HIN:	111
Rating:	C
IRP 2006 Location:	2300
Frequency (yrs):	25+
Predictability:	unpredictable
Material Volume (CY):	10-100
Clast Size (ft):	1-2
Source Elev. (ft):	100-500
Centerline Slope:	-
Alignment Location:	below_deposition_zone
Impact Alignment:	no
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2299+10
IRP 2006 North Margin:	2299+60
Photo #:	5269, 5946

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06	
	CHECK: RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV: 0	**G-122**

RF26. View north/up alignment at rockfall hazard. Photo taken 100 ft right of IRP 2006 2301+00.

Hazard ID #:	RF26
Hazard Type:	rockfall
HIN:	117
Rating:	B
IRP 2006 Location:	2301
Frequency (yrs):	unknown (5-25?)
Predictability:	unpredictable
Material Volume (CY):	10-100
Clast Size (ft):	4+
Source Elev. (ft):	100-500
Centerline Slope:	other
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	undisturbed
Deciduous Trees:	no
IRP 2006 South Margin:	2300+20
IRP 2006 North Margin:	2301+10
Photo #:	3559, 3560, 5946

RF27. View south/down alignment at rockfall hazard. Photo taken 300 ft right of IRP 2006 2308+00

Hazard ID #:	RF27
Hazard Type:	rockfall
HIN:	165
Rating:	B
IRP 2006 Location:	2308
Frequency (yrs):	1-5
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	2-3
Source Elev. (ft):	500-1000
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2303+50
IRP 2006 North Margin:	2308+40
Photo #:	3561

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
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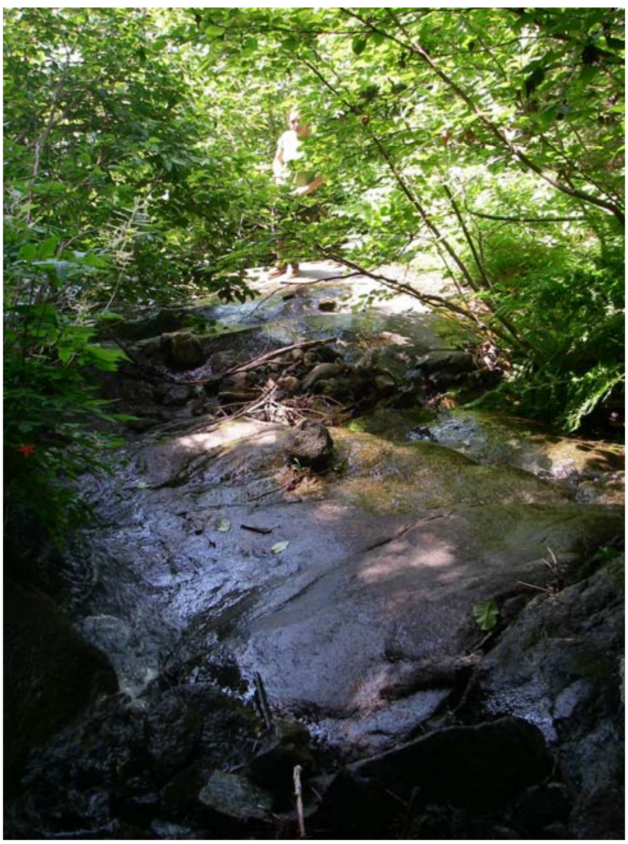
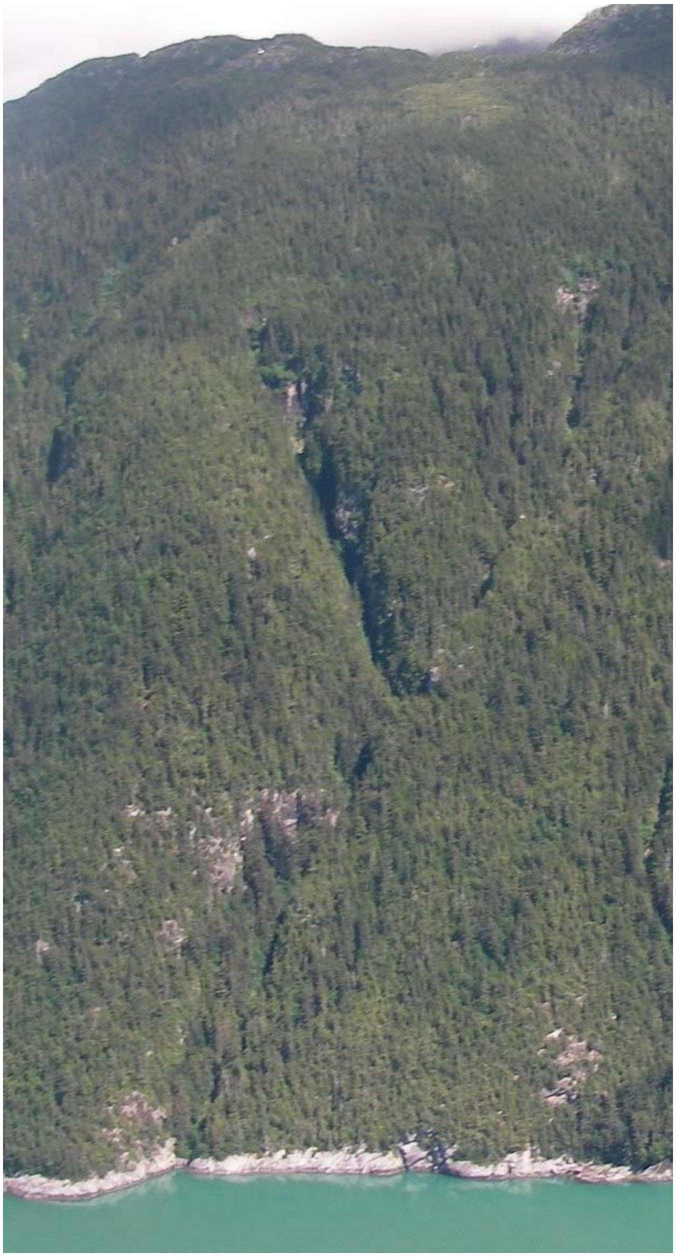
DF36. View east/upslope at debris flow channel.



DF36. View west/downslope at debris flow channel scoured to gneiss bedrock. Photo taken 320 ft right of IRP 2006 2311+50.

Hazard ID #:	DF36
Hazard Type:	debris_flow
HIN:	129
Rating:	B
IRP 2006 Location:	2310
Frequency (yrs):	1-5
Predictability:	high
Material Volume (CY):	10-100
Clast Size (ft):	0-1
Source Elev. (ft):	1000-2000
Centerline Slope:	fan
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	2311+10
IRP 2006 North Margin:	2311+80
Photo #:	3562

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-125**



DF37. View east/upslope at debris flow channel and avalanche path ELC028.

Hazard ID #:	DF37
Hazard Type:	debris_flow
HIN:	129
Rating:	B
IRP 2006 Location:	2321
Frequency (yrs):	1-5
Predictability:	high
Material Volume (CY):	10-100
Clast Size (ft):	1-2
Source Elev. (ft):	1000-2000
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	2321+20
IRP 2006 North Margin:	2322+10
Photo #:	3564, 3565, 3566

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
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DF37. View east/upslope at debris flow channel with extreme cliffs to south (down alignment). Photo taken 320 ft right of IRP 2006 2320+50.

DF37. View east/downslope at boulders deposited by debris flow. Photo taken 320 ft right of IRP 2006 2320+00.

Golder Associates		CADD	ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
		DATE	11/27/06			
		CHECK	RGD			
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PROJECT No.	063-5782	REV	0			

RF28. View east/downslope at rockfall hazard. Photo taken 130 ft right of IRP 2006 2322+00.

RF28. View east/downslope at rockfall hazard area.

Hazard ID #:	RF28
Hazard Type:	rockfall
HIN:	183
Rating:	A
IRP 2006 Location:	2322
Frequency (yrs):	0-1
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	1-2
Source Elev. (ft):	100-500
Centerline Slope:	single_channel
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2322+10
IRP 2006 North Margin:	2322+70
Photo #:	3891, 5948, 6254

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
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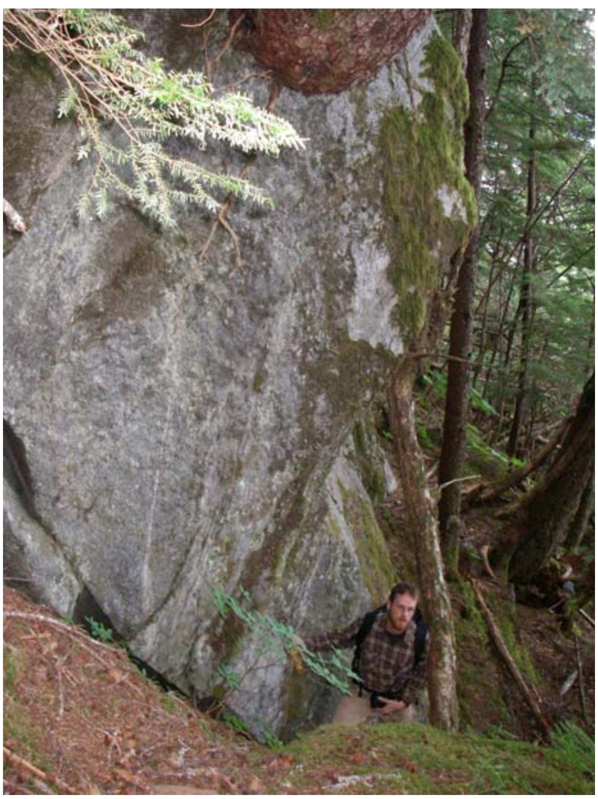
PROJECT No. 063-5782	REV	0		

RF29. View northeast (up alignment and upslope) at rockfall area across IRP 2006 alignment.



RF20. View west/downslope at rockfall hazard. Photo taken 130 ft right of IRP 2006 2329+00.

Hazard ID #:	RF29
Hazard Type:	rockfall
HIN:	105
Rating:	B
IRP 2006 Location:	2328
Frequency (yrs):	25+
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	3-4
Source Elev. (ft):	100-500
Centerline Slope:	open_soil_slope
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	no
IRP 2006 South Margin:	2328+10
IRP 2006 North Margin:	2329+10
Photo #:	6140

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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	CHECK: RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
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RF30. View east/upslope at rockfall hazard.

RF30. View west/downslope at rockfall hazard. Photo taken 230 ft right of IRP 2006 2331+50.

Hazard ID #:	RF30
Hazard Type:	rockfall
HIN:	135
Rating:	B
IRP 2006 Location:	2332
Frequency (yrs):	5-25
Predictability:	unpredictable
Material Volume (CY):	10-100
Clast Size (ft):	4+
Source Elev. (ft):	500-1000
Centerline Slope:	open_soil_slope
Alignment Location:	below_deposition_zone
Impact Alignment:	no
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	no
IRP 2006 South Margin:	2331+40
IRP 2006 North Margin:	2332+80
Photo #:	6142, 6143

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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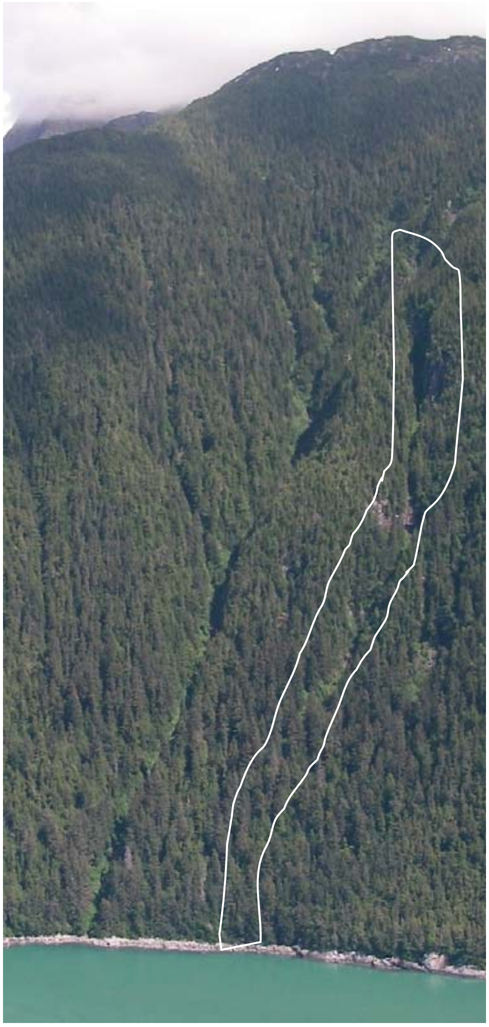
	CHECK: RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV: 0	**G-130**



RF31. View east/upslope at rockfall hazard and avalanche path ELC028-2.

Hazard ID #:	RF31
Hazard Type:	rockfall
HIN:	129
Rating:	A
IRP 2006 Location:	2335
Frequency (yrs):	5-25
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	4+
Source Elev. (ft):	500-1000
Centerline Slope:	single_channel
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	2334+70
IRP 2006 North Margin:	2335+60
Photo #:	6144, 6145

Golder Associates	CADD ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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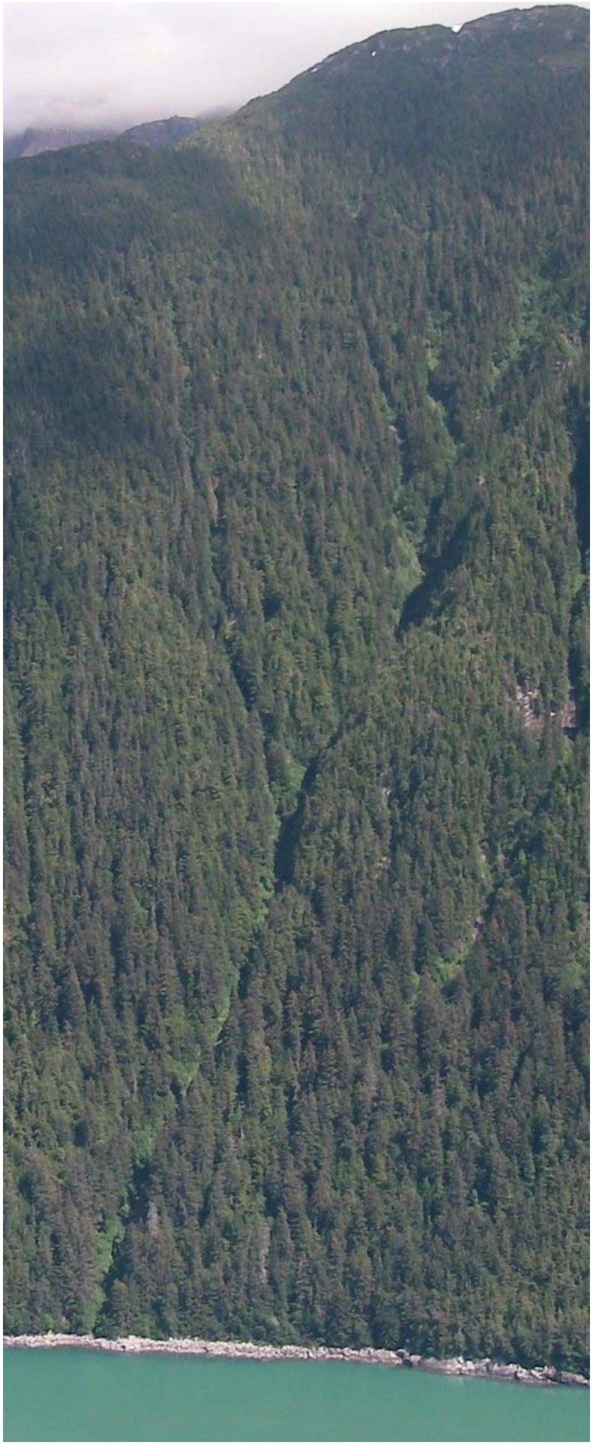
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	G-131
PROJECT No. 063-5782	REV 0		

RF31. View south/down alignment at rockfall with freshly gouged trees. Photo taken 350 ft right of IRP 2006 2335+00.

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-132**



DF38. View east/upslope at debris flow channel and avalanche path ELC029.

Hazard ID #:	DF38
Hazard Type:	debris_flow
HIN:	129
Rating:	A
IRP 2006 Location:	2338
Frequency (yrs):	1-5
Predictability:	high
Material Volume (CY):	10-100
Clast Size (ft):	0-1
Source Elev. (ft):	2000-3000
Centerline Slope:	single_channel
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	denuded
Deciduous Trees:	no
IRP 2006 South Margin:	2338+00
IRP 2006 North Margin:	2338+90
Photo #:	6146

Golder Associates	CADD: ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
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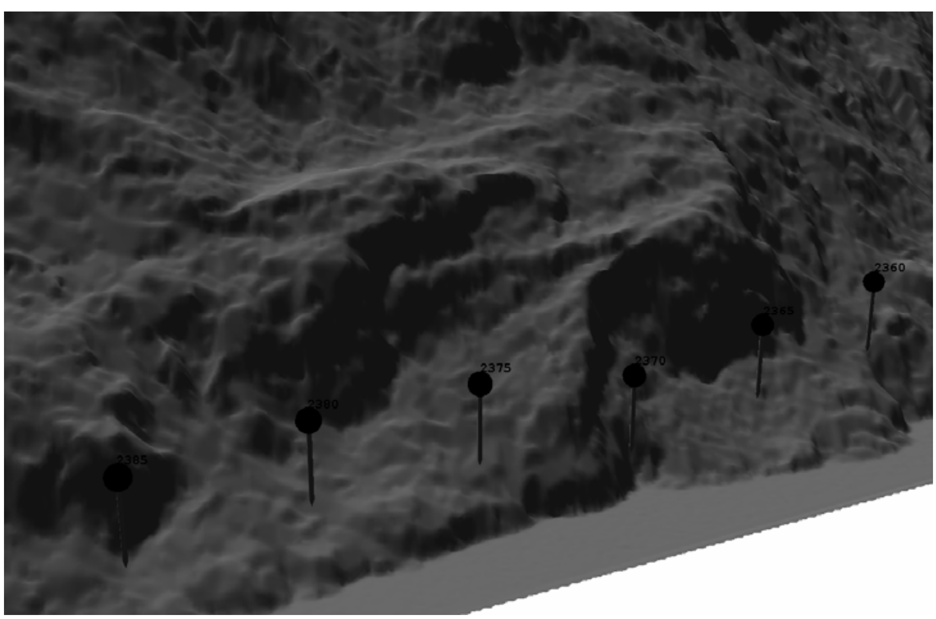
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	G-133
PROJECT No. 063-5782	REV: 0		

DF38. View west/downslope at debris flow channel. Photo taken 490 ft right of IRP 2006 2338+50.

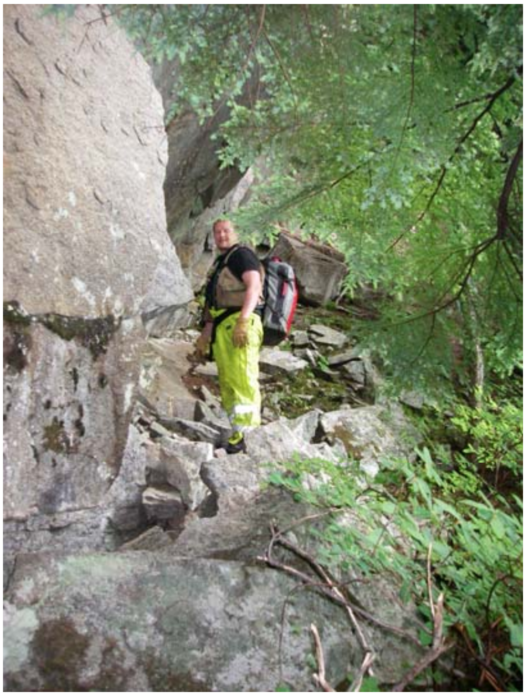
Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-134**
PROJECT No. 063-5782	REV	0		

RF32 & RF33. View east/upslope at rockfall hazard from severe cliffs. This photo presents the area for RF32 and RF33.

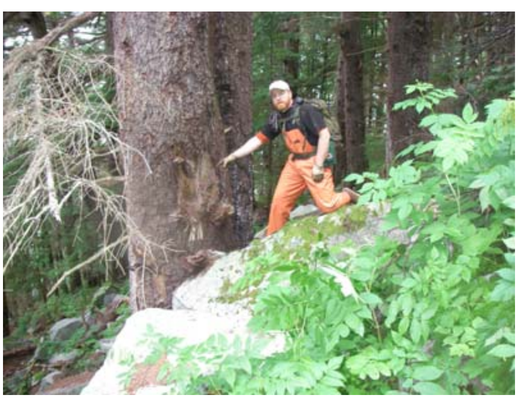


RF32 & RF33. LIDAR image showing topography and cliffs producing rockfall hazards.

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06	
	CHECK: RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV: 0	**G-135**



RF32. View south/down alignment at rockfall hazard. Photo taken 100 ft right of IRP 2006 2364+00.



RF32. View north/up alignment at scar on tree from rockfall/boulder striking tree. Photo taken at centerline at IRP 2006 2364+50.

Hazard ID #:	RF32
Hazard Type:	rockfall
HIN:	201
Rating:	B
IRP 2006 Location:	2370
Frequency (yrs):	0-1
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	1-2
Source Elevation (ft):	100-500
Centerline Slope:	open_soil_slope
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2361+10
IRP 2006 North Margin:	2364+20
Photo #:	3724, 3725

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
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RF33. View south/down alignment at tabular blocks creating rockfall hazard. Photo taken 90 ft right of IRP 2006 2367+00.

Hazard ID #:	RF33
Hazard Type:	rockfall
HIN:	255
Rating:	B
IRP 2006 Location:	2365
Frequency (yrs):	0-1
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	1-2
Source Elevation (ft):	100-500
Centerline Slope:	open_soil_slope
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	500+
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2364+20
IRP 2006 North Margin:	2370+50
Photo #:	3724, 3725

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06	
	CHECK: RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV: 0	**G-137**

RF33. View east/upslope at freshly scarred cliffs.
Photo taken 135 ft right of IRP 2006 2367+50.

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY**
	DATE	11/27/06		**ARRANGED BY IRP 2006 STATIONING**
	CHECK	RGD		LYNN CANAL HIGHWAY PHASE I
				ZONE 4 GEOTECHNICAL INVESTIGATION
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-138**
PROJECT No. 063-5782	REV	0		

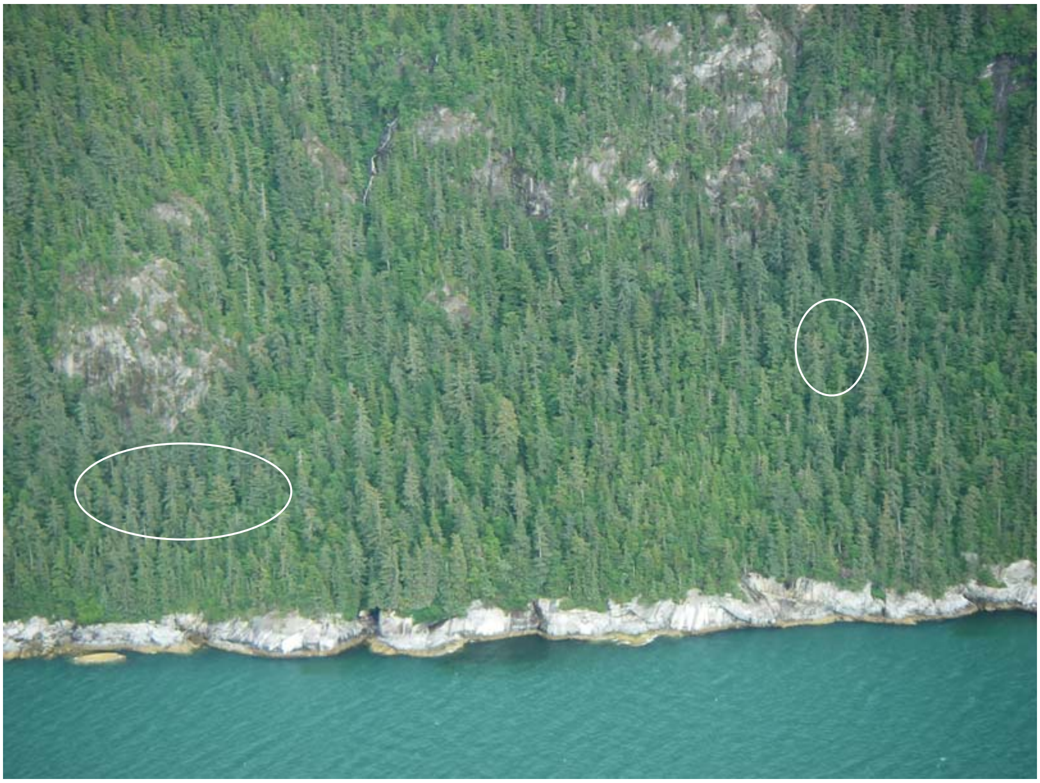
RF33. View north/up alignment at a 300-500 lb boulder/rockfall (fresh) from cliffs above, stopped by a tree. Photo taken at centerline at IRP 2006 2367+00.

