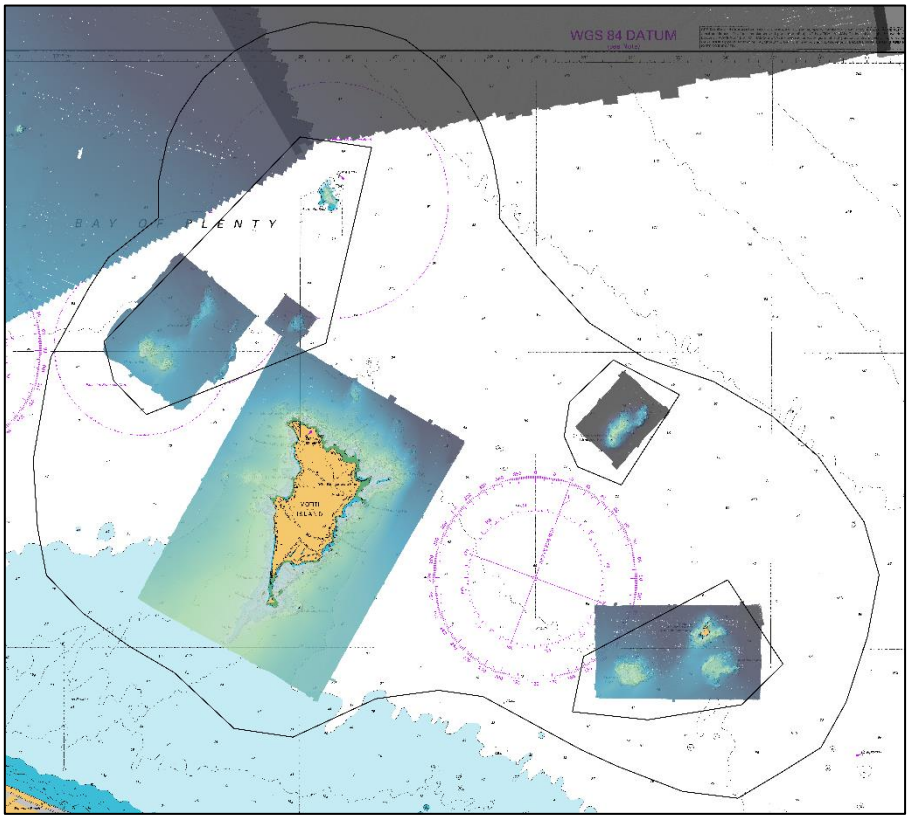
TECHNICAL REPORT

Motiti Natural Environment Management Area

Desktop Scoping Study of Existing Bathymetric Data



Prepared for the Bay of Plenty Regional Council

BAY OF PLENTY REGIONAL COUNCIL TOI MOANA

Prepared by Discovery Marine Limited

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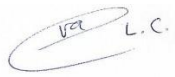
Author		Date: 16 August 2021
Data Scientist	Eva Lichtenberg Cloo	
Checked by		Date: 16 August 2021
Surveyor in Charge	James Van der Pauw *CPHS1, BSurv*	
Approved by		Date: 16 August 2021
Project Manager	Bruce Wallen	

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WORKS CITED

Rowden, A.A.; Lundquist, C.J.; Hewitt, J.E.; Stephenson, F.; Morrison, M.A. (2018). Review of New Zealand's coastal and marine habitat and ecosystem classification. NIWA Client Report 2018115WN, prepared for Department of Conservation. 75 pp.

Federal Geographic Data Committee (2012). Coastal and Marine Ecological Classification Standard. FGDC-STD-018-2012

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1. INTRODUCTION

Discovery Marine Limited (DML) was contracted by the Bay of Plenty Regional Council (BoPRC) to undertake a desktop scoping study of existing bathymetric data in Motiti Natural Environment Management Area (NEMA).

This report will focus on seven historic datasets that are within, or overlap with, Motiti NEMA. The area that Motiti NEMA encompasses is shown below in Figure 1, with the smaller areas representing the three Motiti Protection Areas.

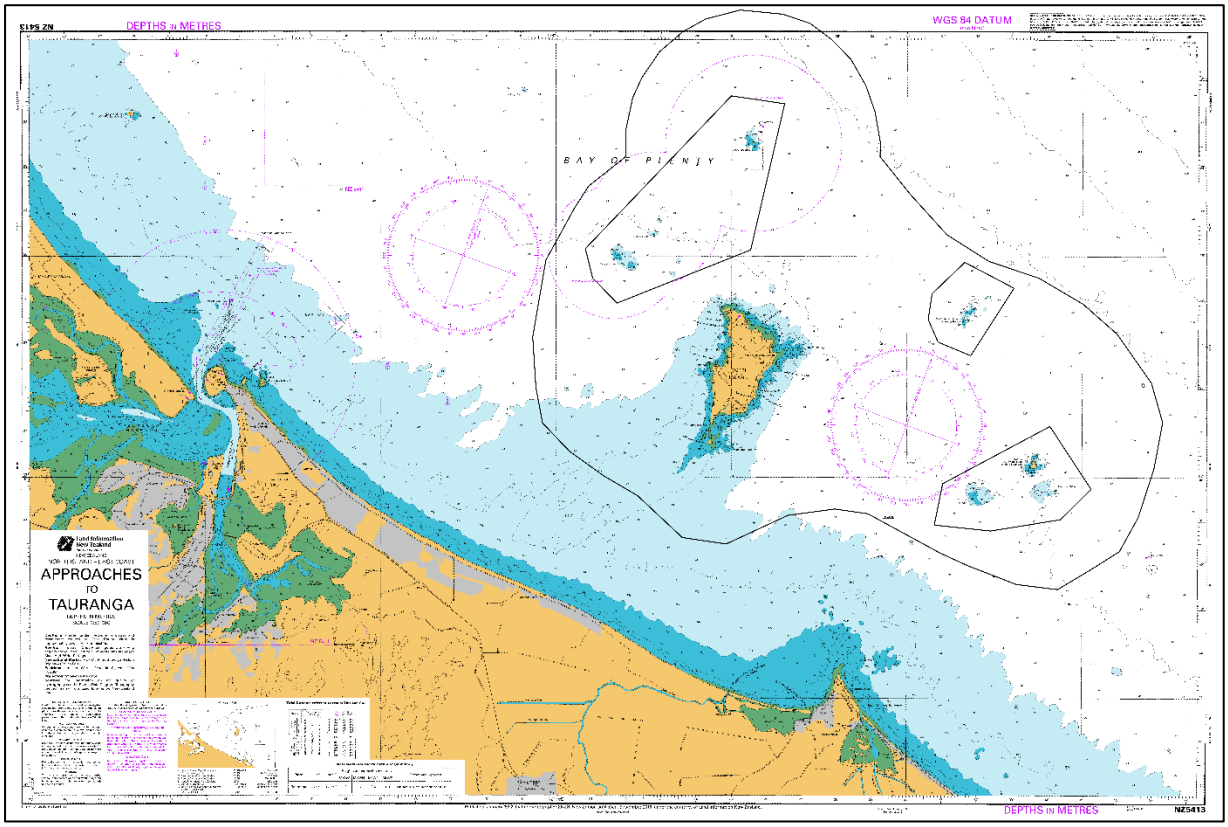


Figure 1 – Motiti NEMA (outer black area) and Motiti Protection Areas (inner black areas).

Datasets were collected from 1960 to 2013 and are varied in collection method. Most of the data provided in this report was supplied by Land Information New Zealand (LINZ) through the LINZ Data Service and is licensed for reuse under the Creative Commons BY 4.0 licence.

The exception to data available for use under the creative commons licence is the side scan dataset, which is owned by Seaworks Ltd, New Zealand.

2. AVAILABLE DATASETS

2.1 HS39 – BAY OF PLENTY HYDROGRAPHIC SURVEY

HS39 is a multibeam echo sounder (MBES) survey which was carried out by IXSurvey for LINZ in 2012 and 2013. The purpose of this project was to provide a validated hydrographic dataset of discrete areas within the Bay of Plenty, as can be seen in Figure 2. Seafloor backscatter data is available for shallow areas of this survey undertaken with SMB ELAINE but not for deeper areas due to a logging failure during the survey, refer to Figure 3.

