

## FORREST BEACH & CASSADY CREEK BOAT RAMP OPTIONS



EXISTING FORREST BEACH RAMP



Queensland Government

## FORNSIGHT RAIL & CANALWAY ACTION PLAN

### Action statement

Date	Name	Position	Action required	Due date
20/11/2013	Martin Anderson	Principal Engineer	Approval	

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**Department** Department of Transport and Main Roads  
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## Document control sheet

### Contact for enquiries and proposed changes

If you have any questions regarding this document or if you have a suggestion for improvements, please contact:

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### Version history

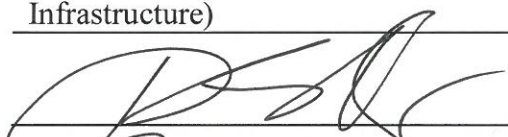
Version no.	Date	Changed by	Nature of amendment
0.1	20/11/2013		

### Document sign off

The following officers have **approved** this document.

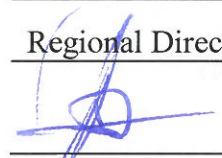
#### Customer

Name Peter Sakkas & Roger Priest  
Position Manager (Project Planning & Corridor Management), Program Manager (Boating Infrastructure)

Signature  Date 29/11/13

**Sponsor** The preferred option is maintain the status quo because existing nearby facilities suit other options not economically or environmentally viable

Name David Atkinson  
Position Regional Director (North Queensland Region)

Signature  PETER AGREES. WE NEED TO BRIEF A. CRIPPS Date 29/11/13

The following officer has **endorsed** this document.

Name Martin Anderson  
Position Project Manager

Signature  Date 28/11/13

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### Table of Definitions

TMR	Department of Transport and Main Roads
HSC	Hinchinbrook Shire Council
GHD	Engineering Consultant GHD
FHA	Fish Habitat Area
LAT	Lowest Astronomical Tide
AHD	Australian Height Datum
CTU	Car Trailer Unit

## 1 Executive summary

Department of Transport and Main Roads (TMR) representatives met with Mr Andrew Cripps (Member for Hinchinbrook and Minister for Mines and Natural Resources) along with several local fishermen on 21 June 2013 at Forrest Beach, near Ingham. The fishermen asked Mr Cripps to meet with them to convey their disappointment with the Hinchinbrook Shire Council (council) report on the Forrest Beach boat ramp and apparent lack of proposed action by TMR.

The local fishermen's major concern with the council report was that if it was implemented there would be no protection from waves generated by south-east winds.

The meeting resolved that TMR would look at further options and costs for upgrading the boat launching facility at Forrest Beach as well as the option of constructing a new boat ramp in the nearby Cassady Creek. The existing ramp is in a tributary of Cassady Creek and is only accessible during high tides. It is difficult to navigate as the mangrove canopy hangs low over the narrow creek.



EXISTING CASSADY CREEK RAMP (NOTE LOW HANGING CANOPY)

It is noted that council commissioned engineering consultant GHD to investigate Forrest Beach boat ramp options in 2010. They produced a report, *Forrest Beach Boat Ramp Options Report August 2010*, for which they undertook extensive community consultation. The issue of using the Forrest Beach ramp during south-east winds was ruled out by the community as it was explained at the time that the boating community did not use the ramp when south-east winds prevailed. The fishermen consulted with on the 21 June 2013 disagreed with the 2010 community consultation saying that without some protection from the south-east (wave break) there was little point in constructing a wave break for north-easterly waves.

This options analysis confirms that the preference is to leave the Forrest Beach ramp as is and leave council's existing Cassady Creek tributary ramp in place. This is because, in accordance with the recommendations of a state wide GHD demand study of 2011, TMR and council have recently upgraded (2006) the nearby all-weather boat launching facility in the Herbert River at Dungeness. Forrest Beach is approximately 40 minutes driving from Dungeness (20km direct). This falls within the accepted norm (*GHD 2011*) of one hour driving for Australians to access sheltered boating facilities. The ramp at Dungeness is a much safer place to launch and retrieve boats in all weathers and thus attracted TMR and council investment ahead of Taylors Beach and Forrest Beach.

Another option although not preferred would be to install a new ramp at Cassady Creek to supplement the Forrest Beach facility for protected mid to high tide use. This option would require constructing a new road through an environmentally significant area. A new Cassady Creek ramp, if environmentally approved, would be protected from the winds could promote the creek as a recreation facility for the community. The sand bar at the entrance means that there would not be a significant improvement in tidal availability to Forrest Beach, but protection from waves when the tide allows access (mid to high tides only).

A third option would be to extend the Forrest Beach ramp to provide a greater tidal window, but with no change to weather protection and the exposed nature of the beach.



## 2 Background Information

In 2010, council commissioned engineering consultant GHD to prepare an options report to examine ways to improve the amenity of the boat ramp at Forrest Beach. In summary, the report identified that constraints on the safe use of the ramp were governed by the state of the tide and by the prevailing wave conditions. The report examined several alternative proposals including lengthening the ramp, duplicating the ramp and provision of various sizes and types of wave calming structures. The aim was to increase the usability of the ramp from its current level of being available for only 25% of the time. However none of the proposals that were considered were able to increase the usability to a level more than 50% of the time.

One of the main reasons for this was that the wave calming structure proposed by GHD was designed to provide protection from north-easterly weather rather than the much more common south-easterly weather. The reason why protection from north-easterly weather was considered more important than protection from south-easterly weather was feedback from the community which indicated that the ramp was generally not used during strong south-east conditions. Another reason against providing protection from south-easterly weather is the associated impact on the natural longshore movement of sand, which moves from south to north.

However during the on-site meeting of the 21 June 2013, local residents expressed a desire for protection from south-easterly weather. Accordingly, TMR agreed to investigate and cost this option.

