Airborne Photo Mosaic-LiDAR Survey Technical Report

On the

Orca and Bear Creek Property
Mineral Claim Tenure Numbers 513976 and 513977

Port McNeill Area

Northern Vancouver Island

NTS Map 092L 55

Latitude 50 Degrees 35 Minutes
Longitude 127 Degrees 07 Minutes

For

Orca Sand and Gravel
Suite 2740, 1055 West Georgia Street
PO Box 11175
Vancouver, British Columbia
V6E 3R5

November, 2007

By

Claude Vickers, Diploma GIS
Craig Sheriff , M.Sc. Spatial Analysis; B.Sc. Geography
Gary Nordin, B.Sc. Geology; P.Geo., BC

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Introduction

Port McNeill is located 350 kilometers northwest of Vancouver, British Columbia at Latitude 50 degrees 30 seconds and longitude 126 degrees 17 seconds, NTS Map 92 L.055. Port McNeill is a forest-based town with a population of 3,000. See Map Figure 1. The town has a good supply of skilled industrial workers. Three logging companies, Weyerhaeuser, Western Forest Products and Canadian Forest Products provide the majority of employment in the area. Fishing and tourism are the other main industry employers.

Access is via ferry from Vancouver to Nanaimo and a 3.5 hour drive north on Island Highway # 19. Daily scheduled air flights by Pacific Coastal Airlines are available from Vancouver to Port Hardy, which is located 40 kilometers northwest of Port McNeill. Port Hardy has a population of 5,000. Charter aircraft and helicopters are located both at Port McNeill and Port Hardy.

A network of private logging roads maintained by Weyerhaeuser and Western Forest Products provide excellent access to the project area. The area has been extensively logged over the last 100 years.

Northern Vancouver Island has a typical, west coast marine climate, which brings cool, moist weather to the area for most of the year. Annual rainfall ranges from 375 mm. to 500 mm. Temperature variations are moderate with an average annual temperature of 8 degrees Celsius (46 degrees Fahrenheit). The summer months, May through September, are considerably drier than the winter. Temperatures average 17.4 degrees Celsius (63 degrees Fahrenheit) in July and August, with hot, sunny days and some cooler days as well. Rarely does the temperature fall below 0 degrees Celsius (32 degrees Fahrenheit) in the winter.

Physiography

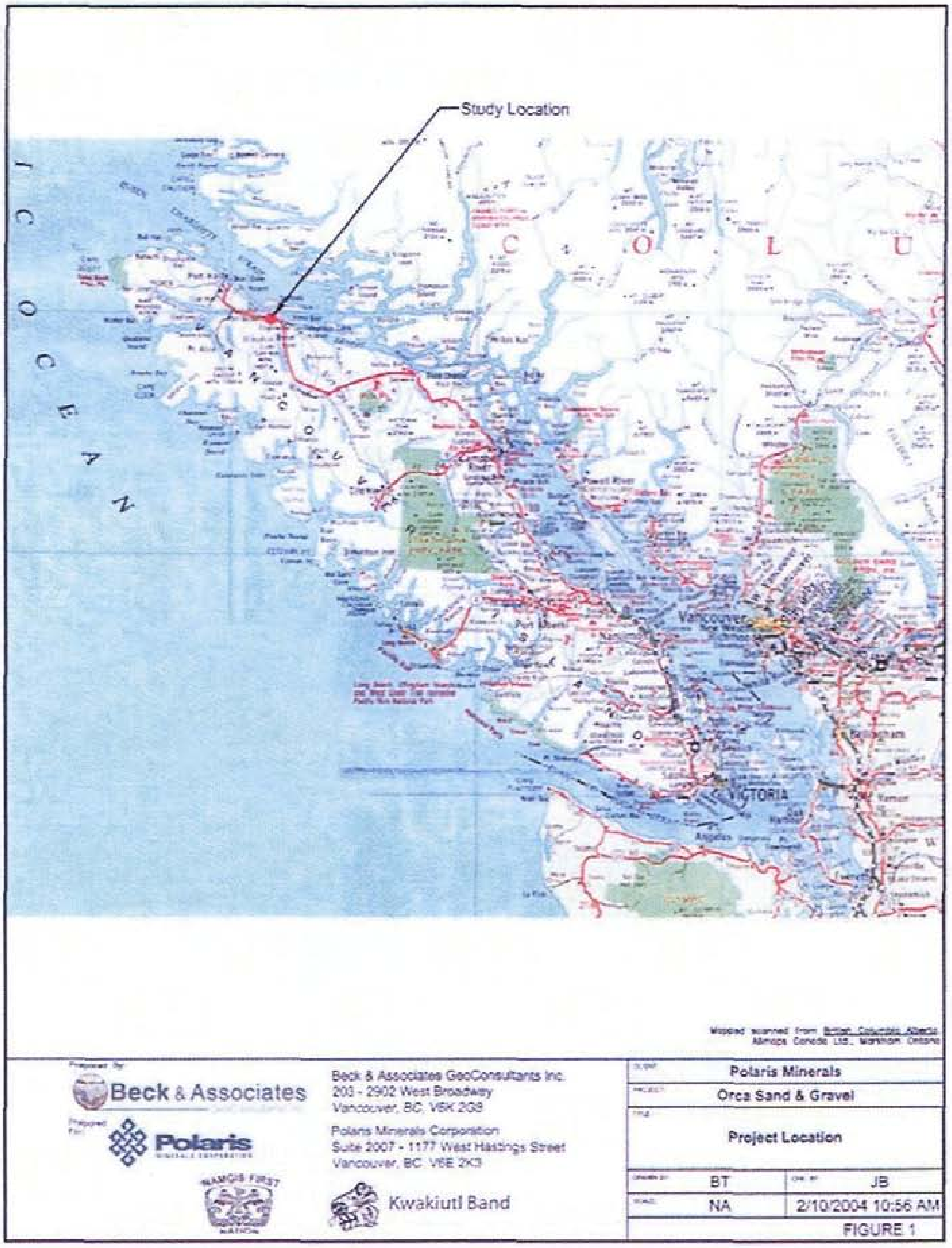
Northern Vancouver Island consists of three major physiographic units: the Nahwitti Lowland, the Susquash Basin and the Vancouver Island Mountains (Figure 6).