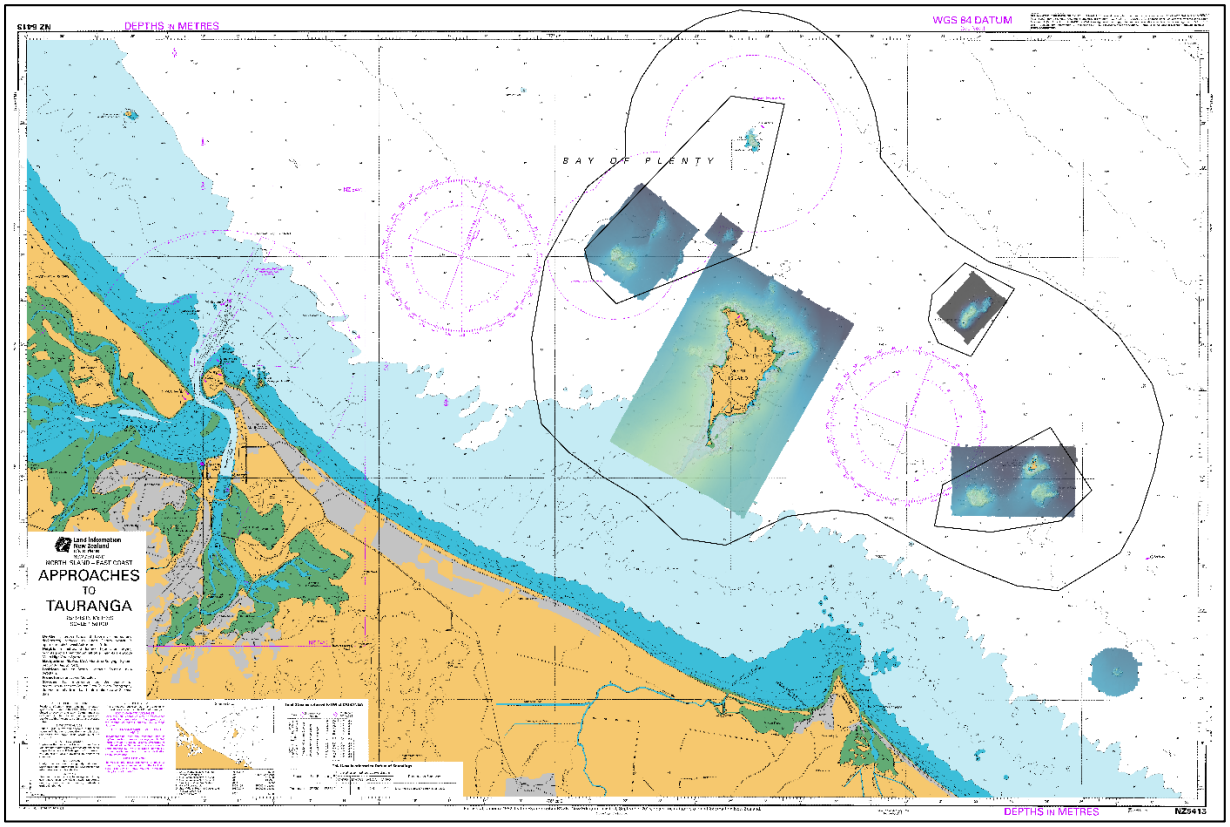


Figure 2 – HS39 Bathymetry Survey Extent in Relation to Motiti NEMA

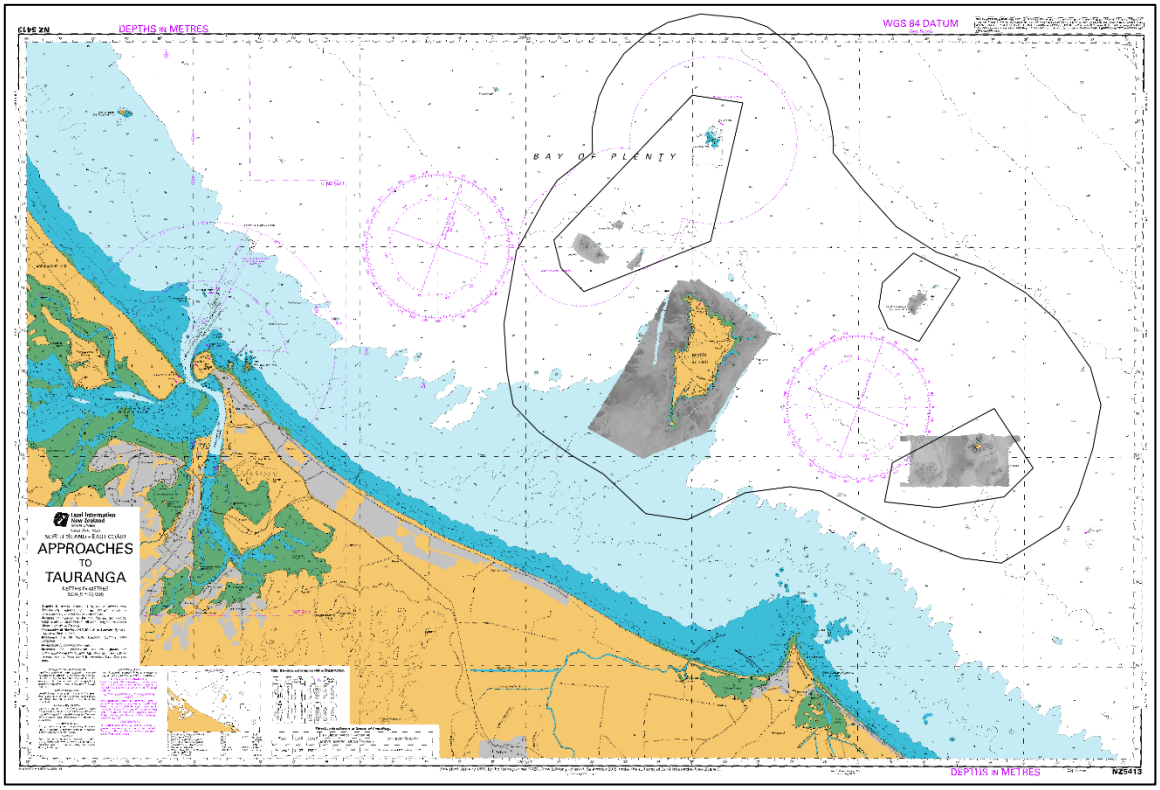


Figure 3 – HS39 Backscatter Survey Extent

Table 1: Summary Information of HS39 Survey

Surveyed By	IXSurvey
Survey Dates	October 2012 – March 2013
Platform Used	SMB ELAINE & MV TRANQUIL IMAGE
Equipment Used	**MBES:** Kongsberg EM3002D **Motion Reference Unit:** IXSEA ROVINS INS & Applanix POS MV 320 **Positioning:** Fugro MarineSTAR 9205
Depth Accuracy	+/- 0.38m (@ 50m water depth)
Horizontal Accuracy	+/- 0.22m (everywhere)
Data Available	2m and 5m bathymetric grids Backscatter* (Full resolution GSF data acquired so 1m grid resolution possible.)
Original Coordinate Reference System	WGS84 UTM60S
Notes	*Backscatter not collected with MV TRANQUIL IMAGE. Only shallow water backscatter available. Divers used for shoal confirmation over Okaparu Reef & Brewis Shoal. One charted & well-known wreck SE of Motiti Island – former tug TAIOMA.

2.2 HS35 - WHITIANGA HARBOUR BATHYMETRIC LIDAR

HS35 is an Airborne Laser Bathymetric (ALB) LiDAR survey of Whitianga Harbour and Motiti Island. It was carried out by Fugro LADS Corporation for LINZ in 2013. The purpose of this project was to deliver ALB data across Motiti Island with 100% coverage and at a point density of 2.5 x 2.5m. Survey extents can be seen below in Figure 4, with accompanying information in Table 2.

