H11660

NOAA FORM 76-35A

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE

DESCRIPTIVE REPORT

Type of Survey Hydrographic Lidar

Field No. N/A

Registry No. H11660

LOCALITY

State Alaska

General Locality West of Prince of Wales Island

Sublocality San Alberto Bay

2007

CHIEF OF PARTY

Scott Ramsay

LIBRARY & ARCHIVES

DATE

NOAA FORM 77-28 (11-72)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

REGISTRY No

HYDROGRAPHIC TITLE SHEET

H11660

INSTRUCTIONS – The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD No

N/A

State Alaska

General Locality West of Prince of Wales Island

Sub-Locality San Alberto Bay

Scale 1:10,000 **Date of Survey** 4/21/2007 - 6/23/2007

Instructions dated 3/15/2007 **Project No.** OPR-O190-KRL-07

Vessel Tenix LADS Aircraft, VH-LCL

Chief of party S.R. Ramsey

Surveyed by Tenix LADS Personnel

Soundings by echo sounder, hand lead, pole Laser Airborne Depth Sounder

Graphic record scaled by N/A

Graphic record checked by N/A **Automated Plot** N/A

Sar by Toshi Wozumi Compilation by **Reser**

Soundings in Fathoms

REMARKS: All times are UTC. UTM Zone 8

The purpose of this survey is to provide contemporary surveys to update National Ocean Service (NOS) nautical charts. Revisions and end notes in red were generated during office processing.

Page numbering may be interrupted or non sequential.

All pertinent records for this survey, including the Descriptive Report, are archived at the National Geophysical Data Center (NGDC) and can be retrieved via http://www.ngdc.noaa.gov/.

NOAA FORM 77-28 SUPERSEDES FORM C&GS-537

DESCRIPTIVE REPORT TO ACCOMPANY

HYDROGRAPHIC SURVEY H11660

SCALE 1:10,000, SURVEYED IN 2007

TENIX LADS AIRCRAFT, VH-LCL

TENIX LADS, INC. (TLI)

MARK SINCLAIR, HYDROGRAPHER

PROJECT

Project Number: OPR-O190-KRL-07 **Original:** DG 133C-06-CQ-0066
Date of Instructions: March 15, 2007 **Task Order:** T0001

Date of Supplemental Instructions:

- December 3, 2007 – Email from Dave Scharff (NOAA COTR) indicating CO-OPS authorized use of the JOA final tide zoning correctors for the project area (refer to Appendix V).
- March 3, 2008 – Email from Dave Scharff (NOAA COTR) approving sub-locality name change in Statement of Work Attachment #4B..

Registry Number: H11660
Sheet: B

A. AREA SURVEYED

Survey operations covered five registered sheets over the OPR-O190-KRL-07 project area, West of Prince of Wales Island, AK (see Figure 1 and Figure 2)[1].

A total of 1969 lineal nautical miles were illuminated in the process of flying 298 main scheme survey lines. An additional 1052 lineal nautical miles were illuminated flying 155 reflies and 459 lineal nautical miles flying 77 crosslines / investigations. The total seabed area surveyed across the project area, from the 0m curve to lidar extinction depth, was 13 square nautical miles (see Appendix III for further information).

Between April 21 and June 23, 2007, the LADS Mk II aircraft conducted 20 sorties West of Prince of Wales Island, based out of Ketchikan. Two forward deployments to Kodiak occurred during this time to conduct survey operations in the OPR-P135-KRL-07 project area. On June 2, 2007, the main base of operations moved to Kodiak. Two forward deployments from Kodiak to Ketchikan were necessary to finalize data collection during June. The specific dates of data acquisition, hours flown and time on task were as follows:

Date	Sortie No.	Hours Flown	Time on Task
22-April-07	1	6:25	5:10
24-April-07	2	5:44	4:50
5-May-07	3	1:47	0:35
7-May-07	4	5:50	4:55
8-May-07	5	5:25	4:20
9-May-07	6	6:05	5:05
10-May-07	7	5:25	4:03
12-May-07	9	5:20	4:08
14-May-07	10	3:03	1:37
15-May-07	11	3:10	2:15
17-May-07	12	6:15	5:03
18-May-07	13	4:32	3:36
23-May-07	14	1:55	0:46
27-May-07	15	5:53	4:41
28-May-07	17	3:18	2:22
28-May-07	18	6:30	5:37
31-May-07	19	2:35	1:10
13-June-07	22	6:00	5:15
15-June-07	23	7:30	5:45
23-June-07	29	4:27	3:50

Table 1: Specific Dates of Data Acquisition

Environmental factors such as water clarity, tide, wind strength and direction, daylight hours, cloud base height and clouds over high terrain influenced the area and duration of data acquisition on a daily basis. See Section B.2.3 for further details.

This Descriptive Report describes Sheet B, which covers the center of the project area, in San Alberto Bay (see Figure 2).

The sheet limits are as follows for Sheet B:

H11660 (B)	Latitude (N)	Longitude (W)
NW corner	55° 36' 31.83"	133° 17' 55.76"
SW corner	55° 27' 54.48"	133° 18' 18.06"
SE corner	55° 27' 49.62"	133° 12' 36.60"
NE corner	55° 36' 26.94"	133° 12' 13.05"

Figure 1 – General Locality of OPR-O190-KRL-07

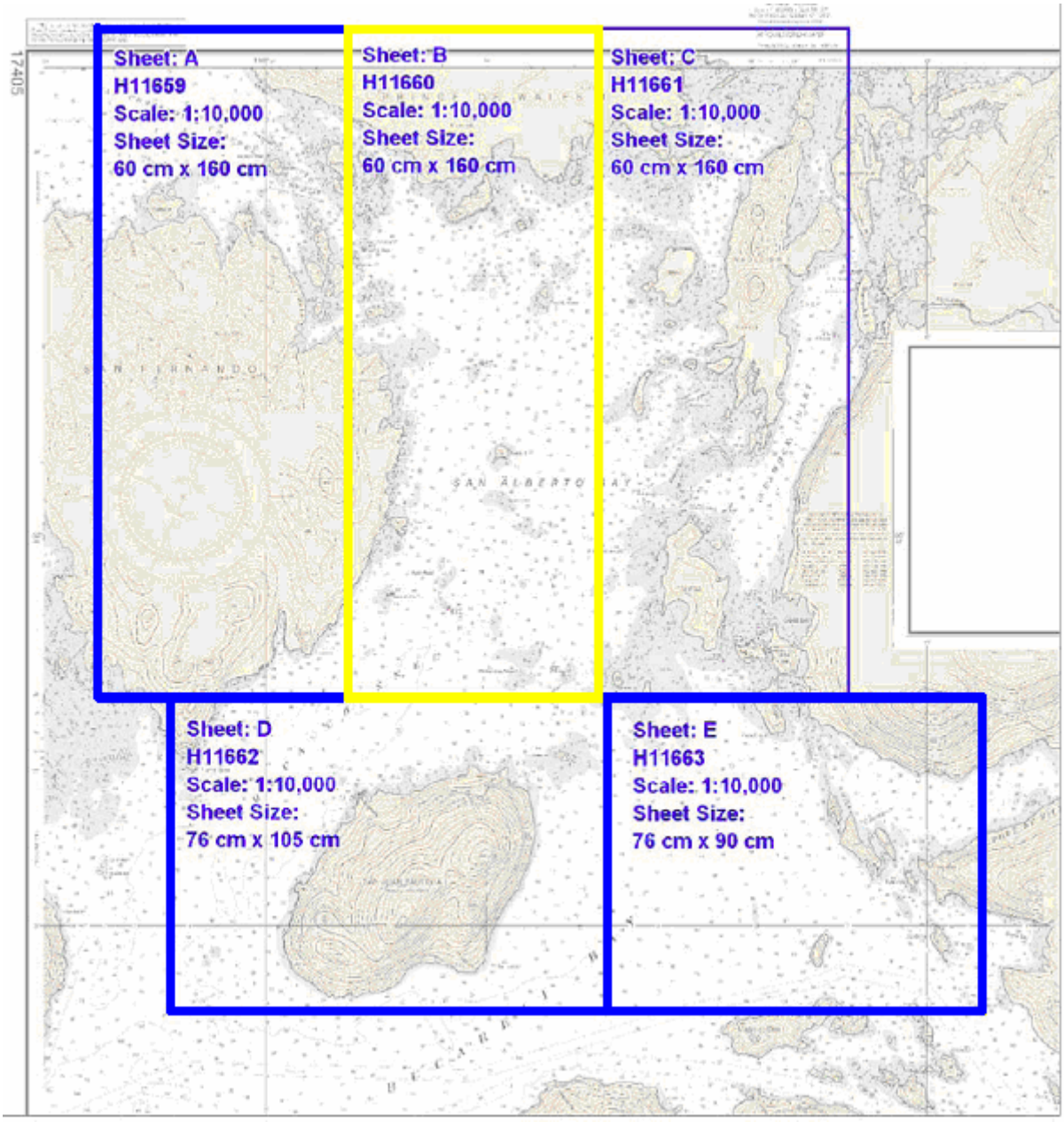


Figure 2 – Sub-Locality of H11660

B. DATA ACQUISITION AND PROCESSING

Refer to the Data Acquisition and Processing Report for a detailed description of the equipment, processing, and quality control procedures used during LADS surveys. A general description and items specific to this survey are discussed in the following sections.

B.1 EQUIPMENT

Data collection was conducted using the LADS Mk II Airborne System (AS), data processing using the LADS Mk II Ground System (GS), and data visualization, quality control and final products using CARIS HIPS and SIPS 6.1 and CARIS BASE Editor 2.1.

B.1.1 Airborne System

The LADS Mk II AS platform consists of a De Havilland Dash 8-200 Series aircraft, which has a transit speed of 250kts at altitudes of up to 25,000ft, and an endurance of up to eight hours. Survey operations are conducted from heights between 1,200 and 2,200ft, at ground speeds of between 140 and 210kts. The aircraft is fitted with an Nd: YAG laser, which is eye safe in accordance with ANSI Z136.1-2000, American National Standard for Safe Use of Lasers. The laser operates at 900 Hertz from a stabilized platform to provide a number of different spot spacings across the seabed.

Green laser pulses are scanned beneath the aircraft in a rectilinear pattern. The pulses are reflected from the land, sea surface, within the water column and from the seabed. The height of the aircraft is determined by the infrared laser return, which is supplemented by the inertial height from the Attitude and Heading Reference System (AHRS) and a Global Positioning System (GPS) receiver. Real-time positioning is obtained by an Ashtech GG24 GPS receiver providing autonomous GPS, or is combined with WADGPS (Fugro Omnistar), to provide a differentially corrected position, when coverage is available. Ashtech Z12 GPS receivers are also provided as part of the AS and GS to log data on the aircraft and at a locally established GPS base station.

A digital camera was installed on the LADS Mk II system platform prior to commencement of this survey. This allowed high quality images to be captured in real-time, georeferenced and overlaid with the processed survey data. These images were also combined into a georeferenced image deliverable across the extent of the survey area. The specifications for the Redlake MegaPlus II ES 2020 digital camera are provided in the Data Acquisition and Processing Report.

B.1.2 Ground System

The LADS Mk II GS ‘Gandalf’ was used to conduct data processing in the field. Gandalf consists of a portable Compaq Alpha ES40 Series 3 processor server with 1 GB EEC RAM, 764 GB disk space, digital linear tape (DLT) drives and magazines, a digital audio tape (DAT) drive, a CD ROM drive, and is networked to up to 12 Compaq 1.5 GHz PCs and a HP 800ps Design Jet Plotter, printers and QC workstations. The GS supports survey planning, data processing, quality control and data export. The GS also includes a KGPS base station, which provides independent post-processed position and height data.

Quality control checks and editing of the data were conducted on GS 'Katrina', at the TLI office in Biloxi, MS, upon completion of the data collection phase of the survey.

B.2 QUALITY CONTROL

B.2.1 Quality Control Checks

The internal relative consistency of the survey data was checked with crossline depth comparisons and depth benchmark comparisons in San Alberto Bay, and dynamic position checks, navigation position checks and by observing position confidence quality factors on the GS. System integrity was checked, in an absolute sense, with depth benchmark comparisons in the Gulf of Esquibel, the local GPS base station site confirmation and the static position check.

B.2.1.1 Crosslines

No specific crosslines were planned due to the high number of investigation / additional coverage lines (77) flown perpendicular to main scheme survey runs (298). These additional lines were flown to achieve better coverage over off-lying rocks and adjacent to long stretches of coastline. Due to the complex nature of the seabed, just 5 of the 77 investigation lines were selected for depth comparison. These five lines exhibited good water clarity and generally low gradient slopes, enabling meaningful statistics to be calculated. Below are the overall depth comparison results for the 52 crossline / main scheme line intersections. A complete summary is presented in the Separates Report.

Total Number of Comparisons	Mean Depth Difference	Mean Standard Deviation
75406	-0.02 +/- 0.10	0.15 +/- 0.03

B.2.1.2 Depth Benchmarks

The depth benchmark area from the 2004 lidar survey in the Gulf of Esquibel (OPR-O167-KRL-04) was used to check the absolute depth accuracy of the LADS Mk II system for the H11660 survey. Following the first sortie, 2 additional benchmark areas were identified within the survey area, and were flown over during each subsequent sortie. These 2 benchmark areas were created in order to assess the consistency of the LADS Mk II system depth performance. Center coordinates for the benchmark areas are as follows:

Gulf of Esquibel Benchmark

		UTM (N) Zone 8	
Benchmark Name	**Nominal Depth**	**Easting**	**Northing**
BM_1	15m	586 250	6 172 300

San Alberto Bay Benchmark

		UTM (N) Zone 8	
Benchmark Name	**Nominal Depth**	**Easting**	**Northing**
BM_2	10m	614 071	6 149 352
BM_3	11m	614 495	6 148 854

Survey lines were attempted over each of the depth benchmark areas during each sortie. The soundings were reduced to MLLW using Craig final tides and Sitka verified tides with time and range correctors as specified in Section C.2.

The LADS survey data is compared against the gridded benchmark surface in the GS, and statistics are generated which include the number of points compared, the mean depth difference (MDD) and the standard deviation (SD) between the data sets. The benchmark comparison function compares the data against the benchmark surface, and as this data is unedited, it may contain noise normally removed during the validation process. These noisy outliers are flagged as the shoalest and deepest differences.

A summary of the average of the MDD and SD for all depth benchmark area comparisons is presented below. Refer to the Separates Report for detailed results of the depth benchmark comparison results.

Gulf of Esquibel Benchmark

GS ID	BM Name	Nominal Depth	MDD	SD
1	BM_1	15m	-0.17 +/- 0.08	0.28 +/- 0.10

San Alberto Bay Benchmark

GS ID	BM Name	Nominal Depth	MDD	SD
2	BM_2	10m	0.07 +/- 0.08	0.21 +/- 0.08
3	BM_3	11m	0.04 +/- 0.04	0.17 +/- 0.04

The depth benchmark comparison results and the crossline comparisons results are within expected tolerances and show that the LADS Mk II depth performance was within specifications throughout the survey period.

B.2.1.3 Positioning Checks

Two independent positioning systems were used during the survey. Real-time positions were determined by autonomous GPS. Post-processed KGPS positions were determined relative to a local GPS base station that was established by JOA on the rooftop of the Best Western Hotel in Ketchikan. The post-processed KGPS positions were applied to each sounding during processing and the KGPS height was used in the topographic datum filter.

Position checks were conducted prior to, during, and following data collection as follows:

a. Local GPS Base Station Site Confirmation. A 24-hour certification of the local GPS base station established was conducted on April 20-21, 2007. The results reveal that the local GPS base station is free from site specific problems such as multipath and obstructions. Details are provided in the Horizontal and Vertical Control Report and scatter plots in the Separates Report.

b. Static Position Check. Prior to commencing data collection, the coordinates of the aircraft GPS antenna were determined relative to three marks, which were surveyed by JOA on the tarmac at the Ketchikan Airport. Data was logged by each LADS Mk II positioning system while the aircraft was static, enabling the positions to be checked against the known GPS antenna point. The absolute accuracy of the post-processed KGPS solution during the static position check was 0.151m (95% confidence). The results and details of the static position check are enclosed in the Horizontal and Vertical Control Report and Separates Report.

c. Dynamic Position Check. During each sortie, GPS data was logged on the aircraft and at the local GPS base station. This provided a check between the real-time and post-processed GPS positions. The mean difference between the real-time and post-processed positions was 2.109m, with an average SD of 0.302m. Details are provided in the Horizontal and Vertical Control Report.

d. Navigation Position Check. Navigation checks were also conducted over a JOA coordinated point on the SE corner of the Petro Marine dock at Craig, AK. This enabled the known position of the structure to be checked against the downward-looking digital image. This provided a gross error check of position. The mean error in Eastings was 1.5 +/- 0.86m and –0.84 +/- 2.7m in the Northings. Further details are provided in the Separates Report.

e. Position Confidence. The position quality was also monitored on the GS by checking a post-processed position confidence (C3), which is determined from the AS platform error, GPS error, and residual errors between the actual GPS positions and aircraft position, as determined from the line of best fit. No position anomalies were detected.

The position checks were within the expected tolerances and demonstrated that the positioning systems were functioning correctly throughout the survey period.

B.2.2 Uncertainty Values

For this survey area, global horizontal and vertical uncertainties have been assigned based on the defined horizontal and vertical error budget, as stated in the Horizontal and Vertical Control Report. The assigned horizontal uncertainty is 2.52m and the assigned vertical uncertainty is 0.40m.

However, when the calculated grid node SD is greater than the assigned vertical uncertainty, the SD is used as the uncertainty value. This has occurred in areas of high relief, which is common throughout the survey area. In some cases the SD may exceed IHO Order-1 limits. This could be attributed to the seabed gradient and a 3m grid resolution being used.

B.2.3 Environmental Factors

B.2.3.1 Sea Conditions - Sea State, Waves, Swell, White Water

The sea state ranged from 1 to 3 on the Beaufort Scale throughout the survey period, but was generally between states 1 and 2 in San Alberto Bay and between 2 and 3 in the northwest of the project area. White water was not a concern due to the protected nature of the survey area.

Calm seas were experienced on occasions, particularly in the northeast of the project area. Under such calm conditions the sea became glassy, which degraded the sea surface model, and resulted in gaps at nadir, where the sea surface returns were completely saturated and seabed returns attenuated.