The Nahwitti Plateau and the Susquash Basin are the main physiographic units in the proposed exploration area with the Vancouver Island Mountains located immediately to the south.

The Nahwitti Plateau dominates the northern tip of Vancouver Island, principally to the west of the coastal exploration area. It is characterized by low relief and a smoothed upland, remnants of a dissected Tertiary erosional surface, which slopes northward towards Cape Scott.

The Susquash Basin is a triangular shaped area along the eastern margin of the Nahwitti Lowland extending between Port Hardy and Port McNeill and it constitutes the bulk of the study area. It is characterized by gentle rolling to level topography below 300 meters elevation with scattered uplands or hillocks. The lowlands are underlain by gently dipping Cretaceous age sedimentary rocks of the Nanaimo Group with the hillocks made up of Triassic age sediments volcanics of the Vancouver Group. Erosion and glaciation of the soft Cretaceous sediments in the basin has produced the lowland topography. The uplands are mantled by colluvial and glacial moraine deposits. Thick Quaternary glacial fluvial and lacustrian deposits consisting of fluvial, glacial fluvial sand and gravel deposits and marine lacustrian clay mantle the eastern lowlands in the Port McNeill area. These deposits formed 9,000-1200 years ago from the melting of the mountain glaciers to the south. The alluvial and glacial fluvial sand and gravel deposits are up to 100 meters thick in the Cluxewe River area and are the principal targets in the proposed exploration area.

Project Maps



General Location Map

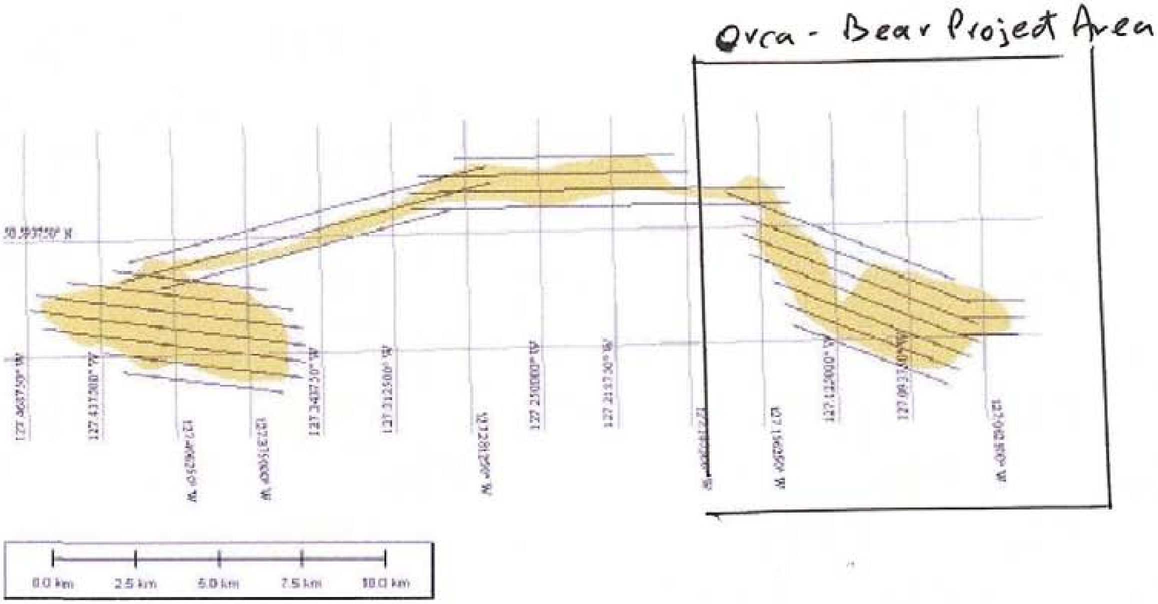


Photo Flightlines

LiDAR Flightlines

Please note that the LiDAR and Photo Mosaics and digital copies of the flightlines above are included as digital maps to aid in the support of this report.