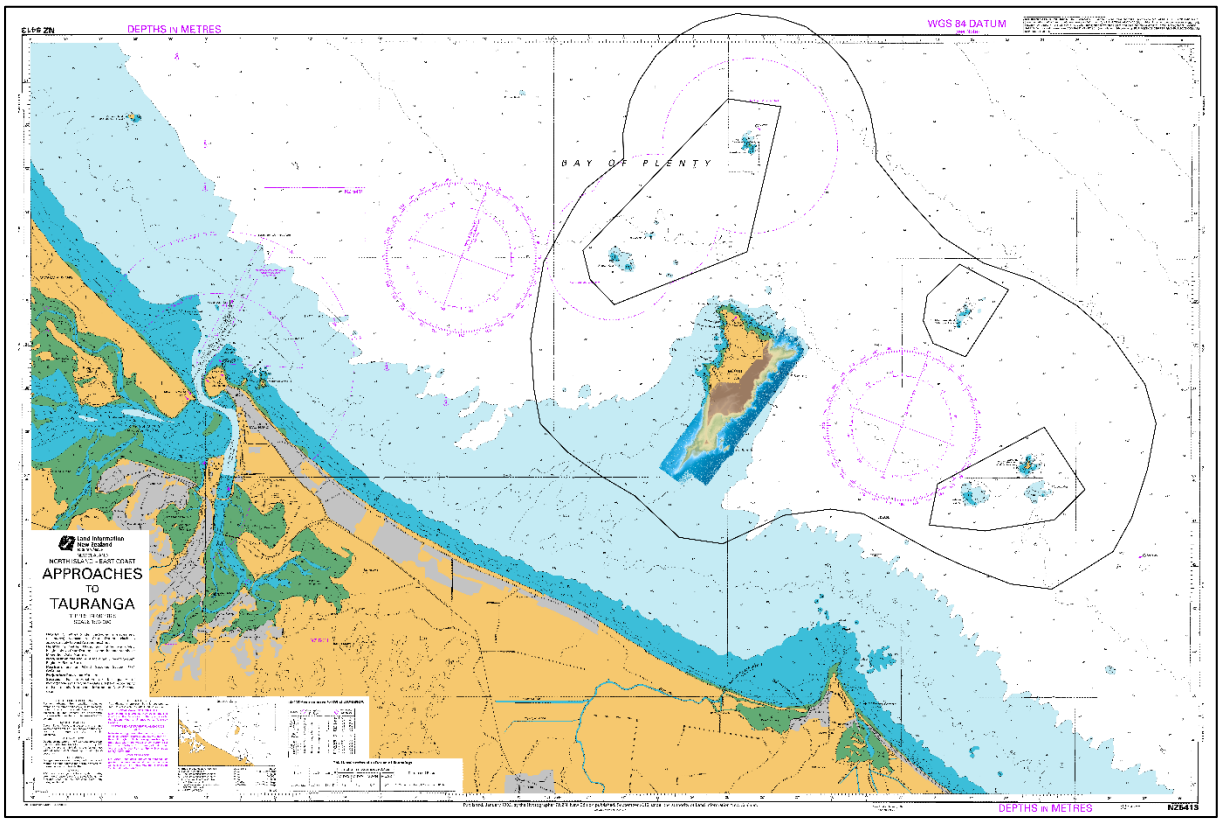


Figure 4 – HS35 ALB LiDAR Survey Extent in Relation to Motiti NEMA

Table 2: Summary Information of HS35 Survey

Surveyed By	Fugro LADS Corporation
Survey Dates	May 2013
Platform Used	Corporate Air Cessna 441 Aircraft VH-VEH
Equipment Used	**LiDAR:** Fugro LADS Mk3 & Riegl VQ-820-G **Motion Reference Unit:** Applanix POS AV 610 V5 **Positioning:** WADGPS, DGPS & KGPS
Depth Accuracy	+/- 0.47m (@ 10m water depth)
Horizontal Accuracy	+/- 3.85m (@ 30m water depth)
Data Available	2p5m bathymetric and topographic grid Raw .las files
Original Coordinate Reference System	WGS84 UTM60S

2.3 BENTHIC PHOTOGRAPHIC PROFILING

Benthic photographic profiling of the Bay of Plenty's Coast occurred in 2015 as part of a collaborative research project by University of Waikato and University of Bremen. An area of 65km x 7km between 2m and 35m water depth was surveyed. This was done with a bottom-towed sled equipped with a high-resolution camera for continuous close-up seafloor photography. The aim of this survey was to create detailed lithofacies and bedform distribution maps and to derive regional sediment transport patterns. The lines in Figure 5 below represent the benthic photographic profiles.

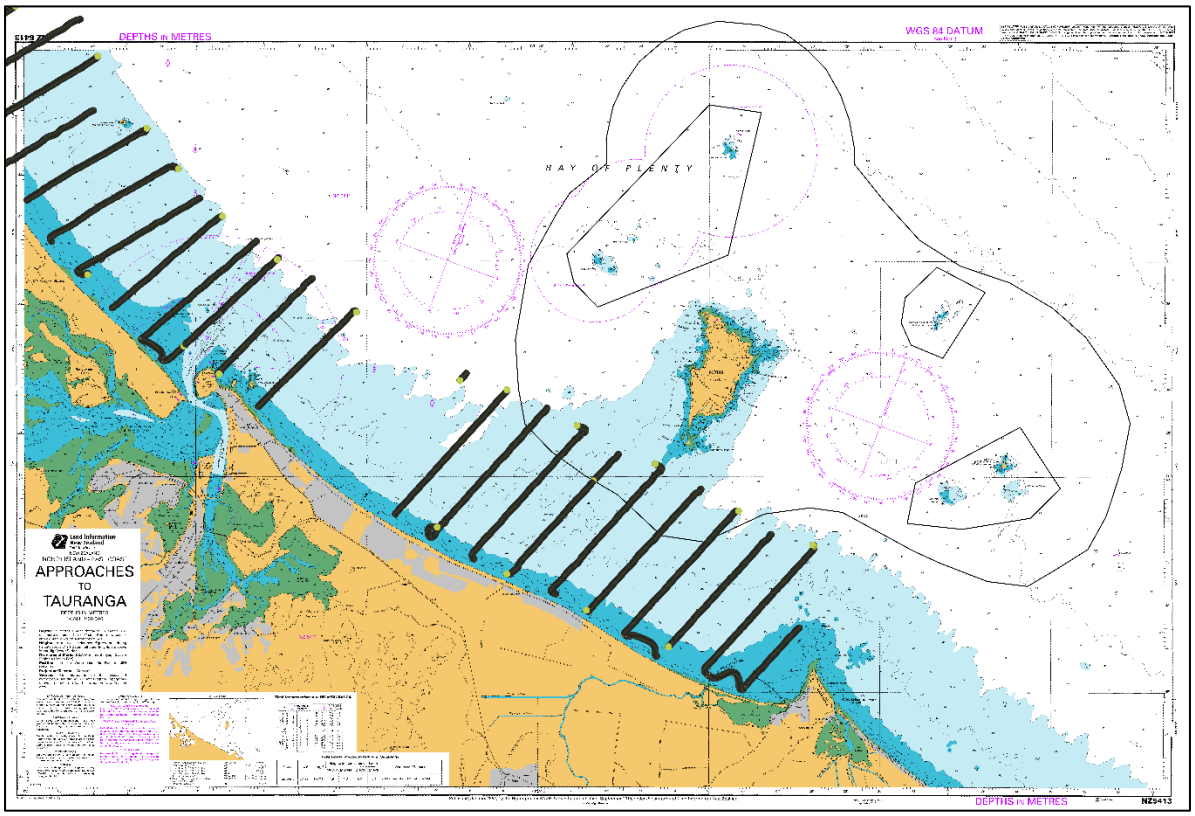


Figure 5 – Benthic Photographic Profiling Extent in Relation to Motiti NEMA

Table 3: Summary Information of the Benthic Photographic Profiling

Surveyed By	University of Waikato & University of Bremen
Survey Dates	2015
Platform Used	MV MACY GRAY
Equipment Used	**Ship-towed Sled:** Benthic Profiler NERIDIS III **Positioning:** Shipboard GPS System **Camera:** AVT Prosilica GC450C **MBES:** WASSP WMB-3250
Depth Accuracy	-
Horizontal Accuracy	-
Data Available	Images in PNG format & XYZ locations QGIS Project
Original Coordinate Reference System	WGS84

2.4 SIDESCAN BACKSCATTER

Acoustic sidescan (SSS) backscatter data was collected by Seaworks Limited in 2012 for Unimar. The area surveyed covers regions deeper than 10m, with 500m line spacing, in five corridors where containers were likely to have moved to. The purpose of this survey was to support the Rena Recovery Programme and Container Salvage Effort. The full report for this survey is not available so supporting information is limited. The extent of SSS data can be seen below in Figure 6.

Note: This dataset is owned by Seaworks Ltd, so reuse of this data in a public domain will require the written permission of Seaworks Ltd.

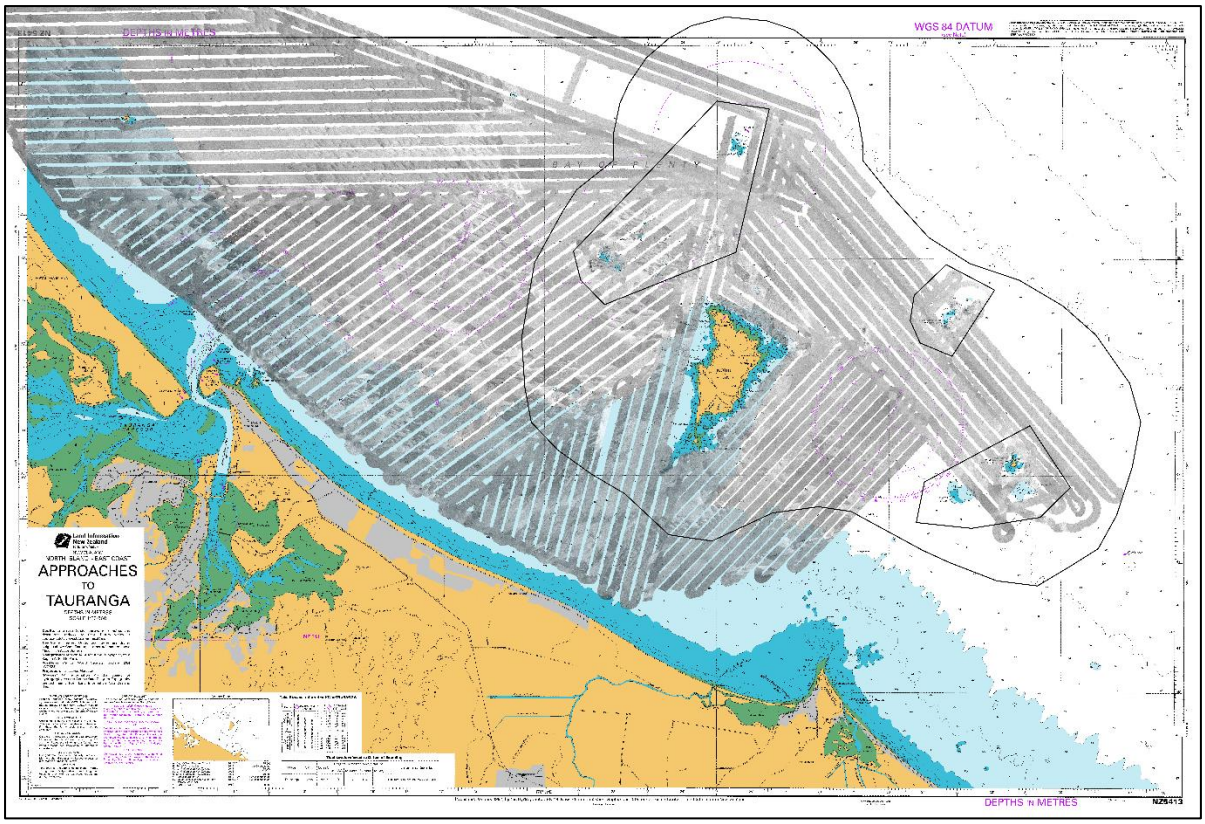


Figure 6 – Sidescan Backscatter Survey Extent in Relation to Motiti NEMA

Table 4: Summary Information of Sidescan Backscatter data

Surveyed By	Seaworks Ltd.
Survey Dates	2012
Platform Used	SEA SURVEYOR
Equipment Used	**SSS:** Edgetech Sidescan sonar
Depth Accuracy	-
Horizontal Accuracy	-
Data Available	5m Backscatter mosaic
Original Coordinate Reference System	WGS84

