



Pilbara Ports Authority

Provision of Positioning Services
Karratha AMSA DGPS Base Station

HYDROGRAPHIC SURVEY REPORT

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 <p>Precision Hydrographic Services Pty Ltd 10 Ragless St St Marys, SA Australia 5042 Tel: +61 (0)8 7120 2211 info@precisionhydrographic.com.au</p>			 <p>Pilbara Ports Authority – Port Hedland Locked Bag 2 Port Hedland, WA Australia 6721 Tel: +61 0 (8) 9173 9000 info@pilbaraports.com.au</p>		

SUMMARY OF REVISIONS

Revision	Date	Actioned by	Summary
A	24/08/20	JB	Draft for Internal Review
0	27/08/20	JB	Issued for Client Review
1	27/08/20	JB	Issued after applying Client Comments
2	30/10/20	JB	Issued to include Integrity Monitor Position

COMPANY DESCRIPTION

PHS is a specialist hydrographic survey company with offices located in South Australia and the Pilbara. PHS specialise in conducting high accuracy hydrographic survey services supervised and approved by AHSCP certified Level 1 hydrographic surveyors. PHS has experience in all facets of producing high resolution multibeam surveys for safety of navigation, dredging and maintenance operations. PHS surveys are conducted to meet local, national and international standards.

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Precision Hydrographic Services Pty Ltd operates under Quality and Safety Management Systems certified ISO 9001:2015 and ISO 45001:2018 by ECAAS (JAS-ANZ registered).

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REFERENCES

1. PPA Hydrographic Survey Standards and Deliverables, Pilbara Port Authority, Version 8, 21/05/2020
2. AUSLIG Survey Report ‘AMSA DGPS Broadcasting Station – Karratha’, dated May 2000.

ABBREVIATIONS

The following abbreviations may appear in this document:

AHD	Australian Height Datum
AHO	Australian Hydrographic Office
AHSCP	Australasian Hydrographic Surveyor Certification Panel
AMSA	Australian Maritime Safety Authority
BM	Benchmark
CPHS1	Certified Professional Hydrographic Surveying (Level 1)
DGPS	Differential Global Positioning System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GRS80	Geodetic Reference System 1980
IHO	International Hydrographic Organisation
ITRF	International Terrestrial Reference Frame
kHz	Kilohertz
MGA	Map Grid of Australia
NTRIP	Network Transport of RTCM via Internet Protocol
PDOP	Position Dilution of Precision
PHS	Precision Hydrographic Services
PPA	Pilbara Ports Authority
QMS	Quality Management System
RTK	Real Time Kinematic (GPS/GNSS)
RINEX	Receiver Independent Exchange Format
SSM	State Survey Mark (Also called PSM – Permanent Survey Mark)
UTM	Universal Transverse Mercator
WA	Western Australia
WHS	Workplace Health and Safety
WGS84	World Geodetic System of 1984

Table 1: Abbreviations

A. INTRODUCTION

Precision Hydrographic Services (PHS) has been contracted by the Pilbara Ports Authority (PPA) to provide positioning services to determine the current position of the Karratha AMSA DGPS Base Station.

The post-processing of the GPS antenna positions has been conducted by FrontierSI. This report presents the methodology and results of the survey.

B. SURVEY METHODOLOGY

The following method was used to acquire data:

- A Trimble SPS 855 receiver was connected to the primary, secondary, and integrity monitor GPS antennas of the Karratha DGPS Base Station. Positioning data was logged in RINEX format for a 24-hour period.
- The PPA has a permanent RTK Base Station at the Dampier PPA Tower, 10km from the Karratha DGPS Base Station. Base data was logged in RINEX format for a 24-hour period coinciding with the logging by each Karratha DGPS Base Station antenna.
- The RINEX data was post-processed by FrontierSI using the Dampier PPA Tower as a baseline to determine the current ITRF2014 position of each antenna. EZSurv software was used to conduct the post-processing.



Figure 1: Survey Location

C. EQUIPMENT

C.1 Dampier RTK Base Station Equipment

The following is a list of components installed at the RTK base station at the Dampier PPA Tower.

- 1 x Trimble SPS 855 GNSS Receiver
- 1 x Zephyr 2 Geodetic Antenna
- 1 x ADL Vantage Broadcasting Radio

C.2 AMSA DGPS Karratha Base Station

The following equipment was used to log the AMSA Karratha DGPS Base Station antennas.