Long period swell was not significant during the survey. However, an allowance has been made in the assessment of vertical accuracy.

B.2.3.2 Water Clarity

The water clarity in the survey area varied significantly during the period of data collection, and this required careful management to achieve the best possible seabed coverage across the project area. Water clarity varied from extremely poor to good. A total of 9 secchi disk reconnaissances were conducted throughout the survey area prior to and during survey flights, to determine optimal times of data collection and correlate water clarity with laser depth performance. Water clarity reconnaissance reports and secchi disk measurements can be found in the Separates Report.

B.2.3.3 Kelp

Kelp is one of the factors that increases the complexity of a particular survey area. It is one of the reasons why 200% coverage is recommended in Alaskan waters. Kelp reduces laser penetration and the resultant seabed coverage achieved by lidar. Kelp also increases the amount of data processing that is required and the amount of boatwork that is recommended, as described in Section D.2.1. Large areas of kelp exist throughout the survey area.

Kelp areas can be recognized in the data by the following indicators:

- Mid-water column returns are of low amplitude.
- Waveforms have poorly defined leading edges.
- Returns from the seabed are highly attenuated.
- Soundings in shallow water are very sparse.
- Soundings do not correlate with overlapping data from adjacent lines.

Kelp areas appear as data gaps in the BASE surface. In such areas of partial bottom coverage, kelp area polygons (WEDKLP) have been defined in the S-57 feature file at the boundaries of data gaps attributed to kelp. Where kelp is present, but seabed coverage was still achieved, kelp point objects (WEDKLP) have been defined in the S-57 feature file (US511660.000).

Rocks detected by the system in kelp areas may be difficult to discriminate as rock or kelp returns. When it is uncertain if the return is from rock or kelp, a decision whether the feature has ‘least depth found’ (LDF) by lidar is provided in Section D.1.6. If it is determined that the LDF on a significant feature has not been achieved by lidar, due to the presence of kelp, the item will appear as a feature for examination in the chart comparison file (H11660_ChartComp.hob).

B.2.3.4 Topography

The LADS Mk II system can measure topographic heights up to 50m elevation, subject to the depth / topographic logging window selected. For this survey, a 20m topographic height logging window was selected. As a result, the coastline was surveyed and elevations up to 20m were measured. During the processing stage, a maximum height of 5m above the sea surface was used to remove areas where large spruce trees grow near the high waterline. For areas of exposed rock that were greater than 5m above chart datum, the topographic heights were retained to ensure that the rock or islet height is correct. In areas where the Mean High Water (MHW) line could not be determined due to spruce trees, a 'gap tree' tag was inserted in the GS and with the use of the georeferenced imagery and exported tags, the MHW line has been dashed to indicate an approximate location.

The maximum topographic heights achieved in this area are limited by the topographic logging window and by spruce tree foliage. This can be seen as gaps in the BASE surface, indicating areas of no coverage in the center of islands and along the coastline. As a result of the restricted topographic window and spruce trees, some island heights will exist above the delivered survey data range.

B.2.3.5 High Ground

For this survey high ground was a significant issue, and the majority of the northeastern survey lines were flown at 2,200ft. Low cloud coverage was often prevalent along the edge of high terrain. During periods of adverse weather, lines were flown around San Juan Bautista Island or through the middle of the survey area at altitudes between 1,200 and 1,600ft, below the cloud ceiling.

B.2.3.6 Wind

Survey operations were conducted in wind strengths of up to 20kts during the survey. In general, the wind strength during sorties was between 5 and 15kts from the SW. In certain areas, wind strengths above 10kts generated turbulence that made data collection difficult. In circumstances when wind speeds were forecast to be greater than 20kts, no flights were planned due to the possibility of dangerous levels of turbulence.

B.2.3.7 Cloud

Low cloud coverage and rain was a significant factor during the survey. The wind direction affected the cloud base in the survey area. For example, in southerly or easterly conditions a low cloud base was experienced. Poor weather was monitored using, and decisions on the flying program were based on:

- Real-time satellite imagery
- Radar data
- Aviation reports
- Reports from local contacts in Craig
- Pilot weather reports
- Images viewed from a webcam located S of Craig

Two Internet sites proved to be invaluable for forecasting the weather. An aviation site, http://adds.aviationweather.gov, provided METAR data, actual wind speed and direction, cloud base and satellite cloud data. The observations were updated every twenty minutes. A NOAA weather site, http://pafc.arh.noaa.gov, provided aviation and general weather forecasts.

B.2.4 Data Coverage and Object Detection

B.2.4.1 Nature of the Seabed

The nature of the seabed in San Alberto Bay is quite complex. The area contains numerous islands and coastlines covered with spruce trees, which made the delineation of the MHW line difficult in some areas.

Throughout the sheet there are numerous rocks, islets and shoals, often surrounded by thick areas of kelp. Typically, kelp grows from the MLLW line to 10m water depth. It is often visible on, or just below the sea surface, in the downward-looking digital imagery. Most gaps in lidar data coverage, in less than 10m depth, are directly attributed to the presence of kelp.

The seabed gradient is generally high along the coasts of San Fernando Island and Prince of Wales Island on the Western side of the survey area, with the seabed dropping from the coastline and edge of islands to beyond 20m depth quickly. There is a relatively low gradient seabed in the vicinity of Balandra Shoal, Ballena Island Shoal, Hermanos Island and Prince of Wales Island on the Eastern side of the survey area. In these areas the seabed has gently undulating slopes.

B.2.4.2 Data Coverage

The survey area was illuminated at 4x4m laser spot spacing, resulting in a 192m swath width. Mainlines of sounding were spaced at 85m, which provided the required 200% coverage.

The gain levels automatically set by the AS accommodate for changes in the sea surface, water column and seabed conditions. In some areas, after long overland passages, low gain levels were initialized when passing back over the water. Where this has been identified in the data, these lines were reflown from the opposite direction to improve the coverage. In some inshore areas, reciprocal lines could not be flown due to the proximity of high ground at the start / end of the line. This adversely affected seabed coverage along some coastlines.

The raw laser waveform returns from the areas that were covered with kelp are considerably attenuated. In order to detect the seabed in such areas, the threshold in the GS was lowered to detect pulses with low signal-to-noise ratios (SNR). This often enabled the seabed depth to be extracted from the waveform, but also resulted in increased false bottom detects, which in turn increased data validation times.

The variable water clarity observed throughout the survey period resulted in maximum lidar extinction depths of 25m for the project, but typically full seabed coverage to 15m depth was achieved for H11660.

B.2.4.3 Object Detection

At the sea surface the footprint of the laser beam is approximately 2.5m in diameter. As the beam passes through the water column, it slowly diverges due to scattering. It should be noted that at 4x4m laser spot spacing, there is a gap of 1.0 to 1.5m between the illuminated area of adjacent soundings at the sea surface. There is a possibility that small objects in shallow water along the coastline may fall between consecutive 4x4m soundings, and not be detected. A description of the Bottom Object Detection (BOD) algorithm used in data processing is presented in the Data Acquisition and Processing Report.

B.3 CORRECTIONS TO SOUNDINGS

Refer to the Data Acquisition and Processing Report for a description of corrections to soundings. There were no deviations from the corrections described therein.

B.4 DATA PROCESSING

B.4.1 Data Management

The database is identified as follows:

Database Name	Sub-Locality	Sheet
07_POW	San Alberto Bay	B

A detailed table of survey line identifiers is presented in the Data Acquisition and Processing Report.

B.4.2 Data Processing Sites

The data acquired during survey flights was processed at the operating site in Ketchikan following each sortie. During the final two forward deployments to Ketchikan in June, a copy of the raw survey data was made following each sortie and the backups were sent to the main base of field operations at Kodiak for processing. Final validation, checking, approving, reports and products were conducted at the office in Biloxi, MS. The quality control of the data was done using CARIS software and was conducted in the Biloxi, MS office.

B.4.3 CARIS BASE Surface

One BASE surface covers the entire survey area. The Shoal layer of the BASE Surface should be used as the official hydrographic record of the survey. A grid resolution of 3m was used for the BASE surface. Grid resolution does not change relative to depth, as the laser pulse footprint stays relatively constant regardless of depth, and the laser spot spacing is constant irrespective of aircraft altitude. The 3m grid provides the largest amount of detail that can be supported by the lidar density.

B.4.4 Gap and Feature Tagging

During data processing on the GS, the operators have the ability to assign S-57 and user-defined tags to gaps and features in the data. This enables accurate delineation and attribution of unsurveyed polygons for the S-57 feature file (US511660.000).

For this survey, the following user-defined tags were used to delineate the seaward extent of gaps in the lidar seabed coverage, typically at a 50m interval:

GK	Bathymetry data gap due to kelp.
GS	Bathymetry / topography data gap due to the secondary exclusion zone (SEZ).
GTR	Topography data gap due to the detection of foliage in spruce trees.

Detailed descriptions of these gaps in seabed coverage are presented in Section B.8 of the Data Acquisition and Processing Report.

The following tags were used in the GS for features that require further examination:

FEK	Feature for examination in kelp, as the least depth has not been determined.
FERK	Feature for examination of a submerged rock, as the least depth has not been determined, or a higher density of data is required to adequately define the feature.
FERA	Feature for examination of a rock awash, as the feature has not been surveyed adequately due to the presence of white water.
FEDR	Feature for examination of a drying rock, as a higher density of data is required to adequately define the potentially drying feature.
FE	Feature for examination, generally in deep water, as the least depth has not been found due to poor water clarity.

The tags associated with features requiring further examination have been compiled in the H11660_Inv.hob file, and each have been given certain priority and a suggested examination method for the undertaking of additional boatwork.

In most cases the least depth has deemed not to be found on a feature, and it requires further examination by boat to determine the least depth.

B.4.5 Georeferenced Imagery

Digital imagery was captured on each sortie. The imagery was used in the validating, checking, and approval stages of survey data cleaning. The images were also combined to produce a georeferenced mosaic of the survey area.

B.4.6 Progress Sketches

Progress sketches were provided to NOAA on a monthly basis. The final progress sketch can be found in Appendix III.

B.4.7 Deliverables Data Formats

Data is provided in the following formats:

- Digital S-57 feature file
- CARIS BASE surface
- CARIS features for investigation and chart comparison files in .hob format

- CARIS compatible data – CAF Format – LADS soundings and waveforms, which can be imported into CARIS HIPS
- CARIS compatible data – HDCS Format – LADS soundings in CARIS HIPS native format
- Tidal data provided in ASCII, .xls and .csv formats
- Digital georeferenced image in .tif / .tfw format

Refer to the Data Acquisition and Processing Report for specific details.

C. VERTICAL AND HORIZONTAL CONTROL

Refer to the Horizontal and Vertical Control Report for a detailed description of the horizontal and vertical control used during this survey. A summary of horizontal and vertical control used for the survey follows.

C.1 VERTICAL CONTROL

Vertical control for the survey was based on the Mean Lower Low Water (MLLW) tidal datum. A temporary gauge installed by John Oswald and Associates (JOA) at Craig, AK served as vertical control for the project area.

Station details are as follows:

		WGS84	
Gauge	**Location**	**Latitude**	**Longitude**
9450551	Craig Petro-Marine dock	55° 29.3' N	133° 08.5' W

C.2 ZONING

NOAA initially supplied tide zones and correctors relative to Sitka (9451600) in the Statement of Work (SOW), covering the extent of the survey area. During field operations, tide data for the National Water Level Observation Network (NWLON) station at Sitka was downloaded from the CO-OPS website, and these preliminary tide values were used to reduce depth soundings.

Following data acquisition, JOA supplied verified tides for the temporary Craig gauge, and new time and range correctors were computed for the tide zone areas provided in the SOW. The new zone correctors relative to the subordinate gauge at Craig were approved for final tide reduction by CO-OPS, and these supplemental instructions are provided at Appendix V. The final tide zone parameters are presented in the table below:

Tide Zone	GS Identifier	Time Corrector	Range Corrector	Reference Station
SA227	TA1	+0 minutes	x 1.03	9450551
SA228	TA2	+0 minutes	x 1.02	9450551
SA229	TA3	+6 minutes	x 1.00	9450551
SA250	TA4	+0 minutes	x 1.00	9450551
SA227A	TA5	-12 minutes	x 1.06	9451600

For final tide application, the time and range correctors were applied to the smoothed tidal data provided by JOA. Soundings were then reduced to MLLW using these corrected tides. An analysis of depth benchmark and crossline comparisons, and overlaps of the mainlines of sounding concluded that final tide zoning was adequate.

Tide zone SA227A was created to reduce soundings over the LADS depth benchmark in the Gulf of Esquibel, in order to check vertical accuracy performance at the beginning and throughout the survey period. Time and range correctors for this tide zone were sourced from the SOW for OPR-O167-KRL-04, conducted by TLI in 2004. It was necessary to create this additional tide zone, outside the survey area, to compare reduced depth soundings in 2007 to the same vertical datum used to establish the depth benchmark area in 2004.

The derived value for the difference between MLLW and MHW at the Craig subordinate tide gauge is 2.842m. From the final zoning, a range factor of 1.01 was applicable for Sheet B, resulting in a MHW value of 2.86m.

C.3 HORIZONTAL CONTROL

Data collection and processing were conducted on the AS and GS in World Geodetic System (WGS84) on Universal Transverse Mercator (Northern Hemisphere) projection UTM (N) in Zone 8, Central Meridian 135° W. This data was post-processed and all soundings are positioned relative to the North American Datum 1983 (NAD83). All units are in meters.

C.3.1 LADS Local GPS Base Station – Ketchikan

Real-time positions were determined using an Ashtech GG24 GPS receiver on the aircraft, operating in autonomous GPS mode. A local GPS base station was established by JOA on the roof of the Best Western Hotel in Ketchikan, AK on April 10, 2007, in order to post-process KGPS positions following survey flights.

The derived NAD83 coordinates for the local GPS base station are:

NAD83		**UTM (N) Zone 8**		
Latitude (N)	**Longitude (W)**	**Easting (m)**	**Northing (m)**	**Ellipsoidal Height (m)**
55° 21' 18.1747"	131° 41' 28.1482"	709 747.774	6 139 286.936	12.85

Post-processed KGPS positions were determined offline using data logged at the local GPS base station and on the aircraft. This data was processed with Ashtech PNAV software to calculate both a DGPS and KGPS position solution for the survey flights. The post-processed KGPS positions were imported into the GS and applied to all soundings. This provided increased sounding position accuracy from the real-time autonomous GPS.

D. RESULTS AND RECOMMENDATIONS

The results for the H11660 survey are submitted separately to this Descriptive Report as the S-57 feature file, BASE surface, CARIS .hob files, georeferenced imagery, Chart Comparison Spreadsheet, etc. on the USB hard drive. Refer to Appendix II of the Data Acquisition and Processing Report for a list of all the deliverable files from H11660.

Below is a table listing the S-57 feature objects found in the S-57 feature file (US511660.000):

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Spatial Attribute	Attribute 1	Attribute 2	Attribute 3	Attribute 4	Comments
Coastline	COALNE	L	The high waterline. Where depth equals 0 relative to MHW.	Quality of position (QUAPOS)	Category of Coastline (CATCOA)				The spatial attribute QUAPOS is used when coastline is interpolated from the (GTR) tags or the georeferenced imagery.
Depth Contour	DEPCNT	L	The approximate location of the line of equal depth. Also referred to as a depth curve.		Value of depth contour (VALDCO)				Tenix is only responsible for defining the 0m curve.
Land Area	LNDARE	P	The solid portion of the Earth's surface, as opposed to sea, water.						Used for defining islet point features.
Land Elevation	LNDELV	P	The vertical distance of a point or level measured from a specified vertical datum.		Elevation (ELEVAT)				Used for defining islet heights related to MLLW.
Underwater / Awash Rock	UWTROC	P	A concreted mass of stony material or coral which dries, is awash or is below the water surface.		Water level effect (WATLEV)	Quality of sounding measurement (QUASOU)	Technique of sounding measurement (TECSOU)	Value of sounding (VALSOU)	
Weed / Kelp	WEDKLP	P, A	Usually large, blade-shaped or vine-like brown algae.		Category of weed / kelp (CATWED)				Polygon limits defined using the (GK) tags exported from the GS. Kelp point features defined using the (GKP) tags exported from the GS and georeferenced imagery.

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Spatial Attribute	Attribute 1	Attribute 2	Attribute 3	Attribute 4	Comments
Unsurveyed Areas	UNSARE	A	Unsurveyed area.		Information (INFORM)				Used to define gaps in data coverage. INFORM has been identified as SEZ (GS) tags.
Meta Objects									
Coverage	M_COVR	A	A geographical area that describes the coverage and the extent of spatial objects.		Category of coverage (CATCOV)				M_COVR: CATCOV = 1 polygons define the extents of good LIDAR data coverage.
Quality of Data	M_QUAL	A	An area within which a uniform assessment of the quality of the data exists.		Category of zone of confidence in data (CATZOC)				

Table 2: S-57 Attribution for the S-57 feature file (US511660.000)

Recommendations for registry number H11660 are divided into 2 components:

1. Recommended charting action, primarily for MCD.
2. Recommended further boatwork to sufficiently junction with lidar seabed coverage and examine uncertain lidar features.

Recommendations for charting action for registry number H11660 are provided in Sections D.1.1 to D.1.6 below. The Chart Comparison Spreadsheet has historically been one of the sources for the lidar features for examination list. In order to provide just one list of features for examination to field units, the Chart Comparison Spreadsheet has had some minor adjustments for this survey (H11660_V1_ChartComp.xls). All features that appear in the chart comparison, but have not accurately had least depth determined by lidar, appear in the features for examination file. Where the least depth has not been found by lidar, no recommended charting action has been specified. Instead, a vessel-based verification method is suggested. The determination of least depth is at the discretion of the ships conducting junctioning / investigations and their results should be reported for charting action to MCD in due course.

Recommendations for ship junctioning and investigations are provided in Section D.2.1. In order to minimize the historical double handling of reporting uncertain lidar soundings on features, the features for examination are now contained exclusively in the CARIS .hob file (H11660_Inv.hob). The features for examination have been prioritized with respect to multibeam junctioning, investigating features in 'coastal' foul areas and within the NALL.

A summary of charting actions and investigations is provided in Section D.2.2.