Golder Associates	CADD ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	G-139
PROJECT No. 063-5782	REV 0		

HR01. View north/up alignment at hazard rock perched 50 ft left of IRP 2006 2374+90.

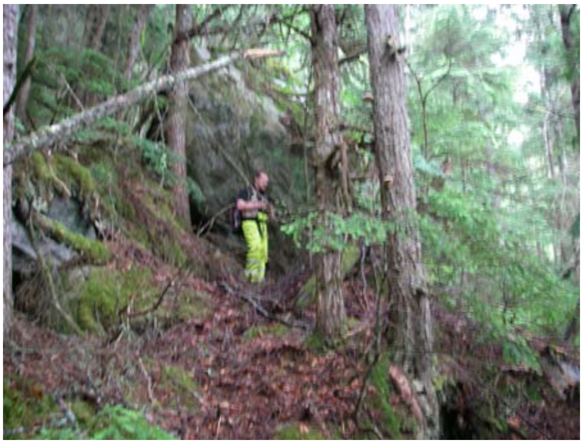
Hazard ID #:	HR01
Hazard Type:	hazard_rocks
HIN:	99
Rating:	C
IRP 2006 Location:	2374
Frequency (yrs):	unknown (>25?)
Predictability:	unpredictable
Material Volume (CY):	10-100
Clast Size (ft):	4+
Source Elev. (ft):	<100
Centerline Slope:	open_soil_slope
Alignment Location:	below_deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	<50
Vegetation:	undisturbed
Deciduous Trees:	no
IRP 2006 South Margin:	2374+90
IRP 2006 North Margin:	-
Photo #:	3722

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06	
	CHECK: RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV: 0	**G-140**



HR01 & HR02. View east/upslope at hazard rocks HR01 (right) and HR02 (left).

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-141**
PROJECT No. 063-5782	REV 0		



HR02. View south/down alignment at hazard rock 75 ft right of IRP 2006 2379+40.

Hazard ID #:	HR02
Hazard Type:	hazard_rocks
HIN:	99
Rating:	C
IRP 2006 Location:	2380
Frequency (yrs):	unknown (>25?)
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	4+
Source Elev. (ft):	<100
Centerline Slope:	open_soil_slope
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	no
IRP 2006 South Margin:	2379+40
IRP 2006 North Margin:	2380+90
Photo #:	3719

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
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PROJECT No. 063-5782	REV 0	**G-142**

RF34 & RF35. View east/upslope at rockfall hazard from severe cliffs: RF34 (right) and RF 35 (left).

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-143**
PROJECT No. 063-5782	REV 0		

RF34. View west/downslope at rockfall hazard. Fresh scarring of spruce tree next to backpack. Photo taken 75 ft right of IRP 2006 2383+00.

Hazard ID #:	RF34
Hazard Type:	rockfall
HIN:	177
Rating:	B
IRP 2006 Location:	2383
Frequency (yrs):	25+
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	4+
Source Elev. (ft):	100-500
Centerline Slope:	open_soil_slope
Alignment Location:	below_deposition_zone
Impact Alignment:	no
Alignment Exposure (ft):	500+
Vegetation:	undisturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2382+50
IRP 2006 North Margin:	2388+50
Photo #:	3712, 3715

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06	
	CHECK: RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV: 0	**G-144**

RF35. View west/upslope at 15 foot overhanging cliffs with fresh rockfall. Photo taken 75 ft right of IRP 2006 2388+00.

Hazard ID #:	RF35
Hazard Type:	rockfall
HIN:	183
Rating:	B
IRP 2006 Location:	2388
Frequency (yrs):	0-1
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	0-1
Source Elev. (ft):	100-500
Centerline Slope:	open_soil_slope
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2388+00
IRP 2006 North Margin:	2388+80
Photo #:	3706

Golder Associates

CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
DATE	11/27/06		
CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-145**
PROJECT No. 063-5782	REV 0		

SR04. View east/upslope at soil raveling hazard.

SR04. View south/down alignment at soil raveling in glacial outwash. Photo taken 30 ft left of IRP 2006 2424+00.

Hazard ID #:	SR04
Hazard Type:	soil_raveling
HIN:	105
Rating:	B
IRP 2006 Location:	2420
Frequency (yrs):	5-25
Predictability:	moderate
Material Volume (CY):	<10
Clast Size (ft):	3-4
Source Elev. (ft):	<100
Centerline Slope:	open_soil_slope
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	500+
Vegetation:	disturbed
Deciduous Trees:	no
IRP 2006 South Margin:	2420+70
IRP 2006 North Margin:	2426+80
Photo #:	3595-3598, 5957, 6061

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-146**

SR04. View east/upslope at slope releasing 1-3 ft diameter rocks. IRP 2006 2426+20 is located where person is standing.

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-147**

LS04. View east/upslope at recent landslide. Photo taken 70 ft right of IRP 2006 2427+00.

LS04. View west/downslope at slope failure in glacial outwash material. Photo taken 75 ft right of IRP 2006 2427+10.

Hazard ID #:	LS04
Hazard Type:	translational_slide
HIN:	33
Rating:	B
IRP 2006 Location:	2426
Frequency (yrs):	5-25
Predictability:	moderate
Material Volume (CY):	<10
Clast Size (ft):	3-4
Source Elev. (ft):	<100
Centerline Slope:	open_soil_slope
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	no
IRP 2006 South Margin:	2426+80
IRP 2006 North Margin:	2427+40
Photo #:	3595, 3597, 3598, 6074

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-148**

Hazard ID #:	RF36
Hazard Type:	rockfall
HIN:	129
Rating:	B
IRP 2006 Location:	2454
Frequency (yrs):	1-5
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	3-4
Source Elev. (ft):	100-500
Centerline Slope:	-
Alignment Location:	below_deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	2454+50
IRP 2006 North Margin:	2455+00
Photo #:	3609, 5960

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-149**

RF36. View east/upslope at rockfall hazard.

RF36. View west/downslope at rockfall chute. Photo taken 90 ft right of IRP 2006 2454+60.

Golder Associates

CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
DATE	11/27/06		
CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-150**
PROJECT No. 063-5782	REV 0		

LS05. View east/upslope at landslide.

LS05. View west/downslope at land-slide. Photo taken 230 ft right of IRP 2006 2457+00.

Hazard ID #:	LS05
Hazard Type:	translational_slide
HIN:	129
Rating:	C
IRP 2006 Location:	2457
Frequency (yrs):	5-25
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	3-4
Source Elev. (ft):	100-500
Centerline Slope:	-
Alignment Location:	below_deposition_ zone
Impact Alignment:	no
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2456+00
IRP 2006 North Margin:	2458+00
Photo #:	3615, 5961, 6077

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-151**
PROJECT No. 063-5782	REV 0		

DF40. View east/upslope at debris flow channel.

DF40. View west/upslope at debris flow channel. Photo taken 315 ft right of IRP 2006 2459+00.

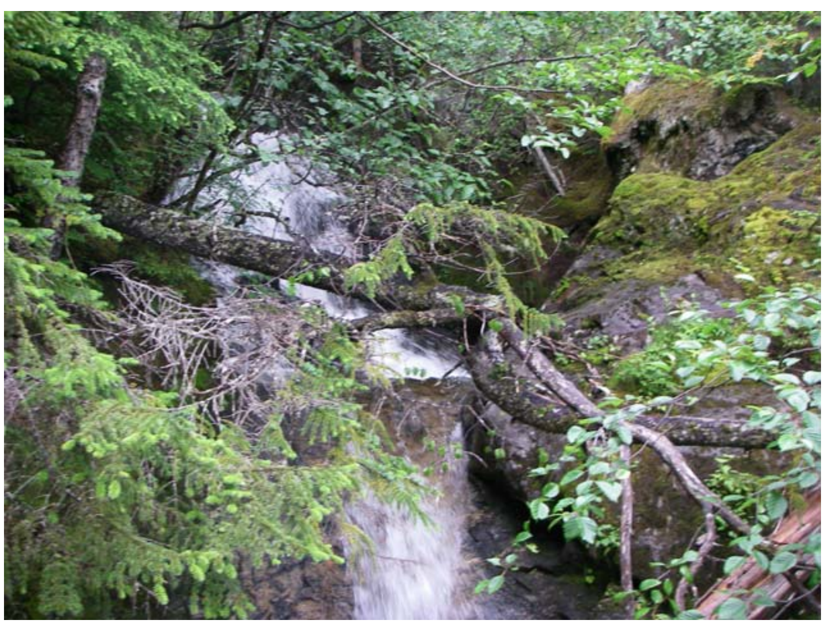
Hazard ID #:	DF40
Hazard Type:	debris_flow
HIN:	135
Rating:	B
IRP 2006 Location:	2459
Frequency (yrs):	5-25
Predictability:	low
Material Volume (CY):	10-100
Clast Size (ft):	0-1
Source Elev. (ft):	2000-3000
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	denuded
Deciduous Trees:	no
IRP 2006 South Margin:	2459+00
IRP 2006 North Margin:	2459+90
Photo #:	3616, 5180, 5961

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06	
	CHECK: RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV: 0	**G-152**

Hazard ID #:	DF41
Hazard Type:	debris_flow
HIN:	129
Rating:	B
IRP 2006 Location:	2460
Frequency (yrs):	1-5
Predictability:	high
Material Volume (CY):	10-100
Clast Size (ft):	0-1
Source Elev. (ft):	3000+
Centerline Slope:	fan
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	2460+40
IRP 2006 North Margin:	2461+00
Photo #:	3616

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE	11/27/06			
	CHECK	RGD			
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK		**G-153**
PROJECT No. 063-5782	REV	0			

DF41. View east/upslope at debris flow channel.



DF41. View east/upslope at debris flow chute with active stream. Photo taken 130 ft right of IRP 2006 2461+00.

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	G-154
PROJECT No. 063-5782	REV 0		

RF37. View east/upslope at rockfall area. Photo taken at centerline at IRP 2006 2468+80.

Hazard ID #:	RF37
Hazard Type:	rockfall
HIN:	69
Rating:	B
IRP 2006 Location:	2467
Frequency (yrs):	1-5
Predictability:	high
Material Volume (CY):	<10
Clast Size (ft):	4+
Source Elev. (ft):	100-500
Centerline Slope:	open_soil_slope
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2466+10
IRP 2006 North Margin:	2470+00
Photo #:	3637, 5181, 5962

RF37. View east/upslope at rockfall hazard.

Golder Associates		CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
		DATE	11/27/06		
		CHECK	RGD		
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PROJECT No.	063-5782	REV	0		

RF38. View south/down alignment at typical talus field within rockfall hazard. Photo taken 10 ft left of IRP 2006 2473+50.

Hazard ID #:	RF38
Hazard Type:	rockfall
HIN:	33
Rating:	B
IRP 2006 Location:	2473
Frequency (yrs):	5-25
Predictability:	high
Material Volume (CY):	<10
Clast Size (ft):	1-2
Source Elev. (ft):	100-500
Centerline Slope:	single_channel
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2473+00
IRP 2006 North Margin:	2474+00
Photo #:	6092

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06	
	CHECK: RGD	
FILE No.: GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No.: 063-5782	REV: 0	**G-157**

RF39. View south/down alignment at rockfall hazard. Photo taken at centerline at IRP 2006 2481+00.

RF39. View east/upslope at rockfall. Photo taken at centerline at IRP 2006 2481+00.

Hazard ID #:	RF39
Hazard Type:	rockfall
HIN:	129
Rating:	B
IRP 2006 Location:	2481
Frequency (yrs):	1-5
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	3-4
Source Elev. (ft):	100-500
Centerline Slope:	other
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2480+30
IRP 2006 North Margin:	2481+50
Photo #:	6083, 6084

RF39 & RF40. View east/upslope at rockfall hazards RF39 (right) and RF40 (left).

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-159**
PROJECT No. 063-5782	REV 0		

RF40. View west/upslope at rockfall hazard. Photo taken 80 ft right of IRP 2006 2487+00.

Hazard ID #:	RF40
Hazard Type:	rockfall
HIN:	147
Rating:	B
IRP 2006 Location:	2487
Frequency (yrs):	1-5
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	3-4
Source Elev. (ft):	100-500
Centerline Slope:	-
Alignment Location:	below_deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	no
IRP 2006 South Margin:	2484+00
IRP 2006 North Margin:	2488+70
Photo #:	5182, 5964, 6085

Golder Associates

FILE No. GEO_HAZ_SUMM.PPT	CADD ALF	DATE 11/27/06	CHECK RGD	DATE 12/05/06
PROJECT No. 063-5782	REV 0			

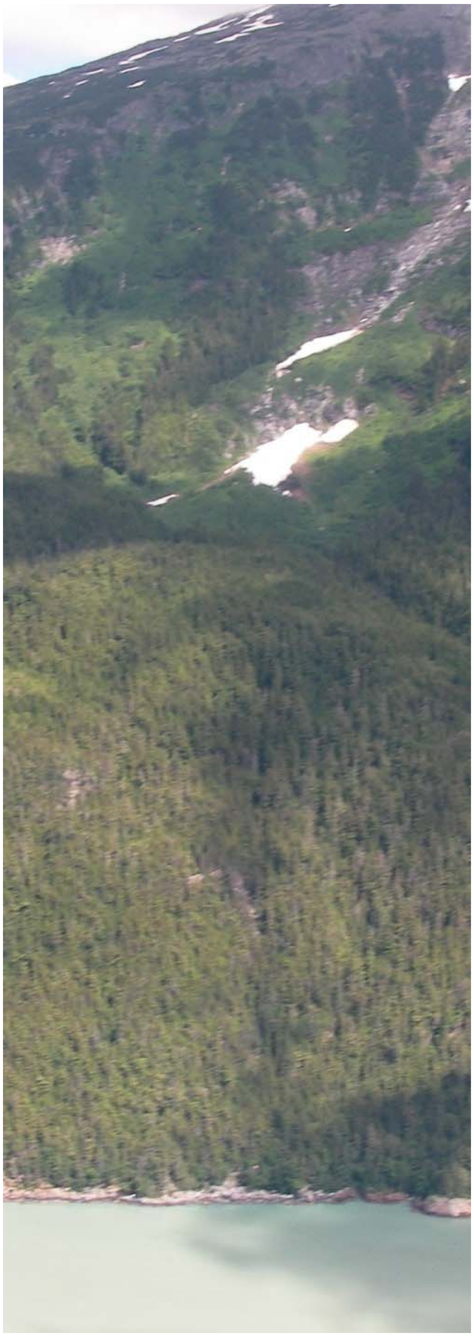
TITLE
GEOLOGIC HAZARD SUMMARY
ARRANGED BY IRP 2006 STATIONING
LYNN CANAL HIGHWAY PHASE I
ZONE 4 GEOTECHNICAL INVESTIGATION

ADOT / LYNN CANAL HWY ZONE 4 / AK

G-160

RF40. View south/down alignment at rockfall hazard. Photo taken 80 ft right of IRP 2006 2484+20.

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-161**
PROJECT No. 063-5782	REV	0		



DF42. View east/upslope at debris flow channel.

Hazard ID #:	DF42
Hazard Type:	debris_flow
HIN:	117
Rating:	B
IRP 2006 Location:	2491
Frequency (yrs):	5-25
Predictability:	moderate
Material Volume (CY):	10-100
Clast Size (ft):	1-2
Source Elev. (ft):	1000-2000
Centerline Slope:	single_channel
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2490+70
IRP 2006 North Margin:	2491+30
Photo #:	6086

Golder Associates	CADD: ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06		
	CHECK: RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-162**
PROJECT No. 063-5782	REV: 0		

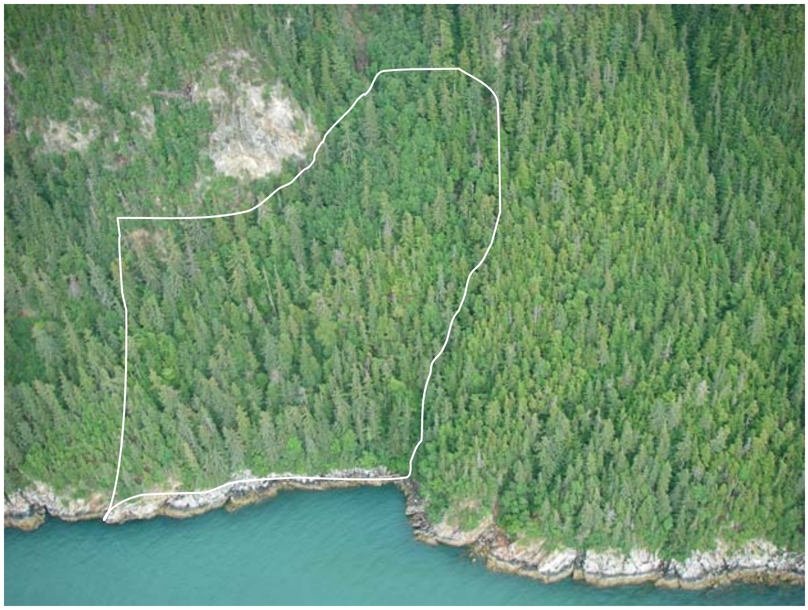
DF42. View east/upslope at debris flow channel.

DF42. View west/downslope at debris flow channel. Photo taken 115 ft right of IRP 2006 2490+50.

Golder Associates	CADD: ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06		
	CHECK: RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-163**
PROJECT No. 063-5782	REV: 0		

Hazard ID #:	RF41
Hazard Type:	rockfall
HIN:	129
Rating:	C
IRP 2006 Location:	2495
Frequency (yrs):	1-5
Predictability:	moderate
Material Volume (CY):	<10
Clast Size (ft):	2-3
Source Elev. (ft):	100-500
Centerline Slope:	open_soil_slope
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	500+
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2495+00
IRP 2006 North Margin:	2505+00
Photo #:	5965, 6094, 6095

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-164**
PROJECT No. 063-5782	REV 0		



RF41. View east/upslope at rockfall hazard.

RF41. View south/down alignment at rockfall stopped by a spruce tree. Photo taken 60 ft right of IRP 2006 2499+50.

Golder Associates	CADD ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	G-165
PROJECT No. 063-5782	REV 0		

RF42. View east/upslope at rockfall hazard.

Hazard ID #:	RF42
Hazard Type:	rockfall
HIN:	105
Rating:	B
IRP 2006 Location:	2502
Frequency (yrs):	unknown (5-25?)
Predictability:	moderate
Material Volume (CY):	<10
Clast Size (ft):	0-1
Source Elev. (ft):	<100
Centerline Slope:	deciduous_trees
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	500+
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	2499+50
IRP 2006 North Margin:	2505+00
Photo #:	6094, 6095

RF42. View east/upslope at rockfall hazard.
Photo taken 60 ft right of IRP 2006 2500+00.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-166**
PROJECT No. 063-5782	REV 0		

Hazard ID #:	HR03
Hazard Type:	hazard_rocks
HIN:	93
Rating:	C
IRP 2006 Location:	2518
Frequency (yrs):	unknown (>25?)
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	4+
Source Elev. (ft):	<100
Centerline Slope:	-
Alignment Location:	below_deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	<50
Vegetation:	-
Deciduous Trees:	no
IRP 2006 South Margin:	2517+80
IRP 2006 North Margin:	-
Photo #:	5311, 5312

HR03. View east/upslope at hazard rock. Photo taken 75 ft right of IRP 2006 2517+80.

Golder Associates	CADD ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	G-168
PROJECT No. 063-5782	REV 0		

Hazard ID #:	HR04
Hazard Type:	hazard_rocks
HIN:	93
Rating:	C
IRP 2006 Location:	2526
Frequency (yrs):	unknown (>25?)
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	4+
Source Elev. (ft):	<100
Centerline Slope:	-
Alignment Location:	below_deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	<50
Vegetation:	-
Deciduous Trees:	no
IRP 2006 South Margin:	2526+00
IRP 2006 North Margin:	-
Photo #:	5318

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-169**

HR04. View south/down alignment at hazard rock. Photo taken 30 ft right of IRP 2006 2526+00.

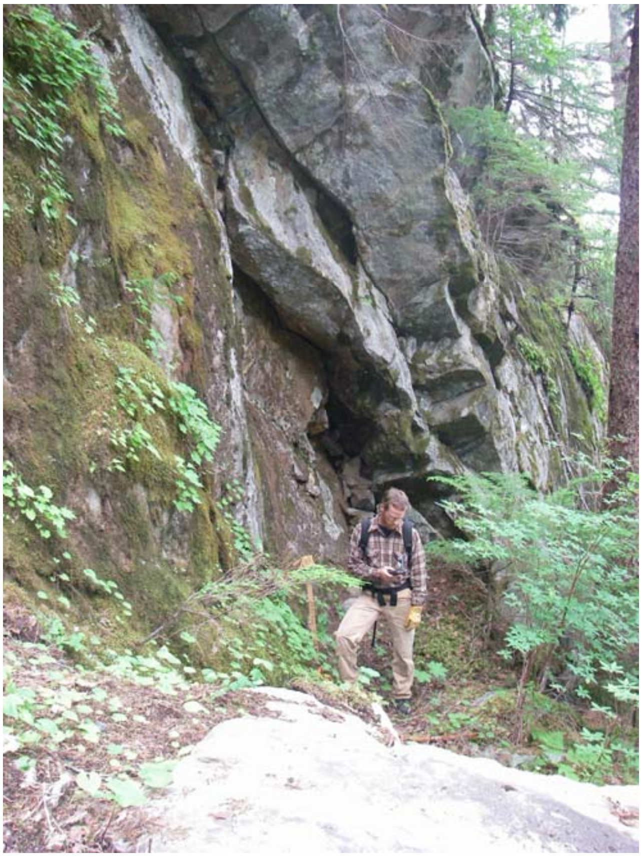
Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-170**
PROJECT No. 063-5782	REV 0		

RF43 & RF44. View east/upslope at rockfall areas RF43 (right) and RF44 (left).

RF43. View south/down alignment at rockfall hazard, recently deposited boulder embedded into 2 ft diameter birch tree. Photo taken 30 ft right of IRP 2006 2529+00.

Hazard ID #:	RF43
Hazard Type:	rockfall
HIN:	129
Rating:	A
IRP 2006 Location:	2529
Frequency (yrs):	1-5
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	2-3
Source Elev. (ft):	100-500
Centerline Slope:	open_soil_slope
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2528+00
IRP 2006 North Margin:	2529+70
Photo #:	3648, 5969

Golder Associates	CADD: ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE: 11/27/06			
	CHECK: RGD			
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK		**G-171**
PROJECT No. 063-5782	REV: 0			



RF44. View south/down alignment at rockfall hazard. Photo taken 10 ft left of IRP 2006 2531+20.

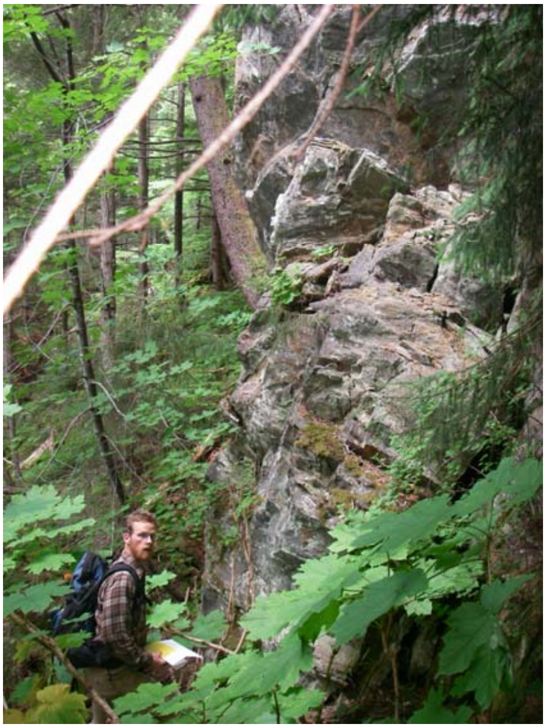
Hazard ID #:	RF44
Hazard Type:	rockfall
HIN:	147
Rating:	B
IRP 2006 Location:	2531
Frequency (yrs):	1-5
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	1-2
Source Elev. (ft):	100-500
Centerline Slope:	open_soil_slope
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	200-500
Vegetation:	disturbed
Deciduous Trees:	no
IRP 2006 South Margin:	2531+00
IRP 2006 North Margin:	2533+20
Photo #:	1565, 5326, 5327

Golder Associates	CADD: ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06		
	CHECK: RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-172**
PROJECT No. 063-5782	REV: 0		

RF45. View west/downslope at rockfall with fresh rockfall stopped by spruce trees. Photo taken 20 ft right of IRP 2006 2537+00.