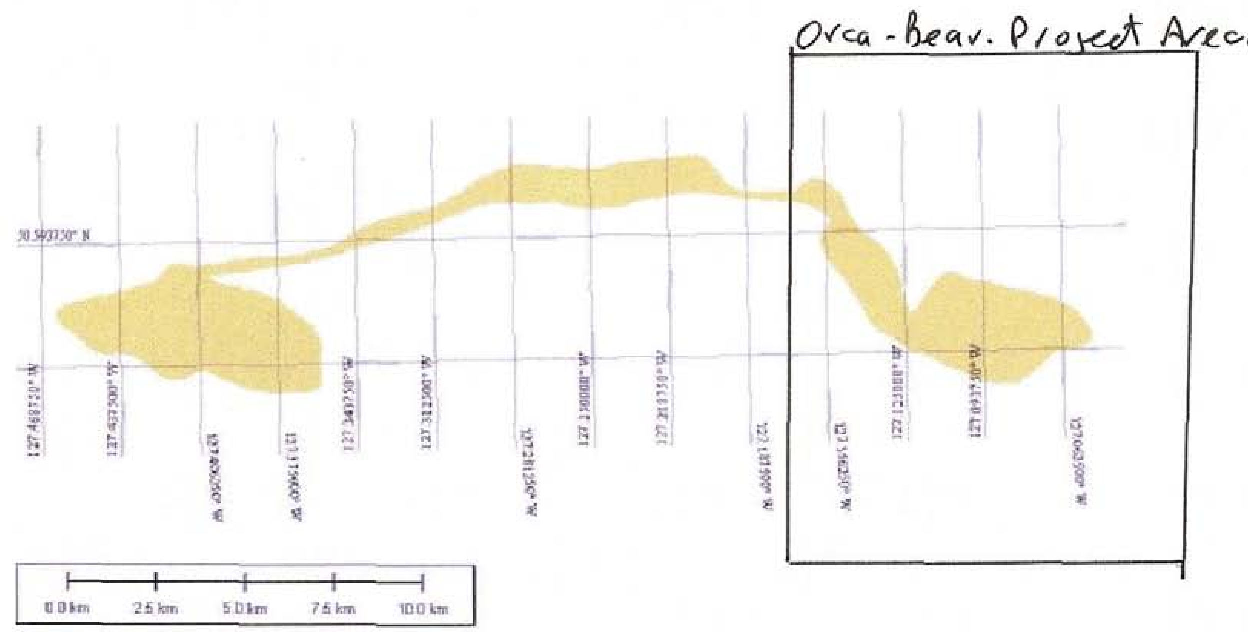
Claim Map (map56349) and Physiography graph are included in Appendix A.

Specific objective of survey

The purpose of the LiDAR data and orthophoto mosaics was to produce high accuracy 3D elevation based geospatial and imagery products to support mining operations at the Orca-Bear project site.

This project is located in Northern Vancouver Island, British Columbia and is bounded by these WGS84 Geographic coordinates:

West_Bounding_Coordinate:	-127.4635 W
East_Bounding_Coordinate:	-127.0483 W
North_Bounding_Coordinate:	50.6173 N
South_Bounding_Coordinate:	50.5501 N



Project Boundary

Brief Theory

LiDAR data is remotely sensed high-resolution elevation data collected by an airborne collection platform. By positioning laser range finding with the use of 1 second GPS with 100 Hz inertial measurement unit corrections; Terrapoint's LIDAR instruments are able to make highly detailed geospatial elevation products of the ground, man-made structures and vegetation.

The LiDAR ground extraction process takes place by building an iterative surface model. This surface model is generated using three main parameters: building size, iteration angle and iteration distance.

The photo is collected on the same instrument platform as LiDAR and positioned with the use of the LiDAR's inertial and GPS system.

The photo was orthorectified without the use of tie-point or Aerial Triangulation (AT) through the use of orientation refinement, model updating and bare earth model creation processing modules to create a superior product then conventional methods.

Make and model of instruments, and procedure

Equipment and Configuration

The following equipment was used in the acquisition of the Orca-Bear Survey:

Helicopter:	Robinson R44
LiDAR System:	Terrapoint ALMIS 350
Laser Unit:	Reigl Q140
Inertial Measurement Unit:	Honeywell HT-1300
Airborne GPS Unit:	NovAtel DL-4
Base Station GPS Unit:	Sokkia GSR 2600
Camera:	Cannon EOS 10.4 Megapixels
In flight Navigation System:	Softnav

The equipment was configured in the following manner:

Nominal Flying Altitude:	175m AGL
Laser Swath Width:	115% of flying height (200 m)
Full Scan Angle:	60 degrees
Scan Rate:	44 Hz
Typical Laser Pulse Rate:	9 kHz
Beam Divergence at exit port:	3 mrads
Laser Returns per pulse:	1
Intensities recorded per pulse:	1
Cross Track Spacing:	0.46 m (non overlapped)
Along Track Spacing:	0.96 m (speed dependent)
Laser Wavelength:	900 μm
Ground Speed:	60 knots