D.1 CHART COMPARISON

H11660 LADS survey deliverables were compared to:

ENC US5AK4BM Edition 1 and ENC US5AK4AM Edition 3, compiled from Raster Charts 17404 13th Edition and 17405 15th Edition. ENC issue date November 8, 2007, and October 18, 2007 at scale 1:40,000.

These charts were downloaded from the NOAA Office of Coast Survey – NOAA Electronic Navigational Charts download website on November 19, 2007.
(http://chartmaker.ncd.noaa.gov/mcd/ENC/download.htm)

Recommendations for charting action are described in Sections D.1.4 to D.1.6.

D.1.1 Dangers to Navigation

Danger to Navigation (DTON) reports were submitted to Pacific Hydrographic Branch (PHB) from the field and during deliverables compilation. The first DTON submission from the field coincided with the delivery of the monthly progress at the end of May 2007. The second DTON submission from the field coincided with the delivery of the monthly progress sketch at the end of June 2007. Final DTON recommendations were provided to PHB, as part of the preliminary survey delivery, during January 2008. A description of each DTON for H11660 is provided below:

- Item number 1 is an 8.0m Rk in the vicinity of a charted 16.4m sounding, located approximately 700m E of Rosary Island. Submitted from the field.
- Item number 2 is a 5.6m Rk in the vicinity of charted 12.8, 16.4, 16.4 and 14.6m soundings, located approximately 350m E of an islet S of Prince of Wales Island. Kelp noted in area. Submitted from the field.
- Item number 3 is a 0.9m Rk, located approximately 100m E of an islet S of Prince of Wales Island. Kelp noted in area. Submitted from the field.
- Item number 4 is a 7.3m Rk, located 100m NW of a charted 21.9m sounding and approximately 130m S of 3 charted drying rocks S of Prince of Wales Island. Submitted from the field.
- Item number 5 is a 7.3m shoal in the vicinity of a charted 14.6m, located approximately 370m S of Prince of Wales Island and 1000m NE of Sombrero Island. Submitted from the field.
- Item number 6 is a 2.9m Rk, located approximately 150m S of Prince of Wales Island and 900m NNE of Sombrero Island. Submitted from the field.
- Item number 7 is a –1.1m drying rock, located approximately 100m S Prince of Wales Island and 1500m NW of Point Ildefonso. Kelp noted in area. Submitted from the field.
- Item number 8 is a possible 5.8m shoal approximately 90m N of a charted 23.7m sounding, located approximately 400m SW of Hermanos Island. This feature requires

further investigation by boat to determine the extent and least depth. Submitted from the field.

- Item number 9 is a 12.3m shoal, located approximately 900m E of Point Ildefonso and 800m W of Sombrero Island. Submitted from the field.
- Item number 10 is a 5.4m shoal, located approximately 600m W of Sombrero Island and 1100m E of Point Ildefonso. Submitted from the field.
- Item number 11 is a 6.2m shoal, located approximately 300m S of Prince of Wales Island and 850m NE of Sombrero Island. Submitted from the field.
- Item number 12 is a 7.5m Rk, located 200m E of 3 charted drying rocks and 800m NE of The Witnesses. Submitted from the field.
- Item number 13 is a 7.5m shoal, located approximately 500m E of Witness Rks. Submitted from the field.
- Item number 14 is a 7.0m shoal, located approximately 450m NE of Witness Rks. Submitted from the field.
- Item number 15 is a 13.2m possible Rk, located approximately 250m WNW of Catalina Island and SE of the Cruz Islands. This feature requires further investigation by boat to determine the extent and least depth. Submitted from the field.
- Item number 16 is a 13.3m Rk in the vicinity of a charted 29.2m sounding, located approximately 680m E of Catalina Island. Submitted from the field.
- Item number 17 is a 6.6m Rk, located approximately 650m N of Catalina Island and 950m E of Cruz Islands. Submitted from the field.
- Item number 18 is a 6.5m shoal, located approximately 130m S of Catalina Island. Kelp noted in area. Submitted from the field.
- Item number 19 is a possible 2.6m Rk in kelp, in the vicinity of a charted 8.2m sounding, located approximately 950m E of Point Polocano. This feature requires further investigation by boat, if possible, to determine the extent and least depth. Submitted from the field.
- Item number 20 is a 6.5m shoal in the vicinity of a charted 14.6m sounding, located approximately 1000m E of Point Polocano. Submitted from the field.
- Item number 21 is a 5.2m shoal in the vicinity of a charted 16.4m sounding, located 720m NE of Point Polocano. Kelp noted in area. Submitted from the field.
- Item number 22 is a 15.3m shoal, located approximately 1000m E of the San Alberto Bay lighted buoy. Submitted from the field.
- Item number 23 is a 9.1m Rk in the vicinity of a charted 29.2m sounding, located approximately 100m N of Parida Island. Submitted from the field.
- Item number 24 is a 12.4m shoal, located approximately 650m off the E coast of San Fernando Island and 1200m NNE of Fern Pt. Submitted from the field.

- Item number 25 is a 3.9m Rk in the vicinity of a charted 10.9m sounding, located approximately 260m SE of a charted drying rock at Parida Island Reef. Kelp noted in area. Submitted from the field.
- Item number 26 is a 2.9m shoal, located approximately 850m E of San Fernando Island and 1150m W of Fern Reef. This feature requires further investigation by boat, if possible, to determine the extent and least depth. Kelp noted in area. Submitted from the field.
- Item number 27 is a 4.0m shoal in the vicinity of a charted 10.4m sounding, located approximately 760m off the E coast of San Fernando Island. This feature requires further investigation by boat if possible to determine the extent and least depth. Kelp noted in area. Submitted from the field.
- Item number 28 is an 11.6m shoal in the vicinity of a charted 23.7m sounding, located approximately 200m NE of Witness Rks. Submitted from the field.
- Item number 29 is a 9.9m shoal, located approximately 300m S of Prince of Wales Island and 450m NE of Rosary Island. Submitted from the field.
- Item number 30 is an 8.7m Rk, located approximately 500m ENE of Hermanos Island. Submitted from the field.
- Item number 31 is a possible 13.6m shoal in sparse lidar coverage, in the vicinity of charted 21.9 and 23.7m soundings, located approximately 800m SE of Point Ildefonso. This feature requires further investigation by boat to determine the extent and least depth. Submitted from the field.
- Item number 32 is a 12.2m Rk, located approximately 1400m E of Sombrero Island and 1900m WNW of Abbess Island. Submitted from the field.
- Item number 33 is a 13.2m shoal in the vicinity of a charted 23.7m sounding, located approximately 1450m SE of The Witnesses. Submitted from the field.
- Item number 34 is a 15.1m shoal, located approximately 850m SSE of Witness Rks and 1100m WSW of The Witnesses. Submitted from the field.
- Item number 35 is a 5.0m Rk in the vicinity of charted 8.2 and 20.1m soundings, located approximately 230m S of Prince of Wales Island.
- Item number 36 is a 4.9m Rk in the vicinity of a charted 14.6m sounding, located approximately 550m off the S coast of Prince of Wales Island.
- Item number 37 is a 7.2m Rk in the vicinity of a charted 23.7m sounding, located approximately 260m off the S coast of Prince of Wales Island and 1300m E of Rosary Island.
- Item number 38 is a 5.4m shoal, located approximately 400m S of Prince of Wales Island.
- Item number 39 is a 16.0m Rk in the vicinity of a charted 37m sounding, located approximately 620m NE of Hermanos Island.
- Item number 40 is a possible 5.8m Rk in kelp, located approximately 300m E of Sombrero Island. This feature requires further investigation by boat, if possible, to determine the extent and least depth.

- Item number 41 is a possible 5.3m shoal in kelp, located approximately 620m S of Prince of Wales Island and 1100m ENE of Sombrero Island. This feature requires further investigation by boat, if possible, to determine the extent and least depth.
- Item number 42 is a possible 11.7m Rk in sparse lidar coverage, located approximately 160m S of Sombrero Island. This feature requires further investigation by boat to determine the extent and least depth.
- Item number 43 is a possible 13.4m Rk in the vicinity of a charted 21.9m sounding, located approximately 550m W of Sombrero Island and 1150m E of Point Ildefonso. This feature requires further investigation by boat to determine the extent and least depth.
- Item number 44 is a 10.8m shoal in the vicinity of a charted 16.4m sounding, located approximately 340m SE of Hermanos Island and 500m NE of San Christoval Rk.
- Item number 45 is a 12.9m Rk, located approximately 950m N of The Witnesses and 1200m ENE of Witness Rks.
- Item number 46 is a 12.9m Rk in the vicinity of a charted 31m sounding, located approximately 1200m ESE of Sombrero Island.
- Item number 47 is a 4.5m Rk in the vicinity of a charted 8.5m sounding, located approximately 1300m NE of The Witnesses and 1500m SE of Sombrero Island.
- Item number 48 is a 4.6m Rk, located approximately 800m NE of The Witnesses.
- Item number 49 is a possible 7.1m Rk in kelp, located approximately 150m NW of Witness Rks. This feature requires further investigation by boat, if possible, to determine the extent and least depth.
- Item number 50 is a 10.3m shoal in the vicinity of a charted 12.8m sounding, located approximately 500m SSE of Witness Rks.
- Item number 51 is a possible 8.9m Rk in sparse lidar coverage, in the vicinity of a charted 14.6 sounding, located approximately 240m E of Catalina Island. This feature requires further investigation by boat to determine the extent and least depth.
- Item number 52 is a possible 3.7m Rk in kelp, in the vicinity of a charted 9.1m sounding, located approximately 330m ENE of Catalina Island. This feature requires further investigation by boat if possible to determine the extent and least depth.
- Item number 53 is a possible 8.4m Rk in kelp, in the vicinity of a charted 10.9m sounding, located approximately 420m W of Catalina Island. This feature requires further investigation by boat if possible to determine the extent and least depth.
- Item number 54 is a 10.9m shoal, located approximately 560m NE of Point Polocano and 750m SE of Catalina Island.
- Item number 55 is a 12.5m shoal in the vicinity of the San Alberto Bay lighted buoy, located approximately 2000m NNW of Parida Island and 2500m E of Point Polocano.
- Item number 56 is a 13.0m shoal, located approximately 1300m E of Point Polocano.
- Item number 57 is a 5.2m Rk in the vicinity of a charted 16.4m sounding, located approximately 770m ENE of Point Polocano. Kelp noted in area.

- Item number 58 is a 5.2m Rk in the vicinity of a charted 11.3m sounding, located approximately 1050m NW of Point Polocano. Kelp noted in area.
- Item number 59 is a 9.0m Rk in the vicinity of a charted 11.8m sounding, located approximately 1050m NE of Parida Island.
- Item number 60 is a possible 1.5m Rk in kelp, located approximately 70m off the N coast of Parida Island. This feature requires further investigation by boat if possible to determine the extent and least depth.
- Item number 61 is a 5.0m Rk in the vicinity of a charted 33m sounding, located on the W extent of Parida Island Reef.
- Item number 62 is a 3.4m Rk, located on the N extent of Fern Reef, approximately 1300m SE of Fern Point. Kelp noted in area.
- Item number 63 is a 13.8m Rk in the vicinity of a charted 29.2m sounding, located approximately 2000m SSE of Fern Point.
- Item number 64 is an 11.9m Rk in the vicinity of a charted 14.6m sounding, located approximately 1500m E of Point Cuerbo.
- Item number 65 is a 14.1m Rk in the vicinity of a charted 27.4m sounding, located approximately 2400m E of Point Polocano.

D.1.2 AWOIS

No AWOIS were assigned to this Task Order.

D.1.3 Aids to Navigation

Seven Aids to Navigation were detected by lidar in the survey area for H11660.

Buoy Name	Charted Position		Average Surveyed Position		Lidar Hits	Difference In Position (m)
	Latitude (N)	Longitude (W)	Latitude (N)	Longitude (W)		
Fern Reef Lighted Buoy 3A	55° 29' 05.92"	133° 15' 52.27"	55° 29' 05.65"	133° 15' 53.04"	5	16
Ballena Island Shoal Lighted Buoy 2	55° 28' 13.89"	133° 13' 15.17"	55° 28' 14.85"	133° 13' 14.97"	4	31
Parida Island South Reef Buoy 5	55° 30' 02.25"	133° 13' 47.91"	55° 30' 03.15"	133° 13' 48.08"	7	28
San Alberto Bay Lighted Buoy 7	55° 32' 15.10"	133° 15' 04.08"	55° 32' 16.13"	133° 15' 05.61"	3	41
Piedras Island Reef Buoy 9	55° 33' 41.04"	133° 17' 56.70"	55° 33' 41.17"	133° 17' 57.40"	5	10

Buoy Name	Charted Position		Average Surveyed Position		Lidar Hits	Difference In Position (m)
	Latitude (N)	Longitude (W)	Latitude (N)	Longitude (W)		
Hermanos Islands Reef Lighted Bell Buoy 8	55° 33' 43.46"	133° 17' 46.23"	55° 33' 43.69"	133° 17' 47.23"	7	19
Ballandra Shoal Buoy 3	55° 28' 31.51"	133° 13' 47.22"	55° 28' 32.33"	133° 13' 47.53"	1	26

D.1.4 Charted Depths and Features

Registry number H11660 lies over part of NOAA charts 17404 and 17405, covering the northern portion of San Alberto Bay, which includes the coastline of Prince of Wales Island, the east coast of San Fernando Island, the east coast of Rosary Island, Hermanos Island, Balandra Shoal, Bellena Island Shoal, Parida Island Reef, Fern Reef and Ursua Channel. From the Source Diagrams, the area covered by H11660 was covered by NOS surveys between 1900 and 1939, presumably by leadline, and between 1970 and 1989, probably using single beam echo sounder. Partial bottom coverage was achieved. The chart in this area was inadequately surveyed, with only the coastline and a number of rocks and islets along the coast portrayed.

The area surveyed is represented by the BASE surface and S-57 feature file in considerably more detail than is currently shown on the chart. The following general recommendations are relevant:

a. Coastline. The charted coastline agrees very well with the surveyed coastline for the larger islands and islets. The surveyed coastline differs from the charted position by a maximum of 50m in some parts of the survey area. There are a few locations where the charted coastline has been surveyed as drying shelf. It is recommended that the coastline on the chart be amended to match the LADS surveyed and extrapolated MHW line.

b. Inshore Islets. A large number of islets have been surveyed close to the coastline. Generally, there is good agreement between the charted data and the surveyed data. It is recommended that the chart be amended to match the LADS survey deliverables. Where significant, these islets are detailed in the Chart Comparison Spreadsheet in Section D.1.6.

c. Rocks. Many rocks and drying rocks have been surveyed along the coastline, which are not presently shown on the chart. It is recommended that the chart be amended to match the LADS survey deliverables. Where significant, these rocks are detailed in the Chart Comparison Spreadsheet in Section D.1.6.

D.1.5 Detailed Chart Comparison

In addition to the general recommendations above, some 342 specific differences between the chart and the LADS survey have been identified and are described in Section D.1.6. An expanded version of the spreadsheet is included digitally on the USB hard drive (H11660_V1_ChartComp.xls). A CARIS .hob file containing just the chart comparison items

has also been compiled and is provided as part of survey deliverables (H11660_ChartComp.hob). The attribution methodology for this file is presented below:

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Attribute 1	Attribute 2	Attribute 3	Attribute 4
Nautical publication information	M_NPUB	P	Used to relate additional nautical information or publications to the data	INFORM (used for storing a unique chart comparison ID)	NINFOM (used for storing the charting recommendation)	PUBREF (used for storing a reference to a Feature for Investigation)	PICREP (used for storing a link to GS screen captures)

The chart comparison was conducted by reviewing the chart, the LADS survey deliverables and the digital georeferenced imagery. For each item identified, screen dumps of the Local Area Display, Raw Waveform Display and Digital Image Window were extracted from the LADS Mk II GS.

These have been reviewed in order to make the following assessments:

a. Type of Feature

b. Kelp Area

c. Least Depth Found

d. Charting Recommendation

e. Remarks

When the least depth has been adequately surveyed by lidar, the LDF Column is populated with a 'Y' for yes. The charting recommendation for a feature that has an adequately surveyed least depth will be either 'Insert' for a new feature, 'Replace' for an amendment to an existing charted feature or 'Remove' for a disproved charted feature.

When the least depth has NOT been found by lidar (populated with an 'N'), the chart comparison number has been used as the identifier within the S-57 feature file that contains the features for examination. If a chart comparison item had previously been identified as a feature for examination during data processing, a reference is made in the 'Remarks' column to the S-57 feature for examination item. For all chart comparison items that have not had least depth surveyed adequately, a suggested boatwork examination method acronym has been assigned. The description of these is provided in Section D.2.1.4.

Each chart comparison was categorized as follows:

1. New shoal found

2. Charted shoal disproved / not found

The fields in the Chart Comparison Spreadsheet have been developed from experience learned and feedback received from previous lidar surveys in Alaska, witnessing survey operations

aboard NOAA ship Rainier, from meetings at PHB and UNH and the 2007 NOAA Field Procedures Workshop. They have been designed for ease of use and to minimize double handling of data and transcription. Continued feedback is welcomed in order to develop these formats to achieve further efficiencies in data handling.

D.1.6 Chart Comparison Spreadsheet

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
1	B1	1				8.05	55° 35' 1.24"	133° 17' 22.32"	Rk	N	Y	Insert	See Danger to Navigation report. Item 1. Submitted from field.
2	B2	1				2.93	55° 34' 32.14"	133° 13' 49.31"	Rk	Y	Y	Insert	See Danger to Navigation report. Item 6. Submitted from field.
3	B3	1				7.42	55° 34' 27.7"	133° 13' 26.04"	Rk	N	Y	Insert	See Danger to Navigation report. Item 5. Submitted from field.
4	B4	1				7.17	55° 34' 27.08"	133° 12' 39.13"	Rk	N	Y	Insert	See Danger to Navigation report. Item 4. Submitted from field.
5	B5	1				0.95	55° 34' 43.66"	133° 12' 43.08"	Rk	Y	Y	Insert	See Danger to Navigation report. Item 3. Submitted from field.
6	B6	1				13.31	55° 32' 45"	133° 16' 55.29"	Rk	N	Y	Insert	See Danger to Navigation report. Item 16. Submitted from field.
7	B7	1				13.23	55° 32' 59.1"	133° 18' 0.17"	Rk	N	Y	Insert	See Danger to Navigation report. Item 15. Submitted from field.
8	B8	1				4.03	55° 29' 13.33"	133° 17' 25.43"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKB10 See Danger to Navigation report. Item 27. Submitted from field.
9	B9	1				3.84	55° 30' 25.86"	133° 14' 27.76"	Rk	Y	Y	Insert	See Danger to Navigation report. Item 25. Submitted from field.
10	B10	1				12.45	55° 30' 51.34"	133° 16' 30.49"	Rk	N	Y	Insert	See Danger to Navigation report. Item 24. Submitted from field.
11	B11	1				2.90	55° 29' 28.99"	133° 17' 2.58"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKB27 See Danger to Navigation report. Item 26. Submitted from field.
12	B12	1				11.62	55° 33' 28.43"	133° 14' 54.89"	Rk	N	Y	Insert	See Danger to Navigation report. Item 28. Submitted from field.
13	B13	1				5.65	55° 34' 44.9"	133° 12' 27.18"	Rk	N	Y	Insert	See Danger to Navigation report. Item 2. Submitted from field.