Hazard ID #:	RF45
Hazard Type:	rockfall
HIN:	129
Rating:	A
IRP 2006 Location:	2537
Frequency (yrs):	1-5
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	1-2
Source Elev. (ft):	100-500
Centerline Slope:	-
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	-
Deciduous Trees:	no
IRP 2006 South Margin:	2536+10
IRP 2006 North Margin:	2537+80
Photo #:	6098, 6099

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-173**



RF46. View north/up alignment at rockfall hazard cliffs. Photo taken 150 ft right of IRP 2006 2546+00.

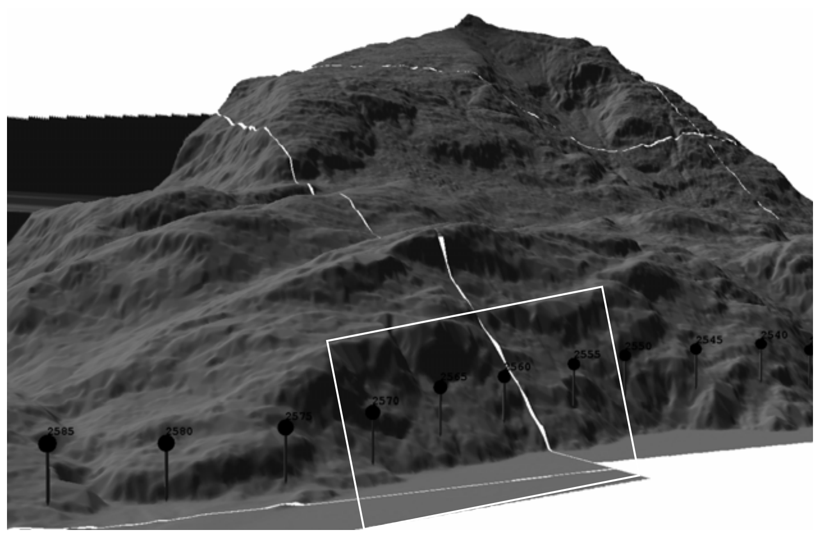
RF46. View northwest (up alignment and downslope) at rockfall hazard area. Photo taken 150 ft right of IRP 2006 2546+00.

Hazard ID #:	RF46
Hazard Type:	rockfall
HIN:	111
Rating:	A
IRP 2006 Location:	2548
Frequency (yrs):	5-25
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	2-3
Source Elev. (ft):	100-500
Centerline Slope:	open_soil_slope
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2546+70
IRP 2006 North Margin:	2548+30
Photo #:	5338, 5339

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-174**

View east/upslope at approximate IRP 2006 range 2550+00 to 2570+00. Regional photo for hazards listed below. Local photos and details for individual hazards follow.

RF47
LS06
HR05
RF49
RF50
RF51
LS07
DF43
RF52



LIDAR bare earth image highlighting IRP 2006 alignment 2550 to 2575.

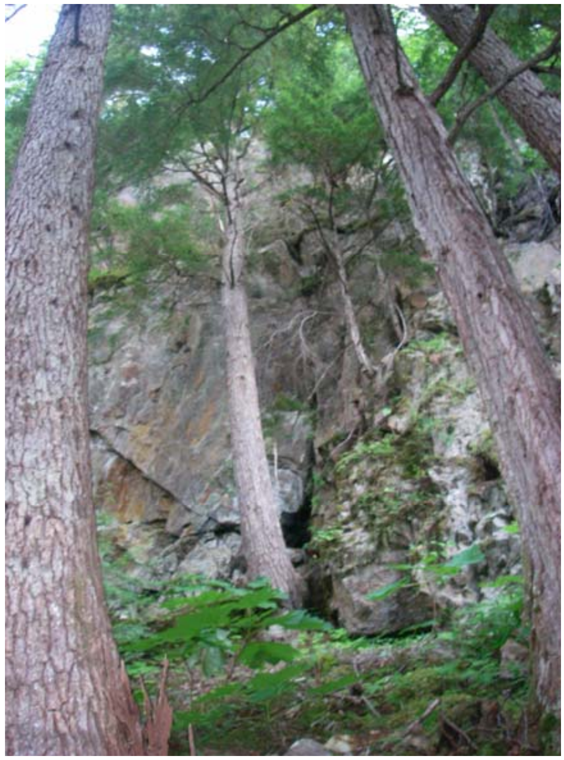
Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-175**

Hazard ID #:	RF47
Hazard Type:	rockfall
HIN:	183
Rating:	B
IRP 2006 Location:	2550
Frequency (yrs):	5-25
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	2-3
Source Elevation (ft):	100-500
Centerline Slope:	open_soil_slope
Alignment Location:	deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	500+
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2549+80
IRP 2006 North Margin:	2556+30
Photo #:	3660

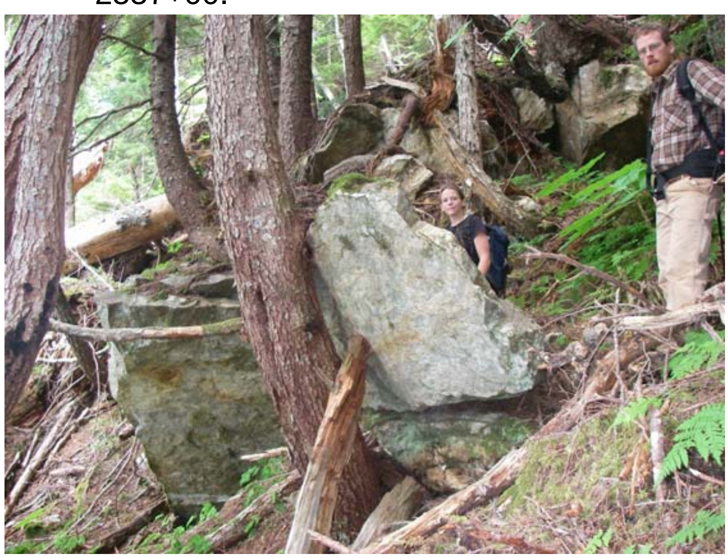
Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-176**

RF47. View east/upslope at rockfall hazard area.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-177**
PROJECT No. 063-5782	REV 0		

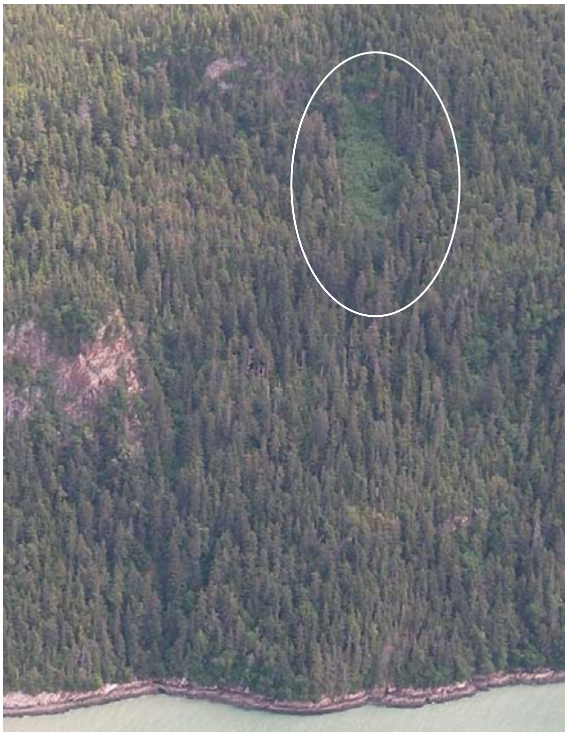


RF47. View east/upslope at rockfall. Photo taken 220 ft right of IRP 2006 2557+00.



RF47. View north/up alignment at rockfall stopped by tree trunk. Photo taken 30 ft right of IRP 2006 2554+00.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-178**
PROJECT No. 063-5782	REV 0		



LS06. View east/upslope at landslide area (green patch of disturbed vegetation in upper right photo).

Hazard ID #:	LS06
Hazard Type:	landslide
HIN:	129
Rating:	C
IRP 2006 Location:	2552
Frequency (yrs):	unknown (>25?)
Predictability:	unpredictable
Material Volume (CY):	10-100
Clast Size (ft):	-
Source Elevation (ft):	500-1000
Centerline Slope:	open_soil_slope
Alignment Location:	below_deposition_zone
Impact Alignment:	no
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	no
IRP 2006 South Margin:	2552+80
IRP 2006 North Margin:	2554+00
Photo #:	5185, 5341, 5342

Hazard ID #:	HR05
Hazard Type:	hazard_rocks
HIN:	93
Rating:	C
IRP 2006 Location:	2554
Frequency (yrs):	unknown (>25?)
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	4+
Source Elevation (ft):	<100
Centerline Slope:	open_soil_slope
Alignment Location:	below_deposition _zone
Impact Alignment:	yes
Alignment Exposure (ft):	<50
Vegetation:	-
Deciduous Trees:	no
IRP 2006 South Margin:	2554+30
IRP 2006 North Margin:	-
Photo #:	5362, 5363

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-180**

HR05. View east/upslope at hazard rock location. The IRP 2006 alignment range for the aerial photograph is 2550 (right) to 2555 (left).

HR05. View east/upslope at hazard rock. IRP 2006 alignment location 2554+00 at stake.

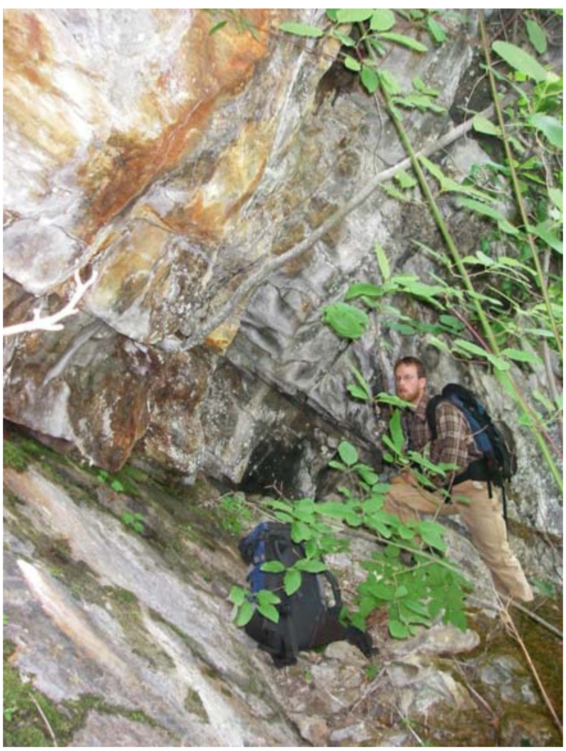
Golder Associates	CADD: ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06		
	CHECK: RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	G-182
PROJECT No. 063-5782	REV: 0		

RF49. View east/upslope at rockfall hazard below cliffs and above IRP 2006 alignment.

Hazard ID #:	RF49
Hazard Type:	rockfall
HIN:	201
Rating:	C
IRP 2006 Location:	2557
Frequency (yrs):	1-5
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	2-3
Source Elevation (ft):	100-500
Centerline Slope:	open_soil_slope
Alignment Location:	below_deposition_zone
Impact Alignment:	no
Alignment Exposure (ft):	500+
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2556+50
IRP 2006 North Margin:	2562+00
Photo #:	3661, 3662, 3664

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06	
	CHECK: RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV: 0	**G-183**

RF49. View east/upslope at the north half of rockfall area.



RF49. View south/down alignment across rockfall hazard. Photo taken 130 ft right of IRP 2006 2560+00.

RF49. View north/up alignment across rockfall hazard. Photo taken 110 ft right of IRP 2006 2565+50.

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-184**

Hazard ID #:	RF50
Hazard Type:	rockfall
HIN:	147
Rating:	B
IRP 2006 Location:	2558
Frequency (yrs):	1-5
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	2-3
Source Elevation (ft):	500-1000
Centerline Slope:	open_soil_slope
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2557+80
IRP 2006 North Margin:	2558+40
Photo #:	3661, 3662, 3664

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-185**
PROJECT No. 063-5782	REV	0		

RF50. View east/upslope at rockfall area.

RF50. View north/up alignment at margin of rockfall hazard. Photo taken 40 ft right of IRP 2006 2558+30.

Golder Associates	CADD: ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE: 11/27/06			
	CHECK: RGD			
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06		ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-186**
PROJECT No. 063-5782	REV: 0			

Hazard ID #:	RF51
Hazard Type:	rockfall
HIN:	147
Rating:	B
IRP 2006 Location:	2560
Frequency (yrs):	1-5
Predictability:	unpredictable
Material Volume (CY):	<10
Clast Size (ft):	2-3
Source Elevation (ft):	500-1000
Centerline Slope:	open_soil_slope
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2559+30
IRP 2006 North Margin:	2560+50
Photo #:	3661, 3662, 3664

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-187**

RF51. View east/upslope at rockfall hazard.

Golder Associates		CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
		DATE	11/27/06		
		CHECK	RGD		
FILE No.	GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-188**
PROJECT No.	063-5782	REV	0		

RF51. View north/up alignment across steep face of rockfall hazard.
Photo taken 160 ft right of IRP 2006 2560+50.

Golder Associates	CADD	ALF	TITLE	GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION	
	DATE	11/27/06			
	CHECK	RGD			
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06		ADOT / LYNN CANAL HWY ZONE 4 / AK	G-189
PROJECT No. 063-5782	REV	0			


LS07. View east/upslope at landslide.

Hazard ID #:	LS07
Hazard Type:	landslide
HIN:	129
Rating:	C
IRP 2006 Location:	2561
Frequency (yrs):	unknown (>25?)
Predictability:	unpredictable
Material Volume (CY):	10-100
Clast Size (ft):	-
Source Elevation (ft):	500-1000
Centerline Slope:	open_soil_slope
Alignment Location:	below_deposition_zone
Impact Alignment:	no
Alignment Exposure (ft):	50-200
Vegetation:	disturbed
Deciduous Trees:	no
IRP 2006 South Margin:	2561+80
IRP 2006 North Margin:	2562+80
Photo #:	5024

Golder Associates

FILE No. GEO_HAZ_SUMM.PPT	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
PROJECT No. 063-5782	DATE 11/27/06		
	CHECK RGD		
	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-190**
	REV 0		

DF43. View north/upslope at debris flow channel. Photo taken 160 ft right of IRP 2006 2563+40.

Hazard ID #:	DF43
Hazard Type:	debris_flow
HIN:	63
Rating:	A
IRP 2006 Location:	2563
Frequency (yrs):	5-25
Predictability:	moderate
Material Volume (CY):	10-100
Clast Size (ft):	1-2
Source Elevation (ft):	500-1000
Centerline Slope:	single_channel
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	50-200
Vegetation:	denuded
Deciduous Trees:	yes
IRP 2006 South Margin:	2563+30
IRP 2006 North Margin:	2564+10
Photo #:	5356

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-191**

DF43. View east/upslope at debris flow channel.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-192**
PROJECT No. 063-5782	REV 0		

Hazard ID #:	RF52
Hazard Type:	rockfall
HIN:	123
Rating:	B
IRP 2006 Location:	2568
Frequency (yrs):	1-5
Predictability:	high
Material Volume (CY):	<10
Clast Size (ft):	4+
Source Elevation (ft):	100-500
Centerline Slope:	open_soil_slope
Alignment Location:	path
Impact Alignment:	yes
Alignment Exposure (ft):	500+
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2564+70
IRP 2006 North Margin:	2570+60
Photo #:	6105, 6106

Golder Associates	CADD ALF	TITLE **GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06	
	CHECK RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV 0	**G-193**

RF52. View east/upslope at rockfall hazard.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-194**
PROJECT No. 063-5782	REV 0		

RF52. View south/down alignment at recent rockfall.
Photo taken 170 ft right of IRP 2006 2565+00.

Golder Associates	CADD	ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE	11/27/06		
	CHECK	RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE	12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-195**
PROJECT No. 063-5782	REV	0		

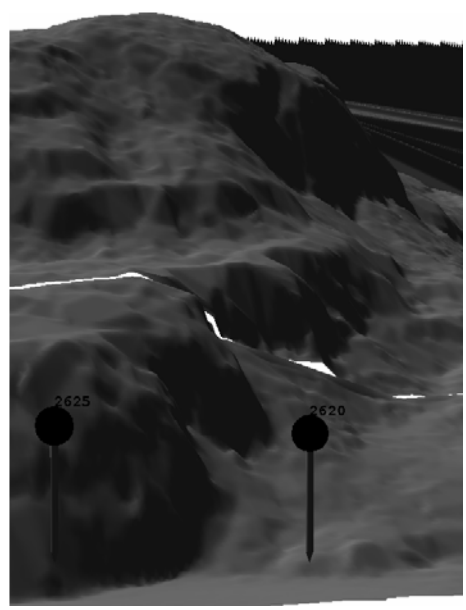
RF52. View east/upslope at source for rockfall hazard. Slope-parallel joints promote planar failure. Photo taken 200 ft right of IRP 2006 2565+20.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-196**
PROJECT No. 063-5782	REV 0		

Hazard ID #:	RF53
Hazard Type:	rockfall
HIN:	201
Rating:	A
IRP 2006 Location:	2620
Frequency (yrs):	25+
Predictability:	unpredictable
Material Volume (CY):	100-1000
Clast Size (ft):	4+
Source Elevation (ft):	100-500
Centerline Slope:	fan
Alignment Location:	below_deposition_zone
Impact Alignment:	yes
Alignment Exposure (ft):	500+
Vegetation:	disturbed
Deciduous Trees:	yes
IRP 2006 South Margin:	2618+90
IRP 2006 North Margin:	2626+00
Photo #:	3683, 3684

Golder Associates	CADD: ALF	TITLE: **GEOLOGIC HAZARD SUMMARY ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE: 11/27/06	
	CHECK: RGD	
FILE No. GEO_HAZ_SUMM.PPT	DATE: 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK
PROJECT No. 063-5782	REV: 0	**G-197**

RF53. View east/upslope at rockfall hazard.



RF53. LIDAR bare earth image of local topography surrounding rockfall hazard. IRP 2006 alignment location 2620+00.

Golder Associates	CADD ALF	TITLE	**GEOLOGIC HAZARD SUMMARY** **ARRANGED BY IRP 2006 STATIONING** LYNN CANAL HIGHWAY PHASE I ZONE 4 GEOTECHNICAL INVESTIGATION
	DATE 11/27/06		
	CHECK RGD		
FILE No. GEO_HAZ_SUMM.PPT	DATE 12/05/06	ADOT / LYNN CANAL HWY ZONE 4 / AK	**G-198**
PROJECT No. 063-5782	REV 0		

TABLES

TABLE 1

CLIMATIC DATA FOR STATIONS ALONG LYNN CANAL, ALASKA

Climate Station	Climate Station Number	Average Annual Maximum Temperature (°F)	Average Annual Minimum Temperature (°F)	Average Annual Total Precipitation (inches)	Average Annual Total Snowfall (inches)	Period of Record
Haines, Alaska	503490	48.1	35.4	47.77	122.7	6/21/1973-12/31/2005
Eldred Rock, Alaska	502770	45.7	36.6	46.44	71.1	9/15/1949-7/16/1973
Juneau Airport, Alaska	504100	47.3	34.6	56.97	94.4	9/1/1949-12/31/2005

Reference: WRCC, 2006, Western Regional Climate Center, Desert Research Institute, Reno, Nevada, Western U.S. historical summaries (individual stations) and Climate of Alaska. ONLINE. Available at http://www.wrcc.dri.edu [Accessed Nov. 13, 2006].

TABLE 2
INTACT ROCK STRENGTH CLASSIFICATION

Grade	Description	Field Identification	Approximate Range of Uniaxial Compressive Strength (Mpa)
R0	Extremely weak rock	Indented by thumbnail.	0.25 - 1.0
R1	Very weak rock	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife.	1.0 - 5.0
R2	Weak rock	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer.	5.0 - 25
R3	Medium strong rock	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer.	25 - 50
R4	Strong rock	Specimen requires more than one blow of geological hammer to fracture it.	50 - 100
R5	Very strong rock	Specimen requires many blows of geological hammer to fracture it.	100 - 250
R6	Extremely strong rock	Specimen can only be chipped with geological hammer.	>250

NOTE:
Materials having a uniaxial compressive strength of less than about 0.5 MPa and cohesionless materials should be classified using soil classifications systems. 1 MPa = 145 psi

REFERENCE:
Brown, 1981, Suggested Methods for Rock Characterization Testing and Monitoring, International Society for Rock Mechanics.

TABLE 3

HAZARD INDEX NUMBER (HIN) WEIGHTING SCHEME

HIN Weight	Hazard Characteristics				
	Frequency (yrs)	**Quantity (CY)**	**Source (ft)**	**Alignment Exposure (ft)**	**Predictability**
81	<1	>1000	>1000	>500	unpredictable
27	1-5	100-1000	500-1000	200-500	low
9	5-25	10-100	100-500	50-200	moderate
3	>25	<10	<100	<50	high

Reference: Adapted from Pierson, L.A., and Van Vickle, R., 1993, Rockfall Hazard Rating System Participants Manual, U. S. Department of Transportation, Federal Highway Administration, Publication No. FHWA SA-93-057.