The ramp at Forrest Beach was constructed by TMR as a beach access ramp under the following guideline:

Beach access boat ramps funded by TMR in exposed locations do not commit TMR to provide protection such as breakwaters or to provide dredged access. Part-tide facilities may be provided where there is demand, and dredged access is not feasible. For instance, beach access ramps may be provided where there is sufficient demand and no suitable nearby sheltered waterway.

There are currently 23 TMR-owned open beach ramps or beach access ramps in Queensland. All of these are in exposed locations. None of them were designed or constructed with the intention of future wave protection. Should a protecting breakwater or wave break be provided at Forrest Beach, each of these would require equal future consideration at a cost of approximately \$3-\$8 million per site. Open beach sites have been become fully protected, when incorporated by a developer into a harbour or marina.

The sheltered waters of Hinchinbrook Channel and the Herbert River lie north of Forrest/Taylors Beaches. There is a bar at the entrance to the Herbert River (Dungeness) which restricts access only at very low tides. Taylors Beach offers better shelter than Forrest Beach in south-easterly weather and better land facilities supplied by council. TMR and council provide a major boat launching facility at Dungeness. Since 2006 TMR has upgraded the Dungeness facility by widening the ramp from three to four lanes, installed a floating walkway (requiring additional ramp widening), and upgraded the span-access pontoon, all to serve boaties generally within one hour driving range.



### 3 Options

At the meeting of 21 June 2013 it was decided to consider additional options to those listed in the GHD report of 2010. The options suggested included consideration of a new boat ramp in Cassady Creek, providing protection against wave action from south-easterly winds and alternate access opportunities at mid to high tides (when wave action may make the Forrest Beach ramp untenable).



**APPROXIMATE SITE OF PROPOSED CASSADY CREEK BOAT RAMP**

The table on the next page provides conceptual costs and available usage times of these new options and the options previously considered in the GHD report of 2010.

Options Table - for improving boating facilities and conceptual cost comparison

Option	Tidal Availability	Wind Availability	Combined Usage	Indicative Capital Cost	Maintenance Cost	Comments
1. Existing Forrest Beach ramp	46%	55%	25%	-	Annual \$30K for ramp	
2. Extension of Forrest Beach ramp by 35m with no wave protection	79%	55%	43%	\$1.5M	Annual \$30K for ramp	No protection from NE or SE winds, improved access during calmer conditions.
3. Forrest Beach piled wave structure (67m), NE protection & longer ramp (35m ext)	79%	63%	50%	\$3.8M	Annual \$30K for ramp, \$50K for wave structure, \$100K for sand by-passing	Protects against NE wind only. Possible sand build-up on ramp due to SE waves.
4. Forrest Beach breakwater (67m) NE protection & longer ramp (35m ext)	79%	63%	50%	\$2.5M	Annual \$30K for ramp, \$10K for breakwater, \$100K for sand by-passing	Protects against NE wind only. Possible sand build-up on ramp due to SE waves.
5. Forrest Beach piled wave structure (67m) SE protection & longer ramp (35m ext)	79%	77%	61%	\$3.8M	Annual \$30K for ramp, \$10K for breakwater, \$300K for sand by-passing	Protects against SE wind only. Possible sand build-up on ramp due to NE waves.
6. Forrest Beach breakwater (67m) SE protection & longer ramp (35m ext)	79%	77%	61%	\$2.5M	Annual \$30K for ramp, \$10K for breakwater, \$300K for sand by-passing	Protects against SE wind only. Possible sand build-up on ramp due to NE waves.
7. Cassady Creek boat ramp & road (10 CTU car park)	100% - creek use 50% to access sea at mouth (at present)	100% - creek use 80%- at mouth (varies)	100% - creek use 40% - to access sea (varies)	\$1.0M (approx 50% each for TMR and council)	Annual \$15K for the boat ramp and \$30K for the car park and road	Significant environmental process to go through. Only 10 car-trailer parks. Water depths at the mouth of the creek vary seasonally and after storms/cyclones



## 4 Constraints and Risks Associated with Options

There are several risks and constraints associated with the options considered in the above table. This section addresses the major constraints and risks associated with the options.

### 4.1 Option 1

This is the status quo option, with regular maintenance to existing facilities.

### 4.2 Option 2 (*lengthen boat ramp*)

Option 2 involves lengthening the ramp thereby increasing the tidal window during which users can launch and retrieve boats. The toe of the ramp would be set at Mean Low Water Springs which is approximately 1.0m below mean sea level and 0.8m above Lowest Astronomical Tide (LAT). This would increase the tidal availability to 79%. However this would not provide protection from wind waves.

### 4.3 Options 3-6 (*wave protection structures*)

Options 3 to 6 each involve either wave protection structures or rock breakwaters to protect boats from waves when launching or retrieving. The four options vary in cost from \$2.5 to \$3.8 million capital cost and from \$140K to \$340K for annual maintenance. To protect from south-east and north-east winds (full protection), the costs would be higher again.

Wave protection structures, even if on piles, interfere with the longshore drift of sand in a similar manner to rock breakwaters. Rock breakwaters dissipate energy available to move sand while piled structures reflect energy available to move sand to some other direction. The picture below shows a typical wave protection structure combined with a breakwater.



Example of wave protection structure adjacent to a rock breakwater

Breakwaters are typically large sized rock structures that extend from the sea bed up and above the surface level of the water.

These wave protection options are expensive in terms of capital and annual maintenance costs and are not considered appropriate for ramps with usage rates experienced at Forrest Beach.

Wave protection structures interfere with the natural movement of sand along the beach and therefore the site would need regular costly dredging to remove built-up sand. TMR concentrates its scarce dredging funds (from boat registration fees) in the eleven state boat harbours.