2.5 1008 SHIPPING LANE 1 – TAURANGA APPROACHES

LINZ Project 1008, Shipping Lane One (SL1), was a MBES survey of an offshore corridor running from Cape Reinga in the North to Tauranga in the south, with routes running into the major ports of Whangarei, Auckland, and Tauranga. This dataset covers the final block of the Shipping Lane 1 work, being the Eastern and Western Approaches to Tauranga, and was carried out by the New Zealand Defence Force (NZDF) for LINZ in 2004.

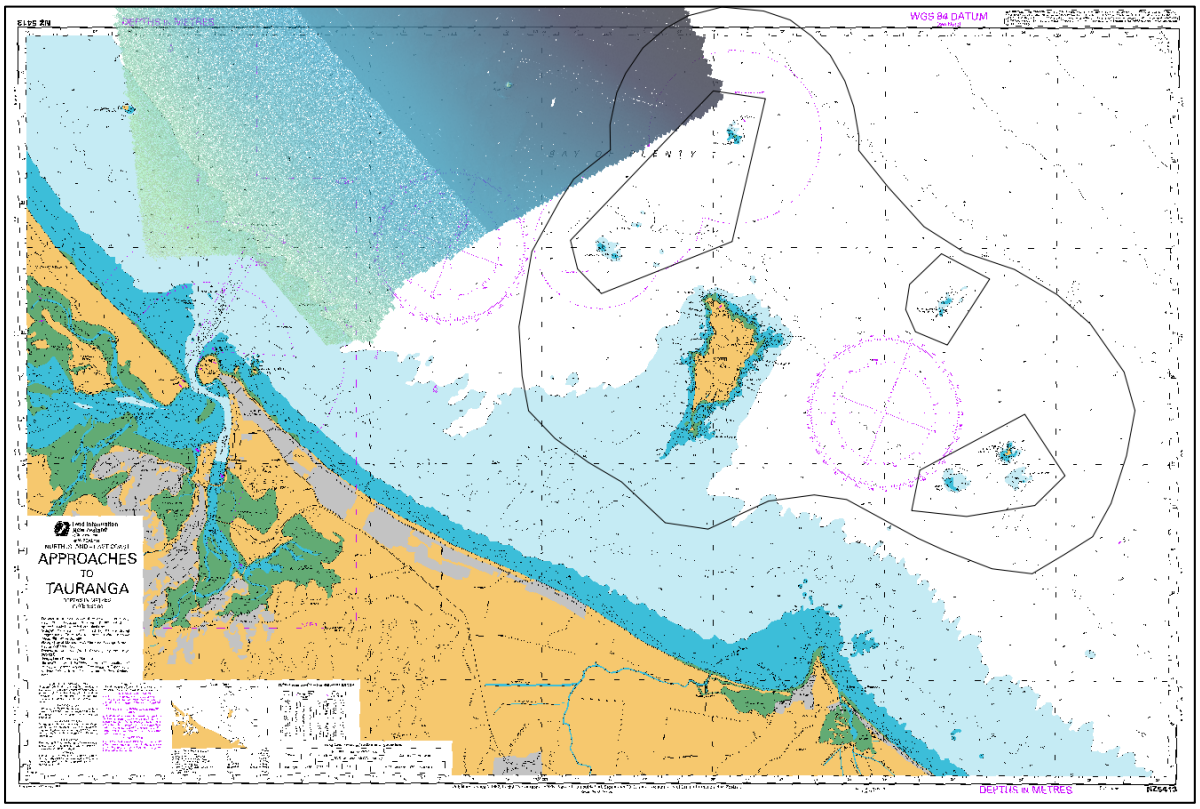


Figure 7 – SL1 Bathymetry Survey Extent in Relation to Motiti NEMA

Table 5: Summary Information of SL1 Survey

Surveyed By	NZDF Joint Geospatial Support Facility
Survey Dates	April – September 2004
Platform Used	HMNZS RESOLUTION
Equipment Used	**MBES:** STN ATLAS Fansweep 20/200 FS20 **Motion Reference Unit:** POS/MV 320 **Positioning:** C-Nav dual-frequency GPS
Depth Accuracy	+/- 0.44m (@ 50m water depth)
Horizontal Accuracy	+/- 3.12m (@ 50m water depth)
Data Available	5m Bathymetric Grid
Original Coordinate Reference System	WGS84 UTM60S

2.6 1011 SHIPPING LANE 4 – NAPIER TO TAURANGA

LINZ Project 1011, Shipping Lane 4 (SL4), was a MBES survey of the shipping lane from Napier to Tauranga. This dataset covers the first phase of data collection in the Bay of Plenty region. The survey was carried out by the NZDF for LINZ in 2005-2006.

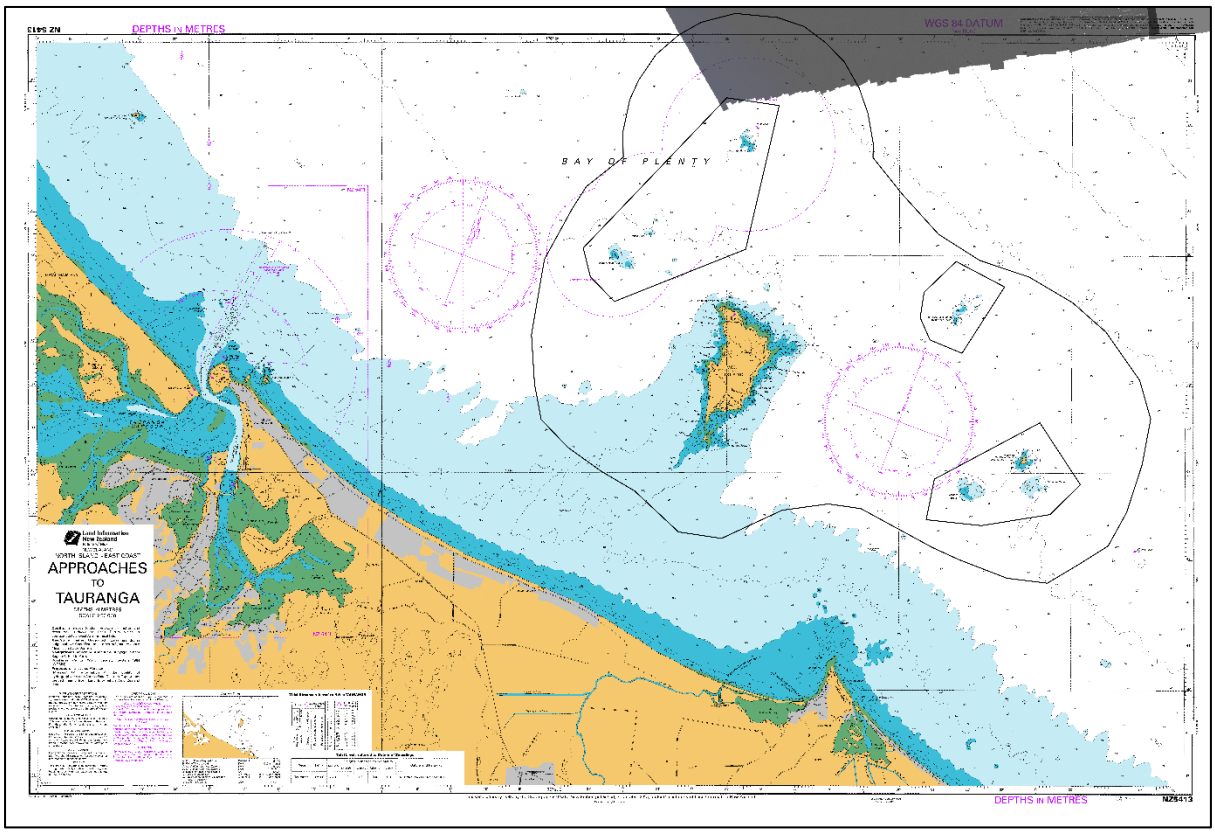


Figure 8 – SL4 Bathymetry Survey Extent in Relation to Motiti NEMA

Table 6: Summary Information of SL4 Survey

Surveyed By	NZDF Joint Geospatial Support Facility
Survey Dates	September 2005 – June 2006
Platform Used	HMNZS RESOLUTION
Equipment Used	**MBES:** STN ATLAS Fansweep FS20 (shallow water) & ATLAS Hydrosweep MD2/30 (medium depth) **Motion Reference Unit:** POS/MV 320 **Positioning:** C-Nav dual-frequency GPS
Depth Accuracy	+/- 0.49m (@ 60m water depth)
Horizontal Accuracy	+/- 3.00m (@ 60m water depth)
Data Available	10m & 20m Bathymetric Grids
Original Coordinate Reference System	WGS84 UTM60S