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
14	B14	1				-1.10	55° 34' 48.87"	133° 16' 40.32"	Drying Rk	Y	Y	Insert	See Danger to Navigation report. Item 7. Submitted from field.
15	B15	1				5.81	55° 33' 57.04"	133° 17' 53.91"	Rk	N	N	BV	Possible small object on seabed. See Danger to Navigation report. Item 8. Submitted from field.
16	B16	1				12.28	55° 34' 2.9"	133° 15' 3.35"	Rk	N	Y	Insert	See Danger to Navigation report. Item 9. Submitted from field.
17	B17	1				5.45	55° 34' 6.17"	133° 14' 50.1"	Rk	N	Y	Insert	See Danger to Navigation report. Item 10. Submitted from field.
18	B18	1				6.20	55° 34' 18.06"	133° 13' 21.61"	Rk	N	Y	Insert	See Danger to Navigation report. Item 11. Submitted from field.
19	B19	1				7.51	55° 33' 32.7"	133° 13' 9.51"	Rk	N	Y	Insert	See Danger to Navigation report. Item 12. Submitted from field.
20	B20	1				7.54	55° 33' 20.13"	133° 14' 38.65"	Rk	N	Y	Insert	See Danger to Navigation report. Item 13. Submitted from field.
21	B21	1				7.05	55° 33' 31.43"	133° 14' 38.68"	Rk	N	Y	Insert	See Danger to Navigation report. Item 14. Submitted from field.
22	B22	1				6.61	55° 33' 18.09"	133° 17' 18.87"	Rk	N	Y	Insert	See Danger to Navigation report. Item 17. Submitted from field.
23	B23	1				6.49	55° 32' 44.93"	133° 17' 33.08"	Rk	Y	Y	Insert	See Danger to Navigation report. Item 18. Submitted from field.
24	B24	1				6.47	55° 32' 15.39"	133° 16' 29"	Rk	N	Y	Insert	See Danger to Navigation report. Item 20. Submitted from field.
25	B25	1				2.56	55° 32' 22.48"	133° 16' 32.01"	Rk	Y	N	BV	Possible Rk in kelp. See Danger to Navigation report. Item 19. Submitted from field.
26	B26	1				9.09	55° 31' 15.59"	133° 14' 44.02"	Rk	N	Y	Insert	See Danger to Navigation report. Item 23. Submitted from field.
27	B27	1				5.20	55° 32' 34.26"	133° 16' 51.36"	Rk	Y	Y	Insert	See Danger to Navigation report. Item 21. Submitted from field.

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
28	B28	1				15.28	55° 32' 12.36"	133° 14' 7.44"	Rk	N	Y	Insert	See Danger to Navigation report. Item 22. Submitted from field.
29	B29	1				15.12	55° 32' 58.66"	133° 14' 46.23"	Rk	N	Y	Insert	See Danger to Navigation report. Item 34. Submitted from field.
30	B30	1				13.21	55° 32' 32.2"	133° 12' 48.87"	Rk	N	Y	Insert	See Danger to Navigation report. Item 33. Submitted from field.
31	B31	1				9.96	55° 35' 6.69"	133° 17' 39.44"	Rk	N	Y	Insert	See Danger to Navigation report. Item 29. Submitted from field.
32	B32	1				8.69	55° 34' 14.83"	133° 17' 9.67"	Rk	N	Y	Insert	See Danger to Navigation report. Item 30. Submitted from field.
33	B33	1				13.57	55° 33' 50.88"	133° 15' 19.39"	Rk	N	N	JV	Sparse lidar coverage in deep water. See Danger to Navigation report. Item 31. Submitted from field.
34	B34	1				12.18	55° 33' 54.91"	133° 12' 52.34"	Rk	N	Y	Insert	See Danger to Navigation report. Item 32. Submitted from field.
35	B35	2	16.4	55° 35' 19.49"	133° 17' 58.52"	6.05	55° 35' 20.19"	133° 17' 57.53"	Rk	N	Y	Replace	
36	B36	1				5.01	55° 35' 15.8"	133° 17' 45.85"	Rk	N	Y	Insert	See Danger to Navigation report. Item 35.
37	B37	2	Drying Rk	55° 35' 19.45"	133° 17' 46.23"				Slope	N	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
38	B38	2	10.9	55° 35' 15.6"	133° 17' 36.15"	6.93	55° 35' 14.82"	133° 17' 37.25"	Rk	N	Y	Replace	
39	B39	2	7.3	55° 35' 12.76"	133° 17' 38.96"	4.93	55° 35' 14.62"	133° 17' 39.98"	Rk	N	Y	Replace	
40	B40	2	14.6	55° 34' 55.71"	133° 12' 23.74"	4.88	55° 34' 56.43"	133° 12' 20.64"	Rk	N	Y	Replace	See Danger to Navigation report. Item 36.
41	B41	2	Islet	55° 35' 1.29"	133° 12' 21.35"	-0.93	55° 34' 59.56"	133° 12' 21.85"	Drying Rk	N	Y	Replace	
42	B42	2	10.0	55° 34' 57.22"	133° 12' 47.68"	4.06	55° 34' 56.67"	133° 12' 45.46"	Rk	N	Y	Replace	
43	B44	2	10.9	55° 35' 4.79"	133° 17' 30.44"	8.06	55° 35' 5.28"	133° 17' 30.06"	Rk	N	Y	Replace	
44	B46	1				2.32	55° 35' 11.67"	133° 17' 34.3"	Rk	N	Y	Insert	

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
45	B47	1				7.35	55° 35' 1.09"	133° 17' 43.95"	Rk	N	Y	Insert	
46	B48	1				3.25	55° 35' 1.24"	133° 17' 58.81"	Rk	N	Y	Insert	
47	B49	2	Drying Rk	55° 34' 56.17"	133° 17' 58.53"				Slope	Y	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
48	B50	2	Rk	55° 34' 45.95"	133° 17' 46.35"	-0.66	55° 34' 45.62"	133° 17' 45.26"	Drying Rk	N	Y	Replace	
49	B51	1				-0.92	55° 34' 57.89"	133° 17' 35.63"	Drying Rk	N	Y	Insert	
50	B52	1				3.02	55° 34' 53.58"	133° 17' 28.91"	Rk	Y	Y	Insert	
51	B54	2	Drying Rk	55° 34' 45.29"	133° 17' 19.72"		55° 34' 45.29"	133° 17' 19.72"	Slope	Y	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
52	B55	1				1.87	55° 34' 46.19"	133° 17' 19.08"	Rk				
53	B56	2	11.3	55° 34' 45.71"	133° 17' 15.71"	2.90	55° 34' 45.02"	133° 17' 16.66"	Rk	Y	Y	Insert	
54	B57	1				2.26	55° 34' 43.13"	133° 17' 16.95"	Rk	Y	N	VV / BV	Possible Rk in kelp.
55	B59	2	23.7	55° 34' 50"	133° 16' 50.06"	7.20	55° 34' 51.13"	133° 16' 51.31"	Rk	N	Y	Replace	See Danger to Navigation report. Item 37.
56	B60	2	Islet	55° 34' 43.18"	133° 16' 36.87"	-2.93	55° 34' 43.29"	133° 16' 36.57"	Drying Rk	Y	Y	Replace	
57	B61	1				-1.57	55° 34' 53.22"	133° 14' 47.07"	Drying Rk	N	Y	Insert	
58	B62	1				-0.98	55° 34' 49.87"	133° 14' 48.32"	Drying Rk	N	Y	Insert	
59	B63	2	10.0	55° 34' 47.82"	133° 14' 33.16"	8.74	55° 34' 46.42"	133° 14' 34.07"	Rk	N	Y	Replace	
60	B64	1				8.83	55° 34' 43.15"	133° 14' 22.41"	Rk	N	Y	Insert	
61	B65	1				-0.63	55° 34' 48.13"	133° 14' 1.8"	Drying Rk	N	Y	Insert	
62	B66	1				2.90	55° 34' 42.66"	133° 14' 0.79"	Rk	N	Y	Insert	
63	B67	2	Islet	55° 34' 52.32"	133° 13' 3.65"	-2.33	55° 34' 51.58"	133° 13' 4.16"	Drying Rk	N	Y	Replace	

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
64	B68	2	Islet	55° 34' 50.5"	133° 13' 5.64"	-2.33	55° 34' 49.74"	133° 13' 6.05"	Drying Rk	N	Y	Replace	
65	B69	2	10.0	55° 34' 47.2"	133° 12' 42.27"	7.43	55° 34' 47.53"	133° 12' 43.51"	Rk	N	Y	Replace	
66	B70	2	9.1	55° 34' 53.37"	133° 12' 33.63"	5.37	55° 34' 51.3"	133° 12' 33.58"	Rk	N	Y	Replace	See Danger to Navigation report. Item 38.
67	B71	1				11.08	55° 34' 41"	133° 12' 27.62"	Rk	N	N	JV	Possible small object on seabed. Shoaler depth probable.
68	B72	2	21.9	55° 34' 35.36"	133° 12' 32.44"	15.21	55° 34' 35.49"	133° 12' 29.38"	Shoal	N	Y	Replace	
69	B73	1				5.32	55° 34' 34.29"	133° 12' 43.02"	Rk	N	Y	Insert	
70	B74	2	13.7	55° 34' 28.25"	133° 12' 56.45"	6.44	55° 34' 29.36"	133° 12' 51.77"	Rk	N	Y	Replace	
71	B76	1				11.37	55° 34' 23.43"	133° 12' 58.71"	Rk	N	Y	Insert	
72	B77	1				3.91	55° 34' 25.63"	133° 13' 9.62"	Rk	Y	Y	Insert	
73	B78	2	12.8	55° 34' 25.59"	133° 13' 15.4"	3.95	55° 34' 25.8"	133° 13' 12.46"	Rk	Y	Y	Replace	
74	B79	1				0.05	55° 34' 32.61"	133° 13' 2.81"	Rk Awash	N	Y	Insert	
75	B80	1				4.54	55° 34' 31.37"	133° 13' 5.46"	Rk	N	Y	Insert	
76	B81	2	14.6	55° 34' 33.57"	133° 13' 11.29"	9.23	55° 34' 33.61"	133° 13' 12.92"	Rk	N	N	JV	Sparse lidar coverage in deep water. Refer to FEB7.
77	B82	2	6.4	55° 34' 31.91"	133° 13' 21.69"	4.97	55° 34' 31.41"	133° 13' 22.19"	Rk	N	Y	Replace	
78	B84	1				2.63	55° 34' 29.92"	133° 13' 39.92"	Rk	N	Y	Insert	
79	B85	2	5.4	55° 34' 29.42"	133° 13' 36.56"	2.84	55° 34' 29.9"	133° 13' 35.6"	Rk	Y	Y	Replace	
80	B86	1				2.98	55° 34' 34.99"	133° 13' 48.92"	Rk	N	Y	Insert	
81	B87	1				0.13	55° 34' 38.57"	133° 13' 49.77"	Rk Awash	Y	Y	Insert	
82	B88	1				9.60	55° 34' 28.47"	133° 13' 49.51"	Rk	N	Y	Insert	
83	B89	1				5.54	55° 34' 37.13"	133° 13' 54.49"	Rk	N	Y	Insert	
84	B90	1				0.24	55° 34' 26.59"	133° 14' 43.45"	Rk Awash	Y	Y	Insert	
85	B91	2	Drying Rk	55° 34' 35.43"	133° 14' 42.95"				Slope	N	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
86	B92	1				0.41	55° 34' 27.31"	133° 14' 49.52"	Rk Awash	N	Y	Insert	
87	B93	1				-3.60	55° 34' 39.49"	133° 15' 25.05"	Islet	N	Y	Insert	
88	B94	1				-1.23	55° 34' 32.81"	133° 15' 37.74"	Drying Rk	N	Y	Insert	
89	B95	1				-0.77	55° 34' 35.6"	133° 15' 42.74"	Drying Rk	Y	Y	Insert	
90	B96	2	Islet	55° 34' 30.59"	133° 15' 41.38"	-3.10	55° 34' 30.01"	133° 15' 39.71"	Drying Rk	N	Y	Replace	
91	B97	1				0.29	55° 34' 36.54"	133° 15' 47.12"	Rk Awash	Y	Y	Insert	
92	B98	1				-1.50	55° 34' 25.79"	133° 15' 46.32"	Drying Rk	Y	Y	Insert	
93	B99	1				-0.49	55° 34' 29.88"	133° 15' 49.79"	Rk Awash	Y	Y	Insert	
94	B100	2	18.2	55° 34' 30.08"	133° 15' 57.13"	4.37	55° 34' 31.49"	133° 15' 58.59"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKB36.
95	B101	1				10.28	55° 34' 27.81"	133° 16' 34.6"	Rk	N	Y	Insert	
96	B102	1				-1.59	55° 34' 29.58"	133° 16' 37.16"	Drying Rk	Y	Y	Insert	
97	B103	2	Drying Rk	55° 34' 30.6"	133° 16' 34.79"				Slope	Y	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
98	B104	1				7.45	55° 34' 31.38"	133° 17' 12.37"	Rk	N	Y	Insert	
99	B105	1				3.86	55° 34' 28.26"	133° 17' 15.39"	Rk	Y	N	BV	Possible Rk in kelp.
100	B107	2	Islet	55° 34' 29.38"	133° 17' 44.22"	-1.58	55° 34' 29.43"	133° 17' 44.72"	Drying Rk	N	Y	Replace	
101	B108	2	Islet	55° 34' 30.69"	133° 17' 44.47"	-3.07	55° 34' 30.8"	133° 17' 44.15"	Drying Rk	N	Y	Replace	
102	B109	2	3.1	55° 34' 33.49"	133° 17' 50.97"	-1.00	55° 34' 33.33"	133° 17' 47.84"	Drying Rk	N	Y	Replace	

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
103	B110	1				0.24	55° 34' 40.9"	133° 17' 46.04"	Rk Awash	Y	Y	Insert	
104	B111	1				-2.03	55° 34' 38.82"	133° 17' 59.28"	Drying Rk	N	Y	Insert	
105	B112	1				-1.34	55° 34' 30.08"	133° 17' 57.07"	Drying Rk	Y	Y	Insert	
106	B113	1				1.70	55° 34' 27.46"	133° 17' 50.64"	Rk	Y	N	VV / BV	Possible Rk in kelp.
107	B114	2	10.0	55° 34' 24.03"	133° 17' 55.32"	7.45	55° 34' 23.78"	133° 17' 52.15"	Rk	N	Y	Replace	
108	B115	1				-1.02	55° 34' 16.99"	133° 17' 55.97"	Drying Rk	Y	Y	Insert	
109	B116	2	Drying Rk	55° 34' 17.66"	133° 17' 58.81"				Slope	Y	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
110	B117	2	10.4	55° 34' 9.87"	133° 17' 58.06"	6.13	55° 34' 10.19"	133° 17' 58.49"	Rk	Y	Y	Replace	
111	B118	2	Islet	55° 34' 10.12"	133° 17' 49.84"	-3.41	55° 34' 10.13"	133° 17' 49.93"	Drying Rk	Y	Y	Replace	
112	B119	1				7.17	55° 34' 14.89"	133° 17' 31.64"	Rk	N	Y	Insert	
113	B120	1				6.95	55° 34' 18.41"	133° 17' 33.67"	Rk	N	Y	Insert	
114	B121	2	11.8	55° 34' 18.55"	133° 17' 29.31"	8.86	55° 34' 17.64"	133° 17' 30.05"	Rk	N	Y	Replace	
115	B122	2	Islet	55° 34' 24.95"	133° 17' 21.1"	-2.35	55° 34' 25"	133° 17' 21.09"	Drying Rk	Y	N	Replace	Note: 2 charted islets in vicinity surveyed as drying rocks.
116	B123	1				0.40	55° 34' 18.97"	133° 17' 18.9"	Rk Awash	Y	Y	Insert	
117	B124	1				1.24	55° 34' 13.16"	133° 17' 19.28"	Rk	Y	N	VV / BV	Possible Rk in kelp. Refer to FEKB26.
118	B125	1				12.89	55° 34' 9.25"	133° 17' 18"	Rk	N	Y	Insert	
119	B126	1				15.98	55° 34' 19.94"	133° 17' 6.29"	Rk	N	Y	Insert	See Danger to Navigation report. Item 39.
120	B127	1				5.46	55° 34' 24.08"	133° 17' 15.96"	Rk	Y	Y	Insert	
121	B128	1				11.93	55° 34' 14.69"	133° 16' 6.03"	Rk	N	Y	Insert	
122	B129	2	12.8	55° 34' 19.83"	133° 16' 2.75"	6.23	55° 34' 20.44"	133° 16' 0.36"	Rk	Y	Y	Replace	