#### ***4.4 Option 7 Cassady Creek boat ramp***

The proposed location of the Cassady Creek ramp is shown in the Appendix. It is in a declared Fish Habitat Area (FHA), as is an existing council-owned ramp further up the Cassady Creek catchment. An indicative footprint for the road, ramp and carpark is shown in the Appendix. The process to build a road to the new site would require revoking part of the FHA. This process involves approvals from other state government agencies, as well as parliamentary approvals and would likely take 12-24 months. There is no guarantee that such a submission would be successful. The table shown in the Appendix details the steps involved to build a ramp in a declared FHA.

The area has many protected mangroves and other marine plants and has significant ecological values for fish habitat and breeding. The FHA revocation process would involve public consultation prior to tabling of a submission in parliament. It is envisaged that there would be significant public interest should any revocation be proposed.

Successful habitat revocation often involves environmental offsets. An option for TMR and council to consider would be the removal of the existing upstream minor ramp in a Cassady Creek tributary and rehabilitation of that foreshore and car-parking area to its natural state. TMR would support such an offset.



## **5 Hydrographic Survey of Cassady Creek**

### **5.1 *Tidal height comparison between Forrest Beach and Cassady Creek***

The toe of the Forrest Beach boat ramp according to as-construct plans is currently approximately 1.4 m above Lowest Astronomical Tide (LAT), which is the datum used for any tidal predictions. This level converted to the land based Australian Height Datum (AHD) is approximately -0.4m AHD.

The existing ramp at Cassady Creek according to council as-construct drawings has a toe level of -0.31m AHD.

A new ramp at Cassady Creek would be constructed such that it is accessible for creek use at all states of the tide.

### **5.2 *Summary observations from hydrographic survey***

The only real advantage for Cassady Creek over Forrest Beach is that it is sheltered and safe to launch a boat in any weather. But this advantage is limited by the need for reasonable weather to safely cross the sand bar at the mouth to access the open sea. Wave conditions at the creek mouth will not allow access to or from the open sea in severe weather even if it is high water.

On good tides boaties would be able to launch from a new Cassady Creek ramp and use the creek for boating activity without crossing the bar.

Cassady Creek is not an all-tide all-weather proposition for access to the open sea from a boat launching facility. Cassady Creek won't provide a reliable solution for vessels returning from a day offshore. It would depend on the tide being reasonably high in the late afternoon. That is, boaties would need to plan ahead on use of Cassady Creek if accessing the open sea.

From the surveyed depths available, the creek and bar are generally navigable in good weather by smaller trailerable boats from mid-tide and higher. That is, at present there is about 50% usability during the day for smaller trailable boats. The sand bar at the creek mouth is a dynamic natural feature and there can be significant seasonal variation in the bar height and channel location. Storms and cyclones can cause dramatic changes at the bar. This is evidenced by viewing "Google Earth" images for different times in the past.

Cassady Creek, if used with caution and local knowledge, can provide an alternate to Forrest Beach for daytime launch and recovery of smaller trailer boats – for access to the open sea in good weather and with half tide or more.

Use of Cassady Creek by larger trailerable boats is quite limited and needs to be planned – based on higher tides – and consideration of the weather if crossing the bar.

### **5.3 Further observations from hydrographic survey**

The survey shows that there is only 0.9m above LAT on the entrance bar at present. That is it dries on lower low tides, and is generally not navigable until the tide is above half way up.

Mean sea level (roughly half tide) is 1.84m above LAT. This means that at roughly half tide a boatie will have 0.9m depth on the bar at present, and 0.6m or more in the best water inside the creek. The channel inside the creek presents more of a depth constraint than the bar - if depths remain similar to those surveyed.

With their motor down, trailer power boat have variable draughts: about 0.7m for tinnies; about 0.9m for cabin boats; and up to about 1.2m or so for larger boats or those with long-leg outboards. This indicates Cassady Creek being more suitable for smaller rather than larger trailable power boats.

So for most boats, somewhat higher than mid-tide would be needed for navigation of the bar (and creek) in good conditions, with a safety margin of even higher tide needed for moderate conditions. And no safe access across the bar in rough/severe conditions – regardless of tide height.

## 6 Preferred Options

The preference (Option 1 in the table at \$30K annual maintenance) is to leave the Forrest Beach ramp as is and leave council's existing Cassady Creek tributary ramp in place. This is because, in accordance with the recommendations of a statewide GHD demand study of 2011, TMR and council have recently upgraded the nearby all-weather boat launching facility in the Herbert River at Dungeness. Forrest Beach is approximately 40 minutes driving from Dungeness. This falls within the accepted norm (*GHD 2011*) of one hour driving for Australians to access sheltered boating facilities. The ramp at Dungeness is a much safer place to launch and retrieve boats in all weathers and thus attracted TMR and council investment ahead of Forrest and Taylors Beaches.

Another option although not preferred (Option 7 in the table at approximately \$1 million plus \$45K annual maintenance) would be to install a new ramp at Cassady Creek to supplement the Forrest Beach facility for protected mid to high tide use. This option would require constructing a new road through an environmentally significant area. A new Cassady Creek ramp, if environmentally approved, would be protected from the winds and could promote the creek as a recreation facility for the community. The sand bar at the entrance means that there would not be a significant improvement in tidal availability to Forrest Beach, but protection from waves when the tide allows access (mid to high tides only).

A third option (Option 2 in the table at approximately \$1.5 million plus \$30K annual maintenance) would be to extend the Forrest Beach ramp to provide a greater tidal window, but with no change to weather protection and the exposed nature of the beach.

Owing to current government election commitments, any TMR investment in Cassady Creek or Forrest Beach (having been rated on a statewide equity and investment return to boaties basis) would need to be programmed in the financial years after June 2016 – unless special additional funding was sourced.

## 7 Standards for Options

To ensure clarity of what is expected from the preferred options the following points are noted in relation to the Cassady Creek and Forest Beach options.