The procedure to produce the survey results is provided below and is divided into section acquisition and processing:

Acquisition

General Overview

The Airborne LiDAR survey was conducted using one ALMIS 350 system flying at a nominal height of 175 metres AGL a total angular coverage of 60 degrees. Flight line spacing was nominally 90 metres providing overlap of 50% on adjacent flight lines. Lines were flown in various block alignment to best optimize flying time considering the layout for the project. The aircraft was a Robinson R44, registration C-GEET, was used for the survey. This aircraft has a flight range of approximately 3.5 hours and was flown at an average altitude 175 meters above ground level (AGL).The aircraft was staged from the Port Hardy Airport and ferried daily to the project site for flight operations.

GPS Receivers

A combination of Sokkia GSR 2600 and NovAtel DL-4 dual frequency GPS receivers were used to support the airborne operations of this survey and to establish the GPS control network.

Number of Flights and Flight Lines

A total of 10 missions were flown for this project with flight time ranging approximately 25 hours under good meteorological and GPS conditions. Approximately 95 LiDAR flight lines and 25 photo flight lines were flown over the project site to provide complete coverage.

Reference Coordinate System Used

Existing NRCan GSD (National Resources Canada Geodetic Survey Division) monuments were observed in a GPS control network to establish 1 new station: 718401.

718401 was used as primary control for the project flight missions and kinematic ground surveys. The published horizontal datum of the NRC GSD stations is NAD83 (CSRS) and the vertical datum CGVD28.

The following are the final coordinates of the newly established control points used in this project:

Station_ID:	718401
West_Longitude:	127 16 13.39261
North_Latitude:	50 36 18.86232
Ellips_Elev:	64.2673
Orthometric_Height:	78.9743

Data was processed and delivered in the following projection

```
Horizontal_Coordinate_System_Definition:
 Planar:
  Grid_Coordinate_System:
   Grid_Coordinate_System_Name: Universal Transverse Mercator
   Universal_Transverse_Mercator:
    UTM_Zone_Number: 9
    Transverse_Mercator:
     Scale_Factor_at_Central_Meridian: 0.999600
     Longitude_of_Central_Meridian: -129.000000
     Latitude_of_Projection_Origin: 0.000000
     False_Easting: 500000.000000
     False_Northing: 0.000000
  Planar_Coordinate_Information:
   Planar_Coordinate_Encoding_Method: Coordinate pair
   Coordinate_Representation:
    Abscissa_Resolution: 0.01
    Ordinate_Resolution: 0.01
   Planar_Distance_Units: metres
 Geodetic_Model:
  Horizontal_Datum_Name: North American Datum of 1983
  Ellipsoid_Name: GRS 80
  Semi-major_Axis: 6378137.0000000
  Denominator_of_Flattening_Ratio: 298.26
Vertical Coordinate_System_Definition:
 Altitude_System_Definition:
  Altitude_Datum_Name: Canadian Geodetic Vertical Datum 1928
  Altitude_Resolution: 0.01
  Altitude_Distance_Units: 0.01
  Altitude_Encoding_Method: Explicit elevation coordinate included with horizontal coordinates
```

Geoid Model Used

The HT2.0 geoid model, published by the Geodetic Survey Division of Canada, was used to transform the ellipsoidal heights to orthometric.

Processing

Airborne GPS Kinematic

Airborne GPS kinematic data was processed on-site using GrafNav kinematic On-The-Fly (OTF) software. Flights were flown with a minimum of 6 satellites in view (13° above the horizon) and with a PDOP of better than 3.5. Distances from base station to aircraft were kept to a maximum of 15 km, to ensure a strong OTF (On-The-Fly) solution. For all flights, the GPS data can be classified as excellent, with GPS residuals of 4cm average but no larger than 10 cm being recorded.

Generation and Validation of laser points (raw data)

Laser data points are generated using Terrapoint's proprietary laser post-processing software. This software combines the raw laser range and angle data file with the finalized GPS/IMU information. The resulting point cloud has been projected into the desired coordinate system in TerraSolid's TerraScan format binary format.

All missions are validated against the adjoining missions for relative vertical biases and collected GPS kinematic ground truthing points for absolute vertical accuracy purposes.

On a project level, a coverage check is carried out to ensure no slivers are present.