TABLE 4
ALL HAZARDS SORTED BY ASCENDING IRP 2006 LOCATION

IRP 2006 Location	Hazard ID#	Hazard Type	Hazard Index Number (HIN)	Geologic Hazard Rating System	IRP 2006 South Margin	IRP 2006 North Margin	Photo #	Bounds	Impact Alignment	Frequency (yrs)	Material Volume (CY)	Source Elevation (ft)	Alignment Exposure (ft)	Predictability	Source Material	Centerline Slope	Clast Size (ft)	Alignment Location	Slope Angle (degrees)	Slope Drainage	Vegetation	Tension Cracks	Seeps	Tilting Trees	Curving Trunks	Deciduous Trees
1493	DF01	debris_flow	225	A	1492+90	1498+90	4098, 4099, 5146	-	yes	1-5	100-1000	>1000	500+	moderate	Qc	fan	1-2	deposition_zone	30-40	into_slide	denuded	other	no	no	no	yes
1515	DF02	debris_flow	129	A	1514+50	1515+50	1515, 2036, 5865	upalignment	yes	1-5	<10	2000-3000	50-200	moderate	Qc	fan	0-1	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
1517	DF03	debris_flow	183	A	1517+00	1518+20	3893, 5148, 5865, 6256	upalignment	yes	0-1	<10	2000-3000	50-200	moderate	Qc	fan	0-1	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
1522	RS01	rock_slide	219	A	1521+80	1525+50	4123, 4124, 4126, 5148, 5865	-	no	unk(>25?)	100-1000	>1000	200-500	unpredictable	Bxv	open_bedrock_slope	4+	deposition_zone	60+	unk	denuded	yes	no	no	no	no
1549	RF01	rockfall	147	C	1549+00	1552+50	4212, 4214, 5148	upalignment	no	1-5	<10	100-500	200-500	unpredictable	Bxv	open_soil_slope	3-4	below_deposition_zone	>60	unk	disturbed	no	yes	no	no	yes
1553	RF02	rockfall	111	C	1553+00	1554+00	3049, 5149	downalignment	no	5-25	<10	100-500	50-200	unpredictable	Bxv	open_soil_slope	0-1	below_deposition_zone	50-60	unk	disturbed	no	yes	no	no	yes
1586	RF03	rockfall	129	B	1584+50	1587+00	4259, 5873	mid	yes	5-25	<10	100-500	200-500	unpredictable	Bxv	single_channel	4+	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
1609	RF04	rockfall	183	B	1605+50	1611+10	4245, 4246, 4247, 4249	downslope	yes	unk(5-25?)	<10	100-500	500+	unpredictable	Bxv	open_soil_slope	4+	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
1657	RF05	rockfall	105	B	1657+00	1658+00	1086, 3904 to 3908, 5154, 6266	upalignment	yes	5-25	<10	<100	50-200	unpredictable	Bxv	open_bedrock_slope	4+	deposition_zone	>60	unk	disturbed	no	yes	no	no	yes
1670	DF04	debris_flow	117	B	1668+50	1670+50	3875	downalignment	yes	5-25	10-100	1000-2000	50-200	moderate	Qc	fan	0-1	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
1674	DF05	debris_flow	129	A	1673+80	1675+30	6203, 6204	upalignment	yes	1-5	10-100	1000-2000	50-200	high	Qc	single_channel	0-1	deposition_zone	30-40	into_slide	denuded	no	no	no	no	no
1678	DF06	debris_flow	201	A	1677+00	1679+00	3876	downalignment	yes	0-1	10-100	2000-3000	200-500	high	Qc	fan	0-1	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
1704	DF07	debris_flow	171	A	1701+50	1705+50	4366, 5155	upalignment	yes	1-5	100-1000	>1000	200-500	moderate	Qc	multi_channel	1-2	deposition_zone	30-40	Into_slide	denuded	no	no	no	no	yes
1720	DF08	debris_flow	129	A	1719+90	1720+80	1126, 5156	upslope	yes	1-5	10-100	>1000	50-200	high	Qc	fan	1-2	deposition_zone	40-50	into_slide	denuded	no	no	no	no	yes
1730	RF06	rockfall	183	A	1729+90	1730+80	4674, 6206	mid	yes	0-1	<10	100-500	50-200	unpredictable	Bxmg	open_bedrock_slope	3-4	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
1733	DF09	debris_flow	153	A	1732+50	1734+40	3307	upslope	yes	unk(1-5?)	10-100	>1000	50-200	low	Qc	single_channel	1-2	path	40-50	into_slide	disturbed	no	no	no	no	yes
1734	RF07	rockfall	279	A	1724+80	1739+80	4674	upslope	yes	0-1	10-100	500-1000	500+	unpredictable	Bxmg	open_bedrock_slope	4+	deposition_zone	>60	into_slide	disturbed	no	no	no	no	yes
1743	DF10	debris_flow	129	A	1742+50	1743+40	4745 to 4748	mid	yes	1-5	10-100	>1000	50-200	high	Qc	multi_channel	0-1	path	40-50	into_slide	denuded	no	no	no	no	no
1748	DF11	debris_flow	129	A	1746+40	1748+20	4741, 4742, 5157	downalignment	yes	1-5	10-100	>1000	50-200	high	Qc	fan	2-3	deposition_zone	40-50	into_slide	denuded	no	no	no	no	yes
1752	DF12	debris_flow	111	A	1751+00	1752+00	4738, 4739, 5157	mid	yes	5-25	10-100	>1000	50-200	high	Qc	fan	2-3	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
1757	DF13	debris_flow	129	A	1756+10	1757+50	4736, 4737, 5157	downalignment	yes	1-5	10-100	>1000	50-200	high	Qc	fan	2-3	deposition_zone	40-50	into_slide	denuded	no	no	no	no	yes
1759	RF08	rockfall	183	A	1759+30	1767+00	5157, 5039, 5040, 5041, 6209	upalignment	yes	5-25	<10	100-500	500+	unpredictable	Bxmg	open_soil_slope	4+	deposition_zone	>60	unk	disturbed	no	no	no	no	no
1763	RF09	rockfall	129	A	1763+20	1763+80	3878	upalignment	yes	1-5	<10	100-500	50-200	unpredictable	Bxmg	open_soil_slope	2-3	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
1773	DF14	debris_flow	111	A	1772+50	1773+60	2093, 4714	downalignment	yes	25+	10-100	>1000	50-200	moderate	Qc	single_channel	2-3	path	30-40	into_slide	disturbed	no	no	no	no	no
1782	DF15	debris_flow	207	B	1782+00	1783+00	3912	-	yes	5-25	1000+	>1000	200-500	moderate	Qc	multi_channel	2-3	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
1783	DF16	debris_flow	225	A	1783+00	1785+30	1141, 2091, 5158	upalignment	yes	1-5	1000+	>1000	200-500	moderate	Qc	multi_channel	2-3	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
1824	DF17	debris_flow	147	B	1824+10	1825+50	1186, 4012, 4015, 5159, 6232,	upalignment	yes	25+	10-100	2000-3000	200-500	low	Qc	fan	1-2	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
1826	DF18	debris_flow	147	A	1825+50	1827+50	1186, 4012, 4015, 5159, 6232,	upalignment	yes	1-5	10-100	2000-3000	200-500	high	Qc	fan	0-1	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
1847	DF19	debris_flow	153	A	1845+30	1849+90	4809, 4812, 4830, 5160	upalignment	yes	5-25	10-100	3000+	200-500	low	Qc	fan	0-1	deposition_zone	40-50	into_slide	denuded	no	no	no	no	yes
1852	DF20	debris_flow	153	B	1852+00	1853+10	1210, 5160	downalignment	yes	5-25	10-100	3000+	200-500	low	Qc	fan	0-1	deposition_zone	40-50	into_slide	denuded	no	no	no	no	yes
1854	RF10	rockfall	111	C	1853+30	1854+30	4816	downslope	no	unk(5-25?)	<10	100-500	50-200	unpredictable	Bxms	other	2-3	below_deposition_zone	50-60	unk	disturbed	no	no	no	no	yes
1865	RF11	rockfall	105	B	1864+80	1866+00	6234	downslope	yes	5-25	<10	<100	50-200	unpredictable	Bxms	open_soil_slope	2-3	deposition_zone	>60	unk	disturbed	no	yes	no	no	yes
1894	DF21	debris_flow	123	B	1893+30	1894+40	5161, 6238	downalignment	yes	1-5	<10	2000-3000	50-200	high	Qc	single_channel	0-1	path	30-40	into_slide	disturbed	no	no	no	no	yes
1915	RF12	rockfall	105	C	1915+20	1916+50	5162	downslope	no	unk(>25?)	<10	100-500	50-200	unpredictable	Bxmg	-	4+	below_deposition_zone	>60	unk	disturbed	no	no	no	no	yes
1932	RF13	rockfall	111	C	1931+80	1933+00	5162	downslope	no	0-1	<10	100-500	50-200	moderate	Bxmg	-	1-2	below_deposition_zone	>60	unk	disturbed	no	no	no	no	yes
1935	RF14	rockfall	129	B	1933+70	1953+00	5163, 5909 to 5911	downslope	yes	unk(5-25?)	<10	100-500	50-200	unpredictable	Bxmg	-	2-3	below_deposition_zone	50-60	unk	disturbed	no	no	no	no	no
1948	RF15	rockfall	129	B	1946+80	1949+00	5163	-	yes	5-25	<10	100-500	200-500	unpredictable	Bxmg	other	4+	deposition_zone	>60	off_slide	disturbed	no	yes	no	no	yes
1984	DF22	debris_flow	147	A	1983+30	1985+70	5047, 5164, 5914	mid	yes	1-5	10-100	2000-3000	200-500	high	Qc	fan	1-2	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	no
2015	RF16	rockfall	129	B	2015+00	2017+40	5052, 5053, 6240	upalignment	yes	unk(5-25?)	<10	100-500	200-500	unpredictable	Bxms	deciduous_trees	3-4	below_deposition_zone	40-50	unk	disturbed	no	no	no	no	yes
2038	DF23	debris_flow	117	A	2041+20	2042+70	5057, 5166	upalignment	yes	5-25	10-100	3000+	50-200	moderate	Qc	multi_channel	1-2	path	40-50	into_slide	disturbed	no	no	no	no	yes
2042	SR01	soil_raveling	171	B	2043+40	2050+10	5090, 5166, 6244	upalignment	yes	0-1	<10	<100	500+	high	Qc	open_soil_slope	1-2	path	40-50	off_slide	disturbed	no	no	no	no	yes
2054	DF24	debris_flow	207	B	2054+40	2056+50	2054, 2239, 3462, 3463, 5093, 6195	upalignment	yes	1-5	10-100	3000+	50-200	high	Qc	multi_channel	1-2	deposition_zone	40-50	into_slide	denuded	no	no	no	no	yes
2055	DF25	debris_flow	129	B	2056+50	2059+00	3462, 3463, 5093, 6195	upalignment	yes	5-25	<10	3000+	200-500	moderate	Qc	fan	0-1	deposition_zone	>60	into_slide	disturbed	no	no	no	no	no
2056	DF26	debris_flow	129	B	2059+00	2060+50	2241, 3470, 6195	upalignment	yes	1-5	10-100	3000+	200-500	high	Qc	fan	0-1	deposition_zone	50-60	-	disturbed	no	no	no	no	yes
2088	DF27	debris_flow	129	B	2088+00	2089+00	3885, 5167, 5924, 6247	upalignment	yes	5-25	<10	2000-3000	50-200	low	Qc	open_soil_slope	0-1	deposition_zone	30-40	into_slide	disturbed	no	no	no	no	yes
2104	DF28	debris_flow	183	A	2102+30	2103+70	3886, 5916	downalignment	yes	0-1	10-100	3000+	50-200	high	Qc	fan	3-4	deposition_zone	50-60	into_slide	denuded	no	no	no	no	yes
2114	DF29	debris_flow	153	A	2115+00	2117+40	5125, 5926, 6248	upalignment	yes	1-5	10-100	3000+	200-500	moderate	Qc	fan	1-2	deposition_zone	>60	into_slide	denuded	no	no	no	no	yes
2123	DF30	debris_flow	135	B	2123+00	2123+90	5168, 5927, 6250	downalignment	yes	5-25	10-100	1000-2000	50-200	low	Qc	single_channel	0-1	deposition_zone	30-40	into_slide	disturbed	no	no	no	no	yes
2129	RF17	rockfall	201	A	2129+00	2130+00	5928, 6251	upalignment	yes	1-5	<10	1000-2000	50-200	unpredictable	Bxmg	open_soil_slope	3-4	path	50-60	unk	disturbed	no	no	no	no	yes
2130	SR02	soil_raveling	171	B	2129+40	2129+80	3889, 5168	upalignment	yes	0-1	<10	<100	<50	unpredictable	Qc	single_channel	0-1	deposition_zone	30-40	into_slide	disturbed	no	no	yes	yes	yes
2134	RF18	rockfall	105	C	2134+00	2134+50	1751, 3490, 5169, 5929	downslope	no	unk(5-25?)	10-100	<100	<50	unpredictable	Bxm	open_bedrock_slope	1-2	starting_zone	30-40	unk	-	no	no	no	no	no
2142	DF31	debris_flow	111	A	2140+50	2142+30	5168, 5169, 5929, 5930	downalignment	yes	5-25	10-100	3000+	50-200	high	Qc	multi_channel	1-2	deposition_zone	50-60	into_slide	denuded	no	no	no	no	yes
2144	RF19	rockfall	273	A	2142+70	2150+30	1357, 3491, 3493, 3495, 3498, 5130, 5168	mid	yes	1-5	<10	3000+	500+	unpredictable	Bxmg	fan	4+	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
2145	RF20	rockfall	165	A	2144+60	2146+80	1357, 3491, 3493, 3495, 3498, 5130, 5131, 5168	downslope	yes	1-5	<10	500-1000	200-500	unpredictable	Bxmg	fan	4+	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
2154	RF21	rockfall	147	C	2154+00	2155+00	6014	-	no	1-5	<10	500-1000	50-200	unpredictable	Bxmg	-	2-3	below_deposition_zone	40-50	unk	disturbed	no	no	no	no	yes
2205	LS01	landslide	183	C	2204+00	2208+00	5171	-	no	unk(>25?)	10-100	1000-2000	<50	unpredictable	Bxmg	-	-	below_deposition_zone	40-50	unk	disturbed	no	no	no	no	no
2207	DF32	debris_flow	51	B	2206+60	2207+20	6018	downalignment	yes	5-25	<10	500-1000	50-200	high	Qc	single_channel	0-1	path	40-50	into_slide	disturbed	no	no	no	no	yes
2220	LS02	translational_slide	135	C	2219+60	2221+00	5000, 5937	mid	no	1-5	10-100	100-500	50-200	unpredictable	Qc	-	0-1	below_deposition_zone	50-60	unk	denuded	no	no	yes	no	yes
2250	DF33	debris_flow	183	B	2252+50	2252+80	6023	mid	yes	unk(5-25?)	10-100	3000+	<50	unpredictable	Qc	single_channel	1-2	path	40-50	into_slide	denuded	no	no	no	no	no
2254	RF22	rockfall	147	B	2253+30	2253+80	5941, 6024	mid	yes	1-5	<10	500-1000	50-200	unpredictable	Bxmg	single_channel	1-2	path	50-60	into_slide	disturbed	no	no	no	no	no
2256	RF23	rockfall	147	B	2254+90	2258+10	3505	downslope	yes	unk(1-5?)	<10	100-500	200-500	unpredictable	Bxmg	other	0-1	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
2260	RF24	rockfall	147	C	2258+90	2261+00	3507	downslope	no	unk(1-5?)	<10	100-500	200-500	unpredictable	Bxmg	-	4+	below_deposition_zone	>60	unk	disturbed	no	no	no	no	yes
2261	RS02	rock_slide	81	A	2261+10	2261+80	3508, 3510, 3511	mid	yes	1-5	10-100	500-1000	50-200	moderate	Bxmg	single_channel	1-2	path	50-60	into_slide	disturbed	no	no	no	no	no
2265	SR03	soil_raveling	147	B	2263+50	2267+40	5579, 5580, 5581	mid	yes	1-5	<10	100-500	200-500	unpredictable	Bxmg	open_bedrock_slope	2-3	path	50-60	unk	disturbed	no	no	no	no	yes
2281	DF34	debris_flow	147	B	2283+70	2287+10	3527, 3528	upalignment	yes	1-5	10-100	3000+	200-500	high	Qct	fan	1-2	deposition_zone	50-60	into_slide	denuded	no	no	no	no	yes
2291	RF25	rockfall	123	B	2290+60	2291+00	3531	upslope	yes	unk(1-5?)	10-100	<100	<50	unpredictable	Bxms	open_bedrock_slope	2-3	deposition_zone	>60	unk	denuded	no	no	yes	yes	yes
2296	DF35	debris_flow	207	B	2293+80	2294+90	3535	downalignment	yes	unk(1-5?)	10-100	3000+	50-200	unpredictable	Qct	fan	3-4	deposition_zone	>60	into_slide	disturbed	no	no	no	no	yes
2300	LS03	translational_slide	111	C	2299+10	2299+60	5269, 5946	mid	no	25+	10-100	100-500	50-200	unpredictable	Qc	-	1-2	below_deposition_zone	50-60	unk	disturbed	no	no	no	no	yes
2301	RF26	rockfall	117	B	2300+20	2301+10	3559, 3560, 5946	downslope	yes	unk(5-25?)	10-100	100-500	50-200	unpredictable	Bxmg	other	4+	deposition_zone	>60	unk	undisturbed	yes	no	no	no	no
2308	RF27	rockfall	165	B	2303+50	2308+40	3561	mid	yes	1-5	<10	500-1000	200-500	unpredictable	Bxmg	fan	2-3	deposition_zone	50-60	unk	disturbed	no	no	no	no	yes
2310	DF36	debris_flow	129	B	2311+10	2311+80	3562	mid	yes	1-5	10-100	1000-2000	50-200	high	Qc	fan	0-1	path	>60	into_slide	denuded	no	no	no	no	yes
2321	DF37	debris_flow	129	B	2321+20	2322+10	3564, 3565, 3566	upalignment	yes	1-5	10-100	1000-2000	50-200	high	Qc	fan	1-2	deposition_zone	50-60	into_slide	denuded	no	no	no	no	yes
2322	RF28	rockfall	183	A	2322+10	2322+70	3891, 5948, 6254	downslope	yes	0-1	<10	100-500	50-200	unpredictable	Bxmg	single_channel	1-2	path	>60	unk	disturbed	no	yes	no	no	yes
2328	RF29	rockfall	105	B	2328+10	2329+10	6140	mid	yes	25+	<10	100-500	50-200	unpredictable	Bxmg	open_soil_slope	3-4	path	>60	unk	disturbed	no	no	no	no	no
2332	RF30	rockfall	135	B	2331+40	2332+80	6142, 6143	mid	no	5-25	10-100	500-1000	50-200	unpredictable	Bxmg	open_soil_slope	4+	below_deposition_zone	>60	unk	disturbed	no	no	no	no	no
2335	RF31	rockfall	129	A	2334+70	2335+60	6144, 6145	mid	yes	5-25	<10	500-1000	50-200	unpredictable	Bxmg	single_channel	4+	deposition_zone	>60	unk	denuded	no	no	no	no	yes

TABLE 4
ALL HAZARDS SORTED BY ASCENDING IRP 2006 LOCATION

IRP 2006 Location	Hazard ID#	Hazard Type	Hazard Index Number (HIN)	Geologic Hazard Rating System	IRP 2006 South Margin	IRP 2006 North Margin	Photo #	Bounds	Impact Alignment	Frequency (yrs)	Material Volume (CY)	Source Elevation (ft)	Alignment Exposure (ft)	Predictability	Source Material	Centerline Slope	Clast Size (ft)	Alignment Location	Slope Angle (degrees)	Slope Drainage	Vegetation	Tension Cracks	Seeps	Tilting Trees	Curving Trunks	Deciduous Trees
2338	DF38	debris_flow	129	A	2338+00	2338+90	6146	mid	yes	1-5	10-100	2000-3000	50-200	high	Qc	single_channel	0-1	path	40-50	into_slide	denuded	no	no	no	no	no
2365	RF33	rockfall	255	B	2364+20	2370+50	3724, 3725	downslope	yes	0-1	<10	100-500	500+	unpredictable	Bxmg	open_soil_slope	1-2	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
2370	RF32	rockfall	201	B	2361+10	2364+20	3724, 3725	downalignment	yes	0-1	<10	100-500	200-500	unpredictable	Bxmg	open_soil_slope	1-2	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
2374	HR01	hazard_rock	99	C	2374+90	-	3722	upalignment	yes	unk(>25?)	10-100	<100	<50	unpredictable	Qct	open_soil_slope	4+	below_deposition_zone	40-50	unk	undisturbed	no	no	no	no	no
2380	HR02	hazard_rock	99	C	2379+40	2380+90	3719	upslope	yes	unk(>25?)	<10	<100	50-200	unpredictable	Qct	open_soil_slope	4+	deposition_zone	40-50	unk	disturbed	no	no	no	no	no
2383	RF34	rockfall	177	B	2382+50	2388+50	3712, 3715	upalignment	no	25+	<10	100-500	500+	unpredictable	Bxmg	open_soil_slope	4+	below_deposition_zone	>60	unk	undisturbed	no	no	no	no	yes
2388	RF35	rockfall	183	B	2388+00	2388+80	3706	downslope	yes	0-1	<10	100-500	50-200	unpredictable	Bxmg	open_soil_slope	0-1	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
2420	SR04	soil_raveling	105	B	2420+70	2426+80	3595 to 3598, 5957, 6061	upalignment	yes	5-25	<10	<100	500+	moderate	Qc	open_soil_slope	3-4	path	40-50	into_slide	disturbed	no	no	no	yes	no
2426	LS04	translational_slide	33	B	2426+80	2427+40	3595, 3597, 3598, 6074	upalignment	yes	5-25	<10	<100	50-200	moderate	Qc	open_soil_slope	3-4	path	40-50	into_slide	disturbed	no	no	yes	yes	no
2454	RF36	rockfall	129	B	2454+50	2455+00	3609, 5960	downslope	yes	1-5	<10	100-500	50-200	unpredictable	Bxmg	-	3-4	below_deposition_zone	>60	unk	denuded	no	yes	no	no	yes
2457	LS05	translational_slide	129	C	2456+00	2458+00	3615, 5961, 6077	upslope	no	5-25	<10	100-500	200-500	unpredictable	Qct	-	3-4	below_deposition_zone	30-40	unk	disturbed	no	no	no	yes	yes
2459	DF40	debris_flow	135	B	2459+00	2459+90	3616, 5180, 5961	mid	yes	5-25	10-100	2000-3000	50-200	low	Qc	fan	0-1	deposition_zone	40-50	into_slide	denuded	no	no	no	no	no
2460	DF41	debris_flow	129	B	2460+40	2461+00	3616	mid	yes	1-5	10-100	3000+	50-200	high	Qc	fan	0-1	deposition_zone	50-60	into_slide	denuded	no	no	no	no	yes
2467	RF37	rockfall	69	B	2466+10	2470+00	3637, 5181, 5962	upalignment	yes	1-5	<10	100-500	200-500	high	Bxmg	open_soil_slope	4+	path	>60	into_slide	disturbed	no	no	no	no	yes
2473	RF38	rockfall	33	B	2473+00	2474+00	6092	mid	yes	5-25	<10	100-500	50-200	high	Bxmg	single_channel	1-2	path	>60	into_slide	disturbed	no	no	yes	no	yes
2481	RF39	rockfall	129	B	2480+30	2481+50	6083, 6084	downslope	yes	1-5	<10	100-500	50-200	unpredictable	Bxmg	other	3-4	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
2487	RF40	rockfall	147	B	2484+00	2488+70	5182, 5964, 6085,	downslope	yes	1-5	<10	100-500	200-500	unpredictable	Bxmg	-	3-4	below_deposition_zone	>60	unk	disturbed	no	no	no	no	no
2491	DF42	debris_flow	117	B	2490+70	2491+30	6086	downslope	yes	5-25	10-100	1000-2000	50-200	moderate	Qc	single_channel	1-2	path	40-50	into_slide	disturbed	no	no	no	no	yes
2495	RF41	rockfall	129	C	2495+00	2505+00	5965, 6094, 6095	upalignment	yes	1-5	<10	100-500	500+	moderate	Bxmg	open_soil_slope	2-3	path	>60	into_slide	disturbed	no	no	no	no	yes
2502	RF42	rockfall	105	B	2499+50	2505+00	6094, 6095	downslope	yes	unk(5-25?)	<10	<100	500+	moderate	Bxmg	deciduous_trees	0-1	path	40-50	unk	denuded	yes	no	no	no	yes
2518	HR03	hazard_rock	93	C	2517+80	-	5311, 5312	downslope	yes	unk(>25?)	<10	<100	<50	unpredictable	Qct	-	4+	below_deposition_zone	40-50	-	-	no	no	no	no	no
2526	HR04	hazard_rock	93	C	2526+00	-	5318	-	yes	unk(>25?)	<10	<100	<50	unpredictable	Qct	-	4+	below_deposition_zone	40-50	-	-	no	no	no	no	no
2529	RF43	rockfall	129	A	2528+00	2529+70	3648, 5969	downalignment	yes	1-5	<10	100-500	50-200	unpredictable	Bxmg	open_soil_slope	2-3	deposition_zone	40-50	unk	disturbed	no	no	no	no	yes
2531	RF44	rockfall	147	B	2531+00	2533+20	1565, 5326, 5327	downslope	yes	1-5	<10	100-500	200-500	unpredictable	Bxmg	open_soil_slope	1-2	deposition_zone	>60	unk	disturbed	no	no	no	no	no
2537	RF45	rockfall	129	A	2536+10	2537+80	6098, 6099	downalignment	yes	1-5	<10	100-500	50-200	unpredictable	Bxmg	-	1-2	deposition_zone	40-50	unk	-	no	no	no	no	no
2548	RF46	rockfall	111	A	2546+70	2548+30	5338, 5339	mid	yes	5-25	<10	100-500	50-200	unpredictable	Bxmg	open_soil_slope	2-3	deposition_zone	>60	unk	disturbed	no	no	no	yes	yes
2550	RF47	rockfall	183	B	2549+80	2556+30	3660	downslope	yes	5-25	<10	100-500	500+	unpredictable	Bxmg	open_soil_slope	2-3	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
2552	LS06	landslide	129	C	2552+80	2554+00	5185, 5341, 5342	mid	no	unk(>25?)	10-100	500-1000	50-200	unpredictable	-	open_soil_slope	-	below_deposition_zone	>60	unk	disturbed	no	no	no	no	no
2554	HR05	hazard_rock	93	C	2554+30	-	5362, 5363	-	yes	unk(>25?)	<10	<100	<50	unpredictable	Qct	open_soil_slope	4+	below_deposition_zone	-	-	-	no	no	no	no	no
2557	RF49	rockfall	201	C	2556+50	2562+00	3661, 3662, 3664	downslope	no	1-5	<10	100-500	500+	unpredictable	Bxmg	open_soil_slope	2-3	below_deposition_zone	>60	unk	disturbed	no	no	no	no	yes
2558	RF50	rockfall	147	B	2557+80	2558+40	3661, 3662, 3664	upalignment	yes	1-5	<10	500-1000	50-200	unpredictable	Bxmg	open_soil_slope	2-3	path	>60	unk	disturbed	no	no	no	no	yes
2560	RF51	rockfall	147	B	2559+30	2560+50	3661, 3662, 3664	mid	yes	1-5	<10	500-1000	50-200	unpredictable	Bxmg	open_soil_slope	2-3	path	>60	unk	disturbed	no	no	no	no	yes
2561	LS07	landslide	129	C	2561+80	2562+80	5024	mid	no	unk(>25?)	10-100	500-1000	50-200	unpredictable	Qct	open_soil_slope	-	below_deposition_zone	>60	unk	disturbed	no	no	no	no	no
2563	DF43	debris_flow	63	A	2563+30	2564+10	5356	downalignment	yes	5-25	10-100	500-1000	50-200	moderate	Qct	single_channel	1-2	path	50-60	into_slide	denuded	no	no	no	no	yes
2568	RF52	rockfall	123	B	2564+70	2570+60	6105, 6106	downslope	yes	1-5	<10	100-500	500+	high	Bxmg	open_soil_slope	4+	path	>60	into_slide	disturbed	no	no	yes	no	yes
2620	RF53	rockfall	201	A	2618+90	2626+00	3683, 3684	downalignment	yes	25+	100-1000	100-500	500+	unpredictable	Bxmg	fan	4+	below_deposition_zone	>60	unk	disturbed	no	no	no	no	yes

TABLE 5
ALL HAZARDS SORTED BY HAZARD TYPE AND ASCENDING HAZARD INDEX NUMBER (HIN)