Cassady Creek proposal includes:

- single lane ramp
- 10 CTU (car-trailer unit) car park
- gravel surfacing only on the road and car park
- supply of water at mains pressure

Forest Beach ramp extension includes:

- demolishing the existing ramp
- construction of new ramp and toe planks.
- ramp not available to public for approximately 16 weeks





## Process for Revocation of Part of a Fish Habitat Area (FHA)

### Steps and timeframes:

Step Number	Details involved	Timeframes
<b>Stage 1 – Revocation Support Study</b>		
1	Initial proposal to revoke part of Fish Habitat Area (FHA) submitted to the Department of National Parks, Recreation Sport and Racing (NPRS&R) by Transport and Main Roads (TMR).  Time to compile proposal	6 weeks
2	Initial assessment of proposal by NPRS&R and development of Terms of Reference (TOR) for Revocation Support Study (RSS), covering FHA Issues.  Assessment time	Timeframes most likely 2 months.  8 weeks
3	TMR prepares Revocation Support Study (RSS) to address TOR and submits to NPRS&R. Study must incorporate proposed change and how it will still support the function and values of the Fish Habitat area. Will need detailed design.  Ecological study, hydrological study and detailed design.	12 to 24 weeks
4	RSS assessed by NPRSR. If accepted, Stage 2 is to follow.  Assessment by experienced Conservation and Fisheries officers:	8 weeks
<b>Stage 2 – Legislative Process for amendment of <i>Fisheries Regulation 2008</i> to revoke part of the FHA</b>		
5	NPRS&R submits Regulatory Assessment Statement (RAS) exemption proposal to Queensland Treasury.	8 weeks
6	If an RAS exemption is awarded, move direct to step 10	
7	If an RAS is required – The RAS is drafted by NPRS&R and submitted to cabinet for approval. - 28 days community consultation. - 4 weeks preparation time	8 weeks
8	NPRS&R prepares Briefing Note to their Minister for approval of <i>Fisheries Regulation 2008</i> amendment.	1 week
9	Minister will submit proposal to Cabinet for approval if the proposal was subject to an RAS or is considered to be 'significant subordinate legislation'	8 weeks
10	NPRS&R prepares drafting instructions and provides to Office of Queensland Parliamentary Council (OQPC).	6 weeks
11	Draft legislation prepared by OQPC and reviewed by NPRS&R.	Up to 24 weeks

12	Amendment of <i>Fisheries Regulation 2008</i> approved by Governor-in-Council and notified in the Queensland Government Gazette.	Up to 24 weeks
	Total	125 weeks Or 3 years

Note 1: An RAS involves the assessment of regulatory impacts of the proposed revocation (such as economic, social, environmental and compliance) on the community or any individual sector of the community.

Note 2: The RAS must have a minimum of 28 days community consultation included.



# HINCHINBROOK SHIRE COUNCIL



## CONCEPTUAL PLAN CASSADY CREEK BOAT RAMP

0 12.5 25 50 75 100 m



### Data Sources & Acknowledgements

While every care is taken to ensure the accuracy of the data used on this map, the HRIC and its partners nor any data providers make no representation or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability for all expenses, losses, damages and costs which you might incur as a result of the data being inaccurate or incomplete in anyway for any reason.

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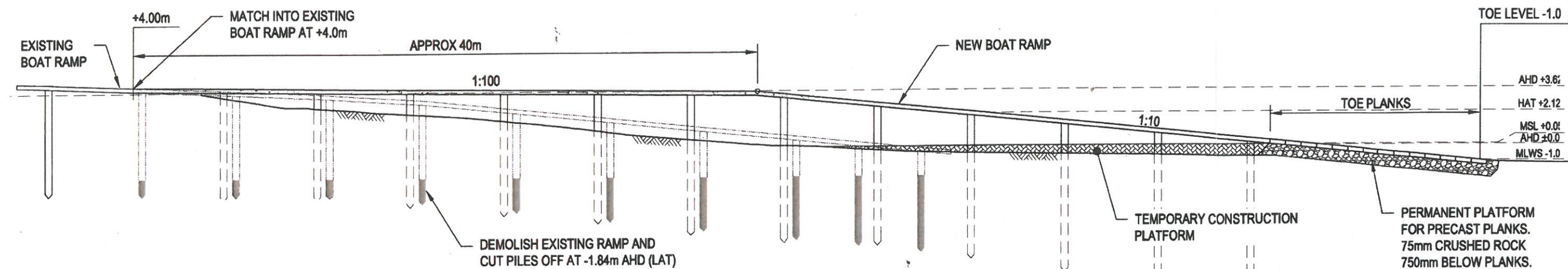
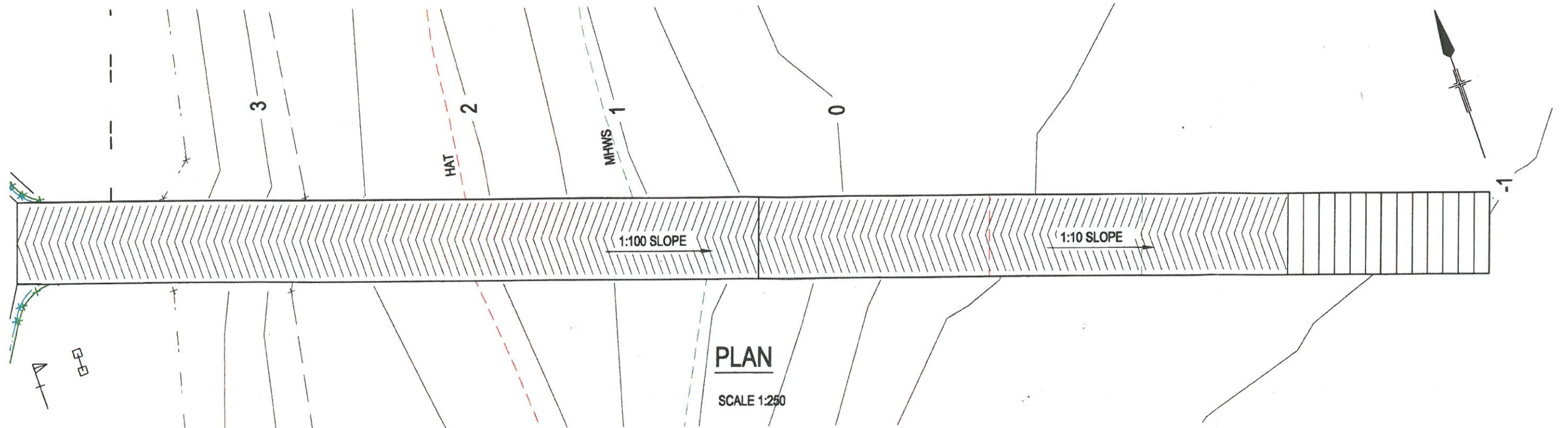
Cadastral Information sourced from Department of Environment Resource Management is current to February 2011 and is accurate 1:50,000.