Data Classification and Editing

The data was processed using the software TerraScan, and following the methodology described herein. The initial step is the setup of the TerraScan project, which is done by importing client provided tile boundary index encompassing the entire project areas. The 3D laser point clouds, in binary format, were imported into the TerraScan project and divided in 88 tiles in LAS 1.0 format. Once tiled, the laser points were classified using a proprietary routine in TerraScan. This routine removes any obvious outliers from the dataset following which the ground layer is extracted from the point cloud. The ground extraction process encompassed in this routine takes place by building an iterative surface model. This surface model is generated using three main parameters: building size, iteration angle and iteration distance. The initial model is based on low points being selected by a "roaming window" with the assumption is that these are the ground points. The size of this roaming window is determined by the building size parameter. The low points are triangulated and the remaining points are evaluated and subsequently added to the model if they meet the iteration angle and distance constraints. This process is repeated until no additional points are added within an iteration. A second critical parameter is the maximum terrain angle constraint, which determines the maximum terrain angle allowed within the classification model. The data is then manually quality controlled with the use of hillshading, cross-sections and profiles. Any points found to be of class vegetation, building or error during the quality control process, are removed from the ground model and placed on the appropriate layer. An integrity check is also performed simultaneously to verify that ground features such as rock cuts, elevated roads and crests are present. Once data has been cleaned and complete, it is then by a supervisor via manual inspection and through the use of a hillshade mosaic of the entire project area.

Deliverable Product Generation

Deliverable Tiling Scheme

All products were delivered in the NTS tiling scheme (4X4 split) with a total of 33 tiles

Surfaces

An ASCII Bare Earth and DEM (Digital Elevation Model) and a Full Feature DEM were built on 1-meter grids interpolated using a Laplacian interpolation method from the processed LiDAR point clouds in Terrapoint's TOPS software. The DEMs were provided in ASCII X, Y, Z format.

Ortho-rectified images (see appendix B)

The images are orthorectified with the use of Simactive's Correlator3D software. This software accomplishes a superior orthorecitfied product without the use of tie-point or Aerial Triangulation (AT) through the use of orientation refinement, model updating and bare earth model creation processing modules. The source data for this process are the exterior and interior orientation files, raw photo, photo events, bare earth and full feature DEM.

The individual orthorectifed images are subsequently mosaiced into processing tiles with the use of InPho's Orthovista package. After an initial review of the resulting mosaic seams, modifications are made to the seam lines where visible discontinuities are observed in man made features such as roads and buildings. The final reviewed product is subsequently retiled in the deliverable square NTS tiles with overlap in Orthovista and clipped to the project boundary in Global Mapper.

LiDAR ASCII point files (see appendix B)

Once the data has been classified, quality controlled and considered complete, the raw points with outliers removed are extracted from the LAS Binary format output to ASCII XYZ format.

Contours

Contours were generated from a triangulated irregular network from the processed LiDAR point clouds in TerraScan. The native format of the contours is DGN and they were subsequently transformed to DWG using AutoCAD.

Results and discussion/interpretation of results/conclusions

This project was flown within 10 flight missions without technical delays or failures. However, weather did cause several standby days at which time the ground survey was carried out. (see digital map figures in appendix B)

No problems were encountered with the GPS solutions, as well as with the data classification and editing aspects of the project.

Overall the survey was conducted within the estimated maximum timeframe, and the results of the survey met or exceeded the required specification.

Accuracy and limitations

LiDAR Positional Accuracy:

The LiDAR data products were compiled to meet 0.30 - 0.45 meter horizontal accuracy at the 95 percent confidence level.

The LiDAR data tested to 0.118 meter for vertical accuracy at 95 percent confidence level (RMSE *1.96) when compared with to GPS kinematic data.

The LiDAR accuracy summary statistics are as follows:

Average dz	+0.047
Minimum dz	-0.048
Maximum dz	+0.139
Average magnitude	0.050
Root mean square	0.060
Standard deviation	0.037

Orthophoto Positional Accuracy:

The orthophoto data products were compiled to meet 0.75 meter horizontal accuracy at the 95 percent confidence level.

The Orthophoto data products tested to 0.5 meter for horizontal accuracy when compared with to 7 GPS surveyed photo targets.

Data Product Limitations

Any conclusions from results of the analysis of the LiDAR and orthophoto data products are not the responsibility of Terrapoint.

The LiDAR data was thoroughly visually verified to represent the true ground conditions at time of collection. Users should be aware of this limitation of this dataset if using for critical applications.

Please note that the LiDAR intensity is not calibrated or normalized. The intensity value is meant to provide relative signal return strengths for features imaged by the sensor.

According to Terrapoint standards; the following aspects of the LiDAR data was verified during the course of the project processing:

- -Data completeness and integrity
- -Data accuracy and errors
- -Anomaly checks through full-feature hillshades
- -Post automated classification Bare-earth verification
- -RMSE inspection of final bare-earth model using kinematic GPS quality control of deliverable products; ensuring integrity; graphical quality; conformance to Terrapoint standards are met for all delivered products.