Hazard Type	Hazard Index Number (HIN)	IRP 2006 Location	Hazard ID#	Geologic Hazard Rating System	IRP 2006 South Margin	IRP 2006 North Margin	Photo #	Bounds	Impact Alignment	Frequency (yrs)	Material Volume (CY)	Source Elevation (ft)	Alignment Exposure (ft)	Predictability	Source Material	Centerline Slope	Clast Size (ft)	Alignment Location	Slope Angle (degrees)	Slope Drainage	Vegetation	Tension Cracks	Seeps	Tilting Trees	Curving Trunks	Deciduous Trees
debris_flow	51	2207	DF32	B	2206+60	2207+20	6018	downalignment	yes	5-25	<10	500-1000	50-200	high	Qc	single_channel	0-1	path	40-50	into_slide	disturbed	no	no	no	no	yes
debris_flow	63	2563	DF43	A	2563+30	2564+10	5356	downalignment	yes	5-25	10-100	500-1000	50-200	moderate	Qct	single_channel	1-2	path	50-60	into_slide	denuded	no	no	no	no	yes
debris_flow	111	1752	DF12	A	1751+00	1752+00	4738, 4739, 5157	mid	yes	5-25	10-100	>1000	50-200	high	Qc	fan	2-3	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
debris_flow	111	1773	DF14	A	1772+50	1773+60	2093, 4714	downalignment	yes	25+	10-100	>1000	50-200	moderate	Qc	single_channel	2-3	path	30-40	into_slide	disturbed	no	no	no	no	no
debris_flow	111	2142	DF31	A	2140+50	2142+30	5168, 5169, 5929, 5930	downalignment	yes	5-25	10-100	3000+	50-200	high	Qc	multi_channel	1-2	deposition_zone	50-60	into_slide	denuded	no	no	no	no	yes
debris_flow	117	1670	DF04	B	1668+50	1670+50	3875	downalignment	yes	5-25	10-100	1000-2000	50-200	moderate	Qc	fan	0-1	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
debris_flow	117	2038	DF23	A	2041+20	2042+70	5057, 5166	upalignment	yes	5-25	10-100	3000+	50-200	moderate	Qc	multi_channel	1-2	path	40-50	into_slide	disturbed	no	no	no	no	yes
debris_flow	117	2491	DF42	B	2490+70	2491+30	6086	downslope	yes	5-25	10-100	1000-2000	50-200	moderate	Qc	single_channel	1-2	path	40-50	into_slide	disturbed	no	no	no	no	yes
debris_flow	123	1894	DF21	B	1893+30	1894+40	5161, 6238	downalignment	yes	1-5	<10	2000-3000	50-200	high	Qc	single_channel	0-1	path	30-40	into_slide	disturbed	no	no	no	no	yes
debris_flow	129	1515	DF02	A	1514+50	1515+50	1515, 2036, 5865	upalignment	yes	1-5	<10	2000-3000	50-200	moderate	Qc	fan	0-1	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
debris_flow	129	1674	DF05	A	1673+80	1675+30	6203, 6204	upalignment	yes	1-5	10-100	1000-2000	50-200	high	Qc	single_channel	0-1	deposition_zone	30-40	into_slide	denuded	no	no	no	no	no
debris_flow	129	1720	DF08	A	1719+90	1720+80	1126, 5156	upslope	yes	1-5	10-100	>1000	50-200	high	Qc	fan	1-2	deposition_zone	40-50	into_slide	denuded	no	no	no	no	yes
debris_flow	129	1743	DF10	A	1742+50	1743+40	4745 to 4748	mid	yes	1-5	10-100	>1000	50-200	high	Qc	multi_channel	0-1	path	40-50	into_slide	denuded	no	no	no	no	no
debris_flow	129	1748	DF11	A	1746+40	1748+20	4741, 4742, 5157	downalignment	yes	1-5	10-100	>1000	50-200	high	Qc	fan	2-3	deposition_zone	40-50	into_slide	denuded	no	no	no	no	yes
debris_flow	129	1757	DF13	A	1756+10	1757+50	4736, 4737, 5157	downalignment	yes	1-5	10-100	>1000	50-200	high	Qc	fan	2-3	deposition_zone	40-50	into_slide	denuded	no	no	no	no	yes
debris_flow	129	2055	DF25	B	2056+50	2059+00	3462, 3463, 5093, 6195	upalignment	yes	5-25	<10	3000+	200-500	moderate	Qc	fan	0-1	deposition_zone	>60	into_slide	disturbed	no	no	no	no	no
debris_flow	129	2056	DF26	B	2059+00	2060+50	2241, 3470, 6195	upalignment	yes	1-5	10-100	3000+	200-500	high	Qc	fan	0-1	deposition_zone	50-60	-	disturbed	no	no	no	no	yes
debris_flow	129	2088	DF27	B	2088+00	2089+00	3885, 5167, 5924, 6247	upalignment	yes	5-25	<10	2000-3000	50-200	low	Qc	open_soil_slope	0-1	deposition_zone	30-40	into_slide	disturbed	no	no	no	no	yes
debris_flow	129	2310	DF36	B	2311+10	2311+80	3562	mid	yes	1-5	10-100	1000-2000	50-200	high	Qc	fan	0-1	path	>60	into_slide	denuded	no	no	no	no	yes
debris_flow	129	2321	DF37	B	2321+20	2322+10	3564, 3565, 3566	upalignment	yes	1-5	10-100	1000-2000	50-200	high	Qc	fan	1-2	deposition_zone	50-60	into_slide	denuded	no	no	no	no	yes
debris_flow	129	2338	DF38	A	2338+00	2338+90	6146	mid	yes	1-5	10-100	2000-3000	50-200	high	Qc	single_channel	0-1	path	40-50	into_slide	denuded	no	no	no	no	no
debris_flow	129	2460	DF41	B	2460+40	2461+00	3616	mid	yes	1-5	10-100	3000+	50-200	high	Qc	fan	0-1	deposition_zone	50-60	into_slide	denuded	no	no	no	no	yes
debris_flow	135	2123	DF30	B	2123+00	2123+90	5168, 5927, 6250	downalignment	yes	5-25	10-100	1000-2000	50-200	low	Qc	single_channel	0-1	deposition_zone	30-40	into_slide	disturbed	no	no	no	no	yes
debris_flow	135	2459	DF40	B	2459+00	2459+90	3616, 5180, 5961	mid	yes	5-25	10-100	2000-3000	50-200	low	Qc	fan	0-1	deposition_zone	40-50	into_slide	denuded	no	no	no	no	no
debris_flow	147	1824	DF17	B	1824+10	1825+50	1186, 4012, 4015, 5159, 6232,	upalignment	yes	25+	10-100	2000-3000	200-500	low	Qc	fan	1-2	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
debris_flow	147	1826	DF18	A	1825+50	1827+50	1186, 4012, 4015, 5159, 6232,	upalignment	yes	1-5	10-100	2000-3000	200-500	high	Qc	fan	0-1	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
debris_flow	147	1984	DF22	A	1983+30	1985+70	5047, 5164, 5914	mid	yes	1-5	10-100	2000-3000	200-500	high	Qc	fan	1-2	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	no
debris_flow	147	2281	DF34	B	2283+70	2287+10	3527, 3528	upalignment	yes	1-5	10-100	3000+	200-500	high	Qct	fan	1-2	deposition_zone	50-60	into_slide	denuded	no	no	no	no	yes
debris_flow	153	1733	DF09	A	1732+50	1734+40	3307	upslope	yes	unk(1-5?)	10-100	>1000	50-200	low	Qc	single_channel	1-2	path	40-50	into_slide	disturbed	no	no	no	no	yes
debris_flow	153	1847	DF19	A	1845+30	1849+90	4809, 4812, 4830, 5160	upalignment	yes	5-25	10-100	3000+	200-500	low	Qc	fan	0-1	deposition_zone	40-50	into_slide	denuded	no	no	no	no	yes
debris_flow	153	1852	DF20	B	1852+00	1853+10	1210, 5160	downalignment	yes	5-25	10-100	3000+	200-500	low	Qc	fan	0-1	deposition_zone	40-50	into_slide	denuded	no	no	no	no	yes
debris_flow	153	2114	DF29	A	2115+00	2117+40	5125, 5926, 6248	upalignment	yes	1-5	10-100	3000+	200-500	moderate	Qc	fan	1-2	deposition_zone	>60	into_slide	denuded	no	no	no	no	yes
debris_flow	171	1704	DF07	A	1701+50	1705+50	4366, 5155	upalignment	yes	1-5	100-1000	>1000	200-500	moderate	Qc	multi_channel	1-2	deposition_zone	30-40	Into_slide	denuded	no	no	no	no	yes
debris_flow	183	1517	DF03	A	1517+00	1518+20	3893, 5148, 5865, 6256	upalignment	yes	0-1	<10	2000-3000	50-200	moderate	Qc	fan	0-1	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
debris_flow	183	2104	DF28	A	2102+30	2103+70	3886, 5916	downalignment	yes	0-1	10-100	3000+	50-200	high	Qc	fan	3-4	deposition_zone	50-60	into_slide	denuded	no	no	no	no	yes
debris_flow	183	2250	DF33	B	2252+50	2252+80	6023	mid	yes	unk(5-25?)	10-100	3000+	<50	unpredictable	Qc	single_channel	1-2	path	40-50	into_slide	denuded	no	no	no	no	no
debris_flow	201	1678	DF06	A	1677+00	1679+00	3876	downalignment	yes	0-1	10-100	2000-3000	200-500	high	Qc	fan	0-1	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
debris_flow	207	1782	DF15	B	1782+00	1783+00	3912	-	yes	5-25	1000+	>1000	200-500	moderate	Qc	multi_channel	2-3	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
debris_flow	207	2054	DF24	B	2054+40	2056+50	2054, 2239, 3462, 3463, 5093, 6195	upalignment	yes	1-5	10-100	3000+	50-200	high	Qc	multi_channel	1-2	deposition_zone	40-50	into_slide	denuded	no	no	no	no	yes
debris_flow	207	2296	DF35	B	2293+80	2294+90	3535	downalignment	yes	unk(1-5?)	10-100	3000+	50-200	unpredictable	Qct	fan	3-4	deposition_zone	>60	into_slide	disturbed	no	no	no	no	yes
debris_flow	225	1493	DF01	A	1492+90	1498+90	4098, 4099, 5146	-	yes	1-5	100-1000	>1000	500+	moderate	Qc	fan	1-2	deposition_zone	30-40	into_slide	denuded	other	no	no	no	yes
debris_flow	225	1783	DF16	A	1783+00	1785+30	1141, 2091, 5158	upalignment	yes	1-5	1000+	>1000	200-500	moderate	Qc	multi_channel	2-3	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
hazard_rock	93	2518	HR03	C	2517+80	-	5311, 5312	downslope	yes	unk(>25?)	<10	<100	<50	unpredictable	Qct	-	4+	below_deposition_zone	40-50	-	-	no	no	no	no	no
hazard_rock	93	2526	HR04	C	2526+00	-	5318	-	yes	unk(>25?)	<10	<100	<50	unpredictable	Qct	-	4+	below_deposition_zone	40-50	-	-	no	no	no	no	no
hazard_rock	93	2554	HR05	C	2554+30	-	5362, 5363	-	yes	unk(>25?)	<10	<100	<50	unpredictable	Qct	open_soil_slope	4+	below_deposition_zone	-	-	-	no	no	no	no	no
hazard_rock	99	2374	HR01	C	2374+90	-	3722	upalignment	yes	unk(>25?)	10-100	<100	<50	unpredictable	Qct	open_soil_slope	4+	below_deposition_zone	40-50	unk	undisturbed	no	no	no	no	no
hazard_rock	99	2380	HR02	C	2379+40	2380+90	3719	upslope	yes	unk(>25?)	<10	<100	50-200	unpredictable	Qct	open_soil_slope	4+	deposition_zone	40-50	unk	disturbed	no	no	no	no	no
landslide	129	2552	LS06	C	2552+80	2554+00	5185, 5341, 5342	mid	no	unk(>25?)	10-100	500-1000	50-200	unpredictable	-	open_soil_slope	-	below_deposition_zone	>60	unk	disturbed	no	no	no	no	no
landslide	129	2561	LS07	C	2561+80	2562+80	5024	mid	no	unk(>25?)	10-100	500-1000	50-200	unpredictable	Qct	open_soil_slope	-	below_deposition_zone	>60	unk	disturbed	no	no	no	no	no
landslide	183	2205	LS01	C	2204+00	2208+00	5171	-	no	unk(>25?)	10-100	1000-2000	<50	unpredictable	Bxmg	-	-	below_deposition_zone	40-50	unk	disturbed	no	no	no	no	no
rock_slide	81	2261	RS02	A	2261+10	2261+80	3508, 3510, 3511	mid	yes	1-5	10-100	500-1000	50-200	moderate	Bxmg	single_channel	1-2	path	50-60	into_slide	disturbed	no	no	no	no	no
rock_slide	219	1522	RS01	A	1521+80	1525+50	4123, 4124, 4126, 5148, 5865	-	no	unk(>25?)	100-1000	>1000	200-500	unpredictable	Bxv	open_bedrock_slope	4+	deposition_zone	60+	unk	denuded	yes	no	no	no	no
rockfall	33	2473	RF38	B	2473+00	2474+00	6092	mid	yes	5-25	<10	100-500	50-200	high	Bxmg	single_channel	1-2	path	>60	into_slide	disturbed	no	no	yes	no	yes
rockfall	69	2467	RF37	B	2466+10	2470+00	3637, 5181, 5962	upalignment	yes	1-5	<10	100-500	200-500	high	Bxmg	open_soil_slope	4+	path	>60	into_slide	disturbed	no	no	no	no	yes
rockfall	105	1657	RF05	B	1657+00	1658+00	1086, 3904 to 3908, 5154, 6266	upalignment	yes	5-25	<10	<100	50-200	unpredictable	Bxv	open_bedrock_slope	4+	deposition_zone	>60	unk	disturbed	no	yes	no	no	yes
rockfall	105	1865	RF11	B	1864+80	1866+00	6234	downslope	yes	5-25	<10	<100	50-200	unpredictable	Bxms	open_soil_slope	2-3	deposition_zone	>60	unk	disturbed	no	yes	no	no	yes
rockfall	105	1915	RF12	C	1915+20	1916+50	5162	downslope	no	unk(>25?)	<10	100-500	50-200	unpredictable	Bxmg	-	4+	below_deposition_zone	>60	unk	disturbed	no	no	no	no	yes
rockfall	105	2134	RF18	C	2134+00	2134+50	1751, 3490, 5169, 5929	downslope	no	unk(5-25?)	10-100	<100	<50	unpredictable	Bxm	open_bedrock_slope	1-2	starting_zone	30-40	unk	-	no	no	no	no	no
rockfall	105	2328	RF29	B	2328+10	2329+10	6140	mid	yes	25+	<10	100-500	50-200	unpredictable	Bxmg	open_soil_slope	3-4	path	>60	unk	disturbed	no	no	no	no	no
rockfall	105	2502	RF42	B	2499+50	2505+00	6094, 6095	downslope	yes	unk(5-25?)	<10	<100	500+	moderate	Bxmg	deciduous_trees	0-1	path	40-50	unk	denuded	yes	no	no	no	yes
rockfall	111	1553	RF02	C	1553+00	1554+00	3049, 5149	downalignment	no	5-25	<10	100-500	50-200	unpredictable	Bxv	open_soil_slope	0-1	below_deposition_zone	50-60	unk	disturbed	no	yes	no	no	yes
rockfall	111	1854	RF10	C	1853+30	1854+30	4816	downslope	no	unk(5-25?)	<10	100-500	50-200	unpredictable	Bxms	other	2-3	below_deposition_zone	50-60	unk	disturbed	no	no	no	no	yes
rockfall	111	1932	RF13	C	1931+80	1933+00	5162	downslope	no	0-1	<10	100-500	50-200	moderate	Bxmg	-	1-2	below_deposition_zone	>60	unk	disturbed	no	no	no	no	yes
rockfall	111	2548	RF46	A	2546+70	2548+30	5338, 5339	mid	yes	5-25	<10	100-500	50-200	unpredictable	Bxmg	open_soil_slope	2-3	deposition_zone	>60	unk	disturbed	no	no	no	yes	yes
rockfall	117	2301	RF26	B	2300+20	2301+10	3559, 3560, 5946	downslope	yes	unk(5-25?)	10-100	100-500	50-200	unpredictable	Bxmg	other	4+	deposition_zone	>60	unk	undisturbed	yes	no	no	no	no
rockfall	123	2291	RF25	B	2290+60	2291+00	3531	upslope	yes	unk(1-5?)	10-100	<100	<50	unpredictable	Bxms	open_bedrock_slope	2-3	deposition_zone	>60	unk	denuded	no	no	yes	yes	yes
rockfall	123	2568	RF52	B	2564+70	2570+60	6105, 6106	downslope	yes	1-5	<10	100-500	500+	high	Bxmg	open_soil_slope	4+	path	>60	into_slide	disturbed	no	no	yes	no	yes
rockfall	129	1586	RF03	B	1584+50	1587+00	4259, 5873	mid	yes	5-25	<10	100-500	200-500	unpredictable	Bxv	single_channel	4+	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
rockfall	129	1763	RF09	A	1763+20	1763+80	3878	upalignment	yes	1-5	<10	100-500	50-200	unpredictable	Bxmg	open_soil_slope	2-3	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
rockfall	129	1935	RF14	B	1933+70	1953+00	5163, 5909 to 5911	downslope	yes	unk(5-25?)	<10	100-500	200-500	unpredictable	Bxmg	-	2-3	below_deposition_zone	50-60	unk	disturbed	no	no	no	no	no
rockfall	129	1948	RF15	B	1946+80	1949+00	5163	-	yes	5-25	<10	100-500	200-500	unpredictable	Bxmg	other	4+	deposition_zone	>60	off_slide	disturbed	no	yes	no	no	yes
rockfall	129	2015	RF16	B	2015+00	2017+40	5052, 5053, 6240	upalignment	yes	unk(5-25?)	<10	100-500	200-500	unpredictable	Bxms	deciduous_trees	3-4	below_deposition_zone	40-50	unk	disturbed	no	no	no	no	yes
rockfall	129	2335	RF31	A	2334+70	2335+60	6144, 6145	mid	yes	5-25	<10	500-1000	50-200	unpredictable	Bxmg	single_channel	4+	deposition_zone	>60	unk	denuded	no	no	no	no	yes
rockfall	129	2454	RF36	B	2454+50	2455+00	3609, 5960	downslope	yes	1-5	<10	100-500	50-200	unpredictable	Bxmg	-	3-4	below_deposition_zone	>60	unk	denuded	no	yes	no	no	yes
rockfall	129	2481	RF39	B	2480+30	2481+50	6083, 6084	downslope	yes	1-5	<10	100-500	50-200	unpredictable	Bxmg	other	3-4	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
rockfall	129	2495	RF41	C	2495+00	2505+00	5965, 6094, 6095	upalignment	yes	1-5	<10	100-500	500+	moderate	Bxmg	open_soil_slope	2-3	path	>60	into_slide	disturbed	no	no	no	no	yes

TABLE 5
ALL HAZARDS SORTED BY HAZARD TYPE AND ASCENDING HAZARD INDEX NUMBER (HIN)

Hazard Type	Hazard Index Number (HIN)	IRP 2006 Location	Hazard ID#	Geologic Hazard Rating System	IRP 2006 South Margin	IRP 2006 North Margin	Photo #	Bounds	Impact Alignment	Frequency (yrs)	Material Volume (CY)	Source Elevation (ft)	Alignment Exposure (ft)	Predictability	Source Material	Centerline Slope	Clast Size (ft)	Alignment Location	Slope Angle (degrees)	Slope Drainage	Vegetation	Tension Cracks	Seeps	Tilting Trees	Curving Trunks	Deciduous Trees
rockfall	129	2529	RF43	A	2528+00	2529+70	3648, 5969	downalignment	yes	1-5	<10	100-500	50-200	unpredictable	Bxmg	open_soil_slope	2-3	deposition_zone	40-50	unk	disturbed	no	no	no	no	yes
rockfall	129	2537	RF45	A	2536+10	2537+80	6098, 6099	downalignment	yes	1-5	<10	100-500	50-200	unpredictable	Bxmg	-	1-2	deposition_zone	40-50	unk	-	no	no	no	no	no
rockfall	135	2332	RF30	B	2331+40	2332+80	6142, 6143	mid	no	5-25	10-100	500-1000	50-200	unpredictable	Bxmg	open_soil_slope	4+	below_deposition_zone	>60	unk	disturbed	no	no	no	no	no
rockfall	147	1549	RF01	C	1549+00	1552+50	4212, 4214, 5148	upalignment	no	1-5	<10	100-500	200-500	unpredictable	Bxv	open_soil_slope	3-4	below_deposition_zone	>60	unk	disturbed	no	yes	no	no	yes
rockfall	147	2154	RF21	C	2154+00	2155+00	6014	-	no	1-5	<10	500-1000	50-200	unpredictable	Bxmg	-	2-3	below_deposition_zone	40-50	unk	disturbed	no	no	no	no	yes
rockfall	147	2254	RF22	B	2253+30	2253+80	5941, 6024	mid	yes	1-5	<10	500-1000	50-200	unpredictable	Bxmg	single_channel	1-2	path	50-60	into_slide	disturbed	no	no	no	no	no
rockfall	147	2256	RF23	B	2254+90	2258+10	3505	downslope	yes	unk(1-5?)	<10	100-500	200-500	unpredictable	Bxmg	other	0-1	deposition_zone	>60	unk	disturbed	no	no	no	no	no
rockfall	147	2260	RF24	C	2258+90	2261+00	3507	downslope	no	unk(1-5?)	<10	100-500	200-500	unpredictable	Bxmg	-	4+	below_deposition_zone	>60	unk	disturbed	no	no	no	no	yes
rockfall	147	2487	RF40	B	2484+00	2488+70	5182, 5964, 6085,	downslope	yes	1-5	<10	100-500	200-500	unpredictable	Bxmg	-	3-4	below_deposition_zone	>60	unk	disturbed	no	no	no	no	no
rockfall	147	2531	RF44	B	2531+00	2533+20	1565, 5326, 5327	downslope	yes	1-5	<10	100-500	200-500	unpredictable	Bxmg	open_soil_slope	1-2	deposition_zone	>60	unk	disturbed	no	no	no	no	no
rockfall	147	2558	RF50	B	2557+80	2558+40	3661, 3662, 3664	upalignment	yes	1-5	<10	500-1000	50-200	unpredictable	Bxmg	open_soil_slope	2-3	path	>60	unk	disturbed	no	no	no	no	yes
rockfall	147	2560	RF51	B	2559+30	2560+50	3661, 3662, 3664	mid	yes	1-5	<10	500-1000	50-200	unpredictable	Bxmg	open_soil_slope	2-3	path	>60	unk	disturbed	no	no	no	no	yes
rockfall	165	2145	RF20	A	2144+60	2146+80	1357, 3491, 3493, 3495, 3498, 5130, 5131, 5168	downslope	yes	1-5	<10	500-1000	200-500	unpredictable	Bxmg	fan	4+	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
rockfall	165	2308	RF27	B	2303+50	2308+40	3561	mid	yes	1-5	<10	500-1000	200-500	unpredictable	Bxmg	fan	2-3	deposition_zone	50-60	unk	disturbed	no	no	no	no	yes
rockfall	177	2383	RF34	B	2382+50	2388+50	3712, 3715	upalignment	no	25+	<10	100-500	500+	unpredictable	Bxmg	open_soil_slope	4+	below_deposition_zone	>60	unk	undisturbed	no	no	no	no	yes
rockfall	183	1609	RF04	B	1605+50	1611+10	4245, 4246, 4247, 4249	downslope	yes	unk(5-25?)	<10	100-500	500+	unpredictable	Bxv	open_soil_slope	4+	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
rockfall	183	1730	RF06	A	1729+90	1730+80	4674, 6206	mid	yes	0-1	<10	100-500	50-200	unpredictable	Bxmg	open_bedrock_slope	3-4	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
rockfall	183	1759	RF08	A	1759+30	1767+00	5157, 5039, 5040, 5041, 6209	upalignment	yes	5-25	<10	100-500	500+	unpredictable	Bxmg	open_soil_slope	4+	deposition_zone	>60	unk	disturbed	no	no	no	no	no
rockfall	183	2322	RF28	A	2322+10	2322+70	3891, 5948, 6254	downslope	yes	0-1	<10	100-500	50-200	unpredictable	Bxmg	single_channel	1-2	path	>60	unk	disturbed	no	yes	no	no	yes
rockfall	183	2388	RF35	B	2388+00	2388+80	3706	downslope	yes	0-1	<10	100-500	50-200	unpredictable	Bxmg	open_soil_slope	0-1	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
rockfall	183	2550	RF47	B	2549+80	2556+30	3660	downslope	yes	5-25	<10	100-500	500+	unpredictable	Bxmg	open_soil_slope	2-3	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
rockfall	201	2129	RF17	A	2129+00	2130+00	5928, 6251	upalignment	yes	1-5	<10	1000-2000	50-200	unpredictable	Bxmg	open_soil_slope	3-4	path	50-60	unk	disturbed	no	no	no	no	yes
rockfall	201	2370	RF32	B	2361+10	2364+20	3724, 3725	downalignment	yes	0-1	<10	100-500	200-500	unpredictable	Bxmg	open_soil_slope	1-2	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
rockfall	201	2557	RF49	C	2556+50	2562+00	3661, 3662, 3664	downslope	no	1-5	<10	100-500	500+	unpredictable	Bxmg	open_soil_slope	2-3	below_deposition_zone	>60	unk	disturbed	no	no	no	no	yes
rockfall	201	2620	RF53	A	2618+90	2626+00	3683, 3684	downalignment	yes	25+	100-1000	100-500	500+	unpredictable	Bxmg	fan	4+	below_deposition_zone	>60	unk	disturbed	no	no	no	no	yes
rockfall	255	2365	RF33	B	2364+20	2370+50	3724, 3725	downslope	yes	0-1	<10	100-500	500+	unpredictable	Bxmg	open_soil_slope	1-2	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
rockfall	273	2144	RF19	A	2142+70	2150+30	1357, 3491, 3493, 3495, 3498, 5130, 5168	mid	yes	1-5	<10	3000+	500+	unpredictable	Bxmg	fan	4+	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
rockfall	279	1734	RF07	A	1724+80	1739+80	4674	upslope	yes	0-1	10-100	500-1000	500+	unpredictable	Bxmg	open_bedrock_slope	4+	deposition_zone	>60	into_slide	disturbed	no	no	no	no	yes
soil_raveling	105	2420	SR04	B	2420+70	2426+80	3595 to 3598, 5957, 6061	upalignment	yes	5-25	<10	<100	500+	moderate	Qc	open_soil_slope	3-4	path	40-50	into_slide	disturbed	no	no	no	yes	no
soil_raveling	147	2265	SR03	B	2263+50	2267+40	5579, 5580, 5581	mid	yes	1-5	<10	100-500	200-500	unpredictable	Bxmg	open_bedrock_slope	2-3	path	50-60	unk	disturbed	no	no	no	no	yes
soil_raveling	171	2042	SR01	B	2043+40	2050+10	5090, 5166, 6244	upalignment	yes	0-1	<10	<100	500+	high	Qc	open_soil_slope	1-2	path	40-50	off_slide	disturbed	no	no	no	no	yes
soil_raveling	171	2130	SR02	B	2129+40	2129+80	3889, 5168	upalignment	yes	0-1	<10	<100	<50	unpredictable	Qc	single_channel	0-1	deposition_zone	30-40	into_slide	disturbed	no	no	yes	yes	yes
translational_slide	33	2426	LS04	B	2426+80	2427+40	3595, 3597, 3598, 6074	upalignment	yes	5-25	<10	<100	50-200	moderate	Qc	open_soil_slope	3-4	path	40-50	into_slide	disturbed	no	no	yes	yes	no
translational_slide	111	2300	LS03	C	2299+10	2299+60	5269, 5946	mid	no	25+	10-100	100-500	50-200	unpredictable	Qc	-	1-2	below_deposition_zone	50-60	unk	disturbed	no	no	no	no	yes
translational_slide	129	2457	LS05	C	2456+00	2458+00	3615, 5961, 6077	upslope	no	5-25	<10	100-500	200-500	unpredictable	Qct	-	3-4	below_deposition_zone	30-40	unk	disturbed	no	no	no	yes	yes
translational_slide	135	2220	LS02	C	2219+60	2221+00	5000, 5937	mid	no	1-5	10-100	100-500	50-200	unpredictable	Qc	-	0-1	below_deposition_zone	50-60	unk	denuded	no	no	yes	no	yes