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<b>Drafted</b>	<b>Designed</b>	<b>Examined By Client</b>
<b>Checked</b>	<b>Checked</b>	Date: ____/____/____
<b>APPROVED</b>		<b>Map No</b>
Date: ____/____/____		





NOTES:  
1. LEVELS ARE IN METRES TO AUSTRALIAN HEIGHT DATUM.



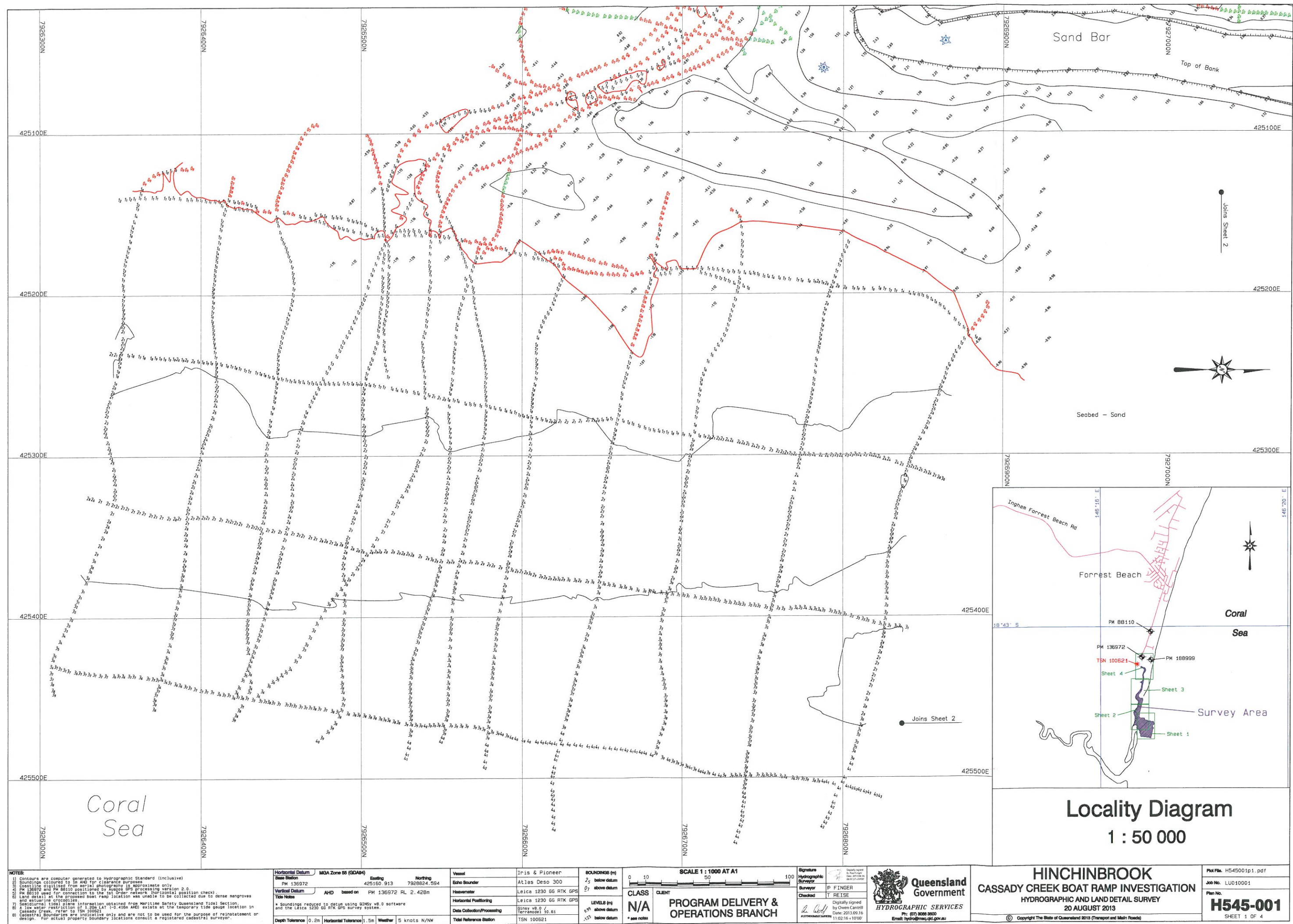
CLIENTS | PEOPLE | PERFORMANCE

Hinchinbrook Shire Council  
Forrest Beach Boat Ramp  
RAMP PROTECTION CONCEPT  
**PROPOSED BOAT RAMP - EXTENSION**  
**RAMP DETAILS**