- 1 x Trimble SPS 855 GNSS Receiver



Figure 2: AMSA Karratha DGPS Base Station

D. DATUM AND CONTROL

The horizontal and vertical datum used throughout the project was the ITRF2014, UTM Zone 50S for grid coordinates. See Table 2 for the ITRF2014 parameters.

Parameter	Value
Datum	ITRF2014
Ellipsoid	GRS 80
Semi Major Axis	6378137.0 m
Inverse Flattening (1/f)	298.257222101
Projection	Universal Transverse Mercator
Zone	50 (South)
Latitude of Origin	0° N
Longitude of Origin	117° 00'E
False Easting (m)	500,000.00
False Northing (m)	10,000,000.00
Central Meridian Scale Factor	0.9996
Epoch	2020.53 (RS1 and RS2) 2020.77 (Integrity Monitor)

Table 2: ITRF2014 Parameters

E. SURVEY RESULTS

Table 3 presents the final post-processed ITRF2014 position of the Karratha AMSA DGPS Base Station antennas, as of October 2020.

ITRF2014, UTM Zone 50S, Epoch 2020.53	RS1 (15/07/2020)		RS2 (11/07/2020)		Integrity Monitor (06/10/2020)	
	Observation	Std. Dev (m)	Observation	Std. Dev (m)	Observation	Std. Dev (m)
Latitude	-20° 42' 24.79127"	0.004	-20° 42' 24.82646"	0.004	-20° 42' 24.72615"	0.004
Longitude	116° 46' 26.18529"	0.003	116° 46' 26.41636"	0.004	116° 46' 26.87435	0.005
Easting (m)	476460.283	-	476466.968	-	476480.211	-
Northing (m)	7710275.064	-	7710273.992	-	7710277.094	-
Ellipsoidal Height of ARP (m)	5.836	0.010	3.944	0.009	5.750	0.014

Table 3: Karratha AMSA DGPS Base Station Positions – July 2020 – ITRF2014

The Karratha AMSA DGPS Base Station was established in May 2000 by AUSLIG². The original ITRF97 coordinates are presented in Table 4.

ITRF97, Epoch 2000.35	RS1 (May 2000)	RS2 (May 2000)	Integrity Monitor (May 2000)
Latitude	-20° 42' 24.8395"	-20° 42' 24.8737"	-20° 42' 24".7730
Longitude	116° 46' 26.1521"	116° 46' 26.3845"	116° 46' 26".8418
Ellipsoidal Height of Antenna Reference point (m)	5.793	3.846	5.585

Table 4: Karratha AMSA DGPS Base Station Positions – May 2000 – ITRF97

In order to determine if there has been any change since the May 2000 survey, the ITRF97 coordinates were transformed into ITRF2014 and then compared against the July 2020 survey.

ITRF2014, UTM Zone 50S, Epoch 2000.35	RS1 (May 2000)	RS2 (May 2000)	Integrity Monitor (May 2000)
Latitude	-20° 42' 24.83643"	-20° 42' 24.87061"	-20° 42' 24.77211" S
Longitude	116° 46' 26.15169"	116° 46' 26.38424"	116° 46' 26.84215" E
Easting (m)	476459.313	476466.041	476479.282
Northing (m)	7710273.675	7710272.633	7710275.680
Ellipsoidal Height of Antenna Reference point (m)	5.735	3.788	5.557

Table 5: Karratha AMSA DGPS Base Station Positions – May 2000 – ITRF2014

A comparison of the easting, northing and height is presented in Table 6.

ITRF2014, UTM Zone 50S, Epoch 2020.53	RS1	RS2	Integrity Monitor
Difference Easting (m)	0.973	0.930	0.929
Difference Northing (m)	1.388	1.358	1.414
Difference Position (m)	1.695	1.646	1.692
Difference Height (m)	0.102	0.156	0.193

Table 6: Karratha AMSA DGPS Base Station Positions – Comparison against May 2000

It has been determined that there is a ~1.7m difference in horizontal position for all antennas, which is likely due to plate tectonics which have pushed the entire continent north-east.

F. APPROVAL

Report, deliverables and data approved by:

Jennifer Brindle

Certified Professional Hydrographic Surveyor Level 1
Senior Hydrographic Surveyor – Precision Hydrographic Services

Date: 30/10/2020