2.7 NAUTICAL CHART NZ5413 - SOURCE H

This survey was undertaken by the NZDF in 1960. The vessel used, HMNZS LACHLAN, was also known as the "White Ghost of the Coast" and surveyed 50% of New Zealand's coast between 1950 and 1975. No report is available for this survey so supporting information is limited. Semi-transparent georeferenced sounding sheets from the survey can been seen in Figure 9 below

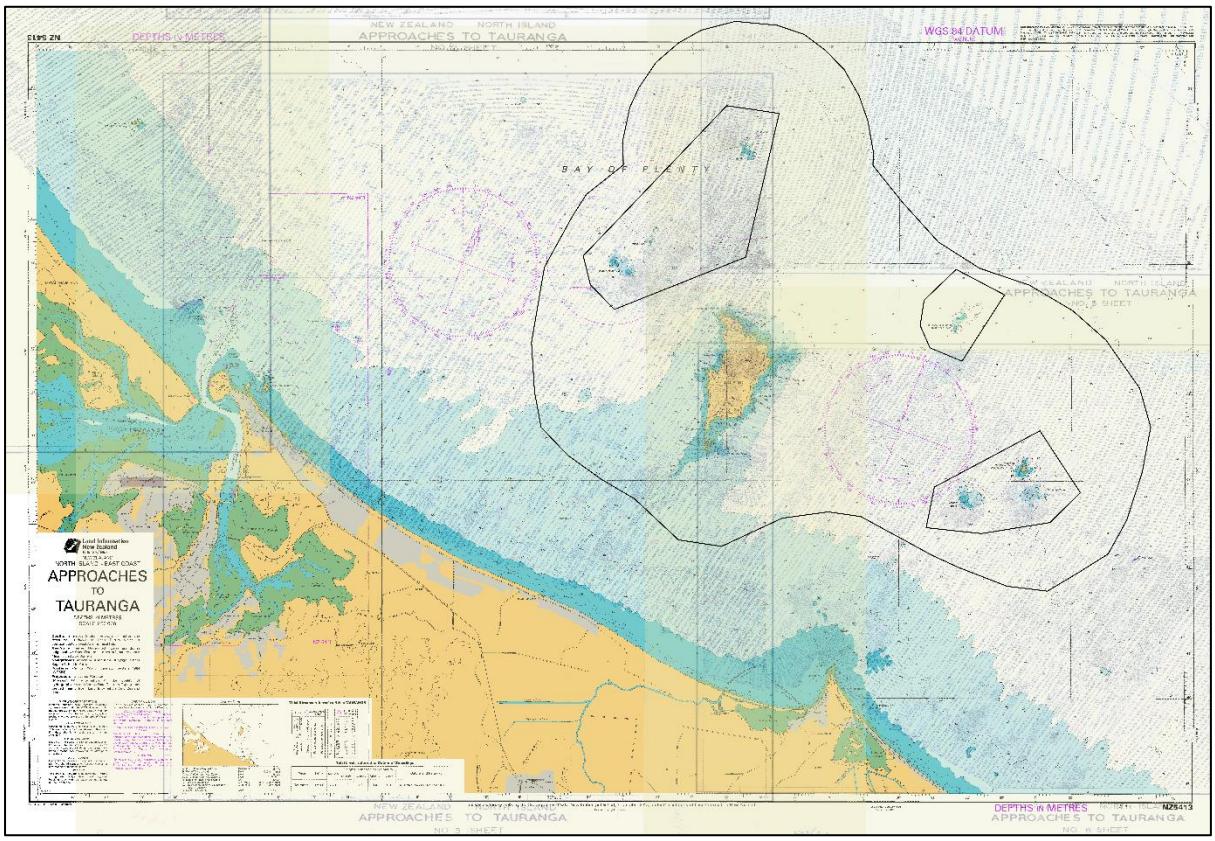


Figure 9 – Source H Bathymetric Survey Extent in Relation to Motiti NEMA

Table 7: Summary Information of Source H Survey

Surveyed By	NZDF
Survey Dates	1960
Platform Used	HMNZS LACHLAN
Equipment Used	**Depth Measurement:** Analogue Single beam echosounder with manual charted depth plotting. Soundings in fathoms. **Positioning:** Likely sextant observation/ run lines.
Depth Accuracy	-
Horizontal Accuracy	-
Data Available	Sounding sheets TIFFs
Original Coordinate Reference System	WGS84
Notes	These sounding sheets (source H) make up the oldest underlying data for Nautical Chart NZ5413.

3. DATA USEFULNESS

This section covers the useability of each dataset for identifying areas of structural complexity not previously mapped. Factors worth considering are age of data, technology used, reliability, resolution, and survey extent.

3.1 HS39 – BAY OF PLENTY HYDROGRAPHIC SURVEY

This dataset is gold-standard when it comes to hydrographic surveying. It is relatively new, collected with state-of-the-art technology, and collected by a trusted LINZ hydrographic surveying panel member. The resolution of the dataset is detailed enough for determining areas of structural complexity. This is further aided by the fact that seafloor backscatter information was collected for shallow areas (Figure 10). Slope and rugosity layers are also provided in the data pack and will be useful for habitat classification (Figure 11 & 12). It is recommended that additional data collection in these areas is unnecessary.