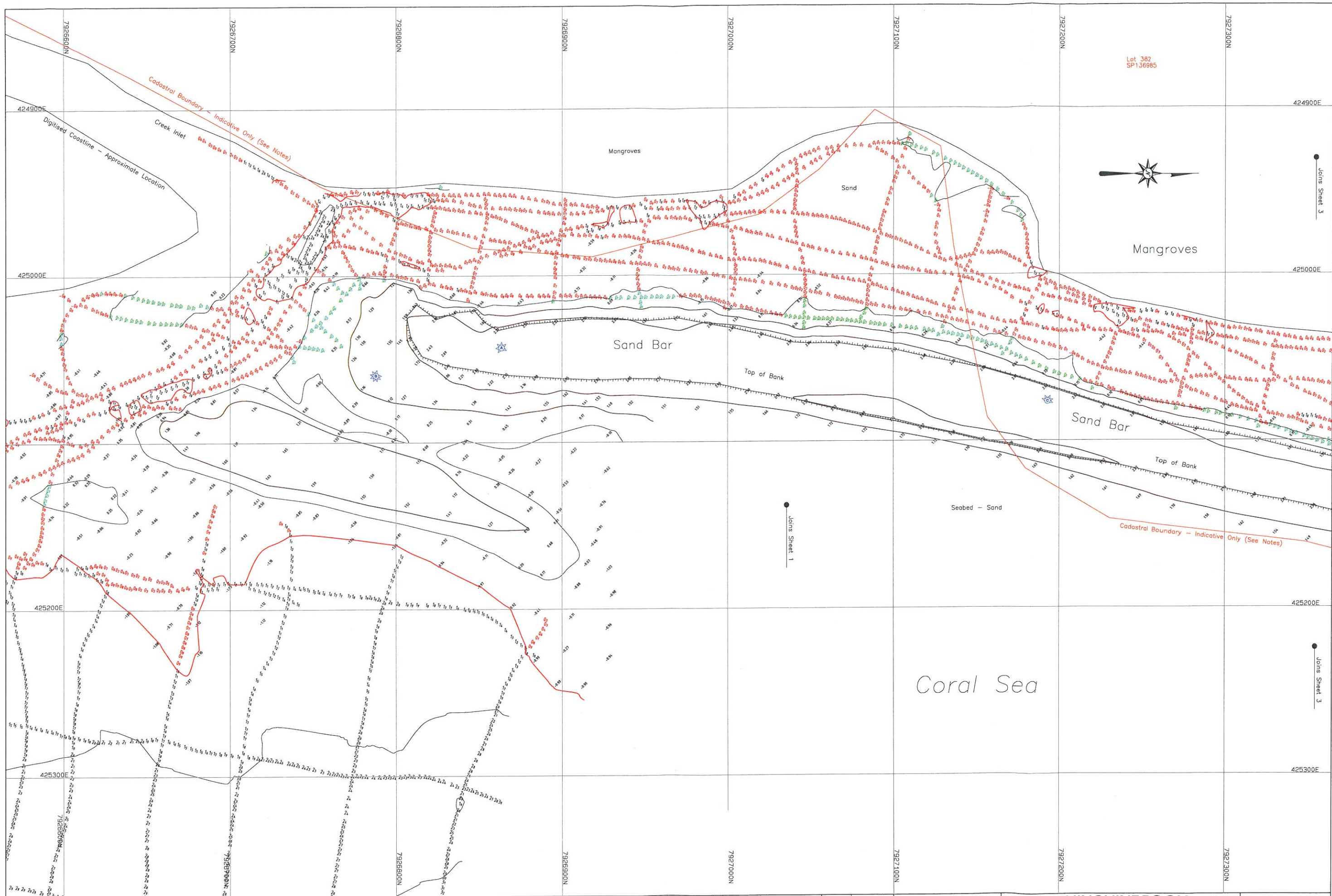
Job Number 41-21629  
Revision B  
Date July 10  
**Figure 07**

Level 4, 201 Charlotte St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnmell@ghd.com W www.ghd.com









NOTES:  
1) Contours are computer generated to Hydrographic Standard (inclusive)  
2) Soundings collected to the 1m depth for clearance purposes  
3) Coastline digitised from aerial photography is approximate only  
4) All soundings are based on the 1st Order network (horizontal position check)  
5) All soundings are based on the 1st Order network (vertical position check)  
6) All soundings are based on the 1st Order network (vertical position check)  
7) A low water restriction of 1.0m LAT (-0.45m AHD) exists at the temporary tide gauge location in Cassidy Creek, refer to TSN 100621  
8) Cadastral Boundaries are indicative only and are not to be used for the purpose of reinstatement or design. For actual property boundary locations consult a registered cadastral surveyor.

Horizontal Datum		MGA Zone 56 (GDA94)	
Base Station	PM 136972	Eastings	425160.913
		Northing	7926824.594
Vertical Datum	AHD based on	PM 136972 RL	2.428m
Tide Notes			
Soundings reduced to datum using QINSY v8.0 software and the Leica 1230 GG RTK GPS survey system.			
Depth Tolerance	0.2m	Horizontal Tolerance	1.5m
Weather	5 knots N/NH		

Vessel	Inis & Pioneer
Echo Sounder	Atlas Deso 300
Heave meter	Leica 1230 GG RTK GPS
Horizontal Positioning	Leica 1230 GG RTK GPS
Date Collection/Processing	QINSY v8.0 TEMPAROS 10.51
Tide Reference Station	TSN 100621