TABLE 6
ALL HAZARDS SORTED BY ASCENDING HAZARD INDEX NUMBER (HIN) AND ASCENDING IRP 2006 LOCATION

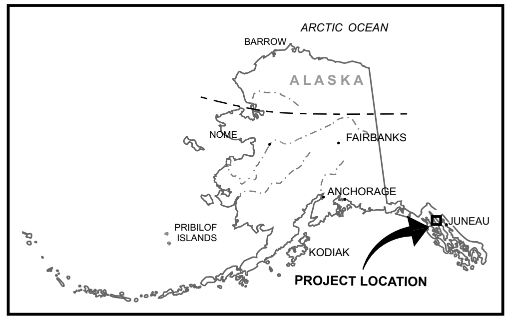
Hazard Index Number (HIN)	Hazard Index Number Weighting					IRP 2006 Location	Hazard Type	Hazard ID#	Geologic Hazard Rating System	IRP 2006 South Margin	IRP 2006 North Margin	Photo #	Bounds	Impact Alignment	Frequency (yrs)	Material Volume (CY)	Source Elevation (ft)	Alignment Exposure (ft)	Predictability	Source Material	Centerline Slope	Clast Size (ft)	Alignment Location	Slope Angle (degrees)	Slope Drainage	Vegetation	Tension Cracks	Seeps	Tilting Trees	Curving Trunks	Deciduous Trees
	Frequency	Quantity	Source	Length at Risk (ft)	Predictability																										
33	9	3	3	9	9	2426	translational_slide	LS04	B	2426+80	2427+40	3595, 3597, 3598, 6074	upalignment	yes	5-25	<10	<100	50-200	moderate	Qc	open_soil_slope	3-4	path	40-50	into_slide	disturbed	no	no	yes	yes	no
33	9	3	9	9	3	2473	rockfall	RF38	B	2473+00	2474+00	6092	mid	yes	5-25	<10	100-500	50-200	high	Bxmg	single_channel	1-2	path	>60	into_slide	disturbed	no	no	yes	no	yes
51	9	3	27	9	3	2207	debris_flow	DF32	B	2206+60	2207+20	6018	downalignment	yes	5-25	<10	500-1000	50-200	high	Qc	single_channel	0-1	path	40-50	into_slide	disturbed	no	no	no	no	yes
63	9	9	27	9	9	2563	debris_flow	DF43	A	2563+30	2564+10	5356	downalignment	yes	5-25	10-100	500-1000	50-200	moderate	Qct	single_channel	1-2	path	50-60	into_slide	denuded	no	no	no	no	yes
69	27	3	9	27	3	2467	rockfall	RF37	B	2466+10	2470+00	3637, 5181, 5962	upalignment	yes	1-5	<10	100-500	200-500	high	Bxmg	open_soil_slope	4+	path	>60	into_slide	disturbed	no	no	no	no	yes
81	27	9	27	9	9	2261	rock_slide	RS02	A	2261+10	2261+80	3508, 3510, 3511	mid	yes	1-5	10-100	500-1000	50-200	moderate	Bxmg	single_channel	1-2	path	50-60	into_slide	disturbed	no	no	no	no	no
93	3	3	3	3	81	2518	hazard_rock	HR03	C	2517+80	-	5311, 5312	downslope	yes	unk(>25?)	<10	<100	<50	unpredictable	Qct	-	4+	below_deposition_zone	40-50	-	-	no	no	no	no	no
93	3	3	3	3	81	2526	hazard_rock	HR04	C	2526+00	-	5318	-	yes	unk(>25?)	<10	<100	<50	unpredictable	Qct	-	4+	below_deposition_zone	40-50	-	-	no	no	no	no	no
93	3	3	3	3	81	2554	hazard_rock	HR05	C	2554+30	-	5362, 5363	-	yes	unk(>25?)	<10	<100	<50	unpredictable	Qct	open_soil_slope	4+	below_deposition_zone	-	-	-	no	no	no	no	no
99	3	9	3	3	81	2374	hazard_rock	HR01	C	2374+90	-	3722	upalignment	yes	unk(>25?)	10-100	<100	<50	unpredictable	Qct	open_soil_slope	4+	below_deposition_zone	40-50	unk	undisturbed	no	no	no	no	no
99	3	3	3	9	81	2380	hazard_rock	HR02	C	2379+40	2380+90	3719	upslope	yes	unk(>25?)	<10	<100	50-200	unpredictable	Qct	open_soil_slope	4+	deposition_zone	40-50	unk	disturbed	no	no	no	no	no
105	9	3	3	9	81	1657	rockfall	RF05	B	1657+00	1658+00	1086, 3904 to 3908, 5154, 6266	upalignment	yes	5-25	<10	<100	50-200	unpredictable	Bxv	open_bedrock_slope	4+	deposition_zone	>60	unk	disturbed	no	yes	no	no	yes
105	9	3	3	9	81	1865	rockfall	RF11	B	1864+80	1866+00	6234	downslope	yes	5-25	<10	<100	50-200	unpredictable	Bxms	open_soil_slope	2-3	deposition_zone	>60	unk	disturbed	no	yes	no	no	yes
105	3	3	9	9	81	1915	rockfall	RF12	C	1915+20	1916+50	5162	downslope	no	unk(>25?)	<10	100-500	50-200	unpredictable	Bxmg	-	4+	below_deposition_zone	>60	unk	disturbed	no	no	no	no	yes
105	9	9	3	3	81	2134	rockfall	RF18	C	2134+00	2134+50	1751, 3490, 5169, 5929	downslope	no	unk(5-25?)	10-100	<100	<50	unpredictable	Bxm	open_bedrock_slope	1-2	starting_zone	30-40	unk	-	no	no	no	no	no
105	3	3	9	9	81	2328	rockfall	RF29	B	2328+10	2329+10	6140	mid	yes	25+	<10	100-500	50-200	unpredictable	Bxmg	open_soil_slope	3-4	path	>60	unk	disturbed	no	no	no	no	no
105	9	3	3	81	9	2420	soil_raveling	SR04	B	2420+70	2426+80	3595 to 3598, 5957, 6061	upalignment	yes	5-25	<10	<100	500+	moderate	Qc	open_soil_slope	3-4	path	40-50	into_slide	disturbed	no	no	no	yes	no
105	9	3	3	81	9	2502	rockfall	RF42	B	2499+50	2505+00	6094, 6095	downslope	yes	unk(5-25?)	<10	<100	500+	moderate	Bxmg	deciduous_trees	0-1	path	40-50	unk	denuded	yes	no	no	no	yes
111	9	3	9	9	81	1553	rockfall	RF02	C	1553+00	1554+00	3049, 5149	downalignment	no	5-25	<10	100-500	50-200	unpredictable	Bxv	open_soil_slope	0-1	below_deposition_zone	50-60	unk	disturbed	no	yes	no	no	yes
111	9	9	81	9	3	1752	debris_flow	DF12	A	1751+00	1752+00	4738, 4739, 5157	mid	yes	5-25	10-100	>1000	50-200	high	Qc	fan	2-3	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
111	3	9	81	9	9	1773	debris_flow	DF14	A	1772+50	1773+60	2093, 4714	downalignment	yes	25+	10-100	>1000	50-200	moderate	Qc	single_channel	2-3	path	30-40	into_slide	disturbed	no	no	no	no	no
111	9	3	9	9	81	1854	rockfall	RF10	C	1853+30	1854+30	4816	downslope	no	unk(5-25?)	<10	100-500	50-200	unpredictable	Bxms	other	2-3	below_deposition_zone	50-60	unk	disturbed	no	no	no	no	yes
111	81	3	9	9	9	1932	rockfall	RF13	C	1931+80	1933+00	5162	downslope	no	0-1	<10	100-500	50-200	moderate	Bxmg	-	1-2	below_deposition_zone	>60	unk	disturbed	no	no	no	no	yes
111	9	9	81	9	3	2142	debris_flow	DF31	A	2140+50	2142+30	5168, 5169, 5929, 5930	downalignment	yes	5-25	10-100	3000+	50-200	high	Qc	multi_channel	1-2	deposition_zone	50-60	into_slide	denuded	no	no	no	no	yes
111	3	9	9	9	81	2300	translational_slide	LS03	C	2299+10	2299+60	5269, 5946	mid	no	25+	10-100	100-500	50-200	unpredictable	Qc	-	1-2	below_deposition_zone	50-60	unk	disturbed	no	no	no	no	yes
111	9	3	9	9	81	2548	rockfall	RF46	A	2546+70	2548+30	5338, 5339	mid	yes	5-25	<10	100-500	50-200	unpredictable	Bxmg	open_soil_slope	2-3	deposition_zone	>60	unk	disturbed	no	no	no	yes	yes
117	9	9	81	9	9	1670	debris_flow	DF04	B	1668+50	1670+50	3875	downalignment	yes	5-25	10-100	1000-2000	50-200	moderate	Qc	fan	0-1	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
117	9	9	81	9	9	2038	debris_flow	DF23	A	2041+20	2042+70	5057, 5166	upalignment	yes	5-25	10-100	3000+	50-200	moderate	Qc	multi_channel	1-2	path	40-50	into_slide	disturbed	no	no	no	no	yes
117	9	9	9	9	81	2301	rockfall	RF26	B	2300+20	2301+10	3559, 3560, 5946	downslope	yes	unk(5-25?)	10-100	100-500	50-200	unpredictable	Bxmg	other	4+	deposition_zone	>60	unk	undisturbed	yes	no	no	no	no
117	9	9	81	9	9	2491	debris_flow	DF42	B	2490+70	2491+30	6086	downslope	yes	5-25	10-100	1000-2000	50-200	moderate	Qc	single_channel	1-2	path	40-50	into_slide	disturbed	no	no	no	no	yes
123	27	3	81	9	3	1894	debris_flow	DF21	B	1893+30	1894+40	5161, 6238	downalignment	yes	1-5	<10	2000-3000	50-200	high	Qc	single_channel	0-1	path	30-40	into_slide	disturbed	no	no	no	no	yes
123	27	9	3	3	81	2291	rockfall	RF25	B	2290+60	2291+00	3531	upslope	yes	unk(1-5?)	10-100	<100	<50	unpredictable	Bxms	open_bedrock_slope	2-3	deposition_zone	>60	unk	denuded	no	no	yes	yes	yes
123	27	3	9	81	3	2568	rockfall	RF52	B	2564+70	2570+60	6105, 6106	downslope	yes	1-5	<10	100-500	500+	high	Bxmg	open_soil_slope	4+	path	>60	into_slide	disturbed	no	no	yes	no	yes
129	27	3	81	9	9	1515	debris_flow	DF02	A	1514+50	1515+50	1515, 2036, 5865	upalignment	yes	1-5	<10	2000-3000	50-200	moderate	Qc	fan	0-1	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
129	9	3	9	27	81	1586	rockfall	RF03	B	1584+50	1587+00	4259, 5873	mid	yes	5-25	<10	100-500	200-500	unpredictable	Bxv	single_channel	4+	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
129	27	9	81	9	3	1674	debris_flow	DF05	A	1673+80	1675+30	6203, 6204	upalignment	yes	1-5	10-100	1000-2000	50-200	high	Qc	single_channel	0-1	deposition_zone	30-40	into_slide	denuded	no	no	no	no	no
129	27	9	81	9	3	1720	debris_flow	DF08	A	1719+90	1720+80	1126, 5156	upslope	yes	1-5	10-100	>1000	50-200	high	Qc	fan	1-2	deposition_zone	40-50	into_slide	denuded	no	no	no	no	yes
129	27	9	81	9	3	1743	debris_flow	DF10	A	1742+50	1743+40	4745 to 4748	mid	yes	1-5	10-100	>1000	50-200	high	Qc	multi_channel	0-1	path	40-50	into_slide	denuded	no	no	no	no	no
129	27	9	81	9	3	1748	debris_flow	DF11	A	1746+40	1748+20	4741, 4742, 5157	downalignment	yes	1-5	10-100	>1000	50-200	high	Qc	fan	2-3	deposition_zone	40-50	into_slide	denuded	no	no	no	no	yes
129	27	9	81	9	3	1757	debris_flow	DF13	A	1756+10	1757+50	4736, 4737, 5157	downalignment	yes	1-5	10-100	>1000	50-200	high	Qc	fan	2-3	deposition_zone	40-50	into_slide	denuded	no	no	no	no	yes
129	27	3	9	9	81	1763	rockfall	RF09	A	1763+20	1763+80	3878	upalignment	yes	1-5	<10	100-500	50-200	unpredictable	Bxmg	open_soil_slope	2-3	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
129	9	3	9	27	81	1935	rockfall	RF14	B	1933+70	1953+00	5163, 5909 to 5911	downslope	yes	unk(5-25?)	<10	100-500	200-500	unpredictable	Bxmg	-	2-3	below_deposition_zone	50-60	unk	disturbed	no	no	no	no	no
129	9	3	9	27	81	1948	rockfall	RF15	B	1946+80	1949+00	5163	-	yes	5-25	<10	100-500	200-500	unpredictable	Bxmg	other	4+	deposition_zone	>60	off_slide	disturbed	no	yes	no	no	yes
129	9	3	9	27	81	2015	rockfall	RF16	B	2015+00	2017+40	5052, 5053, 6240	upalignment	yes	unk(5-25?)	<10	100-500	200-500	unpredictable	Bxms	deciduous_trees	3-4	below_deposition_zone	40-50	unk	disturbed	no	no	no	no	yes
129	9	3	81	27	9	2055	debris_flow	DF25	B	2056+50	2059+00	3462, 3463, 5093, 6195	upalignment	yes	5-25	<10	3000+	200-500	moderate	Qc	fan	0-1	deposition_zone	>60	into_slide	disturbed	no	no	no	no	no
129	27	9	81	9	3	2056	debris_flow	DF26	B	2059+00	2060+50	2241, 3470, 6195	upalignment	yes	1-5	10-100	3000+	200-500	high	Qc	fan	0-1	deposition_zone	50-60	-	disturbed	no	no	no	no	yes
129	9	3	81	9	27	2088	debris_flow	DF27	B	2088+00	2089+00	3885, 5167, 5924, 6247	upalignment	yes	5-25	<10	2000-3000	50-200	low	Qc	open_soil_slope	0-1	deposition_zone	30-40	into_slide	disturbed	no	no	no	no	yes
129	27	9	81	9	3	2310	debris_flow	DF36	B	2311+10	2311+80	3562	mid	yes	1-5	10-100	1000-2000	50-200	high	Qc	fan	0-1	path	>60	into_slide	denuded	no	no	no	no	yes
129	27	9	81	9	3	2321	debris_flow	DF37	B	2321+20	2322+10	3564, 3565, 3566	upalignment	yes	1-5	10-100	1000-2000	50-200	high	Qc	fan	1-2	deposition_zone	50-60	into_slide	denuded	no	no	no	no	yes
129	9	3	27	9	81	2335	rockfall	RF31	A	2334+70	2335+60	6144, 6145	mid	yes	5-25	<10	500-1000	50-200	unpredictable	Bxmg	single_channel	4+	deposition_zone	>60	unk	denuded	no	no	no	no	yes
129	27	9	81	9	3	2338	debris_flow	DF38	A	2338+00	2338+90	6146	mid	yes	1-5	10-100	2000-3000	50-200	high	Qc	single_channel	0-1	path	40-50	into_slide	denuded	no	no	no	no	no
129	27	3	9	9	81	2454	rockfall	RF36	B	2454+50	2455+00	3609, 5960	downslope	yes	1-5	<10	100-500	50-200	unpredictable	Bxmg	-	3-4	below_deposition_zone	>60	unk	denuded	no	yes	no	no	yes
129	9	3	9	27	81	2457	translational_slide	LS05	C	2456+00	2458+00	3615, 5961, 6077	upslope	no	5-25	<10	100-500	200-500	unpredictable	Qct	-	3-4	below_deposition_zone	30-40	unk	disturbed	no	no	no	yes	yes
129	27	9	81	9	3	2460	debris_flow	DF41	B	2460+40	2461+00	3616	mid	yes	1-5	10-100	3000+	50-200	high	Qc	fan	0-1	deposition_zone	50-60	into_slide	denuded	no	no	no	no	yes
129	27	3	9	9	81	2481	rockfall	RF39	B	2480+30	2481+50	6083, 6084	downslope	yes	1-5	<10	100-500	50-200	unpredictable	Bxmg	other	3-4	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
129	27	3	9	81	9	2495	rockfall	RF41	C	2495+00	2505+00	5965, 6094, 6095	upalignment	yes	1-5	<10	100-500	500+	moderate	Bxmg	open_soil_slope	2-3	path	>60	into_slide	disturbed	no	no	no	no	yes
129	27	3	9	9	81	2529	rockfall	RF43	A	2528+00	2529+70	3648, 5969	downalignment	yes	1-5	<10	100-500	50-200	unpredictable	Bxmg	open_soil_slope	2-3	deposition_zone	40-50	unk	disturbed	no	no	no	no	yes
129	27	3	9	9	81	2537	rockfall	RF45	A	2536+10	2537+80	6098, 6099	downalignment	yes	1-5	<10	100-500	50-200	unpredictable	Bxmg	-	1-2	deposition_zone	40-50	unk	-	no	no	no	no	no
129	3	9	27	9	81	2552	landslide	LS06	C	2552+80	2554+00	5185, 5341, 5342	mid	no	unk(>25?)	10-100	500-1000	50-200	unpredictable	-	open_soil_slope	-	below_deposition_zone	>60	unk	disturbed	no	no	no	no	no
129	3	9	27	9	81	2561	landslide	LS07	C	2561+80	2562+80	5024	mid	no	unk(>25?)	10-100	500-1000	50-200	unpredictable	Qct	open_soil_slope	-	below_deposition_zone	>60	unk	disturbed	no	no	no	no	no
135	9	9	81	9	27	2123	debris_flow	DF30	B	2123+00	2123+90	5168, 5927, 6250	downalignment	yes	5-25	10-100	1000-2000	50-200	low	Qc	single_channel	0-1	deposition_zone	30-40	into_slide	disturbed	no	no	no	no	yes
135	27	9	9	9	81	2220	translational_slide	LS02	C	2219+60	2221+00	5000, 5937	mid	no	1-5	10-100	100-500	50-200	unpredictable	Qc	-	0-1	below_deposition_zone	50-60	unk	denuded	no	no	yes	no	yes
135	9	9	27	9	81	2332	rockfall	RF30	B	2331+40	2332+80	6142, 6143	mid	no	5-25	10-100	500-1000	50-200	unpredictable	Bxmg	open_soil_slope	4+	below_deposition_zone	>60	unk	disturbed	no	no	no	no	no
135	9	9	81	9	27	2459	debris_flow	DF40	B	2459+00	2459+90	3616, 5180, 5961	mid	yes	5-25	10-100	2000-3000	50-200	low	Qc	fan	0-1	deposition_zone	40-50	into_slide	denuded	no	no	no	no	no
147	27	3	9	27	81	1549	rockfall	RF01	C	1549+00	1552+50	4212, 4214, 5148	upalignment	no	1-5	<10	100-500	200-500	unpredictable	Bxv	open_soil_slope	3-4	below_deposition_zone	>60	unk	disturbed	no	yes	no	no	yes
147	3	9	81	27	27	1824	debris_flow	DF17	B	1824+10	1825+50	1186, 4012, 4015, 5159, 6232,	upalignment	yes	25+	10-100	2000-3000	200-500	low	Qc	fan	1-2	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
147	27	9	81	27	3	1826	debris_flow	DF18	A	1825+50	1827+50	1186, 4012, 4015, 5159, 6232,	upalignment	yes	1-5	10-100	2000-3000	200-500	high	Qc	fan	0-1	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
147	27	9	81	27	3	1984	debris_flow	DF22	A	1983+30	1985+70	5047, 5164, 5914	mid	yes	1-5	10-100	2000-3000	200-500	high	Qc	fan	1-2	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	no
147	27	3	27	9	81	2154	rockfall	RF21	C	2154+00	2155+00	6014	-	no	1-5	<10	500-1000	50-200	unpredictable	Bxmg	-	2-3	below_deposition_zone	40-50	unk	disturbed	no	no	no	no	yes
147	27	3	27	9	81	2254	rockfall	RF22	B	2253+30	2253+80	5941, 6024	mid	yes	1-5	<10	500-1000	50-200	unpredictable	Bxmg	single_channel	1-2	path	50-60	into_slide	disturbed	no	no	no	no	no
147	27	3	9	27	81	2256	rockfall	RF23	B	2254+90	2258+10	3505	downslope	yes	unk(1-5?)	<10	100-500	200-500	unpredictable	Bxmg	other	0-1	deposition_zone	>60	unk	disturbed	no	no	no	no	no
147	27	3	9	27	81	2260	rockfall	RF24	C	2258+90	2261+00	3507	downslope	no	unk(1-5?)	<10	100-500	200-500	unpredictable	Bxmg	-	4+	below_deposition_zone	>60	unk	disturbed	no	no	no	no	yes
147	27	3	9	27	81	2265	soil_raveling	SR03	B	2263+50	2267+40	5579, 5580, 5581	mid	yes	1-5	<10	100-500	200-500	unpredictable	Bxmg	open_bedrock_slope	2-3	path	50-60	unk	disturbed	no	no	no	no	yes
147	27	9	81	27	3	2281	debris_flow	DF34	B	2283+70	2287+10	3527, 3528	upalignment	yes	1-5	10-100	3000+	200-500	high	Qct	fan	1-2	deposition_zone	50-60	into_slide	denuded	no	no	no	no	yes
147	27	3	9	27	81	2487	rockfall	RF40	B	2484+00	2488+70	5182, 5964, 6085,	downslope	yes	1-5	<10	100-500	200-500	unpredictable	Bxmg	-	3-4	below_deposition_zone	>60	unk	disturbed	no	no	no	no	no
147	27	3	9	27	81	2531	rockfall	RF44	B	2531+00	2533+20	1565, 5326, 5327	downslope	yes	1-5	<10	100-500	200-500	unpredictable	Bxmg	open_soil_slope	1-2	deposition_zone	>60	unk	disturbed	no	no	no	no	no
147	27	3	27	9	81	2558	rockfall	RF50	B	2557+80	2558+40	3661, 3662, 3664	upalignment	yes	1-5	<10	500-1000	50-200	unpredictable	Bxmg	open_soil_slope	2-3	path	>60	unk	disturbed	no	no	no	no	yes
147	27	3	27	9	81	2560	rockfall	RF51	B	2559+30	2560+50	3661, 3662, 3664	mid	yes	1-5	<10	500-1000	50-200	unpredictable	Bxmg	open_soil_slope	2-3	path	>60	unk	disturbed	no	no	no	no	yes
153	27	9	81	9	27	1733	debris_flow	DF09	A	1732+50	1734+40	3307	upslope	yes	unk(1-5?)	10-100	>1000	50-200	low	Qc	single_channel	1-2	path	40-50	into_slide	disturbed	no	no	no	no	yes
153	9	9	81	27	27	1847	debris_flow	DF19	A	1845+30	1849+90	4809, 4812, 4830, 5160	upalignment	yes	5-25	10-100	3000+	200-500	low	Qc	fan	0-1	deposition_zone	40-50	into_slide	denuded	no	no	no	no	yes
153	9	9	81	27	27	1852	debris_flow	DF20	B	1852+00	1853+10	1210, 5160	downalignment	yes	5-25	10-100	3000+	200-500	low	Qc	fan	0-1	deposition_zone	40-50	into_slide	denuded	no	no	no	no	yes
153	27	9	81	27	9	2114	debris_flow	DF29	A	2115+00	2117+40	5125, 5926, 6248	upalignment	yes	1-5	10-100	3000+	200-500	moderate	Qc	fan	1-2	deposition_zone	>60	into_slide	denuded	no	no	no	no	yes
165	27	3	27	27	81	2145	rockfall	RF20	A	2144+60	2146+80	1357, 3491, 3493, 3495, 3498, 5130, 5131, 5168	downslope	yes	1-5	<10	500-1000	200-500	unpredictable	Bxmg	fan	4+	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
165	27	3	27	27	81	2308	rockfall	RF27	B	2303+50	2308+40	3561	mid	yes	1-5	<10	500-1000	200-500	unpredictable	Bxmg	fan	2-3	deposition_zone	50-60	unk	disturbed	no	no	no	no	yes
171	27	27	81	27	9	1704	debris_flow	DF07	A	1701+50	1705+50	4366, 5155	upalignment	yes	1-5	100-1000	>1000	200-500	moderate	Qc	multi_channel	1-2	deposition_zone	30-40	Into_slide	denuded	no	no	no	no	yes
171	81	3	3	81	3	2042	soil_raveling	SR01	B	2043+40	2050+10	5090, 5166, 6244	upalignment	yes	0-1	<10	<100	500+	high	Qc	open_soil_slope	1-2	path	40-50	off_slide	disturbed	no	no	no	no	yes
171	81	3	3	3	81	2130	soil_raveling	SR02	B	2129+40	2129+80	3889, 5168	upalignment	yes	0-1	<10	<100	<50	unpredictable	Qc	single_channel	0-1	deposition_zone	30-40	into_slide	disturbed	no	no	yes	yes	yes
177	3	3	9	81	81	2383	rockfall	RF34	B	2382+50	2388+50	3712, 3715	upalignment	no	25+	<10	100-500	500+	unpredictable	Bxmg	open_soil_slope	4+	below_deposition_zone	>60	unk	undisturbed	no	no	no	no	yes
183	81	3	81	9	9	1517	debris_flow	DF03	A	1517+00	1518+20	3893, 5148, 5865, 6256	upalignment	yes	0-1	<10	2000-3000	50-200	moderate	Qc	fan	0-1	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
183	9	3	9	81	81	1609	rockfall	RF04	B	1605+50	1611+10	4245, 4246, 4247, 4249	downslope	yes	unk(5-25?)	<10	100-500	500+	unpredictable	Bxv	open_soil_slope	4+	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
183	81	3	9	9	81	1730	rockfall	RF06	A	1729+90	1730+80	4674, 6206	mid	yes	0-1	<10	100-500	50-200	unpredictable	Bxmg	open_bedrock_slope	3-4	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
183	9	3	9	81	81	1759	rockfall	RF08	A	1759+30	1767+00	5157, 5039, 5040, 5041, 6209	upalignment	yes	5-25	<10	100-500	500+	unpredictable	Bxmg	open_soil_slope	4+	deposition_zone	>60	unk	disturbed	no	no	no	no	no
183	81	9	81	9	3	2104	debris_flow	DF28	A	2102+30	2103+70	3886, 5916	downalignment	yes	0-1	10-100	3000+	50-200	high	Qc	fan	3-4	deposition_zone	50-60	into_slide	denuded	no	no	no	no	yes