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
123	B130	2	2.7	55° 34' 22.85"	133° 15' 55.81"	1.85	55° 34' 21.46"	133° 15' 54.74"	Rk	Y	N	VV / BV	Possible Rk in kelp. Refer to FEKB18.
124	B131	1				5.33	55° 34' 15.64"	133° 15' 59.13"	Rk	Y	Y	Insert	
125	B132	1				-1.13	55° 34' 16.97"	133° 15' 49.42"	Drying Rk	Y	Y	Insert	
126	B133	1				8.23	55° 34' 21.78"	133° 16' 4.23"	Rk	N	Y	Insert	
127	B135	2	Islet	55° 34' 11.51"	133° 15' 57.94"	-2.64	55° 34' 11.42"	133° 15' 57.5"	Drying Rk	Y	Y	Replace	
128	B136	2	Islet	55° 34' 23.93"	133° 15' 45.4"	-3.37	55° 34' 23.84"	133° 15' 45.54"	Drying Rk	N	Y	Replace	
129	B137	2	Islet	55° 34' 24.08"	133° 15' 44.23"				Drying Shelf	N	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
130	B138	2	Islet	55° 34' 22.64"	133° 15' 44.9"				Slope	Y	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
131	B139	1				-0.10	55° 34' 24.63"	133° 15' 39.61"	Rk Awash	N	Y	Insert	
132	B140	2	Islet	55° 34' 18.3"	133° 15' 48.34"				Slope	N	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
133	B141	2	7.6	55° 34' 6.86"	133° 15' 18.11"	5.86	55° 34' 7.4"	133° 15' 17.04"	Rk	N	Y	Replace	
134	B142	1				4.53	55° 34' 8.98"	133° 15' 12.62"	Rk	N	Y	Insert	
135	B143	1				12.25	55° 34' 6.22"	133° 15' 8.08"	Rk	N	Y	Insert	
136	B144	1				11.23	55° 34' 12.45"	133° 14' 59.37"	Rk	N	Y	Insert	
137	B145	1				4.87	55° 34' 10.46"	133° 14' 51.92"	Rk	Y	Y	Insert	
138	B146	1				7.25	55° 34' 20.14"	133° 14' 44.36"	Rk	N	Y	Insert	
139	B147	1				9.39	55° 34' 22.78"	133° 14' 39.96"	Rk	N	Y	Insert	
140	B148	2	10.4	55° 34' 8.41"	133° 14' 40.94"	8.31	55° 34' 8.1"	133° 14' 41.1"	Rk	N	N	BV	Possible small object on seabed. Refer to FEB5.
141	B149	1				-1.01	55° 34' 13.5"	133° 14' 51.89"	Drying Rk	Y	Y	Insert	
142	B150	1				9.56	55° 34' 13.8"	133° 14' 14.07"	Rk	N	Y	Insert	

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
143	B151	2	10.0	55° 34' 15.83"	133° 14' 11.83"	7.90	55° 34' 16.38"	133° 14' 9.64"	Rk	N	Y	Replace	
144	B152	2	13.7	55° 34' 13.72"	133° 14' 3.39"	11.21	55° 34' 15.45"	133° 13' 59.89"	Rk	N	N	JV	Sparse lidar coverage in deep water. Refer to FERKB12.
145	B153	1				-1.22	55° 34' 8.77"	133° 14' 4.95"	Drying Rk	Y	Y	Insert	
146	B154	1				5.83	55° 34' 6.16"	133° 13' 50.16"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKB9. See Danger to Navigation report. Item 40.
147	B155	1				-0.15	55° 34' 20.4"	133° 13' 14.02"	Rk Awash	Y	Y	Insert	
148	B156	1				5.32	55° 34' 17.53"	133° 13' 10.32"	Rk	Y	N	BV	Possible Rk in kelp. Shoaler depth probable. See Danger to Navigation report. Item 41.
149	B157	1				14.16	55° 34' 17.52"	133° 12' 51.08"	Rk	N	N	JV	Sparse lidar coverage in deep water.
150	B158	2	13.7	55° 33' 57.78"	133° 12' 42"	11.47	55° 33' 58.93"	133° 12' 41.93"	Rk	N	N	JV	Sparse lidar coverage in deep water.
151	B159	1				15.74	55° 33' 51.74"	133° 13' 11.42"	Rk	N	N	JV	Sparse lidar coverage in deep water. Refer to FEB4.
152	B160	1				11.72	55° 33' 55.74"	133° 14' 12.21"	Rk	N	N	JV	Sparse lidar coverage in deep water. Refer to FERKB14. See Danger to Navigation report. Item 42.
153	B161	2	Islet	55° 34' 5.29"	133° 14' 5.22"				Slope	Y	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
154	B162	2	13.7	55° 34' 2.4"	133° 14' 40.84"	11.34	55° 34' 2.66"	133° 14' 39.72"	Rk	N	Y	Replace	
155	B163	2	21.9	55° 33' 58.75"	133° 14' 51.59"	13.45	55° 34' 0.24"	133° 14' 46.7"	Rk	N	Y	Replace	See Danger to Navigation report. Item 43.
156	B164	2	16.4	55° 34' 1.66"	133° 15' 20.61"	8.71	55° 34' 4.22"	133° 15' 20.21"	Rk	N	Y	Replace	
157	B165	2	Islet	55° 34' 5.1"	133° 15' 39.14"				Drying Shelf	Y	Y	Remove	Charted islet surveyed as drying shelf.
158	B166	2	16.4	55° 33' 58.78"	133° 17' 24.68"	10.83	55° 33' 57.55"	133° 17' 26.06"	Rk	N	Y	Replace	See Danger to Navigation report. Item 44.
159	B167	1				15.94	55° 33' 51.94"	133° 17' 23.26"	Rk	N	N	JV	Sparse lidar coverage in deep water. Refer to FERKB9.
160	B168	2	Drying Rk	55° 33' 55.65"	133° 17' 43.85"				Slope	Y	Y	Remove	

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
161	B169	2	12.8	55° 34' 1.97"	133° 17' 48.61"	6.99	55° 34' 3.16"	133° 17' 45.76"	Rk	N	Y	Replace	
162	B170	2	11.8	55° 34' 0.85"	133° 18' 1.42"	4.71	55° 34' 0.54"	133° 17' 58.17"	Rk	Y	Y	Replace	
163	B171	2	14.6	55° 33' 42.26"	133° 18' 1.7"	9.47	55° 33' 41.7"	133° 18' 0.39"	Rk	N	Y	Replace	
164	B172	1				5.39	55° 33' 39.45"	133° 18' 0.69"	Rk	N	Y	Insert	
165	B173	1				9.22	55° 33' 49.17"	133° 17' 55.1"	Rk	N	Y	Insert	
166	B174	2	7.3	55° 33' 45.18"	133° 17' 44.03"	5.84	55° 33' 45.95"	133° 17' 45.08"	Rk	N	Y	Replace	
167	B175	1				4.24	55° 33' 48.85"	133° 17' 47.42"	Rk	Y	Y	Insert	
168	B176	2	16.4	55° 33' 35.27"	133° 15' 50.14"	13.85	55° 33' 35.81"	133° 15' 50.64"	Rk	N	Y	Replace	
169	B177	2	10.4	55° 33' 39.79"	133° 13' 58.46"	7.80	55° 33' 41.32"	133° 13' 57.51"	Rk	N	Y	Replace	
170	B178	1				12.95	55° 33' 33.63"	133° 14' 1.98"	Rk	N	Y	Insert	See Danger to Navigation report. Item 45.
171	B179	2	2.1	55° 33' 33.57"	133° 13' 53.97"	0.87	55° 33' 33.26"	133° 13' 55.54"	Rk	Y	N	VV	Possible Rk in kelp. Refer to FEKB37.
172	B181	2	31.0	55° 33' 46.37"	133° 13' 16.85"	12.93	55° 33' 45.93"	133° 13' 9.73"	Rk	N	Y	Replace	See Danger to Navigation report. Item 46.
173	B182	2	8.5	55° 33' 39.37"	133° 12' 56.66"	4.52	55° 33' 38.49"	133° 12' 57.3"	Rk	N	Y	Replace	See Danger to Navigation report. Item 47.
174	B183	2	7.3	55° 33' 23.42"	133° 13' 7.56"	4.64	55° 33' 21.76"	133° 13' 8.8"	Rk	N	Y	Replace	See Danger to Navigation report. Item 48.
175	B184	1				7.18	55° 33' 19.1"	133° 13' 10.38"	Rk	N	Y	Insert	
176	B185	2	8.2	55° 33' 27.93"	133° 13' 15.61"	5.95	55° 33' 28.69"	133° 13' 13.22"	Rk	N	Y	Replace	
177	B186	2	25.6	55° 33' 18.8"	133° 13' 27.12"	13.56	55° 33' 17.58"	133° 13' 23.65"	Rk	N	Y	Replace	
178	B187	2	8.5	55° 33' 24.15"	133° 13' 27.49"	6.91	55° 33' 24.55"	133° 13' 29.04"	Rk	N	Y	Replace	
179	B188	1				8.45	55° 33' 24.25"	133° 13' 17.44"	Rk	N	Y	Insert	
180	B189	2	Drying Rk	55° 33' 32.18"	133° 13' 18.88"				Slope	Y	Y	Remove	
181	B190	1				12.47	55° 33' 19.7"	133° 13' 33.79"	Rk	N	Y	Insert	
182	B191	1				1.14	55° 33' 30.98"	133° 13' 52.79"	Rk	Y	N	VV / BV	Possible Rk in kelp. Refer to FEKB33.
183	B192	1				11.64	55° 33' 23.28"	133° 14' 40.17"	Rk	N	Y	Insert	
184	B194	1				7.12	55° 33' 28.57"	133° 15' 8.82"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKB7. See Danger to Navigation report. Item 49.

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
185	B195	2	Islet	55° 33' 22.3"	133° 15' 16.19"	-3.20	55° 33' 22.37"	133° 15' 16.06"	Drying Rk	Y	Y	Replace	
186	B196	1				3.73	55° 33' 18.99"	133° 15' 21.19"	Rk	Y	N	BV	Possible Rk in kelp.
187	B197	2	Islet	55° 33' 19.05"	133° 15' 15.08"	-2.49	55° 33' 18.97"	133° 15' 14.9"	Drying Rk	Y	Y	Replace	
188	B198	2	4.5	55° 33' 29.39"	133° 17' 50.97"	2.43	55° 33' 28.99"	133° 17' 51.99"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKB32.
189	B199	2	Islet	55° 33' 29.05"	133° 17' 55.62"				Deep Water	N	N	Remove	Not detected by lidar, not observed in georeferenced imagery.
190	B200	1				10.10	55° 33' 31.94"	133° 18' 2.2"	Rk	N	Y	Insert	
191	B201	2	Drying Rk	55° 33' 18.22"	133° 18' 1.47"				Slope	Y	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
192	B202	1				3.92	55° 33' 4.11"	133° 17' 57.38"	Rk	Y	Y	Insert	
193	B203	1				0.24	55° 33' 4.68"	133° 17' 54.4"	Rk Awash	Y	Y	Insert	
194	B204	2	Drying Rk	55° 33' 9.2"	133° 17' 45.34"				Slope	N	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
195	B205	1				12.11	55° 33' 3.08"	133° 17' 39.03"	Rk	N	Y	Insert	
196	B206	2	7.3	55° 33' 8.04"	133° 17' 33.44"	2.65	55° 33' 8.56"	133° 17' 35.81"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKB23.
197	B207	2	14.6	55° 33' 4.78"	133° 17' 31.41"	8.74	55° 33' 6"	133° 17' 30.47"	Rk	N	Y	Replace	
198	B208	1				4.33	55° 33' 17.05"	133° 17' 25.87"	Rk	Y	Y	Insert	
199	B209	2	Islet	55° 33' 11.6"	133° 17' 38.57"	-3.18	55° 33' 11.63"	133° 17' 38.36"	Drying Rk	Y	Y	Replace	
200	B210	2	Islet	55° 33' 11.7"	133° 17' 34.87"	-2.82	55° 33' 11.59"	133° 17' 34.67"	Drying Rk	Y	Y	Replace	
201	B211	1				9.12	55° 33' 15.71"	133° 15' 24.29"	Rk	N	Y	Insert	
202	B212	1				6.31	55° 33' 14.15"	133° 15' 20.14"	Rk	N	Y	Insert	
203	B213	1				4.75	55° 33' 14.91"	133° 15' 15.91"	Rk	Y	Y	Insert	
204	B214	1				9.87	55° 33' 14.12"	133° 15' 7.29"	Rk	N	Y	Insert	

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
205	B215	1				14.07	55° 33' 7.68"	133° 14' 57.68"	Rk	N	N	JV	Sparse lidar coverage in deep water. Refer to FERKB4.
206	B216	2	12.8	55° 33' 7.07"	133° 14' 49.85"	10.28	55° 33' 6.84"	133° 14' 48.62"	Rk	N	Y	Replace	See Danger to Navigation report. Item 50.
207	B217	1				14.01	55° 33' 14.08"	133° 14' 58.63"	Rk	N	N	JV	Sparse lidar coverage in deep water.
208	B218	1				-0.26	55° 33' 4.1"	133° 13' 54.1"	Rk Awash	Y	Y	Insert	
209	B219	1				-0.60	55° 33' 5.66"	133° 13' 43.04"	Drying Rk	N	Y	Insert	
210	B220	1				13.94	55° 33' 12.25"	133° 13' 24.09"	Rk	N	Y	Insert	
211	B221	2	10.0	55° 32' 56.13"	133° 13' 37.59"	7.57	55° 32' 56.31"	133° 13' 38.7"	Rk	N	Y	Replace	
212	B222	1				0.10	55° 33' 0.09"	133° 13' 42.46"	Rk Awash	Y	Y	Insert	
213	B223	1				-0.82	55° 32' 58.06"	133° 13' 43.21"	Drying Rk	Y	Y	Insert	
214	B224	2	Islet	55° 33' 0.73"	133° 13' 51.2"	-0.71	55° 33' 0.73"	133° 13' 51.2"	Drying Rk	Y	Y	Replace	
215	B226	1				3.11	55° 33' 2.14"	133° 13' 54.3"	Rk	Y	Y	Insert	
216	B227	2	14.6	55° 32' 47.93"	133° 14' 3.16"	13.20	55° 32' 46.55"	133° 14' 2.23"	Rk	N	Y	Replace	
217	B228	1				11.22	55° 32' 53.76"	133° 16' 52.58"	Rk	N	Y	Insert	
218	B229	2	14.6	55° 32' 55.32"	133° 17' 7.62"	8.96	55° 32' 53.99"	133° 17' 4.86"	Rk	N	N	JV	Sparse lidar coverage in deep water. See Danger to Navigation report. Item 51.
219	B230	1				5.07	55° 33' 2.55"	133° 17' 2.61"	Rk	Y	Y	Insert	
220	B231	2	9.1	55° 33' 0.4"	133° 17' 7.84"	3.76	55° 33' 1.12"	133° 17' 6.24"	Rk	Y	N	BV	Possible Rk in kelp. See Danger to Navigation report. Item 52.
221	B232	2	Drying Rk	55° 32' 52.21"	133° 17' 8.82"				Slope	N	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
222	B233	2	Drying Rk	55° 32' 56.6"	133° 17' 12.13"				Slope	Y	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
223	B234	2	Drying Rk	55° 32' 59.88"	133° 17' 15.99"				Slope	Y	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
224	B235	1				-4.20	55° 32' 58.82"	133° 17' 24.41"	Islet	Y	Y	Insert	
225	B236	2	Islet	55° 32' 59.88"	133° 17' 26.71"				Slope	Y	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
226	B237	1				0.34	55° 32' 59.18"	133° 17' 29.82"	Rk Awash	Y	Y	Insert	
227	B238	2	Drying Rk	55° 32' 49.91"	133° 17' 26.11"				Slope	Y	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
228	B239	1				8.40	55° 32' 48.88"	133° 18' 4.01"	Rk	Y	N	JV	Possible Rk in kelp. Refer to FEKB30. See Danger to Navigation report. Item 53.
229	B240	2	Drying Rk	55° 32' 42.84"	133° 18' 4.38"				Slope	Y	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
230	B241	2	Drying Rk	55° 32' 46.28"	133° 17' 28.37"				Slope	N	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
231	B242	1				10.78	55° 32' 32.94"	133° 17' 1.48"	Rk	N	Y	Insert	See Danger to Navigation report. Item 54.
232	B243	1				12.22	55° 32' 35.05"	133° 16' 41.19"	Rk	N	Y	Insert	
233	B244	2	10.0	55° 32' 41.26"	133° 16' 33.15"	8.35	55° 32' 41.26"	133° 16' 33.15"	Rk	N	Y	Replace	
234	B245	1				15.17	55° 32' 33.23"	133° 16' 15.46"	Rk	N	Y	Insert	
235	B246	1				12.48	55° 32' 15.39"	133° 15' 6.79"	Rk	N	Y	Insert	See Danger to Navigation report. Item 55.
236	B247	1				13.06	55° 32' 21.65"	133° 16' 11.81"	Rk	N	Y	Insert	See Danger to Navigation report. Item 56.
237	B248	1				13.58	55° 32' 19.46"	133° 16' 13.67"	Rk	N	Y	Insert	
238	B249	1				7.66	55° 32' 25.35"	133° 16' 27.25"	Rk	N	Y	Insert	
239	B250	1				7.13	55° 32' 18.15"	133° 16' 31.74"	Rk	N	Y	Insert	
240	B251	2	Islet	55° 32' 27.25"	133° 16' 42.26"				Slope	Y	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
241	B252	2	Islet	55° 32' 25.94"	133° 16' 44.82"	-3.19	55° 32' 26.06"	133° 16' 44.67"	Drying Rk	Y	Y	Replace	
242	B253	1				3.35	55° 32' 19.07"	133° 16' 42.34"	Rk	Y	Y	Insert	
243	B255	1				6.28	55° 32' 17.65"	133° 16' 39.63"	Rk	N	Y	Insert	