CLASS

N/A

CLIENT

PROGRAM DELIVERY & OPERATIONS BRANCH

0 10 50 100

SCALE 1:1000 AT A1

Signature

Hydrographic

Surveyor

Checked

P FINER

T REISE

Digitally signed by Owen Cantill Date: 2013.09.16 11:03:38 +1000

Queensland Government

HYDROGRAPHIC SERVICES

Ph: (07) 3008 3000

Email: hydro@maas.qld.gov.au

# HINCHINBROOK

## CASSADY CREEK BOAT RAMP INVESTIGATION

HYDROGRAPHIC AND LAND DETAIL SURVEY

20 AUGUST 2013

Copyright The State of Queensland 2013 (Transport and Main Roads)

Plot File: H545001p2.pdf

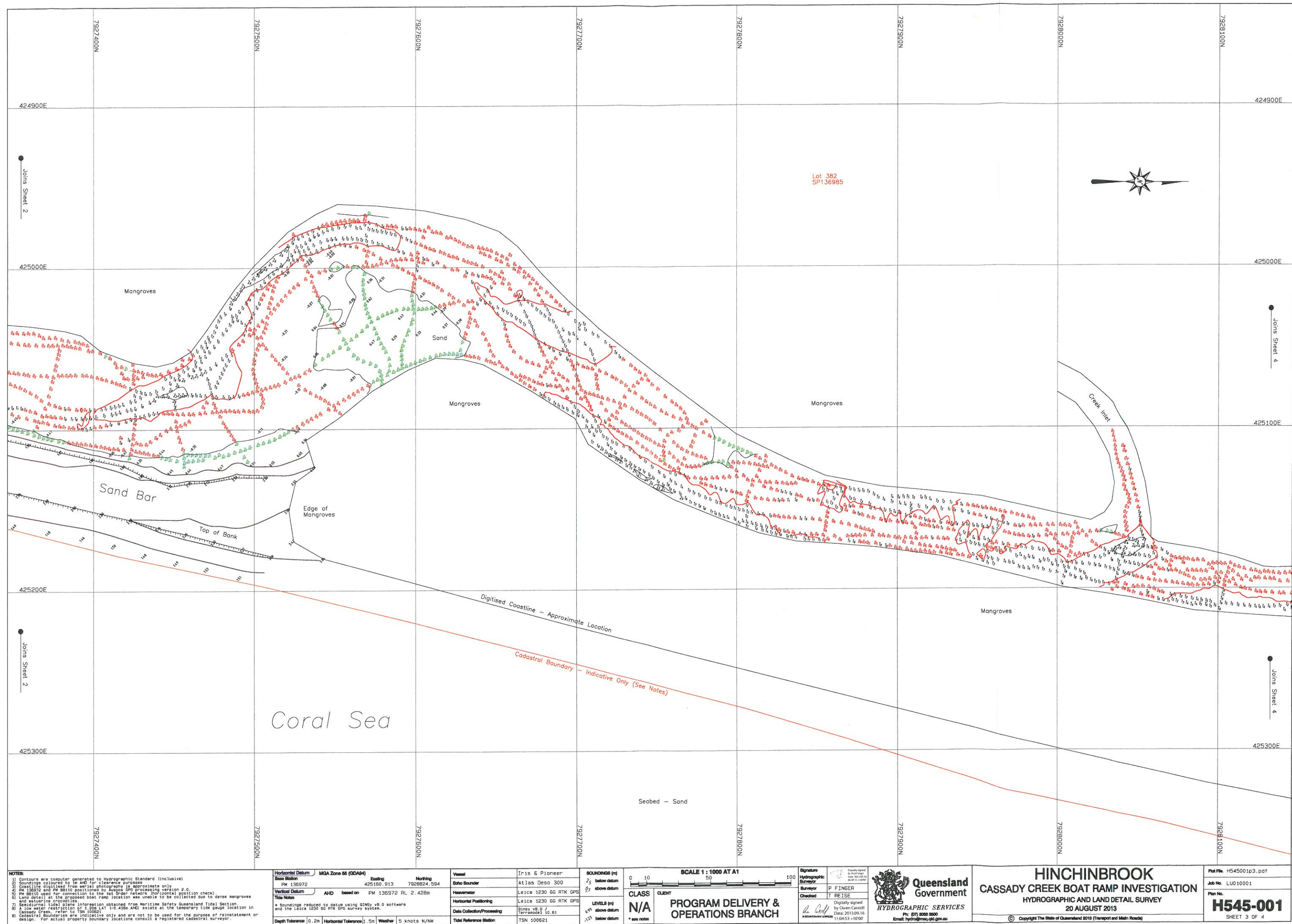
Job No: LU010001

Plan No:

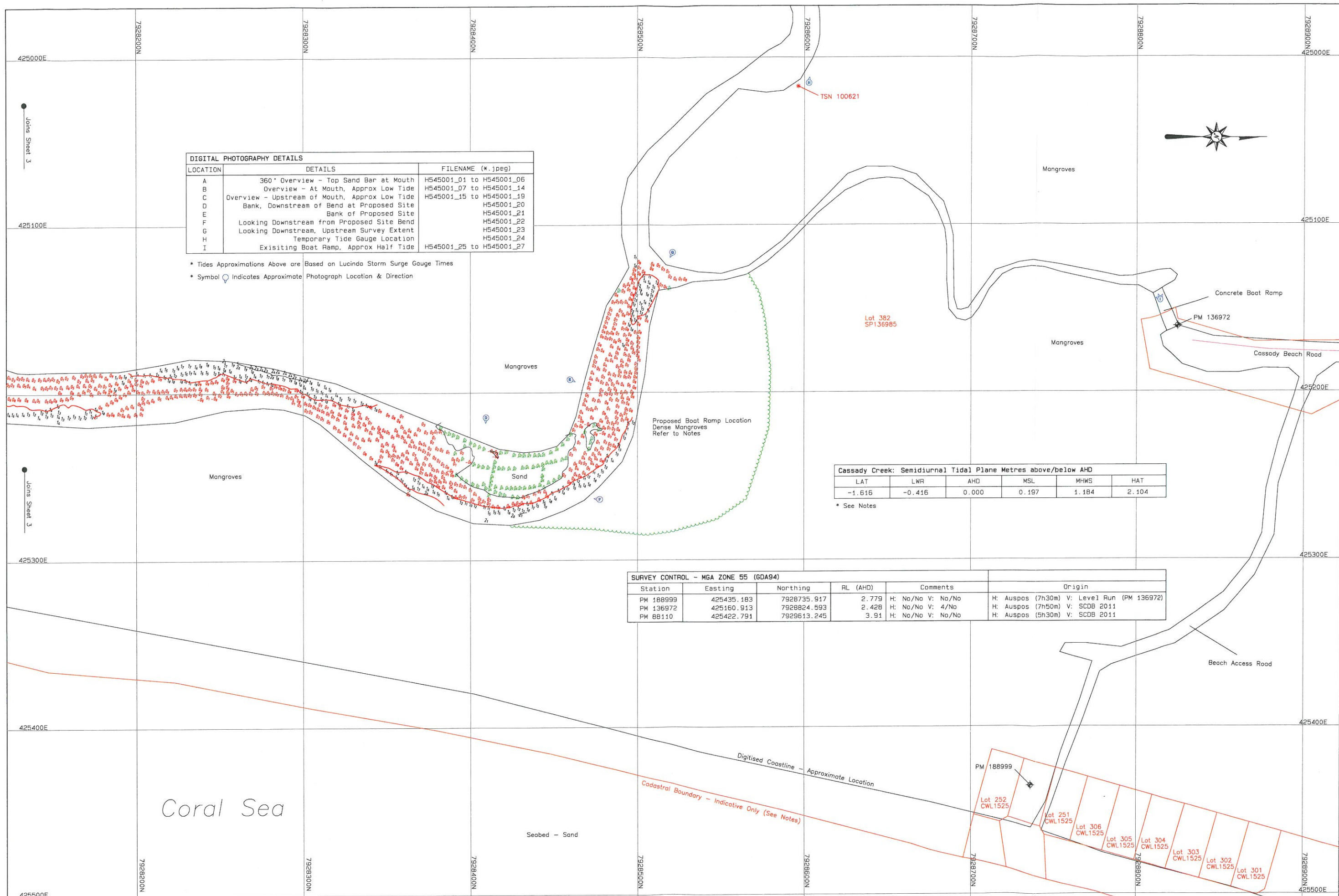
# H545-001

SHEET 2 OF 4










DIGITAL PHOTOGRAPHY DETAILS		
LOCATION	DETAILS	FILENAME (*.jpeg)
A	360° Overview - Top Sand Bar at Mouth	H545001_01 to H545001_06
B	Overview - At Mouth, Approx Low Tide	H545001_07 to H545001_14
C	Overview - Upstream of Mouth, Approx Low Tide	H545001_15 to H545001_19
D	Bank, Downstream of Bend at Proposed Site	H545001_20
E	Bank of Proposed Site	H545001_21
F	Looking Downstream from Proposed Site Bend	H545001_22
G	Looking Downstream, Upstream Survey Extent	H545001_23
H	Temporary Tide Gauge Location	H545001_24
I	Existing Boat Ramp, Approx Half Tide	H545001_25 to H545001_27

\* Tides Approximations Above are Based on Lucinda Storm Surge Gauge Times  
\* Symbol  Indicates Approximate Photograph Location & Direction

Cassidy Creek: Semidiurnal Tidal Plane Metres above/below AHD					
LAT	LWR	AHD	MSL	MHWS	HAT
-1.616	-0.416	0.000	0.197	1.184	2.104

\* See Notes

SURVEY CONTROL - MGA ZONE 55 (GDA94)					
Station	Easting	Northing	RL (AHD)	Comments	Origin
PM 188999	425435.183	7928735.917	2.779	H: No/No V: No/No	H: Auspos (7h30m) V: Level Run (PM 136972)
PM 136972	425160.913	7928824.593	2.428	H: No/No V: 4/No	H: Auspos (7h50m) V: SCDB 2011
PM 88110	425422.791	7929613.245	3.91	H: No/No V: No/No	H: Auspos (5h30m) V: SCDB 2011

NOTES:  
1) Contours are computer generated to Hydrographic Standard (inclusive)  
2) Soundings coloured to 3m AHD for clearance purposes  
3) Coastline digitised from aerial photography is approximate only  
4) PM 136972 and PM 88110 positions are approximate only  
5) PM 88110 used for connection to the 1st order network (horizontal position check)  
6) Land detail at the proposed boat ramp location was unable to be collected due to dense mangroves and extensive crocodiles  
7) Semidiurnal tidal plane information obtained from Maritime Safety Queensland Tidal Section  
8) A low water restriction of 1.20m LAT (-0.416m AHD) exists at the temporary tide gauge location in Cassidy Creek. Refer to TSN 100621  
9) Cadastral boundaries are indicative only and are not to be used for the purpose of reinstatement or design. For actual property boundary locations consult a registered cadastral surveyor.

Horizontal Datum MGA Zone 55 (GDA94)		
Base Station	Eastings	Northing
PM 136972	425160.913	7928824.594
Vertical Datum	AHD based on	PM 136972 RL 2.428m
Tide Notes		
* Soundings reduced to datum using QINSY v8.0 software and the Leica 1230 66 RTK GPS survey system.		
Depth Tolerance	Horizontal Tolerance	Weather
0.2m	1.5m	5 knots N/NW

Vessel	Irish & Pioneer
Echo Sounder	Atlas Deso 300
Heavemeter	Leica 1230 66 RTK GPS
Horizontal Positioning	Leica 1230 66 RTK GPS
Data Collection/Processing	QINSY v8.0 / TerraModel 10.61
Tide Reference Station	TSN 100621

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