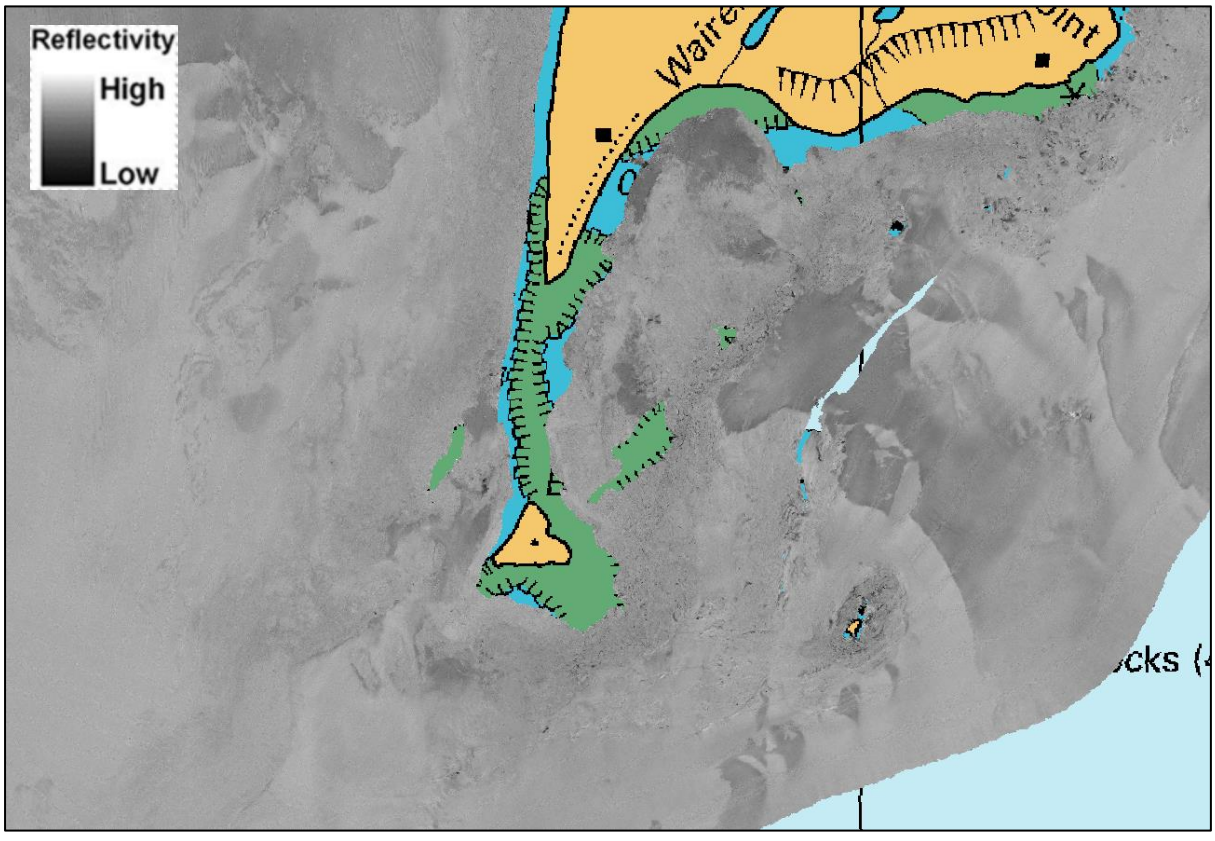


Figure 10 – HS39 Backscatter example of southern Motiti Island

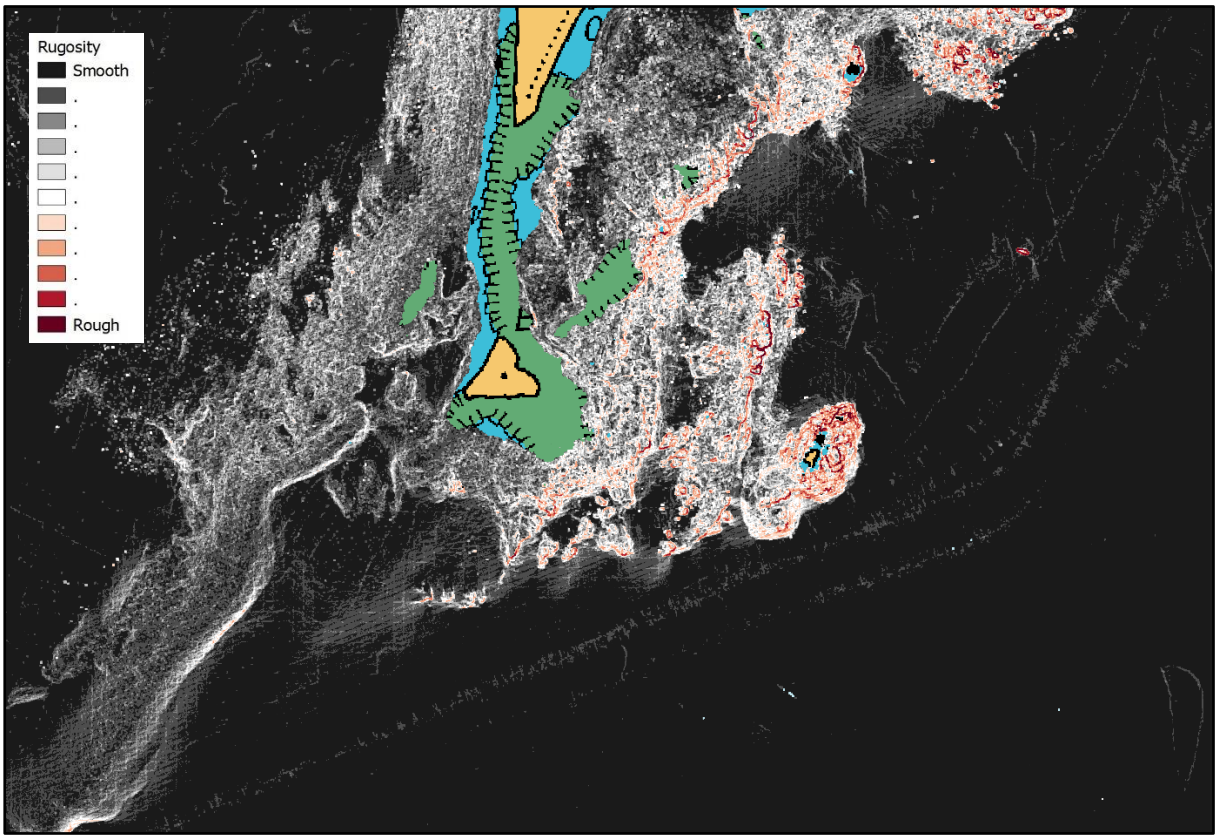


Figure 11 – HS39 Rugosity Surface example of southern Motiti Island

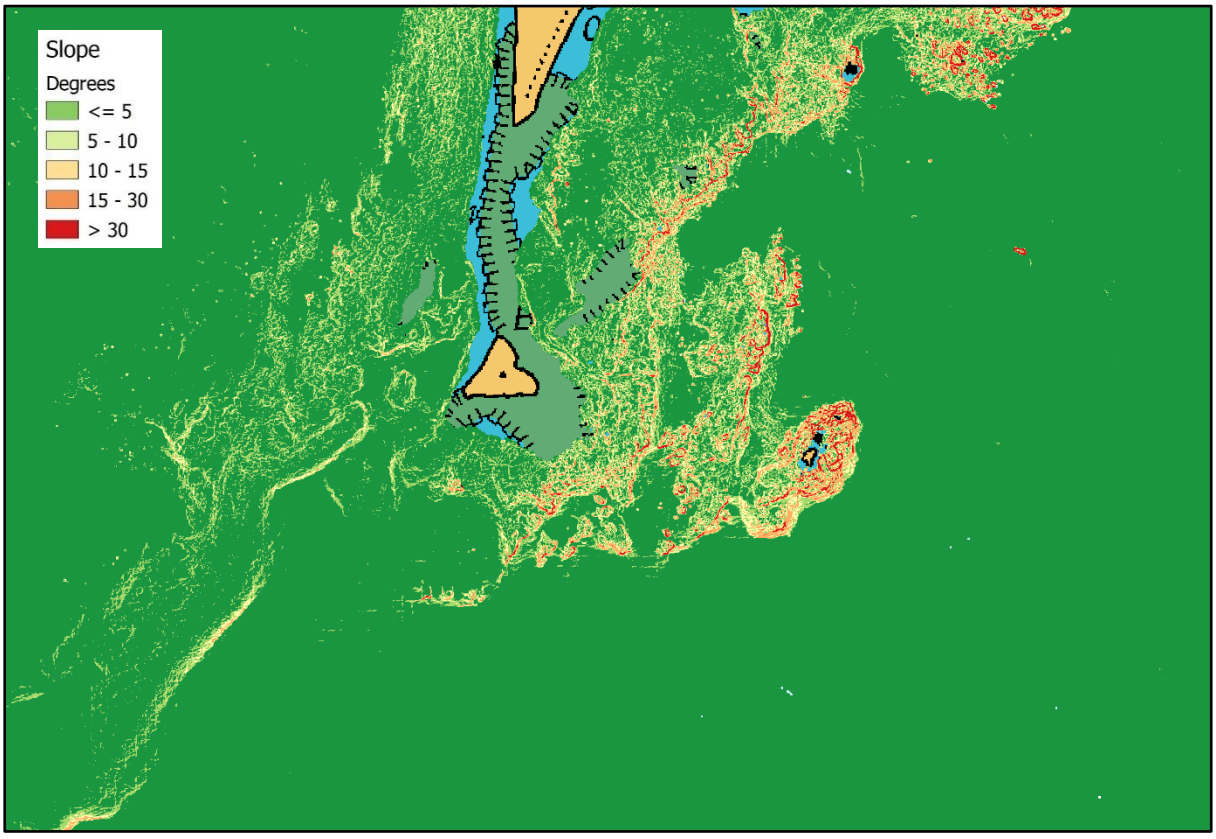


Figure 12 – HS39 Slope Surface example of southern Motiti Island

3.2 HS35 - WHITIANGA HARBOUR BATHYMETRIC LIDAR

Where HS35 LiDAR data overlaps with HS39 MBES data, the MBES data is more reliable, useful, and higher resolution. The LiDAR data will be useful in the gap between the HS39 MBES data, which stops at approximately 2m water depth, and the coastline (Figure 13). This littoral zone is notoriously difficult to collect information on and the LiDAR data is good enough to make informed decisions on structural complexity.

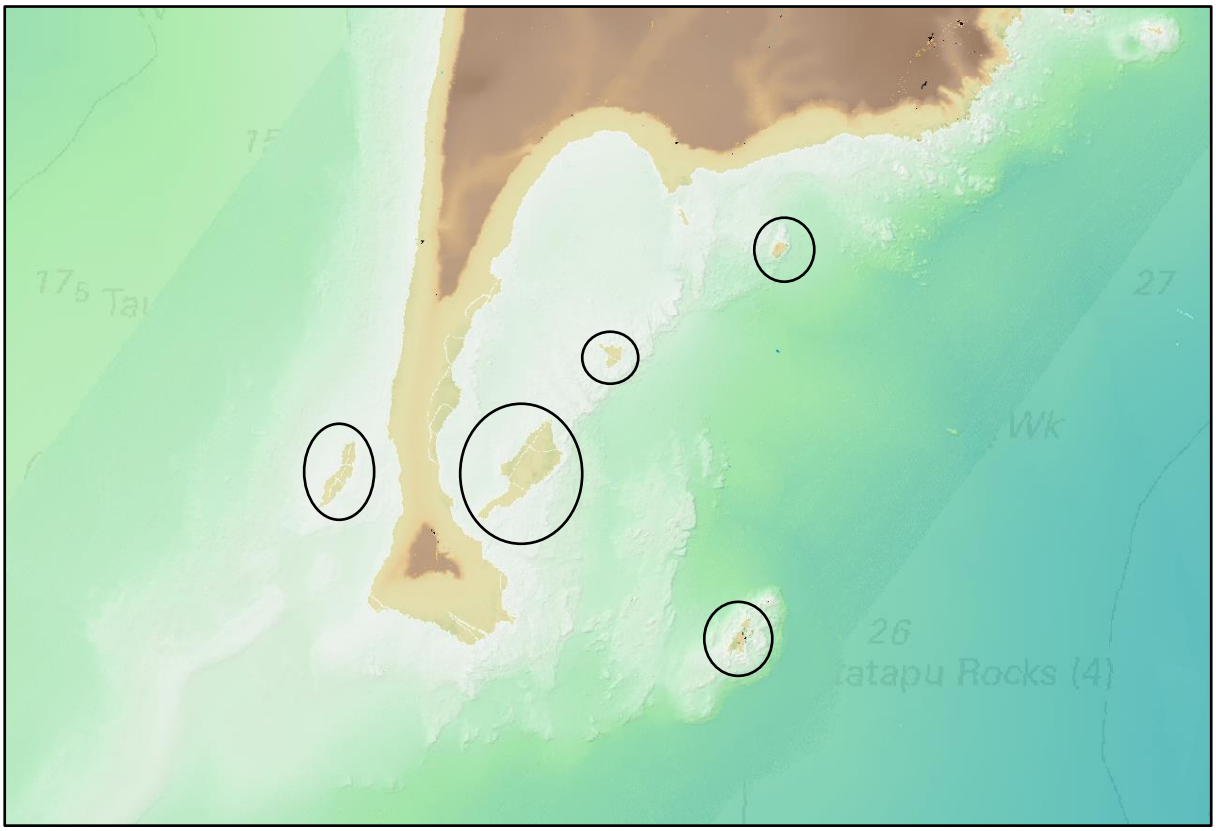


Figure 13 – HS35 LiDAR (brown) with HS39 MBES (light blue) overlaid. Areas circled represent the gap between MBES data and the coastline, covered by LiDAR.