Statement of Costs

	Orca	Bear	Orca-Bear Total
Primary Contract	$18,374	$18,374	$36,748
Change Order (For Additional Survey Area)		$5565	$5,565
			$42,313
			Total
Mob 30%	$5,512	$5,512	$11,024
Data Acquisition 50%	$9,187	$9,187	$18,374
Delivery 20%	$3,675	$3,675	$7,350
Change order fee		$5,565	$5,565
	$18,374	$18,374	$42,313

Statement of Qualifications

Below is a statement of qualification of the authors from Terrapoint:

Claude Vickers

Education	Diploma in GIS	Algonquin College, Ottawa, ON	1998

Expertise

Workforce planning and performance management; customer liaison; project trouble shooting and scheduling; workflow management and data transition; macro and script development for point cloud classification, lattice export, projection transformations and special output formats; software (CAD packages and GIS applications)

Recent and/or Relevant Projects

Veritas

- Technical Project Lead; output GIS data products; consulting and training
- Lake Ridge – Oil & Gas

National Conservancy

- Derived methodology for creating a relative flood height model
- Sacramento – Flood Mapping

Hydro Quebec

- Production Manager; troubleshooting; data management;
- Mecatina River – Flood Mapping

USGS and Coastal Conservancy

- Technical Project Leader; complex deliverable generation; coordinated engineering software development
- San Francisco Bay – Environmental

Dewberry and Davis

- Production Manager (2500 sqkm of dense/urban data)
- Middlesex – Flood Mapping (FEMA)

URS

- Production Manager; value-added customer service and consultancy
- Port Angeles – Airport Obstruction Mapping

Work History

Production Manager	Terrapoint Canada Inc.,	2003 - present
Supervisor – LiDAR Data Processing and Analysis	Terrapoint Canada Inc., Ottawa, ON	2000 - 2002
GIS LiDAR Technologist	Lasermap, Ottawa, ON	1998; 1999 – 2000
Junior Geography Officer	Elections Canada, Government of Canada, Ottawa, ON	1998 - 1999

Craig Sheriff

Education	Master of Spatial Analysis	Ryerson University, Toronto, ON	2003
	BSc Geography	Queens University, Kingston ON	2002
	Survey Technician Diploma	Algonquin College, Ottawa ON	1998

Expertise

Full-cycle field survey operations; pre-processing of GPS, LiDAR and other field data; pre-survey, survey and post-survey operations; evaluation of field conditions (safety, weather and budget); project planning including flight-line planning; field logistics (aircraft, air traffic control); understanding of software systems and applications (operating systems, GPS survey and survey adjustment programs, CAD packages); establishing control survey networks, analysis and adjustments; field data processing and quality control.

Recent and/or Relevant Projects

Queens University

- Field Project Manager – TITAN data acquisition
- Rock Stability LiDAR data, Hwy 15 - Transportation

Counterpoint Energy

- Field Project Manager – TITAN data acquisition
- Circuits 63A and 63C – Transmission Line

Algoma

- Field Project Manager – TITAN data acquisition
- Mobile terrestrial and low altitude LIDAR data collection - Transportation

Publications

- A Quantitative Approach to Line of Sight and Viewshed Analysis in an Urban Environment, 2006 GEOIDE Annual Scientific Conference, Banff, AB
- Computers, Cables, and Collections: Digital field Data collection for GIS Support of Landslide Mapping along Railroad Corridors 2005 International Conference on Landslide Risk Management, Vancouver, BC
- Field Data Collection Systems for Railway Ground Hazards, 2005 General Assembly of the European Geosciences Union, Vienna, AU

Work History	Project Manager, Field Operations	Terrapoint Canada Inc., Ottawa, ON	2006-
	GIS Analyst	Dept of Geological Sciences and Geological Engineering, Queens University, Kingston, ON	2004-2006
	Research Assistant	Centre for the Study of Commercial Activity, Ryerson University, Toronto, ON	2002-2003
	Research Associate	Dept of Geological Sciences and Geological Engineering, Queens University, Kingston, ON	2002
	Research Assistant	Laboratory for Remote Sensing of Earth and Environmental Systems, Dept of Geography, Queens University, Kingston, ON	2000-2002
	GIS Technician	Municipal Property Assessment Corp, Kingston, ON	1999

Below is a statement of qualification of the author from Polaris Minerals Corporation:

Gary D Nordin
Geologist

EDUCATION *B.Sc. Geology Honors, University of Alberta, 1970.*

REGISTRATIONS *P. Geol.-Association of Professional Engineers and Geoscientists of British Columbia*
Fellow- Geological Association of Canada

SPECIALISATION *The Selection Exploration and Development of Mineral Projects leading to Production*

EXPERIENCE

2002-Present **Canasil Resources Ltd. (TSX)**
Director

Assist and overview the selection and implementation of exploration of gold, Silver and copper-gold and base metal projects in BC, and Mexico

2002 – 2007 **Portal Resources Ltd. (TSX)**
Vice President Exploration November 2002-September 2007, Director. Formation of a new TSX Resource company

Currently a Director

Directed the acquisition and exploration of a Rhyolite Dome associated gold silver project in Patagonia, Argentina and copper-gold porphyry in Mendoza, Argentina and the acquisition and exploration of Uranium Projects in Argentina and the United States

2002-2007 **Nevada Pacific Gold Corporation (TSX)**
Consultant, Director

Guide the direction of exploration in Mexico for gold- silver and copper

2001 – Present **Polaris Minerals Corporation (Private Aggregate Corp)**
Consultant,Director

-Research, acquition,exploration and resource definitiont of a crushed rock granite quarry and sand and a gravel aggregate projects in coastal British Columbia for ship transport to the California construction market..