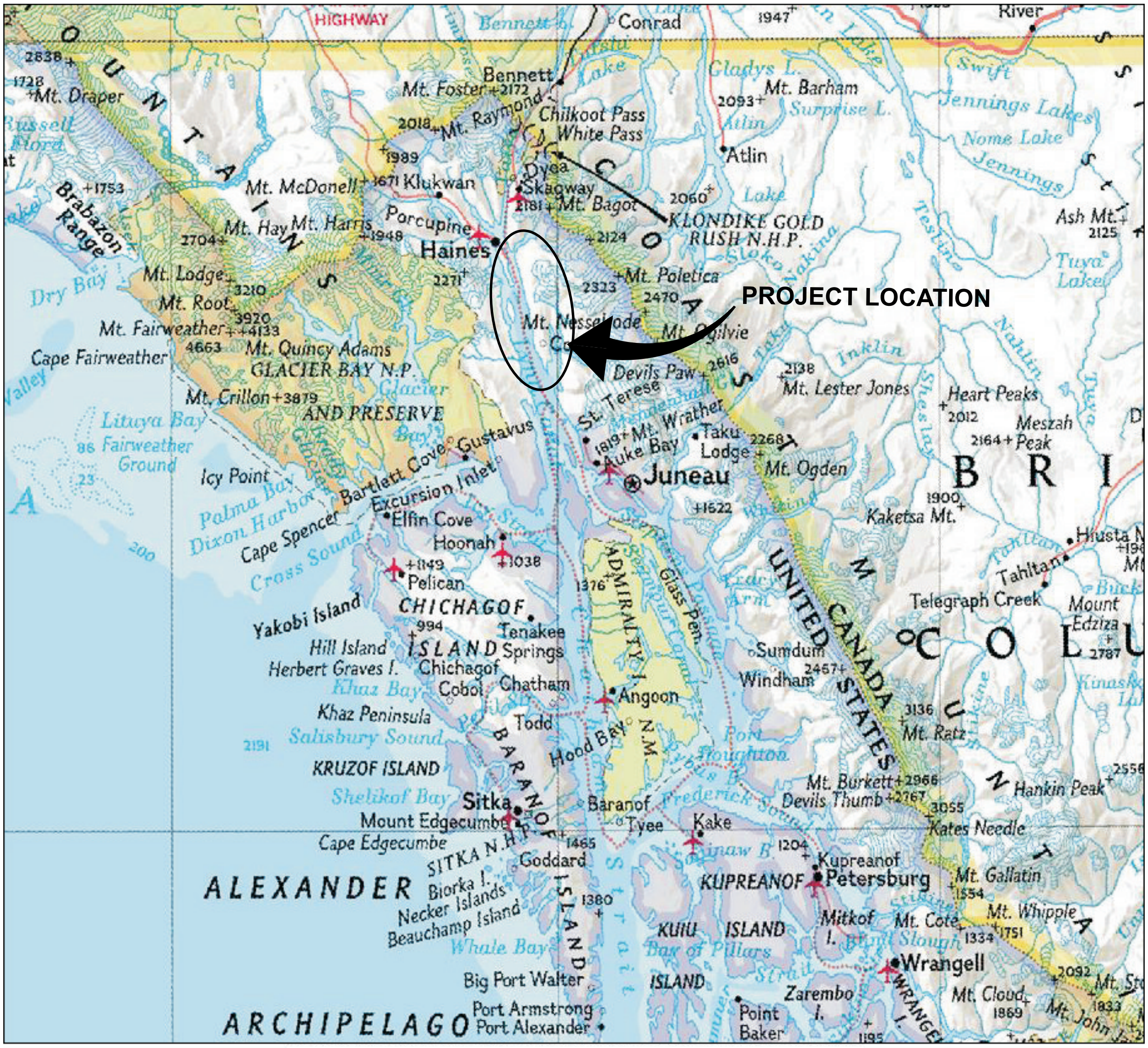
TABLE 6

ALL HAZARDS SORTED BY ASCENDING HAZARD INDEX NUMBER (HIN) AND ASCENDING IRP 2006 LOCATION

Hazard Index Number (HIN)	Hazard Index Number Weighting					IRP 2006 Location	Hazard Type	Hazard ID#	Geologic Hazard Rating System	IRP 2006 South Margin	IRP 2006 North Margin	Photo #	Bounds	Impact Alignment	Frequency (yrs)	Material Volume (CY)	Source Elevation (ft)	Alignment Exposure (ft)	Predictability	Source Material	Centerline Slope	Clast Size (ft)	Alignment Location	Slope Angle (degrees)	Slope Drainage	Vegetation	Tension Cracks	Seeps	Tilting Trees	Curving Trunks	Deciduous Trees
	Frequency	Quantity	Source	Length at Risk (ft)	Predictability																										
183	9	9	81	3	81	2205	landslide	LS01	C	2204+00	2208+00	5171	-	no	unk(>25?)	10-100	1000-2000	<50	unpredictable	Bxmg	-	-	below_deposition_zone	40-50	unk	disturbed	no	no	no	no	no
183	9	9	81	3	81	2250	debris_flow	DF33	B	2252+50	2252+80	6023	mid	yes	unk(5-25?)	10-100	3000+	<50	unpredictable	Qc	single_channel	1-2	path	40-50	into_slide	denuded	no	no	no	no	no
183	81	3	9	9	81	2322	rockfall	RF28	A	2322+10	2322+70	3891, 5948, 6254	downslope	yes	0-1	<10	100-500	50-200	unpredictable	Bxmg	single_channel	1-2	path	>60	unk	disturbed	no	yes	no	no	yes
183	81	3	9	9	81	2388	rockfall	RF35	B	2388+00	2388+80	3706	downslope	yes	0-1	<10	100-500	50-200	unpredictable	Bxmg	open_soil_slope	0-1	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
183	9	3	9	81	81	2550	rockfall	RF47	B	2549+80	2556+30	3660	downslope	yes	5-25	<10	100-500	500+	unpredictable	Bxmg	open_soil_slope	2-3	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
201	81	9	81	27	3	1678	debris_flow	DF06	A	1677+00	1679+00	3876	downalignment	yes	0-1	10-100	2000-3000	200-500	high	Qc	fan	0-1	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
201	27	3	81	9	81	2129	rockfall	RF17	A	2129+00	2130+00	5928, 6251	upalignment	yes	1-5	<10	1000-2000	50-200	unpredictable	Bxmg	open_soil_slope	3-4	path	50-60	unk	disturbed	no	no	no	no	yes
201	81	3	9	27	81	2370	rockfall	RF32	B	2361+10	2364+20	3724, 3725	downalignment	yes	0-1	<10	100-500	200-500	unpredictable	Bxmg	open_soil_slope	1-2	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
201	27	3	9	81	81	2557	rockfall	RF49	C	2556+50	2562+00	3661, 3662, 3664	downslope	no	1-5	<10	100-500	500+	unpredictable	Bxmg	open_soil_slope	2-3	below_deposition_zone	>60	unk	disturbed	no	no	no	no	yes
201	3	27	9	81	81	2620	rockfall	RF53	A	2618+90	2626+00	3683, 3684	downalignment	yes	25+	100-1000	100-500	500+	unpredictable	Bxmg	fan	4+	below_deposition_zone	>60	unk	disturbed	no	no	no	no	yes
207	9	81	81	27	9	1782	debris_flow	DF15	B	1782+00	1783+00	3912	-	yes	5-25	1000+	>1000	200-500	moderate	Qc	multi_channel	2-3	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
207	27	9	81	81	9	2054	debris_flow	DF24	B	2054+40	2056+50	2054, 2239, 3462, 3463, 5093, 6195	upalignment	yes	1-5	10-100	3000+	50-200	high	Qc	multi_channel	1-2	deposition_zone	40-50	into_slide	denuded	no	no	no	no	yes
207	27	9	81	9	81	2296	debris_flow	DF35	B	2293+80	2294+90	3535	downalignment	yes	unk(1-5?)	10-100	3000+	50-200	unpredictable	Qct	fan	3-4	deposition_zone	>60	into_slide	disturbed	no	no	no	no	yes
219	3	27	81	27	81	1522	rock_slide	RS01	A	1521+80	1525+50	4123, 4124, 4126, 5148, 5865	-	no	unk(>25?)	100-1000	>1000	200-500	unpredictable	Bxv	open_bedrock_slope	4+	deposition_zone	60+	unk	denuded	yes	no	no	no	no
225	27	27	81	81	9	1493	debris_flow	DF01	A	1492+90	1498+90	4098, 4099, 5146	-	yes	1-5	100-1000	>1000	500+	moderate	Qc	fan	1-2	deposition_zone	30-40	into_slide	denuded	other	no	no	no	yes
225	27	81	81	27	9	1783	debris_flow	DF16	A	1783+00	1785+30	1141, 2091, 5158	upalignment	yes	1-5	1000+	>1000	200-500	moderate	Qc	multi_channel	2-3	deposition_zone	40-50	into_slide	disturbed	no	no	no	no	yes
255	81	3	9	81	81	2365	rockfall	RF33	B	2364+20	2370+50	3724, 3725	downslope	yes	0-1	<10	100-500	500+	unpredictable	Bxmg	open_soil_slope	1-2	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
273	27	3	81	81	81	2144	rockfall	RF19	A	2142+70	2150+30	1357, 3491, 3493, 3495, 3498, 5130, 5168	mid	yes	1-5	<10	3000+	500+	unpredictable	Bxmg	fan	4+	deposition_zone	>60	unk	disturbed	no	no	no	no	yes
279	81	9	27	81	81	1734	rockfall	RF07	A	1724+80	1739+80	4674	upslope	yes	0-1	10-100	500-1000	500+	unpredictable	Bxmg	open_bedrock_slope	4+	deposition_zone	>60	into_slide	disturbed	no	no	no	no	yes

FIGURES





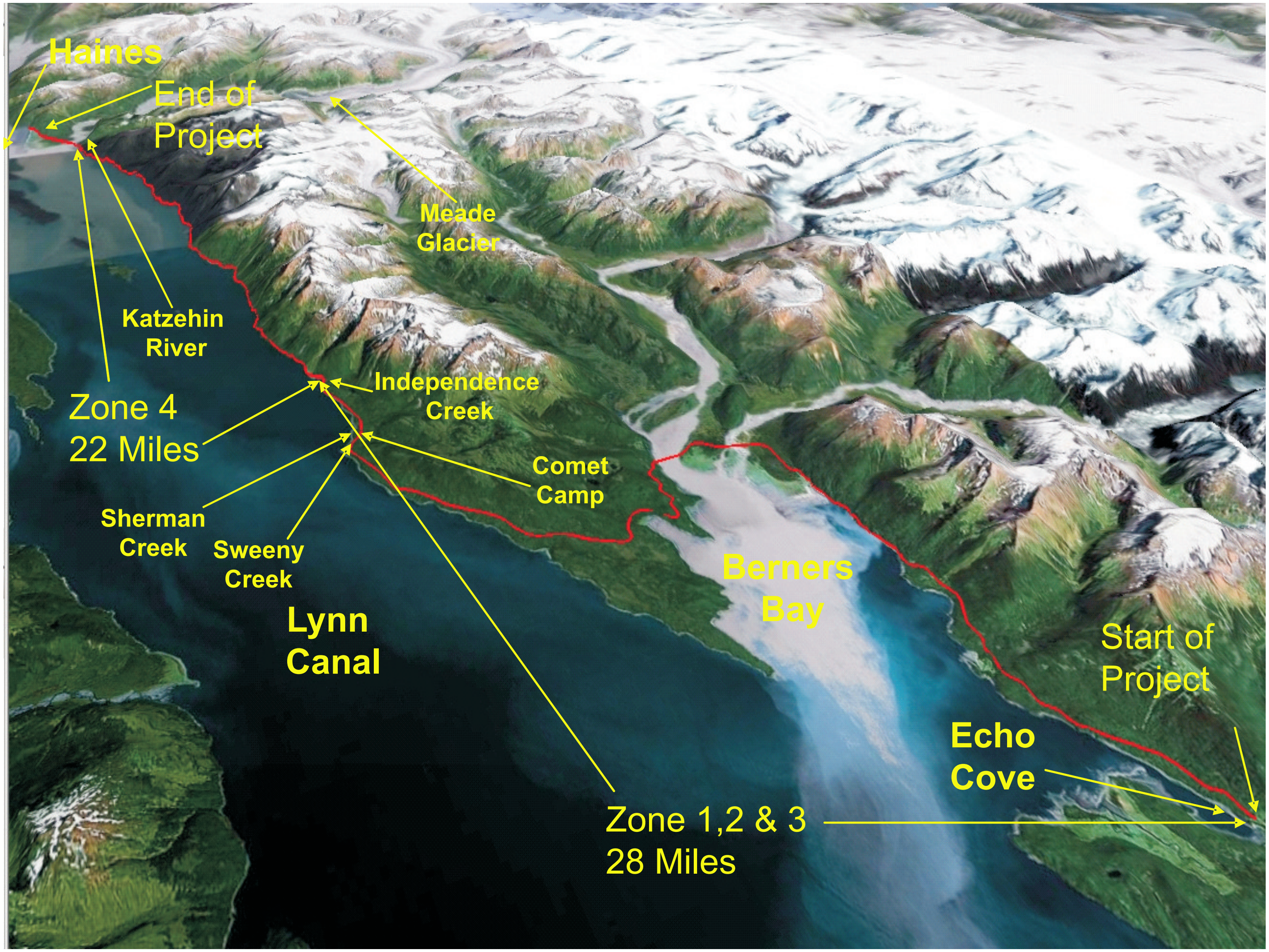
REFERENCE:
Map created using USGS topographical maps on CD-ROM, compiled by National Geographic.

30 15 0 30

APPROXIMATE SCALE MILES

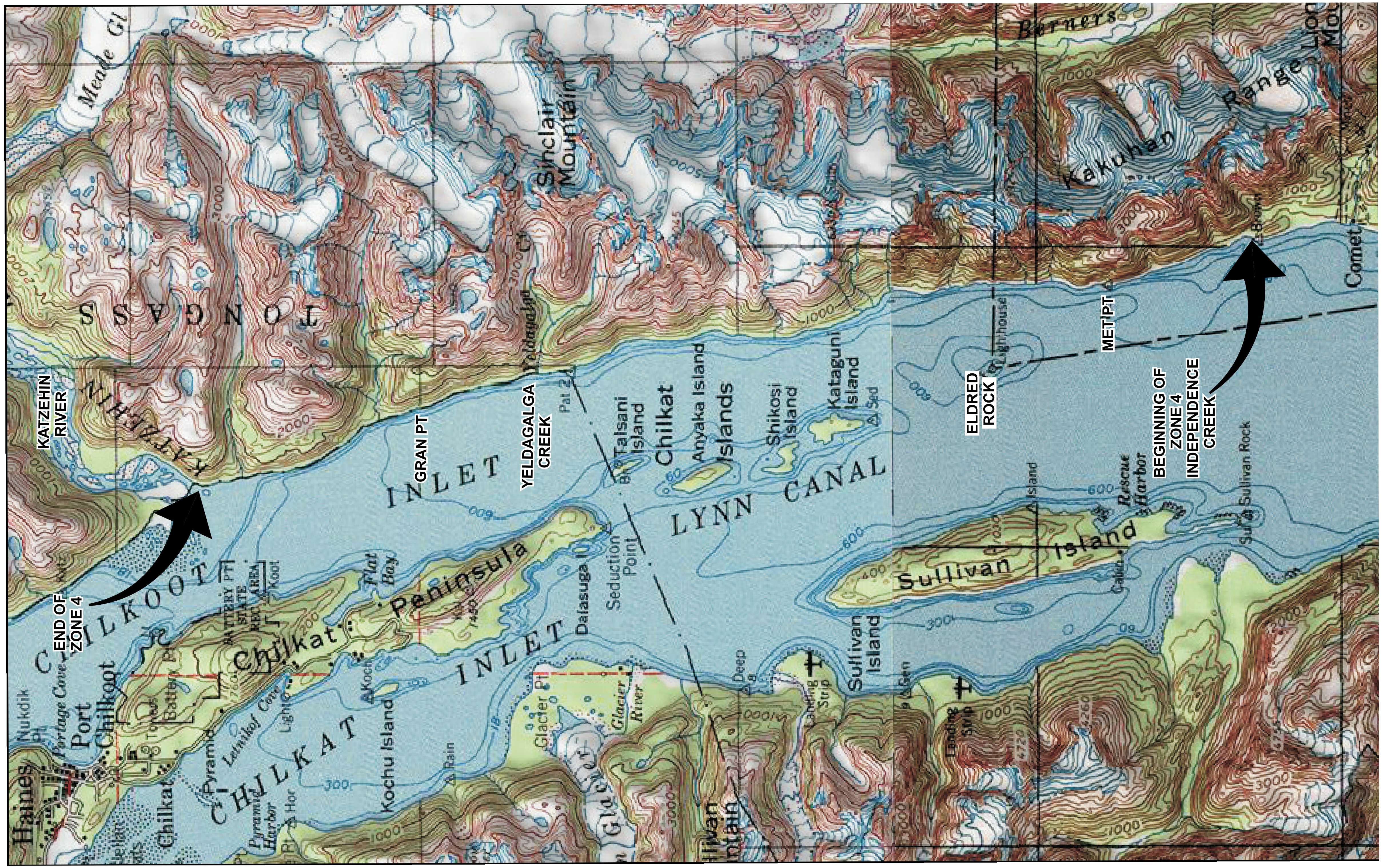
N

Golder Associates, Anchorage, Alaska	SCALE: AS SHOWN	TITLE	
	CADD: ALF	**PROJECT LOCATION MAP**	
	DATE: 10/03/06	LYNN CANAL HIGHWAY PHASE I	
	CHECK: RGD	GEOTECHNICAL INVESTIGATION	
FILE No.: FIG1_LOCATION_MAP.CDR	DATE: 10/09/06		
PROJECT No.: 063-5782	REV.: 0	ADOT&PF / LYNN CANAL HWY / ALASKA	FIGURE 1



REFERENCE:
Image provided by ADOT&PF-SE.