3.3 BENTHIC PHOTOGRAPHIC PROFILING

This dataset only covers a small southern section of Motiti NEMA with six narrow transects. In saying that, the georeferenced images are very beneficial for confirming the substrate and benthic communities. All photos within Motiti NEMA display coarse dark sand with broken shell and intermittent rock and seaweed. In Table 8 below are snips of interesting features taken from the 35,000 images within Motiti NEMA.

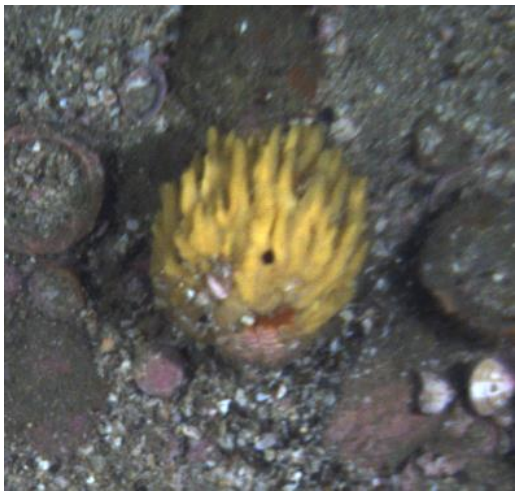
Table 8: Feature of interest within Motiti NEMA & Accompanying Image Filenames

2012_11_24_23_08_34_145.png

2012_11_24_23_08_30_346.png

2012_11_24_23_08_49_341.png

2012_11_24_02_46_06_190.png



2012_11_24_03_16_14_286.png

2012_11_24_03_17_10_880.png

2012_11_24_03_17_22_083.png

2012_11_24_03_18_16_485.png

2012_11_24_03_20_47_483.png

2012_11_24_03_21_56_665.png

2012_11_24_03_27_07_079.png

2012_11_24_03_28_39_478.png

3.4 SIDESCAN BACKSCATTER

The SSS backscatter data was collected for the identification of containers from MV RENA following its grounding on the Astrolabe reef. The dataset is low resolution and is 'striped' rather than 100% seafloor coverage. While the SSS mosaic is not suitable for determining small scale structural complexities it is useful for identifying large areas of seafloor structure and areas of interest for further investigation.

Sidescan backscatter measures the reflectivity of the seafloor, with harder objects such as rock or coarse sand returning more energy and showing up as lighter colours in the mosaic. The opposite is true for softer surfaces such as mud or clay. Figure 14 below is an example of structural complexity portrayal in this type of dataset.

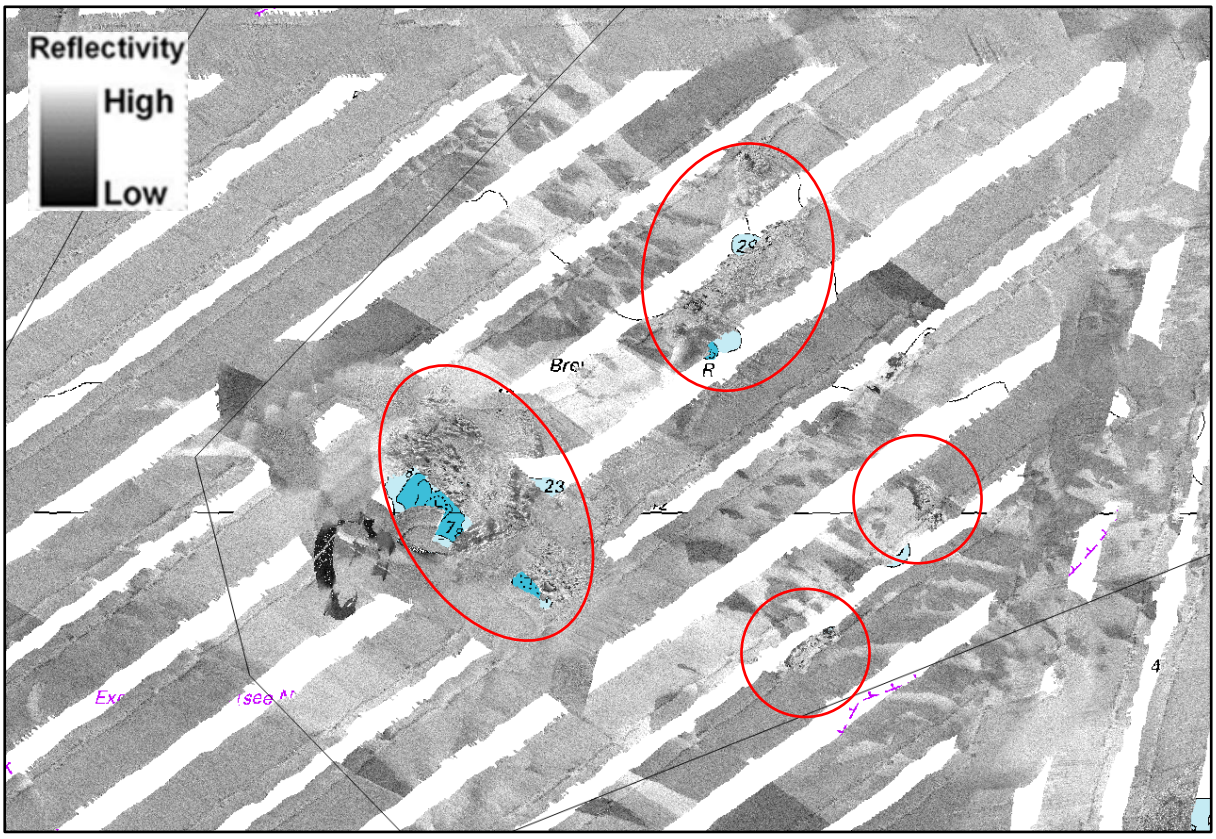


Figure 14 –Backscatter mosaic with differing substrates illustrated by the different shades of grey. Examples of areas of structural complexity circled.

3.5 1008 SHIPPING LANE 1 – TAURANGA APPROACHES

This dataset only covers a small northern portion of Motiti NEMA. It is useful for disproving structural complexity in the area surveyed.

3.6 1011 SHIPPING LANE 4 – NAPIER TO TAURANGA

Same as above.

3.7 NAUTICAL CHART NZ5413 - SOURCE H

The georeferenced sounding sheets are the only datasets that cover all Motiti NEMA. In saying that, it is very old data and was collected when hydrographic surveys in New Zealand were completed by a labour-intensive methodology of pairing simultaneous sextant observations for positioning, with analogue echosounder depths (recorded in fathoms).
It is useful for identifying potential areas of interest as shoal areas were often more densely sounded as illustrated in Figure 15 below. Whether or not these areas can be reliably found in the field is uncertain.