1990-2001 **Eldorado Gold Corporation(TSE)**

Founder, Director, Vice President, Chief Geologist, Founder of Eldorado Gold.

Selection of project areas through USA, Mexico, and acquition of projects leading to production/acqiition decisions at: La Colorado, Mexico; La Trinidad, Mexico; SaoBento, Brazil; Efemcukaru and Kisladag, Turkey.

1990-Present ***Discovery Resource Corporation (PrivateBC Resource Corp); Trend Resources (Private Nevada Corp)***

Discovery Resource Corp.(British Columbia)
President, Founder,Private Mineral Exploration and Investment Corporation

Trend Resources LLC(Nevada) *President and Founder Private Exploration Company active in the Battle Mountain Trend of Northern Nevada. Research and staking of prospective projects and optioning to Junior Exploration Companies.*

1979-1990 ***Bema Gold Corporation(TSE)***

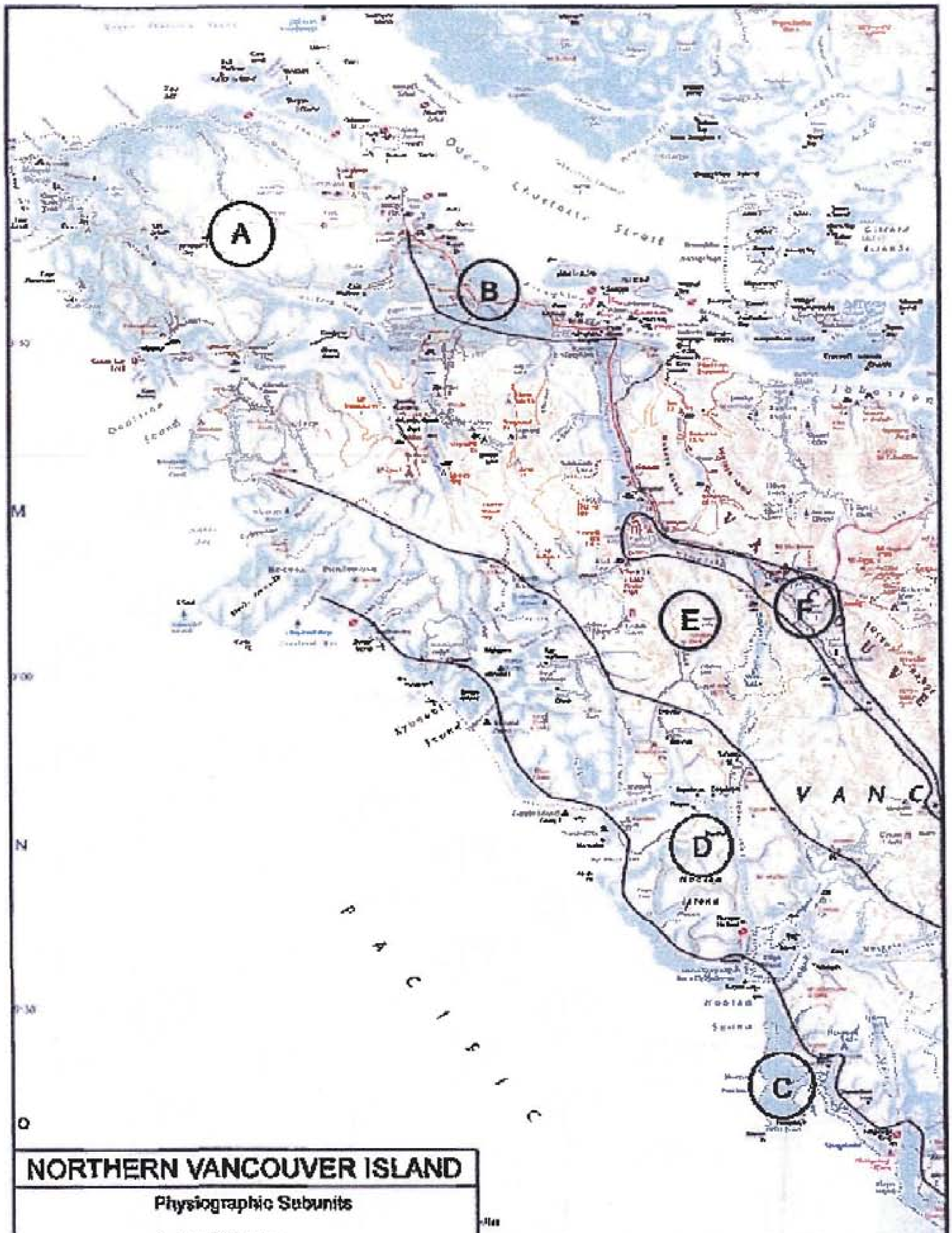
Founder, Director,Vice President Exploration, Chief Geologist, Founder of Bema Gold.

In charge of review and selection of projects and all geological aspects of a project leading to a production decision. Reviewed and directed geology and recommended acquition of Champagne Mine, USA, Ogilvy Project (Indian Rose-Ocotillo Gold Project) Imperial County, California, USA; Refugio Gold Mine, Chile.