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
244	B256	1				2.38	55° 32' 18.54"	133° 16' 50.21"	Rk	Y	N	VV / BV	Possible Rk in kelp. Refer to FEKB14.
245	B257	1				5.18	55° 32' 29.61"	133° 16' 44.93"	Rk	Y	Y	Insert	See Danger to Navigation report. Item 57.
246	B258	2	12.8	55° 32' 28.82"	133° 16' 56.73"	8.43	55° 32' 28.65"	133° 16' 53.4"	Rk	N	Y	Replace	
247	B259	1				9.37	55° 32' 27.26"	133° 16' 59.16"	Rk	N	Y	Insert	
248	B260	1				12.79	55° 32' 19.29"	133° 17' 7.15"	Rk	N	Y	Insert	
249	B261	2	8.2	55° 32' 24.77"	133° 17' 14.52"	6.20	55° 32' 26.12"	133° 17' 14.84"	Rk	Y	Y	Replace	
250	B262	1				-0.86	55° 32' 16.92"	133° 17' 11.05"	Drying Rk	Y	Y	Insert	
251	B263	1				-1.63	55° 32' 26.65"	133° 17' 20.06"	Drying Rk	Y	Y	Insert	
252	B264	1				-1.36	55° 32' 28"	133° 17' 22.53"	Drying Rk	Y	Y	Insert	
253	B265	1				6.95	55° 32' 30.12"	133° 17' 18.43"	Rk	Y	Y	Insert	
254	B266	1				-1.37	55° 32' 27.52"	133° 17' 25.88"	Drying Rk	Y	Y	Insert	
255	B267	1				4.41	55° 32' 29.25"	133° 17' 28.95"	Rk	Y	Y	Insert	
256	B268	1				6.63	55° 32' 26.59"	133° 17' 36.38"	Rk	Y	N	JV	Possible Rk in kelp. Refer to FEKB13.
257	B269	1				0.23	55° 32' 24.96"	133° 17' 45.92"	Rk Awash	N	Y	Insert	
258	B270	1				-1.51	55° 32' 26.29"	133° 17' 46.04"	Drying Rk	Y	Y	Insert	
259	B271	1				-1.10	55° 32' 28.87"	133° 17' 53.43"	Drying Rk	Y	Y	Insert	
260	B272	2	12.8	55° 32' 30.13"	133° 17' 50.49"	7.76	55° 32' 29.88"	133° 17' 46.93"	Rk	N	Y	Replace	
261	B273	1				-0.82	55° 32' 6.56"	133° 17' 6.35"	Drying Rk	Y	Y	Insert	
262	B274	2	Islet	55° 32' 5.33"	133° 17' 7.71"				Coast	Y	Y	Remove	

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
263	B275	2	Drying Rk	55° 32' 2.53"	133° 17' 8.41"				Slope	Y	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
264	B276	2	Islet	55° 32' 3.1"	133° 17' 3.6"				Drying Shelf	Y	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
265	B277	2	Islet	55° 32' 2.49"	133° 17' 0.41"				Coast	Y	Y	Remove	
266	B278	1				12.83	55° 32' 14.61"	133° 16' 59.38"	Rk	N	Y	Insert	
267	B279	2	3.1	55° 31' 59"	133° 17' 4.58"	0.20	55° 31' 59.97"	133° 17' 2.33"	Rk Awash	Y	Y	Replace	
268	B280	1				-1.44	55° 32' 1.11"	133° 16' 59.81"	Drying Rk	Y	Y	Insert	
269	B281	1				4.73	55° 32' 4.68"	133° 16' 54.16"	Rk	N	Y	Insert	
270	B282	2	25.6	55° 31' 58.98"	133° 15' 28.9"	15.36	55° 32' 0.08"	133° 15' 23.53"	Rk	N	Y	Replace	
271	B283	2	12.8	55° 32' 2.55"	133° 15' 19.13"	7.67	55° 32' 3.45"	133° 15' 16.21"	Rk	N	Y	Replace	
272	B284	2	14.6	55° 32' 2.14"	133° 12' 52.59"	13.44	55° 32' 1.4"	133° 12' 51.36"	Rk	N	Y	Replace	
273	B285	2	18.2	55° 31' 52.78"	133° 14' 27.23"	14.12	55° 31' 54.78"	133° 14' 28.21"	Rk	N	Y	Replace	
274	B286	2	Islet	55° 31' 47.5"	133° 16' 59.55"				Slope	Y	Y	Remove	
275	B287	2	Drying Rk	55° 31' 44.63"	133° 16' 58.91"				Slope	N	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
276	B288	2	Drying Rk	55° 31' 56.26"	133° 16' 58.9"				Slope	Y	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
277	B290	2	Drying Rk	55° 32' 0.2"	133° 17' 17.98"				Slope	N	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
278	B291	1				6.18	55° 31' 44.81"	133° 16' 54.59"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKB28.
279	B292	1				5.18	55° 31' 53.13"	133° 16' 54"	Rk	Y	Y	Insert	See Danger to Navigation report. Item 58.
280	B293	2	Islet	55° 31' 56.57"	133° 17' 16.8"	-2.49	55° 31' 56.66"	133° 17' 16.44"	Drying Rk	Y	Y	Replace	
281	B294	1				-0.15	55° 31' 47.35"	133° 17' 4.17"	Rk Awash	Y	Y	Insert	

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
282	B295	2	Drying Rk	55° 31' 31.42"	133° 17' 15.85"				Slope	N	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
283	B296	2	Islet	55° 31' 31.56"	133° 17' 13.28"	-1.49	55° 31' 32.38"	133° 17' 12.75"	Drying Rk	N	Y	Replace	
284	B298	2	Drying Rk	55° 31' 31.04"	133° 17' 1.4"				Slope	N	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
285	B299	1				-1.33	55° 31' 37.25"	133° 16' 59.18"	Drying Rk	Y	Y	Insert	
286	B300	1				-1.77	55° 31' 31.78"	133° 17' 7.56"	Drying Rk	N	Y	Insert	
287	B302	1				9.39	55° 31' 39.75"	133° 16' 57.49"	Rk	N	Y	Insert	
288	B304	1				-0.25	55° 31' 28.12"	133° 16' 41.7"	Rk Awash	Y	Y	Insert	
289	B305	1				-2.75	55° 31' 32.82"	133° 16' 47.3"	Drying Rk	N	Y	Insert	
290	B306	1				2.52	55° 31' 34.59"	133° 16' 39.71"	Rk	Y	N	VV / BV	Possible Rk in kelp.
291	B307	2	11.8	55° 31' 33.94"	133° 13' 51.94"	9.03	55° 31' 35.77"	133° 13' 52.91"	Rk	N	Y	Replace	See Danger to Navigation report. Item 59
292	B308	2	Drying Rk	55° 31' 13.73"	133° 14' 38.43"				Drying Shelf	Y	Y	Remove	
293	B309	2	Islet	55° 31' 13.83"	133° 14' 35.35"	-1.58	55° 31' 13.83"	133° 14' 35.35"	Drying Rk	Y	Y	Replace	
294	B310	1				1.54	55° 31' 13.64"	133° 14' 31.49"	Rk	Y	N	VV / BV	Possible Rk in kelp. Refer to FEKB29. See Danger to Navigation report. Item 60.
295	B311	1				4.67	55° 31' 14.16"	133° 14' 42.44"	Rk	N	Y	Insert	
296	B312	1				-3.16	55° 31' 16.82"	133° 16' 52.24"	Drying Rk	Y	Y	Insert	
297	B313	1				-2.76	55° 31' 11.7"	133° 16' 53.04"	Drying Rk	Y	Y	Insert	
298	B314	1				-1.07	55° 31' 3.91"	133° 16' 51.95"	Drying Rk	Y	Y	Insert	

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
299	B315	2	Drying Rk	55° 30' 56.57"	133° 17' 1.99"				Slope	N	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
300	B317	2	12.2	55° 30' 39.85"	133° 16' 33.98"	10.28	55° 30' 41.61"	133° 16' 33.87"	Rk	N	Y	Replace	
301	B318	1				6.84	55° 30' 35.42"	133° 14' 44.98"	Rk	N	Y	Insert	
302	B319	2	8.2	55° 30' 32.95"	133° 14' 55.09"	5.05	55° 30' 31.25"	133° 14' 59.37"	Rk	N	Y	Replace	See Danger to Navigation report. Item 61.
303	B320	1				14.15	55° 30' 35.22"	133° 16' 34.41"	Rk	N	N	JV	Sparse lidar coverage in deep water.
304	B321	1				6.63	55° 30' 6.66"	133° 14' 1.61"	Rk	Y	Y	Insert	
305	B322	1				15.98	55° 29' 52.77"	133° 15' 13.38"	Rk	N	Y	Insert	
306	B323	1				-4.60	55° 30' 4.18"	133° 16' 51.24"	Islet	Y	Y	Insert	
307	B324	2	Islet	55° 29' 52.53"	133° 17' 2.15"	-3.42	55° 29' 52.53"	133° 17' 2.15"	Drying Rk	Y	Y	Replace	
308	B325	1				-2.20	55° 29' 57.35"	133° 17' 0.32"	Drying Rk	Y	Y	Insert	
309	B326	1				-0.89	55° 30' 6.14"	133° 17' 5.43"	Drying Rk	Y	Y	Insert	
310	B328	1				-1.11	55° 29' 46.24"	133° 17' 37.63"	Drying Rk	Y	Y	Insert	
311	B329	1				-2.65	55° 29' 50.77"	133° 17' 36.34"	Drying Rk	Y	Y	Insert	
312	B330	2	Drying Rk	55° 29' 38.99"	133° 16' 1.64"				Slope	Y	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
313	B331	2	10.0	55° 29' 42.82"	133° 15' 59.88"	8.16	55° 29' 42.94"	133° 16' 1.44"	Rk	Y	Y	Replace	
314	B332	1				3.46	55° 29' 37.1"	133° 16' 3.93"	Rk	Y	Y	Insert	See Danger to Navigation report. Item 62.
315	B333	2	5.4	55° 29' 33.36"	133° 15' 47.84"	2.50	55° 29' 32.33"	133° 15' 48.64"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKB19.
316	B334	1				0.58	55° 29' 28.75"	133° 15' 55.47"	Rk Awash	Y	Y	Insert	
317	B335	1				2.23	55° 29' 25.17"	133° 15' 57.89"	Rk	Y	Y	Insert	
318	B336	1				13.45	55° 29' 30.96"	133° 16' 6.29"	Rk	N	Y	Insert	
319	B337	1				6.97	55° 29' 17.97"	133° 17' 6.72"	Rk	Y	Y	Insert	

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Kelp Area**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
320	B338	1				0.51	55° 29' 17.75"	133° 17' 17.26"	Rk Awash	Y	Y	Insert	
321	B340	2	12.8	55° 29' 6.05"	133° 17' 17.53"	11.40	55° 29' 5.48"	133° 17' 18.94"	Rk	N	Y	Replace	
322	B341	1				4.19	55° 29' 9.77"	133° 17' 18.81"	Rk	Y	Y	Insert	
323	B342	1				3.37	55° 29' 11.35"	133° 17' 17.71"	Rk	Y	N	BV	Possible Rk in kelp.
324	B343	2	Drying Rk	55° 29' 15.66"	133° 17' 13.46"				Slope	Y	Y	Remove	Not detected by lidar, not observed in georeferenced imagery.
325	B344	2	3.6	55° 29' 13.68"	133° 17' 17.53"	1.53	55° 29' 14.49"	133° 17' 16.1"	Rk	Y	Y	Replace	
326	B345	1				2.34	55° 29' 18.08"	133° 17' 11.06"	Rk	Y	Y	Insert	
327	B346	2	29.2	55° 29' 12"	133° 16' 9.55"	13.82	55° 29' 12.33"	133° 16' 6.4"	Rk	N	Y	Replace	See Danger to Navigation report. Item 63.
328	B347	2	20.1	55° 29' 13.58"	133° 15' 53.99"	9.09	55° 29' 12.42"	133° 15' 54.31"	Rk	N	Y	Replace	
329	B348	1				12.46	55° 28' 49.49"	133° 14' 46.31"	Rk	N	Y	Insert	
330	B349	1				12.29	55° 28' 52.73"	133° 14' 49.55"	Rk	N	Y	Insert	
331	B350	2	10.0	55° 28' 30.77"	133° 17' 44.66"	8.94	55° 28' 31.34"	133° 17' 42.55"	Rk	N	Y	Replace	
332	B351	2	14.6	55° 28' 33.28"	133° 17' 35"	11.96	55° 28' 32.35"	133° 17' 33.89"	Rk	N	Y	Replace	See Danger to Navigation report. Item 64.
333	B352	2	5.8	55° 28' 12.23"	133° 13' 3.53"	4.73	55° 28' 11.67"	133° 13' 3.21"	Rk	Y	N	BV	Possible Rk in kelp. Refer to FEKB11.
334	B353	1				2.96	55° 28' 14.08"	133° 13' 6.87"	Rk	Y	N	VV / BV	Possible Rk in kelp.
335	B354	2	23.7	55° 28' 20.24"	133° 14' 55.38"	17.87	55° 28' 20.89"	133° 14' 56.42"	Rk	N	Y	Replace	
336	B355	1				17.79	55° 28' 13.64"	133° 15' 0.2"	Rk	N	Y	Insert	
337	B356	1				20.66	55° 28' 7.44"	133° 15' 4.91"	Rk	N	Y	Insert	
338	B357	1				6.08	55° 28' 8.84"	133° 13' 7.48"	Rk	Y	Y	Insert	
339	B358	2	Islet	55° 33' 30.2"	133° 17' 54.65"				Coast	N	Y	Remove	
340	B359	1				0.37	55° 33' 14.03"	133° 13' 42.77"	Rk Awash	Y	Y	Insert	
341	B360	2	Drying Rk	55° 32' 44.5"	133° 18' 3.16"				Slope	N	Y	Remove	
342	B361	2	27.4	55° 32' 17.6"	133° 15' 5.42"	14.08	55° 32' 17.05"	133° 15' 7.43"	Rk	N	Y	Replace	See Danger to Navigation report. Item 65.

Table 3: Chart Comparison Spreadsheet

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

D.2 ADDITIONAL RESULTS

D.2.1 Supplemental Information for Boatwork

For the H11660 survey, the supplemental information for further boatwork was compiled by:

1. Defining the seaward limit of good lidar seabed coverage as a M_COVR, CATCOV=1 polygon.
2. Reviewing the features for investigation compiled during data processing and adding the uncertain soundings identified during the chart comparison to this examination list.
3. Prioritizing all features for investigation with respect to the M_COVR polygon and dangers to safe vessel-based examination.
4. Recommending the vessel-based method of disproving 'suspicious' lidar features or confirming 'real' lidar feature detections and determining least depth.

D.2.1.1 Seaward Limit of Lidar Coverage

The survey area H11660 consists of a large number of islands, islets and many kelp covered submerged rocks close to the coast. Heavy kelp is present throughout the survey area, especially around the sheltered islands and islets. As a result of periods of poor water clarity experienced during lidar data acquisition and the presence of heavy kelp, several areas across the sheet have poor seabed coverage. This is reflected by gaps in the BASE surface rendered as part of the survey deliverables.

In particular, the areas of poor lidar seabed coverage include:

- NE of Hermanos Island, at positions 55° 34' 34" N, 133° 17' 15" W and 55° 34' 18" N, 133° 17' 18" W, due to kelp.
- Around Hermanos Island, due to kelp.
- Off the coast of Prince of Wales Island, at position 55° 34' 52" N, 133° 13' 00" W, due to poor water clarity.
- Along most of the Prince of Wales Island coastline on W side of the survey area and the San Fernando Island coastline, due to kelp.
- On the San Fernando Island coastline, at position 55° 30' 17" N, 133° 16' 56" W, due to overhanging spruce trees.
- Off the coast of San Fernando Island, at position 55° 20' 02" N, 133° 17' 09" W, due to poor water clarity.
- Over many of the shoals in San Alberto Bay, due to kelp.

Traditionally, the suggested lidar-ship junctioning polyline was drawn too far to seaward, across areas of sparse, 'noisy' lidar coverage. For this survey, the polyline submitted as an S-57 M_COVR CATCOV=1 polygon is the seaward extent of good lidar coverage. When there is poor lidar coverage due to poor water clarity, the presence of kelp, or expansive white water, the

polyline has been drawn just to seaward of the MLLW line. It should be noted that TLI is not providing a recommended junctioning line. The determination of where multibeam survey lines need to be conducted is at the discretion of the PHB and the ships conducting the junctioning.

When planning multibeam junctioning with lidar seabed coverage, the NALL and the following must be taken into consideration:

- Lidar / georeferenced imagery derived MHW line, MLLW line.
- Drying, awash and shallow features detected by lidar.
- Features for examination.
- 'Unsurveyed' polygons due to kelp, poor water clarity and the SEZ.

These are all provided in the S-57 feature file (US511660.000) and the H11660_Inv.hob file for H11660.

The areas of good lidar seabed coverage include:

- Around Hermanos and Rosary Islands.
- Along the Prince of Wales Island coastline, particularly on the E side of the survey area.
- Over Balandra Shoal.

The seaward limit of good lidar data coverage has been described by the S-57 feature object M_COVR in the S-57 feature file (US511660.000).

D.2.1.2 Lidar Features Requiring Further Investigation

A list of uncertain lidar soundings was collated during data processing and is presented in a S-57 feature file. For example, some detections on isolated rocks in thick kelp beds were difficult to correctly classify as either rock or kelp.

Tagging in the GS was used to flag features for which the least depth has not been found. Typically this meant that there were less than 4 supporting soundings, within 0.5 – 1.0m of the depth, on the primary and overlapping lines. These tags were then exported from the GS and compiled in CARIS BASE Editor. Features for examination have been captured within the H11660_Inv.hob as M_NPUB feature objects. Where these features correlate with an item listed in the Chart Comparison Spreadsheet, a reference has been made in the H11660_Inv.hob file. The S-57 attribution methodology for lidar features requiring further investigation is presented below:

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Attribute 1	Attribute 2	Attribute 3	Attribute 4
Nautical publication information	M_NPUB	P	Used to relate additional nautical information or publications to the data.	INFORM (used for storing a unique Feature for Investigation ID)	NINFOM (used for storing the recommended examination method)	PUBREF (used for storing a reference to a Chart Comparison)	PICREP (used for storing a link to GS screen captures)

Refer to Section B.4.4 for the descriptions of the GS tagging philosophy used for all lidar seabed coverage gaps and recommended features for investigation.

In circumstances where least depth has not been found over a significant feature, a recommendation for investigation by boat for 79 uncertain soundings has been made in the CARIS H11660_Inv.hob file. All features in the chart comparison that have not had least depth adequately surveyed also appear in this file.

D.2.1.3 Prioritization of Features Requiring Further Investigation

All features for investigation have been assigned a priority, based on location with respect to the lidar coverage polyline, the coastal foul areas, and the NALL. In addition, they have been attributed with a recommended examination method, as specified in the following section. The priorities are assigned using the following table:

Priority	Location w.r.t. Polyline	Coastal Foul Area / NALL	Examination Method	Remarks
1	Seaward	No	Typically BV or VV / BV for shallow features	MUST be examined prior to multibeam junctioning.
2	Inshore	No NALL Possibly within Foul	Typically BV or VV / BV for shallow features	Investigation at ships discretion. Typically for uncertain shallow features.
3	Inshore / Seaward	NALL Coastal kelp	VV / BV	Investigation at ships discretion. Typically for drying rocks or rocks awash.
4	Seaward	No	JV	Can be safely navigated over during multibeam. Post acquisition comparison required.
5	Inshore / Seaward	Generally No	Typically BV or VV / BV for shallow features	Doubtful sounding. Possibly floating kelp / whale or fish strikes.