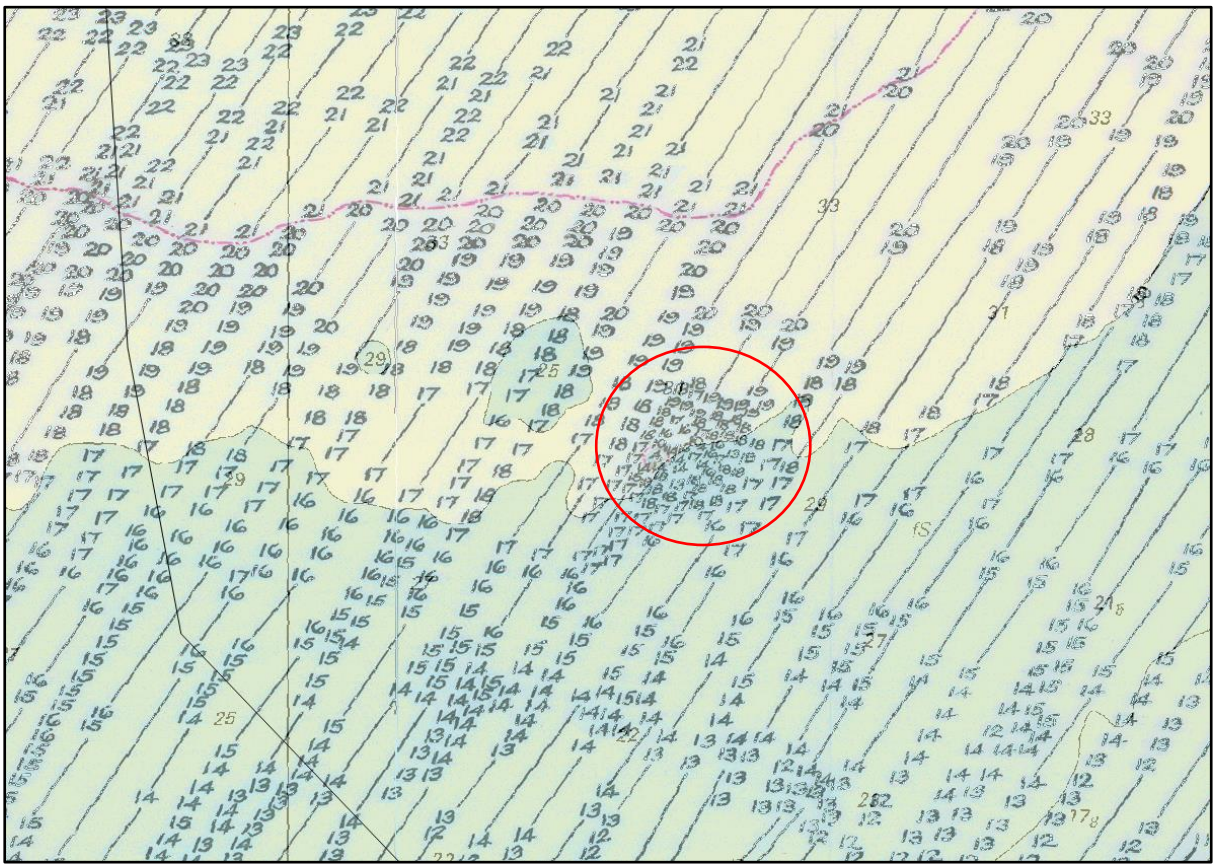


Figure 15 – Sounding sheet over modern-day chart. Shoal area of interest circled.

4. PRIORITY AREAS FOR FUTURE WORK

Outlined below in Figure 16 are suggested priority areas for future mapping in Motiti NEMA. The areas are numbered 1 to 3 according to priority and reliability of source data. All data sources mentioned in Sections 3 and 4 above have been used to make the following inferences.

Top priority areas are labelled with the number "1" and have been delineated using the Motiti Protection Area boundaries and MBES data already available in these areas. Note; If full MBES backscatter is required to cover the Motiti Protection areas then the number one priority areas would increase by approx. 25% (due to missing HS39 backscatter for deeper areas).

Priority "2" areas have been selected using SSS backscatter data and focus on areas of high diversity in seafloor reflectance, usually representing reef structure. Lastly, priority "3" areas have been delineated using the georeferenced sounding sheets (source H - 1960) where shoals or densely clustered soundings were evident.

All other areas within Motiti NEMA are lower priority but would be good to survey at some stage for data completeness. A baseline dataset of the whole area would be ideal for change monitoring, as well as supplementary data such as water column analysis or videos over fish "hotspots".

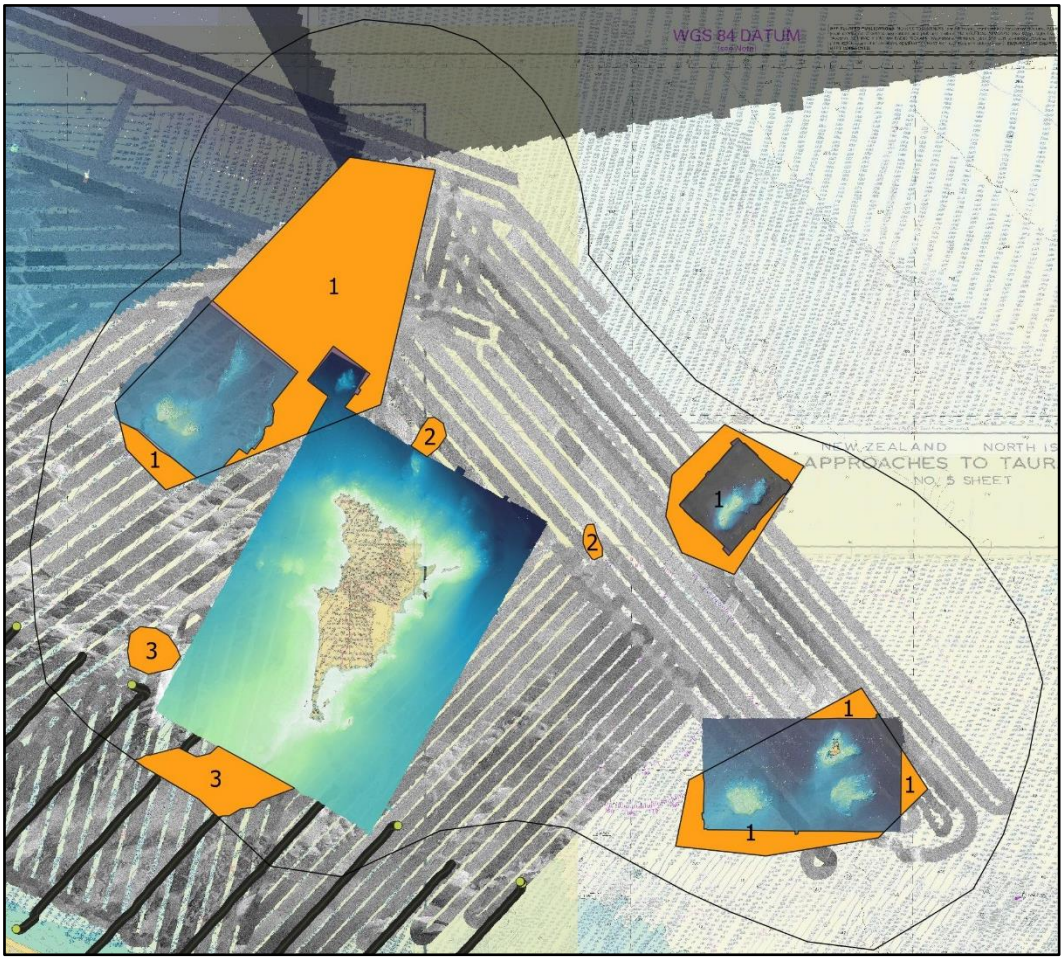


Figure 16 – Areas of Interest for Future Mapping in orange. Different data layers shown underneath.

5. DATA PACK

A data pack accompanies this report. Deliverables within the data pack are outlined in Table 6 below. All data is delivered in the New Zealand Transverse Mercator (NZTM) coordinate reference system.

Table 9: Summary of Data Delivered

Required Deliverables	Directory	File Name	Data Format
Summary Report	Supporting_Documents	2130_BOPRC_MotitiBathyDesktopStudy_Report	.pdf
Historic Reports	Supporting_Documents	1_HS39 – Report of Survey – Ver 2.0 2_LINZ_HYD-2012_13_01_HS35_Whitianga_Harbour_NZ… 3_Kulgemeyer 2016 Lithofacies distribution and sediment… 5_SL1 Tauranga Approaches ROS 6_SL4 Report of Survey Bay of Plenty Area – Phase 1	.pdf
XYZ	1_HS39_HydroSurvey 2_HS35_LiDARSurvey 5_1008_ShippingLane1 6_1011_ShippingLane4	*Location_Resolution*_XYZ_NZTM	.csv
TIFF (bathy) + legend	1_HS39_HydroSurvey 2_HS35_LiDARSurvey 5_1008_ShippingLane1 6_1011_ShippingLane4	*Location_Resolution*_NZTM	.tiff
TIFF (mosaic*) + legend	1_HS39_HydroSurvey 4_SidescanBackscatter	*Type*_Backscatter_NZTM	.tif
TIFF (rugosity**) + legend	1_HS39_HydroSurvey 2_HS35_LiDARSurvey 5_1008_ShippingLane1 6_1011_ShippingLane4	*Location_Resolution*_NZTM_Rugosity	.tif
TIFF (slope***) + legend	1_HS39_HydroSurvey 2_HS35_LiDARSurvey 5_1008_ShippingLane1 6_1011_ShippingLane4	*Location_Resolution*_NZTM_Slope	.tif
TIFF (chart)	7_NZ5413_SourceH	SoundingSheet*X*_SourceH_NZTM	.tif
PNG (geotagged)	3_BenthicPhotographicProfiling	YYYY_MM_dd_Photo ID.png	.png
SHP	8_AreasOfInterest	AreasOfInterest.shp	.shp

*A backscatter mosaic is a georeferenced, greyscale image of seabed reflectivity in which tone and texture are representative of the nature and geomorphology of the seafloor.
**Seafloor rugosity is a georeferenced image of the degree of irregularity of the surface. It is computed using the elevation layers largest inter-cell difference of a central pixel and its surrounding cell.
*** Seafloor slope is a georeferenced image of the angle of inclination from the horizontal and is also generated from the elevation raster.

6. RETENTION OF DATA

DML will retain copies of the project deliverables, including source data files, on its servers for a period of 12 months from completion of the project. The data will then be archived to a digital medium and retained for 7 years. After the initial 12-month period client requests to access and supply project data will incur a fee.

DML wishes to thank Bay of Plenty Regional Council for the opportunity to undertake this project and looks forward to working with you again in the future.