1978-1980 ***Consultant Oil Industry***
Well site consultant, Blue Sky Oil and Gas, Calgary Alberta

1970-1978 ***Exploration Geologist***
Exploration for iron ore- copper porphyry deposits in British Columbia, Alaska, Costa Rica for:
-Anaconda American Brass, British Columbia
-Texada Mines Ltd- Kaiser Exploration, British Columbia-Alaska
-Cities Services Corp, British Columbia- Costa Rica
-British Columbia Department of Mines- Geochemical survey Cassiar-Prince Rupert
-Northair Mines Ltd- Banks Island, British columbia

Appendix A - Additional Maps



NORTHERN VANCOUVER ISLAND

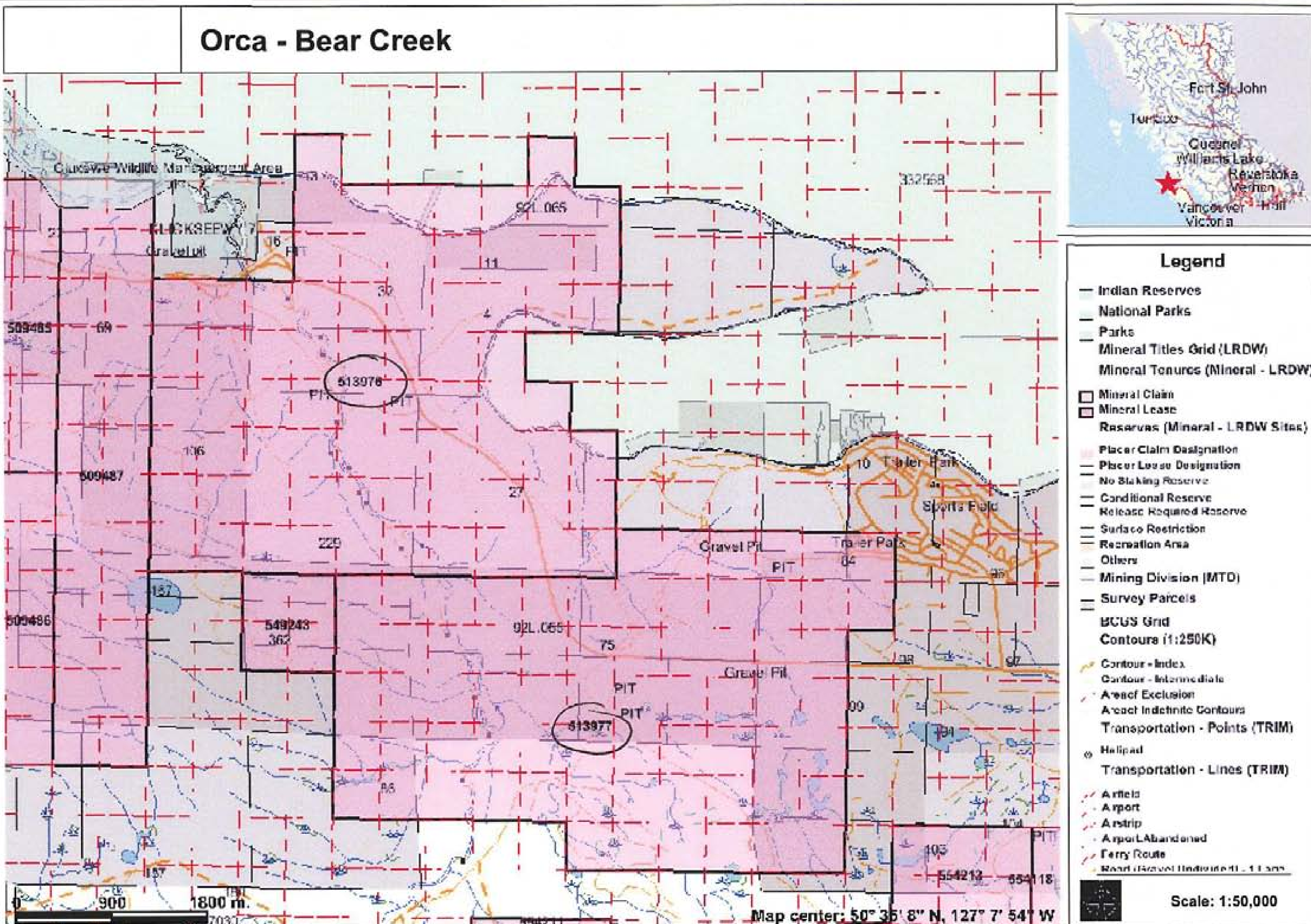
Physiographic Subunits

A. Nahwitti Plateau
B. Suquash Basin
C. Estevan Coastal Plain
D. Fiord-land
E. Vancouver Island Range
F. Nimpkish River Valley

Date:	Scale: As Shown	Fig. No. 6

0 20 40
KILOMETRES

Orca - Bear Creek



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Notes: Claim Map