Note: All features recommended for investigation are reported as possible hazards when conducting survey work by boat.

Table 4: Prioritization Hierarchy for Features Requiring Further Investigation

D.2.1.4 Recommended Examination Method of Features Requiring Further Investigation

Each feature for investigation has been attributed with a recommended examination method, based on the general depth around the feature, the least depth as detected by lidar and the nature of the feature (kelp, white water etc.). The examination methods are categorized as follows:

Acronym	Examination Method
VV	Visual Verification - may be hazardous to approach even with shallow draft vessel running single beam.
VV / BV	Visual Verification required prior to Bathymetric Verification - potentially shoaler than 3m depth.
BV	Bathymetric Verification, generally greater than 3m depth.
JV	Junctioning Verification, generally greater than 6m depth.

Table 5: Recommended Examination Methods for Features Requiring Further Investigation

D.2.1.5 Recommended Junctioning with Unsurveyed Lidar Areas

The 'unsurveyed' gaps in lidar seabed coverage are defined as polygons in the S-57 feature file. They were constructed utilizing the export of the operator assigned gap tags covered in Section B.4.4. In the case of 'unsurveyed' areas for kelp, and SEZ, junctioning is not recommended for the obvious risks to surface vessels.

D.2.1.6 Comparison with prior Surveys

Comparison with prior surveys was not required under this Task Order. See Section D.1 for comparison to the nautical charts.

D.2.2 Summary of Charting Actions and Investigations – H11660

D.2.2.1 Summary of Charting Actions – H11660

Total number of new significant islets recommended for insertion on chart: 3
Total number of new significant drying rocks recommended for insertion on chart: 35
Total number of new significant rocks awash recommended for insertion on chart: 20
Total number of new significant rocks recommended for insertion on chart: 115
Total number of charted features disproved by lidar (Remove): 40
Total number of charted features recommended for amendment by lidar (Replace): 85
Total number of chart comparison items requiring further investigation: 41

Total number of DTONs submitted to PHB during data acquisition: 34
Total number of DTONs submitted to PHB during data processing: 31
Total number of DTONs submitted to PHB for H11660: 65

D.2.2.2 Summary of Lidar Features Requiring Further Investigation – H11660

Total number of Priority 1 investigations identified: 11
Total number of Priority 2 investigations identified: 22
Total number of Priority 3 investigations identified: 16
Total number of Priority 4 investigations identified: 30
Total number of Priority 5 investigations identified: 0

Total number of investigations recommended during data processing: 60
Total number of investigations recommended from georeferenced imagery review: 2
Total number of investigations recommended from chart comparison compilation: 17
Total number of recommended feature investigations: 79

E. APPROVAL SHEET

LETTER OF APPROVAL – OPR-O190-KRL-07

This report and the accompanying LADS survey deliverables are respectfully submitted.

Field operations contributing to the accomplishment of this survey were conducted under my direct supervision with frequent personal checks of progress and adequacy. This report and the accompanying LADS survey deliverables have been closely reviewed and are considered complete and adequate as per the Statement of Work.

Report	Submission Date
Descriptive Report – H11660	March 3, 2008

Mark Sinclair
Hydrographer
Tenix LADS, Incorporated

Date March 3, 2008

[1] The LIDAR survey referenced in this Descriptive Report has been applied to the multibeam survey it junctions with. No stand-alone LIDAR information was compiled to the HCell. For information concerning the compilation of LIDAR features and soundings see the Descriptive Resports for multibeam surveys H11850, H11851 and H12026. LIDAR does not meet IHO object detection requirements. LIDAR was not used to supersede shoaler charted soundings or to disprove charted features.

The Data Acquisition and Processing Report and Horizontal and Vertical Control Report have been filed with the project records.

APPENDIX I – DANGERS TO NAVIGATION

DTONS Submitted to PHB

I.1.1 Danger to Navigation Report

Hydrographic Survey Registry Number:	H11660
State:	Alaska
Locality:	West of Prince of Wales Island
Sub-locality:	San Alberto Bay
Project Number:	OPR-O190-KRL-07
Survey Start Date:	April 22, 2007

Depths are in meters and reduced to Mean Lower Low Water using preliminary tides. Drying heights are in meters relative to MLLW. Positions are based on the NAD83 horizontal datum. All times and dates are relative to UTC.

Charts Affected

Number	Edition	Date	Scale
US5AK4AM	3rd	11/08/07	1:40,000
US5AK4BM	1st	18/10/07	1:40,000

The following items were found during hydrographic survey operations:

No.	Feature	Depth	Latitude (N)	Longitude (W)	Time and Date	Investigate
1	Rk	8.0	55° 35' 01.19"	133° 17' 22.30"	02:54:56, May 28	No
2	Rk	5.6	55° 34' 44.81"	133° 12' 27.17"	01:29:33, May 28	No
3	Rk	0.9	55° 34' 43.62"	133° 12' 42.99"	01:29:37, May 28	No
4	Rk	7.3	55° 34' 26.74"	133° 12' 39.64"	01:38:18, May 29	No

No.	Feature	Depth	Latitude (N)	Longitude (W)	Time and Date	Investigate
5	Shoal	7.3	55° 34' 27.68"	133° 13' 26.20"	01:24:08, May 28	No
6	Rk	2.9	55° 34' 32.16"	133° 13' 49.52"	20:17:00, May 28	No
7	Drying Rk	-1.1	55° 34' 48.95"	133° 16' 40.11"	20:09:46, Jun 15	No
8	Shoal	5.8	55° 33' 56.92"	133° 17' 53.87"	15:36:25, May 17	Yes
9	Shoal	12.3	55° 34' 02.80"	133° 15' 03.24"	03:17:52, May 29	No
10	Shoal	5.4	55° 34' 06.36"	133° 14' 49.84"	19:56:03, May 17	No
11	Shoal	6.2	55° 34' 18.04"	133° 13' 21.84"	16:21:48, May 18	No
12	Rk	7.5	55° 33' 32.82"	133° 13' 09.27"	01:57:11, Jun 16	No
13	Shoal	7.5	55° 33' 20.13"	133° 14' 38.65"	19:46:19, Jun 15	No
14	Shoal	7.0	55° 33' 31.39"	133° 14' 38.61"	23:28:59, May 28	No
15	Shoal	13.2	55° 32' 59.16"	133° 18' 00.25"	03:30:04, May 9	No
16	Shoal	13.3	55° 32' 44.55"	133° 16' 55.82"	00:21:34, May 10	No
17	Rk	6.6	55° 33' 18.00"	133° 17' 18.79"	22:13:39, May 7	No
18	Shoal	6.5	55° 32' 44.81"	133° 17' 33.02"	03:29:55, May 9	No
19	Rk	2.6	55° 32' 22.60"	133° 16' 31.91"	19:44:53, Apr 22	Yes
20	Shoal	6.5	55° 32' 15.31"	133° 16' 29.03"	20:07:36, May 10	No
21	Shoal	5.2	55° 32' 34.26"	133° 16' 51.48"	16:46:53, May 17	No
22	Shoal	15.3	55° 32' 12.52"	133° 14' 07.67"	23:56:45, Jun 13	No
23	Rk	9.1	55° 31' 15.71"	133° 14' 43.97"	19:02:17, May 7	No
24	Shoal	12.4	55° 30' 51.21"	133° 16' 30.43"	03:37:48, May 9	No
25	Rk	3.9	55° 30' 25.78"	133° 14' 27.72"	23:22:41, Apr 24	No

No.	Feature	Depth	Latitude (N)	Longitude (W)	Time and Date	Investigate
26	Shoal	2.9	55° 29' 29.10"	133° 17' 02.51"	20:45:57, May 7	Yes
27	Shoal	4.0	55° 29' 13.24"	133° 17' 25.54"	20:54:51, Apr 22	Yes
28	Shoal	11.6	55° 33' 28.81"	133° 14' 54.17"	19:46:14, Jun 15	No
29	Shoal	9.9	55° 35' 06.61"	133° 17' 39.36"	20:02:25, Jun 15	No
30	Rk	8.7	55° 34' 15.21"	133° 17' 09.39"	20:17:50, May 28	No
31	Shoal	13.6	55° 33' 50.88"	133° 15' 19.23"	23:32:52, Jun 15	Yes
32	Rk	12.2	55° 33' 54.97"	133° 12' 52.44"	00:42:52, May 29	No
33	Shoal	13.2	55° 32' 32.10"	133° 12' 48.89"	02:08:05, Jun 16	No
34	Shoal	15.1	55° 32' 58.64"	133° 14' 46.17"	19:30:54, Jun 15	No
35	Rk	5.0	55° 35' 15.8"	133° 17' 45.85"	02:55:04, May 28	No
36	Rk	4.9	55° 34' 56.43"	133° 12' 20.64"	18:14:59, May 18	No
37	Rk	7.2	55° 34' 51.13"	133° 16' 51.31"	03:47:13, May 29	No
38	Shoal	5.4	55° 34' 51.3"	133° 12' 33.58"	03:41:57, May 29	No
39	Rk	16.0	55° 34' 19.94"	133° 17' 6.29"	01:15:13, May 28	No
40	Rk	5.8	55° 34' 6.16"	133° 13' 50.16"	03:04:50, Jun 24	Yes
41	Shoal	5.3	55° 34' 17.53"	133° 13' 10.32"	00:54:08, May 29	Yes
42	Rk	11.7	55° 33' 55.74"	133° 14' 12.21"	00:36:32, May 28	Yes
43	Rk	13.4	55° 34' 0.24"	133° 14' 46.7"	03:21:01, Jun 14	No
44	Shoal	10.8	55° 33' 57.55"	133° 17' 26.06"	23:17:22, Jun 13	No
45	Rk	12.9	55° 33' 33.63"	133° 14' 1.98"	21:17:59, Jun 15	No
46	Rk	12.9	55° 33' 45.93"	133° 13' 9.73"	03:05:03, Jun 24	No

No.	Feature	Depth	Latitude (N)	Longitude (W)	Time and Date	Investigate
47	Rk	4.5	55° 33' 38.49"	133° 12' 57.3"	00:06:35, May 29	No
48	Rk	4.6	55° 33' 21.76"	133° 13' 8.8"	00:54:26, May 28	No
49	Rk	7.1	55° 33' 28.57"	133° 15' 8.82"	16:22:53, May 17	Yes
50	Shoal	10.3	55° 33' 6.84"	133° 14' 48.62"	21:17:43, Jun 16	No
51	Rk	8.9	55° 32' 53.99"	133° 17' 4.86"	22:23:59, Jun 13	Yes
52	Rk	3.7	55° 33' 1.12"	133° 17' 6.24"	18:40:28, May 7	Yes
53	Rk	8.4	55° 32' 48.88"	133° 18' 4.01"	02:33:44, May 10	Yes
54	Shoal	10.8	55° 32' 32.94"	133° 17' 1.48"	03:12:15, May 9	No
55	Shoal	12.5	55° 32' 15.39"	133° 15' 6.79"	20:03:25, May 7	No
56	Shoal	13.0	55° 32' 21.65"	133° 16' 11.81"	19:01:41, May 7	No
57	Rk	5.2	55° 32' 29.61"	133° 16' 44.93"	02:54:30, May 9	No
58	Rk	5.2	55° 31' 53.13"	133° 16' 54"	16:46:36, May 17	No
59	Rk	9.0	55° 31' 35.77"	133° 13' 52.91"	23:24:57, Jun 13	No
60	Rk	1.5	55° 31' 13.64"	133° 14' 31.49"	18:41:28, May 7	Yes
61	Rk	5.0	55° 30' 31.25"	133° 14' 59.37"	22:48:43, Apr 24	No
62	Rk	3.4	55° 29' 37.1"	133° 16' 3.93"	20:39:40, May 7	No
63	Rk	13.8	55° 29' 12.33"	133° 16' 6.4"	02:16:50, May 9	No
64	Rk	11.9	55° 28' 32.35"	133° 17' 33.89"	02:37:50, Jun 14	No
65	Rk	14.1	55° 32' 17.05"	133° 15' 7.43"	23:16:28, Jun 13	No

COMMENTS: Final verified tides have been applied from the Craig tide gauge (9450551). The shoals were found using LIDAR. DTON items 1 though 34 were submitted during data acquisition from the field. DTON items 35 through 65 were submitted following data

processing from the Biloxi office. DTON items 5, 7, 8, 11, 19, 27 and 62 were not submitted to MCD.

Questions concerning this report should be directed to the Survey Manager, Mr. Scott Ramsay, in the Tenix LADS Inc. office in Biloxi MS. at (228) 594 6800.

DTONS Submitted to MCD

I.1.2 Danger to Navigation Report (Submitted during field operations)

Hydrographic Survey Registry Number:	H11660
State:	Alaska
Locality:	West of Prince of Wales Island
Sub-locality:	San Alberto Bay
Project Number:	OPR-O190-KRL-07
Survey Start Date:	April 22, 2007

Depths are in fathoms and feet, reduced to Mean Lower Low Water using preliminary tides. Positions are based on the NAD83 horizontal datum. All times and dates are relative to UTC.

Charts Affected

Number	Version	Date	Scale
17404	13th Ed	May, 2006	1:40,000
17405	14th Ed	October, 2000	1:40,000

The following items were found during LIDAR hydrographic survey operations:

No.	Feature	Depth	Latitude (N)	Longitude (W)	Time and Date
1	Rk	4_2	55° 35' 01.19"	133° 17' 22.30"	02:54:56, May 28
2	Rk	3	55° 34' 44.81"	133° 12' 27.17"	01:29:33, May 28
3	Rk	covers 2 ft	55° 34' 43.62"	133° 12' 42.99"	01:29:37, May 28
4	Rk	3_5	55° 34' 26.74"	133° 12' 39.64"	01:38:18, May 29
5	Rk	1_3	55° 34' 32.16"	133° 13' 49.52"	20:17:00, May 28

No.	Feature	Depth	Latitude (N)	Longitude (W)	Time and Date
6	Sounding	6_3	55° 34' 02.80"	133° 15' 03.24"	03:17:52, May 29
7	Sounding	3	55° 34' 06.36"	133° 14' 49.84"	02:54:13, May 28
8	Sounding	3_2	55° 34' 18.04"	133° 13' 21.84"	00:42:40, May 29
9	Rk	4_2	55° 33' 32.82"	133° 13' 09.27"	20:05:37, May 28
10	Sounding	4_1	55° 33' 20.13"	133° 14' 38.65"	23:14:41, May 28
11	Sounding	3_5	55° 33' 31.39"	133° 14' 38.61"	23:28:59, May 28
12	Sounding	7_1	55° 32' 59.16"	133° 18' 00.25"	03:30:04, May 9
13	Sounding	7_2	55° 32' 44.55"	133° 16' 55.82"	19:01:27, May 7
14	Rk	3_3	55° 33' 18.00"	133° 17' 18.79"	18:13:39, May 7
15	Sounding	3_2	55° 32' 44.81"	133° 17' 33.02"	03:29:55, May 9
16	Sounding	3_3	55° 32' 15.31"	133° 16' 29.03"	20:07:36, May 10
17	Sounding	2_5	55° 32' 34.26"	133° 16' 51.48"	16:46:53, May 17
18	Sounding	8_5	55° 32' 12.52"	133° 14' 07.67"	19:55:01, May 7
19	Rk	5	55° 31' 15.71"	133° 14' 43.97"	19:02:17, May 7
20	Sounding	6_4	55° 30' 51.21"	133° 16' 30.43"	03:37:48, May 9
21	Rk	2	55° 30' 25.78"	133° 14' 27.72"	23:22:41, Apr 24
22	Sounding	1_3	55° 29' 29.10"	133° 17' 02.51"	20:45:57, May 7
23	Sounding	6_5	55° 33' 28.81"	133° 14' 54.17"	23:00:14, May 28

Comments: This report was compiled by Tenix LADS Inc. and reviewed by PHB. Questions concerning this report should be directed to the Chief, Pacific Hydrographic Branch at (206) 526-6835.

(This is an addendum to the report submitted on June 25, 2007)

Hydrographic Survey Registry Number:	H11660
State:	Alaska
Locality:	West of Prince of Wales Island
Sub-locality:	San Alberto Bay
Project Number:	OPR-O190-KRL-07
Survey Start Date:	April 22, 2007

Depths are in fathoms and feet reduced to Mean Lower Low Water using preliminary tides. Positions are based on the NAD83 horizontal datum. All times and dates are relative to UTC.

Charts Affected

Number	Version	Date	Scale
17400	17th Ed	March, 2007	1:229,376
17404	13th Ed	May, 2006	1:40,000
17405	15th Ed	May, 2006	1:40,000

The following items were found during LIDAR hydrographic survey operations:

No.	Feature	Depth	Latitude (N)	Longitude (W)	Time and Date
1	Sounding	5_2	55° 35' 06.61"	133° 17' 39.36"	20:02:25, June 15
2	Rk	4_4	55° 34' 15.21"	133° 17' 09.39"	01:23:14, May 28
3	Sounding	7_2	55° 33' 50.88"	133° 15' 19.23"	23:32:52, June 15
4	Rk	6_3	55° 33' 54.97"	133° 12' 52.44"	00:42:52, May 29
5	Sounding	7	55° 32' 32.10"	133° 12' 48.89"	02:08:05, June 16
6	Sounding	8_2	55° 32' 58.64"	133° 14' 46.17"	19:30:54, June 15

Comments: The report was compiled by Tenix LADS Inc. and reviewed by PHB. Questions concerning this report should be directed to the Chief, Pacific Hydrographic Branch at (206) 526-6835.

I.1.3 Danger to Navigation Report (Submitted upon completion of data processing)

(This an addendum to the report submitted on June 25, 2007)

Hydrographic Survey Registry Number:	H11660
State:	Alaska
Locality:	West of Prince of Wales Island
Sub-locality:	East of San Alberto Bay
Project Number:	OPR-O190-KRL-07
Survey Start Date:	April 22, 2007

Depths are in fathoms and feet reduced to Mean Lower Low Water using final tides. Positions are based on the NAD83 horizontal datum. All times and dates are relative to UTC.