Golder Associates, Anchorage, Alaska	SCALE NONE	TITLE
	CADD AF	**PROJECT SITE MAP**
	DATE 12/06/06	LYNN CANAL HIGHWAY PHASE I
	CHECK RGD	GEOTECHNICAL INVESTIGATION
FILE No. FIG2_PROJECT SITE_IM.CDR	DATE 12/07/06	ADOT&PF / LYNN CANAL HWY / ALASKA
PROJECT No. 063-5782	REV. 0	FIGURE 2



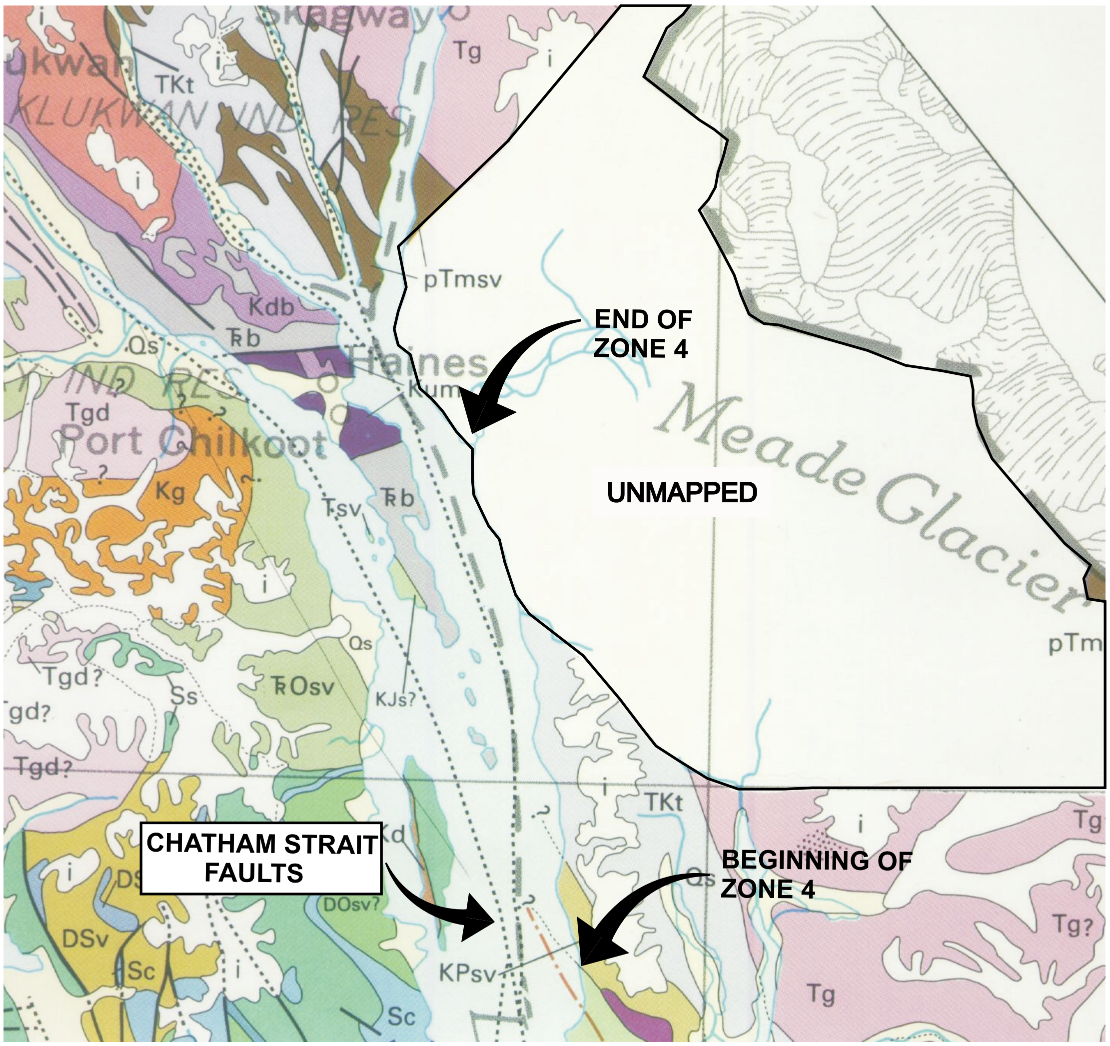
N

REFERENCE:
Map created using USGS topographical maps on CD-ROM, compiled by National Geographic.

MILES

4 2 0 4

Golder Associates Anchorage, Alaska	SCALE AS SHOWN	TITLE	
	CADD ALF	**PROJECT AREA MAP** LYNN CANAL HIGHWAY PHASE I GEOTECHNICAL INVESTIGATION	
	DATE 11/30/06		
	CHECK RGD		
FILE No. FIG3_AREA.CDR	DATE 12/05/06		
PROJECT No. 063-5782	REV. 0	ADOT&PF / LYNN CANAL HWY / ALASKA	FIGURE 3



MILES

9 4.5 0 9

i	Ice
Tg	Granodiorite (Eocene)
Tkt	Tonalite (Paleocene and Cretaceous)
KPsv	Sedimentary and volcanic rocks, undivided (Cretaceous to Permian)
pTmsv	Metasedimentary and metavolcanic rocks (pre-Tertiary)

Fault

N

REFERENCE:
Gehrels, G. E., and Berg, H. C., 1992, Geologic map of southeastern Alaska: U.S. Geologic Survey Miscellaneous Investigation Series I-1867, 24p., 1 sheet, 1:600,000 scale.

Golder Associates
Anchorage, Alaska

FILE No.	FIG4_REG_GEOMAP.CDR	SCALE	AS SHOWN
PROJECT No.	063-5782	CADD	ALF
		DATE	12/06/066
		CHECK	RGD
		DATE	12/07/06
		REV.	0

TITLE

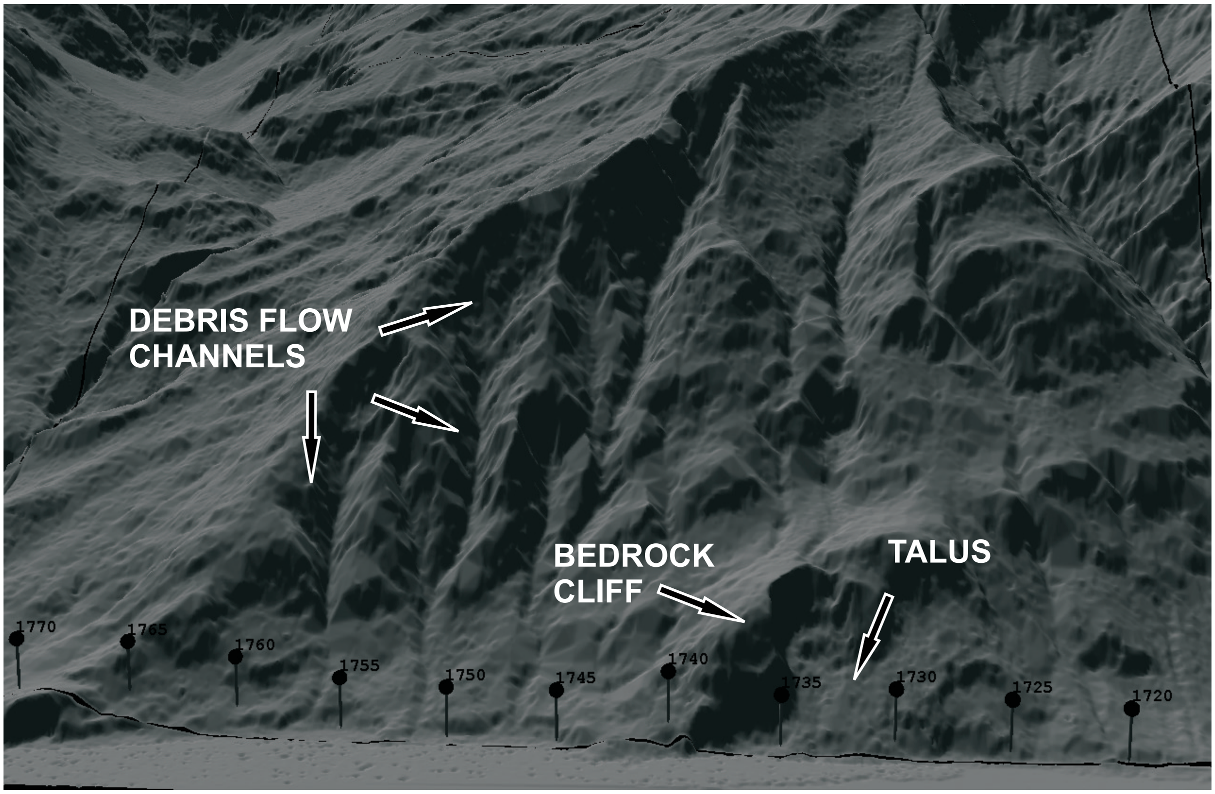
REGIONAL GEOLOGIC MAP

LYNN CANAL HIGHWAY PHASE I
GEOTECHNICAL INVESTIGATION

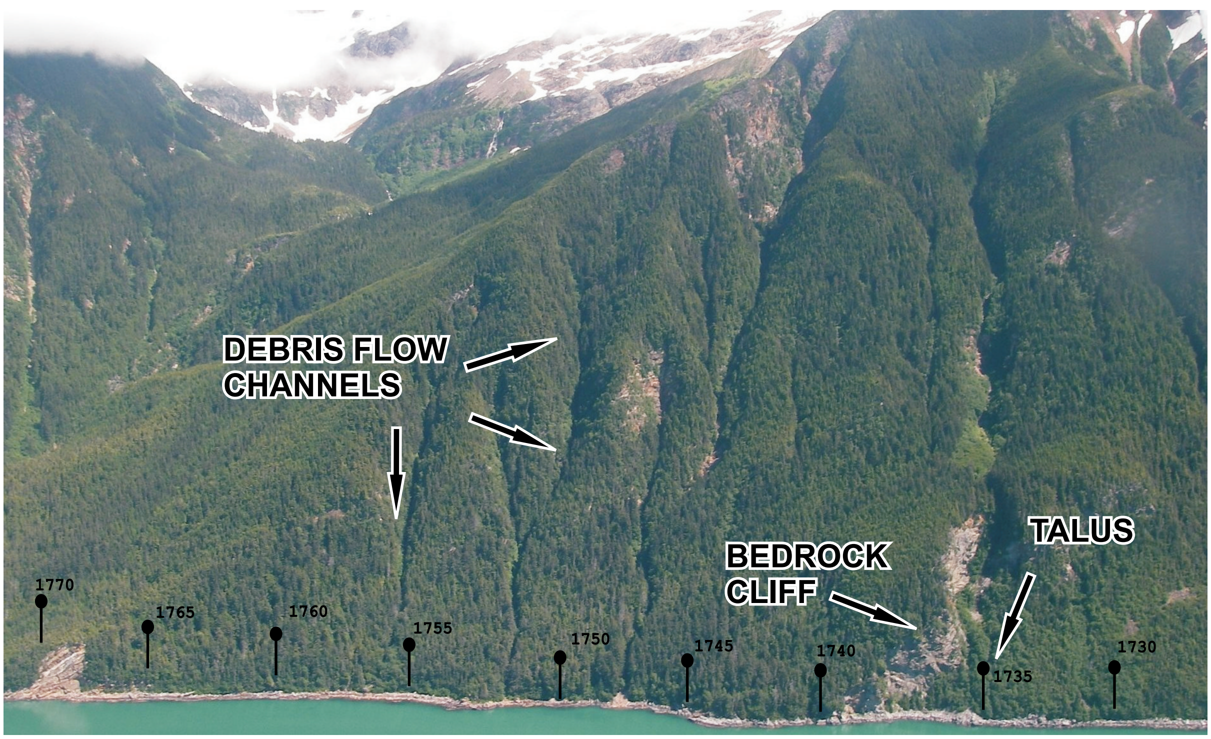
ADOT&PF / LYNN CANAL HWY / ALASKA

FIGURE 4

A)



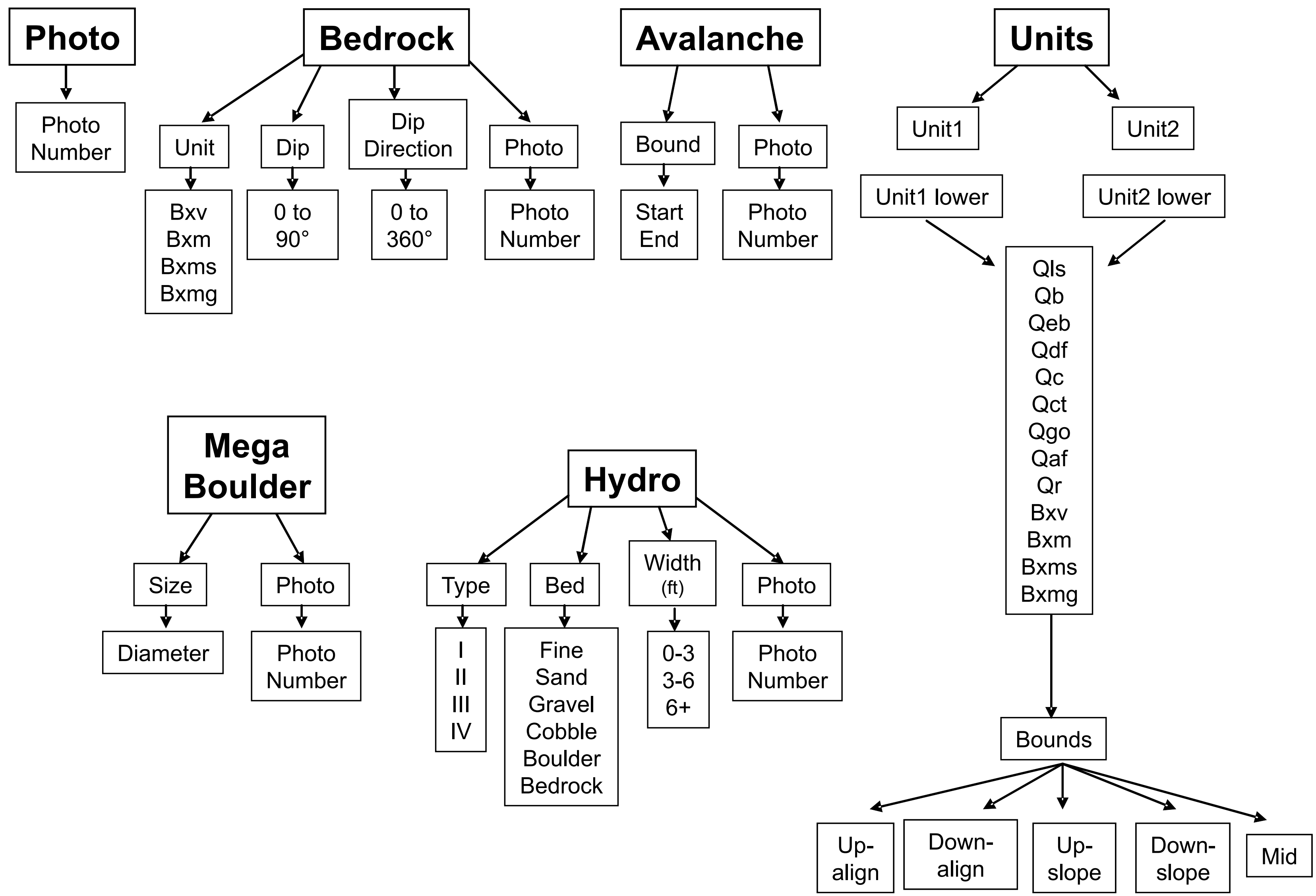
B)



View east at A) bare earth LIDAR image and B) aerial photograph. Alignment stations shown at 500 foot intervals.

Golder Associates
Anchorage, Alaska

SCALE	N/A	TITLE	**LIDAR IMAGE COMPARED TO PHOTOGRAPH** LYNN CANAL HIGHWAY PHASE I GEOTECHNICAL INVESTIGATION
CADD	AF		
DATE	09/06/06		
CHECK	RGD		
FILE No. FIG5_LIDAR_PHOTO.CDR	DATE 10/09/06	ADOT&PF / LYNN CANAL HWY / ALASKA	FIGURE 5
PROJECT No. 063-5782	REV. 0		



Golder Associates
Anchorage, Alaska

SCALE	NONE
CADD	ALF
DATE	11/29/06
CHECK	RGD
DATE	12/03/06
REV.	0

FILE No. FIG6_SURFICIALMAP.CDR

PROJECT No. 063-5782

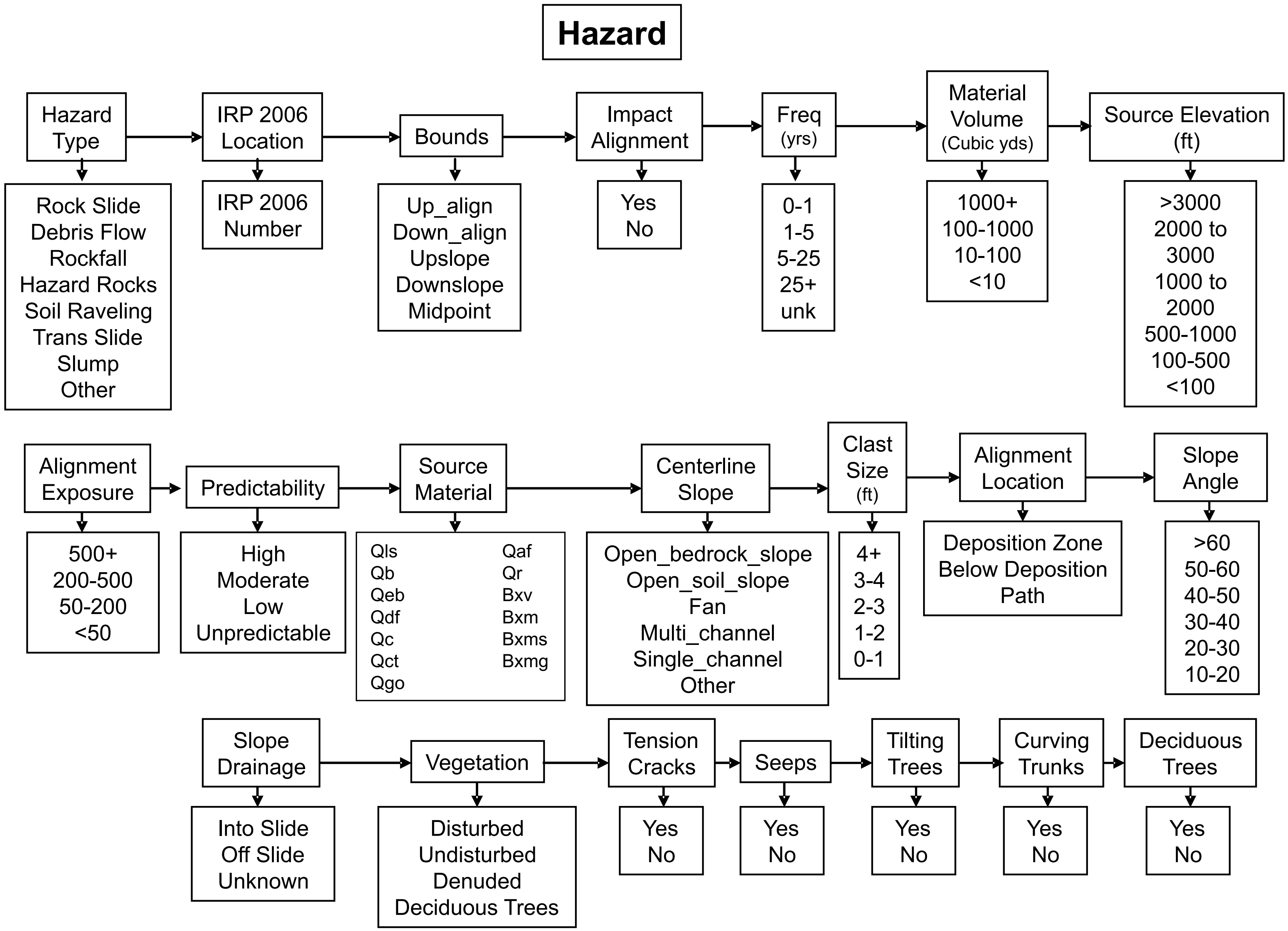
TITLE

SURFICIAL MAPPING SCHEME

LYNN CANAL HIGHWAY PHASE I
GEOTECHNICAL INVESTIGATION

ADOT&PF / LYNN CANAL HWY / ALASKA

FIGURE 6



Golder Associates
Anchorage, Alaska

SCALE	NONE	TITLE	HAZARD MAPPING SCHEME LYNN CANAL HIGHWAY PHASE I GEOTECHNICAL INVESTIGATION
CADD	ALF		
DATE	11/29/06		
CHECK	RGD		
DATE	12/03/06		ADOT&PF / LYNN CANAL HWY / ALASKA
REV.	0	FIGURE	7

FILE No. FIG7_HAZMAPSCHEME.CDR

PROJECT No. 063-5782

063-5782
ADOT Juneau Access Road

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

GPS Coordinates
N ____________
W ____________

Station ID: [ ]

Date: Day [ ] Month [ ] Year [2006]

Inspector: [ ]

Locality Type: [ ]

1. Natural exposure
2. Road cut
3. Quarry Slope
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

Slope Length: [ ]

Slope Height: [ ]

Core Size: [-]

No. of supplementary sheets of discontinuity data sheets: [ ]

Sketch: [ ]

0. No
1. Yes

Photograph

ROCK MATERIAL INFORMATION

Colour: [ ] [ ] [ ]

1. Light	1. Pinkish	1. Pink
2. Dark	2. Reddish	2. Red
	3. Yellowish	3. Yellow
	4. Brownish	4. Brown
	5. Olive	5. Olive
	6. Greenish	6. Green
	7. Bluish	7. Blue
	8. Greyish	8. White
		9. Grey
		10. Black

Grain size: [ ]

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 m- 2 mm)
4. Fine (2-60 m)
5. Very fine (<2 m)

Compressive strength: [ ]

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

Methods to determine compressive strength: [ ]

1. Measured
2. Assessed

Rock Type: [ ]

ROCK MASS INFORMATION

Fabric: [ ]

1. Blocky
2. Tabular
3. Columnar
4. Shattered

Block size: [ ]

1. Very large (>8 m3)
2. Large (0.2-8 m3)
3. Medium (0.008-0.2 m3)
4. Small (0.0002 - 0.008 m3)
5. Very small (<0.0002 m3)

State of weathering: [ ]

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

No. of major discontinuity sets: [ ]

Set #	Spacing
1	
2	
3	
4	
5	

GSI: [ ]

Discontinuity spacing:
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 mm)

REMARKS (exposure type/age, stability condition, design issues etc.)

10/3/2006 GOLDER ASSOCIATES

Golder Associates, Anchorage, Alaska	SCALE: NONE	TITLE: **ROCK STRUCTURE MAPPING DATA SHEET 1** LYNN CANAL HIGHWAY PHASE I GEOTECHNICAL INVESTIGATION	
	CADD: AF		
	DATE: 10/03/06		
	CHECK: RGD		
FILE No.: FIG8_ROCKDATA1.CDR	DATE: 10/09/06		
PROJECT No.: 063-5782	REV.: 0	ADOT&PF / LYNN CANAL HWY / ALASKA	FIGURE 8

063-5782
ADOT Juneau Access Road

DISCONTINUITY SURVEY DATA SHEET

GENERAL INFORMATION

Location	Station ID	Project Element	Date: Day	Month	Year	Inspector	Discontinuity data sheet no.	of
Lynn Canal Highway					2006		1	1

NATURE AND ORIENTATION OF DISCONTINUITY

Location	Type	Dip	Dip Direction	Persistence	Termination	Aperture/ Width	Nature of Filling	Strength of Filling	SR	Shape	Number	Spacing, ft	JRC	Comment

Type

FZ - Fault Zone
F -- Fault
J -- Joint (single)
JS -- Joint Set
Sch -- Schistosity
SH -- Shear
Fo -- Foliation
TC -- Tension Crack
B -- Bedding

Persistence

1. Very low persistence <3ft
2. Low persistence 3-10 ft
3. Medium persistence 10-30 ft
4. High persistence 30-60 ft
5. Very high persistence > 60 ft

Termination

0. Neither end visible
1. One end visible
2. Both ends visible

Aperture/width

1. Very tight (<0.1 mm)
2. Tight (0.1-0.25 mm)
3. Partly open (0.25-0.5 mm)
4. Open (0.5-2.5 mm)
5. Moderately wide (2.5-10 mm)
6. Wide (>10 mm)
7. Very wide (1-10 cm)
8. Extremely wide (10-100 cm)
9. Cavernous (>1 m)

Surface shape

St Stepped
U Undulating
P Planar
C Curved
I Irregular

Nature of filling

1. Clean
2. Surface staining
3. Non-cohesive
4. Inactive clay or clay matrix
5. Swelling clay or clay matrix
6. Cemented
7. Chlorite, talc or gypsum
8. Other - specify
9. Broken rock
10. Silty sand

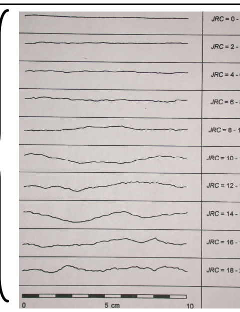
Surface roughness

R Rough
S Smooth
P Polished
K Slickensided
VR Very Rough

Compressive strength of infilling

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

JRC
Refer to Full-Sized Profiles



0-2
2-4
4-6
6-8
8-10
10-12
12-14
14-16
16-18
18-20

10/3/2006 GOLDER ASSOCIATES

Golder Associates
Anchorage, Alaska

SCALE	NONE
CADD	AF
DATE	10/03/06
CHECK	RGD
DATE	10/09/06
REV.	0
FILE No.	FIG9_ROCKDATA2.CDR
PROJECT No.	063-5782

TITLE

ROCK STRUCTURE MAPPING DATA SHEET 2

LYNN CANAL HIGHWAY PHASE I
GEOTECHNICAL INVESTIGATION

ADOT&PF / LYNN CANAL HWY / ALASKA

FIGURE 9