Charts Affected

Number	Version	Date	Scale
17404	13th Ed	May, 2006	1:40,000
17405	15th Ed	May, 2006	1:40,000

The following items were found during hydrographic survey operations:

No.	Feature	Depth	Latitude (N)	Longitude (W)	Time, Date, Year
1	Rk	2_4	55° 35' 15.8"	133° 17' 45.85"	02:55:04, May 28
2	Rk	2_4	55° 34' 56.43"	133° 12' 20.64"	18:14:59, May 18
3	Rk	3_5	55° 34' 51.13"	133° 16' 51.31"	03:47:13, May 29
4	Sounding	3	55° 34' 51.3"	133° 12' 33.58"	03:41:57, May 29
5	Rk	8_4	55° 34' 19.94"	133° 17' 6.29"	01:15:13, May 28
6	Rk	3_1	55° 34' 6.16"	133° 13' 50.16"	03:04:50, Jun 24

No.	Feature	Depth	Latitude (N)	Longitude (W)	Time, Date, Year
7	Sounding	2_5	55° 34' 17.53"	133° 13' 10.32"	00:54:08, May 29
8	Rk	6_2	55° 33' 55.74"	133° 14' 12.21"	00:36:32, May 28
9	Rk	7_2	55° 34' 0.24"	133° 14' 46.7"	03:21:01, Jun 14
10	Sounding	5_5	55° 33' 57.55"	133° 17' 26.06"	23:17:22, Jun 13
11	Rk	7	55° 33' 33.63"	133° 14' 1.98"	21:17:59, Jun 15
12	Rk	7	55° 33' 45.93"	133° 13' 9.73"	03:05:03, Jun 24
13	Rk	2_3	55° 33' 38.49"	133° 12' 57.3"	00:06:35, May 29
14	Rk	2_3	55° 33' 21.76"	133° 13' 8.8"	00:54:26, May 28
15	Rk	3_5	55° 33' 28.57"	133° 15' 8.82"	16:22:53, May 17
16	Sounding	5_3	55° 33' 6.84"	133° 14' 48.62"	21:17:43, Jun 16
17	Rk	4_5	55° 32' 53.99"	133° 17' 4.86"	22:23:59, Jun 13
18	Rk	2	55° 33' 1.12"	133° 17' 6.24"	18:40:28, May 7
19	Rk	4_3	55° 32' 48.88"	133° 18' 4.01"	02:33:44, May 10
20	Sounding	5_5	55° 32' 32.94"	133° 17' 1.48"	03:12:15, May 9
21	Sounding	7	55° 32' 21.65"	133° 16' 11.81"	19:01:41, May 7
22	Rk	2_5	55° 32' 29.61"	133° 16' 44.93"	02:54:30, May 9
23	Rk	2_5	55° 31' 53.13"	133° 16' 54.0"	16:46:36, May 17
24	Rk	4_5	55° 31' 35.77"	133° 13' 52.91"	23:24:57, Jun 13
25	Rk	0_5	55° 31' 13.64"	133° 14' 31.49"	18:41:28, May 7
26	Rk	2_4	55° 30' 31.25"	133° 14' 59.37"	22:48:43, Apr 24
27	Rk	7_3	55° 29' 12.33"	133° 16' 6.4"	02:16:50, May 9

No.	Feature	Depth	Latitude (N)	Longitude (W)	Time, Date, Year
28	Rk	6_3	55° 28' 32.35"	133° 17' 33.89"	02:37:50, Jun 14

COMMENTS and Anti-DTON:

Shoaler depths are evident around the buoy located at 55^o 32’ 15.5N, 133^o 15’ 05.3”W. The survey found a 6 fm 5 ft sounding at 55^o 32’ 15.4”N, 133^o 15’ 06.8”W and a 7 fm 4 ft sounding at 55^o 32’ 17.1”N, 133^o 15’ 07.4”W. PHB recommends the following: Remove the charted 15 fm sounding at 55^o 32’ 17.5”N, 133^o 15’ 06.4”W. Extend the 10 fm curve with blue tint around the charted buoy and the 6 fm 5 ft and 7 fm 4 ft soundings noted above.

Final tides have been applied from the Craig tide gauge (9450551). This report was compiled by Tenix LADS Inc. and reviewed by PHB. Questions concerning this report should be directed to the Chief, Pacific Hydrographic Branch at (206) 526-6835.

APPENDIX II – SURVEY FEATURE REPORT

No AWOIS were assigned to this task order.

APPENDIX III – FINAL PROGRESS SKETCH

FINAL PROGRESS SKETCH

April 21 – June 23, 2007

OPR-O190-KRL-07
West of Prince of Wales Island, AK

Tenix LADS, Inc.
Scott Ramsay, Project Manager

The Tenix LADS aircraft arrived in Ketchikan on April 20, 2007. The site mobilization was undertaken on April 21, 2007, and Ketchikan remained the main base of operations through April and May. The first survey flight was conducted in the West of Prince of Wales Island, AK project area on April 22, 2007. A total of 20 sorties were flown in the project area, with the final flight occurring on June 23, 2007. A total of 4 transit flights to Kodiak were conducted in support of operations for OPR-P135-KRL-07 Southeast of Kodiak Island, AK.

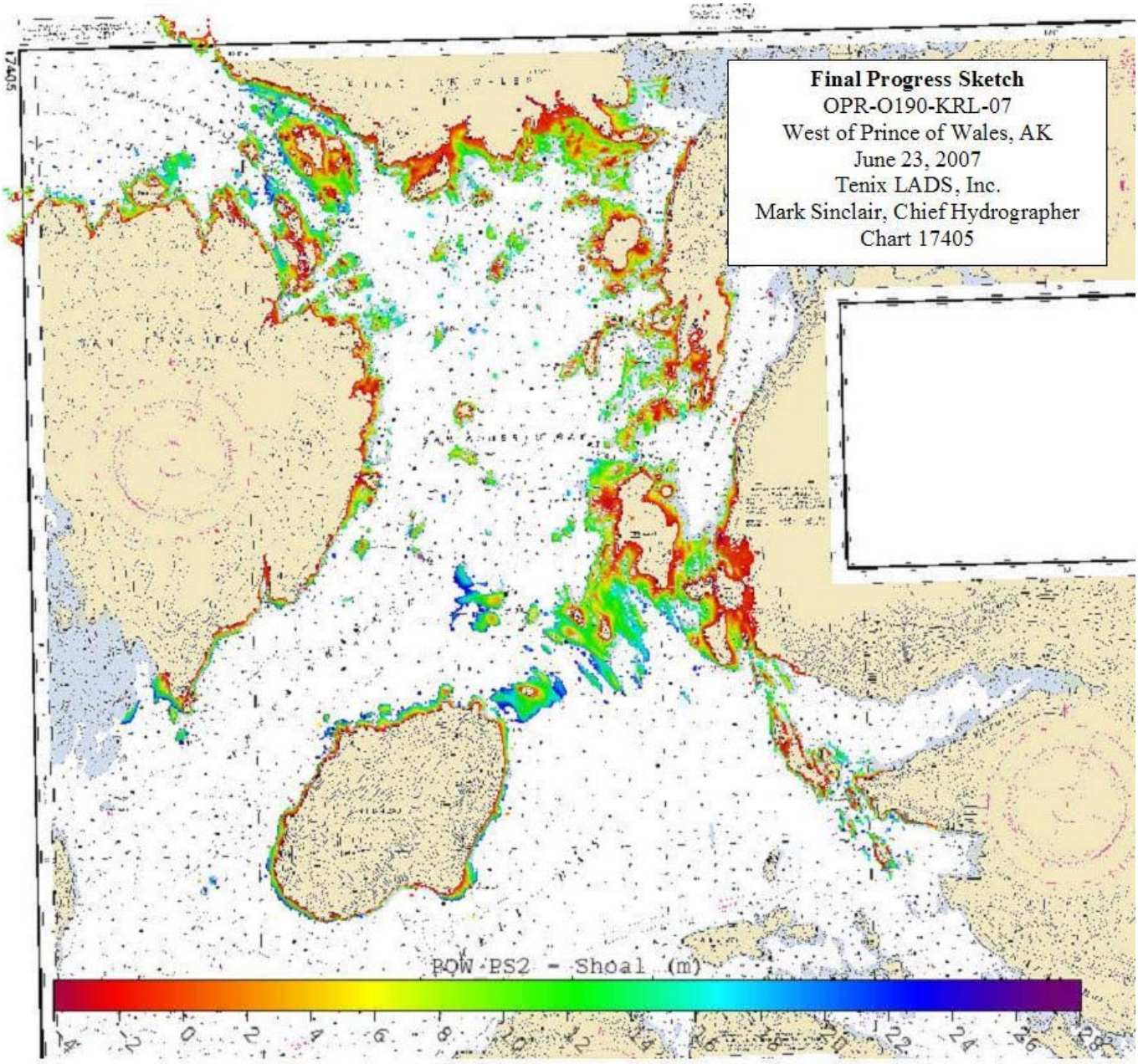
Of the 20 survey flights, 13.5 were deemed fully effective. The remaining flights were sorties aborted prematurely for adverse environmental conditions such as low cloud, high turbulence or marginal water clarity in the survey area, or due to system problems.

The area covered is 13SNM, from the 0m contour to lidar extinction depth (generally 15m), at 200% coverage.

OPR-O190-KRL-07 (Ketchikan Base in April and May)	April	May	June	Total 2007	Total Planned	% Complete
Days on project	6	22	7	35	26	135%
Days mobilization	1	0	0	1	1	100%
Survey flights	2	15	3	20	10	200%
Transit flights (to Kodiak)	1	1	2	4	4	100%
No flight - weather	2	8	1	11		
No flight - water quality	0	1	1	2		
Linear nautical miles flown	555	2247	678	3480	2433	143%
Area surveyed (nm^2)	1 *	9 *	3 *	13 *	17 **	76%

OPR-O190-KRL-07 (Ketchikan Base in April and May)	April	May	June	Total 2007	Total Planned	% Complete
Aircraft flown hours	12:35	67:03	17:57	97:15	70:00	139%
Aircraft on task hours	10:00	50:13	14:50	75:03	56:30	133%
Hours lost to weather	0:00	1:46	0:00	1:46		
Hours lost to system	1:00	3:20	1:30	5:50		
Effective flights conducted				13.5	10	135%
Average time on task per effective flight				4:26	5:39	79%
Survey lines flown				530	375	141%

*Area surveyed value derived from CARIS BASE surface at June 23, from 0m to lidar extinction depth
** Total planned area sourced from OPR-O190-KRL-07 Statement of Work, Attachment #2



Progress Sketch OPR-O190-KRL-07 at June 23, 2007

APPENDIX IV – TIDES AND WATER LEVELS

Abstract of Times of Hydrography

Start and End times refer to tidal applications requirement.

Time on Task indicates actual time of task in the survey area. All times and dates are in UTC.

07_4POW

Date	JD	Sortie	Start Time	End Time	Tide Duration	Time on Task
22-Apr-07	112	1	16:05	21:45	5:40	5:10
24-Apr-07	114	2	20:35	01:25	4:50	4:50
5-May-07	125	3	16:10	16:45	0:35	0:35
7-May-07	127	4	17:20	22:15	4:55	4:55
8-May-07	128	5	23:43	04:03	4:20	4:20
9-May-07	129	6	22:33	03:38	5:05	5:05
10-May-07	130	7	19:14	23:17	4:03	4:03
12-May-07	132	9	21:27	01:35	4:08	4:08
14-May-07	134	10	17:13	18:50	1:37	1:37
15-May-07	135	11	18:46	21:00	2:14	2:15
17-May-07	137	12	15:18	20:21	5:03	5:03
18-May-07	138	13	15:40	19:16	3:36	3:36
23-May-07	143	14	20:12	20:58	0:46	0:46
27-May-07	147	15	23:13	03:54	4:41	4:41
28-May-07	148	17	18:13	20:35	2:22	2:22
28-May-07	148	18	22:35	04:12	5:37	5:37
31-May-07	151	19	21:20	22:30	1:10	1:10
13-Jun-07	164	22	22:10	03:25	5:15	5:15
15-Jun-07	166	23	19:25	02:10	6:45	5:45
23-Jun-07	174	29	00:30	04:20	3:50	3:50

T I D A L D A T U M S

Tidal datums at SITKA, BARONOF ISLAND, SITKA SOUND based on:

LENGTH OF SERIES:	19 Years
TIME PERIOD:	January 1983 – December 2001
TIDAL EPOCH:	1983 – 2001
CONTROL TIDE STATION:	

Elevations of tidal datums referred to Mean Lower Low Water (MLLW), in METERS:

HIGHEST OBSERVED WATER LEVEL (11/02/1948)	= 4.534
MEAN HIGHER HIGH WATER (MHHW)	= 3.029
MEAN HIGH WATER (MHW)	= 2.791
MEAN TIDE LEVEL (MTL)	= 1.618
MEAN SEA LEVEL (MSL)	= 1.610
MEAN LOW WATER (MLW)	= 0.445
MEAN LOWER LOW WATER (MLLW)	= 0.000
LOWEST OBSERVED WATER LEVEL (01/01/1991)	= -1.224

T I D A L D A T U M S

Tidal datums for Craig Subordinate Gauge based on:

LENGTH OF SERIES:	78 Days
TIME PERIOD:	April 17 – July 3, 2007
CONTROL TIDE STATION:	Sitka, AK 9451600

Elevations of tidal datums referred to Mean Lower Low Water (MLLW), in METERS:

MEAN HIGHER HIGH WATER (MHHW)	= 3.099
MEAN HIGH WATER (MHW)	= 2.842
MEAN TIDE LEVEL (MTL)	= 1.630
MEAN LOW WATER (MLW)	= 0.419
MEAN LOWER LOW WATER (MLLW)	= 0.000

APPENDIX V – SUPPLEMENTAL SURVEY RECORDS AND CORRESPONDENCE

Correspondence Regarding Final Tide Zoning

RAMSAY Scott

From: David.Scharff [David.Scharff@noaa.gov]
Sent: Monday, December 03, 2007 8:04 AM
To: RAMSAY Scott
Subject: Tide station: 9450551

Attachments: David_Scharff.vcf

David_Scharff.vcf
(430 B)

Scott,

The tide model based on use of 9450551 has been reviewed and approved by CO-OPS. The data from this station may be applied to OPR-O190-KRL-07 even though the Statement of Work indicates 9450543.

Regards,
Dave

1

RAMSAY Scott

From: RAMSAY Scott
Sent: Wednesday, August 08, 2007 11:27 AM
To: Dave Scharff (E-mail)
Cc: HAWKINS Michael; NEWSHAM Harry; GUILFORD James
Subject: JOA Craig zoning

Attachments: 9450551 Craig Revised Zoning.txt

9450551 Craig Revised Zoning.t...

Dave,

Please find attached the JOA provided zoning for the Craig gauge. I am assuming the dimensions of the tide zone areas do not change even though a new gauge at Craig has been introduced into the tidal model, but there are new range and time correctors for the zones based on the Craig smoothed tide readings.

JOA has indicated the Craig guage reference number is 9450551 in the attched file, but in the SOW it is listed as 9450543.

Could you please confirm with COOPS that the JOA tide zoning for the Craig guage is applicable for final tide application and inform us of the correct gauge reference number for Craig.

Regards,
Scott

-----Original Message-----
From: HAWKINS Michael
Sent: Wednesday, August 08, 2007 9:00 AM
To: NEWSHAM Harry; RAMSAY Scott
Cc: GUILFORD James
Subject: FW: Craig zoning

Harry,

Here are the new time and range correctors from Eric at JOA, I leave them in you trusted hands.

Mick.

-----Original Message-----
From: Erik Oppegard [mailto:eoppegard@acsalaska.net]
Sent: Tuesday, 7 August 2007 10:25 PM
To: HAWKINS Michael
Cc: John Oswald
Subject: Re: Craig zoning

Here you go, the revised zoning based on Craig, AK. I did not change the zone shapes, so your coordinate file will remain the same. Just need to update zone references to the attached file.

Erik

HAWKINS Michael wrote:
> That's pretty much what we did. They didn't give us exact coodinates. So we would draw

9450551 Craig Revised Zoning

JOA revised zoning.
This file was created based on a 1 month TBYT from Sitka to Craig.
The mean time differnce = -9min, (-6min used for zoning)
The range ratio = 1.03
NOAA zone shapes remain the same, reference station changed to Craig 9450551
EO 8/7/07

Zone	Time corrector (mins)	Range Ratio	Reference Station
SA227	0	1.03	9450551
SA228	0	1.02	9450551
SA229	6	1.00	9450551
SA230	0	1.00	9450551

Page 1

Correspondence Regarding Revised Sub-locality Names

RAMSAY Scott

From: David.Scharff [David.Scharff@noaa.gov]
Sent: Monday, March 03, 2008 11:19 AM
To: RAMSAY Scott
Subject: Re: FW: OPR-O190-KRL-07 West of Prince of Wales Island, AK Sub locality names

Attachments: David_Scharff.vcf

David_Scharff.vcf
(430 B)

Scott,

I have registered sheets B&C for Prince of Wales (OPR-O190-KRL-07) using the new sub locality names recommended. Let me know if you have any questions.

H11660 (Sheet B) - "San Alberto Bay"

H11661 (Sheet C) - "East of San Alberto Bay"

Regards,
Dave

APPROVAL SHEET
H11660

Initial Approvals:

The survey evaluation and verification has been conducted according to branch processing procedures and the HCell compiled per the latest OCS HCell Specifications.

Katie Reser
2011.03.28
12:57:32 -07'00'

The survey and associated records have been inspected with regard to survey coverage, delineation of the depth curves, development of critical depths, S-57 classification and attribution of soundings and features, cartographic characterization, and verification or disproval of charted data within the survey limits. The survey records and digital data comply with OCS requirements except where noted in the Descriptive Report and are adequate to supersede prior surveys and nautical charts in the common area.

Digitally signed by
Kurt Brown
Date: 2011.03.28
12:44:50 -07'00'

I have reviewed the HCell, accompanying data, and reports. This survey and accompanying digital data meet or exceed OCS requirements and standards for products in support of nautical charting except where noted in the Descriptive Report.

Digitally signed by Gary C. Nelson
DN: cn=Gary C. Nelson, o=NOAA,
ou=Pacific Hydrographic Branch,
email=gary.nelson@noaa.gov,
c=US
Date: 2011.03.28 13:32:43 -07'00'

David Scharff
2011.04.07 14:11:52 -04'00'